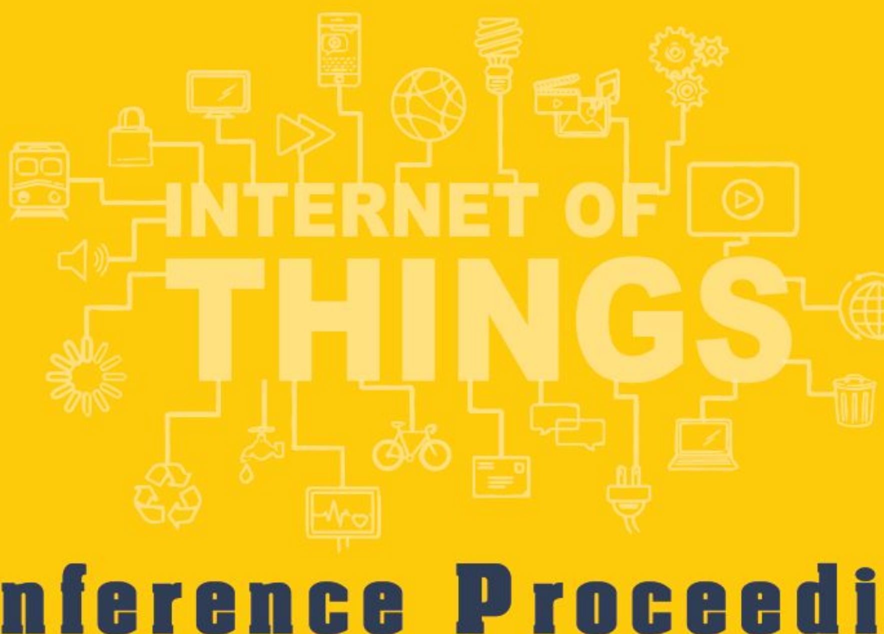
SRI BHARATHI
ENGINEERING COLLEGE FOR WOMEN

NCAAIET - 2024

(Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai)
KAIKKURUCHI, PUDUKKOTTAI – 622 303.
Email : sbecwconference2024@gmail.com
Website : www.sbec.edu.in

NATIONAL CONFERENCE
ON
APPLICATIONS OF AI & IOT IN ENGINEERING AND TECHNOLOGIES
[NCAAIET–2024]

10th February - 2024



Conference Proceedings

ISBN: 978-81-965236-7-1

ABOUT US

SRI BHARATHI ENGINEERING COLLEGE FOR WOMEN (SBECW) the first college started one and only for women's higher education in Pudukkottai District, is named after the famous poet and freedom fighter, Bharathiyar, as the fought for women's freedom. This college started by "Sri Bharathi Educational Trust", in the year 2009 in a rural area of Pudukkottai District which is dedicated for the entire development of education, training and to face the society with positive deportment for women and to serve for the upliftment for the society.

SBECW is located about 6KM away from Pudukkottai. The Mission and Vision of this Institution is to inspire and educate young minds to grow with the principles of Truth, Obedient, Honor, Purity, Integrity and Obedience for their enlightment.

The Destiny of our Nation lies in the hands of children. They should be molded and shaped by proper education. We take care in educating the children to know their responsibilities towards their elders, poor & down trodden people. Apart from education our motto is to train the children to become good citizens of India in all aspects.

Our Institution offers five under graduate programmes in various disciplines,

- **B.E. - CIVIL ENGINEERING**
- **B.E. - COMPUTER SCIENCE & ENGINEERING**
- **B.E. - ELECTRICAL & ELECTRONICS ENGINEERING**
- **B.E. - ELECTRONICS & COMMUNICATION ENGINEERING**
- **B.Tech. - INFORMATION TECHNOLOGY**

SRI BHARATHI ENGINEERING COLLEGE FOR WOMEN

KAIKKURICHI, PUDUKKOTTAI 622 303.

Website: www.sbec.edu.in

E-mail: sbecwconference2024@gmail.com

ISBN: 978-81-965236-7-1

Sri Bharathi Engineering College for Women
(Approved by AICTE, New Delhi and Affiliated to Anna University, Chennai)
KAIKKURICHI, PUDUKKOTTAI – 622 303.

NATIONAL CONFERENCE ON APPLICATIONS OF AI & IoT IN ENGINEERING AND TECHNOLOGIES (NCAAIET-2024)

10th FEBRUARY 2024

CONFERENCE PROCEEDINGS

ACADEMIC YEAR 2023 – 2024

ISBN: 978-81-965236-7-1

PREFACE

Sri Bharathi Engineering College for Women, Kaikkurichi, Pudukkottai has organized a "National Conference on Applications of AI and IoT in Engineering and Technologies (NCAAIET – 2024)" and conducted by the Departments of Civil, Computer Science and Engineering & Information Technology, Electrical and Electronics Engineering, Electronics and Communication Engineering. We feel swollen with pride and fortunate enough to systematize NCAAIET – 2024 on 10th February 2024.

The field of Engineering while looking back to the origins of the history, the contributions where astonishing as well as they stand wonders to exhibit for our age. Due to the wide expansion of the knowledge as well as the population growth, the field of engineering has to spread over a wide spectrum. This has resulted in multi various aspects in the field of engineering and requires specialization in each of the field. Now living through the current age, specialization in a particular field alone will not be helpful.

In such a condition integration of multi various activities of engineering will alone fulfill the requirements of the high-tech modern world and in the days to come. As a fore thought and also to bring out the talents of the students of the various fields of engineering into one point of confluence to understand better and this is a joint venture for this Educational Institution also. We hope very much that such an effort will definitely give raise to a modern world through fulfillment of technologies with inter disciplinary applications.

Our conference aims to integrate the various engineering disciplines and we feel our aim is fulfilled and now we are encouraged by more number of research scholars, academicians and industrialists through their proposals in the form of their full research papers going to be presented at this conference. We have received 102 papers from distinguished and multi-disciplinary engineering domains such as Civil, Electrical, Electronics and Information Technology and Computer Science. Our Technical Core committee short listed those papers into

ISBN: 978-81-965236-7-1

70 in numbers through an optimum quality policy in selection from those 102 papers.

All those selected papers are to uplift the objectives of the conference and to interlink the multi-disciplinary engineering domains with a fore thought to achieve a new generation of engineers with an inter-disciplinary understanding.

My sincere thanks to the respected Chairman cum Managing Director, **Thiru. G.Dhanasekaran M.Com., M.A., M.Phil.,** Sri Bharathi Educational Institutions who is the main root for the cause of this National Conference and also thanks to the Secretary, **Mr. L. Dawood Gani**, and our thanks to the Correspondent **Er. N. Kanagarajan** and all the Trust members who have shouldered the organizational role. My sincere thanks to Chief Advisor of this conference **Thiru. A. Krishnamoorthy**, Administrative Officer and Institutional Publisher, SBECW, Pudukkottai.

I feel my immense pleasure to thank our Patron **Dr. S. Thilagavathi, M.E., Ph.D.,** Principal for giving me this great opportunity for this National Conference NCAAIET – 2024.

I feel my jubilant thanks to all committees especially for Advisory committee, Technical committee and Editorial and Printing committee. I am gratified to the members of NCAAIET – 2024, judges of various session, participants of multi-disciplinary.

I also feel my triumphant delight to all delegates, faculties and non-teaching faculty members of SBECW, supportive staff of NCAAIET – 2024 and finally I am very grateful to the scholars of SBECW.

February 10, 2024,
Kaikkurichi.

Convenor: NCAAIET – 2024,
Dr. B. Prakash Ayyappan,
Associate Professor, Department of EEE,
Sri Bharathi Engineering College for Women,
Kaikkurichi, Pudukkottai.

ISBN: 978-81-965236-7-1

ABOUT THE CONFERENCE

This Conference plays an imperative role in meeting demands of the society and taking the illumination of acquaintance to the depth of obscurity, uplifting the embarrassed by providing the education to the society. This conference will enable under graduate, post graduate, Research scholar, Faculties and Industrial Participants from the various streams of engineering to interact the people and making the bend with the society and awareness about multi-disciplinary fields.

"A unity in diversity" is the normal slogan that is known to most of the Indian Citizen. The Constitution, Government, Law and the basic human rights are all unified irrespective of its diversified regional, religious, linguistic and cultural habitual of the Indian people, does not stand in the way of the unity of Indians. If the country is so, why not we, the engineers who are the pillars of the monumental structure shall unite and hold the nation's pride. The diversified fields are only various parts of the body. The function of a human being is only on united action of the various parts of the body. For anything and everything we need a building or structure with all amenities. For that we require invariably the services of engineers of various disciplines all that we know. As a matter of fact, we are supposed to find out a solution oby finding a way for inter connecting the activities of various disciplines. As the first step, as the Armstrong set his foot on the moon, a proposal for conducting a national conference of this nature is formulated.

Thiru. G. Dhanasekaran, M.A., M.Com., M.Phil.,
Chairman and Managing Trustee,
Sri Bharathi Group of Institutions,
Kaikkurichi, Pudukkottai – 622 303.

MESSAGE

It gives me immense pleasure to know that the Departments of CIVIL, ECE, EEE, CSE, and IT of Sri Bharathi Engineering College for Women, Kaikkurichi, Pudukkottai is organizing a "National Conference on Applications of AI and IoT in Engineering and Technologies (NCAAIET – 2024)".

This conference will sharpen the intellects of the Faculty members and students of this 13 years old Institution and will enlighten the participants with latest trends in Multi-Disciplinary Engineering Domain.

My appreciation and congratulations are due to the faculty members and students for their excellent contribution to the academic growth of this Technical Institution, started exclusively for the benefit of women students of rural areas.

I extend my warm greeting to the Principal, Staff and the participants to this occasion.

"When aims are high and efforts are superfluous,
Production and outcome will be a great success"

I wish the conference a great success.

Thiru. G. Dharasekaran,
Chairman & Managing Trustee

ISBN: 978-81-965236-7-1

Mr. L. Dawood Gani,
Secretary,
Sri Bharathi Group of Institutions,
Kaikkurichi, Pudukkottai – 622 303.

MESSAGE

I am happy to note that a "National Conference on Applications of AI and IoT in Engineering and Technologies (NCAAIET – 2024)" is being organized by various Departments of Sri Bharathi Engineering College for Women, Kaikkurichi, Pudukkottai on 10th February 2024. It is interesting to know that a Souvenir is also being released on this occasion.

This conference will provide an excellent platform for the Faculty members & Research Scholars for exchanging their ideas and experiences for the benefit of the students.

I congratulate the Principal & Faculty members of the various departments such as CIVIL, ECE, EEE, CSE & IT for organizing the conference.

"Creativity is must to shine in this competitive world
Conference is the best way to reach that Paradise"

I wish the conference a great success.

Mr. L. Dawood Gani,
Secretary

ISBN: 978-81-965236-7-1

Er. N. Kanagarajan,
Correspondent,
Sri Bharathi Group of Institutions,
Kaikkurichi, Pudukkottai – 622 303.

MESSAGE

I am very pleasure to inform you that the "National Conference on Applications of AI and IoT in Engineering and Technologies (NCAAIET – 2024)" is being organized and conducted by the various Departments CIVIL, ECE, EEE, CSE & IT of Sri Bharathi Engineering College for Women, Kaikkurichi, Pudukkottai on 10th February 2024.

This conference will provide an excellent platform for the Faculty members & Research Scholars from various parts of the state and country for exchanging their ideas and experiences for the benefit of the students.

I congratulates the Principal & Faculty members of the various departments such as CIVIL, ECE, EEE, CSE & IT for organizing this national conference NCAAIET – 2024.

I wish this conference for a great success.

Er. N. Kanagarajan,
Correspondent

ISBN: 978-81-965236-7-1

Dr. S. Thilagavathi, M.E., Ph.D.,
Principal,
Sri Bharathi Engineering College for Women

MESSAGE

It is a great pleasure for me as a dream has been translated into reality in organizing a "National Conference on Applications of AI and IoT in Engineering and Technologies (NCAAIET – 2024)" in our Fifteen years old college on the most auspicious day of 10th February 2024. I strongly believe that this conference provides a platform for the participants of various disciplines to disseminate, share and exchange their ideas. I promise that Sri Bharathi Engineering College for Women will serve as a grooming ground for new generation of women leaders to exhibit their talents on research through this national conference.

I take this opportunity to sincerely thank the management of our college for encourage financially supporting and extending tall the cooperation in organizing this Sixth National Conference on Cutting Edge Technologies in Science and Engineering in our campus. I would like to place on record my whole hearted appreciating for all the members of the various committees for their untiring efforts put in to make this conference a splendid one. It is hoped that the participants will have a pleasant stay in the campus during the conference period and carry the message of the conference for the benefit of large section of students spread over different institutions. The college will be conducting many more programs in the years to come with continued support from the management and with encouragement received from all the participants. I also thank the principals of other colleges for motivating their faculty and students to submit papers.

I wish the conference a grand success.

Dr. S. Thilagavathi
Principal

ISBN: 978-81-965236-7-1

TABLE OF CONTENT

ISBN: 978-81-965236-7-1

ISBN: 978-81-965236-7-1

ISBN: 978-81-965236-7-1

ISBN: 978-81-965236-7-1

ISBN: 978-81-965236-7-1

ISBN: 978-81-965236-7-1

IoT BASED SMART WATER QUALITY MONITORING SYSTEM FOR ENVIRONMENTAL PROTECTION AND SUSTAINABILITY

[1]VIMALA EBENEZER A
Professor, Department of Civil Engineering,
Sri Bharathi Engineering College for Women, Pudukkottai, Tamilnadu.
[2]RAJA M. A.
Assistant Professor, Department of Civil Engineering,
Meenakshi Sundararajan Engineering College, Chennai, Tamilnadu.

Abstract - **The major source of accessible fresh water, rivers, faces contamination from various sources including population growth, industries, and agriculture, posing significant health risks. Continuous monitoring of parameters like pH, turbidity, dissolved oxygen (DO), and biological oxygen demand (BOD) is essential to ensure safe water supply. Traditional manual methods are inefficient and time-consuming. Integrating Wireless Sensor Networks (WSN) with IoT offers a cost-effective solution for real-time data collection, transmission, and analysis. Sensors placed at different sampling locations gather data which is then pre-analyzed and transmitted to a central office for monitoring. WSN provides autonomy, reliability, and cost-effectiveness, revolutionizing water quality monitoring practices.**

Key words: Water Quality, Monitoring, Internet of Things, Sensors

I INTRODUCTION

Water pollution poses a significant threat to ecosystems and human health, underscoring the urgent need for advanced monitoring technologies. The scarcity of safe water is exacerbated by factors such as population growth, pollution, and climate change, making water pollution a major impediment to sustainable development [1]. Continuous monitoring of drinking water quality is essential to ensure a safe supply. Hence to avoid serious health issues, minimize load in water treatment plant and ensure the safe supply of drinking water there is a need for continuous monitoring of these parameters [2]. They include pH, turbidity, dissolved oxygen (DO), biological oxygen demand (BoD) etc.

Traditional methods are manual, which includes sample collection and laboratory-based analysis and are less effective, costly, time consuming, and lack of real-time results and hence challenging. Thus there is a need to rely on wireless sensor networks or wireless technology, which present challenges including data security vulnerabilities, limited communication coverage, and energy consumption management issues.

The emergence of the Internet of Things (IoT) has revolutionized water quality monitoring by facilitating the development of more efficient, secure, and cost-effective systems with real-time capabilities.

By leveraging IoT technology, stakeholders can address the pressing need for comprehensive water quality management, mitigating the adverse impacts of pollution and fostering sustainable practices in the face of global challenges [3, 4].

II CONCEPTS OF IoT IN WATER QUALITY MONITORING

Integrating Wireless Sensor Networks (WSN) with the Internet of Things (IoT) represents an innovative approach for real-time data collection, transmission, and processing in water quality monitoring systems [4]. Sensors placed strategically at various sampling locations within water sources detect key parameters, with the collected data undergoing initial analysis before transmission to a centralized office. Subsequently, sensor data is routed through a gateway to the cloud or stored within software via communication networks.

Key sensors employed in these systems encompass pH, turbidity, conductivity, dissolved oxygen, and biological oxygen demand sensors. Management software platforms such as Arduino UNO, Raspberry Pi, ZigBee, and XBee facilitate data handling and analysis [5-7]. Continuous monitoring ensures adherence to quality parameters.

The benefits of employing wireless sensor networks are manifold, including autonomy, reliability, robustness, flexibility, speed, accuracy, and cost-effectiveness [8]. By harnessing these advantages, stakeholders can enhance water quality management, addressing environmental concerns and safeguarding public health more effectively.

III RELATED WORK

Petkovski et al. conducted an SLR on IoT-based aquaculture systems, defining five research questions regarding sensor types, single-board computers, data transport protocols, cloud platforms, and IoT benefits. They found 17 sensor types, with temperature, pH, and DO most common. Raspberry Pi, Arduino, and ESP were the top single-board computers. However, the study lacked details on sensor manufacture, models, and costs, leaving gaps in practical implementation understanding. Manoj reviews Water Quality Monitoring Systems (WQMS) for fish ponds, focusing on IoT solutions and implementing a water quality management system with underwater sensors.

ISBN: 978-81-965236-7-1

They identify fifteen recent papers on WQMS, mostly incorporating IoT and pH and temperature sensors. The authors note limited information on sensor costs, mostly deeming them low-cost. Notably, some papers highlight the use of nitrate ($NO^{-}{}^{3}$) and ammonia (NH_3, or AmmoLyt) sensors to gauge freshwater concentrations, crucial for managing total nitrogen levels.

Silva et al. review online and in situ water quality monitoring advancements, focusing on various parameters like color, temperature, DO, turbidity, chlorine, fluorine, metals, nitrogen, pH, phosphorus, ORP, algae, cyanobacteria, coliforms, and E. coli. They highlight optical and electrochemical sensors as common measurement methods, urging for robust real-world assessments to validate recent technological developments. Alexander et al. developed an affordable water quality monitoring system using commercial electrochemical sensors, integrated with WSN and GSM technology. The system accurately monitors water parameters and displays real-time results via a web interface. Tested against standard laboratory setups and Horiba handheld multi-tester, it provides valuable insights into water quality. The system comprises off-the-shelf sensors, a microcontroller, wireless communication, and a customized buoy, disseminating data via a web portal and preregistered mobile phones.

Rahman et al. integrated a smart sensor interface device with Arduino to monitor water quality parameters such as pH, turbidity, temperature, dissolved oxygen, and salinity. The system utilizes Node MCU for online data transmission and features QR codes for users to verify water safety. Suitable for agriculture and public water supply, this innovative solution enables real-time monitoring and ensures safe water consumption.

IV COMPONENTS OF IOT IN SWQM SYSTEM

As an example of high-level flow chart of how an IoT system for water monitoring might work, the sequence of information flow may look like the following (Figure 1). Various components include: Sensors -Water quality sensors are installed in the water sources for real time monitoring [3]. These sensors collect data on various parameters such as pH, temperature, and dissolved oxygen levels; Data collection and transmission- The data collected by sensor is transmitted to a central server or cloud service using a wireless communication protocol such as WiFi, Bluetooth, or cellular [9, 10]; Data storage and processing- The sensor data is stored on the central server or cloud service and then processed and analyzed by algorithms or software to identify trends and patterns; Alerts- If the sensor data indicates that there is a problem with the water quality an alert is sent to the appropriate authorities [11]; Database- The authorities can gather information in database for taking action to address the issue and for future reference.

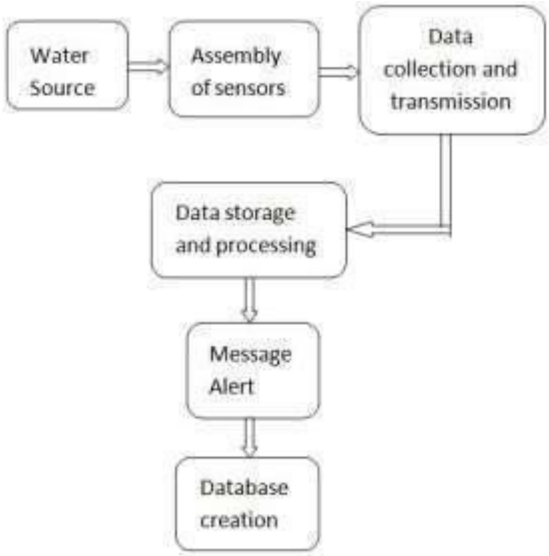


Fig1. Schematic arrangement of IoT components for WQM

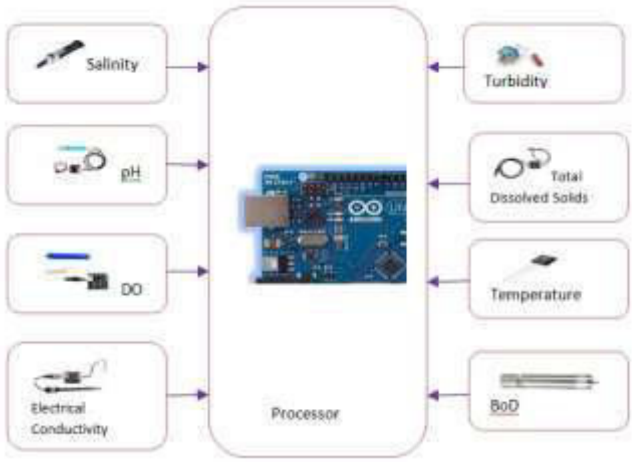


Fig. Various Components identified with IoT

V ADVANCES OF IoT IN WATER QUALITY MONITORING

Continuous Monitoring: IoT devices enable continuous data collection, providing real-time insights into water quality parameters such as temperature, pH, and oxygen levels [5, 8].
Remote Access and Analysis: Data collected by IoT devices can be accessed and analyzed remotely, facilitating monitoring of water quality in remote or inaccessible locations.

ISBN: 978-81-965236-7-1

Quick Response to Issues: Continuous monitoring allows for early detection of water quality issues, enabling prompt intervention to prevent further deterioration and mitigate risks to human health and the environment [13, 14].
Increased Efficiency: IoT technologies streamline the process of water quality assessment, leading to more efficient and cost-effective monitoring practices.

REFERENCES

1. Sendra, S. Parra, L. Jimenez, J.M. Garcia, L. Lloret, J. LoRa-based Network for Water Quality Monitoring in Coastal Areas. Mob. Netw. Appl. 2022.

2. Dinesh P.M, Shree Sapnaa K, Kiranisha A.J, Sabeenian R.S, Paramasivam M.E, Manjunathan A. IOT Based Real Time River Water Quality Monitoring and Control System, https://doi.org/10.1051/e3sconf/202339904013 E3S Web of Conferences 399, 04013 (2023).

3. De Camargo, E.T. Spanhol, F.A. Slongo, J.S. da Silva, M.V.R. Pazinato, J. de Lima Lobo, A.V. Coutinho, F.R. Pfrimer, F.W.D. Lindino, C.A. Oyamada, M.S. et al. Low-Cost Water Quality Sensors for IoT: A Systematic Review. Sensors 2023, 23, 4424. https://doi.org/10.3390/s23094424.

4. Miller, M.; Kisiel, A.; Cembrowska-Lech, D.; Durlik, I.; Miller, T. IoT in Water Quality Monitoring—Are We Really Here? Sensors 2023, 23, 960.

5. Palermo, S.A. Maiolo, M. Brusco, A.C. Turco, M. Pirouz, B. Greco, E. Spezzano, G. Piro, P. Smart Technologies for Water Resource Management: An Overview. Sensors 2022, 22, 6225.

6. Hangan, A. Chiru, C.G. Arsene, D. Czako, Z. Lisman, D.F. Mocanu, M. Pahontu, B. Predescu, A. Sebestyen, G. Advanced Techniques for Monitoring and Management of Urban Water Infrastructures—An Overview. Water 2022, 14, 2174.

7. Olatinwo, S.O. Joubert, T.H. Energy Efficient Solutions in Wireless Sensor Systems for Water Quality Monitoring: A Review. IEEE Sens. J. 2019, 19, 1596–1625.

8. Xavier, F. Martins, L. Oyamada, M. Spanhol, F. Coutinho, F. Pfrimer, F. de Camargo, E. Evaluation of low-cost sensors for real-time water quality monitoring. In Extended Proceedings of the XII Brazilian Symposium on Computer Systems Engineering (SBESC), Fortaleza, Brazil, 21–24 November 2022; pp. 56–61.

9. Petkovski, A. Ajdari, J. Zenuni, X. IoT-based Solutions in Aquaculture: A Systematic Literature Review. In Proceedings of the 2021 44th International Convention on Information, Communication and Electronic Technology (MIPRO), Opatija, Croatia, 27 September–1 October 2021; pp. 1358–1363.

10. Manoj, M. Dhilip Kumar, V. Arif, M. Bulai, E.R. Bulai, P. Geman, O. State of the Art Techniques for Water Quality Monitoring Systems for Fish Ponds Using IoT and Underwater Sensors: A Review. Sensors 2022, 22, 2088.

11. Silva, G.M.e. Campos, D.F. Brasil, J.A.T. Tremblay, M. Mendiondo, E.M. Ghiglieno, F. Advances in Technological Research for Online and In Situ Water Quality Monitoring—A Review. Sustainability 2022, 14, 5059.

12. Alexander T. Demetillo, Michelle V. Japitana, and Evelyn B. Taboada, A system for monitoring water quality in a large aquatic area using wireless sensor network technology, Sustainable Environment Research (2019) 29:12.

13. Md. Mahbubur Rahman, Chinmay Bapery, Mohammad Jamal Hossain, Zahid Hassan , G.M. Jamil Hossain, Md. Muzahidul Islam, Internet of Things (IoT) Based Water Quality Monitoring System International Journal of Multidisciplinary and Current Educational Research (IJMCER) ISSN: 2581-7027, (2020) Volume 2, Issue 4 Pages 168-180.

14. Nandakumar, L. Sangeeth, M. Anna Mariya Thomson, M. Tommy, A. Kiran, M.P. Raji, P. Real Time Water Contamination Monitor using Cloud, IoT and Embedded Platforms. In Proceedings of the 2020 International Conference on Smart Electronics and Communication (ICOSEC), Trichy, India, 10–12 September 2020; pp. 854–858.

ISBN: 978-81-965236-7-1

IOT-BASED ON SMART HOME ISSUES SECURITY AND PRIVACY SYSTEM

Dr.AmbujamKathan[1],Prof/ECE, G.Gopperumdevi [2], AP/ECE
Sri Bharathi Engineering College for Women, Kaikurichi, Pudukkottai.

Abstract **-With the rapid development of the Internet of Things (IoT), the security and privacy of smart home systems based on IoT are more and more popular. As the key component of IoT, wireless communication and sensor technology are prerequisites for the security and confidentiality of smart home systems. Smart home systems integrate electronic information technology and computer control. By designing and installing various sensors in the home for collecting data, and then using the IoT platform for data transmission, the remote control of the home running state can be realized. Home security is guaranteed. This study designs the IoT architecture of a smart home, and then hardware and software are designed according to the system architecture. The hardware part is mainly analyzed from the image recognition module and speech recognition module. In addition, a stereo matching algorithm for smart video surveillance is proposed to optimize the accuracy of the surveillance system. Finally, the simulation results prove that the designed smart home systems have a low cost and high accuracy. It not only optimizes the performance of smart home systems but also improves the safety factor.**

1. INTRODUCTION

Smart Home Environments integrate multiple IoT device send services that collect, process, and exchange data. They provide users with several possibilities to control and adapt the status of their home, either manually or automatically. For that purpose, Smart Home devices and services exchange data with internal and external actors. These interaction stake place with mobile applications on end-user equipment (smartphone) and also with remote services in the Cloud. Due to their interconnected nature, Smart Home devices are subject to several security threats either from remote attackers or from inside the Home Area Network (HAN). Moreover, these threats have an impact not only on a user's data but also on his/her health and safety: this changes the accepted idea that the home is usually a safe place to live in. Smart Home Environments are an emerging domain and because the liabilities are not well defined, it becomes important for all actors to develop adapted security measures to prevent cyber threats. For that purpose, there is a need to secure Smart Home Environments and effectively reduce the threats.

2. LITERATURE SURVEY

2.1. AUTOMATIC SMART HOME SECURITY SYSTEM

Today is the world of advanced ubiquitous mobile applications which are used thoroughly to save energy and time. These applications ease the day-to-day life of common people. Based on these applications and technologies we designed an & quot; Automatic Smart Home Security System & quot;. An attractive market for a & quot;Smart Home Security System & quot; is busy families and individuals with physical disabilities.Users can control electrical appliances in the home or office via smart phone. The application will also provide secure notification and alarm for Burglary, fire hazards, and LPG leakage. This project aims at controlling every happening at home or office on your fingers.

2.2. IOT-BASED SMART SECURITY AND HOME AUTOMATION

Internet of Things is a system where appliances are embedded with software, sensors, and actuators Wi-Fi is one of the main wireless communication protocols for connecting different devices for the exchange of data over the Internet. IoT is implemented in smart home security to device embedded module for standalone operation of collecting and monitoring different sensor data for home security. This project focuses on building a home security system that will be wireless. Security over a network is achieved using Arduino Uno. This system was used for monitoring the status of the home by using different sensors.

3.1 EXISTING SYSTEM

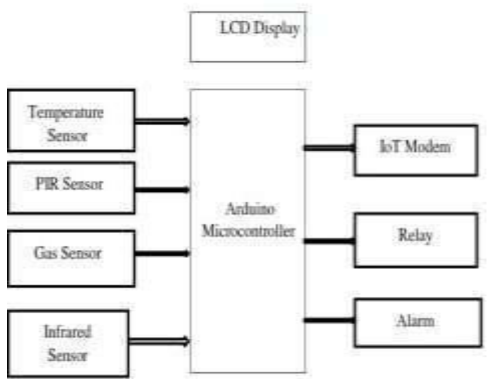
The recent developments in this technology which allow the use of Bluetooth and Wi-Fi have enabled different devices to have capabilities of connecting each other. Using a Wi-Fi shield to act as the micro- web server for the Arduino eliminates the need for wired connections between the Arduino board and computer which reduces the cost and enables it to work as a stand-alone device. The Wi-Fi module needs connections to the internet from a wireless router or a wireless hotspot and this would act as the gateway for the Arduino to communicate with the internet. With this in mind, an internet- based home security system for remote control is designed.

ISBN: 978-81-965236-7-1

3.2 PROPOSED SYSTEM

The smart home system has a plurality of sensing nodes, including the door magnetic sensing node, the smoke detecting node, the gas detecting node, the infrared detecting node, and the temperature and humidity detecting node. Based on the data collection of each monitoring node in the home, the smart home system can realize real-time information transmission with the network layer.

4. BLOCK DIAGRAM



BLOCK DIAGRAM DESCRIPTION

4.1 ARDUINO MICROCONTROLLER
Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards can read inputs - light on a sensor, a finger on a button, or a Twitter message -and turn them into an output - activating a motor, turning on an LED, publishing something online. To do so you use the Arduino programming language (based on Wiring), and the Arduino Software (IDE), based on Processing.

Why Arduino?

Thanks to its simple and accessible user experience, Arduino has been used in thousands of different projects and applications. The Arduino software is easy-to-use for beginners, yet flexible enough for advanced users. It runs on Mac, Windows, and Linux. Teachers and students use it to build low-cost scientific instruments, g, and robotics. Designers and architects build interactive prototypes.

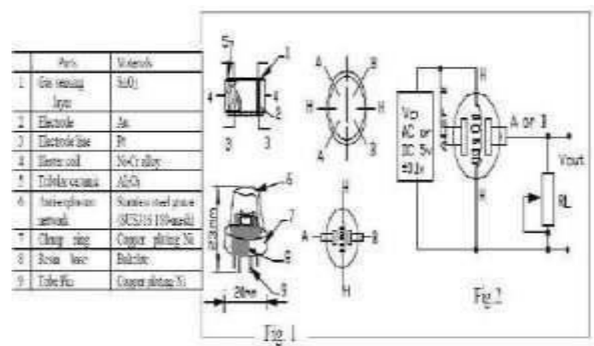
- Cross-platform - The Arduino Software (IDE) runs on Windows, Macintosh OSX, and Linux operating systems. Most microcontroller systems are limited to Windows.

- Relatively inexperienced users can build the breadboard version of the module to understand how it works and save money.

4.2 GAS SENSORS

Gas sensors detect dangerous gas leaks in the kitchen or near the gas heater. This unit detects 300 to 5000ppm of Natural Gas. Ideal to detect dangerous gas leaks in the kitchen. The sensor can be easily configured as an alarm unit. The sensor can also sense LPG and Coal Gas.

Structure and Measuring Circuit



The gas sensor is shown as Fig. 1 sensor composed of a micro AL2O3 ceramic tube, Tin Dioxide (SnO2) sensitive layer, measuring electrode, and heater fixed into a crust made of plastic and stainless steel net. The heater provides necessary work conditions for the work of sensitive components. The enveloped MQ-5 gas sensor has 6 pins,4 of them are used to fetch signals, and the other 2 are used for providing heatingcurrent.

The electric parameter measurement circuit is shown in fig. 2E. Sensitivity characteristic curve Sensitivity characteristics.

RESULT:

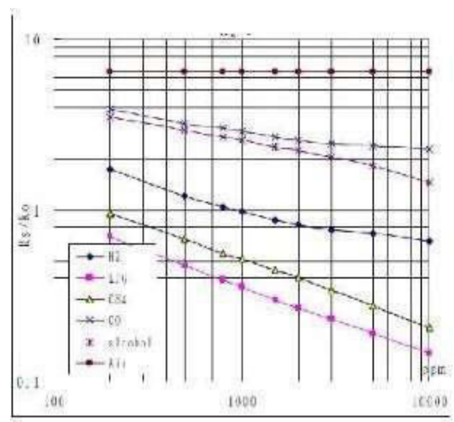


Fig.3 shows the typical Sensitivity characteristics of the MQ-5 sensor for several gases.

ISBN: 978-81-965236-7-1

Temp: 20
Humidity: 65%
O2 concentration 21% RL=20kΩ
Ro: sensor resistance at 1000ppm of H2 in the clean air.
Concentrations of gases.

ADVANTAGES AND APPLICATIONS

ADVANTAGES

- Accuracy
- Low Cost
- Simple Design

APPLICATIONS

This project can be used in our homes for security purposes and it can be used for any place that needs security.

CONCLUSION

With the improvement of people's living standards and the popularization of the network, security and privacy protection have become more and more popular. Especially the concept of IoT and smart home systems has promoted the application of electronic products in the family. Smart home systems can guarantee the security and privacy of life and effectively improve the efficiency of life. The development of smart home products has become a hot topic. It relies on seamless compatibility with the IP network and remote real-time video processing capabilities provided by high-performance embedded processors. It provides technical support for smart homes and has broad marketapplication prospects.

1) Integrating Zigbee, WiFi, GSM/GPRS, and other technologies, this study puts forward an overall design idea for the security and privacy of smart home systems via advanced IoT technology.

2) According to the structure of smart home systems, based on the consideration of economy and low consumption, the design of hardware and software of the system is completed, which provides technical support for the realization of intelligent monitoring.

REFERENCES

[1] Gómez J, Oviedo B, Zhuma E. Patient monitoring system based on internet of things[J]. Procedia Computer Science, 2016, 83: 90-97.

[2] Rau P L P, Gao Q, Wu L M. Using mobile communication technology in high school education:Motivation, pressure, and learning performance[J]. Computers and Education, 2008, 50(1):0-22.

[3] Ferreiros J, Pardo J M, Hurtado L F, et al. ASLP-MULAN: Audio speech and language processing for multimedia analytics[J]. Natural, 2016 (57): 147-150.

[4] Yuan J S, Zhang J, Wang Y. Applied Technology in Smart Home Furnishing Control System in the Internet of Things Based on SCM Microcontroller and GSM[J]. Applied Mechanics and Materials, 2014, 540:372-375.

[5] Wang Y, Wang H, Li X. An intelligent recommendation system model based on style for virtual home furnishing in Three-Dimensional scene[C]//2013 International Symposium on Computational and Business Intelligence. IEEE, 2013: 213-216.

[6] Shi C B, Li WB, Wang K H, et al. Intelligent home furnishing management system[J]. Electronic Design Engineering, 2014, 22(3):136-138.

[7] Zhang S, Xiao P, Zhu J, et al. Design of smart home control system based on Cortex-A8 and ZigBee[C]//2014 IEEE 5th International Conference on Software Engineering and Service Science. IEEE, 2014: 675-678.

[8] Alagoz B B. Obtaining Depth Maps from Color Images by Region Based Stereo Matching Algorithms[J]. Computer Science, 2008.

[9] Banks J, Bennamoun M, Corke P. Fast and Robust Stereo Matching Algorithms for Mining Automation[J]. Digital Signal Processing, 1999, 9(3):137-148.

[10] Hamzah R A, Kadmin A F, Hamid M S, et al. Improvement of a stereo matching algorithm for 3D surface reconstruction[J]. Signal Processing: Image Communication, 2018, 65:165-172.

[11] Hvistendahl M. China pushes the 'Internet of Things[J]. Science, 2012, 336(6086):1223.

[12] Tsai M F, Ye C K, Sinn A. Smart service relying on the Internet of Things technology in parking systems[J]. Journal of Supercomputing, 2016,13(1):1- 24.

[13] Zee E V D, Scholten H. Spatial Dimensions of Big Data: Application of Geographical Concepts and Spatial Technology to the Internet of Things[J]. Nature Genetics, 2013, 22(1):13

ISBN: 978-81-965236-7-1

Review Paper: Enhancement of Efficiency and Response time of Automated Fire Fighting Drone

[1]Dr. B. Prakash Ayyappan, [2]Ms. R. Kaviya, [3]Ms. S. Kopperundevi and [4]Ms. S. Ramadevi
[1]Associate Professor, Department of EEE, Sri Bharathi Engineering for Women, Pudukkotai-622 303
[2,3,4]Student, Department of EEE, Sri Bharathi Engineering for Women, Pudukkotai-622 303.

Abstract: **Fires present an immense threat to humanity, causing massive and irreversible destruction. Firefighters worldwide bravely risk their lives to combat these infernos. Despite considerable technological advancements, effectively addressing fires remains challenging. The proliferation of urban areas has transformed our society into high-rise concrete jungles, often inaccessible during crises, particularly structural fires. Harnessing drone technology could revolutionize firefighting services. Our project focuses on developing a prototype firefighting drone to contain fires and minimize casualties. Drones offer versatility, allowing customization to meet specific requirements. To ensure the system's efficacy, we have outlined requirements and functionalities, designing a quadcopter equipped with an extinguishing system and a surveillance/navigation camera. This drone can be remotely controlled by firefighters, significantly reducing human involvement and the risk of physical injuries during firefighting efforts.**

Keywords: Drones, Firefighting Extinguishing system, Fire containment, Safety Equipments.

Introduction:

Globally, fires have an inevitable impact on humanity, wildlife, and vegetation, causing extensive destruction in both urban and rural areas. The inherent unpredictability of fires makes them highly perilous and life-threatening, with a small flame capable of escalating into a large-scale inferno in less than thirty seconds. In the contemporary world, firefighting primarily relies on manually operated fire equipment, necessitating the active involvement of firefighting personnel at the fire site. Firefighters put their lives on the line, facing both physical and mental risks. Developing effective methods for extinguishing fires with minimal casualties has become imperative. It is crucial to explore how technology can be harnessed to contain crises such as wildfires or structural fires while ensuring public safety.

Recently, there has been a growing focus on research in Unmanned Aerial Vehicle (UAV) systems, both in civilian and military applications. These systems are gaining attention for their capacity to operate autonomously in complex, challenging, and uncertain environments, leading to increased endurance. A UAV, or unmanned aerial vehicle, operates without an onboard human pilot. Drones have played a significant role since their inception in 1907, a decade before the first airplane was invented.

Drones, or UAVs, can either fly autonomously or be remotely piloted, offering the flexibility to carry diverse payloads based on specific requirements and applications. Multi-rotor drones, relying on multiple propellers, are a notable category in this domain. They are relatively easy to manufacture and cost-effective compared to other drone options. The number and placement of rotors on the drone can be tailored according to its intended functionality.

Despite the versatility of drone technology, there is a noteworthy contention that it remains underutilized, potentially offering remarkable advantages to emergency responders and specialists.

Capitalizing on advancements in drone technology, we can employ drones for firefighting services. Drones currently possess a superior capacity for early identification compared to the unaided eye, especially in the case of rapidly spreading fires. This project aims to leverage drone technology for fire extinguishing purposes. A quadcopter equipped with an extinguishing system is meticulously designed, taking into account the layout of requirements and functionalities. Fire personnel can control the drone from a safe distance, while the camera mounted on the drone ensures proper monitoring of the fire site. Upon identifying the target, the user can instruct the drone to spray extinguishing liquid to contain the fire. This project proves effective in suppressing small-scale fires.

Methodology:

In recent times, there has been a significant increase in reports of fire accidents, predominantly involving small-scale fires escalating into uncontrollable large-scale incidents. It is crucial to address and contain these fires at their initial stages. This project aims to achieve that objective by developing a prototype of a firefighting drone. The system must be designed to provide an effective and reliable solution while being user-friendly for fire personnel. To ensure the framework's effectiveness, a comprehensive layout of requirements and functionalities must be established.

Selecting an appropriate fire extinguishing solution is a critical requirement to extinguish the fire effectively. A thorough survey and analysis of each subsystem have been conducted to identify the most effective components and methodologies for the firefighting drone's development. After careful consideration of various options and weighing their pros and cons, a quadcopter emerged as the ideal choice for this project.

Tri-copters presented challenges in assembling hardware due to flight restrictions, and their control software was comparatively more complex than that of a quadcopter. An analysis of various fire extinguishing solutions, a conclusion was reached that a simple yet effective mixture of water, baking soda, and dish soap stands out as the most practical extinguisher among all the options.

Proposed Technique:

This project entails the implementation of a firefighting drone featuring an extinguishing system mounted on a quadcopter. The requirements are categorized into subsystems, specifically mechanical, electronics, and software. Within the mechanical system, the first requirement is the drone platform equipped with the payload and the extinguishing system. The second involves selecting the container for holding the extinguishing liquid, and thirdly, a pumping system to transfer the liquid from the container to the nozzle.

In the electronic realm, a crucial requirement is a custom-designed printed circuit board (PCB) or a power distribution board (PDB) to regulate and control the distribution of electrical power for each subsystem. The PDB and the controller collaborate to manage the on-board mechanisms and facilitate communication between multiple subsystems or devices. Additionally, there is a need for a circuit design to operate the pumping system.

The software component encompasses designing the drone platform using computer-aided design (CAD) and establishing drone controls through Mission Planner software.

System Components:

The choice of components is contingent upon the specific requirements of the project and the intended application of the drone. The selection process initiates with estimating the drone's weight according to project specifications, determining the type and size of the frame and propellers, and subsequently calculating the necessary thrust for each motor to maintain stable flight. Based on the power and current specifications of the motor, appropriate power supply and Electronic Speed Controllers (ESCs) must be selected.

When deciding on the propellers, various factors such as the number of blades, current draw, weight, and stiffness need to be taken into consideration. In the case of frame selection, parameters such as size, material, configuration, and geometry are crucial factors that need careful evaluation. The following section provides a description of the components utilized in this project.
The frame serves as the primary structure or body of the drone, providing support for all components, including hardware and payload, through the use of suitable mounting hardware. An A4-arm X-configuration is adopted for its ease of fabrication and control.

The frame is specifically tailored and designed using computer-aided design (CAD). Constructed with aluminum arms and a polycarbonate plate, it offers a rigid structure while remaining cost-effective.The motors must be chosen to provide ample thrust for the drone, ensuring stable flight with a heavy payload, such as the extinguishing system, while considering torque, speed, and KV variations. The A2212 2450KV brushless DC motors are deemed suitable for this purpose. Two sets of 1045 propeller pairs, each consisting of one clockwise-rotating and one counter-clockwise-rotating propeller with 2 x propeller shaft adapters, are utilized. These propellers control motor speed by adjusting the current based on instructions received from the flight controller, supplying the necessary 3-phase AC current to drive the motors.

For motor speed regulation, a fully programmable 30Amp BLDC ESC Circuit with 5V, 3A BEC (battery eliminating circuit) is employed. The Pixhawk 2.4.6 32bit ARM RC Flight Controller processes and coordinates instructions from other electronic components when signals are transmitted. Equipped with various sensors such as a gyroscope, magnetometer, accelerometer, etc., the flight controller senses different parameters and conditions during operation.

The selection of a battery is influenced by factors such as the number of cells, capacity, and C rating. In this project, a 3-cell, 11.1V LiPo battery with a capacity of 2200 mAh is employed. To address post-flight battery drainage, an appropriate battery charger is chosen.

The power distribution board (PDB) takes the battery voltage as input, offering multiple connection points for all other electronic components. A regulator or Battery Eliminating Circuit (BEC) is included to power low voltage components.

For communication between the ground station and the drone, a Flysky i6B 2.4GHz transceiver set is utilized. The flight controller receives signals from the transmitter or remote control through a radio receiver.

The extinguishing system comprises a mini 12V DC brushless water pump, a nozzle, and a suitable container for the extinguishing liquid. An optional FPV camera can be incorporated for surveillance and target recognition. The camera transmits signals to the Video Transmitter (VTX), and the VTX sends the signal through the antenna to a video receiver, which, in turn, transmits it to a screen.

For an FPV setup, two video antennas are typically needed for transmission and reception. A 2.4GHz transmitter and receiver are considered ideal. Alternatively, a camera module can be interfaced with a Raspberry Pi 3 B+, and the video can be streamed to the Pi's screen.

Working:

Manual control of the firefighting drone is facilitated through the radio receiver, enabling the operator to command the quadcopter's movement in various directions.

ISBN: 978-81-965236-7-1

Stability is achieved by adjusting the speed of the motors and the motion of the propellers. The transmitter at the ground station, manipulated by the user, sends signals to the receiver.

Subsequently, the receiver communicates this information to the flight controller, which utilizes Electronic Speed Controllers (ESCs) to regulate motor speed, resulting in controlled movement.

The operator receives visual feedback from the quadcopter. The transmitter transmits this feedback to the receiver, which relays it to a display device, such as a screen or a base computer. This display aids the operator in navigation and decision-making regarding the target location, specifically the location of the fire.

The extinguishing liquid consists of a solution of baking soda, detergent or dish soap, and water. The pump within the extinguishing container is connected to a power supply and a controller to enable automation. The controller interfaces with a receiver, and the transmitter connects to a controller and a switch under the operator's control. The switch regulates the on-off function of the pump for the purpose of spraying.

Design and Implementation:

The initial phase in constructing a drone involves deciding on its configuration and assembling various frame components, such as the landing gear and mounting plate, using screws and nuts. After determining the suitable positions and orientations for all components, the Power Distribution Board (PDB) is affixed. Before mounting, the battery connector and other small pads are soldered to the PDB. Subsequently, the motors are securely fastened according to their designated positions.

As there are two sets of clockwise and anticlockwise motors, opposite motors within the X configuration must spin in the same direction. After positioning the motors, the four Electronic Speed Controllers (ESCs) are affixed to the arms of the frame using double-sided tape. Each motor possesses three wires that will be connected to the ESC with a bullet connector.

Fig.3.1 Block diagram of Fire Fighting Drone

The next step involves connecting the other end of the Electronic Speed Controller (ESC), which has a positive and negative wire, to the respective pads on the Power Distribution Board (PDB). With the power system now ready, the setup of the First Person View (FPV) system can proceed by powering the camera and Video Transmitter (VTX) from the PDB. Alternatively, a Raspberry Pi can be utilized to interface with the camera and stream video on its screen. It's worth noting that the use of the camera is optional since the primary goal of this project is to extinguish small-scale fires.

Moving on to the wiring of the flight controller, it requires 5V power supplied by the power module, which also enables the Pixhawk to monitor the current and voltage levels of the main battery. The power module has a 6-pin cable plugged into the power port of the flight controller. The signal wire and signal ground wire from each ESC are connected to the flight controller, with output connections to the motors arranged according to their specified order. Additionally, a safety switch and a buzzer must be connected to the Pixhawk flight controller in their designated ports.

The receiver is then mounted and powered, receiving power from the flight controller. The signal wire in the receiver is connected to either a UART RX based on the mode of communication. Pixhawk is compatible with a PPM-Sum receiver, so the ground, power, and signal wires are plugged into the RC pins on the flight controller (Pixhawk). Completing the setup involves binding the transmitter and receiver. The battery can be connected through the power module as needed.

For the extinguishing system, an electronic submersible pump, along with a bent pipe for improved efficiency, is placed inside a suitable container. A nozzle is connected at the container's mouth for spraying the extinguishing liquid. Switch A on the transmitter is programmed to control the on-off function of the pump. Specifically, switch A is assigned to channel 5 on the receiver. The flight controller receives information from this channel through the receiver, and output pin 5 is connected to the pump. This setup allows the user to control the pumping action from the ground station, completing the hardware implementation of the project.

Software Implementation:

The Mission Planner software, an essential ground station application provided for drone pilots, facilitates the configuration of various drone aspects. Calibration and setup of the drone are conducted through this software. After installing the software on a PC, establish a connection between the drone and the PC using a USB cable. Subsequently, peripheral setup is required, involving the configuration of the drone by selecting the frame layout, calibrating various components, and setting up flight modes.

For optimal drone performance, assumptions about the aggregate weight of the quadcopter are made to determine the appropriate frame size, propeller size, and the thrust generated by the motors to lift and maintain stable flight. In this instance, the selected motors are designed to provide an approximate thrust of 800g each. Specific parameters such as the angle between the frame surface and the landing gear (-50 degrees), the height of the landing gear (4.5 inches), and the width of the landing gear (0.2 inches) are considered during the configuration process.

ISBN: 978-81-965236-7-1

Top of Form

- Quadcopterflighttime=(batterycapacity*batterydischarge/averageAmpdraw) *60
- Battery capacity= 2200mAh
- Battery discharge=80%
- Avg amp draw=20A
- Quadcopter Flight time = ([(2200/1000)*(80/100)] /20)*60
- Quadcopter Flighttime = 5.28minutes

Results and discussion:

Through extensive research, design modeling, and multiple testing techniques, a meticulous selection process was employed to meet all the specified requirements for developing and constructing an efficient system. Initially, calibration challenges were encountered, but after two attempts, successful calibration was achieved. The quadcopter, equipped with the extinguishing system, demonstrated the ability to fly and hover over a location illuminated with fire. It is crucial to exercise caution when setting up the fire.

In the initial attempts, a challenge emerged as the drone unintentionally contributed to the fire's escalation due to downward thrust. This issue was attributed to the arrangement of the extinguishing bottle, with its nozzle facing vertically downward. To address this problem, corrective measures were taken by placing the nozzle horizontally at an angle and bending the nozzle pipe.

In summary, the design and development of a firefighting drone, capable of extinguishing small-scale fires, have been successfully executed. For experimental purposes and unforeseen circumstances during test flights, the project was also conducted using a pre-made drone frame.

Conclusion:

Fire, an age-old destructive force, has become more manageable with technological advancements. This paper presents a solution to firefighting challenges using drone technology and a specialized extinguishing system. It outlines and illustrates the construction process for a drone capable of extinguishing small-scale fires. In conclusion, leveraging continually evolving drone technology offers a safer approach to firefighting, reducing firefighter involvement and minimizing the risks of physical injuries and life-threatening situations. Comparing this prototype with the current technology employed by fire departments, which predominantly uses drones for surveillance purposes only, highlights the efficiency of this project.

One notable advantage of drones lies in their dynamic payloads, allowing for multiple equipment configurations based on user requirements. With adequate funding, further development of this prototype could involve the incorporation of thermal imaging and GPS modules, enabling autonomous fire detection and navigation through flames, eliminating the need for human control.

Expansion possibilities include integrating multiple drones through Flying Ad-Hoc Networks, forming an interconnected drone network or a swarm. This approach could address large-scale structural fires and wildfires, providing enhanced monitoring and firefighting coverage. Another potential enhancement involves using a high-grade extinguishing fuel, equipping the drone with a fire extinguishing bomb that outperforms many existing firefighting techniques when deployed into the fire. Utilizing such innovative solutions can alleviate the pressure on the drone and enhance firefighting effectiveness.

REFERENCES:

[1]. “Fire Fighting Drone”, Abinesh.D.V , Deepak.A.K, Chandraprakash.K, Gowtham.M, Ananthi. K Sri Krishna College of Engineering and Technology, International Journal of Innovative and Emerging Research in Engineering Volume 4, Special Issue 1, NCIAR2k17.

[2]. “Low Resolution Person Detection with a Moving Thermal Infrared Camera”, by HotSpot Classification Michael Teutsch1, Thomas M¨uller1, Marco Huber2, and J¨urgen Beyerer1 1Fraunhofer IOSB, Karlsruhe, Germany 2AGT International, Darmstadt, Germany {michael.teutsch, thomas.mueller, juergen.beyerer} @iosb.fraunhofer.de marco.huber@ieee.org, 2017

[3]. “Fire Detection and Human Behaviour”, B. B. PIGOTT Fire Research Station Borehamwood Herts WD6 2BL, UK.

[4]. https://www.dronefly.com/fire-fighting-drones-dronesin-feild-of-infographic

[5]. “Automatic CO2 Extinguisher Fire Fighting Drone”, by Ethara Bala Vyshnavi, Amareswari Ambati, Gorantla Chamundeswari, Garre Vineetha , Dr.Sk.Khamuruddeen, Faculty Dept.of ECE, in (IJERECE) Vol 4, Issue 12, December 2017

[6]. “Use of Fire-Extinguishing Balls for a Conceptual System of Drone-Assisted Wildfire Fighting”, Burchan Aydin, Emre Selvi, Jian Tao and Michael J. Starek, Published: 12 February 2019

[7]. An article on “ fire fighting drone using CO2 ball extinguisher” by Yuvraj Akhade, Akash Kasar, Anuja Honrao, nehal Girme in IJIRCCE vol. 5, issue 2, February 2017

[8]. http://dronenodes.com/firefighter-drones/

[9]. https://www.roboticsbuisnessreview.com/unmanned/firefighting-drones-aim-to-fly-higher-save-lives

ISBN: 978-81-965236-7-1

Applications of Artificial Intelligent and Internet of Things in Electric Vehicle Battery Management System

[1]Dr. B. Priya, [2]Dr. B. Prakash Ayyappan,

[1,2]Associate Professor, Department of EEE, Sri Bharathi Engineering College for Women, Pudukkottai, Tamilnadu.

[3]Ms. A. Gokulapraveena, [4]Ms. S. Sumithra

[3,4]Student, Department of EEE, Sri Bharathi Engineering College for Women, Pudukkottai, Tamilnadu.

[1]bpriyasivakumar@gmail.com, [2]bprakashayyappan@gmail.com

Abstract - **Batteries play a crucial role in electric vehicles, serving as the primary components responsible for the charging and discharging functions that supply power to the vehicle's motor. Without properly functioning batteries, an electric vehicle cannot operate efficiently. Variations in current and voltage have a direct impact on the battery system, making accurate predictions of these measurements challenging. The primary objective of this study is to observe and optimize Battery Energy Management Systems (BEMS) using the Internet of Things (IoT) and Artificial Intelligence (AI). The research also aims to explore effective strategies for managing batteries in electric cars. The choice of lithium-ion batteries is based on their higher energy density compared to conventional batteries. Given the costliness of batteries in electric vehicles, there is a significant opportunity to enhance predictions of Battery State of Health (SOH) and State of Charge (SOC) through AI-Powered Cloud Services, promoting cost-effectiveness and durability.The proposed system, driven by artificial intelligence and hosted on a cloud platform, has the capacity to adapt to evolving changes in battery health resulting from operational conditions. It continuously provides updated information to the battery management system, enabling it to make progressively improved management decisions. The neural network algorithm is implemented using a Python script, while Node-RED is employed for designing the user interface and login on the web server. In the realm of embedded devices, sensors, and mobile apps, the Internet of Things plays a significant role, and the MQTT protocol serves as a reasonably lightweight messaging solution.**

Keywords: Battery Management System, Electric Vehicle, Embedded System, Artificial Intelligent and Internet of Things.

I. Introduction

Implementing a Battery Management System (BMS) is crucial for monitoring battery life, charging and discharging processes, and overall system operation. Instruments used to measure physical quantities like temperature, electric current, and battery potential difference fall under this category. Analyzing these characteristics allows for the assessment of the battery's State of Charge (SOC) and State of Health (SOH). Ensuring the reliable and safe operation of lithium-ion batteries in electric vehicles requires the adoption of online monitoring and status assessment techniques. A battery monitoring system enables car owners and service providers to conveniently evaluate their vehicle's battery condition, regardless of location or time constraints. It allows for the timely identification and replacement of failing batteries before they impact others in the pack.The Battery Management System (BMS) supervises and controls individual cell attributes within the battery pack through continuous monitoring. The capacity of the battery pack can vary among cells, showing an upward trend as charging and discharging cycles increase. Advancements in notification system design have popularized the use of Internet of Things (IoT) technology in providing manufacturers and customers with real-time battery status information.

This proposed work is considered a recommended regular maintenance procedure, as suggested by manufacturers.Electric vehicles (EVs) have emerged as environmentally friendly transportation options, but their limited travel range, dependent on battery size and condition, remains a significant drawback. Monitoring the battery's condition is crucial for ensuring the safe and effective operation of EVs. The Internet of Things (IoT), offering real-time monitoring and remote device control, has gained attention across various industries, including automotive. Integrating IoT into EVs has the potential to enhance user satisfaction, improve battery performance, and increase efficiency.This paper proposes an IoT-based battery monitoring system tailored for electric vehicles, comprising battery sensors, a microprocessor, a wireless connection module, and a cloud server. Battery sensors collect voltage, current, and temperature data, transmitting it to the microcontroller. The microcontroller processes the data and sends it to the cloud server via the wireless connection module. Data is stored on the cloud server, allowing analysis to reveal information about the battery's condition. The suggested solution provides real-time monitoring, optimizing performance, and extending battery life. Additionally, the system's data can be utilized to forecast the remaining range of the EV, aiding drivers in route planning.

II. Methodology

The analysis is structured into three main categories: control system, battery monitoring system, and Internet of Things (IoT). In the IoT battery management system, real-time battery-related data, including voltage, current, and temperature, is promptly transmitted to the cloud during both charging and discharging processes. Subsequently, the system employs machine learning and artificial intelligence algorithms to analyze the data. If any battery malfunction or defect is detected, the driver or service provider is promptly notified. Figure 1 illustrates the overall processes.

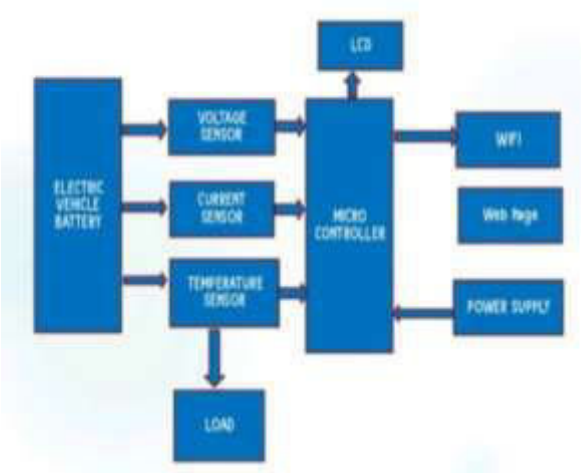


Fig.1. Block Diagram Representation

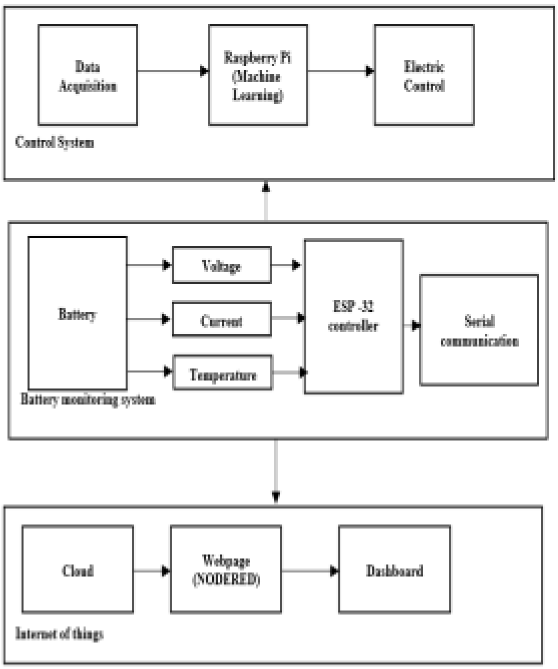


Fig.2. General Flow Diagram

Lithium-ion batteries are composed of one or more lithium-ion cells, along with a protective circuit board and additional components. When these cells are integrated into a device equipped with a safeguarded circuit board, they are commonly referred to as batteries. In the lithium-ion battery, the process involves the migration of lithium ions (Li+) from the cathode to the anode. Simultaneously, electrons exhibit migratory behavior in the external circuit, moving in the opposite direction. This electron movement generates the electrical current, powering the device. During discharge, the anode transports lithium ions to the cathode, facilitating an electron flow that contributes to powering the associated device.

III. Working Principle:

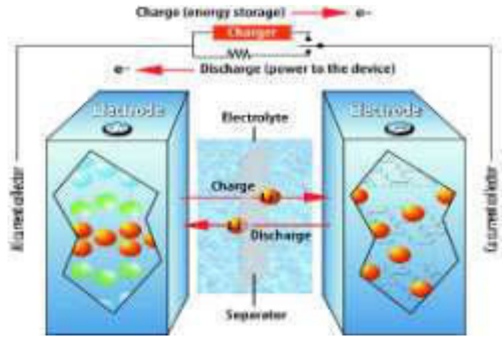


Fig. 3. Overview of Lithium-ion Battery

The operation of a rocking chair powered by lithium-ion batteries involves the conversion of chemical energy into electrical energy through redox reactions. Typically, a lithium-ion battery comprises two or more electrochemical cells that are electrically interconnected. During the charging of the battery, ions tend to migrate towards the anode, the negatively charged electrode. Upon complete discharge, lithium ions undergo a process of returning to the positive electrode, or cathode. This illustrates the reciprocal migration of lithium ions between the positive and negative electrodes during the charging and discharging process.Batteries are equipped with anode and cathode electrodes, where the cathode forms the positive terminal, and the anode forms the negative terminal.

The cathode in a lithium-ion battery primarily consists of a lithium emulsion, while the anode is predominantly composed of graphite. The movement of lithium ions within the battery occurs from the cathode to the anode, or from the positively charged electrode to the negatively charged electrode when the battery is electrically connected. This represents the charging process of the battery. During the discharge phase, lithium ions transfer from the anode to the cathode, corresponding to the movement of ions from the negative electrode to the positive electrode. This discharge process results in the generation of electrical energy.

IV. Sensors

This detector serves to calculate, cover, and determine voltage force. It can ascertain the presence of AC or DC voltage, offering the capability to take voltage as an input and provide switches, analog voltage signals, current signals, or audio signals as output.

ISBN: 978-81-965236-7-1

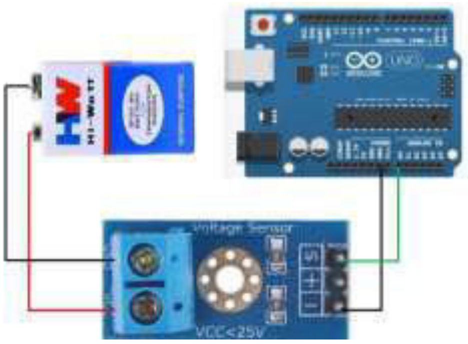


Fig.4. Voltage Sensor

Fig.5. Current Sensor

To measure the current flowing through a circuit, the ACS712 Current Sensor is employed as a detector, capable of detecting and quantifying the amount of current passing through the circuit.For device functionality, the ACS712 Current Sensor is crucial in accurately assessing current flow. In the context of physical processing, the Raspberry Pi, a Linux-based computer, features a set of GPIO (general-purpose input/output) pins. These pins enable the Raspberry Pi to both gather information about and manipulate electronic components. The ESP32, known as the Expressive Systems chip, is a significant component in this setup. It facilitates bidirectional Bluetooth and Wi-Fi connectivity for embedded devices. While manufacturers commonly refer to modules and development boards utilizing this technology as "ESP32," it's essential to recognize that ESP32 is fundamentally a chip.

Fig.6. ESP32 Chip

The Gated Recurrent Unit (GRU), a variation of the recurrent neural network (RNN), is utilized to address challenges associated with long-term memory and gradients during backpropagation. In comparison to the Long Short-Term Memory (LSTM), the GRU boasts a simpler structure with one fewer gate. Figure 7 illustrates the two gates in the GRU model: a reset gate and an update gate. This simplicity results in a model that requires fewer parameters, demands reduced computing power, and facilitates faster training. The reset gate manages the preservation of historical data, with a higher reset gate value indicating fewer disregards of past data. The update gate governs the integration of current and new input.The flow diagram depicted in Figure 7 highlights the effectiveness of GRU in handling large time series data.

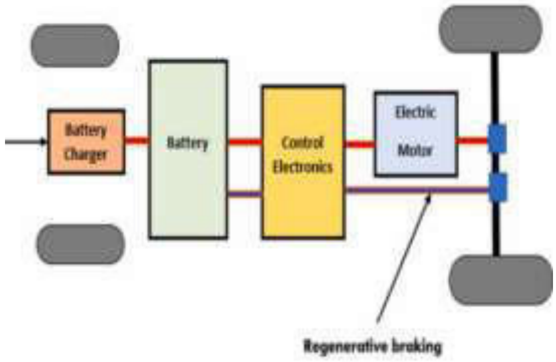


Fig.7. GRU Block Diagram

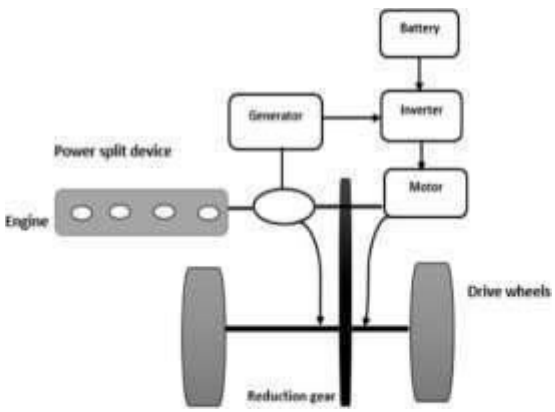


Fig.8. Architect of Electric Braking System

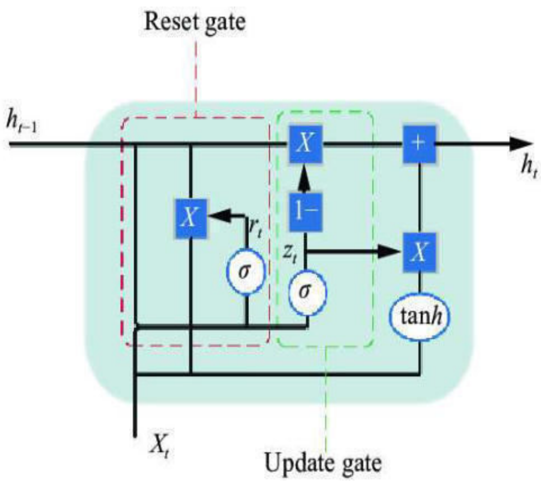


Fig.9. GRU Mathematical Representation

ISBN: 978-81-965236-7-1

The GRU design allows for the utilization of the same parameters at different time steps, making it well-suited for one-dimensional time series data from batteries, encompassing voltage, current, and temperature.Shifting focus to Long-Short-Term Memory (LSTM), the memory cell in the Hidden Layer plays a pivotal role as the foundational building block of the neural network. It characterizes the transient dynamics within a group of objects, underscoring the significance of memory in item categorization. Hidden Layer 1 reflects variants through the connections between memory cells and gates, while Hidden Layer 2 dictates the frequency of a cell's state updates. The output layer integrates an LSTM block, relying on LSTM architecture for the recognition of a battery system.

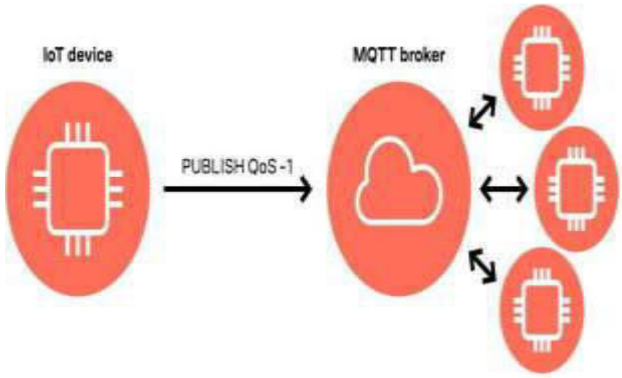


Fig.10. MQTT Cloud with IoT Device

Conclusion:

This research undertakes a thorough exploration of the battery management system, emphasizing two pivotal aspects: state of charge and state of health. The primary aim of this undertaking is to pinpoint the most cutting-edge AI technology applicable to battery management systems. Consequently, an exhaustive review of pertinent literature concerning these specific AI technologies is undertaken, with a special emphasis on the associated challenges. The selection of Li-ion batteries as the optimal energy storage solution for electric vehicles is driven by factors such as extended lifespan, diminished discharge rates, heightened efficiency, and superior power and energy densities. Our research focus is dedicated to scrutinizing and evaluating these crucial characteristics.To ensure the secure and dependable operation of batteries in electric vehicles, this study offers a comprehensive analysis of primary parameters and their respective roles in facilitating safe operation and the operational lifespan of a battery management system. These parameters are regularly updated on the webpage, and notifications are accessible on the dashboard. The IoT and artificial intelligence-based battery energy management system prove to be highly efficient.

References:

1. Yogesh Mahadik, Mohan Thakre and Sachin Kamble, "Electric Vehicle Monitoring System Based on Internet of Things (IoT) Technologies", book: IoT and Analytics for Sensor Networks, pp. 311-322, 2022.

2. H. Khayyam, B. Javadi, M. Jalili and R.N Jazar, "Artificial Intelligence and Internet of Things for Autonomous Vehicles", Nonlinear Approaches in Engineering Applications, 2019.

3. Z. Wang, M. Ogbodo, H. Huang, C. Qiu, M. Hisada and A. B. Abdallah, "AEBIS: AI-Enabled Blockchain-Based Electric Vehicle Integration System for Power Management in Smart Grid Platform", IEEE Access, vol. 8, pp. 226409-226421, 2020.

4. Shabana Urooj, Fadwa Alrowais, Yuvaraja Teekaraman, Hariprasath Manoharan and Ramya Kuppusamy, "IoT Based Electric Vehicle Application Using Boosting Algorithm for Smart Cities", Energies, vol. 1072, pp. 14, 2021.

5. Chitra, P. Sanjeevikumar, Jens Bo Holm-Nielsen and S. Himavathi, "IoT-Based Battery Management System for Hybrid Electric Vehicle", Artificial Intelligent Techniques for Electric and Hybrid Electric Vehicles, 2020.

6. Surendar and P. Pradeepa, "An IOT-based Battery Surveillance System For E-Vehicles", 2021 Fifth International Conference on I-SMAC, pp. 119-124, 2021.

7. Heba Yahia Youssef, Latifa Alkhaja, Hajar Almazrouei, Ali Bou Nassif, Chaouki Ghenai and Mohammad Al-Shabi, "A machine learning approach for state-of-charge estimation of Li-ion batteries", Artificial Intelligence and Machine Learning for MultiDomain Operations Applications IV, pp. 1211329, 2022.

8. Moin Ahmed, Yun Zheng, Anna Amine, Hamed Fathiannasab and Zhongwei Chen, "The role of artificial intelligence in the mass adoption of electric vehicles", Joule, vol. 5.9, pp. 2296-2322, 2021.

9. Phillip Kollmeyer, Carlos Vidal, Mina Naguib and Michael Skells, "LG 18650HG2 Li-ion Battery Data and Example Deep Neural Network xEV SOC Estimator Script", Mendeley Data V2, 2020.

10. Muhammad Nizam, Hari Maghfiroh, Rizal Abdulrozaq Rosadi and Kirana DU Kusumaputri, "Battery management system design (BMS) for lithium-ion batteries", AIP Conference Proceedings, vol. 2217.1, pp. 030157, 2020.

ISBN: 978-81-965236-7-1

11. Yong Feng, Zhenwei Cao, Weixiang Shen, Xinghuo Yu, Han Fengling, Rita Chen, et al., "Intelligent battery management for electric and hybrid electric vehicles: A survey", pp. 1436-1441, 2013.

12. R Ananthraj and Arnab Ghosh, "Battery Management System in Electric Vehicle", 4th Biennial International Conference on Nascent Technologies in Engineering (ICNTE), pp. 1-6, 2021.

13. Dayal Chandra Sati1, Satvir Singh, “IoT Based Battery Management System for Electric Vehicles Using LoRaWAN: A Review”, International Conference on Computing, Networks & Renewable Energy, 2021.

14. Dandge Vishal J, Bari Kunal, Kulkarni Mahesh. Nilam Ghuge, “IoT Based Battery Management System for Electric Vehicles”, International Conference on Communication and Information Processing, 2021.

15. Anjali Vekhande, Ashish Maske, “Iot-Based Battery Parameter Monitoring System For Electric Vehicle”,International JournalOf Creative Research Thoughts (IJERT),ISSN: 2320-2882, Vol, 8, Issue. 7, 2020.

ISBN: 978-81-965236-7-1

Important Strategy for Improving Stability of Perovskite for Fabricating High Efficiency Perovskite Thin Film Solar Cell Device

Mr. G. Shanmuganathan[1] and Mrs. R. Saratha[2]
[1,2]Assistant Professor, Department of Physics
Sri Bharathi Engineering College for Women
Kaikkurichi, Pudukkottai, Tamilnadu, India-622 303.
Corresponding Author: shangovinth@gmail.com

Abstract - **Metal halide perovskite is a promising material for next generation solar cell application due to their promising optical properties. Over the last few years, there are witnessed in high progress photo conversion efficiency (PCE). Till date, highest efficiency 25% is achieved. Here some potential strategy is giving in this present work like novel 2D MOF metal halide perovskite thin film is focused in this presented work. Moreover, two major challenged problems have found and analyzed. In this research work, 2D MOF, n-ZnO, p-CuO materials are used for retain stability, electron transport layer and hole transport layer respectively. Moreover, spray pyrolysis technique is used for making thin film fabrication. Therefore, we are used some potential strategies for fabricating wide area perovskite thin film, high stability and high photo conversion efficiency (PCE).Finally, future application is also discussed in the present work.**

Keywords: 2D-MOF, Perovskite, high stability, high efficiency, Spray Pyrolysis.

I. Introduction

The project is focused on fabricate metal halide Perovskite with 2D metal organic frame work for achieving high stability and efficiency for solar energy harvesting application. To date, Perovskite are one of the leading and peculiar candidates among the solar energy harvesting materials. Perovskite is a good player and sensational candidate in solar cell manufacturing industries. Moreover, Perovskite have promising potential strength such as wide range of band gap which can use absorb all spectrum and transfer its energy efficiently that it uses to make a highly efficient solar cell device. Besides, Perovskite are offering more and more advantages such as low cost and low temperature manufacturing process. The Perovskite materials can also be made cheaper and performed better than conventional device and manufacture at less than 200°C by solution and vapor deposition. So, very recently, Perovskite is strongly promoted to technologically for solar energy production. So far, the efficiency of Perovskite candidate rapidly increased from 3.8% to 25%.The pivot points of Perovskite is encouraged to make a highly power conversion efficiency solar cell. However, there are some challenging problems therefore the problems such as in stability, large area with high uniformity are not yet to be overcome. To eliminate these problems, to retain material stability, we have to use some potential strategies means that new kind of materials such as 2D metal organic framework (2D-MOF) will use as the protection layer on Perovskite layer for no loss efficiency. Therefore, metal halide Perovskite ABX_3 (A=Metal perovskite, B= Pb, X=I, Cl, Br), p-CuO (HTL), n-ZnO (ETL) and FTO, ITO will use as materials and substrates to fabricate 2D MOF metal halide Perovskite thin film**.**Therefore, let us considered a 2D metal organic framework (2D-MOF) on Perovskite layer to achieve stability to retain stability and efficiency. So, the new construction approach will be a blueprint for solar cell applications. Therefore, the research direction is 1.Material construction to improve stability with high efficiency, 2.Spray pyrolysis, 3.Stability Analysis, 4.Efficiency Measurement, 5.Device Fabricate. This research ideas work will demonstrate stability and efficiency of Perovskite.

ISBN: 978-81-965236-7-1

II. METHODOLOGY

Material and Coating Technique

This work focused on fabrication of 2D metal organic framework (MOF) metal halide Perovskite thin film for solar cell application. Simple spray pyrolysis can use to fabricate Perovskite thin film. Moreover, spray pyrolysis is an undoubtedly desirable and gifted technique to control the growth properties of the layers. Spray pyrolysis deposition offers more advantages to scalable fabrication, low cost in fabrication and uniform deposition over large areas. Therefore, undoubtedly, spray pyrolysis deposition will be potential technique to develop scalable device. In spray coating technique, Perovskite shows different photo conversion efficiency (PCE) according to substrate active area, example is 13.9 % (PCE) for 1 cm^2 (active area), 11.7% (PCE) for 3.8 cm^2, 15.5%for 5 cm^2 and remarkably 17.6%,18.26% and 19.19% for 1 cm^2. At research level, they attempt only preliminary level to reveal the photo conversion efficiency (PCE) based on the active area size or substrate size. Therefore, in this work, large active area thin film solar cell will fabricate by spray pyrolysis deposition. In this work, concentration of solutions will concentrate to fabricate uniform large area scalable Perovskite device with high stability. Therefore, 2D metal organic framework metal halide Perovskite thin film will fabricate based on given optimization parameters.FTO, Glass will use as substrate, Perovskite solution concentration and viscosity, Substrate temperature ,Nozzle diameter, Spray flow rate. Materials formula is ABX3 (A=Formamidinium (FA) , A= CH_3NH_3, B= $Pb2^+$, X=I, Cl, Br), 2D MOF (metal organic framework) and n-ZnO and p-CuO will use to fabricate scalable device.

III. Device fabrication

To fabricate scalable device, viscosity, solution concentration, floe rate and substrate temperature will strongly be promising factors for fabricating high quality 2D MOF perovskite thin film for solar cell application. Majorly, the parameters will be used to morphology and film uniform control that lead to fabricate high quality perovskite active layer, electron and hole transport layer. Therefore, spray pyrolysis technique is considering carefully for fabricating scalable perovskite thin film for solar cell application. Our major objective is to fabricate 2D MOF metal halide perovskite thin film for achieving high stability and photoconversion efficiency (PCE). Here, schematic illustration of 2D MOF metal halide perovskite thin film solar cell device in fig 1.

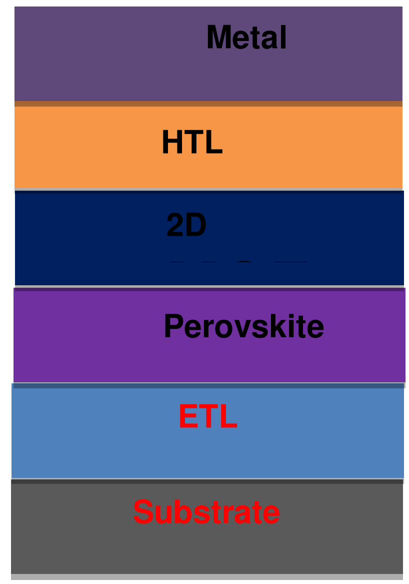


Fig.1.Schematic diagram of 2D-MOF Perovskite thin film.

The major strategy is, material construction is main one to achieve high stability and high efficiency Perovskite thin film device. To achieve high stability such potential materials are introduced here namely metal halide perovskite, 2D-MOF.Because,2D MOF helps to retain stability. Bearing these aims in mind, we turn our care to 2D MOF layer on metal halide perovskite for achieving high stability with no loss efficiency. There is no doubt that the new entrant material construction will offer prospects of captivation. Hence, due to these the present strategies, stability and efficiency can be improved.

IV. Conclusion

For future energy compromise, some important strategies which mean that potential candidates are introduced namely 2 dimension- metal organic frameworks (2D MOF) for achieving high stability Perovskite for solar energy harvesting device fabrication. The 2D MOF metal halide Perovskite device will play a remarkable role in material stability. The performance of this fabricate Perovskite

ISBN: 978-81-965236-7-1

will be a new mile stone in energy production. Therefore, the some main expected results are demonstrate positive contribution stability and energy efficiency, Identification suitable way to achieve stability and efficiency, Capture more light, Improve efficiency, stability at all levels, High efficiency than conventional, High stability than conventional, Working long time, working at moisture and other environmental conditions with no loss in stability and efficiency, Minimum degradation. Hence, the given strategy and potential candidates will be playing a important roll on Perovskite thin film solar cell device fabrication.

Reference:

1. Shindume Lomboleni Hamukwaya et al. A Review of Recent Developments in Preparation Methods for Large-Area Perovskite Solar Cells, Coatings 2022, 12, 252. https://doi.org/10.3390/coatings12020252.

2. Zhichun Yang et al. Research progress on large-area perovskite thin films and solar Modules, J Materiomics 3 (2017) 231-244.

3. Samuel D. Stranks and Henry J. Snaith, Metal-halide perovskites for photovoltaic and light-emitting devices, NATURENANOTECHNOLOGY.

4. *Qi Wei et al.*Recent Progress in Metal Halide Perovskite Micro- and Nanolasers, *Adv. Optical Mater.* 2019, DOI: 10.1002/adom.201900080.

5. Achilleas Savva et al. Inverted Perovskite Photovoltaics Using Flame Spray PyrolysisSolution Based CuAlO2/Cu−O Hole-Selective Contact ,ACS Appl. Energy Mater. 2019, 2, 2276−2287.

6. T.M. Brenner, D.A. Egger, L. Kronik, G. Hodes, D. Cahen, Nat. Rev. Mater. 1, 15007 (2016).

7. E.M. Hutter, M.C. Gelvez-Rueda, A. Osherov, V. Bulovic, F.C. Grozema, S.D. Stranks, T.J. Savenije, Nat. Mater. 16, 115 (2017).

8. N.J. Jeon, J.H. Noh, Y.C. Kim, W.S. Yang, S. Ryu, S.I. Seok, Nat. Mater. 13, 897 (2014).

9. Y. Fu, F. Meng, M.B. Rowley, B.J. Thompson, M.J. Shearer, D. Ma, R.J. Hamers, J.C. Wright, S. Jin, J. Am. Chem. Soc. 137, 5810 (2015).

10. Y. Zhou, O.S. Game, S. Pang, N.P. Padture, J. Phys. Chem. Lett. 6, 4827 (2015).

ISBN: 978-81-965236-7-1

An Experimental study on total Replacement of fine aggregate with plastic waste and crusher dust in paver blocks

Dr.S.Thilagavathi[1]
Principal
Sri Bharathi Engineering College for Women
Pudukkottai – 622303, India
padmaraniramesh@gmail.com

R.Padma Rani[2]
Assistant Professor
Department of Civil Engineering
Sri Bharathi Engineering College for Women
Pudukkottai – 622303, India
flora.dennis7@gmail.com

Abstract
Recent urban infrastructure growth in India has led to an increase in the use of paved surfaces around buildings and along roads. Traditional concrete pavers are the most appropriate, affordable, and locally accessible material for this paving surface. As a result of increased industrialization and urbanisation, the Indian concrete industry must now satisfy the need for cost-effective and efficient building materials in order to meet the country's growing infrastructure demands. They are commonly used on sidewalks, garden paths, courtyard pavers, bus stop shelters, parking lots, and work spaces in industry. Increasing infrastructure development is concurrently accompanied by a rise in construction waste production. This project is comprised of three sets of concrete paver blocks cast using an M20 mix design. In the first batch of paver blocks, sand is completely replaced by crusher dust and plastic waste in proportions of 15%, 30%, and 45%; however, coarse aggregate is not utilized. In the second batch of paver blocks, sand is completely replaced by crusher dust and plastic waste in proportions of 15%, 30%, and 45%; however, coarse aggregates are still utilized. 7-day, 14-day, and 28-day tests were conducted on the compressive strength behaviour of paver block specimens. In addition to the compressive strength and water absorption tests, these blocks were also employed for the compressive strength test. Utilizing waste materials helps to address the problems of scarcity, reduction of disposal costs, low prices, and available quantity of construction materials. Safeguard the environment by lowering production costs and resolving the problem of building waste disposal.

Keywords: Paving surface, Paver block, Compressive Strength, waste disposal.

I. INTRODUCTION

For many years, concrete paving blocks have been widely employed in many nations as a problem-solving technology to supply pavement in locations where conventional forms of building are less durable due to several operational and environmental restrictions. Initially implemented in India's building industry several decades ago to meet a specific need (footpaths, parking lots, etc.), the technology is now being widely used in a variety of contexts where the fabrication of pavement utilizing bituminous combination or cementitious technology is neither possible nor desirable.

Large infrastructure demands owing to rising industrialization and urbanisation provide the greatest issue now facing the Indian concrete sector. Because of this, it is essential to utilise high-quality concrete that maximises strength, durability, and other desired concrete attributes while minimising the usage of resources like lime stone, energy, and money.

The aggregates needed to make conventional concrete blocks for sidewalks, highways, and airport runways have been depleted in recent years due to rising global demand. Since local supplies have been depleted by the massive quantities of aggregate previously used, the only option for filling the gap is to import resources from outside. Spoil heaps are an unpleasant reality in most cities, occupying valuable real estate that cannot be developed.

II. LITERATURE STUDY

In this article, researchers Sarang Shashikant Pawar and Shubhankar Anant Bujone present their findings from an experiment with fly ash, plastic drooping strip, and plastic wire. The plastic bags used in the production of paver block concrete may be reduced, and the tensile qualities of the concrete itself can be improved by using recycled plastic. You may save money on paver blocks by mixing in some of this plastic and fly ash. The article reaches the conclusion that plastic may be used to enhance the qualities of concrete, making it a potential plastic reusing technique. Up to 40 percent less plastic might be produced utilising recycled plastic in paving blocks. The boost in power might go as high as 35 percent. Shanmugavalli, Gowtham, Jeba, Nalwin, and Eswara Moorthy explains that the goal of the initiative is to make paver blocks cheaper by using recycled plastic instead of cement. In this study, they combined plastic trash with stone dust, coarse aggregate, and ceramic trash in varying percentages. There may be financial and environmental benefits to using plastic trash in cement production. Tests indicate that polyethylene terephthalate may be recycled into plastic paver blocks by combining it with 50% quarry dust and 25% fly ash.

To make the concrete, we employed three different aggregate replacement rates: 10%, 20%, and 30% by weight. Over 150 degrees heat is used to melt plastic trash

ISBN: 978-81-965236-7-1

in this process. 215mm*115mm*6mm plastic paving blocks.Peak Maximum load at fracture was measured, and crushing strength was then determined. Recycling plastic into paver blocks is an effective method of disposing of unwanted plastic. Compared to concrete paver block, the price of paver block is more reasonable. It is suitable for usage in areas with low traffic volumes or on roads that see minimal foot and vehicle volume. One more seeks to investigate substituting plastic waste for cement in the production of paving blocks.

The focus of this research is on polyethylene terephthalate-based polymers. Waste plastic is transported to a melting facility, where it is combined with other materials, such as fly ash and stone dust (weighted at 25% PET, 25% fly ash, and 40-50% quarry dust, accordingly). Improvements in recycling practises have allowed paver blocks to use waste materials as a primary component, cutting down on environmental pollution while making the most of available materials. Cement manufacturing is a major contributor to climate change because of the carbon dioxide (CO2) emissions. The usage of cement may be reduced, saving the planet. Plastic paver blocks made from 50% dust and 25% fly ash may be recycled from PET. PPB-2, with its 30% PET content, 25% fly ash, and 45% quarry dust, is the most powerful of the tested mixtures. Based on the findings, this research concludes that waste material (Quarry dust, Fly ash, and PET) may be utilised as key constitutions in the production of paver blocks with improved durability. The authors (Nivetha C. and Rubiya M.)

The aggregates were replaced at 10, 20, and 30% of their original weight in the concrete mix. Including post-consumer plastic trash in concrete not only provides a secure means of disposing of this material, but it also has the potential to enhance the concrete's mechanical properties, chemical resistance, drying shrinkage, and creep qualities. Given that the amount of aggregate in concrete is between 60 and 70, it is calculated that using 20% Recycled plastic material in concrete, which does not alter the characteristics of concrete, is feasible. The plastic can replace up to 20% of the coarse aggregate by weight in a concrete mixture. By replacing some of the water in the concrete with plastic, we can cut the weight of each cube by 15 percent. Their research led them to the conclusion that using Recycled plastic aggregate in concrete is the most effective method of disposing of plastic, which in turn helps to lessen environmental degradation caused by trash.

A. Materials Study:

Cement: Paving blocks are made with cement that meets the standards set out by the Indian Standard (IS) as either good mechanical properties ordinary Portland

cement (IS: 8112) or Portland Pozzolana cement (IS: 1489).

Polyvinylchloride: After polyethylene and polypropylene, polyvinyl chloride (abbreviated PVC) is the synthetic plastic polymer that is mass-produced in the third largest quantity worldwide. There are two primary types of PVC, rigid and flexible.

Rigid PVC is used for piping and profiles like those seen in doors and windows. Bottles, non-food packaging, and greeting cards are additional common uses for it. The most common type of plasticizer utilised is a phthalate, which makes the material softer and more flexible. As a rubber substitute, it finds widespread usage in these forms, as well as in the plumbing, electrical wire insulation, imitation leather, signs, phonograph records, and inflatable product industries. Polyvinyl chloride in its purest form looks like a white, crumbly solid. While it doesn't dissolve in booze, tetrahydrofuran is a little more forgiving.

TABLE 1 - PROPERTIES OF LDPE

Si No	Particulars	Value
1	Melting point	150°
2	Thermal coefficient of expansion	100-200X10^{-6}
3	Density	0.910-0.940
4	Tensile strength	0.20-0.40(N/mm^2)

Quarry dust : An often-observed by-product of the mining and quarrying industry is crusher dust. Crusher dust, which contains tiny particles like soft sand, may be used as a filler and filling material around water tanks, and it can be used with natural sands to increase the durability of the concrete and decrease the amount of water needed to set the concrete. Rock is broken down in state-of-the-art crushing machines to generate crushed sand with a particle size smaller than 4.75 millimeters. Quarry fines are a byproduct of stone cutting and processed in a nearby quarry.

TABLE 2-PROPERTIES OF QUARRY DUST

SLNo	Description	Value
1	Specific gravity	2.62
2	Grading zone	Zone II of soil
3	Fineness modulus	2.952
4	Water absorption	1.80

ISBN: 978-81-965236-7-1

TABLE 3- MIX PROPORTION FOR PAVER BLOCKS

Material	Percentage of Replacement of Fine aggregate used		
PVC powder	15%	30%	45%
Crusher dust	85%	70%	55%

Fig. 1.Images of PVC powder & Quartz sand

III MIXING AND CASTING TECHNIQUES

Mixing concrete is simply defined as the "complete blending of the materials which are required for the production of a homogeneous concrete". The moulds for making concrete paver block specimen were of 130*130*70mm in size, conforming to IS 15658:2006. All the materials were mixed by means of weigh batching in the pan and the concrete was filled in the moulds. The moulds were compacted by using table vibrator in order to avoid air voids in the concrete paver blocks.

Fig. 2. Mixing and Mould for Paver Blocks

A. COMPRESSIVE STRENGTH AND WATER ABSORPTION

The sample should be dried in a 50 °C oven at a low humidity until its bulk is somewhat stable. If the item is too hot to touch, it must be cooled to room temperature before its weight may be taken. For 24 hours at 27 °C rehydrate a thoroughly dry specimen in clean water. Taking the item out of the water, wiping off any remaining moisture with a wet cloth, and then weighing it is the standard procedure.

Fig. 3. Testing of Specimen

TABLE 4- COMPRESSIVE STRENGTH

Pavement block	Compressive strength-Conventional (MPa)	Compressive strength-Without Coarse Aggregate (MPa)			Compressive strength-with coarse aggregate (MPa)		
		15%	30%	45%	15%	30%	45%
7days	33.8	30.96	38.2	45.8	55.73	55.96	56.02
14days	36.4	30.4	35.4	39.2	55.97	57.84	57.91
28days	42.8	34.4	36.24	42.44	56.96	57.88	58.56

Low permeability, especially in regards to freezing and thawing, is a crucial feature of high-quality concrete. Low-permeability concrete is more impervious to water and hence less vulnerable to the damaging effects of temperature swings caused by freezing and thawing. Water can seep through the aggregate and into the cement paste.Drying a specimen to a consistent weight, weighing it, submerging it in water for a certain length of time, and measuring it again are all part of the standard test method for concrete pavers. Weight gain is expressed as a percentage of starting weight (in percent). No sample's average absorption rate may exceed 5%, and no single unit's absorption rate may exceed 7%.

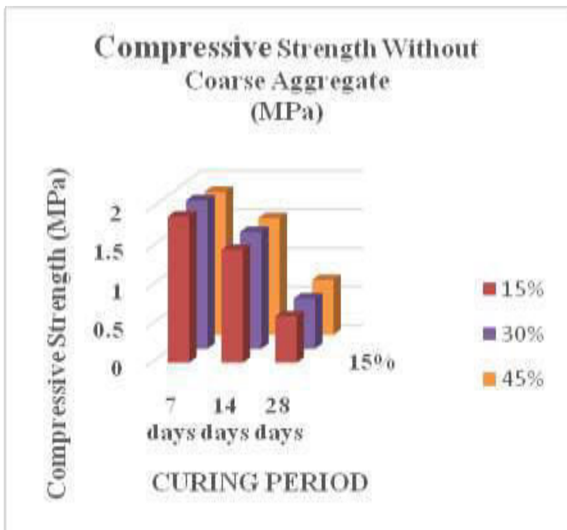


Fig.4.Compressive strength of Paver block without coarse aggregate

ISBN: 978-81-965236-7-1

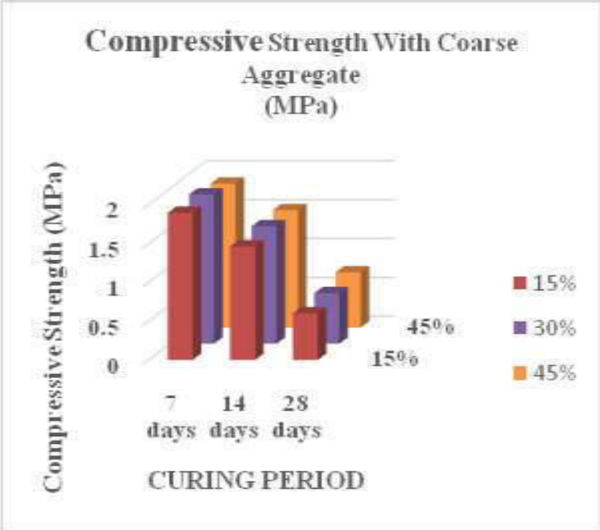


Fig.5.Compressive strength of Paver block with coarse aggregate

TABLE 5- WATER ABSORPTION OF PAVER BLOCKS

Pavement block	Water Absorption-Conventional (%)	Water Absorption-Without Coarse Aggregate (%)			Water Absorption-with coarse aggregate (%)		
		15 %	30 %	45 %	15 %	30 %	45 %
7days	2	1.6	1.27	0.61	1.89	1.46	0.60
14days	0.89	1.33	0.96	0.57	1.92	1.51	0.65
28days	0.40	1.2	0.94	0.53	1.85	1.51	0.71

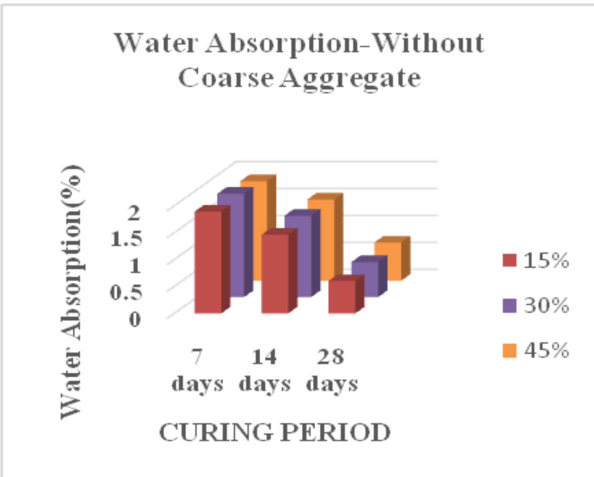


Fig.6.Water Absorption of Paver block without coarse aggregate

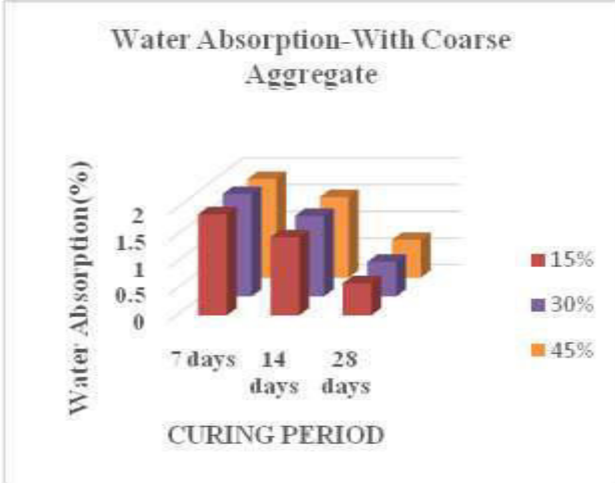


Fig.7.Water Absorption of Paver block with coarse aggregate

IV. CONCLUSION AND RECOMMENDATIONS

- Pavement block without coarse aggregate attains maximum compressive strength of 42.44MPa at 45% replacement of PVC powder and crusher dust at 28 days.
- But the paver block with coarse aggregate attains compressive strength value of 55.73MPa at 15% replacement of PVC powder and crusher dust at 7 days.
- If the replacing content increases the compressive strength with increase in curing period and reach maximum compressive strength 58.56Mpa at 28days with 45% replacement.
- But the water absorption value decreases with increase in addition of PVC powder and crusher dust. Paver block with coarse aggregate gives better water absorption properties than pavement block without coarse aggregate
- The only major limitation is the decrease in workability which can be overcome by the use of flyash or chemical admixtures such as superplasticizers which give high workability at the same water contents.
- To make PVC blocks more accessible and affordable, the use of pozzolanic materials and rubber crump is required.
- Excellent mechanical behaviour is seen after addition of waste materials in PVC blocks. Hence, the development of PVC blocks has to be evaluated using more affordable and readily accessible.

ISBN: 978-81-965236-7-1

V. REFERENCES

1. Sarang Shashikant Pawar, Shubhankar Anant Bujone "Use of fly ash and plastic in paver block" International Research Journal of Engineering and Technology, Volume 04, Issue11,Nov2017.

2. B.Shanmugavalli, K.Gowtham, P.JebaNalwin, B. Eswara Moorthy " Reuse of plastic waste in paver blocks" International Journal of Engineering Research and Technology,Volume6,Issue02,February2017.

3. NivethaC, Rubiya.M, Shobana.S, Vaijayanthi.R, G.Viswanathan, R.Vasanthi"Production of plastic paver block from the solid waste" ARPN Journal of Engineering and Applied Sciences, Volume11, Issue2, January2016.

4. GaneshTapkire, Satishparihar, PramodPatil, HemrajRKumavat "Recycled plastic used in concrete paver block" International Journal of Research in Engineering and Technology, Volume03, Issue09, June2014.

5. Poonam Sharma, Manoj Sharma " Utilisation of quarry dust in cement concrete paver blocks for rural roads" International Research Journal of Advanced Engineering and Science,Volume2,Issue1,2017.

6. Vishal kumar, Dr.A.K.Mishra "Utilisation of waste material in concrete paver blocks: A Review" International Journal for Research in Applied Science and Engineering Technology, Volume4, IssueIV, April2016.

7. MustafaM.Al-Tayeb, Hanafi Ismail, Osama Dawoud, SulaimanR.Wafi, Ismail Al Daoor" Ultimate failure resistance of concrete with partial replacements of sand by waste plastic of vehicles under impact load" International Journal of Sustainable Built Environment.

8. J.Thorneycroft, J.Orr, P.Savoikar, R.J.Ball "Performance of structural concrete with recycled plastic waste as a partial replacement for sand" Construction and Building materials.

9. Gireesh Mailar, Sujay Raghavendra, Sreedhara B.M, Manu D.S, Parameshwar Hiremath, Jayakesh.K "Investigation of concrete produced using recycled aluminium dross for hot weather oncreting conditions".

10. Ashwini MajunathB.T "Partial replacement of Eplastic as coarse aggregate in concrete" International conference on Solid waste management.

11. Dinesh.S, Dinesh.A, Kirubakaran.K "Utilisation of waste plastic in manufacturing of Brick sand paver blocks" International Journal of Applied Engineering Research, Volume 11, Issue3, 2016.

12. IS.383.1970, IndianStandard–Specification for Coarse and Fine Aggregates from Natural Sources for Concrete.

- IS.1237.2012, Indian Standard Cement Concrete Flooring Tiles Specification.
- IS.9103.1999, Indian Standard Concrete Admixtures-Specification.
- IS.10262.2009,Indian Standard Concrete Mix Proportioning- Guidelines.
- IS.12269.1987, Indian Standard Ordinary Portland Cement, 53Grade-Specification.
- IS.15658.2006, Indian Standard Precast Concrete Blocks For Paving-Specifications.

ISBN: 978-81-965236-7-1

Artificial Intelligence System for Crop Protection Against Wild Animals.

G.Gopperumdevi[1],AP/ECE, Dr.AmbujamKathan[2],Prof/ECE, Mrs.M.Sathya[3], AP/ECE
Sri Bharathi Engineering College for Women, Kaikurichi, Pudukkottai.

Abstract **-India is a nation dependent upon agriculture. Improving the efficiency and quality of agro-based goods, therefore, is very critical because crop forms are many times damaged by animals like buffaloes, cows, goats, birds, and wild elephants. This causes major losses for the farmers. To overcome these problems, an animal detection system has been designed to detect the presence of the animals and it offers a warning and diverts the animal without any harm. The designed system will continuously check for any animal to enter the field. PIR sensors are used in this project to detect animal movement and to give a signal to the controller. Further, the animals are being diverted by generating sound signals, and this signal is being transmitted to IoT. The complete safety of crops was ensured by this system from animals thus protecting the farmer's loss.**

1. INTRODUCTION

India is an agrarian region. Agriculture has perpetually been India's most significant economic sector. While most of India's population is dependent on agriculture, the farmers still experience many issues. Overpopulation takes place through deforestation this outcome in a shortage of food water and shelter in forest areas. So, animals' interference in residential areas is growing day by day which disturbs human life and property causing human-animal conflict as per nature's law every single living creature on this earth has a key role in the ecosystem. Agriculture is the strength of the economy but because of animal interference in agricultural lands, there will be a massive loss of crops. The developed system will not harmful and injurious to an animal as well as human beings. The theme of the project is to design an intelligent security system for farm protection by using an embedded system.

2. LITERATURE SURVEY

1. Varshini B., Sushma –Describe microcontroller (Arduino UNO) is used for reading the inputs from PIR, soil moisture sensor, and smoke sensor. The GSM to a farmer when movement or smoke is detected.

2. Describe used IR and an ultrasonic sensor to detect the moment of the animal and send the signal to the controller it diverts the animal by producing sound and signals further, this signal is transmitted to GSM and which gives an alert to formers and forest department immediately.

3. Describe the system which will monitor the field that is at first it will detect intrusion around the field using the sensor, then the camera will capture the image processing and then take suitable action based on the type of the intruder.

4. Finally, send a notification to farm owner and forest officials using GSM, describe during night time the flashlight will be on and the message will be sent to the farmer. Whenever there is an attack by animals on crops in the agriculture field, this system detects sound produced by a buzzer and generates an SMS alert within sound in the field.

3. EXISTING SYSTEM

The existing systems mainly provide surveillance functionality. Also, these systems don't protect wild animals, especially in such an application area. They also need to take actions based the on the type of animal that tries to enter the area, as different methods are adopted to prevent different animals from entering such restricted areas. Also, the farmers resort to other methods by erecting human puppets and effigies on their farms, which is ineffective in warding off the wild animals, though is useful to some extent to ward off birds. The other commonly used methods by the farmers to prevent crop vandalization by animals include building physical barriers, use of electric fences and manual surveillance, and various exhaustive and dangerous methods.

Disadvantages

- A very low range of connectivity
- Data can't be accessed on time if there are any internet issues
- Weather dependent
- High cost
- Harmful to animals

ISBN: 978-81-965236-7-1

4. PROPOSED SYSTEM

In proposed system then checks for the number of PIR sensors that have gone HIGH, to automate the animal ward-off system discussed, we take a decision based on the number of sensors that have gone high. The motion detects then denotes an animal smaller in height such as a wild boar, deer, etc., and we immediately turn on the rotten egg spray unit, which helps to keep away the pigs. Similarly, if more than half or all of the employed PIR sensors have gone high it is naturally because of a huge animal such as the elephant which is another major threat to such farmlands, we initiate the electronic firecrackers to turn ON, the loud noise which in turn helps to ward off the bigger animals. Finally sends a notification to farm owner and forest officials.

BLOCK DIAGRAM

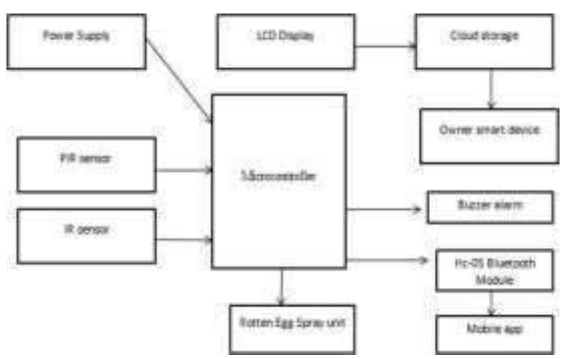


Fig:1 Block Diagram

WORKING ON THE SYSTEM

The system comprises a base station and a Wireless sensor node. A microcontroller acts as a base station. PIR, and IR sensors with associated signal conditioners attached to ATMEL 32-bit controller. Fig. 1 shows the block diagram of the system. In this project, we are measuring the vital parameters. The motion detects then denotes an animal smaller in height such as a wild boar, deer, etc., and we immediately turn on the rotten egg spray unit, which helps to keep away the pigs. Similarly, if more than half or all of the employed PIR sensors have gone high it is naturally because of a huge animal such as the elephant which is another major threat to such farmlands, we initiate the electronic firecrackers to turn ON, the loud noise which in turn helps to ward off the bigger animals Finally sends a notification to farm owner and forest officials using IoT.

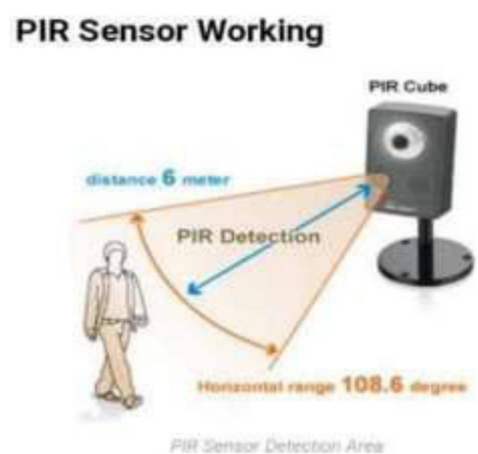
5. HARDWARE DESCRIPTION

5.1 AT Mel MICROCONTROLLER

The Atmel AVR® core combines a rich instruction set with 32 general-purpose working registers. All 32 registers are directly connected to the Arithmetic Logic Unit (ALU), allowing two independent registers to be accessed in a single instruction executed in one clock cycle. The resulting architecture is more code efficient while achieving throughputs up to ten times faster than conventional CISC microcontrollers. The ATmega328/P provides the following features: 32Kbytes of In-System Programmable Flash with Read-While-Write capabilities, 1Kbytes EEPROM, 2Kbytes SRAM, 23 general purpose I/O lines, 32 general purpose working registers, Real Time Counter (RTC), three flexible Timer/Counters with compare modes and PWM, 1 serial programmable USARTs, 1 byte-oriented 2-wire Serial Interface (I2C), a 6- channel 10- bit ADC (8 channels in TQFP and QFN/MLF packages), a programmable Watchdog Timer with internal Oscillator, an SPI serial port, and six software selectable power saving modes.

5.2. PIR SENSOR

The electronic sensor is used to detect the movement of a human being within a certain range of the sensor or passive infrared sensor (approximately have an average value of 10m, but 5m to 12m is the actual detection range of the sensor). Whenever a human being (even a warm body or object with some temperature) passes through the field of view of the PIR sensor, then it detects the infrared radiation emitted by a hot body motion. Thus, the infrared radiation detected by the sensor generates an electrical signal that can be used to activate an alert system or buzzer, or alarm sound.



ISBN: 978-81-965236-7-1

5.6. BUZZER

A buzzer is a mechanical, electromechanical, magnetic, electromagnetic, piezoelectric audio signaling device. A piezoelectric buzzer can be driven by an oscillating electronic circuit or with other audio signal sources. A click or beep can indicate that a button has been pressed. There are several different kinds of buzzers which are based on their sound levels. The common sizes for Sound levels are 80 dB, 85 dB, etc.

6. RESULTS

The implemented system was tested efficiently and tested for proper working. The initialization of the IOTand working of the sensors was verified. Messages were obtained after each alert and corresponding data was uploaded to the cloud storage. The buzzer and sprinkler also worked efficiently.

7. CONCLUSION

Encounter severe threats in rural parts of India like damage done by birds and animals. Hence, to overcome this issue we have designed a system in which sound is played to scare the animals and birds so that they will automatically run away. The GSM module makes a call to the farmer to alert him.

Therefore, the designed system is affordable and useful to the farmers. The designed system won't be harmful to animals and people, and it protects the farm areas.

8. FUTURE SCOPE

A Voice announcement system can be added to indicate the Status of a device. If we can add a voice announcement system with the buzzer and call alert so if there are hazardous parameters then that problem is easily detected then accordingly respective voice message will be announced.

REFERENCES

[1] Varshini B.M, Sushma A.V, "SMART CROP PROTECTION USING ARDUINO", in International Advanced Research Journal in Science, Engineering and Technology Vol. 8, Issue 7, July 2021, DOI: 0.17148.

[2] Vikram. B, Revathi. B, Shanmugapriya. R, Sowmiya.S, Pragadeeswaran. G"Animal Detection System in Farm Areas", in International Journal of Advanced Research in Computer and Communication Engineering Vol. 6, Issue 3, March 2017.

[3] Prajna. P, Soujanya B.S, Mrs. Divya "IoT-based Wild Animal Intrusion Detection System" in International Journal of Engineering Research & Technology (IJERT), ICRTT - 2018 (Volume 06 - Issue 15).

[4] Mohit Korche, Sarthak Tokse, Shubham Shirbhate"Smart Crop Protection System"International Journal of Latest Engineering Science (IJLES)DOI: 10.51386/25816659/ijles-v4i4p101, July to August 2021.

[5] Mukesh Mahajan, Kiran Pa"Smart Crop Protection System from Animals using PIC"International Journal of Scientific Research in Science, Engineering and Technology, 2020.

ISBN: 978-81-965236-7-1

Mathematical Modeling Of Digitally Controlled RF Self-Interference Canceller for Full-Duplex Transceiver

[1]K.A.Muthulakshmi,[2]R.Yogeshwari,[3]V.Nithyapoorani
[1,2,3]Assistant Professor
Department of Electronics and Communication Engineering,
Sri Bharathi Engineering College for Women,Pudukkottai Dist.

***Abstract*—The mobile communications systems revolution the way in which the people communicate with each other. Nowadays Wide range of telecommunication services including advanced mobile services supported by mobile and fixed networks, which are increasingly packet based, along with a support for low to high mobility applications and wide range of data rates for multiuser environment are provided by 4G wireless standard LTE (Long Term Evolution). For the next generations of wireless technology will be required to achieve as much as a thousand-fold throughput increase over the current 4G systems. This can be achieved through different physical layer techniques such as a use of massive number of antennas and the use of centimeter and millimeter wave spectrum among others. In addition to this, more sophisticated transceiver architecture is required to increase the throughput with the physical layer techniques. In band full duplex technology will double the spectral efficiency. This transceiver architecture will help to reduce the demand from applications such as machine to machine communications called Internet of Things (IoT). To simulate the full duplex transceiver architecture using XILINX ISE 14.7. The simulated results produces increased throughput with reduced delay.**

***Keywords*—5G, FDD, LTE, In-band full duplex transceiver, IoT, Peak service rate, digital self-interference cancellation, spectrum efficiency, throughput, VLSI signal processing**

I. INTRODUCTION

The wireless cellular networks of 4G LTE technologies are having great communicational technologies globally. Most of the devices communicate each other via broadband wireless networks because of the advantages of wireless connectivity. This will helps to motivate the major manufacturers and mobile network operators for the development of LTE and LTE-Advanced standards. The road map from LTE to LTE-Advanced is illustrated in Fig.1.

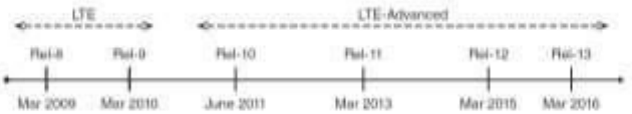


Fig.1. Road map from LTE to LTE Advanced

Signal processing is the most important role in the wireless technology. There are more number of signal processing techniques will be used in next wireless technology of 5G in order to increase the peak service rates, and also greatly increasing capacity, coverage, compatibility, reliability, convergence and efficiency in terms of both power and spectrum. In order to design the more sophisticated transceiver to increase the throughput, In-band full-duplex technology can be used to double the spectrum efficiency (bit/second/Hz) and it helps to reach the 5G standard with full potential [1].

The LTE-Advanced networks use cellular bands from 600 MHz to 3.5 GHz. The new frequency bands above 6 GHz (upto 100GHz) including the so called millimeter (mm) wave bands are expected in 5G. The standardization process for 5G is also expected to play a crucial role for the commercial success in the upcoming year [2].

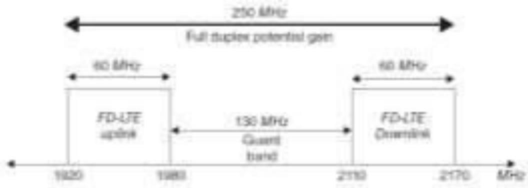


Fig.2. LTE FDD Spectrum Allocation

Full duplex means that “Bi-directional Communication”, the device can transmit and receive at the same time over the same frequency. This will be used in 5G to reuse radio resources simultaneously for access and backhaul. The implementation of full duplex is the self-interference (SI) signal (i.e.).the part of the transmitted signal that leaks into the receiver chain.

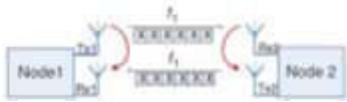


Fig.3. In-band full duplex

II. SELF-INTERFERENCE

The “Transmitter Leakage” that the signal leaks from the device transmitter to its own receiver. It will become an serious issues in decoding the desired signal, which could be noisy with a dramatically affected Signal-to-noise-ratio (SNR). In order to achieve the best performance of a full

ISBN: 978-81-965236-7-1

duplex system, the Self Interference (SI) signal has to be suppressed to reach the receiver's noise floor. There are several SI cancellation methods are described in the current scenario.

The unavoidable SI in the full duplex transceiver limits the throughput, when the transmitted signal couples back to the receiver. Even though the transmitted signal is known in the digital baseband, it cannot be eliminated completely in the receiver because of Radio Frequency (RF) impairments [3] and large power difference between the transmitted and received signals. Co-channel Interference is also a dominant issue than SI. So it is the most challenging task to realize the higher levels of SI cancellation as the required isolation bandwidth is greater and also cause multipath scattering. It is possible for SI cancellation with multi antenna in full band radio transceivers by the use of non linear adaptive SI cancellation algorithms.

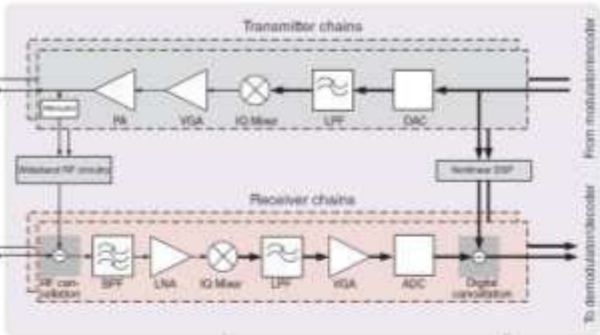


Fig.4. A multiantenna radio transceiver

III. DIGITAL SELF INTERFERENCE CANCELLATION ALGORITHMS

A. Signal Model

The baseband model of a communication link of a communication link with full duplex transceivers is shown in the Fig.1. It shows that the system includes bidirectional communication (source and destination are the same node). Here the full duplex transceiver acts as a relay link and it is simultaneously serving an uplink user and a downlink user in the same frequency band.

Where, A_s Source transmit antennas and A_D destination receive antennas. A_{tx} transmit antennas and A_{rx} receive antennas. These two antenna arrays are spatially separated and the model is applied to the single array design [4][5].

Equation (1) for the MIMO channels from the source to the transceiver.

$$H_{ST}[n] \in C^{A_{rx} \ X \ A_S} \tag{1}$$

Equation (2) for the MIMO channels from the transceiver to the destination.

$$H_{TD}[n] \in C^{A_D \ X \ A_{tx}} \tag{2}$$

At the time n, the source transmits signal vectors in Equation (3)

$$X_S[n] \in C^{\,A_S} \tag{3}$$

At the time n, the transceiver transmits signal vectors in Equation (4)

$$X_T[n] \in C^{\,A_{tx}} \tag{4}$$

While it simultaneously receives signal vector in Equation (5)

$$Y_T[n] \in C^{\,A_{rx}} \tag{5}$$

The output $Y_T[n]$ creates an unavoidable SI feedback loop from the transceiver output to the transceiver input through channel shown in Equation (6)

$$H_{TT}[n] \in C^{A_{rx} \ X \ A_{tx}} \tag{6}$$

Spatial interference suppression is provided by the precoding matrix $G_{tx}[n]$ and beamforming matrix $G_{rx}[n]$ and $A[n]$ is used to subtract the contribution of the transmitted signal form the received signal for the purpose of cancellation. The corresponding received signals in the transceiver and in the destination node can be expressed in Equations (7) and (8).

$$Y_T[n] = G_{rx}[n] * (H_{ST}[n] * X_S[n] + H_{TT}[n] * G_{tx}[n] * X_T[n]) + n_T[n] \tag{7}$$

$$Y_D[n] = H_{TD}[n] * G_{tx}[n] * X_T[n] + n_D[n] \tag{8}$$

Equations (9) and (10) are additive noise vectors in the transceiver and in the destination ($*\ refers\ to\ convolution$) .

$$n_T[n] \in C^{\,A_{rx}} \tag{9}$$

$$n_D[n] \in C^{\,A_D} \tag{10}$$

Here the signal is capable of modeling multipath MIMO channels in the time domain with arbitrary modulation.

B. Basic Principles

Digital cancellation techniques includes the SI signal is generated and then subtracted from the received signal. But here we can apply spatial suppression if transmitter and receiver antennas are spatially separated. This requires multiple antennas in both ends, at the transmitter side precoder is used and the receiver side beam former is used to simultaneously attenuate the SI signal and receive the payload signal. In order to attenuate the effect of RF imperfections RF beam former is used, because they pass through the same channel together with the known part of the SI signal.

This may cause interference in the system, to make a nearly interference–free system, the proper cancellation method is used for each application. When both transmit and receive sides of the full-duplex device behave primarily like a linear filter, cancellation can be reduced to designing a filter that identifies the SI channel, since the transmitted signal is known at every time instant. Any linear cancellation architecture cannot mitigate nonlinear behavior and noise sources, such as nonlinear distortion of the PA, I/Q imbalance during modulation/demodulation, phase noise, or quantization noise at the receiver [6][7][8][9]. So we use the nonlinear architecture for full duplex transceiver architecture. Here digital mitigation is performed in both the time domain and the frequency domain.

The mitigation in the frequency domain involves the processing of each subcarrier signal individually, which may cause the computational demand if the number of subcarriers

ISBN: 978-81-965236-7-1

is large. On the other hand, mitigation in the time domain involves processing the signal samples independently of the number of subcarriers, but, due to the different interference paths between antennas, requires gauging the delay spread of the SI channel [10]. Mitigation takes place after baseband demodulation and digital conversion of the received signal, usually being the first operation within the digital pipeline. As a result, the employed signal must be sampled above the Nyquist rate, which demands the use of special techniques to deal with arbitrary signal spectra [10].

C. Spatial suppression

Spatial-domain suppression [11] employs receive- and/or transmit-side feed forward filters, namely $G_{rx}[n]$ and $G_{tx}[n]$, which are matched to the SI channel alone without relying upon accurately knowing actual signals. This is in contrast to the feedback filters used in subtractive cancellation for generating an estimated copy of the SI signal from the imperfectly known transmitted signal. Nevertheless, spatial suppression can similarly mitigate SI; the pros and cons are weighed up next, when we compare the approach to time-domain cancellation.

In principle, suppression works by employing beam forming filters that direct reception and/or transmission of the signal of interest to the null space of the SI channel such that signal propagation is ideally blocked completely or, if the spatial degrees-of-freedom are scarce, to the weakest Eigen modes thereof such that the effective gain of the residual feedback channel is minimized. Mathematically this means solving in terms of some suitable matrix as in Equation (11)

$$\min ||G_{rx}[n] * H_{TT}[n] * G_{tx}[n]|| \xrightarrow{ideally} G_{rx}[n] * H_{TT}[n] * G_{tx}[n] = 0 \qquad (11)$$

Such a mitigation approach is therefore applicable only with multi-antenna transceivers, and having low rank in the SI channel can boost suppression performance significantly. Likewise, beamforming always consumes the degrees-of-freedom, restricting the trade-off between spatial diversity and multiplexing in the signals of interest, which can be seen as reducing the effective number of antennas used for data transmission if suppression is implemented transparently around actual en/decoding blocks. Suppression is also obviously sensitive to estimation error in feedback channel-state information, not so unlike cancellation. However, the residual interference signal is not linearly proportional to the error term or its gain level because estimation error manifests itself as distorted beam patterns.

The main benefit of suppression over cancellation is the fact that it mitigates blindly all signal, distortion and noise components that pass through the loopback SI channel. Such a receive filter satisfies the Equation (12)

$$\min ||G_{rx}[n] * H_{TT}[n]|| \xrightarrow{ideally} G_{rx}[n] * H_{TT}[n] = 0 \qquad (12)$$

This means that all the adverse transmit-side components caused by non-linear RF imperfections are suppressed at the receiver side together with the linear signal components, no matter how large the transmitter's EVM is Yet suppression is achieved with simple linear digital signal processing without any need for modeling or implementing complex transceiver electronics, in contrast to analog or non-linear digital cancellation. Transmit-side beam forming will conversely suppress SI on-the-air before it even reaches the receiver front end such that problems related to limited ADC dynamic range and quantization noise are alleviated. In Equation (13)

$$\min || H_{TT}[n] * G_{tx}[n]|| \xrightarrow{ideally} H_{TT}[n] * G_{tx}[n] = 0 \qquad (13)$$

Thus it is also beneficial to employ spatial-domain suppression together with linear time-domain cancellation such that the latter efficiently eliminates the linear signal components and then takes care of the residual non-linear distortion components in an economic way.

IV. NONLINEAR CANCELLATION

The different RF impairments distort the observed SI signal such that it is no longer a linear transformation of the original TX signal. This means that nonlinear modeling is required to fully grasp the effects of the effective SI propagation channel, which includes various sources of nonlinear distortion. Nonlinear effects, such as amplifier distortion or mixer nonlinearities, can be accurately modeled using polynomial-based systems [12, 13, 14], whereas I/Q imbalance can be modeled using widely linear filters [24], which have been extensively studied in the literature.

As a starting point, the baseband signal of TX j (j = 1, 2,. . . , N_{tx}) is denoted by x_j (n). The first component distorting the TX signal is the I/Q modulator, [14] which will inherently introduce some I/Q imbalance. The output signal of the I/Q modulator model (using a frequency-independent model for simplicity) is in Equation (14)

$$x_j^{IQM}(n) = k_{1,j}\, x_j(n) + k_{2,j}\, x_j^*(n) \qquad (14)$$

$$k_{1,j} = 1/2(1 + g_j \exp(j\varphi_j)) \qquad (15)$$

$$k_{2,j} = 1/2(1 - g_j \exp(j\varphi_j)) \qquad (16)$$

where g_j , φ_j are the gain and phase imbalance parameters of TX j. Notice that for any practical TX front end $|K_{1,j}| \gg |K_{2,j}|$. The strength of the induced I/Q image component, represented by the conjugated signal term in Equation (14), is typically characterized with the image rejection ratio as $10\, log_{10}\, (|K_{1,j}|^2/|K_{2,j}|^2)$.

The output signal of I/Q modulator is then fed to the TX PA, which will further distort it. A common approach is to use polynomials to model the nonlinear distortion produced by the PA. In brief, polynomial-based systems model nonlinearities by processing higher-order terms of the input signal. Typically, a parallel Hammerstein (PH) model with polynomial branch nonlinearities and FIR branch filters is assumed for the PA. Using the PH model, the output signal of the PA can be written as in Equation (17).

$$x_j^{PA}(n) = \sum_{\substack{P=1 \\ P\ odd}}^{P} \sum_{m=0}^{M} h_{p,j}(m)\varphi_p\, (x_j^{IQM}(n-m)) \qquad (17)$$

where M and P denote the memory depth and nonlinearity order of the PH model, $h_{p,j}(m)$ denote the FIR

ISBN: 978-81-965236-7-1

filter impulse responses of the PH branches for TX j, and the basis functions are defined as in Equation (18).

$$\varphi_p\big(x(n)\big) = |x(n)|^{p-1}x(n) = x(n)^{\frac{p+1}{2}}x^*(n)^{\frac{p-1}{2}} \qquad (18)$$

In general, the number of parameters of a Hammerstein model grows linearly with order P, while in the MIMO case, the increase is also relative to the number of TX and RX antennas [14]. The PH nonlinearity is a widely used nonlinear model for direct as well as inverse modeling of PAs and has been observed, through RF measurements, to characterize the operation of various PAs in an accurate manner [15].

Using Equation [14] and [17], the overall output signal of the TX can be expressed as

$$x_j^{PA}(n) = \sum_{\substack{P=1 \\ P\ odd}}^{P} \sum_{m=0}^{M} h_{p,j}(m)\varphi_p\,(x_j^{IQM}(n-m)) \qquad (17)$$

1.4 Layer Mapping

The Layer mapping process maps the complex valued modulation symbols onto each layer used for transmission. Two layers are used to carry modulated transmit code words with transmit diversity. Transmit diversity is used to separate one source signal into two or more independent signals. The use of transmit diversity is implied when using DCI format 1A [6].

1.5 Pre Coding

The vectors x(i)= $[x^{(0)}(i) \ldots x^{(v-1)}(i)]^T$,i= 0,1,…..,$M_{symb}^{layer} - 1$ is the input block of the precoder from the Layer mapping and generates a block of vectors y(i) = $[\ldots y^{(P)}(i) \ldots]^T$, i = 0,1,…..,$M_{symb}^{ap} - 1$ to be mapped onto resources on each of the antenna ports, where $y^{(P)}(i)$ repersents the signal for antenna port p.

1.6 Mapping to Resource Elements

The RE mapping process maps complex-valued modulation symbols for each antenna port to corresponding REs on resource grids. All REs are mapped in terms of Resource Element Groups (REGs)[8]. Every four REs available for mapping L1/L2 control signals forms a REG. Each REG is mapped with a symbol quadruplet which consists of 4 complex-valued symbols. This mapping method is used to support transmit diversity.

2.PCFICH Receiver

The receiver part of the PCFICH from the channel including the reverse process of transmitter part block and get the original CFI value are discussed below.

2.1 Layer Demapping and Deprecoding

The layer demapping and deprecoding returns the block of symbols d_i. After layer mapping and precoding$r_i^{(p)}$, where p is the antenna port index, the process is according to Equation 1 and 2.

$$d_{2i} = \mathrm{Re}(a_i^0) + \mathrm{Im}(b_i^0)\cdot j \text{ for } i = 0,\ldots,\tfrac{N}{2}-1 \qquad (1)$$

$$d_{2i+1} = \mathrm{Re}(a_i^1) + \mathrm{Im}(b_i^1)\cdot j \text{ for } i = 0,\ldots,\tfrac{N}{2}-1 \qquad (2)$$

where N is the length of input complex-valued symbols and $a_i^{(p)}$ and $b_i^{(p)}$are generated according to Equation 3, 4,5and 6.

$$a_i^0 = r_{2i}^{(0)} + r_{2i+1}^{(1)}\ for i = 0,\ldots,\tfrac{N}{2}-1 \qquad (3)$$

$$a_i^1 = r_{2i}^{(1)} - r_{2i+1}^{(0)}\ for i = 0,\ldots,\tfrac{N}{2}-1 \qquad (4)$$

$$b_i^0 = r_{2i}^{(0)} - r_{2i+1}^{(1)}\ for i = 0,\ldots,\tfrac{N}{2}-1 \qquad (5)$$

$$b_i^1 = r_{2i}^{(1)} + r_{2i+1}^{(0)}\ for i = 0,\ldots,\tfrac{N}{2}-1 \qquad (6)$$

2.2 Demodulation

The BPSK demodulation generates a block of bits $\beta_i for i = 0,1,\ldots,N-1$ where N is the length of input block of symbols d_i. The BPSK demodulation process is according to Table III

TABLE III BPSK demodulation lookup table

d_i	β_i
$1+1i$	0
$-1-1i$	1
0	0

The QPSK demodulation generates a block of bits $\beta_i for i = 0,1,\ldots,2N-1$, where N is the length of input block of symbols d_i[11].The process has hard decision type and soft decision type. The hard decision process returns the bit sequence with value 0 or 1 and is used for PCIFCH demodulation. The hard decision process is done according to Table IV.

Table IV Hard decision QPSK demodulation

Re(d_i)	Im(d_i)	b_i , b_{i+1}
≥ 0	≥ 0	00
≥ 0	< 0	01
< 0	≥ 0	10
< 0	< 0	11

ISBN: 978-81-965236-7-1

2.3 Descrambling

The descrambling process is the reverse of scrambling process which returns the unscrambledbit sequence b_i from scrambled bit sequence B_i. The process is as defined by the Equation 7.

$$B_i = (B_i + c_i)\bmod 2 \text{ for } i=0,\ldots, L-1 \qquad (7)$$

WhereL is the length of B_i and $c_i$is the scrambling sequence, generated as described in the Section 1.2.

IV PCFICH ARCHITECTURE

The Architecture flow of the PCFICH is drawn based on the blocks present in the block diagram. The flow of this diagram is fully based on the DSP. This can be made efficient using the various VLSI concepts like unfolding and retiming. Here both of the conceptsare used to achieve the efficient architecture.

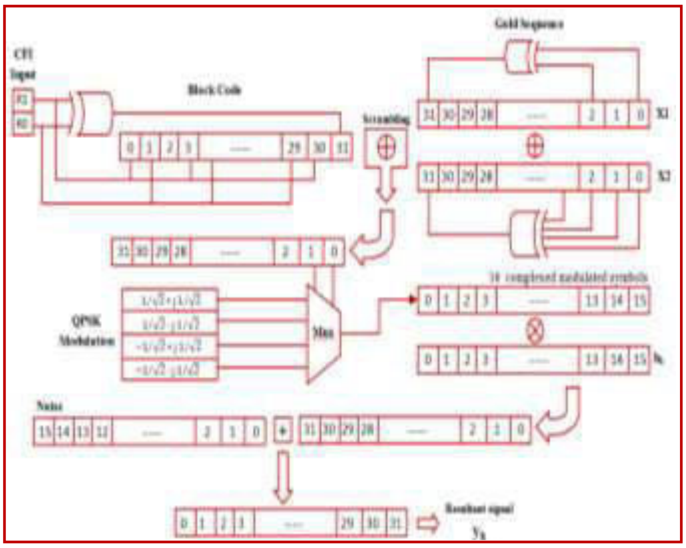


Fig.4 PCFICH Transmitter architecture

3.1 PCFICH Transmitter Architecture

The transmitter architecture of PCFICH downlink physical control channel is presented in Fig.4. The block diagram of the PCFICH transmitter is discussed in the chapter III.The first block of this architecture is block coding.

The input of this block code is the 2 bit CFI value R1 and R0. The 2 bit value is converted into 32 bit value by block coding.The first two bits are same as the original bits and the third bit is the XOR value of the first two bits. The 3 bit pattern is repeated until the required 32 bits are obtained[10]. It is represented in Fig.5. These 32 bits form the CFI codeword.

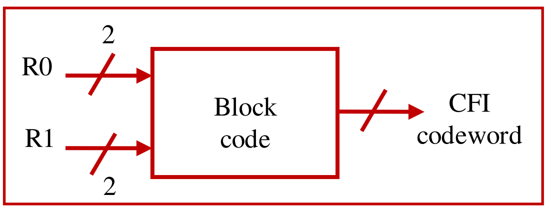


Fig.5 Block code

The second block is the scrambling process. This process requires gold sequence generation. The gold sequence is produced by using the two sequences $x1$ and $x2$. Here the x1 sequence is the predefined sequence i.e,"1000000000000000000000000000000". The $x2$ sequence also have 31 bits that is assumed according to the applications. The 32[nd]bit of both sequences are calculated using Equation (8),(9) and (10). Then these 2 sequences are XORed to get the gold sequence. The result is also a 32 bit value.

$$x1(n+31) = \big(x1(n+3) + x1(n)\big)mod2 \qquad (8)$$

$$x2(n+31) = (x2(n+3) + x2(n+2) + x2(n+1) + x2(n))mod2 \qquad (9)$$

$$c(n) = (x1(n) \oplus (n)\ )mod2 \qquad (10)$$

Then scrambling is done by XOR of the block coded sequence and the gold sequence. It is shown in Fig.6

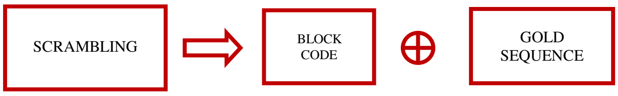


Fig.6 Scrambling process

The resultant scrambled sequence isstored in a shift register. The shift register is set to shift 2 bitsper clock cycle for QPSK modulation. The shifted 2 bits aregiven as control lines for the multiplexer. The inputs to themultiplexer are stored in RAM table. There are 4 possible complexmodulated QPSK symbols. Based on thecontrol, the output appears, which is represented as 16 bitvalue.

The 16 complex modulated symbols are then layer mappedto one, two or four layers based on the information fromhigher layer.Z1 is the output if one antenna is selected.Z2,Z3are outputs if 2 antennas are selected and Z4,Z5,Z6,Z7 if 4antennas are selected.

The modulated symbol is multipliedwith the complex channel frequency response vector h_k, whichis also represented as a 16 bit value. The resultant is a 32 bitvalue. Then noise which is represented using 16 bits is added.Thus the resultant signal y_k is a 32 bit value.

3.2 PCFICH Receiver Architecture

The received signal is demapped from the 16 positions of first OFDM symbol, where CFI value is available. The receiver architecture is presented in Fig.7. It is known that, there are only three possibilities of signal transmitted, namely01,10 or 11(CFI-1,2 or 3)[12].So, the demodulated signal will be one among the three. The received signal is y_k and is multiplied with the conjugate of the complex channel frequency response vector h_k^*, element by element. Then thisresultant term undergoes inner product with the three possible values of d(m). The inner product is done using.

32

The $d^{(m)*}$ is multiplied with $(y_k^0 h_k^*)$ product .For allthe elements the multiplication is done and the results areaccumulated, and the result is a 64 bit value[13]. The real part of accumulated value alone is taken, which is a 32 bit value.

ISBN: 978-81-965236-7-1

This process is done for the three values viz. $d^{(0)}, d^{(1)}, d^{(2)}$.Then among the three results, the codeword which has the maximum argument value is detected as the CFI.

In the receiver side, after removal of cyclic prefix from the received signal, then FFT is performed and then resource element demapping is done. The complex valued output at the *k*-th receive antenna is modeled in Equation(11)

$$y_k = h_k^0 d^{(n)} + u_k \text{ }, k = 1,2, \dots, k \qquad (11)$$

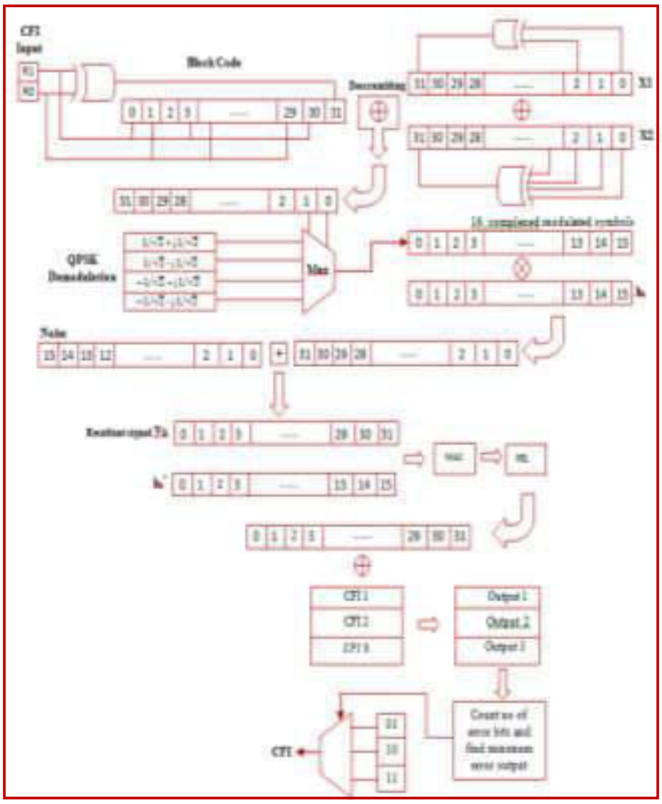


Fig.7 PCFICH Receiver architecture

$y_k$is 16x1 received subcarrier vector, $d^{(n)}$ is the 16x1complex QPSK symbol vector corresponding to the 32-bit CFI code words, where n varies from 1 to 3, $h_k$is 16x1complex channel frequency response and u_k represents the contribution of thermal noise and interference.

The received signal y_k is represented in the figure 2,for single antenna case. The noise term $u_k$is modeled as zero mean circularly symmetric complex Gaussian with covariance$E[u_k u_k^H] = \sigma_u^2 I$,since the interferers are uncorrelated due to independent large scale propagation, short term fading and uncorrelated scrambling sequences.

4.1CFI Estimation

The ML decision rule, by maximizing the log-likelihood function of y_k *and* $h_k$is given in Equation (12)

$$\text{CFI} = \min_{m=1,2,3} \sum_{k=1}^{k} \left| y_k - \left(h_k^0 \, d^{(m)}\right) \right|^2 \qquad (12)$$

Which simplifies to

$$CFI = \operatorname{argmax}_{m=1,2,3} z^{(m)} \qquad (13)$$

Where the soft outputs are given by

$$z^{(m)} = \sum_{k=1}^{k} z_k^{(m)} \quad \text{for m = 1,2,3} \qquad (14)$$

Which is simplified as

$$\text{CFI} = \operatorname*{argmax}_{m=1,2,3} \sum_{k=1}^{k} Re\{\langle y_k^0 h_k^* d^{(m)} \rangle\} (15)$$

4.2 Received Signal

The received signal $y_k$is element by element multiplied with the conjugate of the complex channel frequency response vector h_k^*.Then this term and three possible values of *d* (*m*) undergoes inner product. The inner product is given in Equation (16)

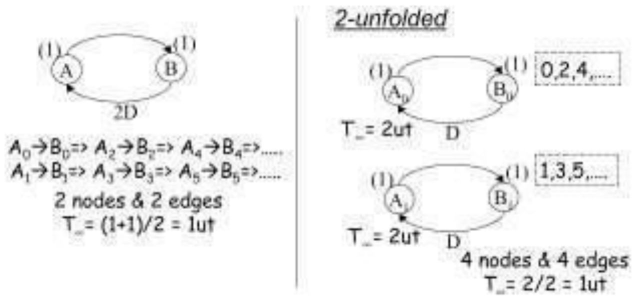
$$\langle x, y \rangle = \sum_{k=1}^{k} x_i y_i^* \qquad (16)$$

The real part of the resultant value is taken. This is done for number of times as the number of antennas used to receive. Then argument max among the three values is selected as the CFI value. If CFI is maximum value when m=1, then the codeword detected is 01, when m=2, it is 10 and when m=3, it is 11.

V UNFOLDING AND RETIMING

5.1 Unfolding

Unfolding = = Parallel Processing



In a 'J'unfolded system each delay is J-slow. if input to a delay element is the signal x(kJ + m), the output is in Equation (16)

$$x((k-1)J + m) = x(kJ + m - J) \qquad (16)$$

Algorithm for unfolding

For each node U in the original DFG, draw J node U_0, $U_1, U_2, \dots, U_{J-1}$

For each edge U→ V with w delays in the original DFG, draw the J edges $U_i \rightarrow V_{(i+w)\%J}$ with [(i+w)/J] delays for i= 0, 1, … , J-1.

Unfolding of an edge with w delays in the original DFG produces J-w edges with no delays and w edges with 1delay

ISBN: 978-81-965236-7-1

in J unfolded DFG for w < J and unfolding preserves precedence constraints of a DSP program[14].

Properties of unfolding :

Unfolding preserves the number of delays in a DFG. Thiscan be stated as follows(17),

$$\lfloor w/J \rfloor + \lfloor (w+1)/J \rfloor + \ldots + \lfloor (w + J - 1)/J \rfloor = w \quad (17)$$

5.2 Retiming

This section considers some techniques used for retiming.

First, two special cases of retiming, namely, *cutset retiming* and *pipelining*, are considered. Two algorithms are then considered for retiming to minimize the clock period and retiming to minimize the number of registers that are required to implement the circuit.Cutset Retiming is a useful technique that is a special case of retiming. A *cutest* is a set of edges that can be removed from the graph to create 2 disconnected subgraphs. Cutset retiming only affects the weights of the edges in the cutset. If the 2 disconnected subgraphs are labeled G_1 and G_2, then cutset retiming consists of adding k delays to each edge from G_1 to G_2 and removing k delays from each edge from G_2 to G_1. For example, a cutset is shown with a dashed line in Fig. 4.4(a). The 3 edges in the cutset are 2 → 1, 3 → 2, and 1 → 4. The 2 subgraphs G_1 and G_2 found by removing the 3 edges in the cutset are shown in Fig.8. For $k = 1$, the result of cutset retiming. The edges from G_1 to G_2 are 3 → 2 and 1→ 4, and one delay is added to each of these edges[15]. The edge from G_2 to G_1 is 2 → 1, and one delay is subtracted from this edge[7].

VI RESULTS AND DISCUSSION

6.1 Simulation result for PCFICH

The each and every block of the PCFICH downlink physical control channel is simulated using the Xilinx ISE 14.7 software.Verilog Hardware description language (VHDL) is used to simulate the codes for each and every block for PCFICH transceiver with unfolding and retiming approach for efficient architecture. The CFI is detected as the output of the after 15 time units.

6.1.1 Block coding

The input of the block code is 2 bit and the output of this block code is 32 bit. It is analyzed based on the CFI present in the system and also depicted according to the application. The simulation waveform for the block code is depicted in the Fig.9.

Fig.9 Simulation result for Block coding

6.1.2 Scrambling and Descrambling

The input of the scrambler block is 32 bit and the output of this scrambler block is also 32 bit. Here 31 gold sequence also generated using the cell specific sequence generator. It was analyzed based on the CFI present in the system and also depicted according to the application. The original CFI value is get back in receiver. The simulation waveform for the block code scrambling and descrambling is depicted in the Fig.10.

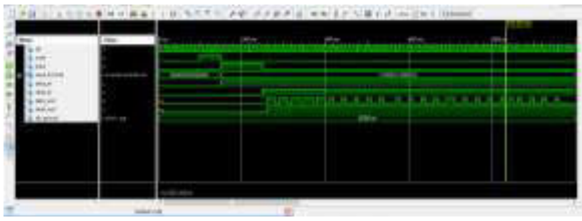


Fig.10 Simulation result for scrambling block

6.1.3 QPSK Modulation and Demodulation

The output of the 32bit scrambling sequence is given to the input of the QPSK modulation and the reverse process is the QPSK demodulation and the simulation result for QPSK modulation and demodulation is shown in Fig.11.

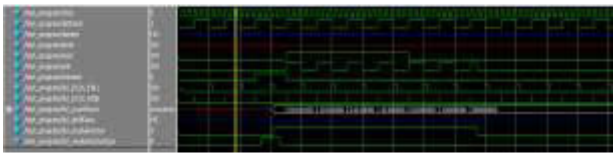


Fig.11 Simulation results of QPSK modulation and demodulation

6.1.4 PCFICH Transceiver Output

The entire block of the transceiver architecture coded and combined as the consequence of output to get the simulation result as in Fig.12.

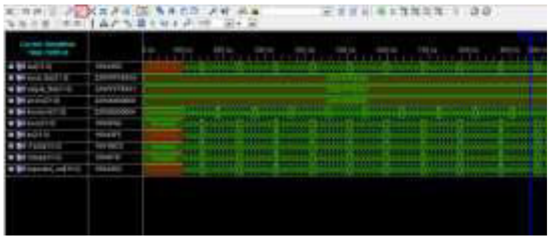


Fig.12 Simulation results of PCFICH Transceiver

ISBN: 978-81-965236-7-1

6.1.5 Unfolding and Retiming

The Output of the PCFICH transceiver is fed into the unfolding and retiming process to get the efficient output of minimum delay and maximize the efficiency. It is shown in Fig.13.

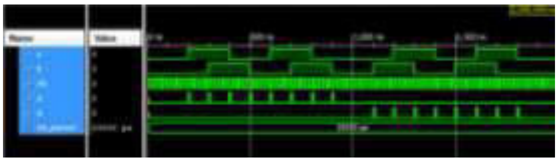


Fig.13.Simulation results of Unfolding and Retiming

VII CONCLUSION

This paper describes about simulated results of each and every block of the transceiver architecture. The output of the entire block is combined and the total output of the system in the receiver side is getting the CFI value. This output will have larger delay due to the channel noise and architecture flow. The unfolding concept is used at the CFI of the receiver architecture to reduce the delay and power consumption. The retiming is also used to reduce the number of registers present in the architecture. The output of the normal architecture will give the best result of time delay of 5 time units. The increased efficiency of architecture is 1.44. The overall architecture result produced in our paper creates the better performance than the previous one. In future work the proposed work will be extended to minimize the number of delays by the use of any other VLSI DSP concept techniques.

REFERENCES

[1] Sabharwal, A., Schniter, P., Guo, D., Bliss, D., Rangarajan, S., and Wichman, R. (2014) In-band full-duplex wireless: challenges and opportunities. IEEE J. Select. Areas Commun., **32**, 1637–1652.

[2] Hong, S., Brand, J., Choi, J., Jain, M., Mehlman, J., Katti, S., and Levis, P. (2014) Applications of self-interference cancellation in 5G and beyond. IEEE Commun. Mag., **52** (2), 114–121, doi: 10.1109/MCOM.2014.6736751.

[3] Korpi, D., Riihonen, T., Syrjälä, V., Anttila, L., Valkama, M., and Wichman, R. (2014) Full-duplex transceiver system calculations: Analysis of ADC and linearity challenges. IEEE Trans. Wireless Commun., **13** (7), 3821–3836.

[4] Sohaib, S. and So, D. (2009) Asynchronous polarized cooperative MIMO communication, in Proc. 69th Veh.Tech. Conf. (VTC Spring 2009), pp. 1–5.

[5] Sohaib, S. and So, D. (2010) Energy analysis of asynchronous polarized cooperative MIMO protocol, in Proc.21st Int. Symp. Personal Indoor and Mobile Radio Commun. (PIMRC 2010), pp. 1736–1740.

[6] Korpi, D., Riihonen, T., Syrjälä, V., Anttila, L., Valkama, M., and Wichman, R. (2014) Full-duplex transceiver system calculations: Analysis of ADC and linearity challenges. IEEE Trans. Wireless Commun., **13** (7),3821–3836.

[7] Bharadia, D., McMilin, E., and Katti, S. (2013) Full duplex radios, in Proc. ACM SIGCOMM ’13, pp. 375–386.

[8] Korpi, D., Anttila, L., Syrjälä, V., and Valkama, M. (2014) Widely-linear digital self-interference cancellation in direct-conversion full-duplex transceiver. IEEE J. Select. Areas Commun., **32** (9), 1674–1687.

[9] Anttila, L., Korpi, D., Antonio-Rodriquez, E.,Wichman, R., and Valkama, M. (2014) Modeling and efficient cancellation of nonlinear self-interference in MIMO full-duplex transceivers, in Proc. IEEE Globecom Workshops, pp. 862–868.

[10] Antonio-Rodriguez, E., Lopez-Valcarce, R., Riihonen, T., Werner, S., and Wichman, R. (2014) SINR optimization in wideband full-duplex MIMO relays under limited dynamic range, in Proc. IEEE 8th Workshop on Sensor Array and Multichannel Signal Processing, pp. 177–180.

[11] Riihonen, T.,Werner, S., andWichman, R. (2011) Mitigation of loopback self-interference in full-duplex MIMO relays. IEEE Trans. Signal Process., **59** (12), 5983–5993.

[12] Bharadia, D., McMilin, E., and Katti, S. (2013) Full duplex radios, in Proc. ACM SIGCOMM ’13, pp. 375–386.

[13] Anttila, L., Korpi, D., Syrjälä, V., and Valkama, M. (2013) Cancellation of power amplifier induced nonlinear self-interference in full-duplex transceivers, in Proc. 47th Asilomar Conf. Signals, Systems and Computers, pp. 1193–1198.

[14] Anttila, L., Korpi, D., Antonio-Rodriquez, E.,Wichman, R., and Valkama, M. (2014) Modeling and efficient cancellation of nonlinear self-interference in MIMO full-duplex transceivers, in Proc. IEEE Globecom Workshops, pp. 862–868.

[15] Tehrani, A. Cao, H., Afsardoost, S., Eriksson, T., Isaksson, M., and Fager, C. (2010) A comparative analysis of the complexity/accuracy tradeoff in power amplifier behavioral models. IEEE Trans. Microwave Theory Tech., **58**, 1510–1520.

ISBN: 978-81-965236-7-1

Automated Detection of kidney Stone through Neural Networks

Mr.B.Reuben

Assistant Professor, Department of Electronics and Communication Engineering,

Sri Bharathi Engineering College for Women, kaikkurichi, Pudukkottai – 622303

princeton.reuben@gmail.com

Abstract — **The Back Propagation Network algorithm is widely utilized in training neural networks, particularly in the context of automated kidney stone classification using image and data processing. Traditional methods for classifying and detecting kidney stones in medical resonance images rely on human examination, which is inherently imprecise when handling large datasets. Magnetic Resonance (MR) Images may exhibit noise due to operator errors, leading to significant inaccuracies in image processing for disease classification. However, the integration of artificial intelligence, neural networks, and feature extraction has demonstrated significant promise in accurately identifying regions of interest using the back propagation network algorithm. In this study, we employed the Back Propagation Network for kidney stone detection, involving two key stages: 1. Feature extraction using principal component analysis and 2. Image classification using Back Propagation Network (BPN). Additionally, we introduced a segmentation method utilizing the Fuzzy C-Mean (FCM) clustering algorithm. The performance of the BPN classifier was evaluated in terms of training execution and classification accuracies. Notably, the Back Propagation Network exhibited precise classification compared to alternative neural network-based methods.**

Keywords— Renal Calculi, Back Propagation Network, Magnetic Resonance Imaging, Artificial Neural Networks.

I. INTRODUCTION

The entities within the provided image undergo processing using conventional image manipulation techniques, including noise reduction and feature extraction, aimed at identifying specific textured areas in the image.

To facilitate computer-based processing, the image is initially converted into numerical format, enabling the computer to analyze it. Each numerical value in the image corresponds to a specific brightness level at a designated location, referred to as a pixel. A digital image chosen for analysis typically comprises 512 × 512 pixels, totaling approximately 250,000 pixels. Modern computing systems may handle larger-sized images.

Once digitized, three fundamental operations are carried out on the image within the computer. Firstly, in point operation, a single pixel in the input image contributes to generating a pixel value in the output image. Secondly, for local operations, the output image's value is influenced by multiple pixels in the input image. Finally, in global operations, each pixel in the input image contributes to producing a pixel in the output image. These operations can be applied individually or in combination to enhance and compress the image. Image enhancement occurs when the information within the image becomes more discernible.

Identifying object groups in real-time images represents a significant breakthrough in image processing, marked by the intricate challenges posed by variations in object similarity within the same class. The complexity is further compounded by distortions arising from cluttered backgrounds, changes in scale, and shifts in viewpoint, resulting in disparate appearances of identical objects. Another layer of difficulty arises from images that may look similar despite distinct classifications, adding to the intricacies of classification problems. Consequently, models designed for object classification must dynamically adapt to accommodate class variability while maintaining the necessary discriminative power to sift through true object occurrences in visually chaotic images.

This paper delves into two distinct approaches for recognizing and classifying objects, with a particular emphasis on addressing the inherent challenges associated with object class recognition. The primary goal of image classification is to accurately pinpoint the region of interest within the analyzed image. The proposed approach in this work concentrates on object class recognition using exclusively edge information. This focused methodology allows for efficient computations of matches between primary images, leveraging geometric properties. This stands in contrast to fragmented approaches that necessitate intricate analyses between each individual edge pixel or changes in technical terminology

The back propagation network algorithm has demonstrated superior performance in the context of kidney stone detection within the aforementioned image processing framework. The term "back propagation" signifies the reverse propagation of error, wherein an error computed at the outer layer is retroactively disseminated throughout the network's layers. Geometric properties present a more straightforward challenge, as they can be easily rectified to address similarities across various scales. However, contour fragments lack scale invariance, requiring additional steps to achieve it. One viable solution involves rescaling through the introduction of aliasing effects, such as adjusting the placement of edge pixels. Alternatively, remodeling the imaging sizing before fragment extraction represents another strategy, albeit at the cost of potential reductions in image resolution or alterations in technical terminology.

The back propagation network algorithm has shown best result for the above explained image processing for the kidney stone detection. The phrase back propagation states the backward propagation of error as an error determined at the outer layer is distributed backwards throughout the network's layers. Geometric properties can be fixed easily, they solve similarities across scales. But, contour fragments are not scale invariant. It must be rescaled by introducing aliasing effects (for e.g., placement of edge pixels apart), or to remodel the imaging sizing before extracting fragments from the image. This may further reduce image resolution.

In literature, it is shown that the standard nature of line segments and definite shapes meet the requirements of the ability to portrait intricate shapes and structures. As individual structures, it appears to be less unique. When the same features are combined, their features are enhances and thereby appears to be adequately discriminative. A bi-level basic abstraction is being performed. Initially, at the first layer it is performed with pairs of primitives. Later, a learned number of shape indications. No constraint is imposed to have standard values of shape-tokens. But it also allows it to be repeated and adaptable to an

ISBN: 978-81-965236-7-1

Object class. This value influences a combination's ability to represent shapes, where simple shapes favor fewer shape-tokens than challenging ones. Continuously, discriminative combinations of varying complexity can be exploited to represent an object class. We study this combination by exploiting, demarcating the shape, geometric, and fundamental restrictions. The shapes inhibit, describes the visual approach of shape tokens, while geometric constraints describe its spatial outline. Structural constraints establish possible structures of an object by the relationships between shape- tokens./change in technical word

II. IMAGE CATEGORIZATION

Primarily, image classification is founded on pixel color considerations. Depending on the desired output effectiveness, images can be maintained in their original state or transformed into a different format. This minimizes computational complexity and enhances system processing time to yield efficient outcomes. The ensuing list delineates various image types, each explained below.

A. Binary Image

A binary image exhibits two distinct pixel-level outcomes. Typically, the colors black and white are employed, but any two colors can be substituted. The foreground color represents objects, while the rest of the image constitutes the background. Binary images are often referred to as bi-level or two-level, signifying that each pixel is stored as a single bit (0 or 1). While commonly associated with black and white, monochrome, or monochromatic terminology, it can encompass any image with a single sample for each pixel.

B. Gray Scale Image

In a grayscale image, each pixel holds a single sample, conveying information solely based on intensity. These images exhibit varying shades of gray within the 0-255 value range, with black (0) representing the weakest shade and white (255) the strongest. Grayscale images are distinct from one-bit black-and-white images, which are fundamental in computer imaging. Unlike binary images, grayscale images feature multiple shades of gray and are characterized by their monochromatic nature, indicating the absence of color-based changes.

Grayscale images convey light intensity at each pixel across the electromagnetic spectrum, captured at a single frequency, rendering them monochromatic.

C. Color Image

A color image assigns color information to every pixel, determined by three numbers. These values signify the color decomposition in the three primary hues: red, blue, and green. Essentially, an image is a vast two-dimensional array, encoding properties of colors and pixels. Each pixel is coded in 3 bytes, representing the three primary colors. Employing RGB encoding, a total of 16.8 million distinct colors (256x256x256) can be generated, adjustable to human vision.

II. METHODOLOGY

The detection of kidney stones is accomplished through the utilization of a Back Propagation Network (BPN), which is evaluated in terms of performance and classification metrics. BPN proves to be an efficient and accurate tool for both quick classification and the identification of kidney stones. Moreover, it is adept at classifying patterns associated with malignant and benign cancer. The back-propagation mechanism is instrumental in adjusting the weights and biases of networks, contributing to the minimization of squared error within the network.

A graphical representation of the kidney stone detection process is commonly referred to as a "Schematic Diagram for Kidney Stone Detection" or simply a "Kidney Stone Detection Block Diagram." Such diagrams visually outline the sequential stages and components involved in the detection methodology, providing a clear overview of the entire process.

In Figure 1, the block diagram illustrates the process of kidney stone extraction, which involves a two-stage approach to distinguish between normal and abnormal kidney images. The initial stage involves training the network with a known dataset. Subsequently, when subjecting a sample image, initial level classification is achieved through feature extraction using the GLCM method. The classification accuracy is further enhanced through preprocessing before feature extraction. Image preprocessing, a term commonly used, operates on images at the lowest level of abstraction, with intensity images as input and output. The primary objective of preprocessing is to refine image data by reducing unwanted distortions and enhancing essential image features for subsequent processing.

Following the back propagation network's classification of the input image, the results indicate whether the input images represent normal or abnormal kidney conditions. If the image is classified as normal, the deduced image does not depict a kidney stone. Conversely, if the image is deemed abnormal, the deduced image is identified as depicting a kidney stone.

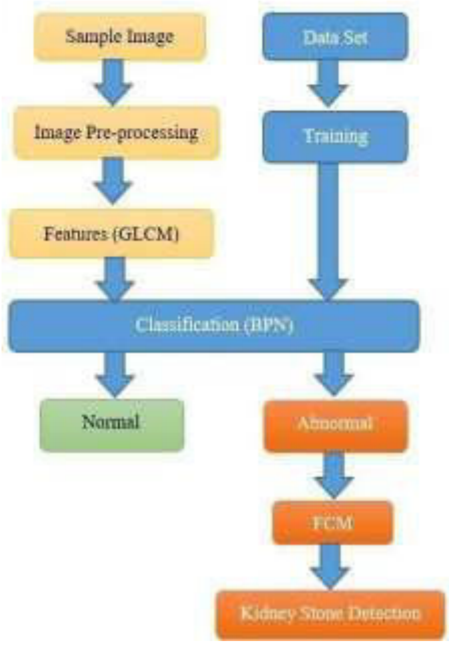


Fig 1 Block Diagram for Kidney stone Detection

III. RESULTS AND DISCUSSIONS

In Figure 2, the input image serves as the sample image for the training system. Subsequently, the image undergoes preprocessing, and through the utilization of GLCM-based feature detection, the detection process is initiated. The preprocessed image is visualized in Figure 3, revealing clearly defined edges from the original image. This enhancement is instrumental in focusing on the region of interest within the image, facilitating the initial stage classification of image detection as normal or abnormal.

Figure 4 portrays the image after feature extraction, highlighting the salient features obtained from the preprocessing stage. Finally, Figure 5 illustrates the segmentation of stones from the image, showcasing the successful isolation of kidney stones based on the applied methodology.

ISBN: 978-81-965236-7-1

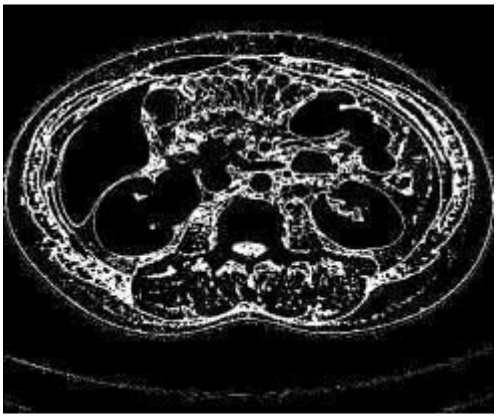


Fig 2 Input Image

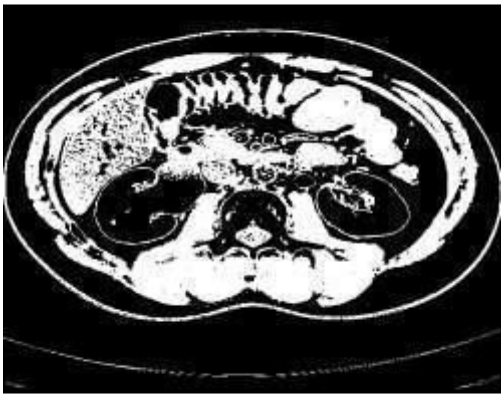


Fig 3 Processed Image

Fig 4 Feature extracted image

Fig 5 Output Image

These results collectively demonstrate the effectiveness of the proposed approach in detecting kidney stones through a systematic process of preprocessing, feature extraction, and segmentation. The discussion will further delve into the quantitative measures of classification accuracy and performance metrics, providing a comprehensive evaluation of the proposed kidney stone detection methodology.

The isolated stone region plays a pivotal role in the early detection of kidney stones. Additionally, individuals undergoing medical treatment can be closely monitored to document their response to the intervention. The method allows for precise monitoring of stone sizes, presenting a distinct advantage over alternative approaches. Due to elevated levels of noise associated with other methodologies, the efficiency of early detection and continuous monitoring is notably superior in the analysis of MR images.

IV. CONCLUSIONS

This study employs the Back Propagation Network (BPN) for the detection of kidney stones in MR images. The two-stage detection process, involving feature extraction and classification, successfully identifies stones within the kidney. Through qualitative analysis, the method proves effective in pinpointing the position of even small-sized stones within the kidney. Notably, the Back Propagation Network demonstrates superior precision in classification compared to alternative neural network-based methods.

The method's advantages lie in its ability to accurately separate stone regions from the images, making it well-suited for the precise classification of kidney stone images and enabling early detection. The results of this study highlight the efficacy of utilizing the Back Propagation Network for kidney stone detection in MR images, showcasing its potential as a reliable and accurate tool in medical imaging applications. Further research may explore enhancements and optimizations to refine the methodology for broader clinical applications.

V. REFERENCES

[1] Saman Ebrahimi and Vladimir Y. Mariano, “Image Quality Improvement in Kidney Stone Detection on Computed Tomography”, Journal of image and graphics, Vol.3, No. 1, June 2015.

[2] Prema T. Akkasaligar, Sunanda Biradar and Veena Kumbar, “Kidney stone detection in computed tomography images”, IEEE, 2017.

[3] Aniket Gaikwad, Azharuddin Inamdar, Vikas Behera, “Lung cancer detection using digital Image processing On CT scan Images”, International research journal of engineering and technology, 2016.

ISBN: 978-81-965236-7-1

[4] Wayne Brisbane, Michael R. Bailey and Mathew D. Sorensen, "An overview of kidney stone imaging techniques", Nat Rev Urol, November 2016.

[5] S. Asadi, H. Hassanpour, and A. Pouyan, "Texture based image enhancement using gamma correction", Middle-East Journal of Scientific Research, vol. 6, no. 6, pp. 569-574, 2010.

[6] R. C. Gonzalez and R. E. Woods,"Digital Image Processing", 2nd ed., 1992, ch. 2, pp. 47-51 and ch.10, pp. 568-611.

[7] D. Y. Kim and J. W. Park, "Computer-Aided detection of kidney tumor on abdominal computed tomography scans", Acta Radiologica, vol. 45, no. 7, pp. 791-795, 2004.

[8] D. T. Lin, C. C. Lei, and S. W. Hung, "Computer-Aided kidney segmentation on abdominal CT images", IEEE Trans. on Information Technology in Biomedicine, vol. 10, no. 1, pp. 59-65, Jan. 2006.

[9] F. L. Coe, A. Evan, and E. Worcester, "Kidney stone disease", Journal of Clinical Investigation, vol. 115, no. 10, pp. 2598-2608, 2005.

[10] F. Grases, A. Costa-Bauza, and R. M. Prieto, "Renal lithiasis and nutrition", Nutrition Journal, vol. 5, no. 23, pp. 1-7, 2006.

[11] Sri Madhava Raja N.,Rajinikanth V., Latha K."Otsu based optimal multilevel image thresholding using firefly algorithm", Modelling and Simulation in Engineering, https://doi.org/10.1155/2014/794574, 2014.

[12] R Vishnupriya, N Sri Madhava Raja, V Rajinikanth". An efficient clustering technique and analysis of infrared thermograms" 2017 Third International Conference on Biosignals, Images and Instrumentation (ICBSII), Chennai, 2017, pp. 1-5, doi: 10.1109/ICBSII.2017.8082275.

[13] N Sri Madhava Raja, SL Fernandes, Nilanjan Dev, Suresh Chandra Satapathy, V.Rajinikanth. "Contrast enhanced medical MRI evaluation using Tsallis entropy and region growing segmentation" J Ambient Intell Human Comput (2018). https://doi.org/10.1007/s12652-018-0854-

[14] Raja N.S.M., Lakshmi P.R.V., Gunasekaran K.P. (2018) Firefly Algorithm-Assisted Segmentation of Brain Regions Using Tsallis Entropy and Markov Random Field. In: Saini H., Singh R., Reddy K. (eds) Innovations in

[15] T.S. Borkar , L.J. Karam , DeepCorrect: correcting DNN models against image dis- tortions, IEEE Trans. Image Process. 28 (12) (2019) 6022–6034 .

[16] H.-C. Shin , H.R. Roth , M. Gao , L. Lu , Z. Xu , I. Nogues , J. Yao , D. Mollura , R.M. Summers , Deep convolutional neural networks for computer-aided de- tection: CNN architectures, dataset characteristics and transfer learning, IEEE Trans. Med. Imaging 35 (5) (2016) 1285–1298 .

[17] T.S. Borkar , L.J. Karam , DeepCorrect: correcting DNN models against image dis- tortions, IEEE Trans. Image Process. 28 (12) (2019) 6022–6034 .

[18].W.G. Couser , G. Remuzzi , S. Mendis , M. Tonelli , The contribution of chronic kidney disease to the global burden of major noncommunicable diseases, Kid- ney Int. 80 (12) (2011) 1258–1270 .

[19] G. Huang , Z. Liu , L. Van Der Maaten , K.Q. Weinberger , Densely connected convolutional networks, in: IEEE Conference on Computer Vision and Pattern Recognition, 2017, pp. 4700–4708 .

[20] X. Zhang , X. Zhou , M. Lin , J. Sun , ShuffleNet: an extremely efficient convolu- tional neural network for mobile devices, in: IEEE Conference on Computer Vision and Pattern Recognition, 2018, pp. 6 84 8–6 856 .

[21] M. Sandler , A. Howard , M. Zhu , A. Zhmoginov , L.-C. Chen , MobileNetV2: in- verted residuals and linear bottlenecks, in: IEEE Conference on Computer Vi- sion and Pattern Recognition, 2018, pp. 4510–4520 .

[22] Z.-H. Zhou , J. Wu , W. Tang , Ensembling neural networks: many could be better than all, Artif. Intell. 137 (1–2) (2002) 239–263 .

[23] S. Sudharson , P. Kokil , Abnormality detection in the renal ultrasound im- ages using ensemble MSVM model, in: IEEE International Conference on Wireless Communications Signal Processing and Networking (WiSPNET), 2019, pp. 378–382 .

[24] T. Alelign , B. Petros , Kidney stone disease: an update on current concepts, Ad- vances in Urology (2018) 1–12 . Article ID 3068365

[25] Z.M. El-Zoghby , J.C. Lieske , R.N. Foley , E.J. Bergstralh , X. Li , L.J. Melton , A.E. Krambeck , A.D. Rule ,Urolithiasis and the risk of ESRD, Clin. J. Am. Soc.Nephrol. 7 (9) (2012) 1409–1415 .

[26] T. Alelign , B. Petros , Kidney stone disease: an update on current concepts, Ad- vances in Urology (2018) 1–12 . Article ID 3068365

B.Reuben,M.E.,M.B.A.,(Ph.D)., working as Assistant Professor in the Department of ECE at Sri Bharathi Engineering College for Women, Kaikkurichi, Pudukkottai – 622303. He received Master's degree in Communication Systems in the year 2012 from Sudharsan Engineering College, Sathyamangalam, Pudukkottai and received Bachelor's Degree in Electronics and Communication Engineeering from Shanmuganathan Engineering College, Arasampatti, Pudukkottai District in 2005. He also received Master's degree in Business Administration from Alagappa University, Karaikudi in 2008. He has Pursuing Ph.D at Periyar Maniammai Institute of Science &Technology, Thanjavur. He has more than Ten years of Teaching Experience in Engineering Colleges. He is interested in the field of Communication systems and Image processing.

VLSI Realization of Area-Efficient Carry Select Adder

C.SANTHOSHKANNAN, M.E.,
Assistant Professor, Department of Electrical and Electronics Engineering,
Sri Bharathi Engineering College for Women.

Abstract:

Design of power-efficient and high- speed data path logic systems are one of the most substantial areas of research in VLSI system design. In digital adders, the speed of addition is limited by the time required to propagate a carry through the adder. The sum for each bit position in an elementary adder is generated sequentially only after the previous bit position has been summed and a carry propagated into the next position.

The CSLA is used in many computational systems to alleviate the problem of carry propagation delay by independently generating multiple carries and then select a carry to generate the sum. However, the CSLA is not area efficient because it uses multiple pairs of Ripple Carry Adders (RCA) to generate partial sum and carry by considering carry input, then the final sum and carry are selected by the multiplexers (mux). The basic idea of this work is to use Binary to Excess-1 Converter (BEC) instead of RCA in the regular CSLA to achieve high speed and low powerconsumption.

Keywords: CSLA, RCA, BEC, area-efficient, low power, propagation delay.

Introduction:

Design of high speed data path logic systems are one of the most substantial research area in VLSI system design. High- speed addition and multiplication has always been a fundamental requirement of high- performance processors and systems.

The major speed limitation in anyadder is in the production of carries and many authors have considered the addition problem. The basic idea of the proposed work is using n-bit Binary to Excess-1 Converters (BEC) to improve the speed of addition. This logic can be implemented with Carry Select Adder to Achieve Low Power and Area Efficiency. The proposed 32-bit Carry Select Adder compared with the Carry Skip Adder (CSKA) and Regular 32-bit Carry Select Adder.

The main advantage of this Binary toExcess Converter (BEC) is logic comes from the lesser number of logic gates than the n- bit Ripple Carry Adder (RCA). A structure of 4-bit Binary to Excess Converter (BEC) and the truth table is shown in Fig.1.1and Table 1 respectively.

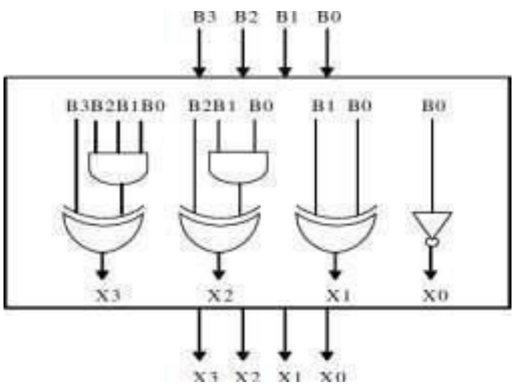


Fig: 1.1:4-bit Binary to Excess-1 Converter (BEC)

Table-1:

B[3:0]	X[3:0]
0000	0001
0001	0010
⋮	⋮
1110	1111
1111	0000

Table.1: Functional Table of 4-Bit BEC

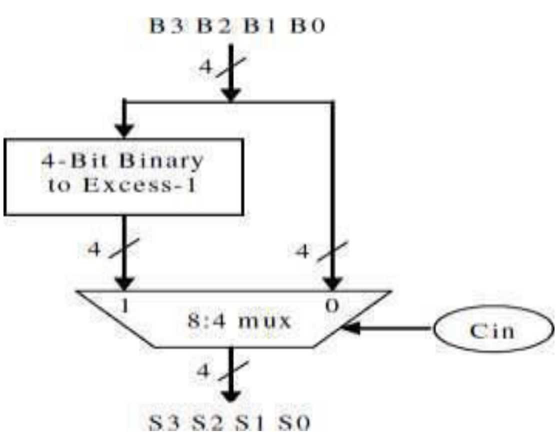


Fig.1.2. 4-b BEC with 8:4 mux

How the goal of fast addition is achieved using BEC together with a multiplexer (mux) is described in Fig.1.2,one input of the 8:4 mux gets as it input (B3,B2, B1, and B0) and another input of the MUX is the BEC Output.

This produces the two possible partial product results in parallel and the Muxes are used to select either BEC output or the direct inputs according to the control signal Cin.

The Boolean expressions of 4-bit BEC are listed below, (Note: functional symbols, ~ NOT, & AND, ^ XOR).

X0 = ~ B0
X1 = B0 ^ B1
X2 = B2 ^ (B0 & B1)
X3 = B3 ^ (B0 & B1 & B2)

1. Carry Select Adder:

A carry-select adder is divided into sectors, each of which – except for the least- significant – performs two additions in parallel, one assuming a carry-in of zero, theother a carry-in of one. A four bit carry select adder generally consists of two ripple carry adders and a multiplexer. The carry- select adder is simple but rather fast, having a gate level depth of O (√n). Adding two n- bit numbers with a carry select adder is donewith two adders (two ripple carry adders) in order to perform the calculation twice, one time with the assumption of the carry being zero and the other assuming one.

After the two results are calculated, the correct sum, as well as the correct carry, is then selected with the multiplexer oncethe correct carry is known. The design schematic of Carry Select Adder is shown inFig.2.1.

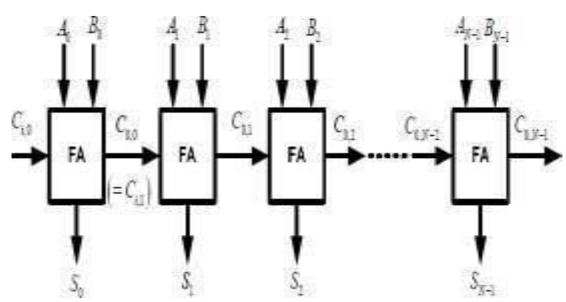


Fig.2.1: The N-bit Ripple Carry Adder Constructed by N set single bit Full-adder

ISBN: 978-81-965236-7-1

In the N-bit carry ripple adder, the delaytime can be expressed as:

TCRA = (N-1) Tcarry + Tsum

In the N-bit carry select adder, the delaytime is:

TCSA = Tsetup + (N/M) Tcarry + MTmux +Tsum

In our proposed N-bit area-efficient carry select adder, the delay time is:

Tnew = Tsetup + (N-1) Tmux + Tsum

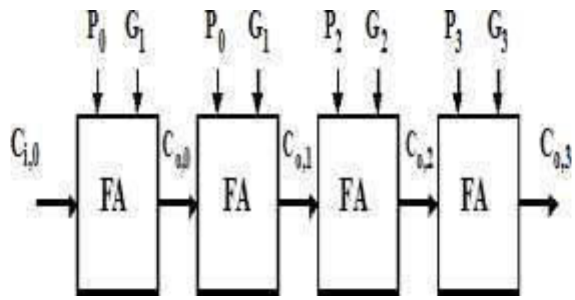
The carry select adder comes in the category of conditional sum adder. Conditional sum adder works on some condition. Sum and carry are calculated by assuming input carry as 1 and 0 prior the input carry comes. When actual carry input arrives, the actual calculated values of sum and carry are selected using a multiplexer.

The conventional carry select adder consists of k/2 bit adder for the lower half ofthe bits i.e. least significant bits and for the upper half i.e. most significant bits (MSB"s) two k/bit adders. In MSB adder"s one adderassumes carry input as one for performing addition and another assumes carry input aszero. The carry out calculated from the last stage i.e. least significant bit stage is used to select the actual calculated values of output carry and sum. The selection is done by using a multiplexer. This technique ofdividing adder in to stages increases the areautilization but addition operation fastens.

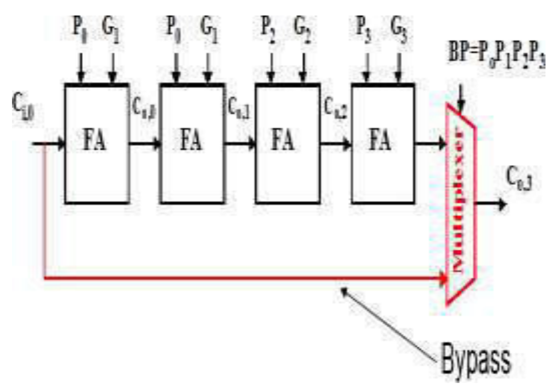
2. Carry Skip Adder:

A carry-skip adder consists of a simple ripple carry-adder with a special speed up carry chain called a skip chain. Carryskip adder is a fast adder compared to ripple carry adder when addition of large number of bits take place; carry skip adder has O(√n) delay provides a good compromise in terms of delay, along with a simple and regular layout This chain defines the distribution of ripple carry blocks, which composethe skip adder. A carry-skip adder is designed to speed up a wide adder by aiding the propagation of a carry bit around a portion of the entire adder.

Actually the ripple carry adder is faster for small values of N. However the industrial demands these days, which most desktop computers use word lengths of 32 bits like multimedia processors, makes the carry skip structure more interesting. The basic structure of Carry Skip Adder is shown in Fig.3.1.



(a). Carry Propagation



(b).Adding By Pass

Fig.3.1. Carry skip adder structure – basic concept

3.1.1. 32-bit Carry Skip Adder

A carry skip divides the words to be added in to groups of equal size of k-bits. Carry Propagate pi signals may be used within a group of bits to accelerate the carry propagation. If all the pi signals within the group are pi=1, carry bypasses the entire group as shown in Fig.3.1.1.

P = pi * pi+1 * pi+2 *… pi+k

ISBN: 978-81-965236-7-1

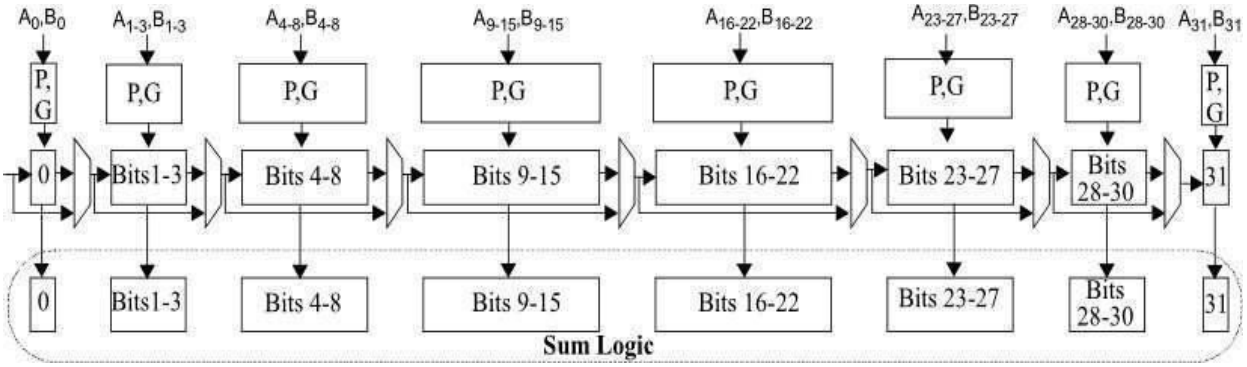


Fig.3.1.1. 32-bit Carry skip adder

In this way delay is reduced as compared to ripple carry adder. The worst- case carry propagation delay in a N-bit carry skip adder with fixed block width b, assuming that one stage of ripple has the same delay as one skip, can be derived:

TCSKA = (b -1) +0.5+ (N/b-2) + (b -1)
= 2b + N/b – 3.5 Stages

3. VLSI:

VLSI stands for "Very Large Scale Integration". This is the field which involvespacking more and more logic devices into smaller and smaller areas.

- Simply we say Integrated circuit is many transistors on one chip.
- Design/manufacturing of extremely small, complex circuitry using modified semiconductor material.
- Integrated circuit (IC) may contain millions of transistors, each a few mm insize.
- Applications wide ranging: most electronic logic devices.

3.1 VLSI Design Flow

3.1.1 Digital Circuit:

Digital ICs of SSI and MSI types have become universally standardized and have been accepted for use. Whenever a designer has to realize a digital function, he uses a standard set of ICs along with a minimal set of additional discrete circuitry. Consider a simple example of realizing afunction as

$$Q\ n+1 = Q\ n + (A\ B)$$

Here on, *A*, and *B* are Boolean variables, with *Q n* being the value of *Q* at the *n*th time step. Here *A B* signifies thelogical AND of *A* and *B*; the „+" symbol signifies the logical OR of the logic variables on either side. A circuit to realize the function is shown in Figure. The circuit can be realized in terms of two ICs – an A- O-I gate and a flip-flop. It can be directly wired up, tested, and used.

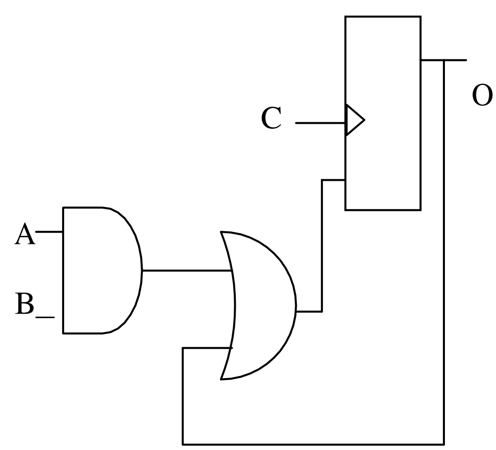


Fig 4.1.1(a): Simple digital circuit

ISBN: 978-81-965236-7-1

With comparatively larger circuits, the task mostly reduces to one of identifying the set of ICs necessary for the job and interconnecting; rarely does one have to resort to a micro level design. The accepted approach to digital design here is a mix of the top-down and bottom-up approaches as follows.

- Decide the requirements at the system level and translate them to circuit requirements.
- Identify the major functional blocks required like timer, DMA unit, register file *etc*., and say as in the design of a processor.
- Whenever a function can be realized using a standard IC, use the same –for example programmable counter, mux, demux, *etc*.
- Whenever the above is not possible, form the circuit to carry out the block functions using standard SSI – for example gates, flip-flops, *etc*.
- Use additional components like transistor, diode, resistor, capacitor, *etc*., whereveressential.

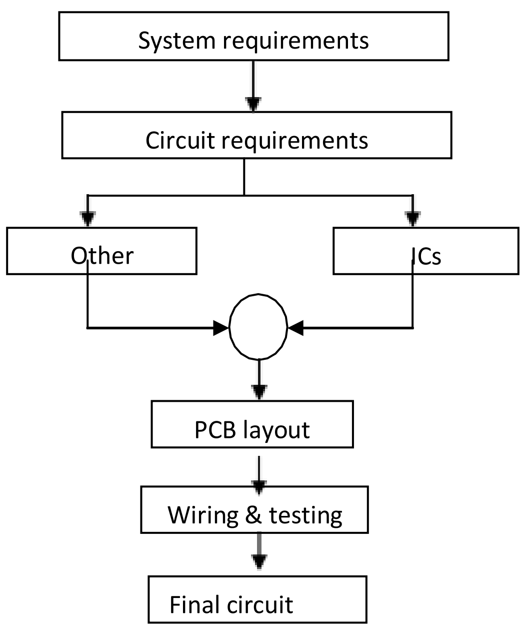


Fig 4.1.1(b): Process flowchart

Once the above steps are gone through, a paper design is ready. Starting with the paper design, one has to do a circuitlayout. The physical location of all the components is tentatively decided; they are interconnected and the "circuit-on paper" is made ready. Once a paper design is done, a layout is carried out and a net-list prepared. Based on this, the PCB is fabricated and populated and all the populated cards tested and debugged.

4. ROLE OF VHDL:

VHDL is an acronym for Very High Speed Integrated Circuits Hardware description Language. The language can be used to model a digital system at many levels of abstraction ranging from the algorithmic level to the gate level. The complexity of the digital system beingmodeled could vary from that of a simple gate to a complete digital electronic system. The VHDL language can be regarded as an integrated amalgamation of sequential,concurrent, net list and waveform generation languages and timing specifications.

5. Software Used:

XILINX:

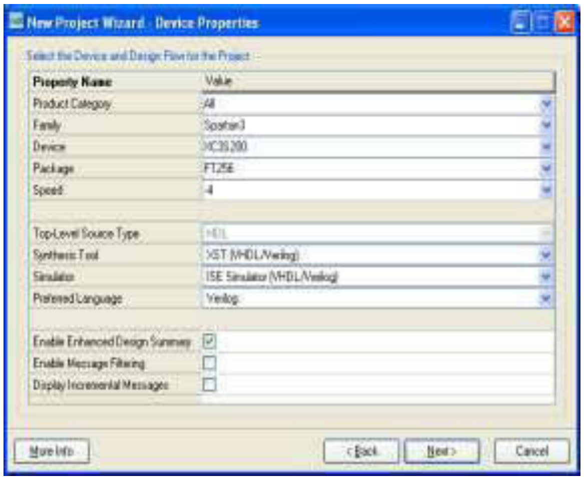
Xilinx software is used by the VHDL/VERILOG designers for performing Synthesis operation. Any simulated code can be synthesized and configured on FPGA. Synthesis is the transformation of VHDL code into gate level net list. It is an integral part of current design flows.

Algorithm:

Start the ISE Software by clicking the XILINX ISE icon.

Create a New Project and find the following properties displayed.

ISBN: 978-81-965236-7-1



Create a VHDL Source formatting all inputs, outputs and buffers if required. Which provides a window to write the VHDL code, to be synthesized?

6. RESULTS:

CSLA WITH RCA IMPLEMENTATION SYNTHESIS REPORT:

Release 8.2i - xst I.31

Copyright (c) 1995-2006 Xilinx, Inc. Allrights reserved.

--> Parameter TMPDIR set to

./xst/projnav.tmp

CPU: 0.00 / 0.32 s | Elapsed : 0.00 / 0.00 s

--> Parameter xsthdpdir set to ./xst

CPU: 0.00 / 0.32 s | Elapsed : 0.00 / 0.00 s

--> Reading design: CSLA_32_RCA.prj

POWER REPORT OF CSLA WITH BEC:

Started: "Generate Power Data".

Loading device for application Rf_Devicefrom file 'v50.nph' in environment C:\Xilinx.

"CSLA_32" is an NCD, version 3.1, devicexcv50, package bg256, speed -5

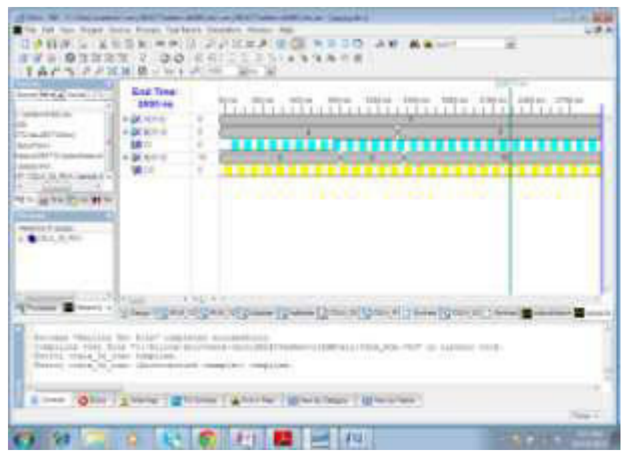
Design load 35% complete

Process "Generate Power Data" completed successfully.

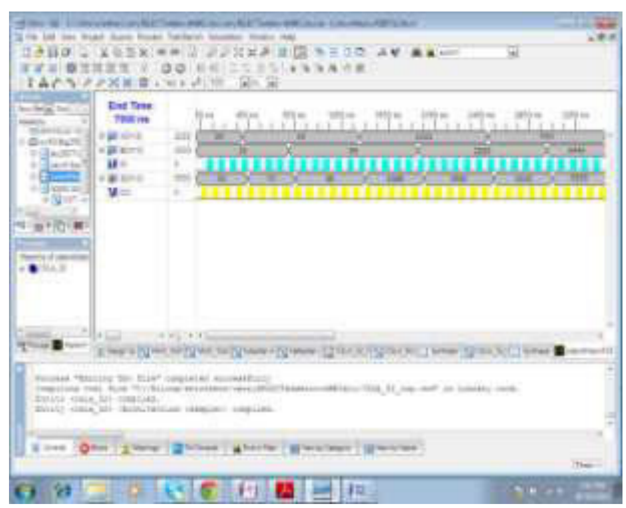
❖ **Comparison Table Between CSLA Adders with RCA and BEC in terms of timing (delay) and power by using the device :** xcv50-5-bg256 to analysis

	TIMING REPORT	POWER
CSLA WITH BEC	36.876ns	7mw
CSLA WITH RCA	51.536ns	27mw

❖ **WAVEFORM OF CSLA WITH BEC:**



❖ **WAVEFORM OF CSLA WITH RCA:**



ISBN: 978-81-965236-7-1

7. CONCLUSION

Addition is the most common and often used arithmetic operation on microprocessor, digital signal processor, especially digital computers. Also, it serves as a building block for synthesis all other arithmetic operations. Therefore, regarding the efficient implementation of an arithmetic logic unit, the adder structures become a very critical hardware unit.

In any book on computer arithmetic, someone looks that there exists a large number of different circuit architectures with different performance characteristics and widely used in the practice. Although many researches dealing with the adder structures have been done, the studies based on their comparative performance analysis are only a few.

Digital Adders are the core block of DSP processors. The final carry propagation adder (CPA) structure of many adders constitutes high carry propagation delay and this delay reduces the overall performance of the DSP processor. In this project, qualitative evaluations of the CSLA adder with and without BEC architectures are given. Among the huge member of the adders we wrote VERILOG (Hardware Description Language) code for Carry skip and carry select adders to emphasize the common performance properties belong to their classes. With respect to delay time and power consumption we can conclude that the implementation of CSLA with BEC is efficient. The main advantage of this BEC logic comes from the lesser number of logic gates than then-bit Full Adder (FA) structure.

Now a day‘s Carry Select Adder (CSLA) used in many data-processing processors toper form fast arithmetic functions. That’s why we have designed a configurable adder with minimal delay overhead, and power efficient. CSLA RCA can be replaced by CSLA BEC Where the speed and power are the major constraints. The proposed CSLA BEC consumes only 17mw which is very less when compare to the existing CSLA RCA which consumes 37mw.

REFERENCES

[1] B. Ramkumar, H.M. Kittur, and P. M.Kannan, “ASIC implementation ofmodified faster carry save adder,” Eur. J.Sci. Res., vol. 42, no. 1, pp. 53–58, 2010.

[2] D. Radhakrishnan, “Low-voltage low power CMOS full adder,” in Proc. IEEE Circuits Devices Syst., vol. 148, Feb. 2001.

[3] E. Abu-Shama and M. Bayoumi, “A newcell for low power adders,” in Proc. Int. Midwest Symp. Circuits and Systems, 1995,pp. 1014–1017.

[4] T. Y. Ceiang and M. J. Hsiao, “Carryselect Adder using single ripple carry Adder,” Electron. Lett., vol. 34, no. 22, pp. 2101–2103, Oct. 1998.

[5] J. M. Rabaey, Digital Integrated Circuits—A Design Perspective. Upper Saddle River, NJ: Prentice-Hall, 2001.

[6] J. Storer andR. J. Turyn, “On binary sequences,” in Proc. Amer. Math.Soc., vol. 12, 1961, pp. 394–399.

[7] M. J. E. Golay, “The merit factor of long low autocorrelation binary sequences,” IEEE Trans. Inform. Theory, vol. IT-28, pp. 543– 549, May 1982.

[8] J. Lindner, “Binary sequences up to length 40 with best possible auto- correlation function,” Electron. Lett., vol. 2, p. 507, 1975.

[9] S. Mertens, “Exhaustive search for low-autocorrelation binary se-quences,” J. Phys. A, vol. 29, pp. L473–L481, 1996.

[10] . (2002) the Bernasconi Model. [Online]. Available: http://odysseus.nat.uni-magdeburg.de/~mertens/bernasconi/

ISBN: 978-81-965236-7-1

Utilizing AI-Based Technology for English Teaching and Learning

Mr.S.Ramesh Raja[1], Mrs.A.Alagumathi[2]

[1,2]Department of English,

[1,2]Assistant Professor, Sri Bharathi Engineering College for Women, Pudukkottai - 622303

[1]rameshraja4687@gmail.com

[2]alagumathia@gmail.com

***Abstract* — Artificial Intelligence (AI) emulates human intelligence through computer-based simulations, functioning akin to human beings. As a key driver of the 4.0 industrial revolution, AI plays a pivotal role in enhancing education, particularly in English Language Teaching (ELT). This library research aims to explore the significance of AI in ELT and investigate its various applications. The findings reveal that AI contributes to creating an optimal learning environment for English acquisition. Its substantial capacity allows for the customization of learning atmospheres, enabling learners to engage multiple senses while honing English skills based on their proficiency levels, vocational requirements, or personal interests.**

AI facilitates real-life simulated dialogues, including spoken English, and enhances practical skills such as written communication. This results in heightened student engagement and optimizes the overall impact of English language instruction in ELT. The evolution of technology and platforms makes learning English more accessible, with AI technology presenting opportunities to refine language skills. A plethora of ELT applications grounded in AI, such as Google Translate, Text to Speech (TTS), English Able, Orai, Elsa, Chatbot, Duolingo, Neo platforms, and others, serve as smart machines capable of simulating human-like intelligence. These technologies offer diverse learning experiences, making it easier for students to comprehend and master the English language.

Keywords— Artificial Intelligence, English Language, Learning, Teaching

I. INTRODUCTION

The industrial era has compelled individuals to adapt swiftly to rapid changes. The advent of globalization and the fourth industrial revolution has ushered in novel forms of creativity, opportunities, and challenges, particularly in the realm of technology. Consequently, technology assumes a crucial role in disseminating information through various mediums such as text, images, and sound, as highlighted by Rahayu and Pujiyono (2017). The primary purpose of technology is to streamline human tasks and activities. Among the technologies undergoing intensive development, Artificial Intelligence (AI) stands out as a noteworthy example.

Artificial Intelligence (AI) stands out as a facet of computational creativity, garnering increased attention for the development of AI technologies (Cheng & Day, 2014). Various AI technologies have been implemented to imbue computers with creativity, as highlighted by Rahman (2009, p. 343). These technologies involve creating software capable of autonomous functions such as knowledge filtering and computational tasks, contributing to areas like student searches.

AI, also known as Machine Intelligence (Mehrotra, 2019), strives to emulate human intelligence in computer systems and robotic devices (Karsenti, 2019). It encompasses the prediction of machine intelligence through the demonstration of natural intelligence exhibited by humans, essentially infusing machines with human-like cognitive abilities. The field of AI, as defined by Mehrotra (2019), explores the analysis and development of smart machines and applications, aiming to make machines think and behave intelligently, akin to human beings.

The term "AI" comprises "artificial" and "intelligence" (Ahmet, 2018). "Artificial" denotes something simulated, not entirely real but not necessarily fraudulent. On the other hand, "intelligence" encompasses various complex attributes such as reasoning, self-knowledge, understanding, emotional awareness, preparation, consciousness, and creativity.

Joshi (2019, p. 4) emphasizes that AI does not necessarily imply creating an incredibly smart computer that can solve all problems; rather, it involves building machines capable of human-like actions. The objective of AI is to develop computer software or hardware systems that exhibit human-like thought processes or display traits traditionally associated with human intelligence (Campesato, 2020). AI, as a theoretical concept, can perform tasks typically involving human intelligence, including speech understanding, language awareness, decision-making, and visual perception.

AI plays a pivotal role in language education, offering tireless and individualized training, providing learners with abundant feedback and scaffolding activities crucial for fluency development. The promise of AI lies in its potential to expedite skill development.

Kaur & Gill (2019) assert that AI represents a digital endeavor to achieve human-level intelligence through various computational processes. It encompasses advanced technologies that enable humans to perceive, comprehend, function, and learn from machines. AI, as a branch of computer science, emphasizes thinking and acting like humans, borrowing human intelligence traits and incorporating them in a computer-friendly manner. Tasks such as learning, planning, decision-making, and language understanding can be performed by AI.

The integration of technology and digital platforms has facilitated English language teaching and learning, offering opportunities for skill enhancement. However, the development of an English class model utilizing AI should complement, rather than replace, traditional teaching methods. Ribeiro (2020) underscores the pragmatic use of AI in English Language Teaching (ELT), especially given the systematic grammatical structure of the English language.

ISBN: 978-81-965236-7-1

In conclusion, this research seeks to comprehend the role of Artificial Intelligence (AI) and investigate AI technologies in English Language Teaching (ELT), recognizing the potential for transformative impacts on education and language learning processes.

II. METHOD

This constitutes a library-based research endeavor, involving the systematic collection of data or scholarly writings with the specific goal of addressing the research objective or amassing bibliographic information. It is an investigative process conducted to tackle a problem, grounded in a meticulous and comprehensive exploration of pertinent library materials. Notably, one distinguishing feature of library research is the direct engagement of the researcher with textual sources, as articulated by Zed (2004, p. 4). The forthcoming analysis will encompass an exploration of various reference books, journals, and the findings of previous related studies, establishing a theoretical foundation for the subject under investigation.

The data sources utilized in this research encompass books, journals, and internet sites pertinent to the selected topic. The researcher draws upon a diverse range of books and journals related to the research topic to gather comprehensive research data. The method employed for data collection in this analysis is documentation, entailing the search for information within documents, books, articles, papers, posts, newspapers, and other relevant sources. However, in this study, an evaluation of concepts and theories is prioritized, relying on the existing literature, particularly drawing insights from various articles published in reputable scientific journals.

Following the collection of all pertinent data, the subsequent phase involves data analysis to derive meaningful conclusions. Employing content analysis techniques is crucial for ensuring accurate and reliable results in the data analysis process. Content analysis, a form of study involving a thorough scrutiny of the contents of written materials, is chosen because the nature of the data necessitates a descriptive elucidation.

III. FINDINGS AND DISCUSSION

Relationship between Artificial Intelligence and English Language Teaching

AI-assisted devices form a subset within computer-assisted language learning (CALL), particularly in the context of foreign language learning. The field of AI brings forth a plethora of advancements in foreign language education, propelled by the exponential growth in natural language processing and technologies adept at handling vast amounts of data (Li, 2020). English Language Teaching (ELT) holds a crucial position as an educational objective, aiming to enhance students' ability to engage globally (Mukhallafi, 2020). The expansive development of natural language processing and technologies proficient in managing big data has enabled AI to provide a wide array of improvements in the realm of foreign language education.

Teaching English through artificial intelligence (AI) is a dynamic and challenging domain (Zhu, 2017). AI technologies have the potential to make classrooms accessible to individuals of diverse linguistic backgrounds or those with visual or auditory impairments, fostering inclusivity on a global scale (Marr, 2018). As highlighted by Gawate (2019), AI serves as a crucial support system, benefiting both English language students and teachers. This assertion is echoed by Li (2017), who states that "Artificial intelligence also functions as a tool for enhancing English teaching." In the realm of AI, the integration of language literacy and digital literacy proves to be a synergistic approach to enhancing global competence, particularly in English language acquisition. The importance of personalized content remains pivotal in digital learning technology, with adaptive systems leveraging big data and artificial intelligence now readily available.

In the current study, Mukhallafi (2020) defines artificial intelligence (AI) as the utilization of AI systems for enhancing the teaching and learning of English, specifically focusing on improving the organization, arrangement, and selection of instructional content. This approach aims to diversify instructional sources and educational streams based on learners' proficiency levels. Additionally, AI is employed to individualize self-study procedures, simulate intelligent and expert systems, and establish innovative teaching techniques and assessment methods. Wang (2019), in his research titled "Research on Artificial Intelligence Promoting English Learning Change," explores the relationship between Artificial Intelligence and English teaching, elucidating the connection as follows:

1. Artificial intelligence changes the atmosphere in which English is learned. Artificial intelligence offers a good learning atmosphere for immersive English learning. Through integrating and logically interpreting information such as images, sound, and text in an intelligent device, English learning becomes more stereoscopic and visual. Students communicate with AI through the interface between man and computer, which not only improves the validity of language environments. This statement is also supported by (Zilberman, 2019) that AI has a significant ability to create a personalized atmosphere in which adult learners use all their senses to concurrently exercise English skills in conjunction with their present level of English or occupational needs or wishes.
2. Artificial Intelligence optimizes the teaching impact of English. AI will provide a real simulation dialog platform for the teaching and learning of English in English. We will help students make better use of English words, spoken English, and English writing, and develop their comprehension skills. Not only can the cultural and customs awareness ofthe various English-speaking countries collected in AI be used to communicate and connect with students, but it can also significantly enhance the interest of students in learning English.
3. Artificial Intelligence increases the practical skill of the students in English class. Artificial Intelligence (AI) is currently the hotspot technology material of social science within the industry. The application of science and technology in English Language Teaching (ELT) requires that teachers and students understand the ability to work the system and solve problems in time. Therefore, as AI is applied to English teaching, it increases the practical operational capacity of the students.

According to Gawate (2019) in his article entitled "Artificial Intelligence (AI) Based Instructional Programs in Teaching-Learning of English Language" states that any advantages of AI-based English language teaching and learning instructional programs are:

ISBN: 978-81-965236-7-1

1. Friendly need-based instructional programs for consumers. The AI-based teaching software combines aim learners and their contextual needs. It is laid down with the learners' clear expectations and exact criteria. English language teaching-learning misleads to no endpoint without analyzing learners' needs.
2. Qualitative contents: through Artificial Intelligence, it is possible to create qualitative teaching-learning material that operates on all levels of language such as hearing, speaking, reading, and writing.
3. Supplementary teacher and student support system. As an external support mechanism, AI plays a critical function for students and teachers of the English language. AI, when it incorporates humanized knowledge, will do this at anytime and anywhere with precise assistance. While AI-based services are built-in, the position of educators is not denied.
4. Fast feedback system: AI-based systems can be built to learn English in a variety of ways to get feedback. It can be used in AI-based instructional programs to quantify and interpret the input according to the needs of the students, such as gradation, review, cross verification, and in-depth presentation. All facets of the students' success are assessed.
5. Changing the teacher's role as a guide and director. It is difficult to change the position of the instructor as a guide and director and exclude the teacher from the method. AI-based systems only modify the teacher's role in the ELT process. Students should be led and assisted by teachers. The teacher can handle and manage such an AI-based program that needs a few manual modifications, and teachers can do it. AI-related instructional services can only be an aid in teaching-learning of the English language.
6. Connectivity globally. For some AI-related instructional systems, it gives students all the possibilities. Owing to Artificial Intelligence, spatial and time constraints are solved. It is possible to exchange knowledge from quality organizations as well as from organizations. This is truly incredible access to AI-based instructional software. With the help of facial recognition, voice recognition, and movements of the students, it allows remote access. In short, all student behaviors can be managed with AI-based applications.
7. Teaching-learning personalization in English. As per the demand and needs of the students, the course can be created. It can be student-centered in its personalization.
8. The AI-based learning platform helps learners to learn at their speed, to repeat topics, and to highlight items that they have issues with to involve them with activities, to cater to their interests, etc. For the advancement of teaching-learning English, AI-based instructional programs are tailored. It emphasizes the need-based creation of the English course material.

Artificial Intelligence Technology in English Language Learning

Artificial intelligence technology is a technology that explores how the robot can complete the intelligent work that only human beings can complete initially as one of the world's most advanced information systems (Han, 2019). Technology also develops in such a way that it becomes more advanced and makes it easier for us to do some work, such as teaching and learning English. One technology that is often discussed in the wider community is artificial intelligence technology. Technology is opening up many new possibilities for language learning (Fryer & Carpenter, 2006).

Luo & Cheng (2020) states that teaching foreign languages is powered by Artificial Intelligence (AI) technologies. The challenges of short teaching hours, limited space, limited resources, and a monotonous measurement method can be solved efficiently by Artificial Intelligence (AI) technology, etc. Thornton (2007, p. 1) defines that almost all programs/technologies Artificial Intelligence (AI) can be said to be doing some form of problem-solving. It means that Artificial Intelligence (AI) is a broad area of science that incorporates this dynamic problem-solving and human-like capacity to sense behavior and purpose. (Cobar, 2019).

The goal of AI can create smart machines that think and act like humans, with the abilityto simulate intelligence and produce decisions through a process in a similar manner to humanreasoning (Salvaris et al., 2018, pp. 3–4). AI works by combining the presence of several data, repetitive processing, and intelligent algorithms. This allows the software to learn automatically from the patterns or features that exist in the data. AI is a very broad field of study. The scope of theories, methods, technologies, and sub-fields that exist in AI is varied including machine learning, neural networks, cognitive computing, computer vision, and scientific language processing. When humans communicate with others by using a language, they may employ, almost effortlessly or extremely complex and still little understood process (Nilsson, 2014). Thus a computer system capable of producing and interpreting fragments of the English language has been very difficult to create. One cause of the challenge is that language has arisen within intelligent beings as a means of communication.

Teaching and learning English has become easier with the development of digital platforms. Artificial intelligence (AI) technology now offers the opportunity to improve English language skills. Language literacy and digital literacy are a neat combination to improve global competence. AI bases its process on the text processing of a language. The more sophisticated the AI, the more and more accurate the language he mastered. Therefore, the use of AI technologies would strengthen foreign language teaching and learning. (Yingsoon, 2021).

AI plays a role in conveying various information and also helps in making the English learning process even more effective. The existence of various kinds of learning technology makes it easier for these learners to understand what has been explained by the teacher. Even students also have the ease of learning even without having to face the teachers directly. There are so many choices of language learning applications based on the technology of Artificial Intelligence (AI) which can be used by both English educators and students/learners. Some examples of AI technology that can be used in English language learning are as follow:

1. **Google Translate**
   Google has created an enormous suite of tools for users, but after their original search engine, possibly the most important application is Google Translate which can be accessed on http.google.com/translate (Smallwood, 2015, p. 51). Text speech has even been replaced by a translator. Applications like Google Translate are

already integrated with Google Board. So translating Indonesian to English, or vice versa is as easy as typing on a keyboard. Covili (2016) states that there are five things about Google Translate, they are: Google Translate can translate into up to 50 different languages. The users can translate entire documents using Google Translate. Google Translate can pronounce words in the new language and provide definitions of the words. By using the mobile app for „translate", the users can translate street signs on the fly. Google Translate also can translate websites into a variety of languages.

Concerning teaching and learning English, Google Translate as a translator is the main function, namely as an online translator. Students can use it to translate words/phrases/sentences/paragraphs from Indonesian English or Indonesian English which are used a lot in Indonesian English translation activities. Google Translate can be used to check the spelling of words that arise due to typos. It is very useful when it comes to checking the English spelling. Google Translate can be used as a tool to learn foreign language word pronunciation. For students who want to learn English for free, especially how to pronounce words, google translate can be used.

2. **Text to speech (TTS)**

Google Translate adds text to speech as an additional feature. The text to speech feature of Google Translate provides various languages to be spoken, from words that are translated from various languages such as English. The text to speech feature in Google Translate can read text with a less flat intonation and is smoother than the others. A Text- To-Speech (TTS) system can be defined as a system that can convert text into speech automatically through phonetization (the arrangement of phonemes to form speech). A TTS system can pronounce any word because the vocabulary is unlimited.

Concerning teaching and learning English, Text-To-Speech (TTS), can convert computer-generated text into pronunciation (audio), where the resulting pronunciation can be adjusted for speed, intonation, and the output audio format to be saved in the form ofan audio file. TTS technology can streamline the teaching and learning process and complement the learning media for English subjects, especially in the English laboratory (Yudhistiro, 2016).

3. **English Able**

English ABLE is an Assessment-Based Learning Environment for English grammar. This technology was developed by Zapata-Rivera et al (2007). Assessment-based learning environments (ABLE) use assessment knowledge to direct instruction from a variety of sources (e.g. formative and summative). Concerning teaching and learning English, English ABLE refers to a learning environment that focused on tests to help English language learners (ELLs) learn about grammar in English. English ABLE uses a TOEFL CBT job library to build new sets with improved assignments aimed at unique ELL component skills. An adaptive, scaffolded learning environment, also offers packages for learners to help students master facets of English grammar.

4. **Orai**

Orai's perfect option for public speaking. It can not only be used to support a teacher but can also be used as a teacher. Orai is getting excellent reviews and is enjoyable to use. Orai is user-friendly. Improving your oratory skills is a quick, self-directed strategy. Concerning teaching and learning English, Orai's strengths are being able to detect how many words we say to detect how many fillers we say while we speak. Using Orai in class, the teachers can combine it with English speaking subject matter at that time, such as describing people, then give students about 15 minutes to use Orai and after that chooserandomly to come forward to practice speaking immediately. Orai provides several features designed to hone students' speaking skills, namely Lessons, Practice, Progress, and Recordings. Each of the main features has interesting content and can be studied repeatedly to hone these speaking skills. In the 'Lessons' feature, those who want to practice speaking can learn and practice their speaking skills on the content provided. Each content consists of three content stages that must be completed before you can learn the next lesson content. Orai is an application purposed to help students to be better English speakers (Suryani et al., 2019).

5. **Elsa**

English Learning Speech Assitant (ELSA) and designed by Vu Van in 2015, and is based in San Francisco, United States. This application makes use of Artificial Intelligence (AI) and speech recognition to help improve and perfect English pronunciation. ELSA (English Learning Speech Assistant) Speak is an application for learning English that applies artificial intelligence and speech recognition. This technology allows for a two-way learning process, for example, the users can pronounce certain words or sentences, then the system will perform analysis and provide corrective input. The ELSA framework is trained to use voice data of people speaking English with multiple accents, to recognize the speech patterns of non-native speakers, distinguishing them from most other speech recognition technologies. Users are given an assessment test to determine their level of proficiency. ELSA provides scores ranging from zero to 100, with most native speakers scoring 95 or above. The results help ELSA personalize the user's learning path, highlighting which sounds hit the spot, and what else needs tweaking. ELSA makes suggestions for specific lessons according to the user's abilities. Concerning teaching and learning English, Application ELSA (English Learning Speech Assistant) Speak is an application for learning English that applies artificial intelligence and speech recognition to help students improve their English speaking skills. This technology allows for a two-way learning process, for example, users can pronounce certain English words or sentences, then the system will perform analysis and provide corrective input (Eka, 2020).

6. **Chatbot**

Chatbots as one of the artificially intelligent conversational systems are the latest technologies designed to communicate both with humans and computers automatically (Nghi et al., 2019). Several previous studies have proven the use of chatbots as a

ISBN: 978-81-965236-7-1

learning medium, especially learning English (Afrianto et al., 2019).

Concerning teaching and learning English, the Chatbot application that is built will act as an English conversation partner. Conversations, in general, can be carried out orally or in writing so that it should be possible for the user to be able to practice both. To support the purpose of the chatbot application as a medium for English conversation training, a grammar error correction feature and a user's daily log feature are needed. The responses obtained included the location of the errors, suggestions for replacing words/sentences, and descriptions of errors. This is an effort to minimize errors in the user's sentence structure. Then the daily log feature is useful for measuring the extent to which the user's practice progresses in conversation mastery and English sentence structure. That way, users not only familiarize themselves with conversational English, but also get corrections and assessments of their practice. The simple chatbot function starts with the message the user sends. The NLP (Natural Language Processing) and chatbot then interpreted the message by referring to the message according to the current database (Haristiani, 2019).

7. Duolingo

Duolingo is a web that is used to learn foreign languages. Duolingo is a language learning application that uses a game method by matching words and filling in the blank parts of sentences. This method aims to teach the grammar, words, and phrases needed in a sentence. Concerning teaching and learning English, Any student at any level of English can learn a new science with Duolingo. So that the learning materials obtained by users match their abilities, Duolingo conducts tests first. After taking the test, Duolingo users will know what level of English they are at. Only then will Duolingo provide English material that has been adapted to the user's abilities. Not only about grammar, but Duolingo is also equipped with learning vocabulary, terms, and so on. Duolingo's English teaching method is also designed to be gaming-like and "competitive" with other users. That way, users of this application can see the development of English language skills that have been learned so far.

8. Neo

Nexgen English Online Co., an English application company from California, United States, launched the neo application, a global English language learning system. Neo is an integrated learning solution via cellphone to gain proficiency in English that can adapt to the development of user learning through artificial intelligence and voice recognition systems. Nexgen Neo is a new solution to learning English. Neo is an application that is effective, flexible, and easy to operate for users who have an active lifestyle. With an easy-to-use interface, an adaptive learning system using international standard English technology and certificates, Neo also presents a different experience for each user. Artificial intelligence (AI) in the neo Study application regularly analyzes user behavior and data to then provide content that automatically adapts as users progress.

Concerning teaching and learning English, Neo helps users master English faster as if they were accompanied by an expert personal teacher. Through the neo Study application, users will use the advanced speech recognition feature which trains them to correct the pronunciation of each word until they become proficient in speaking English.

The benefits of using AI tools in English language learning are: 1) AI can do things that cannot be achieved by individuals, such as evaluating English down to the phoneme and understanding how your language skills have progressed almost immediately over time. 2) At any moment, wherever they are genuinely accessible (sometimes even without the internet). 3) AI tools for learning spoken English are a more accessible and successful alternative. 4) They are more scalable and can serve a lot more students than people do. 5) They can accelerate learning by an increased level of instruction, with human teachers alone becoming difficult with such frequency. 6) For those who lack trust in their speech capacity, AI instruments have a pressure-free learning environment.

III. CONCLUSION

Artificial intelligence endeavors to create robots endowed with intelligence comparable to, or even surpassing, human intelligence. The expectations for artificial intelligence encompass a broad spectrum of capabilities designed to simplify tasks for humans, including natural language processing, perception, reasoning, movement, object manipulation, knowledge acquisition, and learning. The ultimate goal of developing such advanced machines is to enhance efficiency by reducing the time required for various activities. Through the utilization of artificial intelligence, decision-making becomes more cost-effective, contributing to overall efficiency.

The evolution of digital platforms has facilitated the process of learning English. The integration of computer and cell phone technologies not only expands opportunities for people worldwide but also amplifies the incorporation of artificial intelligence in language learning. Personalized content emerges as a pivotal aspect of digital learning technology, with the availability of adaptive systems leveraging big data and artificial intelligence. This enables tailoring the approach to learning English based on the unique needs and schedules of individual users.

IV.REFERENCES

1.Afrianto, I., Irfan, M. F., & Atin, S. (2019). Aplikasi Chatbot Speak English Media Pembelajaran Bahasa Inggris Berbasis Android. Komputika : Jurnal Sistem Komputer, 8(2), 99–109. https://doi.org/10.34010/komputika.v8i2.2273.

2.Ahmet, C. (2018). Artificial Intelligence: How Advance Machine Learning Will Shape The Future Of Our World. Shockwave Publishing via Publish Drive.

ISBN: 978-81-965236-7-1

3.Campesato, O. (2020). Artificial Intelligence, Machine Learning, and Deep Learning. Stylus Publishing, LLC.

4.Cheng, S.-M., & Day, M.-Y. (2014). Technologies and Applications of Artificial Intelligence: 19th International Conference, TAAI 2014, Taipei, Taiwan, November 21-23, 2014, Proceedings. Springer.

5.Cobar, J. (2019). Artificial Intelligence: Data Analytics and Robot Learning in Practice and Theory. Self Publisher.

6.Covili, J. J. (2016). Going Google: Powerful Tools for 21st Century Learning. Corwin Press. Devi, K. G., Rath, M., & Linh, N. T. D. (2020). Artificial Intelligence Trends for Data Analytics Using achine Learning and Deep Learning Approaches. CRC Press.

7.Eka, I. (2020, February 20). Aplikasi ELSA Speak Ekspansi ke Indonesia, Fokus Tingkatkan Kemampuan Berbicara Bahasa Inggris. Dailysocial. https://dailysocial.id/post/elsa- aplikasi-belajar-bicara-bahasa-inggris

8.Fryer, L., & Carpenter, R. (2006). Bots as Language Learning Tools. Language Learning & Technology, 7.

9.Gawate, S. (2019). Artificial Intelligence (AI) Based Instructional Programs in Teaching- Learning of English Language. https://doi.org/10.33329/ijelr.64.69

10. Gawate, S. P. (2019). Artificial Intelligence (AI) Based Instructional Programs in Teaching- Learning of English Language. International Journal of English Language, Literature and Translation Studies (IJELR), 6, 6.

11.Han, B. (2019). Application of Artificial Intelligence in Autonomous English Learning among College Students. International Journal of Emerging Technologies in Learning (IJET), 14(06), 63–74. https://online-journals.org/index.php/i-jet/article/view/10157

12.Haristiani, N. (2019). Artificial Intelligence (AI) Chatbot as Language Learning Medium: An inquiry. Journal of Physics: Conference Series, 1387, 012020. https://doi.org/10.1088/1742-6596/1387/1/012020

13.Joshi, A. V. (2019). Machine Learning and Artificial Intelligence. Springer Nature.

14.Karsenti, T. (2019). Artificial intelligence in education: The urgent need to prepare teachers for tomorrow"s schools. Formation et Profession, 27(1), 105. https://doi.org/10.18162/fp.2019.a166

15.Kaur, D. J., & Gill, N. S. (2019). Artificial Intelligence and Deep Learning for Decision Makers: A Growth Hacker's Guide to Cutting Edge Technologies. BPB Publications.

16.Li, R. (2020). Using Artificial Intelligence in Learning English as a Foreign Language: An Examination of IELTS LIULISHUO as an Online Platform. Journal of Higher Education Research, 1. https://doi.org/10.32629/jher.v1i2.178

17.Luo, M., & Cheng, L. (2020). Exploration of Interactive Foreign Language Teaching Mode Based on Artificial Intelligence. 2020 International Conference on Computer Vision, Image and DeepLearning (CVIDL), 285–290. https://doi.org/10.1109/CVIDL51233.2020.00-84

18.Marr, B. (2018, July 25). How Is AI Used In Education—Real World Examples Of Today AndA PeekIntoTheFuture.Forbes. https://www.forbes.com/sites/bernardmarr/2018/07/25/how-is-ai-used-in-education- real-world-examples-of-today-and-a-peek-into-the-future/

19.Mehrotra, D. D. (2019). BASICS OF ARTIFICIAL INTELLIGENCE & MACHINE LEARNING. Notion Press.

20.Mukhallafi, T. R. A. (2020). Using Artificial Intelligence for Developing English Language Teaching/Learning: An Analytical Study from University Students" Perspective. International Journal of English Linguistics, 10(6), 40. https://doi.org/10.5539/ijel.v10n6p40

21.Nghi, T. T., Phuc, T. H., & Thang, N. T. (2019). Applying Ai Chatbot For Teaching A Foreign Language: An Empirical Research. 8(12), 6.

22.Nilsson, N. J. (2014). Principles of Artificial Intelligence. Morgan Kaufmann.

23.Rahayu, S., & Pujiyono, W. (2017). Media Pembelajaran Kecerdasan Buatan Pokok Bahasan Metode Pelacakan Menggunakan Multimedia Pada E-Learning.JSTIE (Jurnal SarjanaTeknikInformatika)(E-Journal),5(1),136–145. https://doi.org/10.12928/jstie.v5i1.10824

24.Rahman, S., Mahbubur. (2009). Methods and Applications for Advancing Distance Education Technologies: International Issues and Solutions: International Issues and Solutions. IGI Global.

25.Ribeiro, R. (2020, March 9). Artificial Intelligence in English language learning. Cambridge.Org.https://www.cambridge.org//elt/blog/2020/03/09/artificial- intelligence-english-language-learning/

ISBN: 978-81-965236-7-1

26.Salvaris, M., Dean, D., & Tok, W. H. (2018). Deep Learning with Azure: Building and Deploying Artificial Intelligence Solutions on the Microsoft AI Platform. Apress.

27.Shin, M.-H. (2018). How to use artificial intelligence in the English language learning classroom. Indian Journal of Public Health Research & Development, 9(9), 557. https://doi.org/10.5958/0976-5506.2018.01058.6

28.Smallwood, C. (2015). The Complete Guide to Using Google in Libraries: Research, User Applications, and Networking. Rowman & Littlefield.

29.Sridhar, G. S. (2018). Artificial Intelligence: The Future Way of Technology. G.S.SRIDHAR. Suryani, L., Syahrizal, T., & Fauziah, U. N. E. (2019). Using Orai Application in Teaching Pronunciation. Indonesian EFL Journal, 5(2), 93–102. https://journal.uniku.ac.id/index.php/IEFLJ/article/view/1835 Thornton, C. (2007). Artificial Intelligence. New Age International. Wang, R. (2019). Research on Artificial Intelligence Promoting English Learning Change. Proceedings of the 3rd International Conference on Economics and Management, Education, Humanities and Social Sciences (EMEHSS 2019). Proceedings of the 3rd International Conference on Economics and Management, Education, Humanities and Social Sciences (EMEHSS 2019), Suzhou City, China. https://doi.org/10.2991/emehss-19.2019.79

30.Whitby, B. (2009). Artificial Intelligence. The Rosen Publishing Group, Inc.

31.Yingsoon, G. Y. (2021). Using AI Technology to Support Speaking Skill Development for the Teaching of Chinese as a Foreign Language [Chapter]. Multidisciplinary Functions ofBlockchain Technology in AI and IoT Applications; IGI Global. https://doi.org/10.4018/978-1-7998-5876-8.ch010

32.Yudhistiro, K. (2016). Pemanfaatan Teknologi Text-To-Speech Sebagai Media Pembelajaran Pada Laboratorium Bahasa Inggris. Jurnal Teknologi Dan Manajemen Informatika, 2(1), Article 1. https://doi.org/10.26905/jtmi.v2i1.622

33.Zapata-Rivera, D., Vanwinkle, W., Shute, V., Underwood, J. S., & Bauer, M. (2007). English ABLE. Proceedings of the 2007 Conference on Artificial Intelligence in Education: Building Technology Rich Learning Contexts That Work, 323–330.

34.Zed, M. (2004). Metode Penelitian Kepustakaan. Yayasan Obor Indonesia.

35.Zhu, D. (2017). Analysis of the Application of Artificial Intelligence in College English Teaching. Proceedings of the 2017 2nd International Conference on Control, Automation and Artificial Intelligence (CAAI 2017). 2017 2nd International Conference on Control, Automation and Artificial Intelligence (CAAI 2017), Sanya, China. https://doi.org/10.2991/caai-17.2017.52

36.Zilberman, A. (2019, December 31). AI And Learning: The Latest Learning Methodology. ELearning Industry https://elearningindustry.com/artificial-intelligence-best-tool-learning-english.

UTILIZING AUTOMATIC POWER FACTOR COMPENSATION IN INDUSTRIAL APPLICATIONS TO REDUCE PENALTIES

[1]Mr. T. PARTHIBAN, [2]Mrs. P. BOWRNILA
[1,2]Assistant Professor, Department of Electrical and Electronics Engineering,
Sri Bharathi Engineering College for Women,
Pudukkottai, Tamil Nadu, India.
[1]effectualengineer@gmail.com

Abstract - **The increasing prevalence of sensitive loads has brought attention to power quality issues. Many of these loads utilize equipment that is vulnerable to voltage supply distortions or dips. Disturbances in distribution networks are the root cause of most power quality problems. Regulations, which are in place in many locations, impose limits on the distortion and unbalance that customers can introduce to a distribution system. Compliance with these regulations may necessitate the installation of compensators (filters) on customer premises. Utility providers are also expected to deliver low distortion balanced voltage to customers, particularly those with sensitive loads.**

In instances where a DVR (Dynamic Voltage Restorer) is linked to a specific load, it can inject compensating current to ensure that the total demand aligns with the utility connection specifications. Alternatively, this paper aims to explore a DVR that can effectively fulfil both of these functions.

KEYWORDS: Voltage supply distortions, Distribution network disturbances, Regulatory compliance, Compensators (filters), Utility connection specifications, Dynamic Voltage Restorer (DVR), Compensating current, Utility providers.

INTRODUCTION:

Reactive power in power distribution networks is a primary contributor to increasing system losses and various power quality issues. Traditionally, Static Var Compensators (SVCs) combined with passive filters have been utilized for active power compensation and mitigating power quality problems in distribution systems. However, SVCs, while effective at the transmission level, have limitations such as restricted bandwidth, a higher count of passive elements leading to increased size and losses, and slower response times, making them less suitable for modern distribution requirements.

An alternative compensating system has been proposed, integrating SVC and an active power filter to compensate three-phase loads within a minimum of two cycles. This approach involves a controller that continuously monitors load voltages and currents to determine the appropriate compensation needed with minimal response time. The Distribution Static Compensator (DVR) emerges as a solution to overcome the drawbacks of traditional methods, offering precise control and fast response during transient and steady states, with a reduced footprint and weight.

Essentially, a DVR functions as a converter-based distribution Flexible AC Transmission Controller, sharing similarities with a Static Compensator used at the transmission level. While the Compensator Technique at the transmission level handles fundamental reactive power and provides voltage support, the DVR operates at the distribution level or load end for dynamic compensation. Additionally, a DVR can act as a shunt active filter to eliminate unbalance or distortions in source current or supply voltage, conforming to IEEE-519 standard limits.

Given the multifunctional nature of a DVR, the primary goal of any control algorithm should be flexibility and ease of implementation, exploiting its capabilities to the fullest. Before choosing a control algorithm, the converter configuration is a crucial criterion, with two options: voltage source converter or current source converter, coupled with passive storage elements like capacitors or inductors, respectively. Voltage source converters are typically preferred due to their smaller size, lower heat dissipation, and lower capacitor cost compared to an inductor with the same rating.

PROPOSED SYSTEM:

We present a method for restoring the diminished power factor when a load is connected to a single-phase supply, experiencing reduced gain or a change in load conditions. This restoration is achieved through a compensation technique. A MOSFET-based inverter is powered by a 12-volt DC input, with PWM control supplied to the MOSFET gate and source through a dsPIC30F2010. The dsPIC30F2010 is powered by a multi-tapping transformer using an adapter, while the MOSFET receives a 5V input from the same transformer.

ISBN: 978-81-965236-7-1

The coding uploaded to the dsPIC30F2010 is designed to manage gain reduction and compensation. An isolator and driver circuit employing TLP250, with a 12V input, is used to convert the 5V PWM from dsPIC30F2010 to a 12V PWM, isolating the ground to prevent potential circuit disturbances under abnormal conditions.

The experimental setup is connected to a CRO (Cathode Ray Oscilloscope) to observe input and output waveforms. The CRO displays an inverter waveform with an amplitude of 10 volts. To visualize disturbances in the load, the non-compensation button, or the so-called Gain reduction button, is switched ON, resulting in a non-compensated waveform representing a change in load or reduced power factor.

Subsequently, by activating the compensate button, the obtained waveform is compensated, restoring the actual inverter voltage. This process improves power quality, leading to an enhanced power factor.

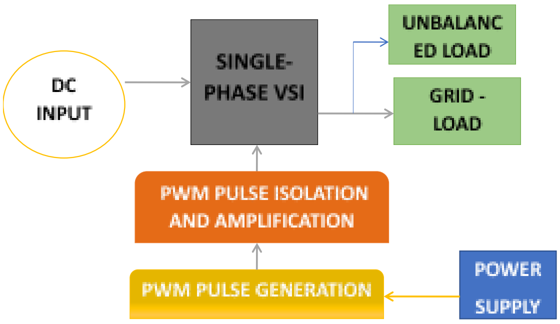


Fig: Block Diagram of the Proposed System

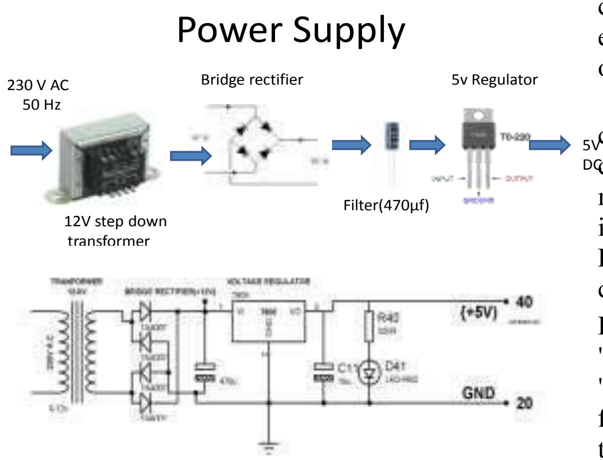


Fig: Power supply of the Proposed System

FACTS DEVICES:

In recent years, Flexible AC Transmission Systems (FACTS) have become widely recognized for enhancing controllability in power systems through the use of power electronic devices. Various FACTS devices have been deployed globally for different applications, and new types are currently in the process of practical implementation. The primary aim in most applications is to enable better controllability, preventing the need for costly or landscape-intensive expansions of power systems, such as upgrades or additional substations and power lines. FACTS devices offer improved adaptation to changing operational conditions and enhance the utilization of existing installations.

The fundamental applications of FACTS devices include:

1. Power flow control
2. Increased transmission capability
3. Voltage control
4. Reactive power compensation
5. Stability improvement
6. Power quality improvement
7. Power conditioning
8. Flicker mitigation
9. Interconnection of renewable and distributed generation and storage.

Efficient utilization of lines for active power transmission should ideally approach thermal limits. FACTS devices play a crucial role in shifting voltage and stability limits. Their importance grows significantly with increasing line length. The impact of these devices is realized through switched or controlled shunt compensation, series compensation, or phase shift control. Operating as fast current, voltage, or impedance controllers, FACTS devices leverage power electronics, allowing for very short reaction times, often below one second.

The evolution of FACTS devices is closely tied to advancements in power electronic components. The foundational concepts involve network elements influencing reactive power or the impedance of a segment within the power system. Figure 1.2 illustrates the number of basic devices categorized into conventional and FACTS devices.

Regarding the classification of FACTS devices as 'dynamic' and 'static,' it's essential to note that 'dynamic' denotes the rapid controllability facilitated by power electronics, distinguishing them from conventional devices. On the other hand, 'static' indicates that these devices lack moving parts, such as mechanical switches, to achieve dynamic controllability. Therefore, most FACTS devices can exhibit both static and dynamic characteristics.

ISBN: 978-81-965236-7-1

COMPENSATION TECHNIQUES:

In 1999, the first Static Compensator with Voltage Source Converter, known as Compensator Technique, was inaugurated. The Compensator Technique exhibits characteristics akin to a synchronous condenser but, being an electronic device, lacks inertia. It surpasses the synchronous condenser in various aspects, including superior dynamics, lower investment costs, and reduced operating and maintenance expenses. Constructed with Thyristors featuring turn-off capability, such as GTO, or modern alternatives like IGCT or increasingly IGBTs, the static line determines the control characteristic for voltage with a specific steepness due to current limitations.

A noteworthy advantage of the Compensator Technique lies in its independence from the actual voltage at the connection point for reactive power provision. This is evident in the diagram, where maximum currents remain unaffected by voltage, distinguishing it from the SVC. Consequently, even during severe contingencies, the Compensator Technique maintains its full capability.

In the realm of distributed energy, Voltage Source Converters for grid interconnection are commonplace today. The ongoing development of the Compensator Technique involves its integration with energy storage on the DC-side. This combination of active and reactive power holds the potential for significantly enhancing performance in power quality and promoting balanced network operation.

COMPENSATOR TECHNIQUEs are structured on the Voltage Source Converter (VSC) topology and employ either Gate-Turn-off Thyristors (GTO) or Isolated Gate Bipolar Transistors (IGBT) devices. These systems act as rapid, electronic counterparts to synchronous condensers. When the COMPENSATOR TECHNIQUE voltage, Vs, (proportional to the dc bus voltage Vc) exceeds the bus voltage, Es, it generates leading or capacitive VARS. Conversely, if Vs is less than Es, it produces lagging or inductive VARS.

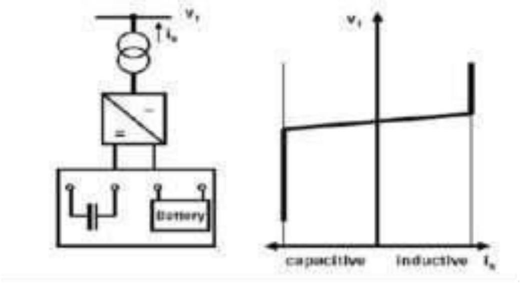


Fig. Compensator Technique Structure and Voltage / Current Characteristic

The three-phase COMPENSATOR TECHNIQUE capitalizes on the principle that in a three-phase, fundamental frequency, steady-state scenario, the instantaneous power entering a purely reactive device must be zero. To supply reactive power in each phase, the strategy involves circulating the instantaneous real power between the phases. This circulation is achieved by strategically firing the GTO/diode switches to maintain the phase difference between the ac bus voltage ES and the voltage generated by the Compensator Technique, VS. The ideal scenario involves constructing a device that circulates instantaneous power without the need for an energy storage device, essentially operating without a DC capacitor.

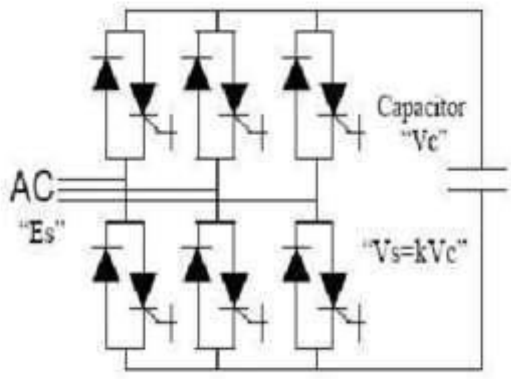


Fig. Pulses Compensator Technique

COMPENSATOR TECHNIQUE EQUIVALENT CIRCUIT:

Various control techniques can be employed for firing control in the Compensator Technique. One method involves fundamental switching of the GTO/diode, occurring once per cycle. Although this minimizes switching losses, it often necessitates more intricate transformer topologies. Alternatively, Pulse Width Modulated (PWM) techniques, involving more than one switch-on and switch-off operation of the GTO or IGBT switch per cycle, can be utilized. While this approach allows for simpler transformer topologies, it comes at the expense of higher switching losses.

The 6 Pulse COMPENSATOR TECHNIQUE, utilizing fundamental switching, inherently produces the 6 N1 harmonics. To mitigate these harmonics, various methods can be applied. These include the basic 12-pulse configuration with parallel star/delta transformer connections, the complete elimination of 5th and 7th harmonic current using series connections of star/star and star/delta transformers, and a quasi-12 pulse method employing a single star-star transformer with two secondary windings. Control of the firing angle produces a 30° phase shift

ISBN: 978-81-965236-7-1

between the two 6-pulse bridges, and this method can be extended to create a 24-pulse and a 48-pulse COMPENSATOR TECHNIQUE, further minimizing harmonics.

Another approach for harmonic cancellation involves a multi-level configuration, allowing for more than one switching element per level and, consequently, more than one switching operation in each bridge arm. The resulting AC voltage exhibits a staircase effect, dependent on the number of levels, and this staircase voltage can be controlled to eliminate harmonics.

THYRISTOR CONTROLLED SERIES CAPACITORS (TCSC):

Thyristor Controlled Series Capacitors (TCSC) are designed to address specific dynamic challenges within transmission systems. One key function is enhancing damping in large interconnected electrical systems. Additionally, TCSCs effectively mitigate the issue of Sub Synchronous Resonance (SSR), a phenomenon involving interactions between large thermal generating units and series-compensated transmission systems. The high-speed switching capability of TCSCs facilitates control over line power flow, enabling increased loading of existing transmission lines and swift readjustment of power flow in response to various contingencies. Moreover, TCSCs can regulate steady-state power flow within specified rating limits. From a technological standpoint, TCSCs share similarities with conventional series capacitors.

In the TCSC configuration, all power equipment, including the Thyristor valve controlling the main capacitor bank, is positioned on an isolated steel platform. Control and protection systems, along with auxiliary components, are situated at ground potential. The operational setup of a TCSC and its diagram are depicted in the figure. The firing angle and thermal limits of the Thyristors define the boundaries of the operational diagram.

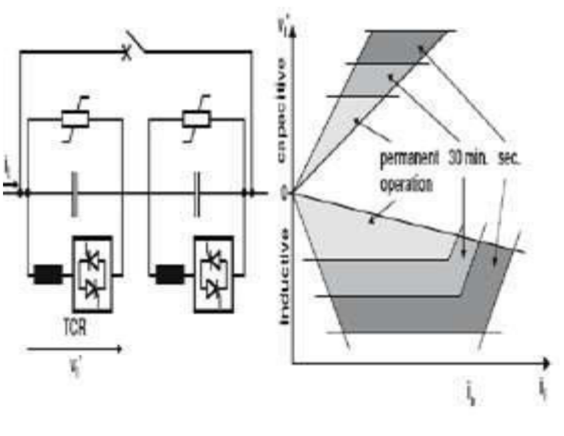


Fig. TCSC circuit and operation diagram

ADVANTAGES:

1. Ongoing regulation of the targeted compensation level
2. Seamless and direct management of power flow within the network
3. Enhanced protection for capacitor banks
4. Specific alleviation of sub-synchronous resonance (SSR) at a local level
5. Attenuation of electro-mechanical (0.5-2 Hz) power oscillations commonly occurring between regions in a large interconnected power network. These oscillations result from the dynamics of inter-area power transfer and often exhibit insufficient damping, particularly when the collective power transfer along a corridor is high relative to the transmission strength.

POWER QUALITY:

The modern container crane industry, much like other sectors, often finds itself captivated by the allure of advanced features such as vibrant diagnostic displays, high-speed performance, and automation capabilities. While these aspects and their associated computer-based enhancements are pivotal for efficient terminal operations, it is crucial not to overlook the foundational element. Power quality serves as the mortar that binds the building blocks.

The impact of power quality extends beyond terminal operational efficiency, influencing crane reliability, environmental considerations, and the initial investment in power distribution systems required for new crane installations. Reflecting on a utility company newsletter accompanying my recent home utility billing, it aptly states, 'Using electricity wisely is a prudent environmental and business practice that not only saves you money but also reduces emissions from generating plants and conserves our natural resources.

As container crane performance requirements continue to surge, with next-generation cranes already in the bidding process, the average power demands are expected to reach 1500 to 2000 kW – nearly double the total average demand from three years ago. This rapid escalation in power demand levels, coupled with an increasing population of container cranes, SCR converter crane drive retrofits, and the substantial AC and DC drives essential for powering and controlling these cranes, is anticipated to bring heightened awareness to the issue of power quality in the very near future.

POWER QUALITY PROBLEMS:

In the context of this article, power quality problems are defined as any power-related issue leading to the failure or malfunction of customer equipment, causing economic burdens to the user, or resulting in adverse environmental impacts.

ISBN: 978-81-965236-7-1

When applied to the container crane industry, power quality issues encompass:

1. Power Factor
2. Harmonic Distortion
3. Voltage Transients
4. Voltage Sags or Dips
5. Voltage Swells

AC and DC variable speed drives used on container cranes significantly contribute to total harmonic current and voltage distortion. While SCR phase control ensures a desirable average power factor, DC SCR drives operate at less than this. Additionally, line notching occurs during SCR commutation, creating transient peak recovery voltages that can be 3 to 4 times the nominal line voltage, depending on system impedance and drive size. The frequency and severity of these power system disturbances vary with drive speed, with harmonic current injection being highest at slow speeds. Power factor is lowest during slow speed or initial acceleration/deceleration, reaching its maximum value when SCR's are phased on to produce rated speed. Above base speed, power factor remains relatively constant. Container cranes often spend considerable time at low speeds during container handling, placing a greater kVA demand on the utility or engine-alternator power source.

Poor power factor not only burdens the utility but also affects voltage stability, potentially causing detrimental effects on the lifespan of sensitive electronic equipment. Voltage transients, generated by DC driveline notching, AC drive voltage chopping, and high-frequency harmonic voltages and currents, serve as significant sources of noise and disturbance for sensitive electronic equipment.

Despite these challenges, end users often remain unaware of power quality issues associated with container cranes, or they may neglect them due to the absence of immediate economic consequences. The emergence of power quality issues coincided with the multiplication of crane populations, increased power demands per crane, and the widespread adoption of static power conversion. Even today, power quality issues are often overlooked during competitive bidding for new cranes. Instead of focusing on raising awareness and understanding potential issues, crane builders and electrical drive system vendors may intentionally or unintentionally disregard power quality concerns. Solutions to power quality problems are available, representing a return on investment. However, if power quality is not specified, it is likely to be overlooked during implementation.

POWER QUALITY IMPROVEMENTS:

Improving power quality in container cranes is crucial, yet the individuals involved in specifying or purchasing these cranes may lack awareness of potential issues. This lack of awareness often stems from those not directly handling utility bills or considering power quality as someone else's responsibility. Consequently, many container crane specifications may not incorporate essential power quality measures like power factor correction and harmonic filtering. Even when specifications do include such requirements, they might lack clarity in defining criteria.

To address this, it is recommended to initiate discussions early in the crane specification process. This involves engaging with the utility company to understand any regulatory or contractual requirements. Additionally, collaborating with electrical drive suppliers helps in determining power quality profiles based on the proposed drive sizes and technologies for the project. Economic evaluations should extend beyond the current scenario, considering the potential impact of future utility deregulation and terminal development plans. By fostering awareness and proactively addressing power quality concerns, stakeholders can ensure optimal performance and longevity of container crane systems.

POWER QUALITY PENALITIES:

Many utility companies impose penalties for low power factor on monthly bills, but the lack of an industry standard means methods for metering and calculating these penalties vary widely. Some utilities meter kVAR usage and apply a fixed rate to the consumed kVAR-hours, while others monitor kVAR demands, penalizing if the power factor falls below a set limit over a demand period.

Certain utility companies serving container terminals may not currently enforce power factor penalties, but their service contracts with ports may mandate a minimum power factor over a defined demand period. Although these companies might not continuously monitor power factor or kVAR usage in monthly bills, they retain the right to assess penalties or demand corrective actions if the service contract criteria are not met.

For instance, a utility company serving multiple east coast container terminals in the USA doesn't include power factor penalties in monthly bills. However, their service contract stipulates that the average power factor should not be less than 85% under operating conditions. Failure to meet this criterion may require the customer to install corrective apparatus at their expense.

ISBN: 978-81-965236-7-1

The contract also emphasizes the importance of avoiding excessive harmonics or transients, possibly necessitating power conditioning equipment or filters, with IEEE Std. 519-1992 serving as a guide for design requirements.

Personnel responsible for maintaining container cranes or specifying new equipment in port or terminal operations need to be aware of these requirements. With the anticipated utility deregulation, utilities are likely to enforce such criteria more rigorously. Therefore, terminal operators should incorporate contingencies into their growth plans to address the potential economic impact of utility deregulation, even if they currently do not face penalty issues.

PRINCIPLE OF DVR:

A DVR (Dynamic Voltage Restorer) functions as a controlled reactive source, comprising a Voltage Source Converter (VSC) and a DC link capacitor connected in parallel. Its capability extends to both generating and absorbing reactive power. Conceptually, it draws parallels to an ideal synchronous machine, producing a balanced trio of sinusoidal voltages at the fundamental frequency. This machine's characteristics include controllable amplitude and phase angle, absence of inertia, instantaneous response, no alteration of system impedances, and the ability to internally generate both capacitive and inductive reactive power.

If the output voltage of the VSC is equal to the AC terminal voltage; no reactive power is delivered to the system. If the output voltage is greater than the AC terminal voltage, the DVR is in the capacitive mode of operation and vice versa. The quantity of reactive power flow is proportional to the difference in the two voltages.

It is to be noted that voltage regulation at Point of Common Coupling (PCC) and power factor correction cannot be achieved simultaneously. For a DVR used for voltage regulation at PCC the compensation should be such that the supply currents should lead the supply voltages and for power factor correction the supply current should be in phase with the supply voltages. The control algorithms studied in this paper are applied with a view to study the performance of a DVR for reactive power compensation and power factor correction.

When the VSC output voltage matches the AC terminal voltage, no reactive power is supplied to the system. In the capacitive mode, where the output voltage exceeds the AC terminal voltage, or in the inductive mode, where it is less, the DVR delivers reactive power.

The quantity of reactive power flow is directly proportional to the voltage difference between the VSC output and the AC terminal. It's important to highlight that achieving voltage regulation at the Point of Common Coupling (PCC) and simultaneous power factor correction is not feasible. When using a DVR for voltage regulation at the PCC, the compensation results in supply currents leading the supply voltages. Conversely, for power factor correction, the goal is to align the supply current with the supply voltages. This paper explores control algorithms with the aim of evaluating the DVR's performance in providing reactive power compensation and power factor correction.

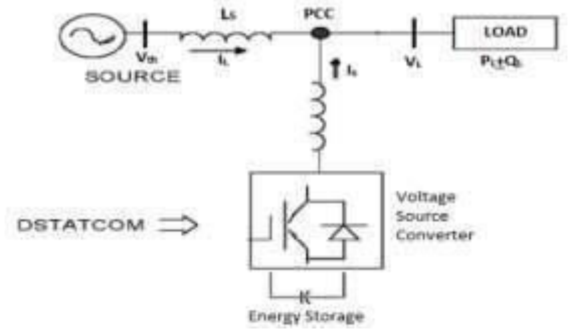


Fig. Basic structure of DVR

HARDWARE SETUP:

Fig: Experimental setup of APFC

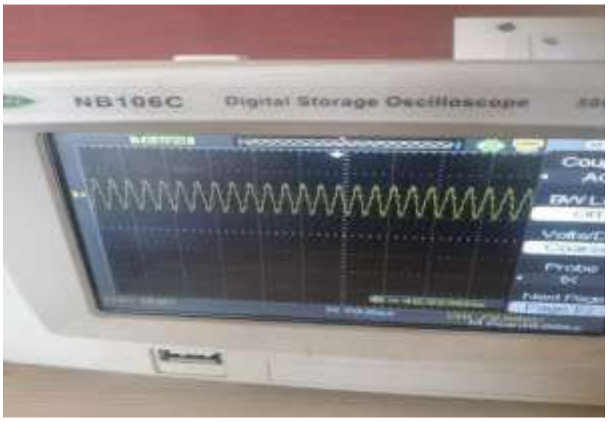


Fig: Output Wave form shown in DSO

Fig: Input Wave form shown in DSO

CONCLUSION:

A control algorithm is presented for generating a reference load voltage in a voltage-controlled Dynamic Voltage Restorer (DVR). A comparative analysis is conducted between the proposed approach and the conventional voltage-controlled DVR. The introduced method offers several advantages, including injecting reactive and harmonic components of load currents at nominal load, leading to Unity Power Factor (UPF). Furthermore, the system maintains nearly UPF even with changes in load, achieves rapid voltage regulation during disturbances, and significantly reduces losses in both the Voltage Source Inverter (VSI) and feeder. Additionally, the proposed scheme exhibits enhanced sag supporting capability with the same VSI rating compared to the traditional approach. Both simulation and experimental results affirm that the proposed algorithm equips the DVR with the capability to address various Power Quality (PQ) issues effectively.

REFERENCES:

1. J. Dixon, L. Moran, and J. Rodriguez, Reactive Power Compensation Technologies: State of art Review, Proceedings of the IEEE. Vol. 93.No. 12,2005.

2. J. Dixon, Y. delValle, M. Orchard, M. Ortizar, L. Moran, and C. Maffrand, A Full Compensating System for General Loads Based on a Combination of Thyristor Binary Compensator, and a PWM-IGBT Active Power Filter, IEEE Trans. On Industrial Electronics'. 18, No. 4, Oct. 2003, pp. 982-9.

3. A. E. Hammad, Comparing the Voltage Source capability of Present and future Var Compensation Techniques in Transmission Systems, IEEE Trans, on Power Deliverv.vol.il. No.1 Jan 1995.

4. J. Nastran, R. Cajhen, M. Seliger, and P. Jereb, Active Power Filters for nonlinear AC loads, IEEE Translon Power Electronics. Vol. 9. No. l, pp. 92-6, Jan. 1994.

5. L. A. Moran, J. W. Dixon, and R. R. Wallace, A three phase Active Power Filter with fixed switching frequency for reactive power and current harmonic compensation, IEEE Trans. On Industrial Electronics. Vol. 42, pp. 402-8, Aug. 1995.

6. L. T. Moran, P. D. Ziogas, and G. Joos, Analysis and design of a three-phase current source solid state Var Compensator, IEEE Trans, on Industry Applications'. 25. No. 2, 1989, pp.356-65.

7. D. Shen, and P. W. Lehn, Modelling, analysis and control of a current source inverter base DVR. IEEE Trans.on Power Deliver. Vol.17. No. l, pp. 248-53, 2002.

8. V. Ye, M. Kazerani, and V. Quintana, Current source converter-based COMPENSATOR TECHNIQUE: Modelling and Control, IEEE Trans. on Power Deliver. Vol. 20. No. 2, pp. 795-800, Apr. 2005.

9. M. Mishra, A. Ghosh, and A. Joshi, Operation of a DVR in voltage control mode, IEEE Trans, on Power Delivery, vol. 18, No.l, pp. 258-264, Jan. 2003.

10. O. A. Lara, and E. Acha, Modelling and Analysis of Custom power Systems by PSCAD/EMTDC, IEEE Trans, on Power Deliver. Vol. 17. No. l, pp. 266-272, Jan. 2002.

ISBN: 978-81-965236-7-1

AIR POLLUTION MONITORING SYSTEM USING IoT

K.VEERASELVAM
Assistant Professor, Department of CIVIL,
Sri Bharathi Engineering College For Women, Pudukkottai.
veeracivil33@gmail.com

***Abstract* - Every vehicle has its emission of gases, but the difficulty is the emission of the gas outside the uniform values. This emission from the vehicles cannot be completely avoided, but in certain things, we can able to control this. In this situation, in most countries, air pollution is a major problem. In our life there are three needed necessities are used on earth i.e. air, liquid substances (water), solid substances(food). Before it consumed the water, the water permits through a reliable cleaning process. From the statistics, without significant weather, the air polluted or not, living beings that breathe over 3000 tons of air per day. Therefore this suggests raising awareness to the public regarding air quality and air pollutants. Because of air pollution not only human health is affected it also damages the atmosphere and surroundings so decrease the mature of live hood.**

Keywords: Internet of Things, Arduino UNO, Air pollution, Gas sensor, Arduino IDE.

1. INTRODUCTION

Pollution can be well-defined as the presence of tiny elements that distract the working of ordinary processes and also yields undesirable health. In other words, pollution can disturb the natural phase and also can disturb the health of the living being. As industrial development is growing widely pollution is also getting make known to a huge manner. At present, there is Air, Water, and Soil is polluted worldwide. This only concentrates on Air pollution. Air pollution is the being there of impurity or tiny elements that affect living being health and surroundings. These pollutants result from vehicles, industries. The WHO (World Health Organization) states that 2.3 million persons die per year due to reasons directly qualified by air pollution. Based on the information above points out, the humanoid should focus on air pollution observing. Air pollutants are measured in Parts per Million (ppm) or ug/m^3. Primary pollutants are released directly into the atmosphere. Secondary pollutants are produced when the primary pollutant reacts with other atmospheric chemicals. Air quality affects public health . There are two approaches to checking air pollution at present-day. One is an inactive sample (non-automatic), and the other is constant online checking (automatic).

The Inactive sample uses simple tools but it does not deliver real-time values. The procedure of continuous online monitoring uses sensors to monitor the parameters, and then send it to the control center by the network. The way records transmission includes wired and wireless organizations. Even although the system is dependable it is consuming small developments at big and dynamic range, such as complex network cabling, expensive, etc. at length rising communication knowledge, now a day's air pollution checking method is often aimed in the wireless method. To implement such a system single-chip microcontroller along with an array of sensors, the IoT module is used. This system focus on gases such as CO_2, temperature, and humidity via sensors. The hardware part collects air pollutant stages also packs them into the frame. The frame is uploaded to the IoT modem communicated to the significant server via IoT. This organization is low budget and energy effective in terms of devices.

2. METHODOLOGY

In this project, we are working to make an IoT Based Air Pollution Monitoring System in which we will observe the Air Quality done on mobile using the internet and will initiate an alarm when the air quality goes beyond a certain level. When there is a sufficient quantity of dangerous gases are exist in the air like CO_2, smoke, temperature, humidity, and rain. It will show the air value in Parts per Million (PPM) on the LCD so that we can display it very easily.

3. HARDWARE COMPONENTS

3.1 Arduino UNO

Fig 1. ***Arduino UNO***

ISBN: 978-81-965236-7-1

Arduino Uno is a microcontroller board that In this project,we are working to make an IOT Based Air Pollution Monitoring System in which we will observe the Air Quality done on mobile using the internet and will initiate an alarm when the air quality goes beyond a certain level. When there is a sufficient quantity of dangerous gases are exist in the air like CO_2, smoke, temperature, humidity, and rain. It will show the air value in Parts per Million (PPM) on the LCD so that we can display it very easily. The Arduino Uno board includes 14 digital input/output pins 6 analog inputs, a USB Connection, a power jack, a reset button. The user community that designs and manufactures single-board microcontrollers and microcontroller kits for building digital devices and interactive objects. The Arduino microcontroller is not only for technical persons but is intended for designers and artists also because of its focus to usability based on its plan which helps to achieve the intended goal.

3.2 Gas Sensor

Fig -2: Gas Sensor

The Gas Sensor (MQ2) component is used for the gas leakage finding. It is used for recognizing LPG Liquefied petroleum gas, CH4, CO (carbon monoxide), Smoke. The circuit is very simple. Gas sensor of the MQ-2 gas sensor is SnO_2 (stannic oxide), which with lesser conductivity in clean air.

3.3 DTH11 Sensor

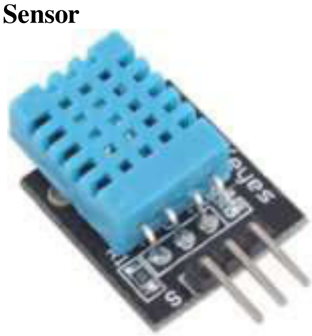


Fig -3: DTH11 Sensor

DHT11 is featured to measure temperature and humidity sensor complex by using temperature & humidity sensing technique with output in the form of the standardized digital signal DHT11 is an inexpensive humidity and temperature sensor which offers high consistency and long period steadiness. DHT11 can be interfaced with any microcontroller like Arduino and get instant results. It gives the output in voltage.

3.4 LCD

Fig -4: LCD Display

LCD (Liquid Crystal Display) an electronic display module. This is a basic (16x2) 16 character by 2 line display. Black text on Green background. It is used to show the Air and Humidity. A (16x2) LCD is a very plain module and is very normally used in different types of devices and circuits.

***3.5* Buzzer**

Fig -5: Buzzer

A Buzzer or beeper is an electronic audio signalling device. Whenever the air pollution or the toxic level in the air goes beyond the threshold level the Buzzer makes sound starts beeping indicating Danger.

3.6 Wi-Fi Module

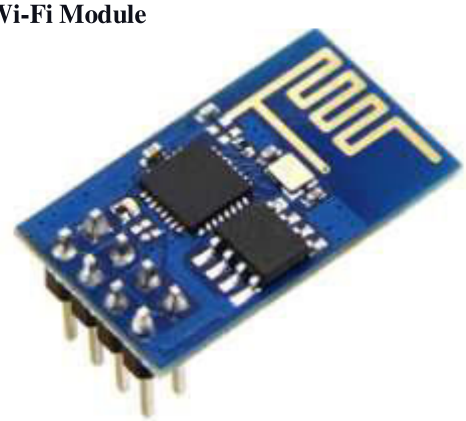


Fig -6: WI-FI Module

ISBN: 978-81-965236-7-1

The ESP8266 is low-cost. Every ESP8266 component comes pre-programmed with an AT expertise set firmware, meaning, we can simply join to the Arduino device. The ESP8266 module is a low-cost board. This module has a dominant sufficient on-board processing and storage capability that allows it to be combined with the sensors.

4. SOFTWARE REQUIREMENTS

4.1 Arduino IDE

The Arduino is an Integrated Development Environment (IDE) or Arduino Software has a text editor for writing programs. It also has a message area, text console, a toolbar with buttons for functions and a series of menus. It links to the Arduino hardware to upload programs and connect with them.

4.2 Thing speak

Thing Speak is an Internet of Things (IoT) platform that lets you gather and hold sensor records in the cloud and develop IoT applications. The Thing Speak IoT platform delivers apps that let you study and visualize your value.

5. SYSTEM DESIGN

5.1 BLOCK DIAGRAM

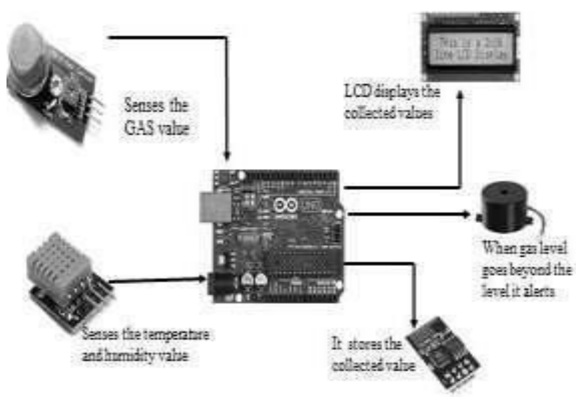


Fig-7: Represents the arrangements of components

5.2 Circuit diagram

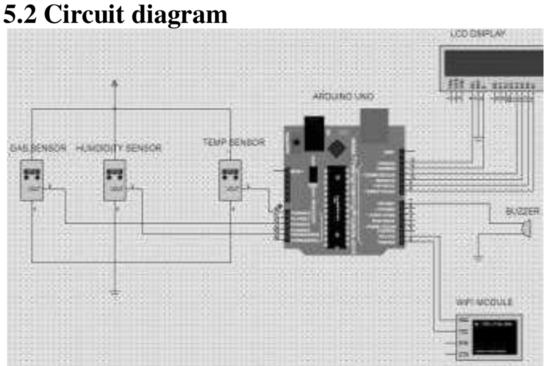


Fig -8: Circuit diagram

6. Working procedure

1. The above sensors can sense temperature, humidity, and smoke.
2. When we will join it to Arduino microcontroller then it will detect the gases, and it will progress the Pollution level in PPM (parts per million).
3. Then our project is based on the wireless that is stored in the cloud database.
4. For that, we have to require some programming concepts to run the project that's why we have to create a code using Aurdino1.6.10. Software.
5. In this software, the code should be written in simple C language with all descriptions of sensors, and another operating system in which the code explains how the sensor, Wi-Fi module, LCD, and so on should be connected.
6. The whole program is dumped into the Arduino microcontroller.
7. With this Wi-Fi module, 8266 is used for Trans receiving the data from hotspot from another device.
8. And it useful for detecting the number of polluted gases in the air with that the values are displayed in the cloud.
9. The percentage levels are monitored continuously in LCD and cloud database also.
10. If the level of gas value more than the threshold value buzzer starts ON automatically.

7. RESULT AND DISCUSSION

In the pollution monitoring system gas sensor (mq2) is used to detect the gas likes oxygen, carbon dioxide, nitrogen, and other toxic gases. The DTH11 sensor is used to detect temperature and humidity. The concentration of air pollutants such as CO, Carbon dioxide (CO_2), methane, propane, NO2, and dust are displayed in 16X2 LCD. When the limit of sensed value exceeds the threshold value the buzzer that alerts. The online application needs to analyze air quality value got from sensors. Thing-speak is an opensource application programming interface that needs to store and recover data from interconnected things using the hypertext protocol over the internet or via a local area network. It also offers access to a wide range of embedded devices and web facilities.

8. CONCLUSION

The system utilizes city buses, industrial areas to collect pollutant gases such as CO, smoke, and temperature. Here we have successfully designed such a system that can monitor the real-time air pollution percentage present in the air which can be accessed from anywhere in the world so, here we have designed a circuit which makes takes corrective action on the increase of air pollution on the particular threshold value.

ISBN: 978-81-965236-7-1

The proposed Wireless Air Pollution Monitoring System be responsible for real-time info about the level of air pollution in these areas, as well as alerts in cases of extreme change in the quality of air. This data can then be used by the establishments to take prompt activities such as leaving people or sending crisis reply team. The system uses city buses to gather pollutant gases such as CO, NO_2, and SO_2. The pollution facts from several mobile sensor ranges are conveyed to a central some that make these facts accessible on the Internet. The facts display the pollutant range and their conformance to local air quality.

REFERENCES

1. Navreetinder Kaur1, Rita Mahajan2, Deepak Bagai3, "Air Quality Monitoring System based on Arduino Microcontroller", International Journal of Innovative Research in Science, Engineering and Technology (An ISO 3297: 2007 Certified Organization) Vol. 5, Issue 6, June 2016.

2. Kennedy Okokpujie, Etinosa Noma-Osaghae, Odusami Modupe, Samuel John and Oluga Oluwatosin, "A SMART AIR POLLUTION MONITORING SYSTEM", International Journal of Civil Engineering and Technology (IJCIET) Volume 9, Issue 9, September 2018

3. Harsh N. Shah 1, Zishan Khan 2, Abbas Ali Merchant 3, Moin Moghal 4, Aamir Shaikh 5, Priti Rane 6, "IOT Based Air Pollution Monitoring System", International Journal of Scientific & Engineering Research Volume 9, Issue 2, February-2018 ISSN 2229-5518.

4. Devahema 1, P.V. Sai Surya Vamsi 2, Archit Garg 3, Abhinav Anand 4, Desu Rajasekhar Gupta 5," IOT based Air Pollution Monitoring System", Journal of Network Communications and Emerging Technologies (JNCET) www.jncet.org Volume 8, Issue 4, April (2018),

5. https://www.arduino.cc/en/guide/environment

6.https://www.electronicshub.org/dht11humiditysensor-arduino/

Bringing Things to Life - The Power of Artificial Intelligence in IoT

[1]Mr.M.Venkatachalam, [2]Ms.K.Kalpana and [3]Ms.S.Vinciya Mary
[1]Assistant Professor, Department of Computer Science and Engineering,
[2,3]UG Student, Department of Computer Science and Engineering,
Sri Bharathi Engineering College for Women, Kaikurichi, Pudukkottai – 622 303.

Abstract: **The landscape of the Internet is undergoing a continual transformation, transitioning from the Internet of Computers (IoC) to the era of the "Internet of Things (IoT)." This evolution is giving rise to intricately connected systems, commonly referred to as Cyber-Physical Systems (CPS). These systems are formed through the integration of various elements such as infrastructure, embedded devices, smart objects, humans, and physical environments. The trajectory we are on is leading us towards an extensive "Internet of Everything" within a Smart Cyber-Physical Earth. The synergy of IoT and CPS, coupled with the field of "data science," holds the potential to usher in the next era of the "smart revolution." However, a significant challenge lies in effectively managing the vast amount of data generated, given the limitations of current computational power. Ongoing research in data science and artificial intelligence (AI) is diligently working to address this challenge. The convergence of IoT with AI could represent a monumental breakthrough. It goes beyond mere cost savings, the implementation of smart technologies, or the reduction of human effort—rather, it seeks to enhance the overall quality of human life. Despite the promises of advancement, critical concerns like security and ethical considerations continue to cast a shadow over the IoT landscape. The true essence lies not only in the allure of IoT with AI but in how the general populace perceives it—whether as a blessing, a burden, or a potential threat.**

Keywords: Artificial Intelligence, Internet of Things, Intelligent Systems, Datascience.

Introduction

The allure of the term "smart" captivates our imagination, yet the reality falls short of human-level intelligence. Take the example of smartphones – while they bear the label "smart," their autonomy remains limited. Consider the scenario where a smartphone, despite its intelligence, cannot automatically switch notifications to 'silent mode' when the owner is driving, showcasing a need for a more sophisticated level of automation. True intelligence, in this context, would involve wireless connections between individuals, their smartphones, and vehicles to enhance safety and reduce distractions.

In another instance, envision a situation where the owner falls ill. A truly smart phone would autonomously initiate an emergency call to a family member or nearby hospital, requiring seamless connections and pertinent information. This interconnectedness extends beyond smartphones – practically everything in the physical world requires connections to fulfill diverse needs. To achieve this level of intelligence, the integration of artificial intelligence (AI) is imperative.

AI, aiming to imbue computers with human- like reasoning, serves as a catalyst for the digital transformation of industries. Whether it's humans, animals, plants, machines, or inanimate objects, connecting and enabling them to make "smart decisions" can create an autonomous world. The realization of autonomy necessitates in the incorporation of machine learning (ML) to mimic human learning and a data analysis (DA) module to assess and analyze the data generated over time for enhanced efficiency.

This trend is gaining momentum, with efforts directed at integrating ML and DA into sensors and embedded systems of smart systems. The technology behind AI poses intriguing possibilities, challenging our preconceptions about the meaning and purpose of life and work. The rapid evolution of ML and DA within AI prompts a need for discussions on emerging trends, challenges, and potential threats.

Central to this transformative trend is the Internet of Things (IoT), envisioning a world teeming with intelligent devices, often termed "smart objects," interconnected through various communication mediums such as the Internet, Bluetooth, or infrared.

ISBN: 978-81-965236-7-1

The Internet of Everything extends this idea, suggesting connectivity between every conceivable object, living or virtual. When applied to the physical world, these concepts manifest as Cyber-Physical Systems (CPS), creating a data-rich environment from which valuable knowledge can be extracted.

In managing this wealth of data, disciplines like Database Management System (DBMS), Pattern Recognition (PR), Data Mining (DM), Machine Learning (ML), and Big Data Analytics (BD) must evolve with improved methods, often overlapping in their scope. This article delves into insights, challenges, and applications of artificial intelligence within the realms of the Internet of Things, Cyber-Physical Systems, and the Internet of Everything.

Artificial Intelligence

Artificial Intelligence (AI) represents the scientific endeavor to impart cognitive abilities to machines, enabling them to perform tasks traditionally within the realm of human intelligence. AI systems are rapidly advancing in terms of application, adaptability, processing speed, and capabilities, gradually assuming less-routine tasks. Unlike human intelligence, which involves making perfect decisions at the right moment, AI focuses on choosing the right decision at the appropriate time. While human ingenuity continually reshapes the role of productive work, AI systems efficiently reduce the repetition of human efforts, delivering results in a comparatively shorter timeframe. Many ongoing AI initiatives fall under the category of 'Narrow AI,' enhancing specific tasks through technology. However, the overarching aim is to achieve something more comprehensive, prompting various fields to collaborate in driving AI development.

A convergence of disciplines such as philosophy, computer science, mathematics, statistics, biology, physics, sociology, and psychology has contributed to the interdisciplinary nature of AI. Intelligence, emanating from data generated across these domains, requires careful analysis to unveil underlying principles. Human brains are adept at this, but the process is time-consuming due to the unwelcome properties of real-world data, including its huge volume, unstructured nature, varied sources, need for real-time processing, and continuous changes.

To efficiently utilize data, AI heavily relies on data science techniques, which involve developing tools and methods to analyze large volumes of data and derive meaningful information. Drawing inspiration from computer science for tool development and incorporating methodologies from both basic and social sciences for analysis, data science encompasses a range of techniques, including pattern recognition, machine learning, data mining, database management systems, and big data analytics. Machine learning (ML) emerges as a key tool for achieving artificial intelligence.

Smartness or Intelligence

Intelligence in the realm of the Internet of Things (IoT) operates on both microscopic and macroscopic scales. While the notion may conjure images of futuristic talking refrigerators and self-driving taxis, its implications extend beyond mere novelty. Presently, the focus of smart objects mimics the natural learning process observed in humans, animals, and even plants. It occurs through supervised, reinforcement, and unsupervised learning, with additional methods like semi-supervised, active, inductive, deductive, and transfer learning. The ultimate goal is not consciousness but designing algorithms that enable machines to learn autonomously.

Learning involves acquiring or improving behaviors, skills, values, and preferences, with ML enabling machines to adapt to their environment and make independent decisions. The IoT scenario, characterized by overwhelming data volume, variety, velocity, and complexity, makes explicit programming impractical. ML, with its emphasis on implicit learning skills, enables machines to teach themselves, contributing to the concept of smartness in Cyber-Physical Systems (CPS) or IoT.

Machine learning, integral to achieving artificial intelligence, revolves around the idea that machines should learn from data. The recent advancements in AI owe much to the transformative perspective brought about by ML. Consequently, ML deserves credit for instilling smartness in machines as we collectively move toward creating human-like AI at an accelerated pace.

It revolves around data, devices, and connectivity. The analysis of this data is crucial for uncovering concealed insights, a task facilitated by Big Data Analytics (BDA). Ultimately, it is the fusion of big data analysis and machine learning that imbues the entire system with intelligence.

ISBN: 978-81-965236-7-1

Internet of Things

A mere few decades ago, the notion of engaging in a video chat with family members on a different continent seemed beyond imagination. Today, it has become a commonplace occurrence. This transformation can be attributed to the increasing affordability of technology and the emergence of devices with enhanced capabilities. Everyday tasks, from sending emails to paying bills, transferring money, or booking a cab, can now be accomplished with a simple click on a smartphone.

The concept of the 'Internet of Computers (IoC)' has been in existence since 1991, gradually expanding as more individuals adopted its use. The evolution continued with the introduction of pocket phones and interconnected devices, giving rise to the 'Internet of Devices.' This network expanded further as mobile phones, computers, laptops, and tablets became more affordable and accessible to the common man. Gartner, Inc. predicted a substantial growth, forecasting that 6.4 billion connected devices would be in use worldwide in 2016, a 30 percent increase from 2015, and anticipating a staggering rise to 20.8 billion by 2020 [24]. In 2016 alone, over 5.5 million new devices were connected daily, signifying the vast potential of the Internet of Things (IoT).

As various entities continue to connect and form the IoT, it encompasses a multitude of disciplines. Therefore, the IoT can be perceived as a convergence of diverse domains. Figure 1 provides a representative list of some of these domains, which often overlap in terms of concepts and techniques. Essentially, the Internet of Things is a connected system comprising physical entities such as appliances, crop fields, plants, animals, and humans. Humans connect to these devices through smart objects attached to both, capable of sending, receiving, and analyzing data. These smart objects serve as representatives of the entities they are attached to within the network."

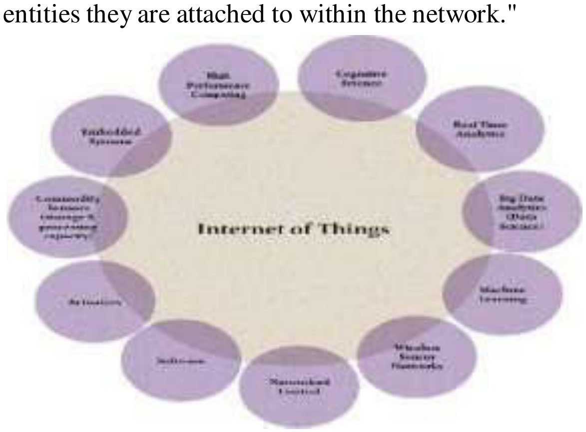


Fig. 1: Different fields merging into IoT

Things and Everything

When we are talking about IoT and IoE, we must be very clear about the concept of "things" and "everything". One straightforward con- cept that may come to mind is anything that can be connected may be the "thing" in IoT. However, we define it other way round. There can be more features in making a physical object a "thing". The "thing" (living or non-living) should have:

1. a way to generate or collect data,
2. a way to process data,
3. a way to send or receive data,
4. a way to identify itself.

The main concept to consider, when thinking of IoT, is that "Things" are physical objects, i.e., anything that has a real life pres- ence. The Internet as we know it is not just made of physical devices. For instance, a website cannot be thought to be a physical entity; it exists somewhere virtually. This is true for services that we might use every day, such as online shopping sites, social media sites, etc. These "intelligent services" along with the "things" make the "every- thing". Thus, inter- connections as well as intra-connections between "things" from physical world and "intelligent services" from the cyber world make the IoE.

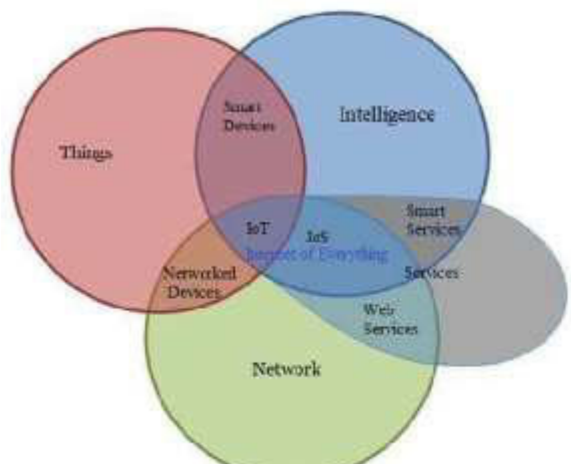


Fig. 2: A Venn diagram for the concept of Internet of Things (IoT), Internet of Services (IoS) and Internet of Everything (IoE)

ISBN: 978-81-965236-7-1

AI enabled IoT

The Internet of Things (IoT) is a comprehensive concept that involves an array of sensors, actuators, data storage, and data processing capabilities interconnected through the Internet. Consequently, any IoT-enabled device has the ability to sense its environment, transmit, store, process gathered data, and take appropriate actions.

The effectiveness of an IoT service in exhibiting true smartness is contingent upon its processing and action capabilities. An IoT system lacking smartness will have limited functionality and an inability to adapt with evolving data. Conversely, a more intelligent IoT system incorporates artificial intelligence (AI), serving the primary goals of automation and adaptation.

In this context, several examples of existing IoT services leveraging AI are explored:

1. Voice Assistants:

Alexa: Amazon's voice assistant utilized in products like Amazon Echo and Amazon Tap. Customizable through the Alexa Skills Kit (ASK).

Siri: Apple's voice assistant employed in Apple Homepod for similar purposes.

Google Assistant: Used in Google Home, capable of recognizing up to six different users.

These voice assistants perform various tasks through continuous application of AI subfields, including automatic far-field voice recognition, wake word detection, natural language processing, contextual reasoning, and more.

2. Robots:

Pepper (SoftBank Robotics): A humanoid companion robot capable of understanding human emotions and interacting with humans in commercial settings.

Sophia (Hanson Robotics): A social humanoid robot with human-like expressions, citizenship, and the ability to engage in interviews and music performances.

Robotic Kitchen (Moley Robotics): An advanced robot integrated into a kitchen, capable of preparing expert-quality food.

Robots, with their sensors, actuators, and AI, continuously learn and adapt, mimicking human interaction.

3. Smart Devices:

Smart Oven by June: Utilizes HD cameras and a food thermometer for precise cooking, operable through voice commands via Alexa.

SkyBell (Honeywell): An HD WiFi doorbell allowing remote interaction through smartphones or voice assistants, enhancing home security.

Smart Lights by Deako: Internet-connected lights controllable remotely, receiving software upgrades for added functionality.

Automotive AI by Affectiva: In-cabin sensing AI for emotional and cognitive state detection in robo-taxis and highly automated vehicles.

4. Industrial IoT:

Primer (Alluvium): Offers real-time Stability Score analysis for industrial solutions, aiding in early issue detection and decision-making.

Plutoshift: Enables continuous tracking of asset performance, financial impact measurement, and support for informed decision-making in industrial sectors.

Combining AI and IoT enhances opportunities and potential, as machine learning (ML) and big data analytics (BDA) extract valuable insights from IoT-generated data. AI is crucial for interpreting the vast amount of data, allowing IoT systems to evolve and adapt to new patterns autonomously. The synergy between AI and IoT holds immense promise for the future.

Components of IoT-CPS

Having established a clear interrelationship between IoT, CPS, and associated terms, the pivotal focus shifts to the ecosystem of these technologies. Given that CPS is an amalgamation of subsystems, our attention can be directed towards the structure and components of IoT initially. Breaking down the various elements of IoT, we unveil a composition depicted in Figure 3.

Figure 3 delineates several components within an IoT system. Beyond network infrastructure and security, a substantial aspect of IoT necessitates data storage and processing on both a macroscopic (i.e., within the overall system) and microscopic level (i.e., within each smart object locally). Smart objects themselves must possess data processing, intelligence, and decision-making capabilities. To achieve this, built-in data processing tools are imperative for analyzing sensor data and making informed decisions. Machine learning and data analytics emerge as optimal candidates for such intelligent data analysis. On a macroscopic level, billions of things generate data independently, transmitted over the network to remote data storage locations for real-time data analysis, resembling a significant big data task.

ISBN: 978-81-965236-7-1

The continuous generation, storage, and processing of substantial data make big data analytics (BDA) and machine learning (ML) integral in shaping the intelligence within IoT.

Moreover, smart objects can boast limited data storage and processing capabilities. For instance, a smartwatch prompts the user to walk when it detects prolonged stationary periods (sitting or lying down), yet refrains from alerting during sleep. It can distinguish between sleep and sedentary states without transmitting data to external servers, conducting local analysis to trigger the alarm. These short-term decision-making capabilities are embedded in smart devices.

For long-term decision-making or gaining insights, remote storage and processing may become requisite.

As IoT entails myriad connected devices, establishing an "everything to everything" connection saturates the physical world with sensors/actuators while inundating the virtual world with data. The ensuing network complexity perpetually generates data throughout the CPS. Distinct analyzing systems handle different facets of the IoT- CPS, prompting the extraction and processing of smaller relevant data portions when necessary. Real-time analysis becomes crucial for making practical decisions, and the data management within IoT is inherently distributed across its individual components, collectively forming a comprehensive system. Subsequent sections delve into the particulars of these IoT components.

Smart Objects

To comprehend such a substantial concept, we'll need a multitude, numbering in the millions or more, of smart objects that generate data. These smart objects serve as the fundamental building blocks of this extensive system. Within the physical realm, two key elements must be considered: a Physical Entity (PE) and a Smart Object (SO).

A Physical Entity (PE) encompasses entities such as people, creatures, and plants that may not directly interface with the IoT but are integral components of the system. These physical entities have smart objects (SOs) attached to them, representing AI elements with the ability to communicate via the network. These SOs can take various forms, including implanted chips, wearables, or smartphones somehow attached to the PE. Therefore, an SO becomes the device facilitating the connection of a PE to the virtual 'Internet' of things.

As the Internet is virtual, both the PE and SO, being physical objects, require a digital representation. The digital entity (DE) serves as the digital representation of the PE by the SO. For instance, if we consider ourselves as the PE, our smartphone becomes the SO, and our social media app becomes the DE.

SOs are the physical world representation of DEs in the digital realm, possessing the capability to sense, store, process (locally), and communicate via networking. SOs may act as intelligent agents with some level of autonomy, cooperating with other entities and exchanging information with human clients and other computing devices within interconnected Cyber-Physical Systems. DEs, on the other hand, are virtual programming elements with autonomous objectives, which can be services or simple coherent data entries.

In the cyber world, a Physical Entity (PE) or thing can be represented by a Digital Proxy (DP). DPs can be likened to users in the cyber world, much like social media profiles (our DP) are perceived as representing us (where we are the PE). Each PE has a DP, used to portray it in the digital world. There are various forms of digital portraits, known as DE, that we can imagine, such as avatars, 3D models, objects (or instances of a class in an object-oriented programming language), and even a social network account.

However, in the context of IoT, Digital Proxies possess two fundamental properties:

Each Digital Proxy must have a unique ID distinguishing it from others, with the association between the Digital Proxy and the Physical Entity established automatically. Relevant digital parameters related to the characteristics of the Physical Entity can be updated upon any changes in the latter. Similarly, changes affecting the Digital Proxy 'might' be reflected on the Physical Entity in the physical world through actuators.

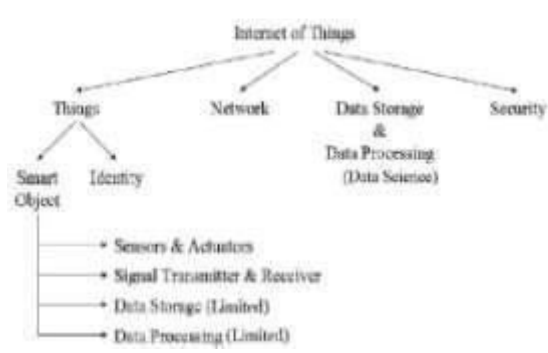


Fig. 3: IoT architecture tree

ISBN: 978-81-965236-7-1

Data Storage and Data Processing

The primary goal of IoT and CPS is to establish an autonomous system capable of handling diverse situations globally, ultimately enhancing the quality of human life. The fundamental framework of IoT-CPS comprises smart objects, resembling nodes in a graph, and the connections between them. Once all nodes and connections are established, data is generated and communicated between nodes continuously. However, the challenge arises as smart objects (SOs) lack the knowledge of how to handle this data—they cannot store it, nor do they understand how to process it. Without proper data storage and processing units, the objective of autonomy, decision-making, and taking actions cannot be fulfilled. This crucial feature is required both locally within smart objects and globally across the entire system.

Smart objects handle small sets of continuously flowing data into the system, temporarily storing it until a task is completed, and then transferring it to the global data store. While the data store of the entire system may not receive streaming data, it mostly accumulates large chunks of collected data over time. To manage both types of data in real-time and utilize them effectively, the role of big data analytics becomes crucial.

While data needs to be stored, the processing phase poses the challenge of uncertainty regarding what exactly needs to be done. A smart IoT-CPS system is expected to operate autonomously, observing its surroundings through various parameters, learning from experiences, understanding the current needs, and making useful decisions or taking actions. To replicate human-like learning capabilities, the system must possess the ability to learn from data independently, especially in situations where human intervention may not be available or desired most of the time. Achieving these functionalities can be effectively facilitated with the integration of artificial intelligence.

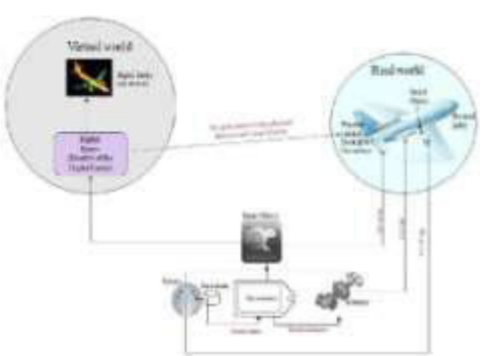


Fig: An example of real world to virtual world mapping

Security

While the prospects of IoT are intriguing, as Sarah Jeong highlighted in her book [31], it also carries the moniker "Internet of Garbage." She emphasizes that if the Internet were a city, its streets would be cluttered with undesirable elements such as harassment, crimes, copyright abuse, malwares, spams, and more. However, there is an opportunity to foster better interactions and discourse through thoughtful architecture, rigorous moderation, and efficient community management. The key is to filter useful content from the garbage and endeavor to find value in it.

As IoT becomes increasingly prevalent worldwide, it brings forth new demands, with security emerging as a paramount concern. Beyond assembling smart objects, implementing big data analytics, and establishing communication capabilities, the critical challenge lies in ensuring security in such a vast scenario. The security of IoT devices extends beyond the devices themselves; the software applications and network connections linking to these devices must also be secure. Users of smart objects and IoT are vulnerable as their data traverses a network. The primary issues revolve around data confidentiality, privacy, and trust. In IoT, users, along with authorized smart objects, access data, necessitating the ability to verify the entity's authorization through authentication and identity management.

The collective effort to protect interconnected systems and their components is commonly referred to as 'cybersecurity.' Cybersecurity plays a pivotal role in safeguarding smart devices, IoT, and CPS, preventing unauthorized access from within the devices and externally. Its objectives include protecting services, hardware resources, information, and data in both transition and storage. Various technologies, such as cryptographic systems, firewalls, intrusion detection systems, anti-malware software, and secure socket layers, contribute to the cyber security framework.

Ethical concerns also come into play, such as the scenario where a wearable gadget records a user's health and fitness information. This information may be accessible to gadget service providers, who might sell user data to other companies without consent. This practice can lead to personalized offers or advertisements based on the user's fitness tracker data, anticipating their potential interests. Some users may find this intrusive, while others may not mind promotional offers. However, the unauthorized sale or distribution of user data without consent is generally not in the user's best interest.

ISBN: 978-81-965236-7-1

User consent should be a prerequisite for data sharing, ensuring that selling or distributing personal data occurs only with the explicit agreement of the user.

AI enabled IoT-CPS

In the realm of IoT-CPS, data is an indispensable component, whether it's vast or compact, playing a vital role in the interconnected world of devices. Smart objects should possess localized processing capabilities and inherent intelligence. However, for decisions reliant on data, a more extensive dataset is essential. Storing such data within a smart object might not always be feasible. This is where the macroscopic approach comes into play; data is transmitted to remote locations in a distributed manner and analyzed. The results of this analysis are integrated, and when necessary, decisions are sent back to the smart object for execution by the actuator. The time between data transmission and decision implementation must be practical; otherwise, it loses its meaning. Traditional analytic tools struggle to capture the entirety of this massive data in real-time. The volume, velocity, and variety are too extensive for comprehensive analysis, and the potential relationships and correlations between different data sources are too vast for manual comprehension by analysts.

An effective machine learning system dealing with big data requires data preparation capabilities, both basic and advanced learning algorithms, automation, adaptability, scalability, ensemble modeling, and real-time decision-making.

While machine learning systems have demonstrated the ability to let computers think on our behalf, addressing big data demands adaptation of existing ML methods and the development of new ideas.

CPS and IoT are fundamentally driven by the pursuit of social, economic, and human benefits. These technologies find applications in various domains such as personalized healthcare, smart grids, smart industries, and smart transportation. For instance, a smart industry can enhance manufacturing processes by sharing real-time information among industrial equipment, supply chains, distributors, business systems, and customers. In healthcare CPS, a smart hospital could remotely monitor patients' physical conditions, especially in hard-to-reach areas, enabling timely interventions during emergencies like road accidents. Quick notifications to the nearest hospital, police station, and family members, along with immediate dispatch of an ambulance and alerting the on-duty doctor, exemplify the potential benefits. Such interconnected autonomous systems are particularly advantageous in emergency situations, and the infusion of artificial intelligence amplifies the overall "smartness" in the IoT-CPS infrastructure.

Applications of IoT-CPS involve components interacting through a complex physical environment, presenting a challenging innovation that has the potential to transform various sectors, including manufacturing, energy systems, healthcare, transportation, critical infrastructure, emergency response, defense, and agriculture. Organizations embracing IoT-CPS should incorporate system-aware assets capable of autonomously assessing potential faults or failures in the system. System-awareness implies that a device embedded in any part of a machine should sense both itself and its environment. The integration of AI into such interconnected IoT-CPS scenarios propels us toward not just a smarter but a "brilliant planet."

Cognitive AI and IoT-CPS

IoT transcends the mere combination of wireless sensor networks, data storage, embedded systems, and security issues; it represents a vision of a world interconnected by intelligence. This may sound like science fiction, but it is the essence that makes IoT a prevalent term today. The conventional approach to programmable computing involves filtering information through a fixed set of rules to arrive at a result. However, this method proves inefficient in addressing the multifaceted aspects of a complex, fast-paced world where the information processing capability diminishes exponentially, leading to underutilization. Cognitive computing, in contrast, overcomes such limitations by learning from the intricate relations within connections involving people, things, the environment, and their interactions. Instead of being deterministic, cognitive frameworks are probabilistic, enabling them to keep pace with the volume, variety, variability, and unpredictability of data generated by the IoT.

Formally termed cognitive computation models, these frameworks constitute an integral part of the artificial intelligence in IoT-CPS. They possess the capability to comprehend the "unstructured" 80 percent of the world's information, including recordings, audio, blogs, images, emails, and tweets. This means that organizations can now illuminate aspects of the IoT that were previously imperceptible. When applied to the IoT, this cognitive understanding results in

ISBN: 978-81-965236-7-1

what is known as Cognitive IoT—systems that integrate intelligence into, and learn from, the physical world.

"Cognition" refers to the process of acquiring knowledge and understanding through thoughts, experience, and senses. Intuitively, Cognitive IoT can be viewed as an extension of IoT that is capable of understanding, reasoning, and learning. While these three aspects of cognition share similarities between human cognition and Cognitive IoT, they carry nuanced meanings. For IoT, to 'understand' implies the ability to collect vast amounts of data from the network and discern the underlying meaning of the data, creating concepts, identifying entities, and defining relationships between them.

The ability to 'reason' means that IoT should be capable of providing appropriate answers to queries or solving relevant problems without explicit programming. Lastly, a cognitive IoT should be able to 'learn,' independently deriving new information from the available data using the past knowledge it has acquired.

AI enabled IoT-CPS

While machines are not designed to replace humans entirely, their purpose is to assist humans in reducing the task load. It is crucial to emphasize that humans should maintain supremacy over machines. Artificial Intelligence (AI) proves most effective when combined with human intelligence rather than replacing it. This underscores the concept that computers and humans possess different strengths in the vast realm of excellence: computers excel at arithmetic tasks and counting, while humans demonstrate remarkable performance in logic and reasoning. These distinct forms of intelligence complement each other rather than being diametrically opposed. AI, therefore, represents the technology that can fulfill the dream of having 'things' that can 'think' [32].

Several examples illustrate how artificial intelligence has been incorporated and utilized in the IoT-CPS scenario:

Energy Utilization: Algorithms have been developed on a small scale to reduce energy consumption in a coffee machine (ARIIMA). This approach can be adapted and implemented in various scenarios, such as temperature control systems in houses, making them more efficient and reducing wastage. The system learns and adjusts temperature settings efficiently based on residents' preferences.

Routing/Traffic: Machine learning is applied in traffic management and routing, considering parameters like traffic, road conditions, weather, etc., to suggest the best routes.

Cost Savings: Predictive abilities are invaluable in an industrial setting. Machine learning algorithms, drawing information from sensors on machines, can learn the usual running conditions. When irregularities occur, the system can identify the machine and raise an alarm, preventing accidents and saving costs. Companies like Augury use vibration and ultrasonic sensors to predict malfunctions and save money [33].

In essence, we aspire to achieve an 'Internet of Things' where both the 'Internet' and the 'Things' have the power to think [32]. This infusion of thought represents the 'intelligence' aspect of IoT. While this may seem overrated, it encapsulates the essence of current research in artificial intelligence.

Challenges

Once an idea is conceptualized, bridging the gap between the idea and a functional prototype poses significant challenges. The development of a working prototype requires substantial resources. Even with a prototype in place, the critical question remains: how can one ascertain the success or failure of this innovative technology? Often, both novices and experts in the domain make erroneous predictions. Recent trends in the Internet of Things (IoT) underscore the rapid influx of data from diverse sources in varied formats, surpassing the capabilities of information systems to absorb, store, analyze, and process it. While databases with petabytes of data are not uncommon, the primary goal is to extract meaningful information, such as patterns, structures, and underlying relationships. This task is intricate and demands advanced storage and processing techniques due to the unprecedented volumes of data.

In response to these challenges, new algorithms are being devised, and established techniques are being revisited and tailored in fields like Pattern Recognition, Machine Learning, and Data Mining. However, the convergence of IoT and Cyber-Physical Systems (CPS) raises additional concerns. The field of Artificial Intelligence (AI) requires further development to align with the emerging IoT-CPS infrastructure. Complex adaptive AI systems could potentially lead to self-sustaining malicious evolution, akin to cancerous growth in the human body. Research efforts are crucial to address these evolving AI systems with superior countermeasures.

ISBN: 978-81-965236-7-1

Cybersecurity emerges as a major concern in this technological era, where the possibility of cyber wars looms. Autonomous systems are susceptible to malicious use if hacked, necessitating the identification and mitigation of vulnerabilities in AI systems. Mock attacks on AI systems can be developed to immunize existing safeguards. Proactive measures, such as predicting new types of attacks, must be integrated into organizational systems. Rapid recovery systems are essential for organizations to bounce back from cyber events disrupting regular business operations. It is imperative to automatically identify and safeguard critical information that could be maliciously exploited, even when shared publicly, and AI systems can play a role in ensuring privacy.

Conclusion

In the future, individuals will engage with intelligent devices, consume smart capsules capable of assessing the impact of medicine on the body, reside in intelligent homes, and more. While this may seem like science fiction, it represents the focal point of ongoing research. The vision is of an interconnected world where every facet is intelligent and linked to the Internet, culminating in what can be termed a 'smart cyber revolution.' Nonetheless, the trajectory prompts a debate on whether this shift is towards creative destruction.

As machines increasingly undertake less routine tasks, this transformation coincides with a period where many workers are already grappling with challenges. With appropriate policies, there is an opportunity to harness the benefits of automation without widespread unemployment. Human ingenuity will redefine the nature of productive work, emphasizing educational opportunities and fostering a workforce equipped with reskilling and upskilling.

Continuous deployment of AI models in real- world scenarios demands a reassessment of the impact of such automation on human life. While these systems offer myriad benefits, they also present inherent risks, including privacy breaches, the codification and reinforcement of biases, diminished accountability, hampered due process, and an escalation in information asymmetry between data producers and holders. The Internet of Things and Cyber-Physical Systems (IoT- CPS) constitute a diverse and intricate network, making it challenging to monitor every ethical or security breach incident. Failures or bugs in the software or hardware can have significant consequences, with even power outages causing inconvenience. Consequently, the implementation of an additional AI system, supervising the IoT's activities in real-time, may become necessary. In the future, we might envision a democracy of such systems, preventing irrational actions. As our lives become increasingly intertwined with technology, we must ensure that humans retain supremacy over the artificially intelligent landscape.

This approach is essential for managing and guiding the ongoing revolution without succumbing to technological enslavement.

References:

[1]. R. Baheti and H. Gill, “Cyber-Physical Systems,” The Impact of Control Technology, vol. 12, pp. 161–166, 2011.

[2]. R. S. Michalski, J. G. Carbonell, and T. M. Mitchell, Machine Learning: Artificial Intelligence Approach. Springer Science & Business Media, 2013.

[3]. E. A. Lee and S. A. Seshia, Introduction to Embedded Systems: A Cyber-Physical Systems Approach. MIT Press, 2016.

[4]. H. Witten and E. Frank, Data Mining: Practical Machine Learning Tools and Techniques. Morgan Kaufmann, 2016.

[5]. L. Monostori, B. Kádár, T. Bauernhansl, S. Kondoh, S. Kumara, G. Reinhart, O. Sauer, G. Schuh, W. Sihn, and K. Ueda, “Cyber-Physical Systems in Manufacturing,” CIRP Annals, vol. 65, no. 2, pp. 621–641, 2016.

[6]. E. A. Lee and S. A. Seshia, “A Theory of Formal Synthesis via Inductive Learning,” Acta Informatica, vol. 54, no. 7, pp. 693–726, 2017.

[7]. Q. F. Hassan, A. R. Khan, and S. A. Madani, Internet of Things: Challenges, Advances, and Applications. Chapman & Hall/CRC Computer and Information Science Series, CRC Press, 2017.

[8]. G. Fortino and P. Trunfio, Internet of Things based on Smart Objects: Technology, Middleware and Applications. Springer, 2014.

[9]. L. T. Yang, B. Di Martino, and Q. Zhang, “Internet of Everything,” Mobile Information Systems, vol. 2017, 2017.

ISBN: 978-81-965236-7-1

[10]. J. Kaplan, Artificial Intelligence: What Everyone Needs to Know. What Everyone Needs To Know, Oxford University Press, 2016.

[11]. N. Marz and J. Warren, Big Data: Principles and Best Practices of Scalable Real- Time Data Systems. Manning, 2015.

[12]. J. Leskovec, A. Rajaraman, and J. D. Ullman, Mining of Massive Datasets. Cambridge university press, 2014.

[13]. J. Holler, V. Tsiatsis, C. Mulligan, S. Avesand, S. Karnouskos, and D. Boyle, From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence. Academic Press, 2014.

[14]. M. M. Gorman, Database Management Systems: Understanding and Applying Database Technology. Elsevier Science, 2014.

[15]. S. Theodoridis and K. Koutroumbas, Pattern Recognition. Elsevier Science, 2008. [16]. N. Gershenfeld, When Things Start to Think: Integrating Digital Technology into the Fabric of our lives. Henry Holt and Company, 2014.

[17]. B. Guo, D. Zhang, Z. Yu, Y. Liang, Z. Wang, and X. Zhou, “From the Internet of Things to Embedded Intelligence,” World Wide Web, vol. 16, no. 4, pp. 399–420, 2013.

[18]. C. Gomez and J. Paradells, “Wireless Home Automation Networks: A Survey of Architectures and Technologies,” IEEE Communications Magazine, vol. 48, no. 6, pp. 92–101, 2010.

[19]. V. Coskun, B. Ozdenizci, and K. Ok, “A Survey on Near Field Communication (NFC) Technology,” Wireless Personal Communications, vol. 71, no. 3, pp. 2259– 2294, 2013.

[20]. J. Fan, F. Han, and H. Liu, “Challenges of Big Data Analysis,” National Science Review, vol. 1, no. 2, pp. 293–314, 2014.Ghosh, N. S. Mishra, and S. Ghosh, “Fuzzy Clustering Algorithms for Unsupervised Change Detection in Remote Sensing Images,” Information Sciences, vol. 181, no. 4, pp. 699–715, 2011.

[21]. Halder, S.Ghosh, and A.Ghosh, “Aggregation Pheromone Metaphor for Semi-Supervised Classification,” Pattern Recognition, vol. 46, no. 8, pp. 2239–2248, 2013.

[22]. D.Cohn, “Active Learning,” Encyclopedia of Machine Learning and Data Mining, pp. 9–14, 2017.

[23]. S.Jha and S. A. Seshia, “A Theory of Formal Sync

ISBN: 978-81-965236-7-1

IoT Driven Servo Motor Control on Raspberry Pi 3B

Mrs.A.KAVITHA
Department of EEE
Sri Bharathi Engineering College
for Women,
Kaikkurichi, Pudukkottai, India.

***Abstract*—This paper presents insight into servo motor control by integrating a servo motor with the Raspberry Pi 3B microcontroller. Utilizing the Blynk app, this approach establishes an interactive platform for precise control. The user-friendly interface, featuring a slider and a submit button within the Blynk app, allows real-time adjustments to the servo motor's position. Building on prior experiences with various microcontrollers, this study extends to the Raspberry Pi, highlighting the immediate responsiveness facilitated by the Blynk app. This concise exploration contributes to the IoT landscape, showcasing efficient servo motor control through a mobile application.**

Keywords—Servo Motors, Raspberry Pi, IoT (Internet of Things), Micro controller.

I. INTRODUCTION

Servo motors renowned for their precision and adaptability, play a pivotal role in shaping contemporary technological advancements, especially in robotics, electric vehicles, aeronautics, and satellite systems. Specialized electric motors, servo motors deliver unparalleled control over the angular position of their output shafts. Their applications range from intricately controlling robotic limbs to ensuring precise movements in aeronautical and satellite systems.

The essence of servo motors lies in their ability to provide meticulous control, making them indispensable in applications where accuracy is paramount. In the dynamic landscape of advancing technology, the demand for servo motors is steadily rising, underscoring the need for a comprehensive understanding of their intricate control requirements.

At the core of a servo motor's functionality is its capability to maintain a specific position or achieve precise movements with high accuracy. This is accomplished through a closed-loop control system, where the motor continuously receives feedback from an internal sensor or encoder, allowing it to adjust its position in real-time. This feedback loop ensures that the servo motor consistently meets the desired angular position, velocity, and acceleration requirements.

The working principle involves a sophisticated combination of a DC motor, gearbox, control circuit, and feedback system. The control circuit interprets the desired position signal, compares it with the actual position feedback, and promptly signals the DC motor to adjust its rotation in the event of any deviation. This continuous feedback loop is instrumental in ensuring the servo motor's unwavering precision, a factor that profoundly influences the safety, reliability, and overall performance of the systems they drive.

To meet the demands of precision control, microcontrollers like the Raspberry Pi emerge as critical components. The Raspberry Pi, a credit-card-sized single-board computer, serves as a versatile platform for various embedded computing applications, including servo motor control. The Raspberry Pi's computational capabilities, flexibility, and compatibility make it an ideal choice for orchestrating intricate control systems. In the context of servo motor control, the Raspberry Pi serves as a computational hub, capable of executing complex algorithms to ensure accurate and responsive movements. Furthermore, the use of the Python programming language enhances the Raspberry Pi's effectiveness, providing a user-friendly and powerful toolset for developing control algorithms. Python's simplicity, readability, and extensive libraries make it well-suited for programming servo motor behaviors, allowing researchers and developers to implement and fine-tune precise control strategies with ease.

The integration of the Internet of Things (IoT) further extends the boundaries of servo motor control. IoT introduces a new dimension, providing a more comfortable and efficient means of managing and monitoring servo motors. This paper explores the symbiotic relationship between servo motors and IoT, offering insights into how interconnected systems enhance the overall control experience, particularly in scenarios where remote and real-time adjustments are essential for optimal performance.

Additionally, Blynk, a versatile and user-friendly Internet of Things (IoT) platform, stands out as a valuable tool for creating custom mobile applications to control and monitor connected devices. With its simple drag-and-drop interface, Blynk empowers users without extensive programming knowledge to design interactive dashboards. Functioning as a bridge between hardware and mobile devices in the IoT realm, Blynk facilitates seamless communication and control.

Adding a distinctive layer to the control ecosystem, the Blynk app serves as a medium of interaction, offering user-friendly and intuitive control interfaces. Its adaptability and ease of integration make Blynk a valuable asset in servo motor control, providing

ISBN: 978-81-965236-7-1

users with a streamlined and accessible means to interact with and manipulate these critical components. In the following sections, we delve into the interconnected roles of precision control, microcontrollers, IoT, and innovative applications like Blynk in the realm of servo motor dynamics.

II. LITERATURE STUDY

The integration of Internet of Things (IoT) technologies with servo motor control has garnered significant attention in recent literature, especially in the context of single-board computers like the Raspberry Pi. The following literature study outlines key themes, methodologies, and advancements in IoT-driven servo motor control, with a specific focus on the innovative use of the Blynk platform.

A. IoT in Servo Motor Control:

Literature reveals a growing trend in leveraging IoT for enhanced control and monitoring of servo motors. Researchers highlight the potential of real-time data exchange, remote accessibility, and seamless integration with IoT platforms to revolutionize servo motor applications. The integration of IoT technologies aims to bridge the gap between physical devices and the digital realm, opening avenues for efficient and intelligent control mechanisms.

B. Raspberry Pi in Control Systems:

The Raspberry Pi, as a versatile and accessible single-board computer, has become a cornerstone in IoT applications. Existing studies underscore its suitability for orchestrating servo motor control systems due to its computational capabilities, GPIO pins, and Linux-based operating system. Researchers delve into the integration of Raspberry Pi in control architectures, emphasizing its role in executing complex algorithms and interfacing with various sensors and actuators.

C. Servo Motor Control Techniques:

Literature provides an in-depth exploration of traditional and advanced servo motor control techniques. Researchers delve into PID (Proportional-Integral-Derivative) control, feedforward control, and adaptive control strategies. The focus is on achieving precise and responsive control over servo motors, particularly in dynamic and variable environments.

D. Blynk as an IoT Platform:

The Blynk platform has gained prominence for its user-friendly interface and adaptability in IoT projects. Recent literature discusses its unique features, such as drag-and-drop widgets and customizable dashboards, making it an ideal choice for developing IoT applications. Researchers emphasize the ease of integration with various hardware platforms, including the Raspberry Pi, to create interactive and remotely accessible control interfaces.

E. Case Studies and Applications:

Numerous case studies highlight successful implementations of IoT-driven servo motor control, with a particular emphasis on Raspberry Pi and Blynk integration. These case studies encompass a spectrum of applications, from home automation and smart devices to industrial robotics. Researchers showcase the practicality, efficiency, and scalability of these systems in real-world scenarios.

F. Challenges and Future Directions:

Despite the progress, literature acknowledges challenges such as security concerns, latency issues, and the need for standardized protocols in IoT-driven servo motor control. Researchers propose avenues for future research, including the exploration of machine learning algorithms for adaptive control and the development of robust cybersecurity measures for IoT-enabled systems.

In summary, the literature study underscores the dynamic landscape of IoT-driven servo motor control, particularly on the Raspberry Pi platform, coupled with the innovative integration of the Blynk platform. The synthesis of existing knowledge provides a foundation for the research paper, paving the way for further exploration and contributions in this evolving field.

III. METHODOLOGY

A. Existing System:

In current servo motor control setups, the commonly used methods often rely on older approaches that don't quite meet the connectivity and integration needs demanded by today's technology. Many systems still use local interfaces for controlling servo motors, limiting flexibility and making real-time adjustments challenging. Furthermore, the lack of robust Internet of Things (IoT) integration means remote access and advanced control functionalities are often constrained. The user interfaces in existing systems may not be as user-friendly or intuitive, prompting the need for a more modernized system that can adapt to current technological requirements.

B. Proposed System:

The proposed system represents a significant advancement in servo motor control by leveraging the computational capabilities of the Raspberry Pi 3B and the Internet of Things (IoT) features of the Blynk platform. This integration aims to overcome the limitations of traditional systems by introducing a dynamic and user-centric control mechanism. The Raspberry Pi acts as a powerful microcontroller, handling complex control algorithms, while Blynk serves as the conduit for seamless communication between the user interface and the servo motor. With this system, users can remotely monitor and control the servo motor through an interface embedded within the Blynk app, providing enhanced accessibility and responsiveness. Real-time adjustments, facilitated by IoT integration, extend the system's utility to applications requiring increased adaptability and remote management. This proposed system not only addresses the shortcomings of existing setups but also lays the foundation for a more sophisticated and efficient era of servo motor control within the IoT framework.

IV. IMPLEMENTATION

A. SERVO MOTOR

The SG90 is a popular model of servo motor known for its compact size and versatility. When interfaced with a Raspberry Pi, the SG90's specifications become relevant for effective integration. The SG90 typically operates on a voltage range of 4.8V to 6V, with a stall torque of approximately 1.8 kg-cm. It has a rotation range of 0 to 180 degrees, making it suitable for various applications requiring controlled and limited movement. When connected to a Raspberry Pi, the GPIO pins can be used to send control signals to the SG90, allowing for precise angular positioning as dictated by the Raspberry Pi's programming. This combination of the SG90 servo motor and Raspberry Pi presents a powerful synergy for applications demanding accurate and programmable motion control.

Fig.1 SG90 Servo Motor

B. RASPBERRY PI 3B

The Raspberry Pi 3, a notable iteration of this popular device, boasts a 1.2GHz quad-core ARM Cortex-A53 processor and 1GB of RAM, offering sufficient computational power for real-time control tasks. Equipped with GPIO pins, the Raspberry Pi facilitates seamless interfacing with external devices, making it an ideal choice for servo motor control. Specifically, for servo motor control using the Blynk app, the GPIO pins serve as the communication bridge between the Raspberry Pi and the servo motor. These GPIO pins, when coupled with the Blynk app, enable users to remotely manipulate and monitor servo motor behavior through an intuitive graphical interface. The integration of the Raspberry Pi 3, with its robust specifications, and the Blynk app provides a comprehensive solution for efficient and accessible servo motor control in various applications.

Fig.2 Raspberry Pi 3B Board

C. BLYNK - IOT PLATFORM

Blynk plays a pivotal role in IoT-driven servo motor control using Raspberry Pi. It acts as the interface through which users can remotely manipulate servo motor parameters. By integrating Blynk with Raspberry Pi, users can design a personalized control dashboard on their mobile devices, featuring intuitive elements like sliders and buttons. This allows for real-time adjustments to the servo motor's position and behavior, providing a convenient and efficient means of controlling the servo motor within an IoT framework. The simplicity and adaptability of Blynk contribute significantly to enhancing the user experience and extending the capabilities of IoT applications involving servo motors and Raspberry Pi.

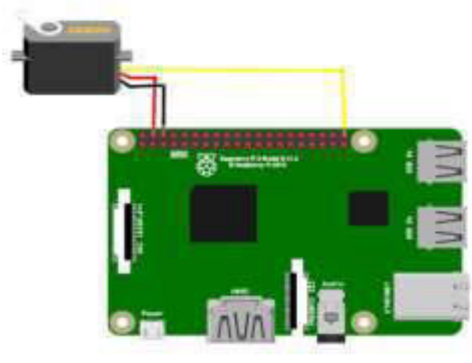


Fig.3 Circuit Diagram for Hardware Component

In the implementation phase, the realization of the IoT-driven servo motor control system on the Raspberry Pi 3B was meticulously executed through a structured series of steps outlined in the provided flowchart. The initial step involved the precise physical setup, including the detailed wiring of the SG90 servo motor to the Raspberry Pi 3B using the GPIO pins. To interface with these GPIO pins, critical libraries such as RPi.GPIO and WiringPi were employed, ensuring seamless communication between the Raspberry Pi and the connected servo motor.

ISBN: 978-81-965236-7-1

Fig.4 Flowchart of Program Design

Subsequently, the software components were methodically configured and deployed. Python scripts, capitalizing on the capabilities of both RPi.GPIO and WiringPi libraries, were intricately crafted to establish a robust communication link between the Raspberry Pi 3B and the Blynk cloud server. Git, serving as the version control system, played a pivotal role in maintaining the integrity and versioning of the codebase throughout the entire implementation process.

Moreover, the Blynk mobile application underwent customization to meet specified requirements, incorporating slider button that seamlessly communicated with the GPIO-controlled servo motor. Rigorous testing, guided by the flowchart and executed in parallel with Git versioning, ensured the reliability and efficiency of the entire system. Dependencies such as RPi.GPIO, WiringPi, and Git were integral components contributing to the successful integration of the IoT-driven servo motor control system. The implementation process, intricately guided by the flowchart, provided a comprehensive and reproducible pathway for deploying an effective IoT-driven servo motor control system using the Raspberry Pi, Blynk, and essential libraries and tools.

V. RESULT ANALYSIS AND DISCUSSION

The experimental results reveal the successful integration and control of the SG90 servo motor using Raspberry Pi 3 and the Blynk app. The system demonstrated remarkable precision and responsiveness, as evidenced by the smooth adjustments within the servo motor's 180-degree range. Analysis of the Blynk interface, featuring slider button controls, highlighted its intuitive design, allowing users to manipulate the servo motor's rotational position seamlessly.

Stability was a notable feature throughout the extended operational duration, with no observed crashes or irregularities. User feedback emphasized the user-friendly nature of the Blynk app, affirming its effectiveness in facilitating precise control. Additionally, the system exhibited low-latency network performance, ensuring real-time adjustments, and maintained efficient power consumption levels, contributing to its overall reliability.

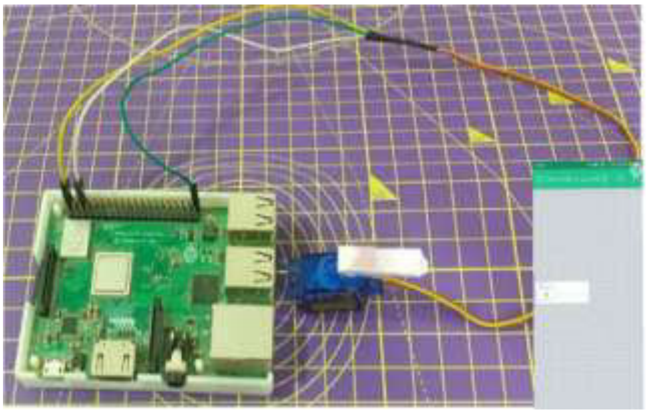


Fig.5 Practical Prototype Model

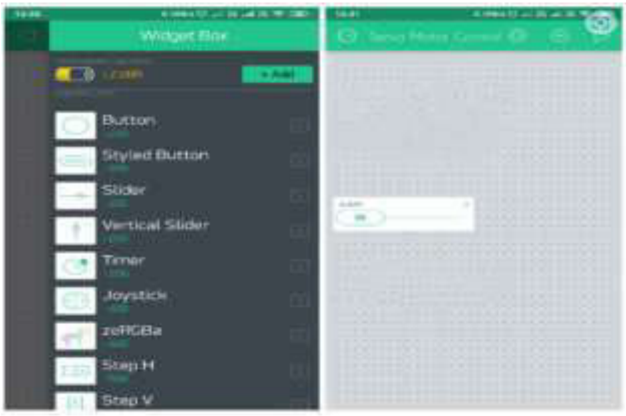


Fig.6 Blynk Interface Slider of Servo Motor

The scalability and flexibility of the setup were evident in its ability to accommodate different servo motor configurations. These findings collectively underscore the practical feasibility and robustness of the integrated system for various applications in robotics and automation. The positive outcomes open avenues for further exploration, such as refining control algorithms and investigating broader applications within the field.

ISBN: 978-81-965236-7-1

VI. CONCLUSION

In conclusion, this study successfully demonstrates the implementation and effectiveness of IoT-driven SG90 servo motor control on Raspberry Pi 3B utilizing the Blynk platform. The experimental results underscore the precision and responsiveness achieved through the Blynk app, offering a user-friendly interface for seamless control. The integration of Blynk and Raspberry Pi in servo motor control, supported by low-latency network performance, showcases the potential for practical applications in the Internet of Things (IoT) domain. This research contributes valuable insights into the synergy between Blynk, Raspberry Pi, and servo motors, laying the groundwork for enhanced control systems in IoT-driven scenarios. The positive outcomes open avenues for further exploration, such as refining control algorithms and investigating broader applications within the field.

REFERENCES

[1] Lu, Y., Li, H., & Huang, G. (2017). Internet of Things: A Survey. Information Systems Frontiers, 17(2), 243–259.

[2] Das, S. K., & Cook, D. J. (2014). Guest Editorial: Introduction to the Special Section on Internet of Things (IoT): Analytics and Applications. IEEE Transactions on Knowledge and Data Engineering, 26(10), 2483–2486.

[3] Upton, E., & Halfacree, G. (2014). Raspberry Pi User Guide. John Wiley & Sons.

[4] Jain, A., & Dey, A. (2018). A Comprehensive Study on Raspberry Pi: Technology, Architecture, and Its Applications. Procedia Computer Science, 132, 953–960.

[5] Blynk Documentation. [https://docs.blynk.io/]

[6] Alarco, J. I., & Vargas, W. S. (2019). Internet of Things Applications Using the Blynk Platform. IEEE Latin America Transactions, 17(3), 363–368

[7] S. Monk. Make: action: Movement, light, and sound with Arduino and Raspberry Pi. San Francisco, CA: Maker Media. (2016)

[8] Yfoulis, C., Papadopoulou, S., Trigkas, D., & Voutetakis, S. (2018). Switching PI speed control of a nonlinear laboratory dc micromotor using low-cost embedded control hardware and software. 5th Int. Conference on Control, Decision and Information Technologies (CoDIT'18).

[9] Chayna Bhandarkar, Saloni Deshmukh, Kartik Yeole, Rakshit Dalvi, Smita Kapse, Pranay Shete, "Monitoring Health of IoT Equipped 3-Phase Induction Motor using Interactive Dashboard", 2023 IEEE International Students' Conference on Electrical, Electronics and Computer Science (SCEECS), pp.1-6, 2023.

[10] Ramakrishnan Raman, Kshitij Naikade, "Smart Industrial Motor Monitoring with IoT-Enabled Photovoltaic System", 2023 7th International Conference on I-SMAC (IoT in Social, Mobile, Analytics and Cloud) (I-SMAC), pp.53-57, 2023.

[11] Maria G. Ioannides, Elias B. Koukoutsis, Anastasios P. Stamelos, Stylianos A. Papazis, Erofili E. Stamataki, Athanasios Papoutsidakis, Vasilios Vikentios, Nikolaos Apostolakis, Michael E. Stamatakis, "Design and Operation of Internet of Things-Based Monitoring Control System for Induction Machines", Energies, vol.16, no.7, pp.3049, 2023.

ISBN: 978-81-965236-7-1

AN EFFICIENT LOAD BALANCING IN VIRTUAL MACHINES USING DYNAMIC ALLOCATION METHOD FOR CLOUD COMPUTING ENVIRONMENT

Mrs. S. LAVANYA PRABHA., AP/CSE,
Sri Bharathi Engineering College for Women, Pudukkottai.

Abstract - **This paper proposes a Dynamic resource allocation method for Cloud computing. Cloud computing is a model for delivering information technology services in which resources are retrieved from the internet through web-based tools and applications, rather than a direct connection to a server. Users can set up and boot the required resources and they have to pay only for the required resources. Thus, in the future providing a mechanism for efficient resource management and assignment will be an important objective of Cloud computing. In this project we propose a method, dynamic scheduling and consolidation mechanism that allocate resources based on the load of Virtual Machines (VMs) on Infrastructure as a service (IaaS). This method enables users to dynamically add and/or delete one or more instances on the basis of the load and the conditions specified by the user .Our objective is to develop an effective load balancing algorithm using Virtual Machine Monitoring to maximize or minimize different performance parameters (throughput for example) for the Clouds of different sizes (virtual topology de-pending on the application requirement).**

Keywords : Cloud computing, Infrastructure -as-a Service, Amazon ec2, Optimizing VM Load, Load balancing.

1. INTRODUCTION

Cloud computing refers to the delivery of computing and storage capacity as a service to a heterogeneous community of end-recipients. Cloud computing is an internet technology that utilizes both central remote servers and internet to manage the data and applications. This technology allows many businesses and users to use the data and application without an installation. Users and businesses can access the information and files at any computer system having an internet connection.

Cloud computing provides much more effective computing by centralized memory, processing, storage and bandwidth[8].Cloud computing has several applications such as Infosys is using Microsoft's Windows Azure Cloud services, including SQL Data Services, to develop Cloud-based software capabilities that would let automobile dealers share information on inventories and other resources. Best Buy's Giftag applet uses Google App Engine to let users create and share wish lists from Web pages they visit. Wang Fu Jing Department Store, a retailer in China, uses IBM Cloud services, including supply chain management software for its network of retail stores[9].

Cloud computing providers offer their services according to three fundamental models Infrastructure as a service (IaaS), platform as a service (PaaS), and software as a service (SaaS). IaaS is the most basic and each higher model abstracts from the details of the lower models. Platform -as-a-service in the Cloud is defined as a set of software and product development tools hosted on the provider's infrastructure. Developers create applications on the provider's platform over the Internet. PaaS providers may use APIs, website portals or gateway software installed on the customer's computer. In the software-as-a-service Cloud model, the vendor supplies the hardware infrastructure, the software product and interacts with the user through a front-end portal. Infrastructure-as-a-Service is to start, stop, access and configure their virtual servers and storage.

In the enterprise, Cloud computing allows a company to pay for only as much capacity as is needed, and bring more online as soon as required. Because this pay-for-what-you-use model resembles the way electricity, fuel and water are consumed, it's sometimes referred to as utility computing[1]. Several issues are existed in Cloud computing such as Performance, Security, Availability, and Inability to Customize. In this paper we are focusing performance issue. Operating in a Cloud computing environment does not eliminate application performance issues[10].

In fact, the Cloud is very complex and will possibly introduce even more performance problems then in non Cloud environments. As such the ongoing monitoring of all the applications is accessed via the Cloud. This will ensure that Service Level greements are met and performance and uptime are optimal. On a Cloud computing platform, dynamic resources can

ISBN: 978-81-965236-7-1

be effectively managed using virtualization technology. The subscribers with more demanding SLA can be guaranteed by accommodating all the required services within a Virtual Machine image and then mapping it on a physical server. This helps to solve problem of heterogeneity of resources and platform irrelevance. Load balancing of the entire system can be handled dynamically by using virtualization technology where it becomes possible to remap Virtual Machines (VMs) and physical resources according to the change in load . Due to these advantages, virtualization technology is being comprehensively implemented in Cloud computing[11].

A Virtual Machine (VM) is a software implementation of a computing environment in which an operating system (OS) or program can be installed and run. The Virtual Machine typically emulates a physical computing environment, but requests for CPU, memory, hard disk, network and other hardware resources are managed by a virtualization layer which translates these requests to the underlying physical hardware. VMs are created within a virtualization layer, such as a hypervisor or a virtualization platform that runs on top of a client or server operating system. This operating system is known as the host OS. The virtualization layer can be used to create many individual, isolated VM environments.

This paper focuses on dynamic allocation method for efficient load balancing on Virtual Machines. This paper is organized as follows section 2 describes existing system, section 3 describes Experimental setup, section 4 describes Results and analysis, section 5 describes conclusion and section 6 describes bibliography.

2. VM LOAD BALANCING

2.1. OVERVIEW

Virtual Machine enables the abstraction of an OS and Application running on it from the hardware. The interior hardware infrastructure services interrelated to the Clouds are modeled in the simulator by a Data center element for handling service requests. These requests are application elements sandboxed within VMs, which need to be allocated a share of processing power on Datacenter's host components. Data Center object manages the data center management activities such as VM creation and destruction and does the routing of user requests received from user via the Internet to the VMs. The Data Center Controller, uses a VM Load Balancer to determine which VM should be assigned the next request for processing. Most common VM load balancer are throttled and active monitoring load balancing algorithms.

Active Monitoring Load Balancer maintains information about each VMs and the number of requests currently allocated to which VM.When a request to allocate a new VM arrives, it identifies the least loaded VM. If there are more than one, the first identified is selected[6].

In this paper we studied two load balancing algorithms in Cloud computing was done. The algorithms are throttled load balancer, active monitoring load balancer. A new algorithm has been proposed from modifying the active monitoring load balancing algorithm in Virtual Machine environment of Cloud computing in order to achieve better response time, processing time and cost.

2.2. PROPOSED VM LOAD BALANCING METHOD

Optimization of Virtual Machine load is a process of reassigning the total load to the individual Virtual Machines to make resource utilization effective and to improve the response time of the job. A load balancing algorithm which is dynamic in nature does not consider the previous state or behavior of the system, that is, it depends on the present behavior of the system. The important things to consider while developing such algorithm are, estimation of load, comparison of load, performance of Virtual Machine, nature of work to be transferred, selecting of Virtual Machine and many other ones. This load considered can be in terms of CPU load, amount of memory used, delay or Network load.

The time required for completing a task within one process is very high. So the task is divided in to number of sub tasks and each sub task is given one one job. The Proposed Load balancing algorithm is divided into two phase. A two-level task scheduling mechanism based on load balancing to meet dynamic requirements of users and obtain a high resource utilization.

It achieves load balancing by first mapping tasks to Virtual Machines and then Virtual Machines to host resources thereby improving the task response time, resource utilization and overall performance of the Cloud computing environment. In the first phase, find the cpu utilization and memory required for each instance and also find available cpu cycle and memory of each VM. In second phase compare the available resources and required resources, if resources are available instance is to be added otherwise discard the instance finally returns instance status to user. The Cloud Watch monitoring service is a special storage engine that is designed for time series data.

ISBN: 978-81-965236-7-1

On one end data collected periodically from servers and from other services is pumped into the monitoring store, and at the other end clients can run queries against the store to extract data from it.

2.3. DETAILED DESIGN

The load balancing service is designed to serve as a first level of distributing load across a number of instances, dealing specifically with DNS and handling the failure of an availability zone. Amazon Cloud Watch provides monitoring for AWS Cloud resources and the applications customers run on AWS. Developers and system administrators can use it to collect and track metrics, gain insight, and react immediately to keep their applications and businesses running smoothly. Amazon Cloud Watch monitors AWS resources such as Amazon EC2 and Amazon RDS DB instances, and can also monitor custom metrics generated by a customer's applications and services. With Amazon Cloud Watch, you gain system-wide visibility into resource utilization, application performance, and operational health[3].

Functions of our proposed system are,

Bucket creation- S3 Browser allows to easily create Amazon S3 Buckets in all regions supported by Amazon S3. Once created a new bucket, one who can create virtual folders to organize files, and upload and download files to and from Amazon S3[3].

Uploading instance- VM Import/Export enables to easily import Virtual Machine images from existing environment to Amazon EC2 instances and export them back to on-premise environment. This offering allows to leverage an existing investments in the Virtual Machines that who built to meet IT security, configuration management, and compliance requirements by seamlessly bringing those Virtual Machines into Amazon EC2 as ready-to-use instances. One who can easily export imported instances back to your on-premise virtualization infrastructure, allowing you to deploy workloads across your IT infrastructure[3].

Monitoring instance- Amazon Cloud Watch provides a reliable, scalable, and flexible monitoring solution that can start using within minutes. No longer need to set up, manage, or scale own monitoring systems and infrastructure. Using Amazon Cloud Watch, which can easily monitor as much or as little metric data as you need. Amazon Cloud Watch lets you programmatically retrieve your monitoring data, view graphs, and set alarms to help you troubleshoot, spot trends, and take automated action based on the state of Cloud environment[3].

Amazon Cloud Watch enables to monitor AWS resources in real-time, including Amazon EC2 instances, Amazon EBS volumes, Elastic Load Balancers, and Amazon RDS DB instances. Metrics such as CPU utilization, latency, and request counts are provided automatically for these AWS resources. One who can also supply his own custom application and system metrics, such as memory usage, transaction volumes, or error rates, and Amazon Cloud Watch will monitor these too.

Algorithm 1: To describe add/remove instance.

Desc_add/remove_inst()

{

Find Instance Id 'inst_id' from ec2InstanceRequest;

Find required cpu utilization 'reqcpuUtil'

From ins_size*60*60*24;

Find VM Id 'VmId' from ec2AvailabilityZones;

Print availcpuUtil;

If '*availcpuUtil' result in a loop* **then**

Add instance to controller

else

discard Instance from user request**;**

end

}

Algorithm 2: Add instance to controller.

Add_inst()

{

Find availability zones 'Avail' from

ec2 AvailabilityZones;

Find Key pair 'key' from ec2KeyPairs;

Describe user Instances 'Inst' from ec2DescribeInstance;

Create new key pair 'newKey' from ec2KeyPair;

Assign 'Instance' to VM;

Find instance ststus 'InstStat' from RunInstanceRequest;

Print InstStat;

}

To test our algorithm we are using WebCrawler application to describe better optimization of load on each Virtual Machine. A WebCrawler is a computer program that browses the World Wide Web in a methodical, automated manner or in an orderly fashion. This process is called Web crawling or spidering.

ISBN: 978-81-965236-7-1

Many sites, in particular search engines, use spidering as a means of providing up-to-date data. Web Crawlers are mainly used to create a copy of all the visited pages for later processing by a search engine that will index the downloaded pages to provide fast searches. Crawlers can also be used for automating maintenance tasks on a Web site, such as checking links or validating HTML code. Also crawlers can be used to gather specific types of information from Web pages, such as harvesting e-mail addresses (usually for sending spam).

3. EXPERIMENTAL SETUP

In this section we describe the experimental setup that was used to run workflows. Java language is used for implementing VM load balancing algorithm. EC2 was chosen because it is currently the most popular, feature-rich, and stable commercial Cloud Workflows are loosely coupled parallel applications that consist of a set of computational tasks linked via data and control-flow dependencies. Unlike tightly-coupled applications in which tasks communicate directly via the network. In order to have an unbiased comparison of the performance of workflows on EC2 the experiments presented in this paper attempt to account for these differences by (a) running all experiments on single nodes and (b) running experiments using the local disk on EC2. Although single-node experiments do not enable us to measure the scalability of Cloud services they do provide an application-oriented understanding of the capabilities of the underlying resources that can help in making provisioning decisions. Testing the scalability of Cloud services when running workflows on multiple nodes is left for future work.

4. RESULTS AND ANALYSIS

Fig 1 shows an interface designed facilitating the user to create bucket on Cloud and send request to the instance monitor. Client provides an option for creating bucket, deleting bucket, refreshing AWS amazon web account and downloading the contents resides in the bucket. When user sends a request to the Cloud, IaaS converts it into an instance and sends it to job manager.

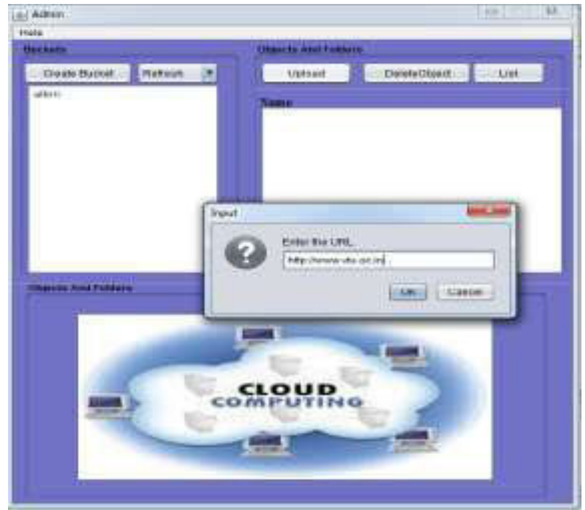


Fig 1: Client Interface

Fig 2 shows an Job manager, receives the user request from client. Received instance is to be divided into number of sub tasks(instances). After dividing an instance sends it to task manager.

Fig 2: Job Manager

Fig 3. Shows an Instance monitor, monitors the status of the instance and Virtual Machine(VM's) by checking the required resources of instance and available resources such as cpu usage and memory available of VM's. Dynamic instance module decides whether to add instance or delete instance based on the status of the instance monitor. If the resources are available on Virtual Machine the instance is to be added to Cloud otherwise discard the instance.

ISBN: 978-81-965236-7-1

Fig also shows a Task manager receives the instances from job manager. Process the user request and sends results back to client. Client displays the results to the user.

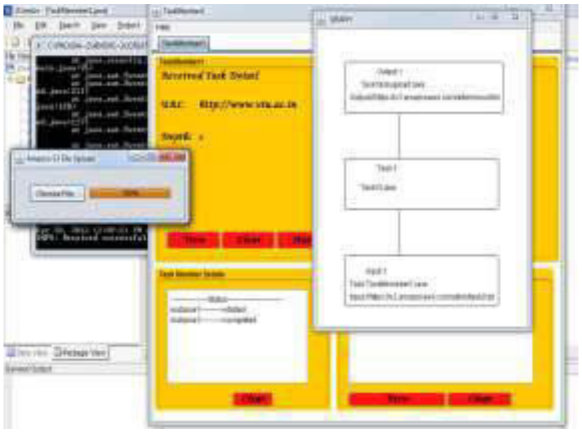


Fig 3: Task Manager

Table 1 Describes results of existing method [7]

ID	RESOURCES	THRESH_VALUE	CPU_CYCLE
1	0	Added	10
2	1	Added	9.67
3	2	Added	9.33
4	3	Added	9

Fig 4 Shows the graphical representation of the Table 1 with respect to Cpu cycle and Storage in Kb.

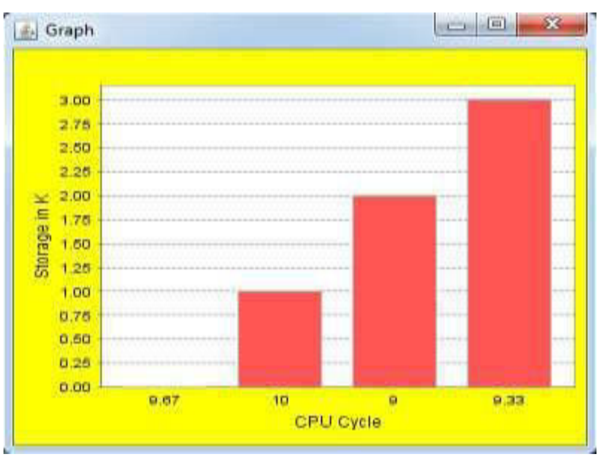
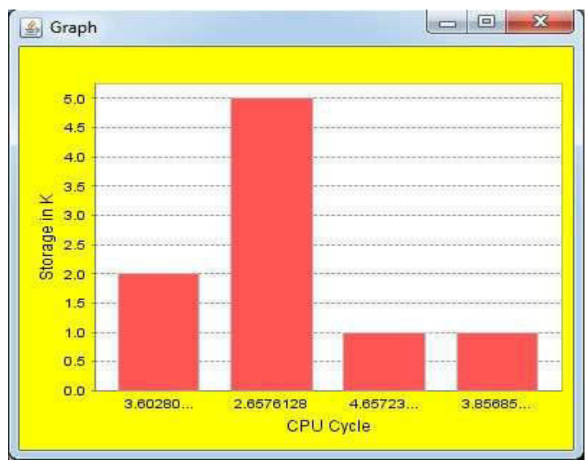


Table 2 describes average values of the Dynamic Instance method by taking 5 trial values.

NAME	INST_ID	AMI_ID	TYPE	VALUE	CPU CYLE
FIRST INSTANCE	i-2aa8c44d	ami-8f8c54c6	T1.micro	5	4.87854
INSTANCE1	i-54502733	ami-8f8c54c6	T1.micro	1	2.76843
INSTANCE 2	i-6c41350b	ami-8f8c54c6	T1.micro	1	3.85687142857143
INSTANCE 3	i-6c45280b	ami-8f8c54c6	T1.micro	2	3.602800000000007

Fig 5 Shows the graphical representation of the Table 2 with respect to Cpu cycle and Storage in Kb.



ISBN: 978-81-965236-7-1

5.CONCLUSION

In this paper a new VM load balancing algorithm was proposed and then implemented in Amazon EC2 Cloud computing environment using java language. Proposed algorithm find the available cpu cycle of each Virtual Machine (VM) and Send the ID of Virtual Machine to the Cloud controller for allocating the new request. We conclude that Cloud controller utilizes the available resources on Virtual Machine then it effect the overall performance of the Cloud Environment and also decrease the average response time.

REFERENCES

[1] Panzieri, Ozalp, Babaoglu1, Stefano, Ferretti, Vittorio, Ghini, Moreno Marzolla, Distributed Computing in the 21st Century: Some Aspects of Cloud computing Fabio Technical Report UBLCS 2011-03 May 2011.

[2] Patricia Takako Endo, André Vitor de Almeida Palhares, Nadilma Nunes Pereira, Resource Allocation for Distributed Cloud: Concepts and Research Challenges, 2011 IEEE.

[3] Amazon Inc., "Amazon Elastic Compute Cloud," http://aws.amazon.com/.

[4] Shuai Zhang, Cloud computing Research and Development Trend, Hebei Polytechnic University College of Science Hebei huoxiuzhen@126.com 2010 IEEE DOI 10.1109/ICFN.2010.58.

[5] G. Soundararajan et at al, “Resource Allocation for Database Servers Running on Virtual Storage”,In Proc. of 6th USENIX Conference on File and Storage Technologies, 2009.

[6] Meenakshi Sharma, Pankaj Sharma, Dr. Sandeep Sharma, Efficient Load Balancing Algorithm in VMCloudEnvironment, IJCST Vol. 3, Iss ue 1, Jan. - March 2012.

[7] Atsuo Inomata, Taiki Morikawa, Minoru Ikebe,Yoshihiro Okamoto, Satoru Noguchi, Kazutoshi Fujikawa, Hideki Sunahara Information Science, Nara Institute of Science and Technology, Sk. Md. Mizanur Rahman School of Information Technology and Engineering University of Ottawa,Ottawa, Canada, Proposal and Evaluation of a Dynamic Resource Allocation Method based on the Load of VMs on IaaS, 978-1-4244-8704-2/11/2011.

[8] Brief Description Of Cloud Computing By Robert S Bob.

[9] Real-World Cloud Computing Applications - Cloud-computing by John Foley.

[10] Cloud Computing Performance – by Tevron - Application Monitoring .

[11] A Genetic Algorithm Scheduling Approach for Virtual Machine Resources in a Cloud Computing Environment by Shailesh Sawant.

IOT-BASED SENSOR SAFE FOOD WAREHOUSE SYSTEM

[1]Mrs.V Nithya Poorani, [2]Mrs.M.Sathya
[1,2]Assistant Professor, Department of Electronics and Communication Engineering
Sri Bharathi Engineering College for Women, Pudukkottai-622303, Tamil Nadu, India
[1]aswinkarthick1605@gmail.com, [2]malardaksat@gmail.com

***Abstract* - manufacturers, intermediaries, merchants, consumers, etc. all utilize Storehouses. Farmers lose a great deal of money every year as a result of the issue with storehouse storage requirements. This results from inadequate food storage monitoring and inadequate refrigeration equipment. Numerous antiquated storage techniques were used, necessitating a labor-intensive and ineffective manual process. This research describes a smart IOT-based food monitoring system for storehouses that employs a Raspberry Pi and a number of sensors to continually check the many elements that might have an impact on the quality of the food. Adafruit serves as a cloud that facilitates data visualization. Popsql is used to manage a database, and a login page is made to assist the warehouse administrator.**

INTRODUCTION

India is the nation where the economy is mostly based on the agriculture sector. Due to storage regulations and inadequate food storage monitoring, farmers deal with a number of issues each year. Storage needs are met by warehouses. The state-run [1] warehouses only hold a small portion of the food grains. There are inadequate storage facilities for a significant portion of the Tomatoes, Onion, Radish and Cucumber are all produced worldwide. However, the country loses annually as a result of incorrect storage because of the variations in market availability from season to season and year to year.

The natural contamination of food grains is influenced by a number of environmental conditions, including temperature, humidity, light levels, pH, and type of storage structure. Food will become less valuable the longer it is stored. Food safety becomes an issue as a result. [2, 3]. A number of antiquated storage techniques were used, necessitating a labor- intensive manual process that is both time-consuming and inefficient. The lack of a multi-parameter monitoring system was another disadvantage. Therefore, the Internet of Things (IoT) based food grain monitoring system not only seeks to create a multi-parametric system that aids in reducing loss against many causes including moisture, aging, and decaying, but it also does so in a time- and money-efficient manner.

1. LITERATURE SURVEY

Rajesh Kumar Kaushal et. al [4]proposed an IoT framework to prevent food from getting contaminated during storage and transportation. System architecture.K Mohan Raj et. al proposed [5]an IoT based smart warehouse monitoring system. Varioustypes of sensors used in the system are vibration, humidity, temperature, fire sensors etc. Alexandru Popa et. al [6]proposed a method of integrated food monitoring. The system is suitable for vacuum-packed foods. Sipiwe Chihana et. al [7] proposed and developed a real-time intrusion and tracking system. Soumya T K et.al proposed [8] a multi-parameter monitoring system using wifi. Saleem Ulla Shariff proposed a system [9] for monitoring food grains at home. The information related to the food and storage is sent to the owner using the auto SMS and email alert system.

Sazia Parvin et. al proposed [10] a grain storage system with monitoring and controlling. Qinghua Zhang et. al proposed an IoT based system framework for the monitoring of the warehouse environment. Li Lijuan et.al [11] present a wireless transceiver and microcontroller-based monitoring system.The system described in the literature survey shows efforts taken by the researchers in the area of food management. However, the food management system needs to be continuously monitored to check the temperature and humidity.

2. WORKING PRINCIPLE

The suggested system's primary goal is to offer an Internet of Things-based warehouse monitoring system. A system that runs in the cloud is suggested to improve the characteristics. Additionally, the system keeps track of any deviations from the sensor limits. There are three components to the system:

Sensor Subsystem

Three sensors make up the sensor network: the DHT 11 sensor, the LDR sensor, and the MQ 3 sensor. Temperature and humidity are both measured by the DHT 11. It has a thermistor and a humidity detecting component. It will keep an eye on the food's storage area's humidity and temperature all the time. For the same, a threshold has been set.

ISBN: 978-81-965236-7-1

The two electrodes of the humidity sensor component are separated by a substrate that retains moisture. As the humidity varies, so does the resistance between the electrodes. Similar to this, the thermistor—a variable resistor whose value essentially changes with temperature—is used to measure temperature. The nitrogenous gases released by rotting food are picked up by the MQ 3 sensor. The existing sensitive material's conductivity.

The resistivity of an LDR sensor is dependent on the amount of light that is incident upon it. These sensors' resistance reduces with light and reaches its maximum in the absence of light. The sensor features an integrated ADC that provides the output voltage in digital form, along with a potential divider circuit.

Processing Unit

The primary processor is a Raspberry Pi 3. The system architecture's block diagram is displayed in Fig. 1. A tiny computer is called a Raspberry Pi. It contains a built-in Wi-Fi module in addition to CPU, GPU, RAM, and video outputs.Raspberry is preinstalled on the NOOBS (New Out of the Box Software). Included are Python, Scratch, and more.

Python is a high-level, object-oriented programming language. This research project's whole algorithm was created in Python. Real-time data on the warehouse's environmental conditions is sent to the WebApp. Hypertext Mark-up Language is used to construct web applications (HTML).

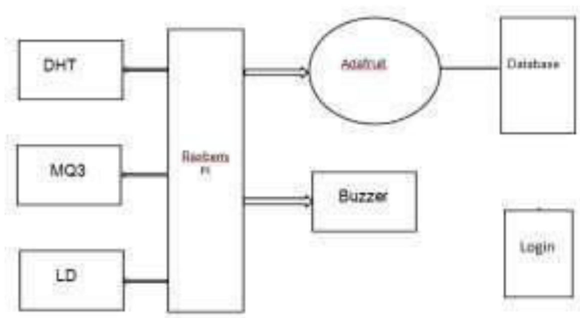


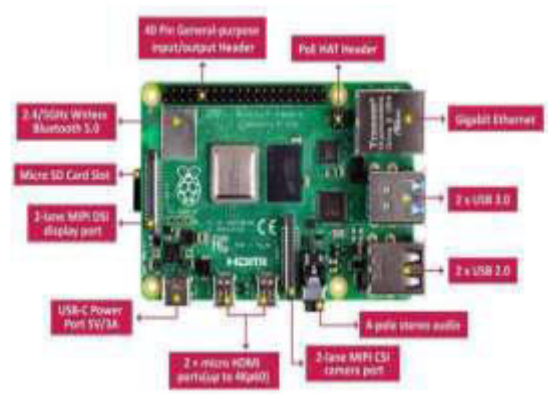
Figure. 1 Block diagram of system architecture

Web service

A Web service is an electronic connection between two devices over a network. To access the dashboard, the user is given a web URL. The service is accessible via a laptop and PC as well as a mobile device. Adafruit provides a cloud-based IoT analytics platform solution for realtime data stream visualization and analysis [12, 13]. For more sophisticated investigation, the Adafruit als o supports MATLAB coding. Adafruit is utilized in this project for data analysis and visualization.

3. SYSTEM REQUIREMENTS

Fig.2: Raspberry Pi Board



Rassperry Pi : The Raspberry Pi is a very cheap computer that runs Linux, but it also provides a set of GPIO (general purpose input/output) pins, allowing to control electronic components for physical computing and explore the Internet of Things (IoT).

Fig-3:DHT11Sensor

DHT11 Sensor: This sensor mainly consists of two parts capacitive humidity sensor and thermistor. It converts the analog data to digital signal which indicates the humidity and temperature.

Fig-4:LDR Sensor

LDR Sensor: It is a light intensity sensing sensor. The resistance of the sensing material changes based on the light intensity. The change of resistance causes change in voltage, which is used to determine the light intensity.

MQ3 Sensor: It is used to sense the presence of alcohol using SnO_2 as the sensitive material. The concentration of alcohol gas in the environment increases the conductivity of the sensing material,

Fig-5:MQ3 Sensor

ISBN: 978-81-965236-7-1

using which the alcohol presence in the environment can be determined. 4.

RESULTS AND DISCUSSION

Critical environmental elements including temperature, humidity, light, and moisture are monitored by the wireless sensor unit. The Raspberry Pi receives temperature and humidity readings from the DHT-11 sensor at the warehouse. The digital value obtained from the analog value conversion process is compared to the threshold value. The buzzer will activate and alert warehouse management if the parameter is over or below the threshold value. Adafruit Cloud is used to depict environmental parameters that are continually observed. It gathers data and creates a graph based on that data. Taking daily, weekly, and monthly reports for data analysis is made easier by this.

The ideal temperature range needed for the crops is displayed in Table 1.

TABLE -1: Favourable temperatures for Vegitables

	Optimal	Maximum Centigrade	Minimum Centigrade	Season (days)
Tomatoes	12 -18	21- 24	10	50-85
Cucumbers	16-24	32	10	50-70
Radish	10-20	25	5	20-30
Onion	13-24	30	4-10	130-160

An IoT device must be put in a warehouse, grocery shop, etc. It begins reading data from the interfaced sensors as soon as it is linked to the internet. Every two seconds, the DHT11 sensor obtains a real-time readout of the temperature and humidity. The supply voltage that the sensor needs to function is between 3.5 and 5.5V.Likewise, the LDR and MQ3 sensor values are captured and sent to the Rasberry Pi for additional processing.

The Raspberry Pi serves as the system's primary hub, managing every operation. Its job is to operate in response to inputs received from the sensor's outputs. On the Cloud server, data is uploaded for monitoring and presentation. The Rasberry Pi converts the analog output to a digital value. The web service is in charge of the display portion. Python is a programming language that is available as open source. For Internet of Things connections, the Raspberry Pi's inbuilt wifi module is utilized. Every sensor's threshold value is stored in an internal SD slot.

The controller utilizes a buzzer to sound a warning in the event that there is any fluctuation in range. You may connect using HDMI to monitor this as well.

5. CONCLUSION

In this study, we have successfully interfaced the Raspberry Pi with many sensors, including the MQ3, LDR, and DHT 11 sensors, to monitor and manage the ambient conditions in warehouses in order to prevent food commodities, namely wheat, rice, and maize, from rotting. Additionally, the device has a buzzer that functions as an alarm and will sound as soon as the sensor's threshold value exceeds a predetermined threshold. To the Adafruit server is transferred data.

Adafruit provides users with updates on food grains. To provide secure database access, a login page is put in place. By uploading the data to the Adafruit cloud computing server via Internet of Things (IoT), the system not only helps to monitor the different characteristics of the warehouse.

REFERENCES:

1. D. K. Singh, R. Desai, N. Walde, P. B. Karandikar, "Nano warehouse: A New Concept for Grain Storage in India," 2014 International Conference on Green Computing Communication and Electrical Engineering, 2014, pp. 1-6.

2. H. L. Yin, Y. M. Wang, "An Effective Approach for the Design of Safety Fresh Food Supply Chain Networks with Quality Competition", IEEE International Conference on Information and Automation, 2017, pp.921-924.

3. F. Kamoun, O. Alfandi and S. Miniaoui, "An RFID Solution for the Monitoring of Storage Time and Localization of Perishable Food in a Distribution Center", Global Summit on Computer& Information Technology, 2015, pp. 1-6.

4. Rajesh Kumar Kaushal, Harini. T, Pavithra Lency.D, Sandhya.T, Soniya.P, "IoT Based Smart Food Monitoring System", International Journal Of Current Engineering And Scientific Research, Vol 6, Issue 6, 2019, pp. 73-76.

5. K.Mohanraj, S.Vijayalakshmi, N.Balaji, R.Chithrakkannan, R.Karthikeyan, "Smart Warehouse Monitoring Using IoT", International Journal of Engineering and Advanced Technology, Vol 8, Issue 6, 2019, pp. 3597-3600.

ISBN: 978-81-965236-7-1

6. Alexandru Popa , Mihaela Hnatiuc , Mirel Paun , Oana Geman , D. Jude Hemanth ,Daniel Dorcea , Le Hoang Son,Simona Ghita, “An Intelligent IoT-Based Food Quality Monitoring Approach Using Low-Cost Sensors”, Symmetry, MDPI, 2019, pp. 1-18.

7. Sipiwe Chihana, Jackson Phiri, Douglas Kunda, “An IoT based Warehouse Intrusion Detection (E-Perimeter) and Grain Tracking Model for Food Reserve Agency”, International Journal of Advanced Computer Science and Applications, Vol. 9, No. 9, 2018, pp. 213-223

8. Soumya T K et. al , “Implementation of IoT based Smart Warehouse Monitoring System”, International Journal of Engineering Research & Technology, Vol 6, Issue 5, 2018, pp. 1-4.

9. Saleem Ulla Shariff , M. G. Gurubasavanna, C. R. Byrareddy, “IoT-Based Smart Food Storage Monitoring and Safety System”, International Conference on Computer Networks and Communication Technologies, 2018,pp. 623-638.

10. S. Parvin, A. Gawanmeh and S. Venkatraman, "Optimised Sensor Based Smart System for Efficient Monitoring of Grain Storage”, 2018 IEEE International Conference on Communications Workshops, 2018, pp. 1-6.

11. Li Lijuan and Minchai Hao, "The mathematical model of food storage safety monitoring and control system”,International Conference on Computer Application and System Modeling, 2010, pp. 591-594.

12. S. R. Prathibha, A. Hongal and M. P. Jyothi, "IOT Based Monitoring System in Smart Agriculture," International Conference on Recent Advances in Electronics and Communication Technology, 2017.

13. Kayode E. Adetunji, Meera K. Joseph, "Development of a Cloud-Based Monitoring System Using 4Duino: Applications in Agriculture", International Conference on Advances in Big Data Computing and Data Communication Systems, 2018, pp. 4849-4854.

14. Rohan Wagle,Mayur Shah,Aditya Kadam & Ramgopal Sahu, “A Survey on Monitoring and Control System for Food Storage using IoT”, International Journal of Innovative Research in Computer and Communication Engineering, May2017,Vol.5,Issue5.

15. ProfessorRajeshKumarKaushal,Harini.T,PavithraLency.D, Sandhya.T & Soniya.P, “IOT based Smart Food Monitoring System”, Technical research organization India,14Jun2019,Vol.6Issue6.

16. B. Ravi Chander, P.A. Lovina & G. Shiva Kumari, “Food Quality Monitoring System by using Arduino”, Journal of engineering sciences, Apr 2020,Vol.11 Issue4.

ISBN: 978-81-965236-7-1

IMPLEMENTATION OF INDUSTRIAL WIRELESS SENSOR NETWORK

[1]Mrs.P.Alagumathi, [2]Mrs.R.Saratha
[1,2]Assistant Professor, Department of Science and Humanities
Sri Bharathi Engineering College for Women, Kaikurichi, Pudukkottai – 622 303

***Abstract*- Primary objective of this paper is "Industrial parameter monitoring" through serial communication and to develop an embedded system which will monitor all the devices through Zigbee enabled wireless technologies. Since the monitoring application have been developed in medicine, agriculture, military, building, motion tracking and many other fields which involves the measurement of voltage, current, temperature, etc., These can be done by using sensor which are configured to measure internal temperature, remote temperature, remote current, remote voltage.**

Keywords: Zigbee, Automation, Sensors, Wireless Sensor Networks, Monitoring & Control

I. INTRODUCTION

Industrial Automation Networks involves Programmable Logic Controller (PLC) or Distributed control system (DCS) that communicate with the sensors to collect the data related to the process. To provide the control PLC or DCS act on the physical variables measured by issuing the commands or signals that activate relays, solenoid, motors and actuators. Developments in Wireless Sensor Network domain plays an important role in the implementation of an Industrial monitoring and Controlling Network, which contains number of sensor nodes that measures the value of physical parameters such as Temperature, Pressure, Flow, level, Density etc., and transmit them to the centralized control room through intermediate nodes or remote control panels present in field.

Generally this can be achieved through wired networks by involving standard 4-20mA Electrical System. Wired Industrial monitoring and Controlling Network increase the implementation cost because the cost of cabling and structural support arrangement may be sometimes higher than the cost of Transmitter itself and also leads to increase the maintenance cost.

Wireless Sensor Technology has been effectively is an open standard. This paper proposes an Intelligent Industrial Automation system based on Wireless Sensor Network which may be implemented in Home Automation, Environmental monitoring, Health monitoring and so on. Bluetooth, X-10, Wi-Fi and Zigbee are the suitable wireless technologies to be employed in above mentioned areas. The wireless technology like Wi-Fi and X-10 are not suitable for Industrial automation applications because Wi-Fi is most suitable for high data rate application and X-10 is most suitable for very low data rate applications only.Hence Bluetooth and Zigbee may be the suitable wireless technologies for low data rate application like monitoring and control.Zigbee is capable of establishing two way communications between multiple devices over a simple networks using low power and with low cost. It uses license free 2.4 GHz band and IEEE defined 802.15.4 standard.

ISBN: 978-81-965236-7-1

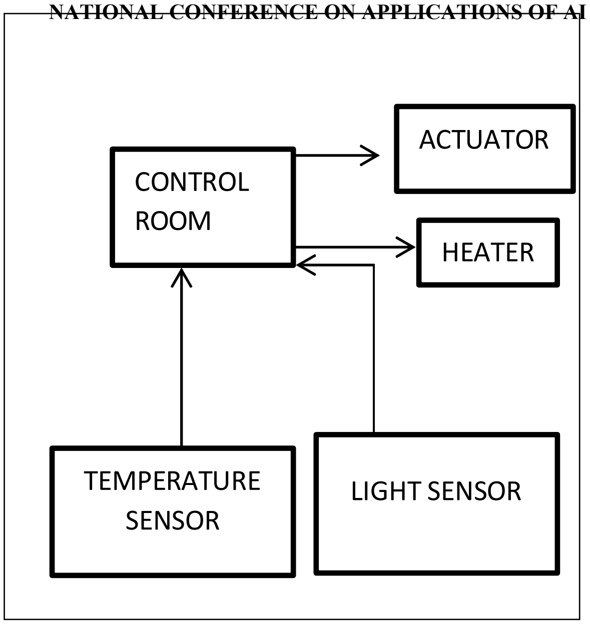


Fig 1. Traditional Industrial Monitoring System

II. TRADITIONAL METHOD

In wired Industrial Automation Network (Fig 1) closed and open loop control is achieved by passing the values of physical variables measured in the process to the base station through signal cables. The control action performed by the controller present in the control Room.

As a result the controllers will send signal to the final control element, which in turn cause the changes in the process to maintain the physical parameters at desired value to perform closed loop control. In the above method in case of melting of cable it may either leads to shut down or reinstallation it may further leads to production loss as well as large reconfiguration cost.

III. PROPOSED METHOD

Wireless sensor networks (WSNs) provide one potential solution to tackle the above listed challenges. Compared with a wired system,WSNs have many inherent advantages, such as relatively low cost, convenience of installation, and ease of relocation. These merits make a low-cost condition monitoring system for noncritical equipment possible.

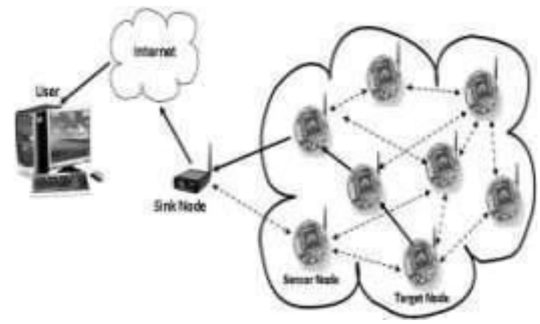


Fig2. Proposed Monitoring Method

However, industrial processes and devices have unique characteristics that make further demands on industrial WSNs (IWSNs), such as processing heterogeneous sensor signals, higher sampling rates, faster data transmission rates, and higher reliability.In our proposed method radio module is either electrically powered or battery powered data transmission or reception must occur through wireless.

a. Sensor Network Architecture

Wireless sensor network (Figure 2)is thenetwork of tiny low power devices capable of performing Sensing,Processing,

ISBN: 978-81-965236-7-1

and Communication within the single chip. Wireless sensor network [6] classified into two types. First one consists of hundreds or thousands of node operate in large geographical areas. This network used in communication, military, and environmental monitoring. Second one consists of ten of sensors which used in remote measurement applications.

1. Sensor node consists of following components Sensing sub system (Sensor which consists of Signal conditioning & A/D convertor)
2. Processing subsystem (Microcontroller with Small amount of data storage)
3. Communication subsystem (Radio module)
4. Power supply

b. Monitoring & Data logging

In particular, the following two functionalities are of great significance [1].

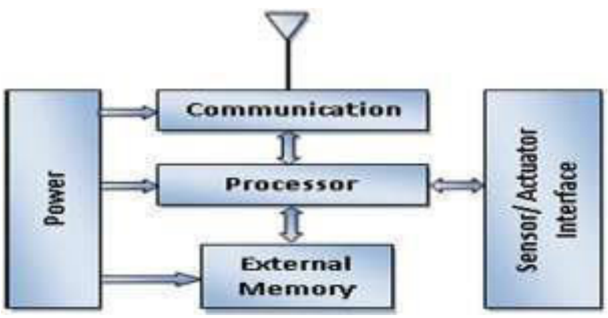


Fig 3. Typical Sensor Node

1. Graphic interface. The graphic interface allows representing the whole system display the status of all or part of the field. This allows the human operator to evaluate how the system is working and to recover quickly from critical conditions.
2. Historian module. The historian module Allows to record all significant parameters and to display them as suitable graphs. This can be useful to discover the reasons of some problems which occurred in the field.

Several IWSNs for industrial device monitoring have been developed. Most of these applications only use WSNs for data acquisition and transmission and complete the feature extraction and fault diagnosis functions on a central computer. On-sensor feature extraction and fault diagnosis is a promising alternative approach to raw data transmission, which can reduce the quantity of transmitted data, save node energy, and prolong node lifetime.

c. Communication Technologies Commercially available wireless protocols (Table 1) for WSNs, including IEEE802.15.4,IEEE802.11(Wi-Fi), and IEEE802.15.1 Bluetooth). IEEE 802.15.4 was demonstrated IWSNs. Three protocols based on the IEEE802.15.4 physical layer, ZigBee, Wireless HART, and ISA 100.11a, will be explored.

ISBN: 978-81-965236-7-1

	Zigbee	Bluetooth	Wibree	Wi-Fi
Frequency band (GHZ)	2.4	2.4	2.4	2.4
Range (ft.)	-11.6	30–300	Up to 10	100–150
Data rate (Mbps)	250 kbps	1	1	11-54
Power	Low	Medium	Low	High
Cost	Low	Low	Low	High
Modulation/protocol	DSSS, CSMA /CA	FHSS	FHSS	DSSS

Table 1. Comparison of Communication Technologies

d. ZigBEE

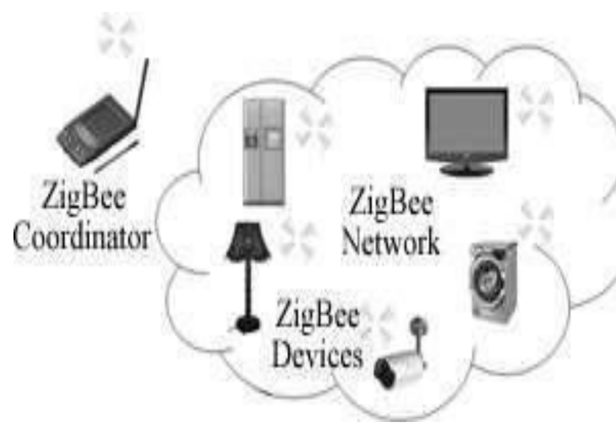


Fig 4:ZigbeeNetwork

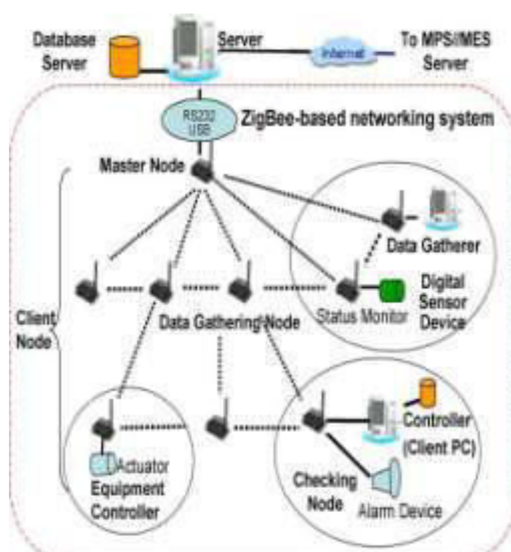
Nowadays, Zigbee [4] a de facto standard for WSNs has become one of the most promising protocols for wireless home networking and automation due to its low power consumption, low cost, and support for various ad hoc network configurations. ZigBee is a radio frequency (RF) communications standard based on IEEE 802.15.4.

The Zigbee coordinator is responsible for creating and maintaining the network. Each electronic device (i.e. Washing Machine,Television, Lamp etc.) in the system is a Zigbee device managed by the coordinator. All communication between devices propagates through the coordinator to the destination device.

The ZigBee standard theoretically provides 250kbps data rate, and as 40kbps can meet the requirements of most control systems, it is sufficient for controlling most industrial automation whereas Wi-Fi provides 54 Mbps. Soit only suitable for high data rate applications.

e. ZIGBEE BASED MONITORING SYSTEM

The Zigbee network [5]Fig.5depicts the monitoring networks by a ZigBee network system. The networks include a master node connected with a server PC and a series of client nodes, which are classified into master, sensor, gatherer, actuator and, controller. The main functions of each element are described as follows.



ISBN: 978-81-965236-7-1

Fig 5.Zigbee Based Monitoring System Server: Issues commands to the networks and collects responding information from the sensor network. Database: Logs the system configuration data and monitoring data. Master Node:Collects original monitoring data and reports to management software; connects with the Server via a USB or a RS232 port. Gathering Node (Reader): Composes the backbone of data collecting and status monitoring network. Equipment Controller: Controls the actuator action to start or close the connected equipment/machine. Checking Node (controller):Acts as a checker a client PC can connect with a checking node used to display the real-time message of the system and issue control commands to the network when a specified event occurs. Alarm device:Functions as an emergency reporter used to notify the production controller.

IV. IMPLEMENTATION:

Fig 6 shows the typical transmitter diagram. It consists of Sensor, Communication module, Processor& Power supply. Sensor usually deployed in the field, from where the sensed phenomenon is transferred via transmitter to the control station which has receiver from that received information controller will initiate corrective action to establish control.The above implementation setup capable to cover up to 30 meters in order to address the large area relay concept may be applied

Fig 6.Typical Transmitter

Fig7. shows typical receiver diagram. It also has the same components as above.

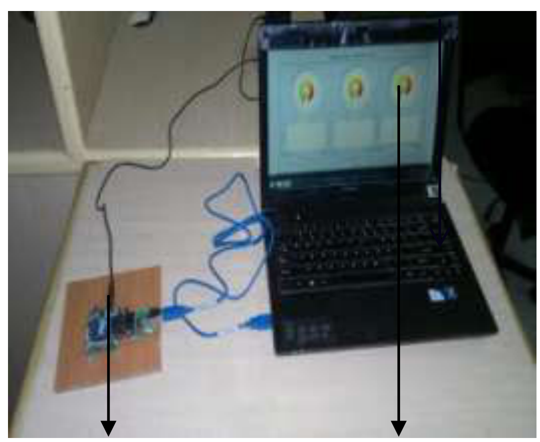


Fig 7. Typical Receiver

Fig 6 & 7 Shows the experimental setup for the data transmission and reception.

ISBN: 978-81-965236-7-1

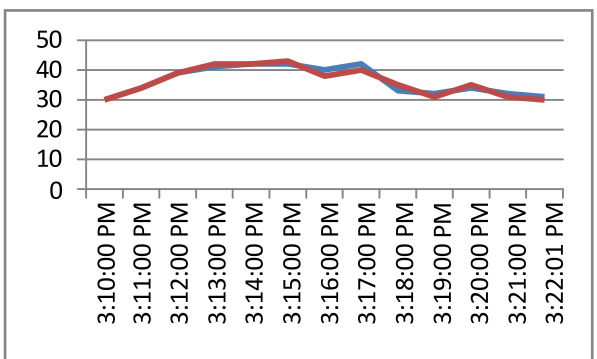
V. Results & Conclusion

The experiment conducted for 15 minutes by keeping TX and RX at the distance of 30mand observe the results. The table 5.1& 5.2 given below summarizes the TX and RX values at time distant.

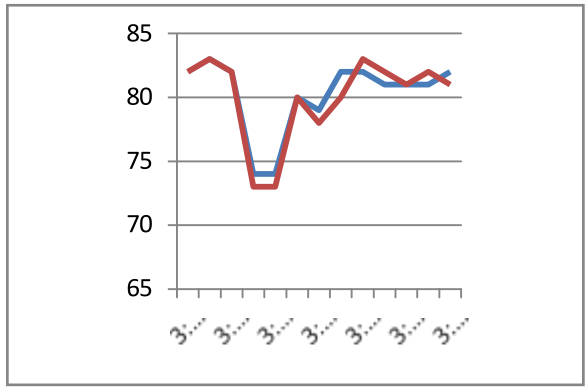
TIME	TX TEMP	RX TEMP	TX LIGHT	RX LIGHT
3.10	30	30	82	82
3.11	34	34	83	83
3.12	39	39	82	82
3.13	41	42	74	73
3.14	42	42	74	74
3.15	42	43	72	71
3.16	42	40	79	78
3.17	43	41	82	83
3.18	32	32	44	40
3.19	44	42	70	70
3.20	32	31	81	81

Table 5.1.Tx& RX from temperature sensor& Light Sensor

The following graphs(a,b) depicts the relationships between TX & RX value.



a) Graph of Temperature Sensor



b) Graph of Light Sensor

—— TX Value,______RX Value

VI. REFERENCES

1. "A Hybrid Wired/Wireless Networking Infrastructure for Greenhouse Management"Orazio Mirabella, Senior Member, IEEE, and Michele Brischetto, IEEE TRANSACTIONS ON INSTRUMENTATION AND MEASUREMENT, VOL. 60, NO. 2, FEBRUARY 2011.

2. "Novel Industrial Wireless Sensor Networks for Machine Condition Monitoring and Fault Diagnosis"LiqunHou and Neil W. Bergmann,IEEE TRANSACTIONS ON INSTRUMENTATION AND MEASUREMENT.

3. "Wireless HART: Applying Wireless Technology In Real-Time Industrial Process Control" Jianping Song, Song Han, Aloysius K. Mok, IEEE Real-Time and Embedded Technology and Applications Symposium.

ISBN: 978-81-965236-7-1

4. "A ZigBee-Based Home Automation System"Khusvinder Gill, Shuang-Hua Yang, Fang Yao, and Xin Lu,IEEE Transactions on Consumer Electronics, Vol. 55, No. 2, MAY 2009.

5. "A plug-and-play data gathering system using ZigBee-basedsensor network sensor network" Kun-Yung Lu,Department of Electronics Engineering, National United University,Lienda, Kungching Li, Miaoli 36003, Taiwan, ROC.

6. "A review of wireless sensors and networks' applications in agriculture" Aqeel-ur-Rehman , Abu ZafarAbbasi , Noman Islam, Zubair Ahmed Shaikh.

7. "Recent and Emerging Topics in Wireless Industrial Communications: A Selection" Andreas Willig, Member, IEEE, IEEE TRANSACTIONS ON INDUSTRIAL INFORMATICS, VOL. 4, NO. 2, MAY 2008.

8. "Wired and Wireless Reliable Real-Time Communication in Industrial Systems"Magnus Jonsson and Kristina Kunert Halmstad University Sweden.

ISBN: 978-81-965236-7-1

A SYNOPSIS OF MACHINE LEARNING BASED PATIENT MONITORING SYSTEMS ON THE INTERNET OF THINGS

[1]Mrs.K.PRIYANKA M.E.,
Assistant Professor, Department of CSE
Sri Bharathi Engineering College for Women, Kaikkurichi, Pudukkottai.
[2]S.SIVAHARINI
Student, Department of CSE
Sri Bharathi Engineering College for Women, Kaikkurichi, Pudukkottai.
Priyankakings92@gmail.com, harinivasan21@gmail.com

Abstract - **Patient monitoring systems are among the many applications that make extensive use of the Internet of Things (IoT). Healthcare systems are designed to keep an eye on patients in order to identify potential risks, respond swiftly to urgent situations, and facilitate long-distance contact for remote treatment. Long-term effects of the Internet of Things include physiological data, critical care, patient monitoring, and patient management. In order to gather data, sensors are attached to the patient. System controls receive the data first, then healthcare providers receive it on their own. Numerous biosensors use wireless networks to transmit medical data to websites or mobile applications. As a result, the Internet of Things allows healthcare providers to monitor patients and manage therapy outside of hospital boundaries.**

Keywords - IOT, Machine Learning, HealthCare, WBAN

I. INTRODUCTION

The Internet of Medical Things (IoMT) or Healthcare Internet of Things (H-IoT) represents a paradigm shift in the evolution of medical industry information systems. These systems are essential for determining a patient's current state of health and improving their quality of life. These are intricate systems that encompass systems from different disciplines, including computer science, medicine, microelectronics, and other systems.

The IoMT applications are in their growth phase, which runs from 2017 to 2022. As more beneficiaries show interest in these applications, these developments will quicken and enhance the medical sector overall. It follows that the Internet of Things (IoT) will undoubtedly redefine medical devices, applications, and integrated networks of healthcare solutions, thereby transforming the healthcare sector. IoT regularly.

II. HEALTHCARE SYSTEMS

Healthcare systems are a complicated network since they include: doctors, nurses, employees, healthcare providers, insurance companies, laboratories, and pharmacies. The parties involved are all located in and ongoing observation; particularly for ICU patients. These patient monitoring systems employ sensors to gather physiological data, which they subsequently analyze and store on the cloud. The patient's online caregiver group, which consists of the patient's family and the nurse, receives this data for additional analysis. A large team of medical experts collaborate based on individual specialties to evaluate the analysis that IoMT has performed using its data collection. As a result, high risk patients (those in need of urgent surgery, cardiac patients, etc.) can identify medical emergencies more easily.

Nevertheless, regardless of where they are, they can all start transactions on the healthcare systems, and the outcomes of those transactions will be saved on the device for everyone to view on the integrated system. At the moment, these transactions are kept on various, unintuitive platforms that take a long time to process and are prone to mistakes. A global ledger contains all of the transaction data for IoT healthcare systems. This implies that test results, insurance coverage, benefits and eligibility, medications, allergies, and medical records are all kept in a safe database that is accessible and safe (much like blockchain technology). The same database may be used to manage and track the requirements for medication, supplies, and other consumables, making healthcare management easier.

IoT can be evaluated in a number of ways, but the three most crucial factors to take into account are context awareness, remote patient monitoring, and care quality. The automated medical data collecting in IoMT reduces the possibility of human error, which could be detrimental to the patient's health. It also improves patient health and raises the standard of diagnosis. The many elements of clinical care will be reviewed in the sections.

2.1 Clinical care

Hospitals need to have access to round the clock, continuous monitoring in order to respond quickly and save lives in an emergency; this is especially important for patients in the intensive care unit. These patient monitoring systems employ sensors to gather physiological data, which they subsequently analyze and store on the cloud. The patient's online caregiver group, which consists of the patient's family and the nurse, receives this data for additional analysis. A large team of medical experts collaborate based on individual specialties to assess the analysis that IoMT has performed using its data collection. As a result, high and ongoing observation; particularly for ICU patients. These patient monitoring systems use sensors to gather physiological data, which they then process, store in the cloud, and send to the patient's online caregiver group, which consists of the nurse and the patient's family, for additional analysis.

To assess the study that IoMT has performed with its acquired data, a large number of medical professionals collaborate depending on their individual areas of expertise.

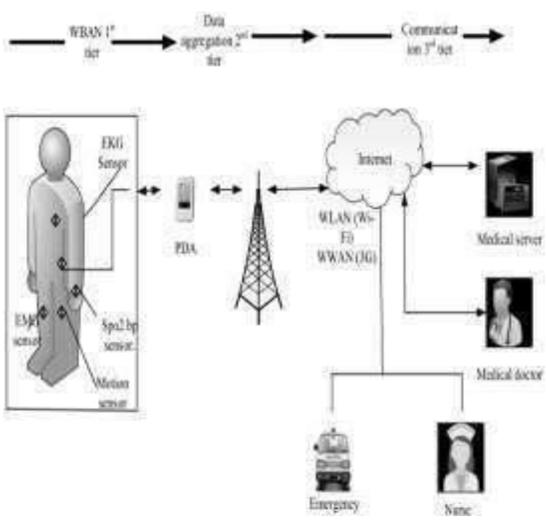


Figure 1. Real time remote monitoring systems

As a result, high risk patients (cardiac patients, patients in need of emergency surgery, etc.) have an easier time being identified as medical emergencies.

2.2 Remote patient monitoring

For numerous practical applications, remote patient monitoring, or RPM, is a crucial paradigm.

Consequently, the system furnishes details on the patient's health condition and gives prompt therapy, thereby mitigating subsequent difficulties and adverse effects. As a result, the technology enables real-time patient monitoring in the medical field. Additionally, it facilitates quicker diagnosis using input sensors, thus saving patient lives

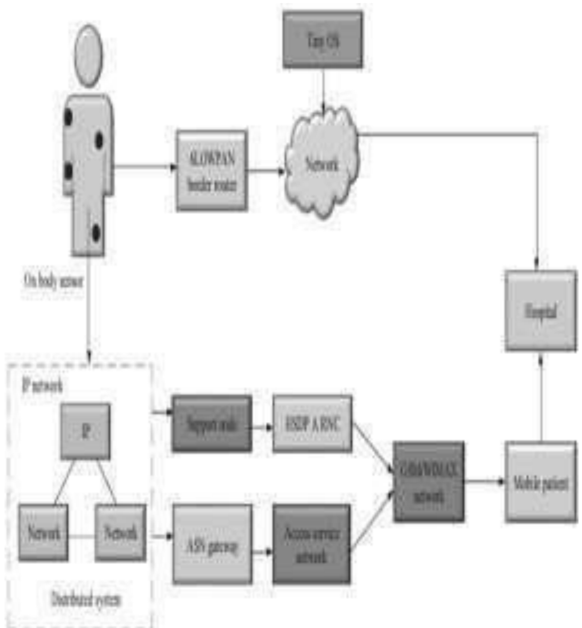
Context awareness

One important requirement for IoMT applications is context awareness. Because IoMT can track both the physical surroundings and the health status of individuals, it can assist healthcare workers in understanding abrupt changes that may impact their condition. Changes in the environment might raise risk factors and a person's susceptibility to illness, putting them at risk. The numerous specialized sensors collect valuable information that aids in comprehending the condition of the patient at the time of hospitalization, at home, or wherever the patient may be. These data include a variety of physiological status indicators, such as the patient's ability to walk, run, or sleep, as well as information about the patient's physical surroundings, including temperature, humidity, and other factors, and the relationship between the awareness.

2.3 Healthcare networks in IoT

To increase the effectiveness of the health care system, a variety of devices and systems must function in the framework of the Internet of Things. One of the key components of the Wireless Body Area Network (WBAN) is the Internet of Things (IoT) healthcare network. The WBAN facilitates general system communication and the effective transfer of data. Network topology, a platform, and an architecture make up IoMT.

ISBN: 978-81-965236-7-1



2.3.1 IoT network topology

Figure 2. IoT network topology in remote patient monitoring [3]

With the use of this technology, caregivers may keep an eye on patients from a distance and react based on the data that is sent. The healthcare data pipeline, which makes use of an interconnected network with WiMAX, Internet Protocol Network, and Access service networks, is shown in Figure 2.

IoT topology network showcases the gateway systems in figure 2. It also points out iMedpack. Additionally, various sensors, and wireless network topology interfaces create essential gateways for healthcare applications. IoMT makesdiagnostics and analysis possible via connecting the different wearable devices to the healthcare gateway. IoMT is also able to store the collected data, analyze, review, and lastly: present them. All IoT networktopologies are recognized and their infrastructures areconnected with the integrated healthcare systems. Themain IoT network topology components provide essential medical care, and they are generally used to help healthcare service providers. These faculties are used for medical emergency services. Therefore, network topology becomes important in medical systems. [3]

2.3.1 IoT network platforms

Two important IoT platforms are the IoT platform for healthcare service model and the cloud computing IoMT model. The healthcare service model mostly focuses on residents' health data as shown in figure 2. The figure also depicts the structure of the IoMT network platform which shows the user how to access the database layer for healthcare support from thevery first layer of the application. This can ensure thatthe interoperability of the platform and its automated design, which are engineered for rehabilitation are employed suitably for their intended goals. The business layer, data persistent layer, support layer, and accessing layer make up the framework itself. To manage many users connected to sensors, you must have an activation method to access the IoT gateway.

This model makes the management of multiple users possible via the use of multiple sensors during the data collection process. The IoT database uses Multi- Tenant databases; and the source layer is mostly responsible for sharing the healthcare system's data and interpolation using the resource control mechanism. This systematic framework makes theuser interface and the IoT's capacities possible in the health sector.

2.3.2 IoT network architecture

IoMT architecture consists of the device's operational layers, physical parts, and stated operating principle. The compatibility of the Internet of Things gateway with the wireless local area network (WLAN), secure communication between the IoT gateway and caregivers, and multimedia streaming are some essential components that have been discovered for this kind of network design. The Internet of Things (IoT) network health system uses specific protocols to communicate wearable device and sensor data across a secure communication channel. The user Datagram Protocol (UDP) is used by the data transmission architecture to reply to the sensor nodes. This offers a safe, integrated communication method for the patient and the medical staff. [3]

2.3.3. IoT network architecture based on Wireless Body Area Network

Wireless Body Area Network (WBAN) is composed of three different layers. Figure 3 shows on-body sensors, and different sensor nodes. These sensors are known as on-body or wearable sensors which are embedded on the patient's skin, and can work via wireless networks. The sensors receive signals from the body, and then transmit the patient's vital signs such as blood pressure, heart rate, blood sugar, body temperature, and humidity.

The tags or low-level management system provide information about and/or forecast the capabilities and operations of the nodes. Using the nearby personal web server (PWS), the data gathered from the on-body sensor is transmitted to the master communication controller or the central controller system. As a result, it can transmit emergency data recovery, synchronization of time, etc. Thus, the user's health state can be ascertained by the personal web server using the health information that is now available.

ISBN: 978-81-965236-7-1

Additionally, it offers input regarding the user interface and the sensors. Both the IP address and patient data are stored on a personal web server.

The second layer system uses restricted human bond communication (HBC) to allow the interfaces of the WBAN sensor nodes and personal web servers to communicate with other services via the information bank. PWS nodes are linked to mobile computers (PCs) and other computing devices. The primary purpose of this is to keep an eye on senior patients. A network coordinator maintains the stability of the link between the body area network and the personal web server. Initialization, sensor node customisation and registration, and an all- around safe and secure connection are all included in the network configuration.

Medical server:

The storing, processing, and analysis of medical data is the primary duty of the medical server. The storing, processing, and analysis of healthcare apps that deliver healthcare services are also included in this. An essential component of the medical server is patient authentication. Medical data is transmitted for testing by sensors that are based on IoT medical servers.If any deviation is observed in the patient's health, or any causes for concerns are raised; the medical unit will be immediately notified. Due to the aforementioned processes, patient authentication, secure connections, and the effective protection of the patient's personal data are of the utmost importance, and are thoroughly considered in all aspects of healthcare systems. For this reason, and to also provide overall security in general communication, the range of wireless communication is limited. [3]

3. The main challenges of Healthcare systems

Regardless of the user's geographical location, IoT- based healthcare solutions link clinics, hospitals, and patients to an integrated system to coordinate medical care or services**.**. However, there are manyother issues to carefully consider in research beforethese systems can become viable for mainstream use.

3.1. Interoperability, standardization, and regulations

Concerns regarding IoT standards exist. All parties involved in the Internet of Things manufacturers, consumers, and healthcare providers need operational consistency. IoT standardization can become a complicated problem since IoT producers want to enter as many different industries as they can, industries that are governed by various regulations. agencies, and regulatory boards, and all have a different set of standardization. This becomes even more complex with the strict guidelines that exist in the medical industry. For example, in the United States of America, the standardization of wireless medical devices requires a multi-agency regulatory collaboration including: the Food and Drug Administration (FDA), the Centers for Medicare and Medicaid Services (CMS), and the Federal Communications Commission (FCC). This means companies must carefully review and evaluate all the regulations, and policies set by these three agencies. IoT healthcare systems must also operate within a complicated structure of agencies to make IoTeHealth products available to the market. These complicated regulations and standardization processes are not limited to the US. Generally, eHealth faces the same issues and complications all across the globe.

3.2 Heterogeneity

IoT healthcare applications require a wide range of contextual data which are obtained through various heterogeneous sources. Heterogeneity is generally defined in two ways:

Data heterogeneity : Multimodal Data heterogeneity can be brought about by sensors with varying functions, formats, and structural characteristics. Since these gathered datasets lack explicit explanations, using or sharing them may be difficult or confusing.

Sensor heterogeneity : Interoperability issues might arise when many sensors are integrated, each of which operates at a different frequency and requires a different network protocol. Furthermore, these problems may get worse when medical equipment and sensors are combined. Interferences in the network's range and frequency overlap can have a major negative impact on the system and obstruct access to crucial data.

3.3 Interface and user compatibility

It is crucial to take into account additional aspects when using an application, such as human compatibility, user acceptance, and the degree to which a given technology facilitates human connection. The user-friendliness and interface of front-end technology, sensors, tablets, smartphones, and other devices are critical to the electronic well- being of the Internet of Things. It is critical that end users of IoT eHealth can receive on-the-job training on how to operate sophisticated medical equipment and all of its accessories. The end users typically don't know much about wireless networks, sensor synchronization, or other technical topics.

Therefore, it is vital that the IoT eHealth devicesmade for remote access be designed as self-sufficiently and simply as possible. For example, one of the largest IoT eHealth end users are senior citizens so the interface must be user friendly, and require minimal professional assistance. Participatory design can help the human compatibility of the interface via encouraging

ISBN: 978-81-965236-7-1

the end users to engage with the design team, and communicating their user experience so the ease of use, likes, dislikes, andcomfort levels in interaction can be devised.

3.4 Scalability

The more compact For the Internet of Things (IoT) to process user requests and guarantee that all medical services are available to users via personal devices like smartphones, portable devices with data-collecting sensors and centralized servers are necessary. By extending this procedure throughout the entire hospital, it will be possible to guarantee that every patient will get access to healthcare, be kept informed of their progress, and gain from ongoing observation. Given that the city's antennas and sensors are capable of gathering data, the Internet of Things can be expanded to include the entire city. Algorithms, Application Programming Interface all data through smartphones, and mobileapplications, and furthermore; send feedback topatients about their healthstatus, enabling everyone tohave access to test results, and integrated medicalservices. IoMT allows users a more straightforward access to their medical records, and test results which cuts out patient waiting- times significantly, and is therefore more time- effective for users.

Upscaling a small IoT network to the entire city can potentially improve overall efficiency, support relationship building between organizations, and promote trust between medical professionals, and patients.

3.5 Power consumption

Another important factor to consider for IoT is power consumption. The limited battery life of the sensors can negatively affect the lifecycle of the devices. Charging, or changing the batteries in IoT devices are extremely complicated, and often have little effect, especially if a system uses multiple sensors. The battery life of an IoT device will depend on varying factors such as the transmission range, the communication channel usage, overall time of use, and the complexity level of signal and data processing.

3.6 Disadvantages

Some IoT e-Health applications require the patient to constantly wear the sensors or carry them around, which can become tedious and inconvenient to the user. Thus, more efforts must be made in order not to decrease the quality of life for the subject, or cause unnecessary inconveniences to their daily routines.

4. Other studies

Many scientists and researchers are working in the field, considering the importance of the healthcare systems and their application in IoMT. Therefore, the rest of this section will focus on reviewing some of these studies. Azadeh Zamanifar, and her colleagues have introduced a system for IoT applications called DSHMP-IoT, whose function is the tracking of IP- based sensors - in smartphones - and their direction of movement in a multi-user environment such as a healthcare system. [5] This was the first time that an AI solution was used for tracking the direction of mobile nodes in an IP-based phone network. This design uses a Hidden semi-Markov Model (HSMM) to predict and track direction with high accuracy and low overhead.

They also proposed a method to predict the ECG sensor data, and in addition, the patient’s health status which would not require a jointanalysis. [6] This method uses mobile sensors, and a HSMM to predict a patient's overall health status and has two prediction outputs.

They also introduced a design named DMP-IoT, which predicts the new distributed direction ofmobile sensor nodes in healthcare applications to reduce the operation costs of the mobile sensor nodes. They have customized the Hidden-Markov second-order to achieve this. DMP-IoT includes a detection mechanism that identifies incorrect predictions, and avoids disconnecting the sensor nodes from the network in cases of false movement prediction. This mechanism prevents misprediction and losing the network connection. Zamanifar also emphasizes the importance of IoMT in predicting patient health status in a chapter of her co-authored book titled:“Remote Patient Monitoring: Health Status Detection and Prediction in IoT-Based Health Care, in IoT in Healthcare and Ambient Assisted Living.” [8] They have used cloud computing and mobile edge computing to communicate between different Healthcare subsystems.

Mobile edge computing is a distributed computing paradigm that moves computing and data storage to optimized positions in order to improve response time, and save bandwidth. Healthcare systems based on mobile edge computing are more effective since their computing is done near the patient. Thus, the patient’s health status predictions are done in real-time, which is a vitalfunction to have in healthcare systems. The same chapter presents IoT- based healthcare devices and methods which are used to identify or predict a patient’s health status.

In their book“A new machine learning-based healthcare monitoring model for student’s condition diagnosis in Internet of Things environment,” Alireza Souri and his colleagues present an IoT- based student health care system that continuously monitors students via their vital signs to detect physiological and

ISBN: 978-81-965236-7-1

behavioral changes through IoMT devices. In this method, vital signs are collected through IoT devices and analyzed with Machine learning methods to detect possible risks or changes in the students' physiology, or behaviors. Khizra Saleem and her colleagues have invented a system to monitor and analyze sleep patterns using environmental parameters in their book titled:"IoT healthcare: design of smart and cost-effective sleep quality monitoring system." The proposed system is effective enough to monitor the patient's sleeppatterns using Commercial Off the Shelf (COS) sensors, and to furthermore; predict the results using the random forest model. The patient's physiological data including physical body movement, heart rate, SPO2 level (oxygen saturation level in the blood),and snoring patterns are monitored through this system, and the collected data can be sent tocomputer systems. This real-time system is made of two parts. One part consists of the behavioral data analysis collected through random forest and decision-rules in real-time. This system notifies the caregiver in cases of any changes to the sleeping participant's status. The second part enables batch data processing which establishes the condition of the patient at a given period of time through statistical methods. This cost-effective suggested method can easily analyze the sleep pattern of a patient and provide better treatments.

CONCLUSION

In a world that is changing quickly, most individuals, such as energy conservation, water supply management, traffic control, delivery management, agribusiness, home automation, and navy management. Thanks to the management. The integration of IoT with emergency services, smart homes, and smart hospitals is the Internet of Things, wearable sensor technology has grown to be a profitable industry in the healthcare industry. More detection gateways are needed when IoT penetrates the medical field in order to facilitate data ultimate goal of this new technology.

Real-time patient monitoring can be aided by the data that smart hospitals and smart equipment gather. This can be beneficial.if not all of them, now need remotely accessible, networked devices with data analysis capabilities. IoT has been developed in response to this need. IoT is a mechanism for internet-to-device connectivity. This is the process by which smart lights, watches, etc. "smart." The Internet of Things makes people more independent, an us learn more about diseases, medicines, and vaccines.

Healthcare systems are a huge part of the IoT applications. The large data collections in these systems need to be extracted so they can be analyzed for the information hidden in them. An important function of IoMT is its precise prediction of a patient's health status remotely, especially in intensive care.

Various health applications are increasingly including predictions of patient movement, and health status changes in their interfaces; and due to the IoMT's significant contribution to disease study, and gathering intelligence about the physical environment of the patient, pervasive systems, and assistive technologies, it has become an outstanding field of research.

An overview of healthcare systems in the Internet of Things was done in this article and the many challenges, and benefits of the field were examined. Also several methods in predicting patient health's conditions using machine learning were analyzed.

REFERENCE

[1] Perumal, K. and M. Manohar, A survey on internet of things: Case studies, applications, and future directions, in Internet of Things: Novel Advances and Envisioned Applications. 2017, Springer. P. 281-297.

[2] Farahani, B., F. Firouzi, and K. Chakrabarty, Heathcare IoT, in intelligent Internet of Things. 2020, Springer. P. 515-545.

[3] Dhanvijay, M. M. and S.C. Patil, Internet of Things: A survey of enabling technologies in healthcare and its applications. Computer Networks, 2019. **153:** P. 113-131.

[4] Chiuchisan, I., H.-N. Costin, and O. Geman. Adopting the Internet of Things technologies in health care systems. In 2014 international Conference and and Exposition on Electrical and Power Engineering (EPE). 2014. IEEE.

[5] Zamanifar, A., E. Nazemi, and M. Vahidi-Asl, DSHMP- IOT: A distributed self healing movement prediction scheme for internet of things applications. Applies Intelligence, 2017. **46(3):** P. 569-589.

[6] Zamanifar, A. and E. Nazemi, An approach for predicting health status in IoT health care. Journal of Network and Computer Applications, 2019. **134**: P. 100-113.

[7] Zamanifar, A., E. Nazemi, and M. Vahidi-Asl, DMP-IOT: A distributed movement prediction scheme for IOT health-care applications. Computers & Electrical Engineering, 2017. **58**: P.310-326.

[8] Zamanifar, A., Remote Patient Monitoring: Health Status Detection and Prediction in IoT-Based Health Care, in IoT in Healthcare, and ambient Assisted Living. 2021, Springer. P. 89-102.

ISBN: 978-81-965236-7-1

[9] Souri, A., et al., A new machine learning-based healthcare monitoring model for student's condition diagnosis in Internet of Things environment. Soft Computing, 2020. **24**: P.1711- 17121.

[10] Saleem, K., et al., IoT healthcare: design of smart and cost- effective sleep quality monitoring system. Journal of Sensors, 2020

[11] Moreno-Fernandez-de-Leceta, A., et al. Real prediction of elder people abnormal situations at home. In international Joint Conference SOCO'16-CISIS'16-ICEUTE'16. 2016.

[12] Ani, R., et al. IoT based patient monitoring and diagnostic prediction tool using ensemble classifier. In 2017 International conference on advances in computing, communications, and informatics. (ICACCI). 2017. IEEE.

[13] Sahoo, P. K., S. K. Mohapatra, and S. -L. Wu, analyzing healthcare big data with prediction for future health condition. IEEE Access, 2016. **4**:P 9786- 9799

ISBN: 978-81-965236-7-1

A NOVEL TOOL FOR COGNIZANCE MULTILIGUISTIC IMAGE ANALYSIS USING NLP

Mrs. R. MEENA
Assistant Professor, Department of Computer Science and Engineering
Sri Bharathi Engineering College for Women, Kaikkurichi, Pudukkottai.
r.meena.cse.90@gmail.com

Abstract - **Language Identification is the process of determining in which natural language the contents of the text is written. Language identification is a fascinating field to be studied due to increased demand of natural language processing applications. Language Identification can be done using two types of techniques: computational techniques and non-computational techniques. Computational techniques are based on statistical methods and require large set of training data for each of the language while non- computational techniques require that researcher must have extensive knowledge about the language to be identified. In this work, a novel method is proposed to identify the language of the text using SVM classifiers. Once the language is identified, classes based on the frequency of their co – occurrence with other words are considered for further processes. Content Based Image Retrieval is used to display the images that are tagged for the words. While tagging, the language of individual words is identified using language models and dictionaries. When a word is displayed, the proposed method searches for the alphabets available in the dataset dictionary. It is followed by separation of the word into alphabets. Then, the tagged images for the appropriate alphabets will be displayed from the dataset. The proposed method is done for four languages viz., English, Tamil, Hindi and Malayalam. A dataset context is incorporated to improve the performance of the proposed method. This method is implemented and the results show that the proposed method is more efficient than the existing methods.**

INTRODUCTION

Research in recent years has given a lot of interest to textual data processing and especially to multilingual textual data. This is for several reasons: a growing collection of networked and universally distributed data, the development of communication infrastructure and the Internet, the increase in the number of people connected to the global network and whose mother tongue is not English. This has created a need to organize and process huge volumes of data. The manual processing of these data (expert , or knowledge based systems) is very costly in time and personnel, they are inflexible and generalization to other areas are virtually impossible, so we try to develop automatic methods.

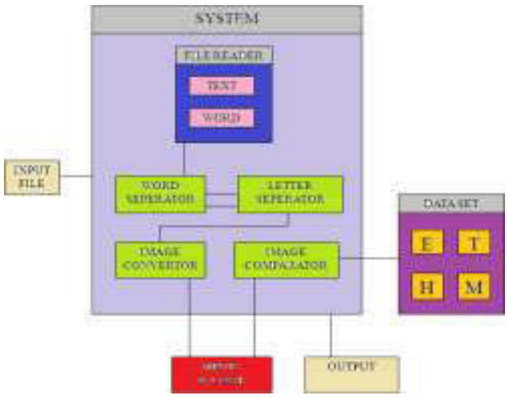


Figure 1.1.1 Overview of the process

ALGORITHMS AND TECHNIQUES

In order to perform computation, create four folders viz. English, Tamil, Hindi and Malayalam. Enrich all the folders with their respective alphabets' images. These folders are substitutes of training corpus. Another folder named Input folder is created to store input images

ISBN: 978-81-965236-7-1

1. Get the input file. The file can be a text or word document.

```
Firstclass1
{
String name;   // gets the input file
}
```

2. Access the file and read it word by word.

```
Wordsep1
{
Fileread() // reads text file word by word
}

Readwordfile
{
Filereadword() // reads a word file word by word
}
```

3. For each word i, do the following:

- Create a new folder $input_i$ inside the Inputfolder.
- Separate the letters of this word.
- Convert each letter into images and store them in $input_i$.
- Compare $input_i$'s images with the images of predefined folders (English, Tamil, Hindi and Malayalam).
- If all the images of $input_i$ matches a particular language, then that is the desired language.

```
Letterimg
{
Lettersep() //separates letters of each word
Texttoimg()//converts letter to an image and stores in inputi
}
Tclass1
{
Imgcomp()  // creates thread for image comparison
search()  // compares inputi images with predefined folders.
}
```

4. The User Interface for the system is accomplished using the following classes.

```
Frontend
{
//calls the SecondFrame class
}
SecondFrame
{
// gets input for the system and activates Firstclass1
}
Sample
{
  // lists the set of languages and its words in the document
}
```

2. LITERATURE REVIEW

2.1 Title: "A survey of Language Identification Techniques and Applications", A Journal of Emerging Technologies in Web Intelligence, Vol 6, no 4, pp 388, November 2014. Author: Archana Garg, Vishal Gupta and Manish Jindal

Language Identification is the process of determining in which natural language the contents of the text is written. Language identification is always been an important research area which has been carried out from early 1970's. Still it is a fascinating field to be studied due to increased demand of natural language processing applications. In many applications, it works as a primary step of some larger process. A number of applications are outlined where language identification is working successfully. Language Identification can be done using two types of techniques: computational techniques and non-computational techniques. Computational techniques are based on statistical methods and require large set of training data for each of the language while non-computational techniques require that researcher must have extensive knowledge about the language to-be-identified. In this paper, a brief review of the few papers is presented which outlines the various statistical and non-statistical techniques that have been applied by the different researchers for language identification. Besides it, different researchers performed language identification for different type of documents such as monolingual, multilingual, long and short and for a particular set of languages.

ISBN: 978-81-965236-7-1

2.2 Title: "Automatic Language Identification: An alternative unsupervised approach using a new Hybrid algorithm", International Journal of Computer and Applications, Techno-Mathematics Research Foundation, Vol. 7, No. 1, pp 94-107, 2010. Author: Abdelmalek Amine, Zakaria Elberrichi and Michel Simonet

It deals with research on unsupervised classification for automatic language identification purpose. The study of this new hybrid algorithm shows that the combination of the K means and the artificial ants and taking advantage of an n-gram text representation is promising. We propose an alternative approach to the standard use of both algorithms. A multilingual text corpus is used to assess this approach. Taking into account that this method does not require a priori information (number of classes, initial partition), it is able to quickly process large amount of data and that the results can also be visualized. We can say that, these results are very promising and offer many perspectives.

2.3 Title: "Automatic Language Identification using both N-gram and word information", International Conference on Statistical Analysis of Textual Data (JADT), Vol.2, pp 263-268, December 23, 1998. Author: Bruno M. Schulze

The predominant language of a Sample text is automatically identified using probability data that include N-gram probability data for at least one language and word probability data for at least one language. The N-gram probability data of a language indicate, for each N-gram, the probability that it occurs if the language is predominant. Similarly, the word probability data of a language indicate, for each word, the probability that it occurs if the language is predominant. The probability data are used to automatically obtain Sample probability data for at least two languages. The sample probability data include N-gram probability information for at least one language and word probability information for at least one language. The Sample probability data are used to automatically obtain language identifying data identifying the language whose Sample probability data indicate the highest probability. The N-grams can be trigrams, while the words can be short words of no more than five characters. Some languages can have both trigram and word probabilities, while some can have only trigram probabilities.

3. RELATED WORK

Multilingual posts can potentially affect the outcomes of content analysis on micro blog platforms. To this end, language identification can provide a monolingual set of content for analysis.

The unedited and idiomatic language of micro blogs is found to be challenging for state-of-the- art language identification methods. To account for this, we identify five micro blog characteristics that can help in language identification: the language profile of the blogger (blogger), the content of an attached hyperlink (link), the language profile of other users mentioned (mention) in the post, the language profile of a tag (tag), and the language of the original post (conversation), if the post we examine is a reply. Further, the methods combine these priors in a post-dependent and post-independent way. We present test results on 1,000 posts from five languages (Dutch, English, French, German, and Spanish), which show that our priors improve accuracy by 5 % over a domain specific baseline, and show that post-dependent combination of the priors achieves the best performance. When suitable training data does not exist, our methods still outperform a domain unspecific baseline. We conclude with an examination of the language distribution of a million tweets, along with temporal analysis, the usage of twitter features across languages, and a correlation study between classifications made and geo-location and language metadata fields.

Multilingual speakers switch between languages in online and spoken communication. Analyses of large scale multilingual data require automatic language identification at the word level. For experiments with multilingual online discussions, we first tag the language of individual words using language models and dictionaries. Secondly, incorporate context to improve the performance. Accuracy achieve of 98%. Besides word level accuracy, we use two new metrics to evaluate this task.

CBIR is one of the most widely used approaches for detecting images from an extensive image database. Now a day, numerous approaches have been developed to enhance the CBIR performance. The CBIR have a tendency to retrieve images depending on their visual content. CBIR evades several issues which are linked to the current ways of retrieving images by keywords. Most existing CBIR systems are based on color, text documents, informative charts, and shape of the pictures. A CBIR system takes the input query image and retrieves the similar images. The proposed approach here involves an efficient statistical feature extraction and further classification of the images by these features using Artificial Neural Network (ANN), Naïve Bayes Classifier and Fuzzy Neural-Network. The classifiers help to categorize the images according to the data set. The Precision and Error Rate have been calculated and compared according to the

ISBN: 978-81-965236-7-1

retrieved content of the images from the datasets and the results have been shown.

The exponential growth in image data over the internet has resulted in a growing need for searching images according to our requirements. Content based image retrieval systems extract similar images from databases or the internet for facilitation of their users. A number of different feature sets and classifiers have been used by researchers for content based image retrieval. The goal of this research is to evaluate some common features sets used for classification of images and identify the best features depending upon the user requirement. Some commonly used features have been studies and a set of six feature sets have been selected for evaluation by the Back - Propagation Neural Network (BPNN). The results have been evaluated on the basis of precision and recall and it can be concluded that for natural images none of the feature sets perform well universally on all classes and the selection of optimal feature set depends on the type/class of images.

4. EXISTING SYSTEMS

Landmark retrieval is to return a set of images with their landmarks similar to those of the query images. Existing studies on landmark retrieval focus on exploiting the geometries of landmarks for visual similarity matches. However, the visual content of social images is of large diversity in many landmarks, and also some images share common patterns over different landmarks. On the other side, it has been observed that social images usually contain multimodal contents, i.e., visual content and text tags, and each landmark has the unique characteristic of both visual content and text content. Therefore, the approaches based on similarity matching may not be effective in this environment. Investigate whether the geographical correlation among the visual content and the text content could be exploited for landmark retrieval. In particular, we propose an effective multimodal landmark classification paradigm to leverage the multimodal contents of social image for landmark retrieval, which integrates feature refinement and landmark classifier with multimodal contents by a joint model. The geo-tagged images are automatically labeled for classifier learning. Visual features are refined based on low rank matrix recovery, and multimodal classification combined with group sparse is learned from the automatically labeled images. Finally, candidate images are ranked by combining classification result and semantic consistence measuring between the visual content and text content. Experiments on real-world datasets demonstrate the superiority of the proposed approach as compared to existing methods.

4.1.1 DISADVANTAGES

- Ignores the geographical correlation between images.
- When the value of neighborhood keeps increasing, the performance will degrade gradually

4.2 PROPOSED SYSTEM

A novel method is proposed to identify the language of the text using SVM classifiers. Once the language is identified, classes based on the frequency of their co – occurrence with other words are considered for further processes. Content Based Image Retrieval is used to display the images that are tagged for the words. While tagging, the language of individual words is identified using language models and dictionaries. When a word is displayed, the proposed method searches for the alphabets available in the dataset dictionary. It is followed by separation of the word into alphabets. Then, the tagged images for the appropriate alphabets will be displayed from the dataset. The proposed method is done for four languages viz., English, Tamil, Hindi and Malayalam. A dataset context is incorporated to improve the performance of the proposed method. This method is implemented and the results show that the proposed method is more efficient than the existing methods.

4.2.1 ADVANTAGES

- Image Re-ranking is included in this technique which helps the user to obtain the image result that is in the highest priority and in the least priority.
- This tool also provides a descriptive note of the image that is produced as the output which describes its surrounding, texture etc...

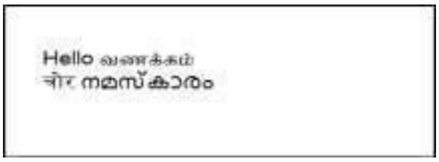
5. SYSTEM MODULES

- Input
- Word Separation
- Letter Separation
- Image Conversion
- Image Comparison

ISBN: 978-81-965236-7-1

5.1 INPUT

- The system is designed to get a multilingual document as an input in text or word format. For instance, “hello.txt” is given as input.



5.2 WORD SEPARATION

In this module, the words of the input document are separated. For instance, the separated words of the above document are as follows**:**

Hello வணக்கம் चीर നമസ്കാരം

5.3 LETTER SEPARATION

The letters of each word are separated individually in text format respectively. For instance, the word Hello is separated.

H E L L O

5.4 IMAGE CONVERSION

The letters of each word are separated and converted into individual images respectively. For instance, the word Hello is converted into images as follows:

5.5 IMAGE COMPARISON AND OUTPUT

- This a computation approaches, that the system should have a prior data for language identification.
- The data used here is the alphabets’ images of each language.
- The input images are compared pixel-by-pixel with the images in the data set.
- If all the images of the letters of a word matches the data set of a particular language, then that is the desired language.
- Repeat the above process for all the words in the document.

6. CONCLUSION & FUTURE WORK

The proposed model is used to identify the words of any of these four languages: Tamil, English, Hindi and Malayalam. The related images that are displayed give some idea of the letters of the unknown languages. In future, this method can extend for other Indian languages. The proposed method is planned to execute using a large dataset.

6.1 REFERENCES

[1] Abdelmalek Amine, Zakaria Elberrichi, “Automatic Language Identification: An alternative unsupervised approach using a new Hybrid algorithm”, International Journal of Computer and Applications, Techno-Mathematics Research Foundation, Vol. 7, No. 1, pp 94-107, 2010.

[2] Archana Garg, Vishal Gupta, Manish Jindal, “A survey of Language Identification Techniques and Applications”, A Journal of Emerging Technologies in Web Intelligence, Vol 6, no 4, pp 388, November 2014.

[3] Bruno M. Schulze, “Automatic Language Identification using both N-gram and word information”, International Conference on Statistical Analysis of Textual Data (JADT), Vol.2, pp 263-268, December 23, 1998.

[4] Carlos Ramisch, “N-gram models for Language identification”, December 21, 2008.

[5] Carter.S, Weerkamp.W, Tsagkias.M, “Microblog Language Identification: Overcoming the limitations of short, unedited and idiomatic text, Lang Resources and Evaluation”, 47, pp.195-215, 2013.

[6] Aditya Koli, Diksha Khurana, Kiran Khatter, Sukhdev Singh, “Natural language processing: state of the art, current trends and challenges”, Multimedia Tools and Applications (2023) 82:3713–3744.

ISBN: 978-81-965236-7-1

Operation research in the Field of IOT

[1]Mrs.R.Rajeswari,AP/Mathematics
Assistant Professor, Department of Science and Humanities,
Sri Bharathi Engineering College for Women, Pudukkottai-622 303, Tamilnadu, India.
Email: [1]rajirajipappa@gmail.com

Abstract: **These days Internet of Things (IoT) increased an extraordinary consideration structure specialist, since it turns into a significant innovation that guarantees a shrewd individual life, by permitting an interchanges between objects, machines and each thing together with people groups. IoT speaks to a framework which comprises a things in reality, and sensors joined to or consolidated to thesethings, associated with the Internet through wired and remote system structure.In this paper I have represented the various application of the operation research in the field of IoT**

Keywords: Operations Research,Internet of Things

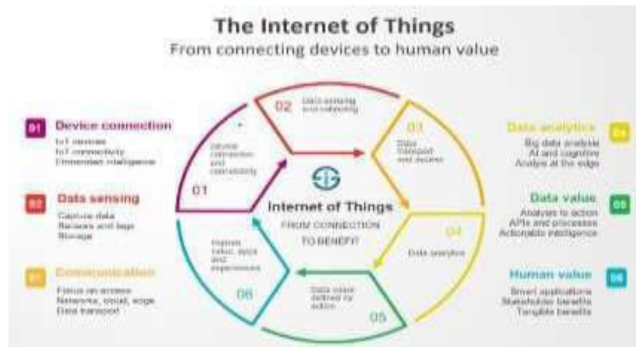
1. Introduction

Operations research (OR) is an analytical procedureto solve problem and decision-making which is used by the management of organizations. In operations research, problems are divided intodifferent components and then by using mathematical analysis ,solution of each component is found out .In similar way it works in the field of IoT.Without using the quantitative and qualitative techniques of Operation Research,IoT cannot be completed.Hence OR(operation research) plays a vital role in the field of IoT(internet of things)

2. What is iot

People today have made significant progress in front of the early-man ages when they needed to physically take part in the consummation of every one of their needs and necessities. Today life has gotten less complex, quicker just as more helpful than it at any point was. Have you at any point figured what it resembles to have allthe gadgets, individuals, protests just as living and non-living elements to be associated over a typical system?

The Internet of Things known as IoT, is a method for associating all the gadgets and articles around us into a common cloud network. Through the appearance of this innovation, we will have the option to impart just as send/get information over this system without the requirement for any human mediation. You will be stunned to realize that while this mechanical change is by all accounts to some degree unimaginable at the present time; the execution of IoT towards making a savvy world has just been set into movement. The development of Internet ofThingstechnology is expanding so quickly that a significant number of the IT technology speculators have begun putting resources into IoT stocks market.



3.APPLICATION OF OR (OPERATION RESEARCH) IN Iot(INTERNET OF THINGS)

In this section ,I am discussing the various tools and technologies of operation research which are necessaryto meet the required challenges of IoT

Game Theory :

Game theory is used to choose the best strategy out of the available strategies to maximize the winning.this approach is used in multi tasking like data distribution to optimize it. Now we are using LTE, 5G ,the optimization of these data distribution is investigated through game theory.

Math Programming :

In operation research we find optimal solution of linear, nonlinear, integer programming, dynamic programming. This programming is used as networking in IoT.By using this technology we can optimize (minimize/maximize)the use of networking.

Graph Theory:

Graph theory is a pictorial representation of vertices and edges in which vertices are connected with each other through the edge(edges).Which is similar as networking. In IoTwe use three types of networks known as topological networks, data-functional networks, and domio-functional networks.Graph theory is used to combine this networks .it is also used in cell phone networking, computer networking, sensor networking.

ISBN: 978-81-965236-7-1

CPM(Critical Path Method) :

Critical path is used to visualize the project in the graphical form. It defines the tasks which are most important.it also reduce the time of the project and identify the critical activities in which more attention is required. In the similar way it is used in the networking of IoT. It helps the signal to follow those paths in which less time is consumed. Networking of IoT is tottaly followed the management as CPM.

Agent based Modelling :

In IoT lots of messages ,emails,signals move at the same time ,which creates traffic. To Reduce the traffic load agent based modeling is used which works as smart objent interaction.

4.Conclusion

The Iot has become an interesting cocept with sensory hardware, smart phones, communication protocols along with social and cyber networks .It also include lots of complexities whose range is from mechanisim, information management, communication, presentation and interaction with in the IoT. No doubt there are lots of existing model which are capable to design and solve problems related to IoT.

But as the use of it increasing day by day lot of research work is required., This paper presents a synthetic reaction- inspired computational model utilizing the ideas of graphs and game, which endeavors to address the complexities related with the perception, demonstrating, communication, investigation and deliberation of data in the IoT.

5.References

1.Borgia, E.,2016. Special Issue on Ïnternet of Things: Research Challenges and Solutions (editorial). 89, p1–4.

2.Brandenburger, A.M.; Nalebuff, B.J., 1995. “The right game: Use game theory to shape strategy”. Harvard Bus., 73, p57–71.

3.Gubbi, J.; Buyya, R.; Marusic, S.; Palaniswami, M., 2013. “Internet of Things (IoT): A vision, architectural elements,and future directions”. Future Gener.Comput. Syst. 29, p1645–1660.

4.Lessman, K.; Riecken, M.; O’Connor, M.J., 2016. “Modeling & Simulation of the Internet of Things and Cyber Physical Systems for Cybersecurity”. In Proceedings of the Simulation InnovationWorkshop, Orlando, FL, USA.

5.Manoj Dubey,2019 ‘ ‘Internet of Things: Mathematical Relevance’’ International Conference on Recent Advances in Interdisciplinary Trends in Engineering & Application

6.Ribeiro, R.A.; Falcao, A.; Mora, A.; Fonseca, J.M.,2014. “A fuzzy information fusion algorithm based on multi-criteria decision making”. Knowl.-Based Syst., 58, p23–32.

7.Rose, K.; Eldridge, S.; Chapin, L., 2015. “The internet of things: An overview”. In Understanding the Issues and Challenges of a More Connected World; The Internet Society (ISOC):Washington, DC, USA, pp. 1–50.

ISBN: 978-81-965236-7-1

RENEWABLE ENERGY SOURCES

Mrs.S.RENUGADEVI, M.Sc., M.Phil., B.Ed.,
ASSISTANT PROFESSOR, SRI BHARATHI ENGINEERING COLLEGE FOR WOMEN
KAIKKURICHI, PUDUKKOTTAI -622303.

***Abstract* - Water is a critical resource for human survival and ecosystem health, yet increasing demands, population growth, and climate change pose significant challenges to its sustainable management. This abstract provides an overview of the current state of water resources, addressing the challenges faced in their management and highlighting innovative approaches for sustainable water use. The document delves into the global water crisis, discussing the imbalance between water supply and demand, water scarcity in various regions, and the detrimental impacts on ecosystems. It emphasizes the need for integrated water resources management (IWRM) to address complex interactions among water, land, and ecosystems. Innovations in water technology play a pivotal role in enhancing water use efficiency and quality. Advanced water treatment processes, smart water distribution systems, and the application of Internet of Things (IoT) technologies are explored as solutions to optimize water resource utilization and minimize wastage.**

INTRODUCTION:

The abstract also addresses the importance of watershed management, emphasizing the need for conservation, restoration, and sustainable development practices. It discusses the role of green infrastructure, such as wetlands and forests, in maintaining water quality, regulating flow, and supporting biodiversity.

Overall, this abstract provides a comprehensive overview of the current state of water resources, challenges in their management, and innovative solutions. It aims to contribute to a broader understanding of the importance of sustainable water management for environmental, social, and economic well- being, urging concerted efforts towards a water-secure future.

In any discussion about climate change, renewable energy usually tops the list of changes the world can implement to stave off the worst effects of rising temperatures. That's because renewable energy sources, such as solar and wind, don't emit carbon dioxide and other greenhouse gases that contribute to global warming.

Clean energy has far more to recommend it than just being "green." The growing sector creates jobs, makes electric grids more resilient, expands energy access in developing countries, and helps lower energy bills. All of those factors have contributed to a renewable energy renaissance in recent years, with wind and solar setting new records for electricity generation.

For the past 150 years or so, humans have relied heavily on coal, oil, and other fossil fuels to power everything from light bulbs to cars to factories. Fossil fuels are embedded in nearly everything we do, and as a result, the greenhouse gases released from the burning of those fuels have reached historically high levels.

Renewable power is booming, as innovation brings down costs and starts to deliver on the promise of a clean energy future. American solar and wind generation are breaking records and being integrated into the national electricity grid without compromising reliability.

This means that renewables are increasingly displacing “dirty” fossil fuels in the power sector, offering the benefit of lower emissions of carbon and other types of pollution. But not all sources of energy marketed as “renewable” are beneficial to theenvironment. Biomass and large hydroelectric dams create difficult trade- offs when considering the impact on wildlife, climate change, and other issues. Here’s what you should know about the different types of renewable energy sources—and how you can use these emerging technologies in your own home.

- What Is Renewable Energy?
- Types of Renewable Energy Sources
- Other Alternative Energy Sources
- Renewable Energy in the Home
- What Is Renewable Energy?

ISBN: 978-81-965236-7-1

Renewable energy, often referred to as clean energy, comes from natural sources or processes that are constantly replenished. For example, sunlight and wind keep shining and blowing, even if their availability depends on time and weather.

While renewable energy is often thought of as a new technology, harnessing nature's power has long been used for heating, transportation, lighting, and more. Wind has powered boats to sail the seas and windmills to grind grain. The sun has provided warmth during the day and helped kindle fires to last into the evening. But over the past 500 years or so, humans increasingly turned to cheaper, dirtier energy sources, such as coal and fracked gas.

Now that we have innovative and less-expensive ways to capture and retain wind and solar energy, renewables are becoming a more important power source, accounting for more than 12 percent of U.S. energy generation. The expansion in renewables is also happening at scales large and small, from giant offshore wind farms to rooftop solar panels on homes, which can sell power back to the grid. Even entire rural communities (in Alaska, Kansas, and Missouri) are relying on renewable energy for heating and lighting.

As renewable use continues to grow, a key goal will be to modernize America's electricity grid, making it smarter, more secure, and better integrated across regions.

Dirty or Nonrenewable energy

Nonrenewable, or "dirty," energy includes fossil fuels such as oil, gas, and coal. Nonrenewable sources of energy are only available in limited amounts. When we pump gas at the station, we're using a finite resource refined from crude oil that's been around since prehistoric times.

Nonrenewable energy sources are also typically found in specific parts of the world, making them more plentiful in some nations than others. By contrast, every country has access to sunshine and wind. Prioritizing renewable energy can also improve national security by reducing a country's reliance on exports from fossil fuel–rich nations.

Many nonrenewable energy sources can endanger the environment or human health. For example, oil drilling might require strip- mining Canada's boreal forest; the technology associated with fracking can cause earthquakes and water pollution; and coal power plants foul the air. To top it off, all of these activities contribute to global warming.

Types of Renewable Energy Sources

SOLAR ENERGY

Humans have been harnessing solar energy for thousands of years—to grow crops, stay warm, and dry foods. According to the National Renewable Energy Laboratory, "more energy from the sun falls on the earth in one hour than is used by everyone in the world in one year." Today, we use the sun's rays in many ways—to heat homes and businesses, to warm water, and to power devices.

Solar panels on the rooftops of East Austin, Texas Solar, or photovoltaic (PV), cells are made from silicon or other materials that transform sunlight directly into electricity. Distributed solar systems generate electricity locally for homes and businesses, either through rooftop panels or community projects that power entire neighborhoods. Solar farms can generate enough power for thousands of homes, using mirrors to concentrate sunlight across acres of solar cells.

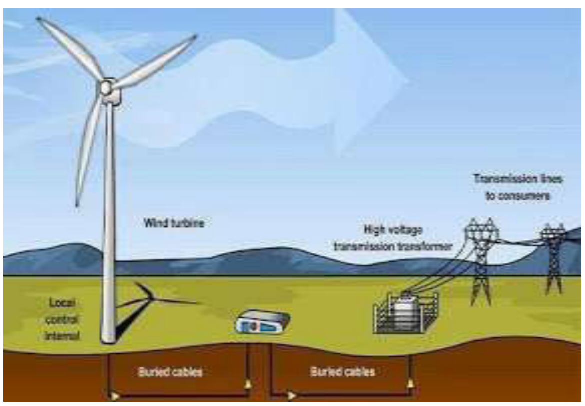
ISBN: 978-81-965236-7-1

Floating solar farms or “floatovoltaics” can be an effective use of wastewater facilities and bodies of water that aren’t ecologically sensitive. Solar supplies nearly 3 percent of U.S. electricity generation (some sources estimate it will reach nearly 4 percent in 2022). But 46 percent of all *new* generating capacity came from solar in 2021.

Solar energy systems don’t produce air pollutants or greenhouse gases, and as long as they are responsibly sited, most solar panels have few environmental impacts beyond the manufacturing process.

WIND ENERGY

We’ve come a long way from old-fashioned windmills. Today, turbines as tall as skyscrapers—with turbines nearly as wide in diameter—stand at attention around the world. Wind energy turns a turbine’s blades, which feeds an electric generator and produces electricity.



Wind which accounts for 9.2 percent of U.S. electricity generation, has become one of the cheapest energy sources in the country. Top wind power states include California, Iowa, Kansas, Oklahoma, and Texas, though turbines can be placed anywhere with high wind speeds—such as hilltops and open plains—or even offshore in open water.

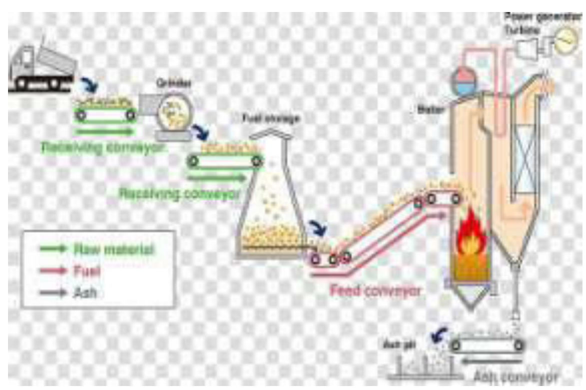
HYDROELECTRIC POWER

Hydropower is the largest renewable energy source for electricity in the United States, though wind energy is soon expected to take over the lead. Hydropower relies on water—typically fast-moving water in a large river or rapidly descending water from a high point—and converts the force of that water into electricity by spinning a generator’s turbine blades.

Nationally and internationally, large hydroelectric plants—or mega-dams—are often considered to be nonrenewable energy. Mega-dams divert and reduce natural flows, restricting access for animal and human populations that rely on those rivers. Small hydroelectric plants (an installed capacity below about 40 megawatts), carefully managed, do not tend to cause as much environmental damage, as they divert only a fraction of the flow.

BIOMASS ENERGY

Biomass is organic material that comes from plants and animals, and includes crops, waste wood, and trees. When biomass is burned, the chemical energy is released as heat and can generate electricity with a steam turbine.

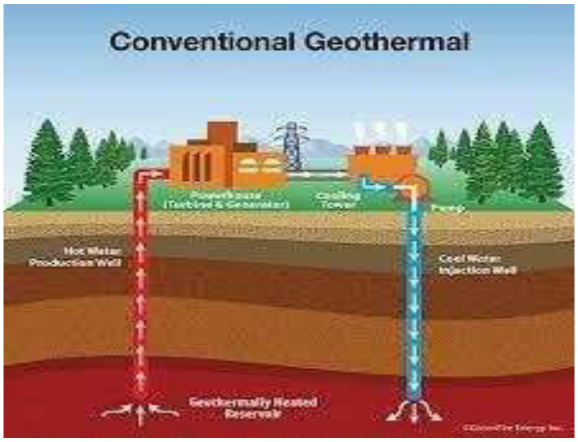


Biomass is often mistakenly described as a clean, renewable fuel and a greener alternative to coal and other fossil fuels for producing electricity. However, recent science shows that many forms of biomass—especially from forests— produce higher carbon emissions than fossil fuels. There are also negative consequences for biodiversity. Still, some forms of biomass energy could serve as a low-carbon option under the right circumstances. For example, sawdust and chips from sawmills that would otherwise quickly decompose and release carbon can be a low-carbon energy source.

ISBN: 978-81-965236-7-1

GEOTHERMAL ENERGY

The Svartsengi geothermal power plant near Grindavík, Iceland



If you've ever relaxed in a hot spring, you've used geothermal energy. The earth's core is about as hot as the sun's surface, due to the slow decay of radioactive particles in rocks at the center of the planet. Drilling deep wells brings very hot underground water to the surface as a hydrothermal resource, which is then pumped through a turbine to create electricity. Geothermal plants typically have low emissions if they pump the steam and water they use back into the reservoir. There are ways to create geothermal plants where there are not underground reservoirs, but there are concerns that they may increase the risk of an earthquake in areas already considered geological hot spots.

OCEAN

Tidal and wave energy are still in the developmental phase, but the ocean will always be ruled by the moon's gravity, which makes harnessing its power an attractive option. Some tidal energy approaches may harm wildlife, such as tidal barrages, which work much like dams and are located in an ocean bay or lagoon. Like tidal power, wave power relies on dam-like structures or ocean floor–anchored devices on or just below the water's surface.

Renewable Energy in the Home Solar power

At a smaller scale, we can harness the sun's rays to power the whole house—whether through PV cell panels or passive solar home design. Passive solar homes are designed to welcome in the sun through south-facing windows and then retain the warmth through concrete, bricks, tiles, and other materials that store heat.

Some solar-powered homes generate more than enough electricity, allowing the homeowner to sell excess power back to the grid.

Batteries are also an economically attractive way to store excess solar energy so that it can be used at night. Scientists are hard at work on new advances that blend form and function, such as solar windows and roof shingles.

Geothermal heat pumps

Geothermal technology is a new take on a recognizable process—the coils at the back of your fridge are a mini heat pump, removing heat from the interior to keep foods fresh and cool. In a home, geothermal or geoexchange pumps use the constant temperature of the earth (a few feet below the surface) to cool homes in summer and warm houses in winter—and even to heat water.

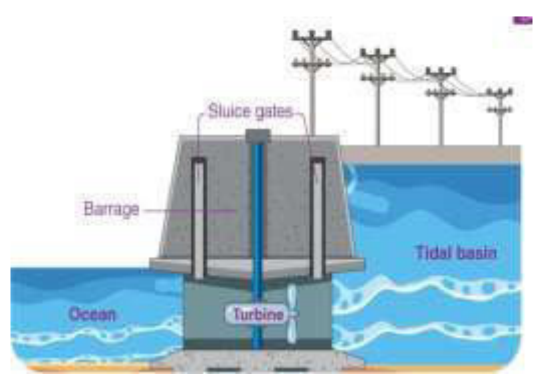
Geothermal systems can be initially expensive to install but typically pay off within 5 to 10 years. They are also quieter, have fewer maintenance issues, and last longer than traditional air conditioners.

Small wind systems

A backyard wind farm? Boats, ranchers, and even cell phone companies use small wind turbines regularly. Dealers now help site, install, and maintain wind turbines for homeowners, too—although some DIY enthusiasts are installing turbines themselves. Depending on your electricity needs, wind speeds, and zoning rules in your area, a wind turbine may reduce your reliance on the electrical grid.

Selling the energy you collect

Wind- and solar-powered homes can either stand alone or get connected to the larger electrical grid, as supplied by their power provider. Electric utilities in most states allow homeowners to only pay the difference between the grid-supplied electricity consumed and what they have produced—a process called net metering.



If you make more electricity than you use, your provider may pay you the retail price for that power.

ISBN: 978-81-965236-7-1

Renewable energy and you

Advocating for renewables, or using them in your home, can accelerate the transition toward a clean energy future. Even if you're not yet able to install solar panels, you may be able to opt for electricity from a clean energy source. (Contact your power company to ask if it offers that choice.) If renewable energy isn't available through your utility, you can purchase renewable energy certificates to offset your use.

CONCLUSION

Renewable energy sources represent a critical and sustainable solution to the global energy challenge. As the world grapples with the escalating threats of climate change, dwindling fossil fuel reserves, and the need for energy security, the transition to renewable energy has become more imperative than ever. The benefits of renewable energy, including environmental preservation, reduced greenhouse gas emissions, and increased energy independence, underscore its significance in shaping a cleaner and more resilient future.

Moreover, the rapid advancements in renewable technologies, coupled with decreasing costs, have made these sources increasingly accessible and economically viable. The deployment of solar, wind, hydro, and other renewable technologies not only mitigates the adverse impacts of conventional energy sources but also opens up new avenues for innovation, job creation, and sustainable development.

Governments, businesses, and individuals must collectively embrace and invest in renewable energy initiatives to accelerate the transition to a low-carbon and sustainable energy landscape. It is essential to foster international collaboration, implement supportive policies, and prioritize research and development to overcome challenges and unlock the full potential of renewable energy sources.

In essence, the widespread adoption of renewable energy sources is not just a necessity but a transformative opportunity. By harnessing the power of nature responsibly, we can build a cleaner, greener, and more resilient world for generations to come.

REFERENCE

1. Dr. G. K. Vijayaraghavan, Dr. R. Rajappan Dr. S. Sundaravalli- Renewable energy sources.

2. Ocean Energy White Paper: Alternative Energy Production Paperback – April 30, 2014 by Franklin C Kostenko (Author).

3. Akhtar Hussain, Syed Muhammad Arif, Muhammad Aslam-Emerging renewable and sustainableenergy technologies: state of the art.

4. Simon R. Sinsel, Rhea, L. Riemke, Volker H. Hoffmann- Challenges and solution technologies for the integration of variable renewable energy sources—a review.

5. Jakub Jurasz, Jerzy Mikulik, Magdalena Krzywda, Bartłomiej Ciapała, Mirosław Janowski -Integrating a wind- and solar- powered hybrid to the power system by coupling it with a hydroelectric power station with pumping installation.

6. Hasan Mehrjerdi-Modeling, integration, and optimal selection of the turbine technology in the hybrid wind- photovoltaic renewable energy system design.

ISBN: 978-81-965236-7-1

IOT-ENHANCED LIVING: ELEVATING COMFORT AND SECURITY THROUGH SMART HOME AUTOMATION

[1]Saranya S
Department of Electronics and Communication Engineering,
Sri Bharathi Engineering College for Women,
Pudukkottai-622303,
[1]shansaran.ece2007@gmail.com

[2]Balaji K
Department of Aeronautical Engineering,
Parul Institute of Engineering and Technology,
Parul University, Gujarat,
India- 391760.
[2]arobalaji@gmail.com

***Abstract* — The "Internet of Things" is quickly emerging as a disruptive business opportunity in technology, with standards primarily developing for wireless communication between devices and gadgets in everyday human life, commonly referred to as Things. The objective of this project is to manage home appliances and construct an intelligent wireless home security system utilizing Wi-Fi as the communication protocol. Various types of wireless communication techniques, including ZigBee, Wi-Fi, Bluetooth, GSM, etc., can be employed for implementing Home Automation. However, these existing methods have limitations due to their short-range functionality. To overcome these drawbacks, we plan to execute the project titled "IoT-based Smart Security and Smart Home Automation." The project concentrates on regulating lights and fans, termed as Home Automation, and ensuring smart security by transmitting a captured image via email to the owner through the internet when an object is detected. The implementation of this project will involve the utilization of the "Node MCU" Module, offering significant assistance to handicapped and elderly individuals.**

Keyword- Ariduino,IOT,MCU,Smart Phone,WI-FI

1. INTRODUCTION

Home automation involves the management and regulation of household appliances through micro- controller or computer technology. The prevalence of automation is on the rise due to its ability to offer convenience, security, and efficiency. In this system, sensors detect the status of appliances and transmit updates to a web server. When users are away from home, they can remotely access and modify the status of appliances, such as turning them on or off, using a local PC. This paper will outline the methodology for controlling home appliances through a web server.The essence of this IoT-based smart security and smart home automation system lies in its pursuit of combining comfort with simplicity. The project seamlessly integrates wireless home security and home automation, offering a comprehensive solution. The current prototype of the system excels in sending timely alerts to the owner via email over the Internet, triggered by the detection of human movement near the entrance of their house.

The system's functionality extends beyond mere security alerts. When the owner discerns that the person entering their house is not an intruder but an unexpected guest, they have the flexibility to take various actions. The user can remotely make arrangements, such as opening the door and activating specific appliances inside the house, all controlled by the embedded micro-controller. This enables the owner to warmly welcome their guest without being physically present.Similarly, the system caters to the user's convenience as they enter their home. By leveraging the same set of sensors, the user can pre-set conditions, ensuring a seamless transition to comfort upon entering. This includes automating the activation of electrical appliances or tuning into their favorite TV channel, all accomplished without manual intervention.

One noteworthy advantage of this IoT system is its adaptability to connectivity challenges. Even in the absence of Wi-Fi, the system seamlessly switches to 3G or 4G services, ensuring continuous functionality. This capability sets it apart from existing methods where such flexibility might be limited.In essence, the IoT-based smart security and smart home automation project not only addresses security concerns but also enhances the overall living experience. By overcoming various drawbacks present in traditional approaches this project brings forth a harmonious blend of comfort.

ISBN: 978-81-965236-7-1

And simplicity, paving the way for a more sophisticated and user-friendly home environment.

2. METHODS

Bluetooth-based home automation systems, employing smartphones, Arduino boards, and Bluetooth technology, offer a secure and cost-effective solution for controlling various devices. The system proposed by R. Piyare and M. Tazil [2] utilizes a Bluetooth connection with a PC or smartphone serving as the receiver device. With high communication rates, robust security features, and low costs, this Bluetooth-based home automation system is suitable for real-time applications.

Despite its advantages, one notable limitation is the Bluetooth network's restricted range, reaching up to 10 meters. If a smartphone goes beyond this range, it loses the ability to control home appliances, representing a significant drawback for users.

On the other hand, voice recognition-based home automation systems present an innovative solution [1,3]n for individuals with disabilities or elderly individuals who may find it challenging to operate devices manually. In this setup, wireless communication between the smartphone and Arduino UNO is facilitated through Bluetooth technology. The system enables users to control appliances by issuing voice commands, enhancing accessibility.

However, the voice recognition system is not without its challenges. The effectiveness of communication between the user and the voice recognition tool depends on the signal-to-noise ratio (SNR). In instances where the voice signal is noisy, the communication may be significantly affected, leading to inaccuracies in command recognition. This limitation highlights the importance of a stable and clear audio input for optimal functionality.

The ZigBee-based wireless home automation system, as explored in previous studies [4], shares similarities with Bluetooth technology[4]. ZigBee is a widely adopted transceiver standard known for its low data rate and power consumption. With a physical range of 10 to 20 meters, extendable up to 150 meters using direct sequence spread spectrum (DSSS), ZigBee is well-suited for prototyping and research activities. This technology provides an efficient solution for wireless communication within smart home setups.

In contrast, the GSM-based home automation system relies on the Global System for Mobile communication [5, 6]. This system facilitates communication between the main module and appliances through text messages. However, a notable drawback of the GSM-based system is its reliance on text messages, which lacks the guarantee of consistent message delivery. Consequently, the system's reliability is compromised, introducing a limitation that may affect the consistent and seamless operation of the home automation functions.

To overcome existing drawbacks, we are implementing "IoT-Based Smart Security and Smart Home Automation." This advanced solution utilizes Internet of Things (IoT) technology, eliminating limitations like short ranges and unreliable messaging systems. The project aims to provide a more robust and versatile smart home experience, enhancing security measures and automation capabilities

3. HARDWARE

Arduino UNO: Arduino UNO is a microcontroller board that serves as the brain of the system. It is responsible for controlling and coordinating the various components in the project, executing programmed instructions, and facilitating communication.

Fig 1.Arduino UNO

Node MCU: Node MCU is another microcontroller board that often integrates Wi-Fi capabilities. It enables wireless communication and connectivity, making it suitable for IoT applications.

Fig 2. Node MCU

Relays for connecting home appliances: Relays act as switches for home appliances, allowing the microcontrollers to control the power supply to these devices. They facilitate automation by enabling or disabling appliances based on programmed conditions.

Air purity Sensor (MQ135): This sensor measures air quality by detecting the presence of various gases.

ISBN: 978-81-965236-7-1

In this context, it can provide information about the purity of the air within the environment. Humidity and Temperature Sensor (DHT11): The DHT11 sensor measures the humidity and temperature of the surrounding environment. This data is valuable for maintaining a comfortable and controlled atmosphere in the home.

IR Sensor: Infrared (IR) sensors are used to detect infrared radiation. In the project, they may be employed for applications such as motion detection or as part of a security system.

Camera module (OV7670): The OV7670 camera module captures images. It can be utilized for surveillance or monitoring purposes, enhancing the security features of the system.

Mobile phone for operating home appliances: A mobile phone serves as a remote control interface, allowing users to operate and monitor home appliances from a distance. This enhances user convenience and accessibility.

Blink app installed on the mobile phone: The Blink app is likely used for monitoring and controlling the system remotely through the mobile phone. It provides a user-friendly interface for interacting with the smart home features.

Arduino IDE (Software): The Arduino Integrated Development Environment (IDE) is a software platform used for programming and uploading code to the Arduino and Node MCU boards. It facilitates the development and implementation of the system's logic and functionality.

Together, these hardware components form a comprehensive system for smart home automation and security, integrating sensors, controllers, and communication devices to create an intelligent and responsive environment.

4. PROPOSED METHOD

The proposed system is successfully implemented using Node MCU, effectively addressing the limitations of previous methods. All sensors are seamlessly integrated into the Node MCU board, and real-time results are accessible on a smartphone, updating every second. The system offers proactive monitoring, detecting gas leakages through the air purity sensor. In such instances, a high sensor value prompts the activation of a fan to expel the gas.

To accommodate the camera module's requirements, it is connected to the Arduino UNO board. Unlike Node MCU, which has limited analog pins, Arduino UNO provides multiple analog pins necessary for the camera module's operation. The system employs an IR sensor to detect motion, triggering the camera module to capture images. These images are not only stored locally on a PC but are also sent to the user's email, enhancing the security features of the project. This comprehensive approach ensures effective monitoring, timely responses to environmental changes, and secure image capture for further analysis.

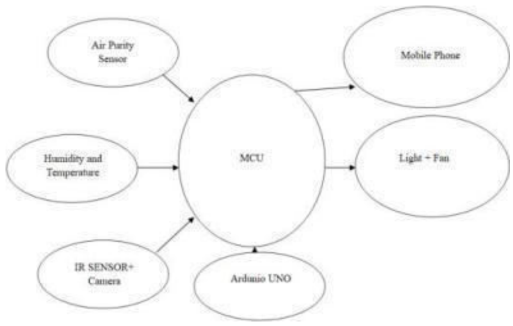


Fig 3. Proposed System

The versatile prototype can be utilized in the following ways:

a. Smart Security System:
The system operates as a smart security solution by integrating sensors such as the air purity sensor, IR sensor, and camera module. It detects gas leakages, monitors motion through the IR sensor, and captures images using the camera module. In case of unusual events, the system can alert the user in real-time, providing enhanced security for the monitored environment.

b. Smart Home Automation System:
The prototype functions as a smart home automation system by connecting various sensors to the Node MCU board. Users can remotely control home appliances through their smartphones, with real-time updates on sensor readings. This offers convenience and customization, allowing users to manage their home environment efficiently.

c. Environment Monitoring:
The system is also capable of environmental monitoring through sensors like the air purity sensor and humidity/temperature sensor. It continuously assesses air quality and environmental conditions, providing valuable data for analysis. This feature contributes to creating a healthier and more comfortable living space.

The proposed system boasts several advantages:

Comprehensive Solution at Low Cost:

This system offers a cost-effective solution that caters to both home security and home automation needs. Despite its affordability, it provides a wide range of functionalities, making it an accessible option for various users.

ISBN: 978-81-965236-7-1

Enhanced Accessibility for Handicapped and Aged Individuals:

Particularly beneficial for handicapped and elderly individuals, the system's remote control capabilities simplify daily tasks. Users can operate devices and ensure home security with ease, enhancing their overall quality of life.

Long-Distance Device Control:

The system enables remote control of devices from a considerable distance. This feature adds a layer of convenience, allowing users to manage their home environment even when they are far away.

High Security and Time Efficiency:

The system prioritizes security, ensuring that both home automation and security measures are highly secure. Additionally, the system is designed for optimal time efficiency, streamlining tasks and minimizing manual interventions.

5. RESULTS

The outcomes of the implemented setup are visualized through the Blink app, providing users with real-time data and updates. The captured images from the OV7670 camera are not only stored in a designated folder on the PC but are also sent directly to the user's email. This dual functionality ensures that users have convenient access to visual data through the Blink app while also having a secure and retrievable archive of captured images for further reference. The combination of these features enhances the monitoring and security aspects of the system, providing a comprehensive solution for users.

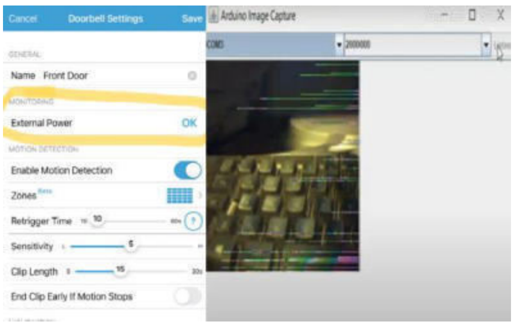


Fig 4. Output Images

6. CONCLUSION

The Internet of Things (IoT)-based home automation system relies on internet connectivity for operation. The proliferation of IoT devices presents both challenges and advantages. Notably, the system can seamlessly switch to 3G or 4G services when Wi-Fi is unavailable, highlighting the adaptability of IoT technology.

- One noteworthy feature of this project is the integration of a camera with the microcontroller. This addition allows users to make informed decisions, such as determining whether to welcome a guest based on the captured picture received. In cases of uncertainty or potential security threats, users can take proactive measures by forwarding the image to the police station, providing an added layer of security and responsiveness.
- It's worth mentioning that this project is not limited to a specific microcontroller, as indicated by the mention of Raspberry. This flexibility allows users to choose hardware that best suits their requirements, enhancing the project's versatility and adaptability to various setups and preferences.

REFERENCES

1. Ravi Kishore kodali and Vishal jain " IOT based smart security and Home Automation system" International conference on computing, communication and automation (ICCCA 2016)

2. R. Piyare and M. Tazil, "Bluetooth based home automation system using cell phone," Consumer Electronics (ISCE), 2011 IEEE 15th International Symposium on, Singapore, 2011, pp. 192-195.

3. S. Sen, S. Chakrabarty, R. Toshniwal, A. Bhaumik, "Design of an intelligent voice controlled home automation system", International Journal of Computer Applications, vol. 121, no.15, pp. 39-42, 2015

4. H. AlShu'eili, G. S. Gupta and S. Mukhopadhyay, "Voice recognition based wireless home automation system," Mechatronics (ICOM), 2011 4th International Conference On, Kuala Lumpur, 2011, pp. 1-6.

5. R. Teymourzadeh, Salah Addin Ahmed, Kok Wai Chan and Mok Vee Hoong, "Smart GSM based Home Automation System," Systems, Process & Control (ICSPC), 2013 IEEE Conference on, Kuala Lumpur, 2013, pp. 306-309.

6. A.R.C.Y.O.K.Withanage,C.,"A omparison of the popular home automation technologies," pp. 1 – 11, may 2014.

ISBN: 978-81-965236-7-1

Idea for synthesis of Hybrid quantum dots thin film for solar cell application

R.Saratha
Assistant Professor, Department of Physics
Sri Bharathi Engineering College for Women
Kaikurichi, Pudukkottai, Tamil nadu, India-622 303.
Corresponding Author: sarukrish14@gmail.com

Abstract - **Hybrid quantum dots are promising candidate for fabricating next generation solar cell application due to their promising optical properties. Over the last few years, their wide applications are in optoelectronics such as photodetectors, light-emitting diode and photovoltaics. Recently, some QD based solar cell has shown its efficiency (PCE) of 13.8% due to surface passivation and device structure. Among the nanostructure, quantum dots are great interest in optoelectronics industries due to its size dependent effect. Basically, there is some problem to select the parent materials for synthesis quantum dots for solar cell fabricating application. In order to address and solve the crisis problem, here ZnO, FeS_2 and Se semiconductors will be used. These materials offer great advantages for optoelectronics properties alignment (Fermi level, band edge and band gap). Hence, the optoelectronics properties will be alignment on selected semiconductor materials for potential use in thin film solar cell. Therefore, the aim of this work is to develop the semiconductor (ZnO:K, FeS_2 and Se) hybrid quantum dots thin film for fabricating thin film device for solar energy harvesting application.**

I. INTRODUCTION

Nowadays, solar energy is an amazing candidate for addressing crisis in global energy and eventually assists for reducing carbon emission. Still, there exists a great challenge among researchers to develop the thin film for photovoltaic with more friendly at reduced cost of renewable energy device and global warming [1 **Peng Yu**]. Moreover, there are limited availability of sources such as fossil coal, hydropower, nuclear and biomass. Solar energy is only most abundant and sustainable source to fulfill the demand of global energy. For decades, organic and inorganic thin films have been utilized for improving the more solar efficiency.Recently, inorganic quantum dots have been fabricated for light absorber to replace conventional materials because quantum dots thin film exhibits desired properties and shown 66% efficiency [1-5]. However, its efficiency suffers by imperfect alignment of optoelectronics properties such as Fermi level, band edge and energy level. Novel nanostructure has been focused for various applications. The quantum confinement effect in three dimension that can modify the optical properties. The unique optical properties of semiconductor quantum dots has been emerged for wide range of applications especially for solar energy harvesting. Therefore, optoelectronics properties of inorganic quantum dots have to alignment with perfect size and shape for best solar efficiency.

II. COATING TECHNIQUE

To date, several sophisticated techniques and methods have been employed for making the thin film for solar cell device application. Moreover, rf sputtering, spin coating and spray pyrolysis techniques offers more advantages for developing thin film **[6].** Among the different sophisticated techniques, rf magnetron sputtering has become the choice for deposition of all kind of semiconductors. Hence, rf magnetron sputtering was used extensively in semiconductor industries for optoelectronics device fabrications. It has some favorable advantages such as large area coating, high density, high quality and high adhesion [8]. Following it, the spray pyrolysis technique is one of the main for thin and thick films developing. Moreover, the spray pyrolysis offers desired advantages for developing thin film of various material compositions. Even stack layer thin films can be easily prepared by spray pyrolysis technique. Therefore, the spray pyrolysis technique has been used in various optoelectronics especially solar cell industry. Moreover, the spin coating is currently major technique to develop uniform thin film with various layer thicknesses in the order of micrometer to nanometer range. Therefore, the spin coating was also employed more than fifty years in thin film technology. The technique has also been employed in manufacturer of optical mirror, color television screens and magnetic disk for data storage **[7].** The present all techniques contains more preferred advantages in thin film developing. Hence, radio frequency sputtering, spin coating and spray pyrolysis will be used to develop the hybrid quantum dots thin film.

ISBN: 978-81-965236-7-1

Several semiconductor candidates have been developed and tried for improving solar efficiency. In thin film solar industries, crystalline silicon, Cu_2S, a-Si, m-Si,n-Si, CdTe, CIGS,CNTS, concentration solar cell such as Si, GaAs and other dye, Organic and hybrid solar cells have been developed. However, those candidates have some challenging problems such as toxic, expensive, imperfection optoelectronics properties and efficiency degradation which restricts their efficiency. Moreover, these materials loses their efficiency by poor stability, poor durability, low charge carrier mobility, high operating temperatures, low exciton binding energy, degradation and photon lack**.** Following them, Since few years, quantum dots based thin film solar was emerged (66 % efficiency) than others due to their size and shape effect. However, their efficiency was also suppressed by non - alignment optoelectronics properties (Fermi level, band edge and photon trapping). Therefore, if optoelectronics properties will construct perfectly with size and shape that the maximum energy efficiency can be achieved.

Among the nanostructure, quantum dots are great interest in optoelectronics industries due to its size dependent effect. Recently, quantum dots has shown 66% solar energy efficiency. This indicates that the great advantages of semiconductor quantum dots. In order to address and solve the crisis problem, ZnO, FeS_2 and Se semiconductors will be used. These materials offers great advantages for optoelectronics properties alignment (Fermi level, band edge and band gap). Hence, the optoelectronics properties will be alignment on selected semiconductor materials for potential use in thin film solar cell. Therefore, the aim of this work is to develop the semiconductor (ZnO:K, FeS_2 and Se) hybrid quantum dots thin film with perfect optoelectronics properties alignment to improve solar energy efficiency.

The objectives of this work is to develop the hybrid quantum dots thin film on ZnO, FeS_2 and selenium for solar energy application. Zinc oxide, Pyrite and selenium semiconductors are much suitable for improving solar efficiency. Zinc oxide contains wide band gap (3.37 eV), acceptable large exciton binding energy (60 meV) and n-type behavior good optoelectronics properties at room temperature. Moreover, ZnO becomes more stable and electron mobility $\mu_e = 200\ cm^2V^{-1}s^{-1}$ and make it attractive for thin film solar cell. FeS_2 has high electron mobility, high optical absorption coefficient ($10^6\ cm^{-1}$ in the visible region),suitable band gap(0.95 eV), non-toxic, absorption coefficient ($\alpha\ 10^5\ cm^{-1}$, $\lambda \leq$ 700 nm), charge carriers concentrations $10^{18}\ cm^{-3}$ and electron and hole motilities 164 and 1.3 $cm^2\ v^{-1}\ S^{-1}$, and electron carrier mobility is 360 $cm^2\ V^{-1}\ S^{-1}$. Selenium also contains good capacity to absorb infrared below the band gap. In order to address and solve the mentioned crisis problems, hybrid quantum dots thin film will be constructed to determine the solar efficiency with perfect optoelectronics properties alignment. Hence the main objective of this proposal is to develop the new hybrid ZnO:K, FeS_2 and Se quantum dots thin film for best solar performance.

III. Synthesis and Device fabrication

Materials and experiment work

Here, Zinc chloride, potassium acetate, deiniozed water will be used to prepare K doped ZnO quantum dots. Hydrated ferric nitrate Fe $(NO_3)_3{\cdot}9H_2O$,2-methoxythanol and acetyl acetone will be used for synthesis of FeS_2 quantum dots. Selenium quantum dot will be used along with ZnO and FeS_2. In the thin film fabrication section, glass, quartz and tin oxide substrates will be used. Acetone, methanol and demonized water will be used to clean the substrates. Rf sputtering, spin coating and spray pyrolysis techniques will be used to fabricate the quantum dots thin films.

IV. COCLUSION

In this work, highly efficient hybrid semiconductor quantum dots thin film is focused to attain the maximum efficiency. The main physical parameters such as (i) Thickness (ii) Particle size (iii) optoelectronics properties (band edge, Fermi level, energy gap and photon trapping structure) and (iv) Stability will be analyzed in the work. In the present work, ZnO:K, FeS_2 and Se does not exhibits toxic and expensive result in low cost and zero green house effect. Moreover, the present hybrid quantum dots thin film can be functioned at low sunshine. After incorporation of FeS_2 and Se along with ZnO:K are (i) efficiency stability will be improved (ii) Solar energy can be harvested at minimum light intensities and (iv) Can also be used under all environmental conditions. The hybrid quantum dots semiconductors thin film will be low cost, flexibility and stability. Therefore, the new hybrid semiconductor quantum dot thin film will be a new candidate in solar industries.

ISBN: 978-81-965236-7-1

V. REFERENCES

1. Long Hu et al, Flexible and efficient perovskite quantum dot solar cells via hybrid interfacial architecture, Nature Communications vol. 12, (2021).

2. Yankai et al. Selection, Preparation and Application of Quantum Dots in Perovskite Solar Cells, *Int. J. Mol. Sci.* 2022, *23*(16), 9482.

3. Sonali Das et al. High efficient hybrid bulk hetero junction thin-film solar cell embedded with kesterite Cu2ZnSnS4 quantum dots, Superlattices and Microstructures, Vol.148, December 2020, 106719.

4. Hau-Vei Han et al. A Highly Efficient Hybrid GaAs Solar Cell Based on Colloidal-Quantum-Dot-Sensitization, Scientific Reports vol. 4, (2014).

5. Bo Gao et al. Organic-Inorganic Perovskite Films and Efficient Planar Heterojunction Solar Cells by Magnetron Sputtering, https://doi.org/10.1002/advs.202102081Citations: 10.

6. Asim Jilani et al. Advance Deposition Techniques for Thin Film and Coating, DOI: 10.5772/65702.

7. Niranjan sahu et al. Fundamental understanding and modeling of spin coating process: A review, Indian Journal of Physics, Vol.83,PP. 493–502, (2009).

8. Elisabetta Petrucci et al. Effect of Spin Coating Parameters on the Electrochemical Properties of Ruthenium Oxide Thin Films, DOI:10.3390/electrochem2010008.

ISBN: 978-81-965236-7-1

APPLICATION OF AN ENHANCED CNN FOR PRECISION AGRICULTURE

[1]Mrs.M.Sathya, AP/ECE, [2]Dr.AmbujamKathan,Prof/ECE, [3]Mrs.G.Gopperumdevi,AP/ECE
Department.of Electronics and Communication Engineering,
Sri Bharathi Engineering College for Women, Kaikkurichi, Pudukkottai.

Abstract — **Rice is a primary food and Encounter has an Essential role in providing food security worldwide. However, the existing Disease diagnosis method for rice is neither accurate nor efficient, and special equipment is often required. In this study, The disease classification is done by an SVM classifier and therefore the detection accuracy is improved by optimizing the info exploitation. In this proposed system we are using image processing techniques to classify diseases. This approach will enhance the productivity of crops. Furthermore in precision agriculture, The accurate segmentation of crops and weeds has been always been the center of attention. This work proposes a segmentation method based on a combination of semantic segmentation and the K means algorithm for the segmentation of crops and weeds in the color image. The proposed algorithm provided more accurate segmentation in comparison to other methods with a maximum accuracy of equivalent to 99.19% the result indicates that the proposed method successfully provided accurate results for the segmentation of crop and weed in the image with a complex presence of weed.**

Keywords: semantic segmentation; k-means algorithm; precision agriculture; leaf disease detection SVM.

1 .INTRODUCTION

Rice is an important crop in agriculture however, crop diseases can significantly reduce its yield and quality, which is a great threat to food supplies around the world. Through early detection search for diseases and remedial steps took a timely can avoide huge loss and can yield good crop that is high in quantity and best quality. Research in agriculture aims to improve the productivity and quality of the crop yield with less expenditure and good yield. There is a variety of plant diseases such as viral bacterial fungal and these can damage different plant parts above and below the ground. The spread of various diseases in rice leaf is increased in recent years. Identifying the correct disease symptoms and understanding when to control these diseases is difficult. During this process, the advanced techniques of the Support vector machine play a key role in disease classification.

Weeds are unwanted plants and can significantly reduce crop yield. The broad categories of weeds found in paddy fields are grass, sedges, and broadleaved weed.

It would beneficial if each of these weeds are treated with a specific type of herbicide application. Therefore it would be of great help for the farmer if this task of classification of weeds in paddy fields were done automatically. This paper focuses on Implementing a deep learning-based computer vision technique for the automatic classification of paddy crops and two types of weeds, namely broadleaved weed and sedges weed. The standard way of handling weed in India is hand weeding mechanical weeding and herbicides. Hand weeding is a time-consuming and labor-intensive job. Mechanical weeding is carried out using a machine called a rotary weeded. Herbicides have an ill effect on the environment. When controlling weeds with herbicides, it is important to know the species of the weed so that the right herbicides. The proposed method brings up promising techniques for the segmentation of crops and weeds. The result of semantic segmentation and the separation of crop and weed allows us to analyze the shape, detect weed and make an accurate analysis of weed control operation in precise agriculture...

LITERATURE REVIEW

Savita .N.Ghaiwat describe the different type of Technique classification & identification of green foliage of the plant. for class estimation, they use K nearest neighbor technique as thebeat method.

K. Jagan Mohan, M.Balasubramanian, and S.Palanivel describe scale-invariant feature transform (SIFT) as used to get a feature for recognition and detection of disease.

Y. J. Shang & L. Way describe the scheme in their paper as using a KNN classifier for plant disease identification & detection where a developed algorithm can work for five dissimilar varieties of maize disease.

Dipak Kumar Kole and Diplest Majumdar gave a solution that applies image processing & ANN mechanism to detect disease in various commonly grown plants resulting in an accuracy of 99%.

Bakshipour A. & Jafari.A. provide the classification of sugar beet crop & four types of weed done using an SVM & artifi cial neural network classifier using shape feature. The correct identification of weed by ANN & SVM was 92% & 93%.

ISBN: 978-81-965236-7-1

Solidago W.E.Leite, N.J.Teruel, B.J.Kerleth discrimination of Rice seedling & weed done using the deep FCN.FCN model had an accuracy of 83% for soil background, 92% for rice & 92% for weeds.

Abdalla. An H.Cen, L.Wan, R. RASHID, H. Waleng. took advantage of a convolution neural network for semantic segmentation of oilseed rape images. In their study, the beat accuracy that was achieved amounted to 96%.

Majeed. Y, M.Karkee, Q.Zhang, M.D.Within their study determine grapevine Corden shape using semantic segmentation & deep learning. The result of the study could fit about 80%.

Richle.D, D.Reiser, H.W.Griepentrong. used an index-based Semantic method for the plant background segmentation in RGB image plant segmentation was done successfully accuracy of 97.4%.

C. Polena, D. Nardi, P.A.Jaly. In Fast & accurate crop & weed identification with the summarized train set for precision agriculture. applied CNN on RGB images for the identification Of weed images of different datasets were used and & the accuracy was 98.7%.

PADDY DISEASE AND ITS SYMPTOMS :

Lessening the yield due to paddy leaves affected with a disease can cause damage to plants to a great extent and affect the entire Crop if not timely diagnosed. Paddy disease is due to many Constraints such as insect pests, deficiency of nutrients, pathogen C And unusual environmental conditions. This section provides Information about the paddy disease with its appearance. Detailed as follows:

1.Brown spot(BS)
2.bacterial leaf blight(BLB)
3.leaf smut(LS)

A) BROWN SPOT:

This disease occurs on the leaves of rice plants. This is a fungal disease that infects the entire crop that can be easily identified in the early stage. The symptoms of the disease are round to oval shape with dark brown Lesions.

B) BACTERIAL LEAF BLIGHT

Dew drops with bacterial masses can be seen on fresh lesions early in the morning. a narrow yellow border the surrounding lesion also characterizes these spots.

The lesions turn the entire leaf into white or straw-colored on a sheath of leaf disease.

C) LEAF SMUT(LS)

The wounds of LS on the leaves may be oval or Circular in shape or irregular in shape with a kind of rough Surface. Heavily infected leave turn yellow, and the leaf tips Die and turn gray.

WEED IN PADDY FIELD

Weeds in the paddy field can be broadly categorized into 3 types,

1. Broad-leaved weed.
2. Grasses
3. Sedge

a) BROAD LEAVE WEED

Broadleaf plants have relatively broad leaves. Leaves of the broad leaf have one main vein from which smaller veins branch. Broad-leaved weeds are usually dicot with the taps roof system.

ISBN: 978-81-965236-7-1

b) GRASSES

Annual summer grass that germinates throughout the season, Capable of producing 1501000 seeds per plant, per season. Short, flat, purplish-green steams perennial grass most active During the cool spring and fall season.

c) SEDGE

Sedge is a perennial plant that is found in moist soil. They are grass-like in appearance & often grow in a thick cluster. Depending on the species these weeds can research reach up to Four feet in height.

PROPOSED METHOD:

SYSTEM architecture

We use a plant dataset containing rice plant species Digital cameras were used to capture the image in The paddy field under natural lighting conditions Some of them were healthy & some were affected by various Disease. Different growth stages of paddy have consisted By the image. The image was saved in RGB color space (540x733) In JPG format. PYTHON 3.7 was used to process the Image. The sample image was resized when working With python 3.7 . to overcome reflection, a shadow of a plant, & unwanted objects here the field problem, we segmented The ground object from the background by using YCBR Model. The Support vector machine is a supervised classifier The SVM with radial basis function(RBF) kernel was used. In this approach, a support vector machine was designed for Classification to achieve the classification of paddy leaf disease. SVM classifier is approached to maximize the classification Accuracy, & minimize the available dataset.

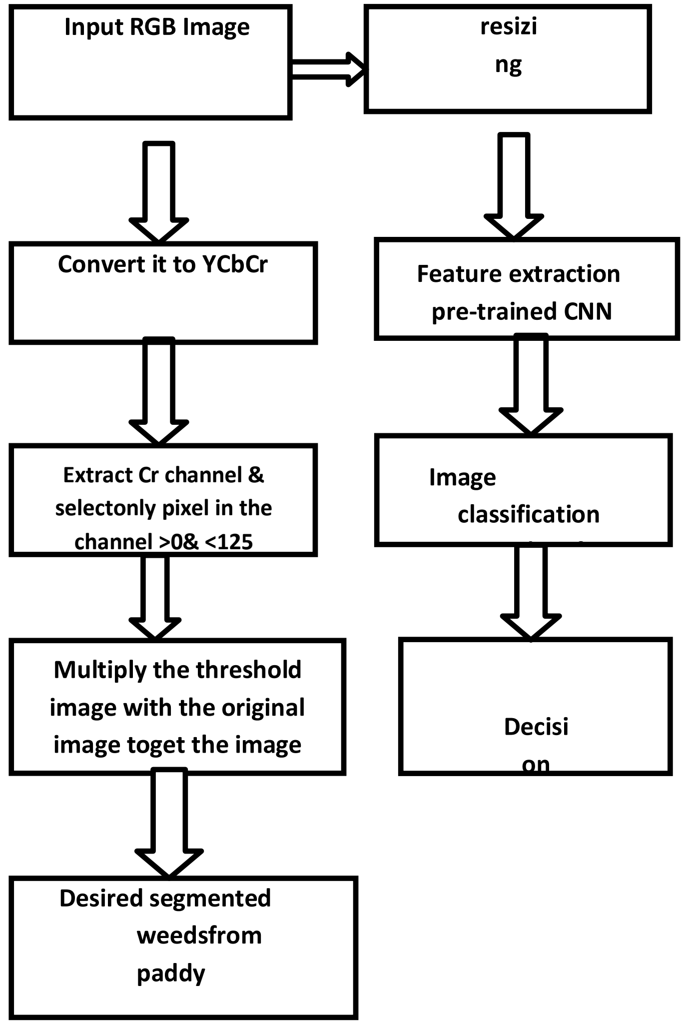
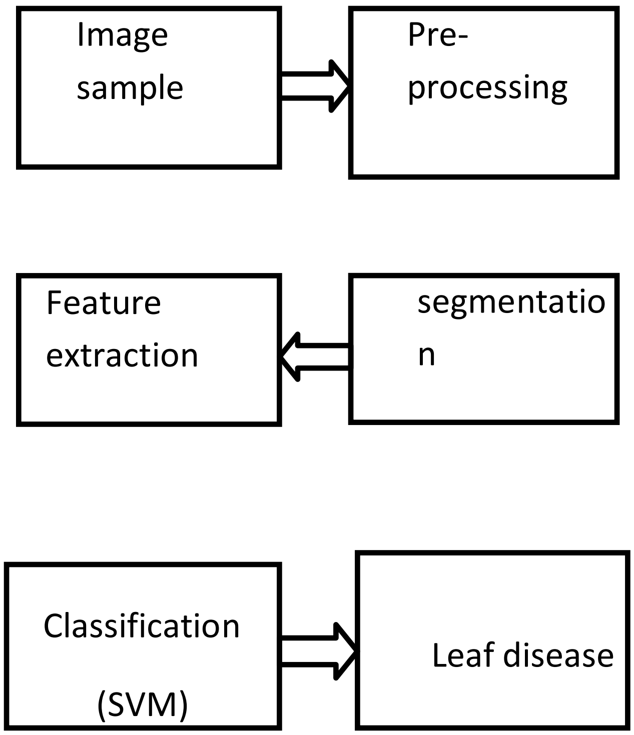


Image-segmentation- Keras APIs were used for the Implementation of a different model. In the model, transfer learning was used to get a better result. each RGB original image has a corresponding annotated Image with the same format. weight obtained from the ADE-20 k dataset was used as the initial weight in the Model. Semantic segmentation models are built upon A standard CNN network.ADE-20K dataset weights Are trained on 150 different classes. Deep learning is a subset of machine learning. many Research used convolutional machine learning techniques In combination with image features to accomplish the Task of weed recognition. These techniques can work With smaller data sizes and are not computationally Intensive.

ISBN: 978-81-965236-7-1

BLOCK DIAGRAM FOR CLASSIFICATION USING SVM



SUPPORT VECTOR MACHINE(SVM):

When your data has exactly two classes and support vector machine used.

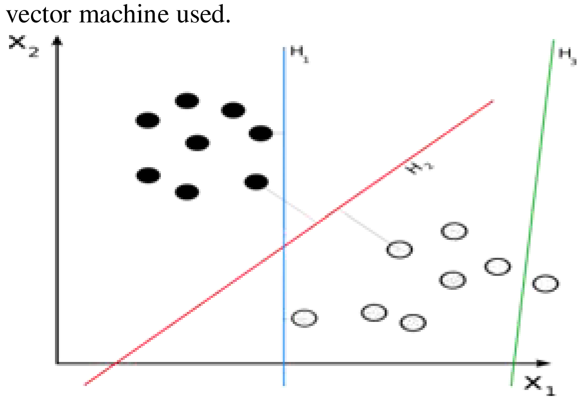


IMAGE ACQUISITION:

The image acquisition stage is the first stage of any vision system. in real-time application. Photographs of rice plant leaves are collected using a high-resolution digital camera. In addition, this stage includes the preprocessing undertaking, for example, image, and scaling. A dataset containing the image of both normal and diseased leaves was in the analysis process.

PRE-PROCESSING:

An input image has some unwanted noise as well as redundancy present in it. Images in the dataset were scaled to a uniform size of 300x450 pixels to limit demands for storage and processing power. It is a sort of signal dispensationin which the input is the image, like a video edge or photo and the result may be a picture or characteristics related to that image. Accordingly. The RGB image was first converted into HSV images next, the S value (saturation) was used to account for the presence of excess exposure.

FEATURE EXTRACTION:

Extracting the relevant information from the input images Is called a process of feature extraction. The color was also used to define share and feature. The importance of feature data. Component extraction is a core limit in various image-processing applications like Remork detecting, biomedical imaging, and object-based image. Using GLCM features image analysis techniques are used to extract contrast, correlation, and homogeneity of the image.

SEGMENTATION

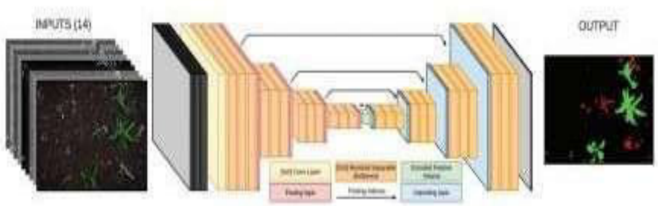
The main goal of the segmentation is to extract meaningful and useful information from the iq2mage concerning certain features. The centroid value was used to make accurate segments for resolution randomness issues by constructing a histogram of hue components. It is a standout among the most troublesome errands in computerizedimage processing. When your data has exactly two classes Support vector machine (SVM) is used

CLASSIFICATION:

The classification technique is used for both the training and testing process. A time training model was then used to determine how well the model could be generalized to different plant species datasets. So the support vector machine technology is used for the classification of leaf disease. The trained classifier is used to group different pictures. For this purpose, the training image was divided into two denoted as ds1 and ds2. SVM is a binary classifier that used a hyperplane this hyper plan is a line in each class way

ISBN: 978-81-965236-7-1

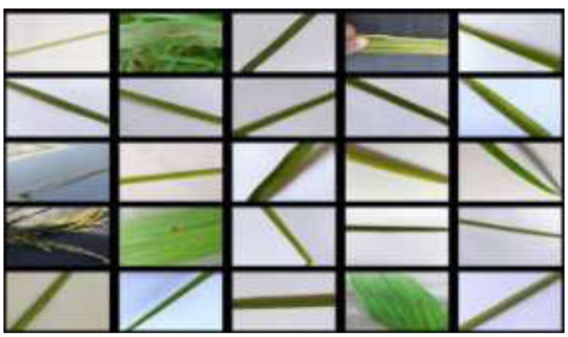
Architecture for pixel-wise segmentation

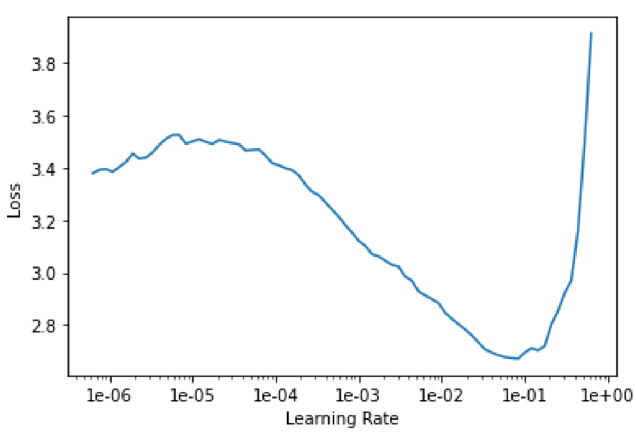


EXPERIMENTAL RESULT:

The system accepts the input image, these images are unknown to the SVM classifier compares the image feature based on the previously Trained image feature, and produce the output. The input leaf Image for the system taken are The image was classified into 8 classes: bacterial leaf blight, brown spot, false smut, healthy, Hispa, leaf blast, neck blast, and sheath blight rot.

Sample for disease detection in paddy leaves.





CONCLUSION:

Detection & identification of leaf disease using multiclass SVM plays a very important role in agricultural solutions to their problems. the algorithm predicted the rice leaf disease with varying degrees of accuracy. It is observed that the CNN model with a high-level fusion technique is the best solution with test accuracy exhibiting. This approach facilitates the use of simplistic statistical learning techniques together with a decreased computational workload to ensure both high efficiency and high classification accuracy. Overall results indicate that deep-based semantic segmentation of paddy crops and weeds can be used. And this is towards safe food production. the pre-trained U Net model was chosen for feature extraction since it provided a promising performance in the general texture dataset evaluation and exhibited the smallestprocessing time. Hence in future work, the quality of the solution image will be improved by using the quality of the enhancement methods. Also, the proposed method will be used for crop weed segmentation in multi-spectral images.

REFERENCES

[1]Zhang, S. W., Shang, Y. J., & Wang, L. (2015). “Plantdisease recognition based on plant leaf image.” Journal ofAnimal & Plant Sciences, 25(3), 42-45.

[2]K. Jagan Mohan, M. Balasubramanian, S. Palanivel, “Detection and Recognition of Diseases from Paddy PlantLeaf Images ", IJCA, Volume 144 – Number 12, Page No.34-41

[3] Santiago, W. E., Leite, N. J., Teruel, B. J., Karkee, M.,Azania, C. A. M. et al. (2019). Evaluation of bag-of-features (BOF) technique for weed management in sugarcane production. Australian Journal of Crop Science, 130(11), 0 1819. https://doi.org/10.21475/

[4] Bakhshipour, A., & Jafari, A. (2018). Evaluation of support vector machine and artificial neural networks in weed detection using shape features. Computers and Electronics in Agriculture, 145, 0 153–160. https://doi.org/10.1016/j.compag.2017.12.032

[5] Diptesh Majumdar, Dipak Kumar Kole, Aruna Chakraborty, Dwijesh Dutta Majumder, REVIEW: DETECTION & DIAGNOSIS OF PLANT LEAF DISEASE USING INTEGRATED IMAGE PROCESSING APPROACH, International Journal of Computer Engineering and Applications, Volume VI, Issue-III June 2014

ISBN: 978-81-965236-7-1

[6] Hiteshwari Sabrol, Satish Kumar, Recent Studies of Image and Soft Computing Techniques for Plant Disease Recognition and Classification, International Journal ofComputer Applications (0975 –8887)
Volume 126 – No.1, September 2015

[7] A. Abdalla, H. Cen, L. Wan, R. Rashid, H. Weng, W. Zho u, e t al. Fine-tuning convolutional neural network with transfer learning for semantic segmentation of ground-level oilseed rape images in a field with high weed pressure Comput Electron Agric, 167 (2019), p. 105091, 10.1016/j.compag.2019.105091

[8]Y. Majeed, M. Karkee, Q. Zhang, L. Fu, M.D. Whiting Determining grapevine cordon shape for automated green shoot thinning using semantic segmentation based deep learning networksComput ElectronAgric, 171 (2020), p. 105308, 10.1016/j.compag.2020.105308

[9] Singh, V., & Misra, A. K. (2015, March). “Detection of an unhealthy region of plant leaves using Image Processing and Genetic Algorithm.” In Computer Engineering and Applications (ICACEA), 2015 International Conference on Advances in (pp. 1028-1032).IEEE.

[10]Y. Lu and S. Young, ``A survey of public datasets for computer vision tasks in precision agriculture,'' Comput. Electron. Agricult., vol. 178, Nov. 2020.

[11]P. Napoletano, ``Hand-crafted vs learned descriptors for color texture classification,'' in Computational Color Imaging, vol. 10213. Cham, Switzerland: Springer, 2017.

[12]K. Chatfield, K. Simonyan, A. Vedaldi, and A. Zisserman, ``Return of the devil in the details: Delving deep into convolutional nets,'' 2014.

[13]D. P. Hughes and M. Salathe, ``An open access repository of images on plant health to enable the development of mobile disease diagnostics,,, 2015.

[14]C. Shorten and T. M. Khoshgoftaar, ``A survey on image data augmentation for deep learning,'' J. Big Data, vol. 6, no. 1, p. 60, 2019

[15]X.-X. Niu and C. Y. Suen, ``A novel hybrid CNNSVM classier for recognizing handwritten digits,'' Pattern Recognit., vol. 45, no. 4, pp. 13181325, Apr. 2012

E-Voting System using Ethereum Network

[1]Mrs.G.Sugapriya,
[2]Ms.V.Hema, [3]Ms.M.Subashini, [4]Ms.D.Swetha
[1]Assistant Professor, Department of Computer Science and Engineering,
[2,3,4]UG Student, Department of Computer Science and Engineering,
Sri Bharathi Engineering College for Women, Kaikurichi, Pudukkottai – 622 303.

Abstract: **An e-voting system using the ethereum network is an electronic voting platform that utilizes blockchain technology to enable secure, transparent, and decentralized voting. Ethereum is a distributed computing platform that allows for the creation of decentralized applications, including e-voting systems. The system operates on a peer-to-peer network, and each vote is recorded on the ethereum blockchain, which is immutable and tamber-proof. The platform ensures that each vote is recorded accurately and can be verified by anyone on the network. Additionally, the use of smart contracts on the ethereum network eliminates the need for intermediaries, such as election officials or third-party auditors, reducing the potential for fraud and corruption. The e-voting system using ethereum also faces challenges, such as technical complexity and scalability limitations. To ensure the system's security and accuracy, rigorous testing and auditing are required, which can be costly and time-consuming. In this paper we store the details of voting in all systems. So that no one can edit the details of voting once entered in system. To ensure the system's security and accuracy, rigorous testing and auditing are required, which can be costly and time-consuming. In this paper we store the details of voting in all systems. So that no one can edit the details of voting once entered in system.**

Keyword:* *Ethereum blockchain, Smart-contracts, Peer-to-peer network, Decentralized, Tamber-proof.

1. INTRODUCTION:

Electronic voting (E-voting) is a modern approach to voting that utilizes digital technologies to facilitate the electoral process. E-voting has the potential to provide a more secure, transparent, and efficient voting system compared to traditional paper-based systems. One of the most promising technological solutions for e-voting is blockchain technology, which offers decentralization, immutability, and transperancy. Ethereum is a popular blockchain platform that allows the development of decentralized applications (DApps) using smart contracts. Smart contract are self-executing computer programs that can automate the enforcement of rules and regulations. This makes ethereum an ideal platform for developing e-voting systems. Using ethereum, and e- voting system can be developed that allows votes to cast their votes securely and anonymously. The bockchain provides transparency, making it possible to verify the integrity of the voting process. The use of smart contracts ensures that the voting rules are enforced automatically, reducing the need for human intervention. E-voting using the ethereum network has the growing demand for more secure and transparent voting systems, the future of e-voting using ethereum looks promising.

2. SYSTEM ARCHITECTURE:

An e-voting system using the Ethereum network provides a secure and transparent way for voters to cast their votes in an election. The decentralized nature of the Ethereum network ensures that votes are recorded accurately and transparently, while the smart contract ensures that the rules and regulations governing the e-voting system are followed.

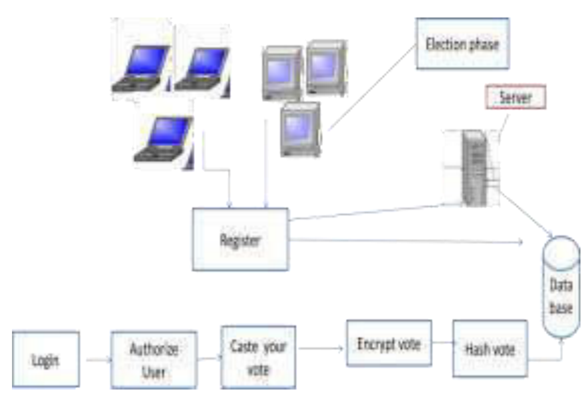


Figure 1.1 System Architecture

ISBN: 978-81-965236-7-1

3. EXISTING SYSTEM:

A finger sensor system typically consists of several components, including:

- Sensor: A small electronic component that is used to capture an image of the fingerprint. The sensor may use a variety of technologies, such as optical, capacitive, ultrasound.
- Database: A database that is used to store the fingerprints of authorized users. When a fingerprint is scanned, the processor compares it to the finerprint in the database to determine if there is a match.
- User Interface: A user interface that allows users to interact with the system, such as by scanning their fingerprint or entering a password.
- Software: Software that is used to manage the fingerprint sensor system, such as by adding or removing users from the database, configuring system settings, and generating reports.
- Power Supply: A power supply that is used to provide electricity to the fingerprint sensor system. This may be a bettery or a wired power source.

4. PROPOSED SYSTEM:

An e-voting system using the ethereum network is an interesting idea. Here's a high-level overview of how such a system might network:

- User Registration: The first step would be create a system for users to register to vote. This could be done through a web portal that would require users to provide their personal information and proof of identity. Once verified, the user's identity would be added to the ethereum network.
- Smart Contract creation: The next step would be to create a smart contract that would represent the election. The contract would specify the results of the rules of the election, including the eligible voters, the candidates, the voting period, and the criteria for winning.
- Voter Authentication: On election day, voters would log into the system using their unique ethereum identity, which would be authenticated against the list of eligible voters.
- Casting votes: once authenticated, voters would be able to cast their vote by sending a transaction to the smart contract that.
- Vote Tally: At the end of the voting period, the smart contract would automatically tally the votes and declare the winner based on the predefined criteria.
- Result Verification: After the election, anyone could review the result by querying the smart contract and verifying the vote counts. Since the blockchain is immutable, the results would be transparented and tamber-proof.

However, there are still some challenges that would need to be addressed, such as ensuring the privacy of the voters and protecting against attacks on the ethereum network itself.

5. ALGORITHM:

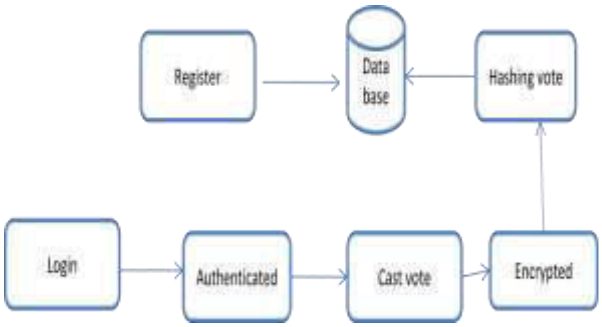
A Smart contract should be developed using the solidity programming language on the etereum network. This smart contract will be responsible for managing the voting process, storing the votes, and computing the results.

The smart contract will need to define the rules for the election, including the number of candidates, the number of votes each voter is allowed to cast, and the deadline for voting. Before the election begins, voters will need to register with the e-voting system. The voter's ethereum address will be used to verify their identity, and each voter will only be allowed to register once. Once the voter is registered, they can cast their vote using ethereum wallet. The voter will send a transaction to the smart contract indicating their vote. The smart contract will validate the vote and record it. After the voting deadline has passed, the smart contract will count the votes and determine the winner. The winner will be determined based on the rules defined in the smart contract. Once the winner has been determined, the e-voting will announce the results on the ethereum network.

The result will be publicly visible and verifiable, allowing anyone to confirm the accuracy of the results. To ensure the security of the e- voting system, the smart contract code should be audited by security experts the identity any vulenerabilities. Additionally, access to the e-voting system should be restricted to authorized users to prevent unauthorized access or tampering. Overall, an e-voting system using the ethereum network can provide a secure, and decentralized way to conduct elections.

ISBN: 978-81-965236-7-1

6. DATA FLOW DIAGRAM:



MODULES:

Registration
Login
Voting
Result

Modules Description

Registration:

Registration module is used for registering the user account into the system used validate details. Enter all the required fields and click register button. Students would register their details to get a separate login so that they can perform their assigned their login.

Login:

A login page is a web page or an entry page to a website that requires user identification and authentication, regularly performed by entering a username and password combination. The student can login their account using their user id and password any number of times for completing all their tasks.

Voting:

A voting module is a software component or application that allows users to cast their votes in an election or poll. The module typically consists of a user interface that allows voters to input their selections, as well as backend logic that tallies the results and ensures that the voting process is fair and secure. The voting module can be designed to handle different types of elections, such as single or multiple-choice elections, or elections with ranked or weighted voting. It can also be integrated with other systems, such as a voter registration system, to ensure that only eligible voters are allowed to participate.

Result:

A voting result module typically displays the results of an election or poll in a clear and concise manner, allowing viewers to easily understand the outcome. The module may include a variety of information, such as:

- ➢ Total number of votes cast.
- ➢ Number of votes received by each candidate or option.
- ➢ Percentage of votes received by each candidate or option.
- ➢ Presentation of the vote distribution (e.g., bar graph, pie chart, etc.)
- ➢ Any relevant comments or explanations about the voting process or results.

7. CONCLUSION:

In conclusion, an e-voting system based on the ethereum network can offer numerous advantages such as increased security, transparency, decentralization, and accessibility. However, the implementation of such a system may also come with some challenges, including complexity, scalability, and cost issues. To ensure the success of an e-voting system project using the ethereum network, it is crucial to carefully evaluate and address these challenges. This may involve engaging experienced developers with the technical expertise required to develop, deploy, and maintain the system, as well as implementing measures to ensure scalability and manage costs. Overall, an e-voting system based on the ethereum network has the potential to revolutionize the voting process, providing a secure, transparent, and weigh the pros and cons and ensure that the system is designed and implemented in a way that maximizes its benefits while minimizing its potential drawbacks.

8. FUTURE ENHANCEMENT:

E-voting using the ethereum network is a potential future enhancement that could bring greater transparency, security, and accessibility to the voting process. Ethereum is a blockchain-based platform that allows for the development of decentralized application, including smart contract that can automate the execution of agreements and transaction. Firstly, the decentralized nature of the ethereum network means that all transactions are publicly recorded on the blockchain, making the voting process more transparent and auditable.

ISBN: 978-81-965236-7-1

Secondly, the use of smart contract could help to prevent fraud and tampering by automating the vote counting process and ensuring that each vote is accurately recorded. Thirdly, e-voting on the ethereum network could be accessible to anyone with an internet connection, potentially increasing voter turnout and making the voting process more convenient. Finally, there are also potential challenges and limitation to implementing e-voting on the ethereum network. For example, there are concerns around the security of internet- based voting systems, and ensuring the privacy and anonymity of voters would be critical. Additionally, the ethereum network can be slow and expensive to use, which could make it difficult to scale e-voting to larger population.

7. REFERENCES:

[1] Murali R Prasad, Polaiah Bojja and Madhu Nakirekanti, "AADHAR based Electronic Voting Machine using Arduino, International Journal of Computer Applications "Vol. 145(12), pp.39-42, July 2016.

[2] Hari K. Prasad et.al., "Security Analysis of India's Electronic Voting Machines, International Journal of Engineering Science", October 4th 2010.

[3] Julius Mutebi ,Emily Bagarukayo , Ivan Ssempebwa , Michael Kalanda, "Online Voting System with Reliable Voter Authentication Protocols", 2018 IST-Africa Week Conference (IST-Africa).

[4] Idongesit Efaemiode Eteng, paul umoren, "An Online Voting System for Colleges and Universities", publication/326059800 May 2018.

[5] Saurabh Yadav and Ajay Kr. Singh, "A Biometric Traits based Authentication System for Indian Voting System, International Journal of Computer Applications". (0975 – 8887) Volume 65,pp.15, March 2013.

[6] Prof. R.L. Gaike, Vishnu P. Lokhande, Shubham T. Jadhav and Prasad N. Paulbudhe, "Aadhar Based Electronic Voting System", Vol. 1, Issue 2 May 2016, ISSN (Online) 2456-0774 international journal of advance scientific research and engineering trends.

[7] Soumyajit Chakraborty1, Siddhartha Mukherjee1, Bhaswati Sadhukhan1 and Kazi Tanvi Yasmin1, "Biometric Voting System", Vol. 4, Issue 4, April 2016.

[8] Firas Hazzaa, Seifedine Kadry,"New System of E-voting Using Fingerprint, International Journal of Emerging. Technology and Advanced Engineering",Vol. 2, pp 355-363, 2012.

[9] Sobia Baig, Ummer Ishtiaq, Ayesha Kanwal, Usman Ishtiaq, and M. Hassan Javed, "Electronic Voting System Using Fingerprint Matching with Gabor Filter, Proceedings of International BhurbanConference on Applied Sciences & technology Islamabad, Pakistan", pp 130- 135, 2011.

ISBN: 978-81-965236-7-1

A Review on Deep Ensemble Models to Detect an Classify Intruder Behavior

EL.Thanga Uma,
Assistant Professor,Department of Computer Science and Engineering,
Sri Bharathi Engineering College for Women, Pudukkottai-622 303, Tamilnadu, India.
Email: uma085@gmail.com

Abstract - **Intrusion Detection Systems(IDS) can be used to find intrusions in computer networks, cloud computing, and data systems. It involves challenging to demonstrate that these systems are secure and to maintain their security while they are in use. The Deep Ensemble Model for Intrusion Detection and Classification is a solution to these issues. The application of this approach consists of three primary stages: classification, best feature selection, and feature extraction. Among the tasks performed during the feature extraction step are feature reduction, feature conversion, and data standardization. The data provided is the first standard using an improved data normalization technique. Following the normalization of the data, feature conversion is carried out. For feature reduction, the Principal Component Analysis (PCA) approach is employed. Then, from the smaller pool that is left, the best traits are selected. To do this, we suggest applying the SUSSO (Self-Upgraded Squirrel Search Optimization) method.**

Keywords—PCA, SUSSO, IDBN, RNN

I INTRODUCTION

Cloud computing describes a brand-new Internet-based infrastructure that consumers lower-cost access to a range of computer and information technology (IT) features are OS, data storage services, network architecture, hardware parts, and software application suites. The notion of cloud computing and the advancements in Internet technology provides widespread accessibility of computer resources [1]. through a variety of on-demand service models, these cloud resources are made available to client applications. The services cloud computing provided are referred as "Software- as-a-Service" (SaaS), "Infrastructure-as-a-Service" (IaaS), "Platform-as-a-Service" (PaaS), and "Expert-as-a-Service" (EaaS) [7]. IDS is a vital component of network security in Web-based software, including e-commerce platforms, plays a critical role in identifying cyber attacks. They accomplish this by analyzing a wide range of networked data records. Network security has grown in significance for websites and web-based applications in recent years. An intrusion detection system (IDS) can identify intrusions in two ways: either by using anomaly detection, which focuses on identifying deviations from typical patterns that may signal intrusions, or by using abuse detection[8], which uses system vulnerabilities or known attack patterns to identify intrusions. These two approaches are explained in this article.

Since cloud computing intrusion detection is a challenging task, a significant amount of data security research has been done to find and stop intrusions [9]. When used in tandem with firewalls, effective intrusion detection systems aim to reduce false negatives and increase detection rates, improving overall security.

It is often difficult for traditional intrusion detection systems to react to new incursions, data mining and meta-heuristic algorithms based on information gathered from several sources have been adopted [10]. Fuzzy Clustering Algorithms, Artificial Bee Colony (ABC) algorithm, and Artificial Neural Networks (ANNs) are the three parts of a novel technique that combines these three techniques. While ANNs can function independently in an IDS, their combined use with fuzzy clustering and ABC improves system performance [11]. By dividing the dataset into homogenous groupings, fuzzy clustering speeds up the training process. By creating homogenous subsets of the training data, this is achieved. In order to link loads and preferences more quickly and efficiently, ABC helps the ANN discover the ideal values. It may take some time and work to integrate these two algorithms into the ANN, but [15]. If one wishes to enhance the detection of rogue nodes, they may want to take into account putting adaptive optimization principles into practice [16].

II LITERATURE REVIEW

A new IDS has been developed, according to Hajimirzaei and Navimipour [1] (2018), by combining fuzzy clustering techniques, the Artificial Bee Colony (ABC), and the Multilayer Perception (MLP) network. The MLP was utilized by the authors to distinguish between normal and anomalous traffic packets. Additionally, they adjusted the link weights and intrinsic biases of the MLP using the ABC technique.

In 2018, Seth and Chandra [2] developed a cloud-based DOS attack detection model (CDOSD) using Binary Artificial Bee Colony Optimization (BABCO) and a DT classifier. After extracting characteristics from the gathered dataset using BABCO, the authors classified the elements using the DT Classifiers.

ISBN: 978-81-965236-7-1

Using distributed denial of service tools, a real- time attack on a cloud server was conducted to assess the efficacy of the concept. The data showed that the CDOSD model was adequate, with a lower false positive rate and improved accuracy.

Based on the Voting Extreme Learning Machine (V-ELM), Kushwah and Ranga [4] presented a novel approach in 2020 for identifying distributed denial of service (DDoS) attacks in cloud computing environments. Two benchmark datasets were utilized in the experiments to assess the effectiveness of the system: The NSL-KDD and ISCX intrusion detection datasets are two that are frequently used in intrusion detection. Additionally, a number of tests were conducted to look into how well the system performed with various parameter values, such as the amount of ELMs in V-ELM and the number of neurons in a single ELM's hidden layer.

Tummalapalli and Chakravarthy [7] developed a clustering and two-level classifier-based cloud-based intrusion detection system in 2020. The nodes were first grouped using Bayesian fuzzy clustering, and the groupings' likelihood of compromise was then predicted using a two-tiered gravitational group search-based support vector neural network (GG-SVNN) classifier. The gravitational search algorithm and the group search optimizer were combined by the GG-SVNN technique. The number of compromised nodes was ascertained by the level 2 classifier using the compacted intrusion data that it had acquired from the level 1 classifier. In 2020, Rabbani et al. [8] introduced a novel technique to enhance the Cloud service's capacity to simulate user behavior. To find and identify bad actors in the cloud, a particle swarm optimization-based probabilistic neural network (PSO-PNN) was employed. After the users' behaviors were interpreted in an intelligible way, a multilayer neural network was utilized to identify dangerous conduct. A detailed examination of the test results validated the method's potential utility for security monitoring and anomaly detection.

Table 1: Characteristics of detecting harmful activity in cloud computing

Adopted Methodology	Features	Challenges
fuzzy clustering technique, artificial bee colony (ABC) network, and multilayer perceptron (MLP) network	Minimize the square root of the error, often known as the mean absolute error (MAE). raises the kappa value	Training efficiency must be increased. There have to be tweaks made to improve the detection's precision.
CDOSD	The accuracy of detection has been enhanced. Low rate of false positives	It is feasible to determine more host characteristics.
FCM-ANN	A high degree of precision in the detection The low percentage of false alarms	It is recommended that the classifier's capacity for learning be improved.
Voting extreme learning machine (V-ELM)	Enhanced precision	The use of resources is significantly higher than average. There needs to be more emphasis placed on maintaining security.
DLMNN	Better overall recall value. The results for F-measure and accuracy are significantly	more excellent. Enhances should be made to achieve better compression times and ratios.

III.METHODOLOGY

Many firms are outsourcing their data and computing needs in order to take advantage of the rapid advancements in computer technology. Upholding security criteria like confidentiality, availability, and integrity is crucial for cloud-based computing, so a highly secure platform should be on focus.

Knowing the entire behavioral space that malware resides in offers a significant advantage over more traditional protection approaches. This proposal includes a novel approach to enhance cloud service providers' ability to simulate the behavior of their clients. Proposed feature extraction, ideal feature selection, and attack categorization are the three main steps that must be completed in order to identify and recognize hazardous conduct.

ISBN: 978-81-965236-7-1

IV. Conclusion

A brand-new intrusion detection system is analysed in order to reduce the dangers connected with recurrent invasions and technical issues in computer networks. The three main phases of this model are categorization, ideal feature selection, and feature extraction. Three steps are involved in the feature extraction phase: feature reduction, feature conversion, and data normalization. An enhanced data normalization method is used to the input data. Following normalization, feature conversion is applied to the data. The PCA method is then applied to the modified features in order to reduce their feature count. The optimal feature selection procedure is then applied to the reduced features, and the most pertinent portions are chosen by using the SUSSO algorithm. The characteristics that were chosen are then sent on to the classification phase, where an ensemble model made up of classifiers from the Improved Deep Belief Network (IDBN), Recurrent Neural Network (RNN), and Deep Maxout Network is used. The Deep Maxout Network receives the classifications produced by the IDBN and RNN classifiers, which use the chosen features as input. By using the suggested SUSSO technique, the Deep Maxout Network's weights are adjusted. Lastly, a variety of intrusions, such as worms, analysis, DoS, backdoors, shellcode, exploits, generic, standard, fuzzes, and reconnaissance will be detected by the system's output.

References

[1] Bahram Hajimirzaei1 and Nima Jafari Navimipour," Intrusion detection for cloud computing using neural networks and artificial bee colony optimization algorithm," ICT Express, January 2018

[2] N. Pandeeswari & Ganesh Kumar, "Anomaly Detection System in Cloud Environment Using Fuzzy Clustering Based ANN," Mobile Network Application, 2016

[3] Gopal Singh Kushwah and Virender Ranga, "Voting extreme learning machine based distributed denial of service attack detection in cloud computing," Journal of Information Security and Applications, vol.53, 2020

[4]. Deevi Radha Rani, G. Geethakumari, "Secure data transmission and detection of anti-forensic attacks in cloud environment using MECC and DLMNN," Computer Communications, November 2019

[5]. Ahmad Shokoohsaljooghi and Hamid Mirvaziri, "Performance improvement of an intrusion detection system using neural networks and particle swarm optimization algorithms," International Journal of information technology, 2019

[6]. Siva Rama Krishna Tummalapalli and A. S. N. Chakravarthy, "Intrusion detection system for cloud forensics using Bayesian fuzzy clustering and optimization based SVNN," Evolutionary Intelligence, April 2020

[7] Mahdi Rabbani, Yong Li Wang, Reza Khoshkangini, Hamed Jelodar, Ruxin Zhao, Peng Hu, "A hybrid machine learning approach for malicious behavior detection and recognition in cloud computing," Journal of Network and Computer Applications, vol.151, 2020

[8] Jagsir Singh, Jaswinder Singh, "Detection of malicious software by analyzing the behavioral artifacts using machine learning algorithms," Information and Software Technology, vol.121, May 2020

[9] Shamsul Huda, Suruz Miah, John Yearwood, Sultan Alyahya, Robin Doss, "A malicious threat detection model for cloud-assisted internet of things (CoT) based industrial control system (ICS) networks using deep belief network," Journal of Parallel and Distributed Computing, vol.120, pp. 23-31, October 2018

[10] Amandeep Singh Sohal, Rajinder Sandhu, Sandeep K. Sood, Victor Chang, "A cybersecurity framework to identify malicious edge device in fog computing and cloud-of-things environments," Computers & Security, vol.74, pp.340-354, May 2018

[11] Abdulaziz Aldribi, Issa Traoré, Belaid Moa, Onyekachi Nwamuo, "Hypervisor-based cloud intrusion detection through online multivariate statistical change tracking," Computers & Security, vol.88, January 2020

[12] Sahil Garg, Kuljeet Kaur, Shalini Batra, Gagangeet Singh Aujla, Rajiv Ranjan, "En-ABC: An ensemble artificial bee colony based anomaly detection scheme for cloud environment," Journal of Parallel and Distributed Computing, vol.135, pp. 219-233January 2020

[13] Preeti Mishra, Ishita Verma, Saurabh Gupta," KVM Inspector: KVM Based introspection approach to detect malware in a cloud environment," Journal of Information Security and Applications, vol.51, April 2020

[14] G. Somani, M. S. Gaur, D. Sanghi, M. Conti, and M. Rajarajan, "Scale Inside-Out: Rapid Mitigation of Cloud DDoS Attacks," in IEEE Transactions on Dependable and Secure Computing, vol. 15, no. 6, pp. 959-973, 1 Nov.-Dec. 2018

[15] O. Alkadi, N. Moustafa and B. Turnbull, "A Review of Intrusion Detection and Blockchain Applications in the Cloud: Approaches, Challenges and Solutions," in IEEE Access, vol. 8, pp. 104893-104917, 2020

[16]. A. Sahi, D. Lai, Y. Li, and M. Diykh, "An Efficient DDoS TCP Flood Attack Detection and Prevention System in a Cloud Environment," in IEEE Access, vol. 5, pp. 6036-6048, 2017

[17] S. Dong, K. Abbas, and R. Jain, "A Survey on Distributed Denial of Service (DDoS) Attacks in SDN and Cloud Computing Environments," in IEEE Access, vol. 7, pp. 80813-80828, 2019

A Mathematical Model for Nonlinear Optimization Which Attempts Membership Functions to Address the Uncertainties

Mrs.R.USHA
Assistant Professor, Department of Mathematics,
Sri Bharathi Engineering College for Women, Pudukkottai-622 303 , Tamilnadu, India.
Email:ushaclever21@gmail.com

Abstract:

The problem of optimizing an objective function that exists within the constraints of equality and inequality is addressed by nonlinear programming (NLP). A linear program exists if all of the functions are linear; otherwise, the problem is referred to as a nonlinear program. The development of highly efficient and robust linear programming (LP) algorithms and software, the advent of high-speed computers, and practitioners' wider understanding and portability of mathematical modeling and analysis have all contributed to LP's importance in solving problems in a variety of fields. However, due to the nature of the nonlinearity of the objective functions and any of the constraints, several practical situations cannot be completely explained or predicted as a linear program. Efforts to overcome such nonlinear problems quickly and efficiently have made rapid progress in recent decades. The past century has seen rapid progress in the field of nonlinear modeling of real-world problems. Because of the uncertainty that exists in all aspects of nature and human life, these models must be viewed through a system known as a fuzzy system. In this article, a new fuzzy model is proposed to address the vagueness presented in the nonlinear programming problems (NLPPs). The proposed model is described; its mathematical formulation and detailed computational procedure are shown with numerical illustrations by employing trapezoidal fuzzy membership functions (TFMFs).Here, the computational procedure has an important role in acquiring the optimum result by utilizing the necessary and sufficient conditions of the Lagrangian multipliers method in terms of fuzziness. Additionally, the proposed model is based on the previous research in the literature, and the obtained optimal result is justified with TFMFs. A model performance evaluation was completed with different set of inputs, followed by a comparison analysis, results and discussion. Lastly, the performance evaluation states that the efficiency level of the proposed model is of high impact. The code to solve the model is implemented in LINGO, and it comes with a collection of built-in solvers for various problems.

Keywords: nonlinear optimization; fuzzy nonlinear programming problem; Lagrangian multiplier method in terms of fuzziness; fuzzy numbers; trapezoidal membership functions; ranking index.

Introduction

NLP typically describes rather more significant challenges than LP. The situation is perhaps always difficult if all of the constraints are linear and the objective function is nonlinear. For example, the feasible set may or may not be convex, and the optimum result could be placed within the feasible set, on its boundary, or at its vertex. For the most part, the scientific programming issue manages the ideal use or distribution of constrained assets to meet the ideal goal. The fuzzy NLP issue is valuable in taking care of issues due to the uncertain, emotional nature of the problematic definition, or due to its precise arrangement. In this case, an objective function must improve while working within certain constraints. Ref [1] introduced the theory of fuzzy and fuzzy decision-making, and the right decision used in decision problems to attain the optimum result [2]. Finally, the evaluation of the optimal results for the mentioned two cases reveals the newness and cost effectiveness so far fuzzy model, addressing the ambiguity and providing significantly more optimum values.

Literature Survey

This section highlights certain identified research work collections of existing fuzzy NLP, as shown below: Fuzzy programming techniques are likely to have a broader range of applications for nonlinear optimization and also stochastic optimization, specifically for allocation problems in supply chain management. A genetic algorithm technique has been used to illustrate the nonlinear transportation problem as an improved version of their previous findings for linear transportation problems, which obtained feasibility due to chromosome structures and genetic operators [19]. An innovative application for nonlinear network flow problems has been presented, which is strong enough to handle mixed-integer nonlinear optimization problems that in corporate an online a transportation problem with the best solution[20].

ISBN: 978-81-965236-7-1

The outcomes are compared to a proposed approach for the design of the lowest cost canal sections in Newton's method, which is applied to KKT conditions for the constrained into unconstrained NL optimization problems with standard algorithms [28].The fuzzy-based Lagrangian method can be described as the digital information mechanism to support vector machines for readily accessible biomedical data interpretation [29].

Preliminaries

In this section, some essential primary concepts and backgrounds are outlined in fuzzy mathematics[5,6].Nowitseemstoaddressafewdefinitionswhicharemostrequired:

Definition1

Let $T=[t_1,t_2,t_3,t_4]$ *beatrapezoidalfuzzynumberwiththefollowingMF,*

$$\mu_T(x)=\left\{\begin{matrix} \frac{x-t1}{t2-t1}, t1 \le x \le t2 \\ 1, t2 \le x \le t3 \\ \frac{x-t3}{t3-t4,}, t3 \le x \le t4 \end{matrix}\right\}$$

TheMF $\mu_T(x)$ *isillustratedintheFigure1below*

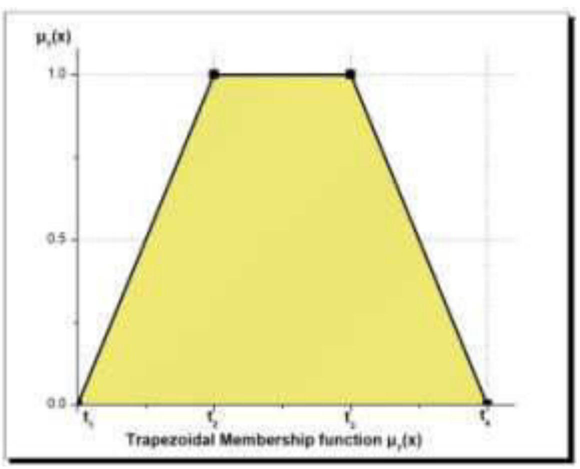


Figure1. TrapezoidalMembershipfunction$\mu_T(x)$.

Definition2

LetafuzzysetTinXandanyrealnumberαin[0,1],thentheα-cutof T, denoted by $^{\alpha}T$ *is the crisp set* $^{\alpha}T=\{x\in X : \mu_T(x) \ge \alpha\}$. *For illustration, let T be a fuzzy set whosemembershipfunctionisgivenasabove*$\mu_T(x)$.

Tofindtheα-cutofT,whereα$\in[0,1]$,*letus set the reference functions of T to each left and right.*

Expressing xtoα, where$x^{(1)}=(t_2-t_1)\alpha+t_1$ *and* $x^{(2)}=t_4+(t_3-t_4)\alpha$ *which provides the α−cut of T is*

$$^{\alpha}T=[x^{(1)},x^{(2)}]=[(t_2-t_1)\alpha+t_1,t_4+(t_3-t_4)\alpha].$$

An Optimization Model for Fuzzy Nonlinear Programming

Research emphasison fuzzy optimization issues in the area of NLP is mainly limited. However, little attention has focused on NLP, such as within quadratic programming, separable programming and search methods, and many others. However, apart from that, there are several numerous forms of fuzzy NLP addressed extensively in various significant issues, mostly in complex industrial systems. Research emphasis on problems of fuzzy optimization in the field of NLP is generally limited. Furthermore, there is little interest in NLP to address the vagueness soft the issues. Besides this, in many real issues, many kinds of fuzzy NLPs occur, mainly in complex manufacturing systems. This cannot be signified and enlightened by traditional models. Meanwhile, scientific studies on modeling techniques and enhancing approaches for NLP in fuzzy situations are important not only from the frame work of fuzzy optimization but also in the application of the challenges.

Numerical Illustration

This section outlines two illustrative examples that canbe used to optimize the models for addressing the problem of fuzzy NLP using TFMF and its mathematical calculations[5–7,32]. In Case(i),the fuzzy model explains the procedure using the MF approach,and inCase(ii), the same problem was investigate during the robus tranking approach.

The NLP in the manner of fuzziness is as follows, and the fuzzified form of the considered NLPP can be stated as below:

Minimize

$$[-1,0,2,3]{x^{(k)}}^2+[-1,0,2,3]{x^{(k)}}^2+[-1,0,2,3]{x^{(k)}}^2,\text{forall } k=1,2,3,4.$$

ISBN: 978-81-965236-7-1

$x_1^{(k)}, x_2^{(k)}, x^{(k)} \geq 0$, for all $k=1,2,3,4$

$[-2x_2+2x_2\lambda, 0, 4x_2-4x_2\lambda, 6x_2-6x_2\lambda]=0$

$[-2x_3, -\lambda, 4x_3-3\lambda, 6x_3-4\lambda]=0$

$$2x_1-x_2^2-12, 3x_1+x_3-13, 5x_1+2x_2^2+3x_3-15, 6x_1+3x_2^2+4x_3-16=0$$

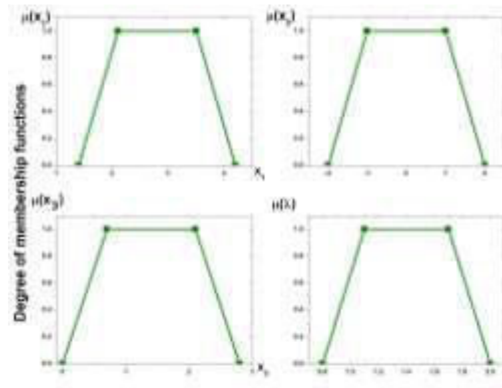
Solving the above the equations results in the extreme points,they are;

Extremepoint1:$(x_\circ,\lambda_\circ)$=[(1,1.5,2.5,3),(−2,0,4,6),(0,0.5, 1.5,2),(−1,0,2,3)]
Extremepoint2:$(x_\circ,\lambda_\circ)$=[(1,1.5,2.5,3),(−2,0,4,6),(0,0.5, 1.5,2),(−1,0,2,3)]

Extremepoint3:$(x_\circ,\lambda_\circ)$=[(1.4,2.1,3.5,4.2),(−2,−1,1,2),(0, 0.7,2.1,2.8),(0.8,1.1,1.7,2)]

By employing the sufficiency conditions to evaluate whether the extreme point sare maximum or minimum. Hence, the sufficient conditions for the LMM for minimizing the above NLPP as H=

[−2,−1,1,2]	[2,3,5,6]	[0,1,3,4]x_2	,1,3,4]
[2,3,5,6]	[0,1,3,4]	[−2,−1,1,2]	[−2,−1,1,2]
[0,1,3,4]x_2	[−2,−1,1,2]	[0,1,3,4]−[0,1,3,4]λ	[−2,−1,1,2]
[0,1,3,4]	[−2,−1,1,2]	[−2,−1,1,2]	[0,1,3,4]



The fuzzy vectors (x_1), (x_2), (x_3) and the Lagrangian multiplier (λ)

$\lambda^{(k)}$=[0.8,1.1,1.7,2]&$Z^{(k)}$=[−9.8,0,19.6,29.4],*for all* k=1,2,3,4.

Case(ii):The Robust Ranking Approach for NLP with Fuzzy MFs

The NLP in the manner off fuzziness i s as follows, and the fuzzified form of the considered NLPP can be stated as below:

Minimize

$[-1,0,2,3]x^{(k)2}+[-1,0,2,3]x^{(k)2}+[-1,0,2,3]x^{(k)2}$, *for all* k=1,2,3,4.

Subject to the constraints,

$$[2,3,5,6]x^{(k)}+[-1,0,2,3]x^{(k)2}+[0,1,3,4]x^{(k)}=[12,13,15,16], \textit{ for all } k=1,2,3,4.$$

$$x^{(k)}, x^{(k)}, x^{(k)} \geq 0, \textit{ for all } k=1,2,3,4$$

The confidence interval for each degree α & the trapezoidal structures will be characterized by the functions of α.

Therefore,

$[x^{(1)}, x^{(2)}]=T^L T^U=[(t_2-t_1)\alpha+t_1, t_4+(t_3-t_4)\alpha]$

$=[\alpha-1, \alpha-3]$

$R(T)=R[-1,0,2,3]=(0.5)*T^L T^U d\alpha=(0.5)(2)d\alpha=1$

ISBN: 978-81-965236-7-1

Using the proposed approach in the previous section, the fuzzy NLPP can be modified to the conventional crisp problem; the crisp problem is

$Minimize Z = x_1^2 + x_2^2 + x_3^2$

Subject to the constraints,

$$4x_1 + x_2^2 + 2x_1 = 14; x_1, x_2, x_3 \geq 0.$$

Now apply the existing conventional approach to the NLPP by using necessary and sufficientconditionsoftheLMMandobtainedtheoptimumsolutionfortheaboveis

$x_1 = 2.8, x_2 = 0, x_3 = 1.4$ $\lambda = 1.4$ & Minimum $Z = 9.8$.

Models Performance Evaluation with Different Sets of Inputs

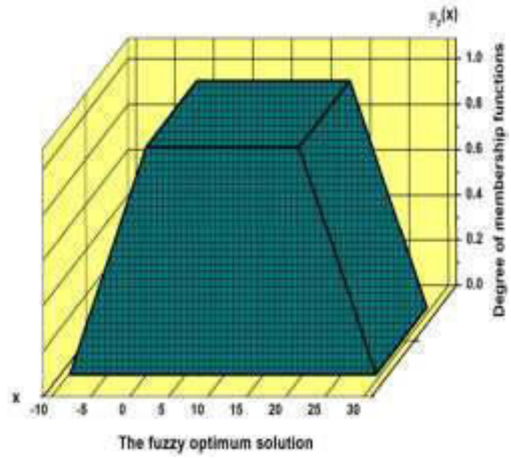
This section is encapsulated to determine the efficiency of the fuzzy model and its solutions. For this efficiency test,we have considered four different sets of inputs in fuzzy format and then, using the ranking function provided in the earlier section, wehave defuzzified all these inputs to obtain the equivalent crisp number. The fuzzy inputs are available in Table 1.With the defuzzified value, we have solved the model for each set using LINGO software and we have obtained the optimal solution for the NLPP.The results are given in Table1 and here it canbe easily observed that for any arbitrary set of trapezoidal fuzzy inputs,the model is solvable and gives the optimal solution. The code to solve the model is implemented in LINGO, and it comes with a collection of built-in solvers for various problems. The modeling environment is strictly aligned to the LINGO solver and because of this interconnectivity, it transmits problems directly to memory which results in the minimization of compatibility issues between the solver and modeling components. It uses multiple CPU cores for model simulation, thus giving faster results

Results and Discussion

Employing the suggested model numerical illustrations demonstrate that the optimum value of the FNLPP is [−9.8, 0, 19.6, 29.4], which might be a fresh attempt to clear the vagueness.The optimum solution for the fuzzified NLPPs will be continuously greater than −9.8 and lessthan 29.4, and the most likely outcome will be some where in the range of 0 and 19.6.The varieties in cost with significance probability can be seen in Figure 3. Additionally, obtained fuzzy optimum solutions x_{ij} might be empirically comprehended.

The decision maker perception,the entire value of the fuzzy NLPP,will be higherth−9.8and lessthan 29.4. The decision-maker for the entire fuzzy NLPP estimations are going to be bigger than or sufficient to 0 and less than or equivalent to 19.6. The extent of the favors of the decision-maker for the rest of the estimations of the entire fuzzy NLPP value has frequently been attained as below: Here x describes the significance of the entire NLPP,and also the perception of decision- makers for $\mu_{min}(X)$.

$$\mu_{min}(X) = \begin{cases} \dfrac{x+9.8}{9.8} for -9.8 \leq x \leq 0 \\ 1 for\ 0 \leq x \leq 9.6 \\ \dfrac{x-29.4}{9.8} for\ 19.6 \leq x \leq 29.4 \\ 0, \quad otherwise \end{cases}$$



Conclusions

Finally, an effort has been made to create a model that solves the problem of NLP in a fuzzy environment. The fuzzy version of the problem has been addressed using the necessary and sufficient conditions of Lagrangian multipliers in terms of fuzziness with the aid of an umerical illustration. This approach clarifies by solving two numerical illustrations; one is using MFs, and the other, the approach of robust rankings.MFs provide a significant role in the creation of a model in a fuzzy context.Most of there search techniques have been discussed in establishing only the MFs for the fuzzy objectives or constraints.However, this approach solved the mutually contradictory complexity ofthe objectives as well as constraints using MFs.This model offers an efficient approach to dealing with the problems of NLP.

ISBN: 978-81-965236-7-1

Therefore, the optimal solution has been signified through fuzziness with in the result and discussion.Additionally, the solution is explained by the manner of TFMs which have models of performance evaluation with different sets of inputs. This shows that the efficiency level of the model is of high impact. The code to solve the model is implemented in LINGO, and comes with a collection of built-insolvers for various problems. Furthermore, the comparison analysis could be a newly-designed effort to solve NLPs under fuzziness. The model focuses on addressing the decision-makers uncertainties and subjective experiences, and can help to solve decision-making issues. The model's future scope suggests that the model be used in other types of NLPPs or suitable nonlinear optimization models in upcoming models, preferably optimization models, under numerous fuzzy situations.

References

1. Zadeh,L.A. Information and Control.In Fuzzy Sets; World Scientific: Singapore,1965;Volume8,pp.338–353.
2. Zimmermann, H.-J. Fuzzy Sets, Decision Making, and Expert Systems; Springer Science & Business Media:Berlin/Heidelberg, Germany, 2012; Volume 10.
3. Vasant, P.; Nagarajan, R.; Yaacob, S. Fuzzy linear programming:A modern tool for decision making.In Computationa lIntelligence for Modelling and Prediction;Springer:Berlin/Heidelberg,Germany,2005;pp.383–401.
4. Kheirfam,B.;Hasani,F.Sensitivity analysis for fuzzy linear programming problems with fuzzy variables.Adv.Model.Optim. 2010,12,257–272.
5. Palanivel, K. Contributions to the Study on Some Optimization Techniques in Fuzzy Membership Functions; Bharathidasan University:Trichy, Tamil Nadu, India, 2013.
6. Palanivel,K Fuzzy commercial traveler problem of trapezoidal membership functions with in the sort of α optimum solution using ranking technique. Afr. Mat. 2016,27,263–277. [CrossRef]
7. Saranya,R.;Palanivel,K.Fuzzy nonlinear programming problem for inequality constraints with alpha optimal solution in terms of trapezoidal membership functions.Int. J. Pure Appl. Math. 2018, 119, 53–63.
8. Tang,J.;Wang,D.Anonsym metric model for fuzzy nonlinear programming problems with penalty coefficients. Comput.Oper. Res.1997, 24, 717–725. [CrossRef].
9. Tang,J.;Wang,D.;Ip,A.; Fung,R.Ahybridgenetic algorithm for a type of nonlinear programming problem.Comput.Math.Appl. 1998,36,11–22.[CrossRef]
10. Fung, R.Y.; Tang, J.; Wang, D. Extension of a hybrid genetic algorithm for nonlinear programming problems with equality and inequalityconstraints.Comput.Oper.Res.2002,29,261–274. [CrossRef]
11. Sarimveis,H.;Nikolakopoulos,A.Alineupevolutionary algorithm for solving nonlinear constrained optimization problems.Comput.Oper.Res.2005,32,1499–1514.[CrossRef]
12. Syau,Y.-R.;StanleyLee,E.Fuzzy convexity and multi objective convex optimization problems.Comput.Math.Appl.2006,52,351–362.[CrossRef]
13. Chen, S.-P. Solving fuzzy queueing decision problems via a parametric mixed integer nonlinear programming method. Eur. J. Oper. Res. 2007,177,445–457. [CrossRef]
14. Qin,X.S.;Huang,G.H.;Zeng,G.M.;Chakma,A.;Huang,Y.F.Aninterval-parameter fuzzy nonlinear optimization mode lfor stream water quality management under uncertainty. Eur. J. Oper. Res. 2007, 180, 1331–1357. [CrossRef]
15. Kassem, M.A.E.-H. Stability achievement scalarization function for multiobjective nonlinear programming problems.Appl. Math.Model.2008, 32, 1044–1055. [CrossRef]
16. Shankar, N.R.; Rao, G.A.; Latha, J.M.; Sireesha, V. Solving a fuzzy nonlinear optimization problem by genetic algorithm.Int. J. Contemp. Math. Sci. 2010,5,791–803.
17. Abd-El-Wahed, W.F.; Mousa, A.A.; El-Shorbagy, M.A. Integrating particle swarm

ISBN: 978-81-965236-7-1

optimization with genetic algorithms for solvingnonlinearoptimizationproblems.J.Comput.Appl.Math.2011,235,1446–1453.[CrossRef]

18. Jameel,A.F.; Sadeghi, A. Solving nonlinear programming problem in fuzzy environment. Int.J.Contemp.Math.Sci.2012, 7, 159–170.

19. Michalewicz,Z.;Vignaux,G.A.;Hobbs,M.A nonstandard genetic algorithm for the nonlinear transportation problem. ORSAJ. Comput.1991, 3, 307–316. [CrossRef]

20. Ilich,N.;Simonovic,S.P.Anevolutionprogramfor non-linear transportation problems.J.Heuristics2001,7,145–168.[CrossRef]

21. Hedar, A.-R.; Allam, A.A.; Deabes, W. Memory-Based Evolutionary Algorithms for Nonlinear and Stochastic Programming Problems. Mathematics2019, 7, 1126. [CrossRef]

22. Klanšek, U. A Comparison between Milp and Minlp Approaches to Optimal Solution of Nonlinear Discrete Transportation Problem. Transport 2014, 30,135–144. [CrossRef]

23. Das, A.; Bera, U.K.; Maiti, M. A profit maximizing solid transportation model under a rough interval approach. IEEE Trans. Fuzzy Syst.2016, 25, 485–498. [CrossRef]

24. Das, A.; Lee, G.M. A Multi-Objective Stochastic Solid Transportation Problem with the Supply, Demand, and Conveyance Capacity Following the Weibull Distribution. Mathematics2021, 9, 1757. [CrossRef]

25. Ahmadini,A.A.H.;Varshney,R.;Ali,I.Onmultivariate-multi objective stratified sampling design under probabilistic environment:A fuzzy programming technique. J.KingSaud. Univ.-Sci. 2021,33,101448. [CrossRef]

26. Khan, M.F.; Modibbo, U.M.; Ahmad, N.; Ali, I. Nonlinear optimization in bi-level selective maintenance allocation problem. J. KingSaud.Univ.-Sci.2022,34,101933. [CrossRef]

27. Ali,S.S.;Barman,H.;Kaur,R.;Tomaskova,H.; Roy,S.K.Multi-Product Multi Echelon Measurements of Perishable SupplyChain: Fuzzy Non-Linear Programming Approach. Mathematics 2021, 9, 2093. [CrossRef]

28. El-Sobky, B.; Abo-Elnaga, Y.; Mousa, A.A.A.; El-Shorbagy, M.A. Trust-Region Based Penalty Barrier Algorithm for Constrained Nonlinear Programming Problems: An Application of Design of Minimum Cost Canal Sections.Mathematics 2021,9, 1551. [CrossRef]

29. Gupta, D.; Borah, P.; Sharma, U.M.; Prasad, M. Data-driven mechanism based on fuzzy Lagrangian twin parametric-margin support vector machine for biomedical data analysis. NeuralComput. Appl. 2021,1–11. [CrossRef]

30. Lin,L.;Lee,H.-M.Fuzzy nonlinear programming for production inventory based on statistical data.J.Adv.Comput.Intell.Intell. Inform. 2016, 20, 5–12. [CrossRef]

ISBN: 978-81-965236-7-1

AN EXPERIMENTAL INVESTIGATION ON CONCRETE BY PARTIAL REPALCEMENT OF CEMENT BY SILICA FUMEAND FINE AGGREGATE BY RUBBER TYRE POWDER

[1]Mrs.P.Dennis flora
Assistant Professor,
Department of Civil Engineering
Sri Bharathi Engineering College for Women
Pudukkottai – 622303, India
[1]flora.dennis7@gmail.com

[2]S. Pushpaveni
Department of Civil Engineering
Sri Bharathi Engineering College for Women
Pudukkottai – 622303, India
[2]Pushpaveni200125@gmail.com

Abstract - **Concrete is a major building material which is used in construction throughout the world .It is extremely versatile and is used in all type of structure due to rapid growth in construction activity. The consumption of concrete is increased. Thus it is becoming inevitable to use alternative material for aggregates in concrete., In which to increase the market demand of cement, on other hand rising prices, to overcome such problems, we use industrial by product / waste like silica fumeand rubber tyre as the partial replacement of fine aggregate and cement it should be used to promoted for better performance as well as for environmental sustainability, which also increase strength than the conventional concrete.**

Keywords: Silica fume, Rubber tyre powder, Compressive strength.

INTRODUCTION

GENERAL

Waste materials resulting from various physical and chemical processes are the most important challenge in the industrial and developing countries. Extensive investigations on wastage recycling are being implemented to minimize the environmental damages. One of the non-recyclable materials enters the environment is automotive used tires. Large quantities of scrap tires are generated each year globally. This is dangerous not only due to potential environmental threat, but also from fire hazards. Over the years, disposal of tires has become one of the serious problems in environments. Land filling is becoming unacceptable because of the rapid depletion of available sites for waste disposal. Investigations show that used tires are composed of materials, which do not decompose under environmental conditions and cause serious contaminations. Burning is a choice for their decomposition; however, the gases exhausted from the tire burning results in harmful pollutions. In order to prevent the environmental problem from growing, recyclingtire is an innovative idea or way in this case. Recycling tire is the processes of recycling vehicles tires that are no longer suitable for use on vehicles due to wear or irreparable damage. Based on examinations, another way is using the tires in concrete. This results in the improvement of such mechanical and as energy adsorption, ductility, and resistance to cracking. However, this may cause a decrease in compressive strength of the concrete.

The cracker mill process tears apart or reduces the size of tire rubber by passing the material between rotating corrugated steel drums. By process an irregularly shaped torn particles having large surface area are produced and this particles are commonly known as rubber tyre. Mixing of rubber tyre particles with Portland cement concrete does not involve high temperature mixing hence final bond between the cement strength of the matrix. Portland cement concrete with addition of c rubber tyre powder becomes a heterogeneous mixture due to different specific gravities of the ingredients. The past research shows that rubber Portland cement concrete causes the reduction in strength, it improves certain durability aspects such as freeze thaw resistance, sound absorption, and damping properties and reduces water absorption.

Silicon metal and alloys are produced in electric furnaces .The raw materials are quartz, coal, and woodchips. The smoke that results from furnace operation is collected and sold as silica fume, rather than being land filled. In recent years, using silica fume in concrete in order to increase its strength has attracted much attention. Filling capability and pozzolanic property of silica fume results in filling the capillary gel pores with thismaterial and its compounds with calcium hydroxide. This phenomenon increases theconcrete strength significantly. The reaction of silica fume in concrete depends on the amount of this material. One of the main features of silica fume, which improves the properties of fresh and hardened concrete, is its fine particles. Most of the silica fume particles are in the range of 0.01- 0.3 micrometre and their mean particle size ranges between 0.1- 0.2 micrometre. It is apparent that silica grains, which are 100 times smaller than the cement particles, fill the free spaces between the cement and increase the concrete strength. Silica fume is available from suppliers of concrete admixtures and, when specified, is simply added during concrete production. Placing, finishing, and curing silica-fume concrete require special attention.

ISBN: 978-81-965236-7-1

RUBBER TYRE

Rubber tyre is a term usually applied to recycled rubber from automotive and truck scrap tires. During the recycling process steel and fluff is removed leaving tire rubber with a granular consistency. Continued processing with a granulator and/or cracker mill, possibly with the aid of cryogenics or mechanical means, reduces the size of the particles further. The particles are sized and classified based on various criteria includingcolour (black only or black and white). The granulate is sized by passing through a screen, the size based on a dimension (1/4") or mesh (holes per inch: 10, 20, etc.).Mesh refers to material that has been sized by passing through a screen with a given number of holes per inch. For example, 10 mesh crumb rubber has passed through a screen with 10 holes per inch resulting in rubber granulate that is slightly less than 1/10 of an inch. The exact size will depend on the size of wire used in thescreen.

Rubber tyre powder

SILICA FUMES

Silica fumes also known as micro silica is a fine-grain, thin, and very high surface area silica. It is sometimes confused with fumed silica (alsoknown as pyrogenic silica) and colloidal silica. These materials have different derivations, technical characteristics and application. Silica fumes is a by-product silicon metal or ferrosilicon alloys. One of the most beneficial uses for silica fumes is in concrete. Because of its chemical and physical properties, it is a very reactive pozzolana. Concrete containing silica fumes can have high strength and can be very durable. Silica fume is available from suppliers of concrete admixtures and, when specified is simply added during concrete production. Placing, finishing, and curing silica-fumes concrete require special attention on the part of the concrete contractor. A silica fume consists primarily of amorphous (non-crystalline) silicon dioxide (sio2). The individual particles are extremely small, approximately 1/1000th the size of an average cement particle. Because of its fine particles, large surface area, and the high sio2 content, silica fumes is a very reactive pozzolana when used in concrete. Silica fume for use in concrete is available in wet and dry forms. It is usually added during concrete production at a concrete plant as shown in the photo.

Fig.2 Silica fume

SILICA FUMES WORK IN CONCRETE

In cementitious compounds, silica fumes works on two levels, the first one described here is a chemical reaction called the pozzolanic reaction. The hydration (Mixing with water) of Portland cement produces many compounds including calcium silica hydrates (CSH) and calcium hydroxide (CH). The CSH gel is known to be the source of strength in concrete. When silica fumes is added to fresh concrete it chemically reacts with the CH to produces additional CSH. The benefit of this reaction is twofold, increased compressive strength and chemical resistance. The bond between the concrete paste and the coarseaggregate, in the crucial interfacial zone is greatly increased, resulting in compressive strengths that can exceed 15000 psi. The additional CSH produced by silica fume is more resistant to attack from aggressive chemicals then the weaker CH. The second function silica fume performs in cementitious compound is a physical one. Because silica fumes is 100 to 150 times than a cement particle it can fill the voids created by free water in the matrix. This function, called particle, packing, refines the microstructure of concrete, creating a much denser pore structure. Impermeability is dramatically increased, because silica fume reduces the number and size of capillaries that would normally enable contaminants to infiltrate the concrete. Thus silica fumes modified concrete is not only stronger, it lasts longer, because it‘s more resistant to aggressive environments. As filler and pozzolana silica fume‘s dual action in cementitious compounds are evident throughout the entire hydration process.

SCOPE

Now a day due to the rapid industrial growth, waste material management is a challenging field. It possesses lot of environmental impact. Due to the rapid growth in construction field, construction material scarcities will arise. So we need to find some alternate material for construction. Crumb rubber is a waste material from the scrap tyre. By using this as fine aggregate we can prevent the natural aggregate depletion. This avoids so much of environmental problems.

ISBN: 978-81-965236-7-1

OBJECTIVES

The main object of investigation is to study the strength behaviours of crumb rubber concrete with economical basis. Partially replacement of cement by using silica fumes up to 15%. Partiallyreplacement of sand by using crumb rubber up to 5%. To investigate the use of crumb rubber in conventional concrete. Find The Compressive Strength of concrete cubes with 5% to15% replacement of fine aggregate by crumb rubber with silica fume. Find The Split Tensile strength of concrete cylinder. Find The Flexural strength of concrete beam. Comparisons of all the above results with ordinary concrete.

REVIEW OF LITERATURE

A. Khan., S. Danish., S. Arif., S. Ramzan., M. Mushtaq (2013)

This paper, through experimental study and literary sources investigates the utilization of rubber waste in developing Green Concrete (GC). The natural aggregate (sand) of Conventional Concrete (CC) is replaced as 10%, 20% and 30% with coarse and fine rubber aggregate. The samples were tested in laboratory after a specific time on various aspects including compression strength and results were compared with each other and also with Conventional Concrete Mix (CCM). The paper concludes that structural and non-structural rubberized concrete can be developed by using specific quantity of rubber waste in placement of fine and coarse aggregates in conventional concrete. The key objective of this research is to find out an efficient solution for utilizing rubber waste for better environment and also to provide initiative for concerned government organization for framing effective legislation for the use of rubberized concrete in building and construction industries. It reveals from compressive strength's tests of rubberized concrete (RC) that it can be produced for various use in building and construction Industries. RC will not only save the natural ingredients of concrete resulting environmental sustainability but recycling of rubber waste will also contribute towards better environment. The replacement of 10 % of fine aggregate (sand) of Conventional Concrete (CC) with Fine Crumb Rubber (FCR) is useful for producing Structural Concrete. Therefore use of CCR concrete should be encouraged for use so that maximum consumption of waste rubber could be achieved.

K. C. Panda, P. S. Parhi and T. Jena (2012)

In this study an attempt has been made to identify the various properties necessary for the design of concrete mix with the coarse tyre rubber chips as aggregate in a systematic manner. In the present experimental investigation, the M20 grade concrete has been chosen as the reference concrete specimen. Scrap tyre rubber chips, has been used ascoarse aggregate with the replacement ofconventional coarse aggregate. Slump value is decreased as the percentage of replacement of scrap tyre rubber increased. So decrease in workability. The compressive strength is decreased as the percentage of replacement increased, but rubber concrete developed slightly higher compressive strength than those of without rubber concrete. The split tensile strength is increased with decreased percentage of scrap tyre rubber. Decrease in compressive strength, split tensile strength and flexural strength of the specimen. Lackof proper bonding between rubber and cement paste matrix.

G.SenthilKumaran, NurdinMushule, M.Lakshmipathy (2008)

This study reviews the feasibility of using waste tires in the form of chips and fibers with different sizes in concrete to improve the strength as well as protecting the environment. Also it reviews the potential application in the field by exploiting its unique characteristics and properties. In this study, we outline the use of rubberized concrete in structural and non-structural members and show how it is suitable for the concrete, its uses, barriers and benefits and way to future study. A research is underway using the grade of cement 53, to improve the strength, fine sand and coarse aggregate of a combination of 10mm and 20mm. The waste tyre rubber shall be used in the form of chips and fibers by partially replacing the coarse aggregate by 0, 5, 10, 20 and 25%.Recycling technology for concrete has significantly developed in the recent years, making the material sufficiently recyclable. It is evident that from the above discussion, the reduction of compressive and tensile strength can be increased by adding some super plasticizers and industrial wastes as partial replacement of cement will definitely increase the strength of waste tyre rubber modified concrete. Many studies reveal that there will be increase in strength enhancements as well as environmental advantages. The future NGC using waste tyre rubber could provide one of the environmental friendly and economically viable products. Though problems remain regarding the cost of production and awareness among the society the wastes can be converted into a valuable product But further research is needed to increase performance against fire.

ISBN: 978-81-965236-7-1

El-Gammal, A., A. K. Abdel-Gawad, Y. El-Sherbini, and A. Shalaby (2010)

In this paper the density and compressive strength of concrete utilizing waster tire rubber has been investigated. Recycled waste tire rubber has been used in this study to replace the fine and coarse aggregate by weight using different percentages. The results of this paper shows that although, there was a significant reduction in the compressive strength of concrete utilizing waste tire rubber than normal concrete, concrete utilizing waste tire rubber demonstrated a ductile, plastic failure rather than brittle failure. A total of 4 main mixtures were cast. One control mixture and three concrete mixtures. The control mixture was designed to have a water cement ratio of 0.35 with cement content of 350 kg/m^3. To develop the rubberized concrete mixtures, tire rubber was used to replace the aggregate by weight. In the first rubberized concrete mixture, the chipped rubber totally replaced the coarse aggregate in the mixture. While, in the other two concrete mixtures, the tire rubber replaced the fine aggregate by 100% and 50% of fine aggregate weight. Concrete casted using chipped rubber as a full replacement to coarse aggregate shows a significant reduction in the concrete strength compared to the control specimen. However, significant ductility was observed before failure of the specimens. Concrete casted using chipped rubber as a full replacement to coarse aggregate shows a significant reduction in the density of concrete compared to the control specimens. Concrete casted using crumb rubber as a full replacement to sand shows a significant reduction in the concrete strength compared to the control specimen. However, significant ductility was observed before failure of the specimens. Concrete casted using crumb rubber as a full replacement to sand shows a significant increase in the concrete strength compared to the concrete casted using chipped rubber as a replacement to coarse aggregate. There was no significant increase in the concrete compressive strength and the concrete density when different percentage of crumb rubber, as a replacement to sand, was used in the concrete mix. It is recommended to test concrete with different percentage of crumb rubber ranging between (10% up to 25%) to study its effect on the concrete strength.. It is recommended to use concrete in the production of curbs, roads,concrete blocks, and non-bearing concrete wall.

T. SenthilVadivel& R. Thenmozhi (2012)

In this Study, our present study aims to investigate the optimal use of waste tyre rubber crumbs as fine aggregate in concrete composite. A total of 90 cubes, cylinders and beam specimens were cast with the replacement of fine aggregate by shredded rubber crumbs with the proportion of 2, 4, 6, 8, and 10% by weight and compared with 18 conventional specimens. Fresh and hardened properties of concrete such as workability, compressive strength, tensile strength and flexural strength were identified and finally it is recommended that 6% replacement of waste tyre rubber aggregate with fine aggregate will gives optimal and safest replacement in concrete composites. Compressive strength decreases when the percentage of replacement of shredded fine rubber crumbs increases. Split tensile strength decreases at the maximum of 25% when rubber crumbs replaces up to 10% in fine aggregate. Flexural strength of concrete increases when rubber crumbs increases up to 6%. It is identified that the grade of concrete plays the major role in the ductility performance of rubber replaced Concrete. Slump test results show no change in workability in all the percentage of replacement of rubber crumbs. Hence no effect in consistency during rubber replaced concrete. 6% replacement of waste tyre rubber proves exceptionally well in compression, tensile and flexural strength and follow the curvature of the conventional specimens all the tests in both the grades. Hence it is recommended that 6% replacement of waste tyre rubber aggregate with fine aggregate will gives optimal and safest replacement in concrete composites. Further it is suggested to use this concrete composite for lintel beams, floor slabs, and ribs where load carrying capacity not governing the design.

2. METHODOLOG YMATERIAL USED

Various materials used for the experimental study are the following:

CEMENT

Cement is a material that has cohesive and adhesive properties in the presence of water. Such cement is called hydraulic cements. These consist primarily of silicates and aluminates of lime obtained from limestone and clay. There are different types of cement; out of that I have used one type.

ORDINARY PORTLAND CEMENT

Ordinary Portland cement (OPC) is the basic Portland cement and is best suited for use in general concrete construction. It is of three types, 33 grades, 43grade, 53 grade. One of the important benefits is the faster rate of development of strength. Cement is a fine, grey powder. It is mixed with water and materials such as sand, gravel, and crushed stone to make concrete. The cement and water form a paste that binds the other materials together as the concrete hardens. The basic composition of cement is provided in table. In the present work 43 grade cement was used for testing.

FINE AGGREGATE

Locally available free of debris and nearly riverbed sand is used as fine aggregate. Among various characteristics, the most important one is its grading coarse sand may be preferred as fine sand increases the water demand of concrete and very fine sand may not be essential in as it usually has larger content of thin particles in the form of cement. The sand particles should also pack to give minimum void ratio, higher voids content leads to requirement of more mixing water.

3. 4 WATER

Water is an important ingredient of concrete as it actively participates in the chemical reactions with cement. The strength of cement concrete comes mainly from the binding action of the hydration of cement get the requirement of water should be reduced to that required chemical reaction of un hydrated cement as the excess water would end up in only formation undesirable voids or capillaries in the hardened cement paste in concrete. It is important to have the compatibly between the given cement and the chemical

ISBN: 978-81-965236-7-1

material admixtures along with the water used for mixing.

It is generally stated in the concrete codes and also in the literature that the water fit for drinking is fit for making concrete. This may not be true always. For example some water containing a small amount of sugar would be suitable for drinking, but they are good for cement concrete, as the sugar would adversely affect the hydration process. The limits of the content of water have to be determined from the following considerati on. High content of cement is susceptible to a rapid loss of workability on Account of higher amount of heat of hydration generated. Therefore attention is required to see that the initial hydration rate of cement should not be significantly affected. The saltin water would not interface with the development of strength of later ages. Apart from the strength consideration, the durability characteristics such as porosity, degree of resistance to diffusion of CO_2, $CaSO_4$, moisture, air oxygen, etc. should also be investigated after specified curing period.

MIX DESIGN DEFINITION

Mix design is the process of selecting suitable ingredient if concrete and determines their relative proportion with the object of certain minimum strength and durability as economically as possible.

DESIGN OF M25 GRADE CONCRETE

Design parameters

Characteristic strength: 25 N/mm²Compaction factor: 0.85

Degree of quality control: GoodType of exposure:Moderate

Data on material

Cement used: Grade 53 conforming to

IS: 12269-1987

Specific gravity of cement: 3.15Sand: Conforming to zone II

Specific gravity of fine aggregate: 2.62 Bulk density of fine aggregate: 1.698 Fineness of modulus: 2.71

Specific gravity of coarse aggregate: 2.72 Bulk density of coarse aggregate: 1.82 Fineness of modulus: 2.59

Bureau of Indian Standards method (a). Target mean strength for specified characteristic cube strength is

Fck = fck +ts

= 25+1.65x 4

= 3 1 . 6 N/mm²

(b).Selection of water cement ratio required for the target mean strength of 31.6/mm² is maximum freeW/C ratio is 0.5 from IS 456-2000

(c). Selection of water and cement content

20mm maximum size aggregate sand containing to grading zone II. Water content per cubic meter of concrete 186 kg and sand content as percentage of total aggregate by absolute volume 35% Correction for decrease in water cement ratio: Total aggregate by absolute volume is 35-3 = 32%(d).

Determination of cement content

W/C ratio = 0.45

Water = 160

lit

Cement = 160/ 0.45 =355.5Kg/m^3

(e). Determination of course and fine aggregate.

The amount of entrapped air is 2% rubber tyrepowder is 5%

Absolute volume of concrete, V = 1- (0.02+ 0.10)

= 0.93

Determination of fine aggregate:

V = {W+ C/Se + (1/P x fa/Sfa)} x 1/1000

0.93 = {160+ 355 .5/3.15 + (1/.32 x fa/2.62)} x 1/1000

FA = 684 kg/m^3 (Similarly for coarse

aggregate)V = {W+ C/Se + [1/ (1-P) x

(Ca/Sca)]} x 1/1000

0.93 = {160+ 3 5 5 . 5 /3.15 + (1/0.68 x Ca/2.67)} x 1/1000

Course aggregate, CA = 1030 Kg/m^3

The mix proportion per cubic meter

Water = 160 lit

Cement= 355.5 Kg

Fine aggregate= 6 8 4 k g /m^3

Course aggregate= 1030 Kg/m^3

ISBN: 978-81-965236-7-1

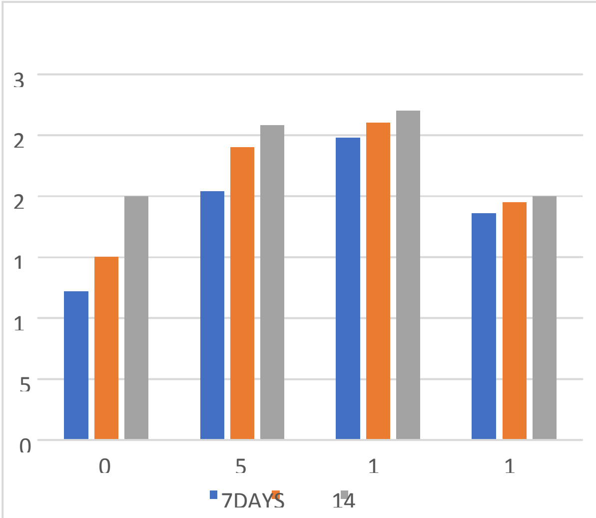
COMPRESSIVE TEST OF CONCRETE CUBE

Compression test of the concrete specimen is most widely used to measure its compressive strength .Two types of concrete cube specimen are used to for this test.Cube sizeof 150mm x 150mm x 150mm in diameter is used.Cubes for compression test are caste in a steel or cast-iron mould of prescribed dimensions.BS1881: Part 108:1983 approximately 50mm.Compaction of each layer is achieved by not less than 35 strokes for 150mm cubes or 25 strokes for 100mm cubes.A standard tampingbar of a 25mm square of steel section is used for this purpose. Compaction by vibrating or tamping rod may also be used.

After finishing the cube it should be stored at a temperature of 15 degree celcius to 25degree celcius ,when the cubes are to be tested at or more than 7 days. When thetest days are less than 7 days,the temperature to be maintained is 18 degree celcius to 22 degree celcius.Also, relative humidity of 90 percent is to be maintained always.The cube is demoulded just before testing at 24 hours.For greater ages at test,demoulding takes place between 16 to 28 hours after adding water in a concretemix and the specimens are stored in a curing tank until the required age of 7,14 and28 days.

The load applied at constant rate of stress within the range of 0.2 to 0.4 Mpa/sec. practically,the compression testing system ratherdevelops a complex system of stresses due to end restrains by steel plates. The strength if concrete is also decreases with the size of the specimen till its lateraldimension is 450mm,all larger specimens or members give approximately the same strength.This is evident from the fact that the probability of occurrence of weak spots is greater when the volume of the concrete is larger for a given stress level to whichitis subjected.

Experimental Setup for Testing of Cube Specimens



ISBN: 978-81-965236-7-1

CONCLUSIONS

The 7- day and 28- day compressive strength of the specimens increased by addition of silica fumeto concrete containing crumb rubber. This happens because of filling capability of silica fume fine particles as well as good adhesion between the rubber and the cement paste.

Based on the above test results concluded thefollowing:

Compressive strength decreases when the percentage of replacement of shredded fine silica fume increases.

Split tensile strength decreases at the maximum of 15% when rubber crumbs replaces up to 5% in fine aggregate.

Flexural strength of concrete increases when rubber crumbs increases up to 5% and silica fumeupto 10%.

It is identified that the grade of concrete plays the major role in the performance of rubber replaced concrete

CRSF 3 (10) % replacement of waste tyre rubber proves exceptionally well in compression, tensile and flexural strength and follow the curvature of the conventional specimens all the tests in M20 grades.

Hence it is recommended that Crumb rubber (CR) 5% replacement of fine aggregate, Silica fume (SF) 10% replacement of cement will gives optimal and safest replacement in concrete composites.

REFERENCES

1. Amudhavalli, N. K. & Mathew, J. (2012). Effect of silica fume on strength and durability parameters of concrete. International Journal of Engineering Sciences& Emerging Technologies. Perumal, K., Sundararajan , R. (2004). Effect of partial replacement of cement with silicafume on the strength and durability characteristics of High performance concrete.
2. 29th Conference on our world in concrete & structures: 25 – 26 August 2004, Singapore. Kumar, R. , Dhaka, J. (2016). Review paper on partial replacement of cement with silica fume and its effect on concrete properties. International Journal for Technological Research in Engineering.
3. N, Eldin, A. B, Senouci,. "Rubber-tire particles as concrete aggregate". Journal of materials in civil engineering.
4. IS: 456:2000, "Plain and Reinforced Concrete", Code of Practice, Bureau of Indian Standards, New Delhi, 2000.
5. IS: 2386 (Part v) -1963, Methods of test for aggregates for concrete, Bureau of Indian standards, New Delhi, India.
6. IS 10262: 1982 Recommended Guidelines for Concrete Mix Design

ISBN: 978-81-965236-7-1

REALTIME BUS TRACKING SYSTEM USING MOBILE TECHNOLOGY

Mrs.M.Parveenbanu[1]
[1]Assistant professor, Sri Bharathi Engineering College for Women, Kaikkurichi.
Ms.Meiyyammal.M[2], Ms.Prasannadevi.P[3], Ms.Sathiyasri.P[4]
[2,3,4]Student, Sri Bharathi Engineering College for Women, Kaikkurichi.

Abstract - **This Realtime Bus Tracking System Using Mobile Technology proposes the development of a bus tracking and ticket booking system that allows passengers to track the live location of buses in real-time, calculate ticket fares base distance and book tickets online. The project will require the integration of live GPS data from the buses, a real-time tracking system, a fare calculation algorithm, and a ticket booking system. The tracking system will use mapping tools such as Google Maps API to display the live location of the buses, while the fare calculation algorithm will take into account the distance between the passenger pickup and drop-off points to calculate the fare. The ticket booking system will allow passengers to book tickets online and receive a booking confirmation and unique ticket ID. The project will require knowledge of programming languages such as Python, JavaScript, and HTML/CSS, as well as experience working with APIs, web development, and databases. Additional features such as user accounts, payment integration, or a mobile application can also be added based on specific requirements. The system real-time tracking feature allows passengers to track the live location of buses, obtain estimated arrival times, and plan their travel accordingly. This feature provides passengers with accurate information about bus locations, which helps them avoid waiting for long periods at bus stops. Additionally, the fare calculation feature enables passengers to calculate ticket fares based on the distance travelled, eliminating the need for manual fare calculation and reducing the chances of errors. This feature also eliminates the need for passengers to queue up at ticket counters, thereby reducing the overall waiting time and congestion at bus stations Overall, the proposed system provides a comprehensive solution to the common problem s faced by passengers during their commute, such as uncertainty about bus arrival times, long waiting periods and difficulties in purchasing tickets.**

Keyword: Real-time Bus Tracking, Ticket Booking System, GPS Technology, Google Maps API, Fare Calculation Algorithm, Online Ticket Reservation, Web-based Application, Mobile Technology, System Architecture, Data Flow Diagram, User Accounts, Payment Integration, Mini Project, Passenger Experience, Live GPS Data, Mapping Tools, Integration Testing, User Interface Design, Web Development, Database Management.

1. INTRODUCTION

The world is advancing at an unprecedented pace, and technology is making our lives easier in every possible way. The transportation sector has seen at remendous change with the advent of modern technologies. Bus tracking and ticket booking systems are becoming increasingly popular as they offer passengers a convenient and hassle-free experience. In this context, this mini project proposes the development of a bus tracking and ticket booking system that enables passengers to track the live location of buses, calculate ticket fares in real-time and book tickets online. The project aims to create a system that utilizes the live GPS data from buses to track their live location on a map, making it easier for passengers to know when their bus will arrive.

A real-time tracking system using mapping tools such as Google Maps API will be developed to show the live location of the buses additionally, the project will include an algorithm that calculates the fare based on the distance between the passenger pickup and drop-off points, which takes into account discounts or promotions that may be applicable.

The system will also enable passengers to book tickets online and receive a booking confirmation and unique ticket ID, making it easier for them to board the bus without any hassle. To develop this project, we will need to use various programming languages such as Python, JavaScript, and HTML/CSS. We will also need to have experience working with APIs, web development, and databases.

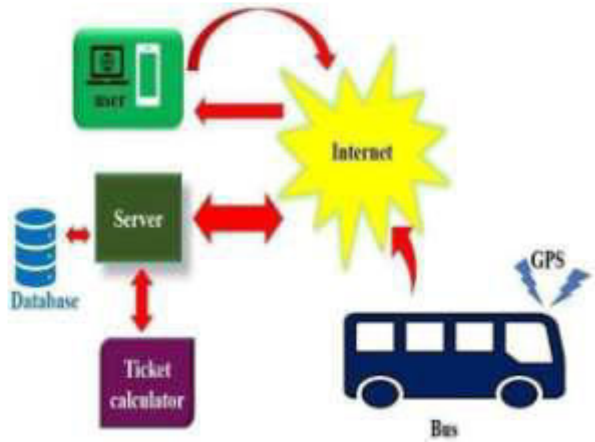
2. SYSTEM ARCHITECTURE

A real-time bus tracking system using mobile technology requires a well- designed architecture that integrates multiple components, from GPS devices and mobile applications to central servers and network infrastructure in fig 1.1 By leveraging the latest advances in mobile and data analytics technologies, such a system

ISBN: 978-81-965236-7-1

can provide commuters with real-time information about bus locations and arrival times, improving the overall user experience and making public transportation more accessible and convenient.

Fig1.1BUS TRACKING ARCHITECTURE



3. EXISTING SYSTEM:

The existing transportation system lacks real-time bus tracking, live ticket calculation, and online ticket booking features.

- ➢ Traditional methods often involve manual processes for ticket purchases, limited information on bus locations, and challenges in estimating arrival times.
- ➢ The absence of a modernized system may lead to inconveniences for passengers, such as uncertainty about bus arrival times, long waiting periods, and difficulties in purchasing tickets efficiently.
- ➢ The proposed project aims to bridge these gaps by introducing a comprehensive bus tracking and ticket booking system that leverages GPS technology and online platforms to enhance the overall passenger experience.

4. PROPOSED SYSTEM:

Proposed system for mini project that can track a bus live location with live ticket calculation and ticket booking .The proposed bus tracking and ticket booking system will be a web-based application that will utilize live GPS data to track the live location of buses. The system will use mapping tools such as Google Maps API to display the live location of buses in real-time.

Passengers will be able to see the location of the bus they intend to board, and get an estimate of the arrival time of the bus at their pickup point.

The system will have an algorithm that calculates the fare based on the distance between the passenger's pickup and drop-off points. The algorithm will take into account any discounts or promotions that may be applicable, and will provide the passenger with a fare estimate before they confirm the booking.

ADVANTAGE:

- Convenience for passengers
- Efficient fare calculation
- Real-time tracking of buses
- Reduced wait time
- Better management of operations

5. ALGORITHM

The algorithm for the proposed bus tracking and ticket booking system can be outlined as follows:

- User Registration: Users register on the system by providing necessary details. Unique user accounts are created for each registered user.
- User Login: Users log in to their accounts using valid credentials.
- Bus Tracking: GPS data from buses is collected in real-time. Mapping tools like Google Maps API are used to display the live location of buses. Users can interact with an interface showing the bus location, estimated arrival time, and any delays or route changes.
- Fare Calculation: An algorithm calculates the fare based on the distance between the passenger's pickup and drop- off points. Discounts or promotions are considered in fare calculation.
- Ticket Booking: Users select the desired bus, journey date, and check seat availability. Payment options, including credit/debit cards, digital wallets, and net banking, are provided. Upon successful payment, users receive a booking confirmation with a unique ticket ID.
- Notification: Users receive notifications or alerts with updates, such as booking confirmations and any changes in bus schedules.
- Data Flow: Bus location data, estimated arrival time, and fare details are continuously updated and displayed to users.

ISBN: 978-81-965236-7-1

- System Security: Measures are implemented to ensure the security of user data and transactions. Access to sensitive information is restricted to authorized users.

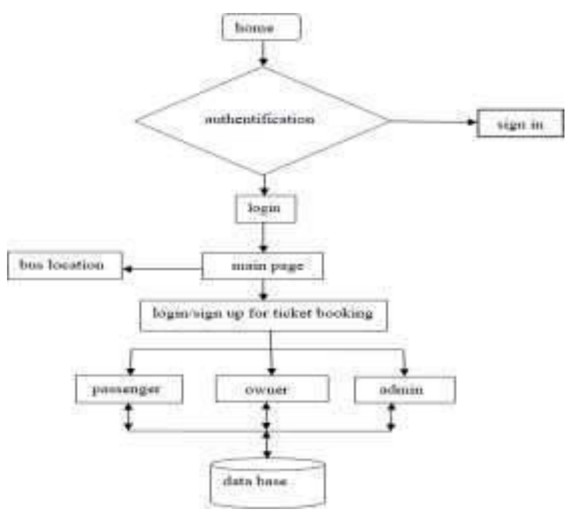
- Integration Testing: The system components are tested together to ensure seamless integration and functionality.

- User Experience Enhancement: Continuous improvements are made to enhance the overall user experience and address any identified issues.

6. DATA FLOW DIAGRAM:

Data flow diagram is flow carries the current location data of buses, which is received by the tracking system and stored for further processing Estimated Arrival Time Data.

Fig1.1BUS TRACKING DATAFLOW



This flow provides the estimated arrival time of a bus at a specific location Data flow diagram is flow carries the current location data of buses, which is received by the tracking system and stored for further processing Estimated Arrival Time Data This flow provides the estimated arrival time of a bus at a specific location.

7. CONCLUSION:

In conclusion, the Real Time Bus Tracking System Using Mobile Technology is a web application that aims to provide an efficient way to track the live location of buses, calculate fares in real-time, and allow users to book tickets online.

- This project requires specific hardware and software requirements such as a dedicated server, GPS-enabled mobile devices, reliable internet connectivity, payment gateway integration, and a responsive design framework.
- To develop this system, a suitable operating system, web server software, database, PHP framework, GPS tracking library/API, and payment gateway integration must be used.
- Additionally, a code editor, version control software, and a development environment are required for coding and debugging the PHP web application.
- The project must be designed with scalability, performance, and security in mind to ensure a successful and secure implementation.
- It is recommended to consult with experienced developers or IT professionals to ensure the right hardware and software setup for this project.

In conclusion, a real-time bus tracking system using mobile technology has many benefits for both public transportation providers and passengers.

8. FUTURE ENHANCEMENT:

There are several future enhancements that can be made to a real-time bus tracking system using mobile technology to further improve its functionality and user experience. Some of these enhancements include:

- Real-time notification: users can receive real-time notifications on the estimated arrival time of the bus, delays, and other important information.

- Route optimization: the system can suggest the optimal route for the bus to take, taking into account traffic conditions and other factors, to ensure faster and more efficient trave.

- Multiple payment options: allow users to choose from a variety of payment options such as credit/debit card, mobile wallet, and net banking.

- User ratings and feedback: users can rate their experience and provide feedback on the quality of the service, which can be used to improve the system.

- Multilingual support: the web application can support multiple languages to cater to users who speak different languages. Real-time traffic updates: the system can provide real-time traffic updates to help users plan their journey better.

ISBN: 978-81-965236-7-1

9. REFERENCES

1. Deb, S., Chakraborty, C. (2020).”A comprehensive survey on real-time bus tracking system using mobile technology”.
2. Goyal, A.,Rathore, S. (2017).”Real-time bus tracking system using GPS and mobile application”.
3. Jain, R.,Jain, V. (2019).”Development of real- time bus tracking and fare calculation system”.
4. Jayalakshmi, K., Sivasankari, G. (2018).”A study on real time bus tracking system using mobile technology”.
5. Kumar, R., Nigam, A. (2019).”Real-time bus tracking and fare calculationsystem using GPS and mobile application”.
6. Lingareddy, N., Priya, T. G. (2017).”Real-time bus tracking and ticket reservation system using GPS and GSM”.
7. Choudhury, S., Mishra, P. (2018).”Real-time bus tracking system using GPSand GSM”.
8. Mandal, M. K., Banerjee, S. (2018).”Development of real-time bus trackingsystem using GPS and mobile technology”.
9. Nair, A., Sreenath, P., Rajan, A. (2020).”Design and implementation ofa real-time bus tracking system using GPS and mobile application”.
10. Negi, A., Verma, A. (2019).”Real-time bus tracking and ticketing systemusing GPS and mobile application”.
11. Patel, H., Bhavsar, D. (2018).”Real-time bus tracking system using GPS andmobile technology”.
12. Prakash, P., Saran, M. (2019).”Real-time bus tracking and ticket bookingsystem using GPS and mobile application”.

ISBN: 978-81-965236-7-1

A New Technique for Segmentation of the Oil Spills From Synthetic-Aperture Radar Images Using Convolutional Neural Network

Mrs.M.Parveen Banu,AP/CSE
Assistant Professor, Department of Computer Science and Engineering,
Sri Bharathi Engineering College for Women, Pudukkottai-622 303, Tamilnadu, India.
Email: parveenbanu.cs@gmail.com

Abstract—**Oil spills have proven to have detrimental effects on the marine-based environment and economy. Thus, it is necessary to identify oil spills and classify them in the sea to reduce oil-induced pollution in seas and oceans. Synthetic-aperture radar (SAR) imaging is a good option for rapid oil detection, as it covers a wide area, collects data at short intervals, and allows taking images in all weather conditions throughout the day. The reason for using deep neural networks is that training several images enhances segmentation accuracy significantly. This article intended to separate the oil spills of SAR images using U-NET and DeeplabV3 neural net- works, separately with the lowest number of images and the highest accuracy possible. Each of these neural networks carries out image segmentation with different architectures independently and thus we could not combine these two networks for oil spill segmentation. We managed to find two accurate convolutional neural networks (CNNs) for oil spill segmentation because we did not have access to sufficient hardware facilities, such as GPU, to train dozens of neural networks. The two networks we used in the article are among the most well-known and widely used networks. Our purpose was to figure out which network was the best in SAR oil spill detection. Given the limited number of SAR oil spill images and as the input of CNNs needs many images for training, we increased the number of input images to 9801 using the augmentation technique. Then, we carefully identified oil spills with 300 epoch and a batch size of 5 using the Python programming language on the GoogleColab server. The oil spill detection accuracy was 78.8% in the U-NET network and 54% in the DeepLabV3 network. Accordingly, we conclude that the most accurate identification of SAR oil spills in images belong to the U-NET network.**

***Index Terms*—Convolutional neural networks (CNNs), DEEPLABV3, feature extraction, oil spill, segmentation, syntheticaperture radar (SAR), U-NET.**

I. Introduction

OIL spills near the coast can result from ship accidents, broken pipelines, explosion of oil rig platforms, and deliberate discharge of tank-cleaning wastewater from ships [1], [2], [3], [4], [5]. This is caused by the frequent tanker accidents and oil spills in waters as the main cause of oil leaks in oceans and seas. By the leakage of oil into water bodies, a thin layer is rapidly formed by spreading over the water surface, known as an oil spill. Due to several environmental factors, marine oil spills are hazardous and can rapidly spread over an extensive area.

Oil spills caused by unintentional or intentional releases into coastal or oceanic waters present a primary threat to marine ecosystems. Hence, the adverse effects of oil spills on these ecosystems are the subject of significant environmental, political, and scientific concerns [6]. The NEREIDs program made the first serious attempt with the support of the European Commission to utilize metocean, shipping, and geological data to characterize oil spills in one of the key oil exploration areas in the world to hinder any major oil spill accidents. These data revealed that oil spill models were generated to simulate trajectories, develop oil spills, assess the susceptibility of the coastal zone, and find suitable measures to alleviate its environmental effects [7]. Hence, identifying and classifying oil spills are essential in preventing water contami- nation [8]. Nonetheless, some natural phenomena (e.g., waves, ocean currents, and human factors) can alter light intensity over the sea's surface, which leads to non-uniform intensity or high noise from oil spills or lookalikes, sometimes making it very difficult to segment oil spills automatically. Hence, the accurate segmentation technique crucially contributes to oil spill control [9]. Synthetic- aperture radar (SAR) is a cohesive imaging technology capable of producing high-resolution, large-scale images of the earth and targets. SAR can function at both night and day and in adverse conditions to overcome the limitations of optical and infrared systems [10]. Thus, oil spills are detected as "dark" areas in SAR images [11]. Traditionally, SAR imaging is conducted by a moving aircraft or spacecraft [12]. Oil spills emerge in SAR images in form of dark patches, because they produce low-backscatter responses in comparison to nearby clean sea regions [13].

An image of oil spills appears as dark gray pixels in SAR images. It is not simple to transfer image segmentation approaches to SAR images. These images comprise speckle arising with scatterers' complex summation within a resolution cell from coherent signals. Through such noise, together with SAR sensor representation of geometry, it becomes challenging to consider edge information in the segmentation of the SAR image [14]. Nevertheless, SAR images are normally polluted by multiplication noise or speckle caused by the destructive and constructive interference scattered from coherent returns scattered by small reflectors within each resolution cell. Computer vision systems and human explainers encounter difficulties in interpretation and processing due to the presence of speckle noise in SAR images. Therefore, removing speckles from SAR images is essential to enhance the performance of

ISBN: 978-81-965236-7-1

various computer vision algorithms, such as recognition, segmentation, and detection [2]. However, it has many ambiguities in separating dark spots. Indeed, there is a hybrid area in the feature space for oil spills and lookalikes. For instance, SAR image properties of biological oil layers are very similar to those of oil spills. Without other auxiliary information like environmental information and remote sensing images, even experts cannot make a clear judgment about samples in a hybrid area of a feature space [15]. Over the recent years, convolutional neural networks (CNNs) have been extensively developed in radar imaging and semantic segmentation [16]. A CNN is an in-depth learning method specifically designed for image recognition and classification. This network is de- signed to be similar to multi-layered neural networks. CNNs are the same as biological neural networks employed for speech recognition and visual and image processing. CNNs can extract spatial information effectively and share weights among nodes for reducing the number of parameters [17]. A CNN works well in recognizing two-dimensional shapes and learning structural features and presents a way to distinguish features from points automatically. Short training time makes it easier to use artificial neural networks and improves diagnostic accuracy [18]. A CNN also works well to automatically learn features from raw data, particularly for structural features [19]. CNN was successfully used in image classification and recognition, indicating the satisfactory results of CNN in hand-written recognition [20]. CNN is also used in image segmentation. A study in 2005 reviewed oil spill classification and segmentation methods [21]. According to Solberg et al., there are three feature extraction steps for oil spill detection in SAR images, including oil pollution detection, dark spot detection, and look-alikes.

The oil extraction location is affected by the accuracy of dark spot detection. In this article, different methods were reviewed for satellite-based oil spill detection in the marine environment. Manual and automatic methods were considered based on various satellite sensors and oil spills under different circumstances to differentiate between oil spills and look in terms of pattern recognition [21]. In another study, two neural networks were implemented by Duan et al. [19] for segmenting dark objects and separating oil spills from similar ones. The presented technique was very auspicious in detecting dark formations and oil spills from similar cases because dark formations are recognized with an overall accuracy of 94%. Moreover, 89% of the examined items were correctly recognized. The framework was used in different other assessments [6] , [22]. According to Krestenitis et al., semantic segmentation with deep CNN (DCNNS) deployment can be used success- fully in oil spill detection. The established DCNN segmentation model was trained and evaluated using a common database on a case-by-case basis. Generally, the best performance was re- ported by the DeepLabv3 model with the highest accuracy based on greater inference time. The mentioned study is advantageous since the complexity of the problem was extensively discussed, along with relative figures.

Though, it is expected that this deficiency was caused by the small number of specimens for the small object size and the training method [23]. A super pixel segmentation method was introduced by Zhang et al., to hypersegmente SAR images. A statistical dissimilarity measurement technique was proposed in the super pixel integration section to transform soft super pixels into a self- connected weight graph. Moreover, phase integration and super pixel generation were run under a unified deep network. This method is advantageous since its shape is alternately adjusted based on the segmentation results and boundaries during training to achieve the desired segmentation results. The segmentation method is efficient computationally due to the simple network structure and includes advanced performance and good generalization [24]. A boundary clustering method was designed by Ma et al. to assess the specific tasks of super pixels. A soft graph convolutional network was proposed in the segmentation section taking the connectivity map as input and subdividing super pixels intelligently.

The super pixel and graph complexity parts can be trained under a unified framework until obtaining optimal parameters of the two parts, which is the advantage of this technique. Furthermore, the super pixel shape can be adjusted by the network gradually in terms of segmentation. The results revealed that the boundary information could be preserved by the suggested super pixel generation model, which has good resistance to stains. This technique was efficient computationally and performed consistently with generalizability [25]. A benchmark solution was presented by Hang et al., by establishing a general framework for deep learning of multiple MDL components. Generally, the MDL framework is used to classify pixel tasks and model spatial information with artificial neural networks. A general framework was presented comprising two sub networks, i.e., ex-framework and FU-net, to present a basic solution for classification tasks of pixel-level images using MULTIMODAL data. Various hybrid strategies have been presented in this regard. In networks, the three “what,” “how,” and “how” were focused along with two feature extraction approaches associated with FC-NET and CNN to classify pixels and spatiospectral classes, respectively [26]. The CNN network can record spatial-spectral properties to classify hyper spectral images. Recently, GCNNs have been used in data analysis and visualization despite the sampling restrictions. Hong et al., assessed the complete HS image arrangement with GCNN and CNN. MINIGCNN can infer the output data without altering the network and enhancing the classification performance. It also facilitates the training of large-scale graph networks through the MINIBATCH technique. MINIBATCH allows the joint use of GCNN and CNN to extract more distinct and diverse properties for the classification of HS images [27]. Usually, HS images are combined into a data cube using spatiospectral data. Generally, it can be considered a sequence of data along with the spectral dimension.

ISBN: 978-81-965236-7-1

An inverter-based backbone network was proposed by Hong et al., by further focusing on the ex- traction of spectral information from classifying these images without using it. This method can be improved by investigating self-organizing learning and creating a weighted network in terms of transformers to reduce the network complexity while maintaining more performance [28].

In this article, we needed many images to train convolutional networks. For this case, we increased 99 images of oil spills received from the Sentinel-1 and EnviSat satellites from the desired sites to 9801 images using the augmentation technique. Thus, we removed the oil spill 2 from the image and placed it on the oil spill 1. Several images are required by the CNNs for training. Only 99 images were used in the article as the database. The method as the main creativity and innovation of the article was used to increase the number of images of each oil spill on the remaining 98 oil spills. Thus, the images with various oil spills were incremented to 9801. Furthermore, the method was used to train CNNs well and perform image segmentation with higher accuracy. The main background of the new image was the oil spill 1. By this innovation, CNNs are trained without over- fitting and perform segmentation with considerable accuracy. The remaining sections of the article were arranged as follows: The collection procedure for images required for training neural networks was introduced in Section II. Section III described the proposed method. Section IV explained the analysis results of segmented images of the oil spill output from CNNs in detail with their accuracy tables. Section V presented conclusions and implications.

II. DATASETS

This section deals with the way SAR radar oil spill images were collected for the database to train CNNs. SARs send information to Earth in Earth's orbit in any weather conditions and at any time of day or night. Images sent by the Sentinel-1 and EnviSat radars at alternating time periods per month can be downloaded from the relevant websites. This dataset shelters major types of oil spill candidates detected under various sea conditions [29]. In oil spill images, it is necessary to consider satellite type, frequency band, resolution, polarization, and SAR or POLSAR type. For instance, on the ESA SciHUB site, images sent from the Sentinel-1 radar can be received and converted to desired formats, like JPG, using SNAP software. A high resolu- tion (up to MB) SAR radar is needed to train the neural network of convulsive images of oil spills. In this article, about 99 original images of oil spills were collected from different SARs. SAR images are needed in addition to annotated images of oil spills to train CNNs for oil spill segmentation. An annotated image of an oil spill made using Supervisely software is presented in Fig. 1. The mask image shows all the borders of oil spills accurately.

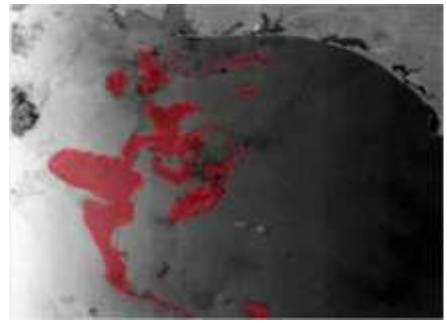


Fig. 1. Annotated sample of oil spill image from oil bank

Fig. 2. Image of oil spills dataset

A. Creating a Database of SAR Oil Spills Images in Google Drive

We put each of the oil spills images on the other oil spills to increase the images for training CNNs. An example of an oil spills shown on an oil spills is shown in Fig. 2. For instance, we removed the oil spill in the first image. To do so, we multiplied the mask in the same image, and the resulting matrix returned the image values in the spots and was zero in spots without oil spills. Using matrix techniques, we placed the spot image in Fig. 2. The oil spill of the first image may overlap with the second oil spill, which does not affect the output of our work in this case. Using this method, we can produce many new images. The block diagram of the image data augmentation technique is shown in Fig. 3. We put all the 9801 images of SAR oil spills along with annotated images in a folder in the Google drive to provide a better access and established the link for addressing the folder in the program code. Each folder in the Google drive had two original images and a mask. The original image was the image received from SARs, and the annotated image was the image obtained from the software for training CNNs. The database of the images is available here and online. The original and annotated images were preserved in two separate folders.

III. PROPOSED ALGORITHM

In this article, we first masked all the oil spill images with supervisely software. Deep learning models become hungry of data, particularly with large architectures comprising numerous trainable parameters. For learning general classification rules and features and not over fitting the training

ISBN: 978-81-965236-7-1

data, the model must be exposed to numerous input-output pairs that are segmentation masks and SAR images for oil spill detection. Although unlabeled data are inexpensive and accessible in large degree, there are normally scarce labels expensive for achievement [30].

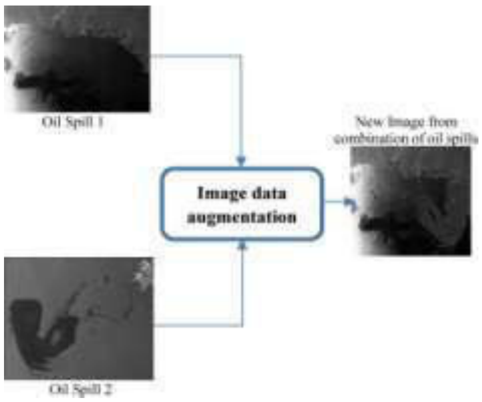


Fig. 3. Image data augmentation technique.

By augmenting the dataset during training, over fitting the training data was avoided in the model, and the generalization ability of the model was enhanced over invisible instances. The generalization performance can be improved by randomized data augmentation in various computer vision tasks, such as applications on remote sensing [29]. Then, using the image data augmentation technique, we increased the SAR oil spill images to 9801 images. We needed many images to train convolutional networks to avoid over fitting. Next, we trained the images to U-NET [31] and DEEPLABV3 networks separately, and at the end, we gave some images to the network as a test sample. The oil spill segmentation images were also displayed. The block diagram of the proposed flowchart is shown in Fig. 4. The encoder-decoder networks have been applied success- fully to several computer vision tasks, such as human pose estimation [32], object detection [20], [33], [34], and semantic segmentation [35], [36], [37], [38], [39], [40], [41], [42]. Characteristically, encoder-decoder networks comprise: an encoder module gradually reducing feature maps and capturing higher semantic information and a decoder module gradually recovering spatial information. Hence, we proposed to utilize DeepLabv3 as the encoder module and added an effective yet simple decoder module to achieve sharper segmentations [43].

IV. EXPERIMENTAL RESULTS

Although unlabeled data are inexpensive and accessible in large degree, there are normally scarce labels expensive for achievement [30]. By augmenting the dataset during training, overfitting the training data was avoided in the model, and the generalization ability of the model was enhanced over invisible instances.

The generalization performance can be improved byrandomized data augmentation in various computer vision tasks, such as applications on remote sensing [29]. Then, using the image data augmentation technique, we increased the SAR oil spill images to 9801 images. We needed many images to train convolutional networks to avoid overfitting. Next, we trained the images to U-NET [31] and DEEPLABV3 networks separately, and at the end, we gave some images to the network as a test sample. The oil spill segmentation images were also displayed. The block diagram of the proposedflowchart is shown in Fig. 4. The encoder-decoder networks have been applied success- fully to several computer vision tasks, such as human pose estimation [32], object detection [20], [33], [34], and semantic segmentation [35], [36], [37], [38], [39], [40], [41], [42]. Characteristically, encoder-decoder networks comprise: an encoder module gradually reducing feature maps and capturing higher semantic information and a decoder module gradually recovering spatial information. Hence, we proposed to utilize DeepLabv3 as the encoder module and added an effective yet simple decoder module to achieve sharper segmentations [43].

We considered the size of all the oil spill images at 1024 1024 pixels. We programmed the database address as/ content/drive/My Drive/DataSets/OilSpillGen. The target image was developed at 723× 543 pixels on November 20 at ESRIN, Italy. As shown in Fig. 10, the scattering oil spill was not collected in one part, and the U-NET network managed to identify areas containing oil and even narrow oil borders.

In Fig. 11, the oil spill accumulated in one part and was not dispersed. The U-NET network identified oil spills well in the tested image and was marked in red with full details. Fig. 12 shows the detection on November 20 at ESRIN, Italy. As seen, the oil spill had a closed-loop shape, and there were clear areas inside the loop with no oil spill. The U-NET network recognized well around the thick borders of the spot, and the borders were well displayed.

ISBN: 978-81-965236-7-1

A. SAR Oil Spill Detection Results Using U-NET Network

Multiplying the original images by the annotated images gave us original fragmented images. As seen, an oil spill was augmented to the image, and in the annotated images, both parts of the mask oil spill were removed. This algorithm was used in the U-NET network application code. As observed in Fig. 5, the final oil spills had a black background and the spots were quite clear. The network was trained with 90% of the input images. Here, we considered 90% of the original images for training and 10% for testing. Then, after the image augmentation technique, we used 10% of this educational data for validation. Identifying oil spills means that areas containing oil spills surrounding the SAR image are entirely isolated. The U-NET network training results in Table I are given here. Then, images with 300 epoch and a batch size of 5 were considered for network training. As observed, in the epoch i = 22, the values of the parameters were mean_iou = 0.9058 and val_mean_iou = 0.7888, which had the closest and highest values. The proximity of these two parameters' values showed the good training of the network, and the value of val_mean_iou showed the oil spill detection accuracy by the network, which was among the highest values (0.788 or 78.8%). Furthermore, we saved weights obtained from the network training in the program algorithm so that no time was spent on re-testing the network training, and we could use the weights. In Table I, the loss showed the network error value, and val_loss showed the validation error value. Additionally, the mean_iou parameter indicated the oil spill detection accuracy, and the val_mean_iou grid showed the network accuracy for validation data. Diagrams of network training parameters are shown below.

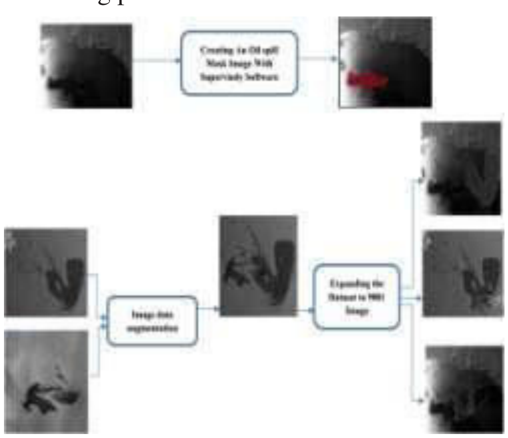


Fig. 4. Proposed flowchart.

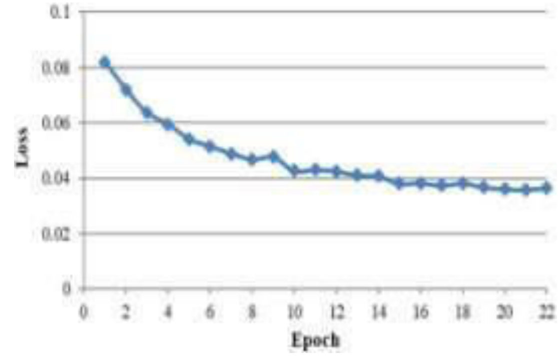


Fig. 5. (a) Original oil spill image. (b) Oil spill annotated image. (c) Multi- plying 2 side images with original fragmented images and U-NET network.

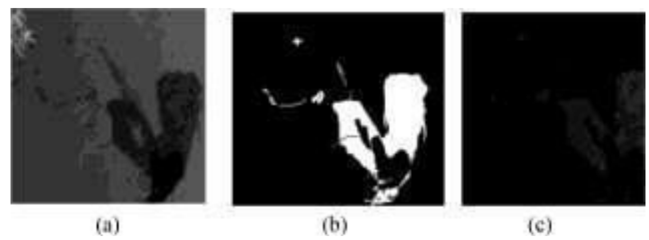


Fig. 6. U-NET network Loss diagram.

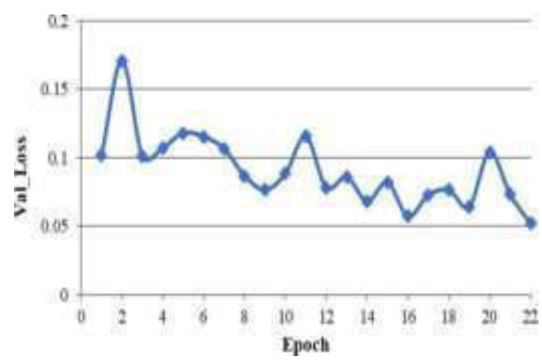


Fig. 7. U-NET network Val_Loss diagram.

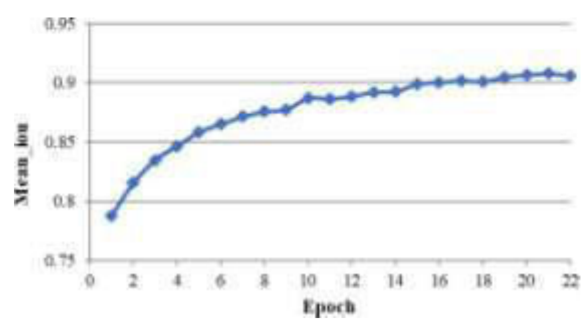


Fig. 8. U_NET network Mean_iou diagram.

ISBN: 978-81-965236-7-1

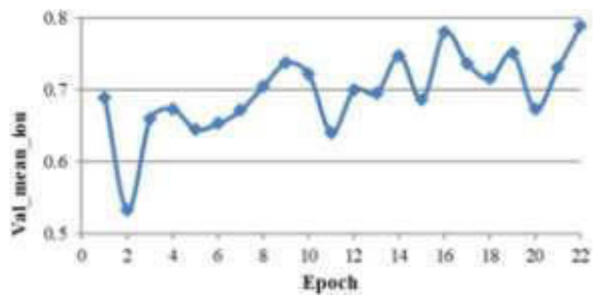


Fig. 9. U-NET network Val_mean_iou diagram.

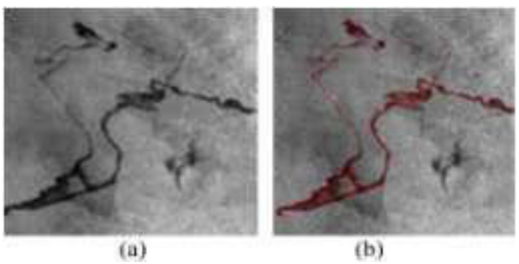


Fig. 10. (a) Original oil spill 1. (b) Oil spill detection 1 with U-NET network.

Multiplying the original images by the annotated images gave us original fragmented images. As shown, an oil spill was augmented to the image, and in the annotated images, both parts of the mask oil spill were removed. The same algorithm was used in the DeepLabV3 network application code. As shown in Fig. 13, the final oil spills had a black background, and the oil spills were quite clear. The network was trained with 90% of the overview images. Here, we considered 90% of the original images for training and 10% for testing. Then, after the augmentation technique, we used 10% of this educational data for validation. Identifying oil spills means that areas containing oil spills surrounding the SAR image are entirely isolated.

As shown in Fig. 14, the Deeplabv3 network error value decreased with an increase in the number of epochs and reached a constant value.

The Deeplabv3 network validation data error value reached a value between 0.5 and 1 after a series of fluctuations around the value of 1. There were more errors in this network compared to U-NET. The loss val diagram in the DeepLabV3 network is shown in Fig. 15. The mean_iou diagram in the Deeplabv3 network reached a fixed value of 0.5 after increasing epochs compared to that in the U-NET network. Accordingly, the network was weaker in the detecting oil spill segmentation.

The mean_iou diagram in the DeepLabV3 network is shown in Fig. 16. As the diagram in Fig. 17 shows, with the increase of epochs, the mean_iou value in the validation data increased to 0.55, which was lower than the U-NET value, and segmentation in the validation data in Deeplabv3 had a more unsatisfactory performance. Network testing was performed on three images for which the network was not yet trained. Parts of the oil spills were highlighted in red. The target image was produced at 723× 543 pixels on November 20 at ESRIN, Italy. As the image shows, the oil spill was diffused and did not shrink in one part, and the DeepLab3 network had moderately identified areas with oil spills and narrow oil borders. As shown in Fig. 18, the left part of the image had marked parts with a pale red in addition to the oil spill, which was considered a problem. In Fig. 19, the oil spill accumulated in one part and was not dispersed.

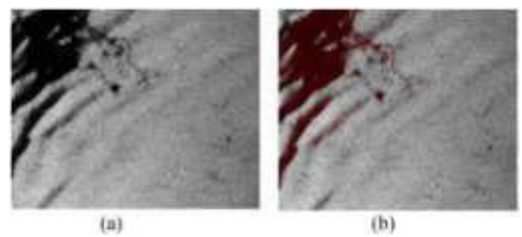


Fig. 11. (a) Original oil spill 2. (b) Identification of oil

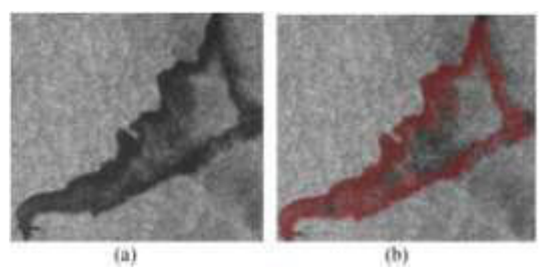


Fig. 12. (a) Original oil spill 3. (c) Oil spill 3 detection with U-NET network.

spill 2 with U-NET network.

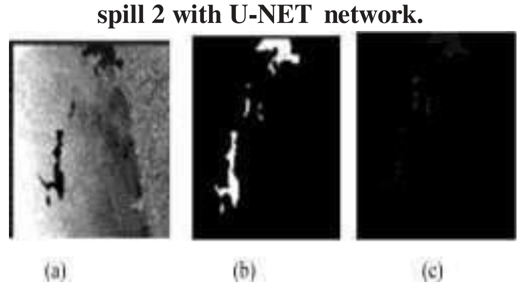


Fig. 13. (a) Original oil spill image. (b) Oil spill annotated image. (c) Multi- plying 2 side images with original fragmented images and DeepLabv3 network.

ISBN: 978-81-965236-7-1

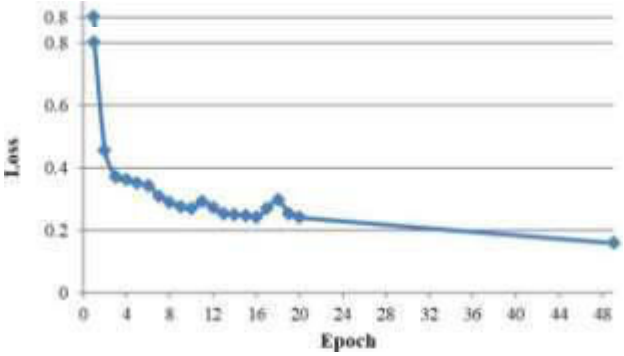


Fig. 14. DeepLabV3 network Loss diagram.

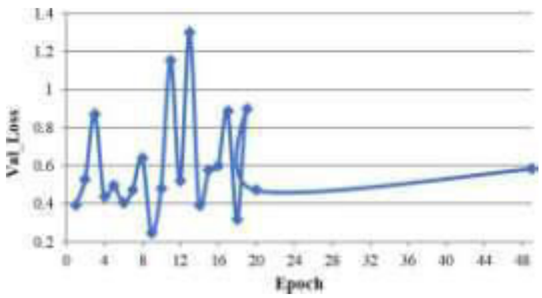


Fig. 15. DeepLabV3 network Val_Loss diagram.

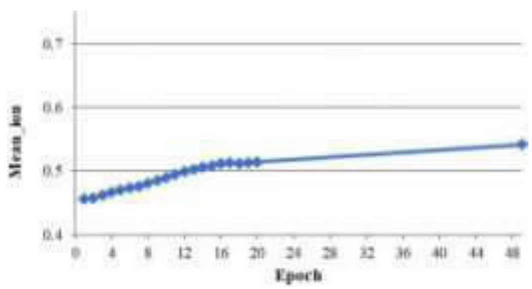


Fig. 16. DeepLabV3 network Mean_iou diagram.

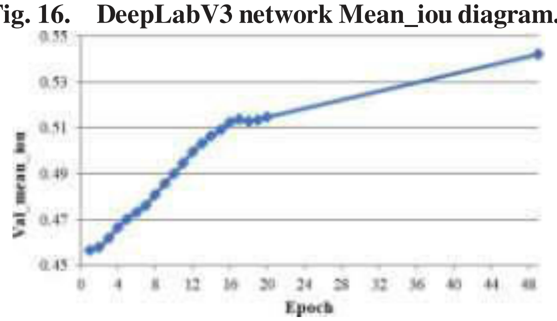


Fig. 17. DeepLabV3 network Val_mean_iou diagram

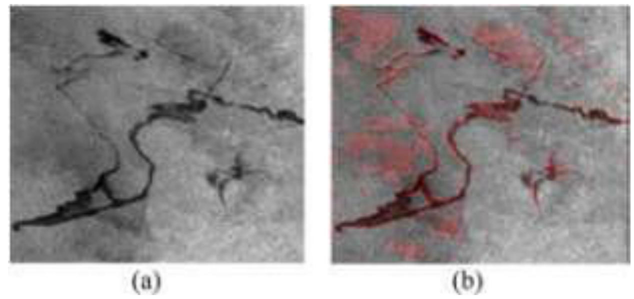
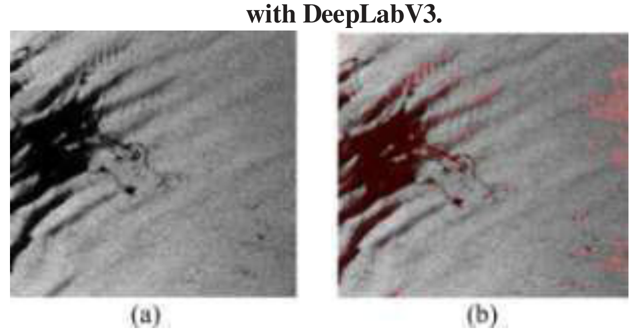


Fig. 18. (a) Original oil spill 1. (b) Oil spill 1 detection with DeepLabV3.

Fig. 19. (a) Original oil spill 2. (c) Oil spill 2 detection with DeepLabV3.



The target image was produced at 723× 543 pixels on November 20 at ESRIN, Italy. As the image shows, the oil spill was diffused and did not shrink in one part, and the DeepLab3 network had moderately identified areas with oil spills and narrow oil borders. As shown in Fig. 18, the left part of the image had marked parts with a pale red in addition to the oil spill, which was considered a problem. In Fig. 19, the oil spill accumulated in one part and was not dispersed.

Fig. 20 shows the detection on November 20 at ESRIN, Italy. As observed, the oil spill had a closed-loop shape, and there were clear areas inside the loop without the oil spill. The U-NET network recognized well around the thick borders of the spot, and the borders were well shown. However, the network detected excess oil spills inside the loop, on the border, and outside the loop.

ISBN: 978-81-965236-7-1

Fig. 20. (a) Original oil spill 3. (d) Oil spill 3 detection with DeepLabV3.

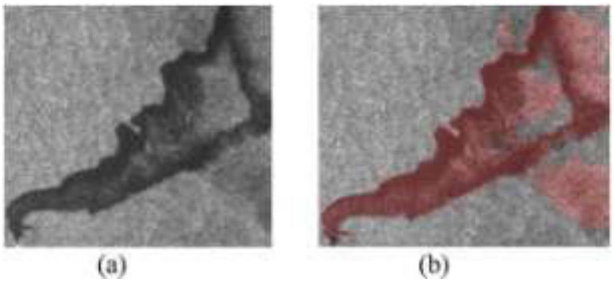
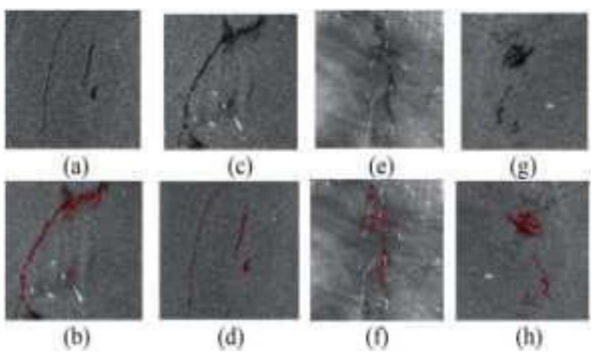


Fig. 21. Segmentation results of oil spill SAR images with noise. (a) Original SAR oil spil1-1. (b) Segmented oil spill-1 image with U-NET. (c) Original SAR oil spil1-2. (d) Segmented oil spill-2 image with U-NET. (e) Original SAR oil spil1-3. (f) Segmented oil spill-3 image with U-NET. (g) Original SAR oil spil1-4. (h) Segmented oil spill-4 image with U-NET.



In this article, the following hyperparameters were used in U-NET and DeepLabv3 networks: optimizer; activation function; learning rate; epochs; and batch size. In DeepLabv3 and U-NET networks, the activation function parameter is equal to ReLU. In U-NET, the optimizer parameter is equal to RMSprop, and DeepLabv3 networks are equal to Adam. The learning rate parameter in DeepLabv3 and U-NET is equal to 0.001. In U-NET, the batch size parameter is 5, while in DeepLabv3, it is 4. The epoch parameter in U-NET and DeepLabv3 equals 300. In other words, during the test, the hyperparameters did not change.

Considering a prominent feature of oil spill segmentation with this technique and networks, it can be concluded that the generality of this method was examined. Hence, noisy images, such as speckle noise, were tested, yielding accurate segmentation results, which are considerably displayed here.

The types of the oil spill segmentation results of SAR radar are presented in Fig. 21, along with the speckle noise of the unit network. Remarkable accuracy was obtained for the segmentation results.

Considering the future challenges and motivations, it is worth noting that oil spill segmentation was investigated in this article by using CNN networks. For the next ideas, the number of input images of the networks should increase; for instance, data transmission satellites should be checked, which comprise more images containing oil spills to increment the accuracy of the segmentation. The neural network architecture can be deepened at the same time to obtain better accuracy.

Also, the neural network with optimal settings should be updated; for instance, the optimizer parameter or learning rate should be changed. There is a problem with spectral variability for hyperspectral images gathered from airborne or satellite sources, inevitably making it difficult to accurately estimate the spectral mixing. An advanced ALMM linear mixing model was introduced by Heng et al., to cope with spectral variability by using a data-based learning strategy for hyperspectral mixing inverse problems. Then, other spectral variables were modeled, such as temperature, local humidity, and atmospheric influence, as well as instrument settings such as noise and nonlinear effects. The ALMM model considered both the main scale factor and other spectral variables by introducing the spectral diversity dictionary to increment the end member dictionary scalability.

More importantly, the presented technique can achieve more accurate frequency estimation than other advanced algorithms because it models spectral variables separately as scale and other spectral variables based on distinctive features [45]. Radar images are formed by the coherent interaction of transmitted microwaves with targets, unlike optical images. Therefore, the speckle noise effect is caused by the coherent summation of randomly scattered signals in each pixel. There is more noise in radar images than in optical images. SAR images are de- graded inherently due to the coherent nature of the scattering phenomena known as speckle. The utility of the SAR images is reduced by the presence of speckles by reducing the capability to discover ground objects, which has adverse effects on the image quality and hampers the observation of crucial information in the image.

In this article, noise-free images of SAR radar oil spills were considered for the training and input of the network. The inclusion of noise in SAR radar oil spill images should be assessed as a new issue. Here, the test data for the U-NET and DeepLabv3 networks were the oil spill images of noisy radar. As seen, good results are obtained for oil spill segmentation with noise by using the U-NET network.

ISBN: 978-81-965236-7-1

V. Conclusion

Deep network training needs a significant sum of data and usually faces the overfitting issue with a small volume of data. In this article on SAR images, our data was limited, and it was shown that with this number of deep segmentation networks, the networks faced the overfitting issue and were not efficient. In overcoming this problem, one approach is to use augmentation techniques, although the desired number of several thousand images cannot be reached with these techniques. The innovative task carried out in this article was to combine the existing images to produce a large number of images.

However, in addition to detecting oil spills, the DeepLabV3 network indicated additional areas as oil spills, which were network errors. The oil spill detection accuracy reached about 78.8% using the U-NET network. Regarding the remaining motivations and challenges, it should be said that this article investigated oil spill segmentation by using CNN networks. For the next ideas, it is better to increase the number of input images of the networks, for instance, to check data transmission satellites containing more images of oil spills and to increase the segmentation accuracy. At the same time, the neural network architecture can be deepened or updated by optimal settings (e.g., changing the optimizer parameter or learning rate) to achieve better accuracy. The following are some approaches to improve the accuracy of oil spill segmentation:

In other words, increasing the input data will lead to more training of neural networks, and as a result, the accuracy of oil spot spill segmentation will be improved. Another idea can be mentioned to increase the number of epochs and further training. Again, more CNN training will lead to better accuracy. Here, it can be said that using a deeper and different neural network will definitely increase the accuracy of oil spill segmentation. Finally, updating and optimizing hyperparameters (such as the optimizer and learning rate) will contribute significantly to improving the accuracy of oil spill segmentation.

References

[1] A. Raeisi, G. Akbarizadeh, and A. Mahmoudi, “Combined method of an efficient cuckoo search algorithm and nonnegative matrix factorization of different zernike moment features for discrimination between oil spills and lookalikes in SAR images,” IEEE J. Sel. Topics Appl. Earth Observ. Remote Sens., vol. 11, no. 11, pp. 4193–4205, Nov. 2018.

[2] T. M. Alves, E. Kokinou, G. Zodiatis, R. Lardner, C. Panagiotakis, and H. Radhakrishnan, “Modelling of oil spills in confined maritime basins: The case for early response in the eastern Mediterranean sea,” Environ. Pollut., vol. 206, pp. 390–399, Nov. 2015.

[3] R. Lardner and G. Zodiatis, “Modelling oil plumes from subsurface spills,” Mar. Pollut. Bull., vol. 124, no. 1, pp. 94–101, Nov. 2017.

[4] T. Soomere et al., “The potential of current- and wind-driven transport for environmental management of the Baltic sea,” Nat. Center Biotechnol. Inf., Ambio, vol. 43, no. 1, pp. 94–104, Feb. 2014.

[5] A. Chrastansky and U. Callies, “Model-based long-term reconstruction of weather-driven variations in chronic oil pollution along the Ger- man north sea coast,” Mar. Pollut. Bull., vol. 58, no. 7, pp. 967–975, Jul. 2009.

[6] S. Singha, T. J. Bellerby, and O. Trieschmann, “Satellite oil spill detection using artificial neural networks,” IEEE J. Sel. Topics Appl. Earth Observ. Remote Sens., vol. 6, no. 6, pp. 2355–2363, Dec. 2013.

[7] K. Topouzelis, V. Karathanassi, P. Pavlakis, and D. Rokos, “Detection and discrimination between oil spills and look-alike phenomena through neural networks,” ISPRS J. Photogramm. Remote Sens., vol. 62, no. 4, pp. 264–270, Sep. 2007.

[8] J. S. Murgan and V. Parthasarathy, “AETC: Segmentation and classifica- tion of the oil spills from SAR imagery,” Environ. Forensics, vol. 18, no. 4, pp. 258–271, Nov. 2017.

[9] H. Guo, G. Wei, and J. An, “Dark spot detection in SAR images of oil spill using segnet,” Appl. Sci., vol. 8, no. 12, pp. 1–17, Dec. 2018.

[10] P. Wang, H. Zhang, and V. M. Patel, “SAR image despeckling using a convolutional neural network,” IEEE Signal Process. Lett., vol. 24, no. 12, pp. 1763–1767, Dec. 2017.

[11] G. Chen, Y. Li, G. Sun, and Y. Zhang, “Application of deep networks to oil spill detection using polarimetric synthetic aperture radar images,” Appl. Sci., vol. 7, no. 10, pp. 1–15, Sep. 2017.

[12] J. F. Penner and D. G. Long, “Ground-Based 3D radar imaging of trees us- ing a 2D synthetic aperture,” Electronics, vol. 6, no. 1, pp. 1–13, Jan. 2017.

[13] F. M. Bianchi, O. Martine, M. Espeseth, and N. Borch, “Large-Scale detection and categorization of oil spills from SAR images with deep learning,” Remote Sens., vol. 12, no. 14, Jul. 2020, Art. no. 2260.

ISBN: 978-81-965236-7-1

[14] D. Malmgren-Hansen and M. Nobel-Jorgensen, “Convolutional neural networks for SAR image segmentation,” in Proc. IEEE Int. Symp. Signal Process. Inf. Technol., 2015, pp. 231–236.

[15] J. Zhang, H. Feng, Q. Luo, Y. Li, J. Wei, and J. Li, “Oil spill detection in quad- polarimetric SAR images using an advanced convolutional neural network based on superpixel model,” Remote Sens., vol. 12, no. 6, pp. 1–26, Mar. 2020.

[16] R. Li et al., “DeepUNet: A deep fully convolutional network for pixel-level sea-land segmentation,” IEEE J. Sel. Topics Appl. Earth Observ. Remote Sens., vol. 11, no. 11, pp. 3954–3962, Nov. 2018.

[17] B. Liu, Y. Li, G. Li, and A. Liu, “A spectral feature based convolutional neural network for classification of sea surface oil spill,” ISPRS, Int. J. Geo-Inf., vol. 8, no. 4, pp. 1–14, Mar. 2019.

[18] H. Guo, D. Wu, and J. An, “Discrimination of oil slicks and lookalikes in polarimetric SAR images using CNN,” Sensors, vol. 17, no. 8, pp. 1–20, Aug. 2017.

[19] Y. Duan, F. Liu, L. Jiao, P. Zhao, and L. Zhang, “SAR image segmentation based on convolutional-wavelet neural network and Markov random field,” Pattern Recognit., vol. 64, pp. 255–267, Apr. 2017.

[20] T. Y. Lin, P. Dollár, R. Girshick, K. He, B. Hariharan, and S. Belongie, “Feature pyramid networks for object detection,” in Proc. IEEE Conf. Comput. Vis. Pattern Recognit., 2017, pp. 936–944.

[21] C. Brekke and A. H. Solberg, “Oil spill detection by satellite remote sensing,” Remote Sens. Environ., vol. 95, no. 1, pp. 1–13, Mar. 2005.

[22] O. Garcia-Pineda, I. R. MacDonald, X. Li, C. R. Jackson, and W. G. Pichel, “Oil spill mapping and measurement in the gulf of Mexico with textural classifier neural network Algorithm(TCNNA),” IEEE J. Sel. Topics Appl. Earth Observ. Remote Sens., vol. 6, no. 6, pp. 2517–2525, Dec. 2013.

[23] M. Krestenitis, G. Orfanidis, K. Ioannidis, K. Avgerinakis, S. Vrochidis, and I. Kompatsiaris, “Oil spill identification from satellite images using deep neural networks,” Remote Sens., vol. 11, no. 15, pp. 1–22, Jul. 2020.

[24] F. Ma, F. Zhang, D. Xiang, Q. Yin, and Y. Zhou, “Fast task-specific region merging for SAR image segmentation,” IEEE Trans. Geosci. Remote Sens., vol. 60, 2022, Art. no. 5222316.

[25] F. Ma, F. Zhang, D. Xiang, Q. Yin, and Y. Zhou, “Fast SAR image sefmen- tation with deep task-specific superpixel sampling and soft graph convolu- tion,” IEEE Trans. Geosci. Remote Sens., vol. 60, 2022, Art. no. 5214116.

[26] D. Hong et al., “More diverse means better: Multimodal deep learning meets remote-sensing imagery classification,” IEEE Trans. Geosci. Re- mote Sens., vol. 59, no. 5, pp. 4340–4354, May 2021.

[27] D. Hong, L. Gao, J. Yao, B. Zhang, A. Plaza, and J. Chanussot, “Graph con- volutional networks for hyperspectral image classification,” IEEE Trans. Geosci. Remote Sens., vol. 59, no. 7, pp. 5966–5978, Jul. 2021.

[28] D. Hong et al., “SpectralFormer: Rethinking hyperspectral image classification with transformers,” IEEE Trans. Geosci. Remote Sens., vol. 60, pp. 1–15, Nov. 2021, Art. no. 5518615, doi: 10.1109/TGRS. 2021.3130716.

[29] L. Xu, M. J. Shafiee, A. Wong, F. Li, L. Wang, and D. Clausi, “Oil spill candidate detection from SAR imagery using a thresholding-guided stochastic fully-connected conditional random field model,” in Proc. IEEE Conf. Comput. Vis. Pattern Recognit. Workshops, 2015, pp. 79–86.

[30] Y. Bengio, A. C. Courville, and P. Vincent, “Unsupervised feature learn- ing and deep learning: A review and new perspectives,” Jun. 2012, arXiv:1206.5538v1[cs.LG].

[31] Q. Fan et al., “Ship detection using a fully convolutional network with com- pact polarimetric SAR images,” Remote Sens., vol. 11, no. 18, pp. 1–15, Sep. 2019.

[32] A. Newell, K. Yang, and J. Deng, “Stacked hourglass networks for human pose estimation,” in Proc. Eur. Conf. Comput. Vis., Comput. Vis., Sep. 2016, pp. 483–499.

[33] A. Shrivastava, R. Sukthankar, J. Malik, and A. Gupta, “Beyond skip connections: Top-down modulation for object detection,” Sep. 2017, arXiv:1612.06851v2[cs.CV] .

[34] C. Y. Fu, W. Liu, A. Ranga, A. Tyagi, and A. C. Berg, “Dssd: Deconvolu- tional single shot detector,” Jan. 2017, arXiv:1701.06659v1[cs.CV].

[35] J. Long, E. Shelhamer, and T. Darrell, “Fully convolutional networks for semantic segmentation,” in Proc. IEEE Conf. Comput. Vis. Pattern Recognit., 2015, pp. 3431–3440.

ISBN: 978-81-965236-7-1

Modeling of Modular Multilevel Converter

M.Barkavi, Assistant Professor, Department of EEE,
Sri Bharathi Engineering College for Women, Pudukkottai.
bharkavi8@gmail.com

Abstract — **This paper provides the simulation and analysis of single phase Modular Multilevel Converter using differential equations. The Modular Multilevel Converter is a new solution in the field of medium and high power electronics applications. It is a combination of cascaded multilevel converter and flying capacitor multilevel converter. The converter operation is based on the modular approach. By overcoming the drawbacks of multilevel converter modular multilevel converter is designed. In this project capacitor voltage balancing strategy using differential equations for three phase modular multilevel converter without output distortion also proposed. Besides balancing strategy has reduced the losses and improved the efficiency of anticipated modular multilevel converter.**

Keywords –Modular multilevel converter, capacitor voltage control.

I. INTRODUCTION

The current energy scenario is unavoidably changing. The dependence on fossil fuels and the progressive increase of its cost is leading to the investment of huge amounts of resources, economical and human, to develop new cheaper and cleaner energy resources not directly related to fossil fuels as well as to seek for the maximum efficiency in every energy conversion process. The MMC is a new and promising converter that can be used with high voltage and power levels. Among the different multilevel topologies; the modular-multilevel converter is designed for different voltage level. It is a new configuration of IGBT based VSC.

A. Advantages

Overcome the drawbacks of this multilevel converter, advantages over previous types of converters. Just one isolated DC supply is required. In other words, it is similar to a conventional converter in the sense of having a dc side and an AC side. Low switching frequency, high quality in the output waveform, reduced voltage steps in the switches. Modular realization, easily achieved just by using more cells than strictly needed. Faults cells can be easily by passed. The internal arm currents are not chopped, they flow continuously. The sub modules are two terminal devices. There is no need to supply the DC side capacitor with energy. This is true for real power or reactive power transmission of the converter in any direction or combination. Voltage balancing of the sub modules is not critical with respect to the timing of the pulses or the semiconductor switching times. In simple the MMC have low switching losses and there is no need of bulk DC capacitor.

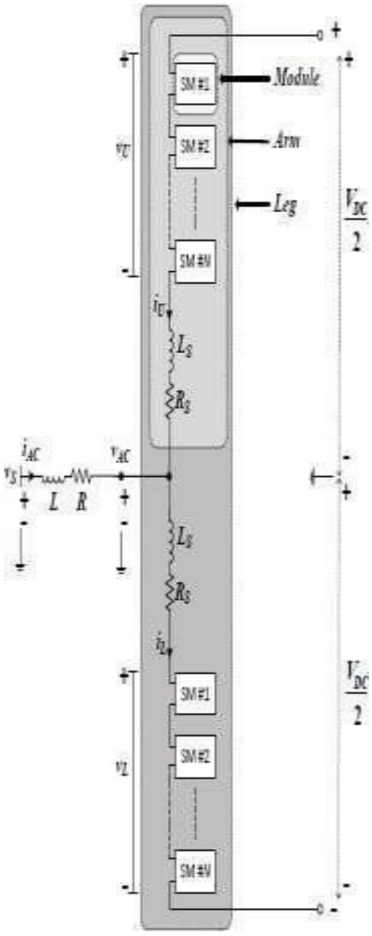
II. LITERATURE SURVEY

In [1], design and operation of Modular Multi Level converter is implemented. Here sub modules are connected in series, and form a single phase converter by expanding the single phase converter into three phase converter by adding more legs. Here study was done for known about the operation and principles of modular multi-level converter and intrinsic features about the Modular Multi Level Converter configuration. In [2], MMC family is based on multiple bidirectional chopper cells or single phase full bridge cells. MMC classified into four types from circuit configuration as follows: single star chopper cell (SSCC), single delta bridge cell (SDBC), double star chopper cell (DSCC), double star bridge cell (DSBC). Based on the applications double star chopper cell(DSCC)is used. In [3], performance of converter depends upon the pulse width modulation. Based upon the frequency, carrier and reference signal, modulation technique is used for control of converter. Several PWM techniques are used to analysis of MMC.

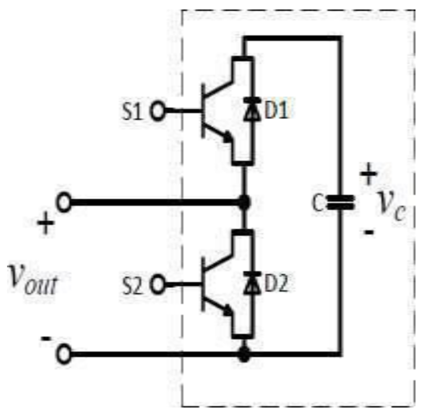
Using the sinusoidal pulse width modulation and types of its method depends upon phase shifting among carrier wave forms, and classified as phase disposition (PD) technique, phase opposition disposition (POD), alternate phase opposition disposition (APOD). Due to the advantage of alternate phase opposition disposition technique, it will be used for the analysis. In [4], describing the structure and operation of a single module, which will then be included in a single-phase model and finally in a three-phase model and the switching operations of the converter. Using the sinusoidal pulse width modulation, the control of MMC and harmonics reduction in current and voltage was performed by simulation. In [5], describing the modeling of the modular multilevel converter based on differential equations. By using two cascaded control loops a multilevel voltage and capacitor voltage balancing was obtained. The simulation was done by using the detailed modeling equations, which is suitable for n number of sub modules. In [6], authors proposed two types of pulse width-modulated modular multilevel converters (PWMMMCs) with focus on their circuit configurations and voltage balancing control. Combination of averaging and balancing controls enables the PWM-MMCs to achieve voltage balancing without any external circuit. The viability of the PWM-MMCs, as well as the effectiveness of the voltage-balancing control, is confirmed by simulation and experiment. In [7], authors proposed an improved phase disposition pulse width modulation (PDPWM) for a modular multilevel inverter which is used for Photovoltaic grid connection.

This modulation method is based on selective virtual loop mapping, to achieve dynamic capacitor voltage balance without the help of an extra compensation signal.

A. Structure of MMC



B. Structure of submodule



C. Equations

Five level mmc mathematical equation

$$V_{AO} = V_{PO} - \sum_{i=1}^{n/2} V_{ci} \cdot (1 - S_i)$$

$$V_{BO} = -V_{ON} + \sum_{i=n/2+1}^{n} V_{ci} \cdot S_i$$

$$V_{AB} = V_{AO} - V_{BO} = V_{PO} + V_{ON} - \sum_{i=1}^{n/2} V_{ci} \cdot (1 - S_i) - \sum_{i=n/2+1}^{n} V_{ci} \cdot S_i$$

D. Capacitor voltage control

A control method and the operating performances of Modular Multilevel Converter (MMC) for high-voltage motor drive. The magnitude of capacitor voltage ripples increases when operating frequency decreases. To deal with the significant voltage fluctuation under low frequency conditions, theoretical analysis is presented in this paper, and a new capacitor voltage balancing control strategy is proposed, which is based on carrier phase-shifted sinusoidal pulse width modulation (CPS-SPWM). The simulation results show that MMC works well and capacitor voltages are balanced with the control strategy at low frequency.

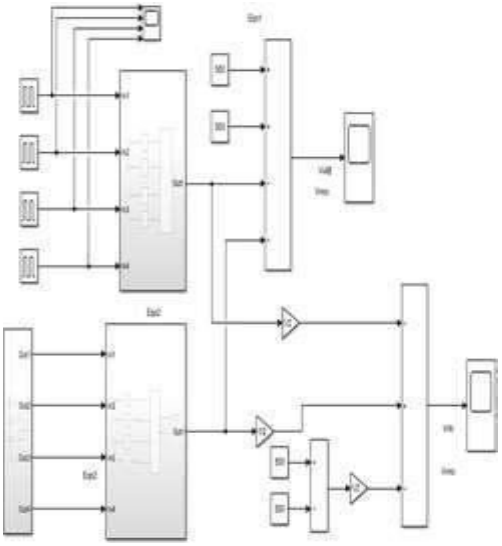
High-voltage AC-AC power converters have been widely used in industry, because of the wide speed range, quick response and good performances. In the field of high-voltage AC-AC power conversion, traditional "high-low-high" two-level AC-AC converters with introduction of transformers have the disadvantages of large volume, high cost and low efficiency, and high-voltage AC-AC converters based on power electronic devices in series are hard to achieve. Contrast to the drawbacks of traditional AC-AC converters mentioned above, the multilevel converter technology has the advantages of low harmonic component, small *dV/dt*, high power factor, and it has developed rapidly in the last few years. Modular Multilevel Converters (MMCs) are made up of many sub modules (SMs)connected in series. In order to avoid semiconductor over- voltages, SM capacitors should be kept within strict voltage limits.

The Capacitor Balancing Controller (CBC) is used to sort SM capacitor voltages prior to modulation. As a generation of high-capacity Voltage Source Converter (VSC), Modular Multilevel Converter (MMC) is a potential topology of VSC based High Voltage Direct Current Transmission System(VSC-HVDC).Focuses on the voltage balancing control of floating dc capacitors based on CPS-PWM. The imbalance mechanics of capacitor voltage between and within arms are theoretically revealed. A new balancing control strategy called Capacitor Voltage Balancing Control Loop (CVBC Loop) is proposed, which can directly and accurately regulate the active power injected into the MMC module to guarantee dc voltage balance of capacitors within the same arm. The experiment

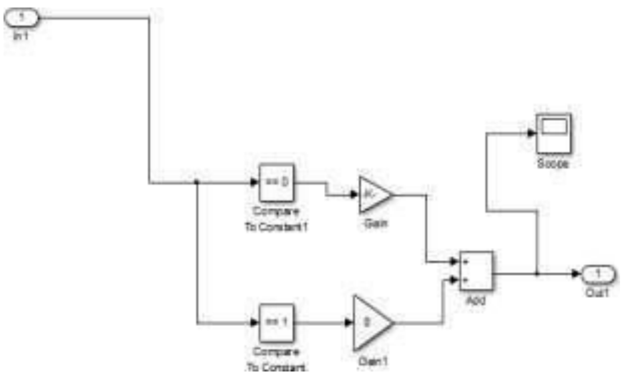
ISBN: 978-81-965236-7-1

Results verify the validity of the proposed control strategy under both steady and dynamic state.

III. Mathematical Modeling of an MMC



A. Basic diagram of submodule in simulation



B. Considerations

- No of level=N=5
- No of cells per arm=N-1
  =5-1=4
- No of switches per cell=2
- Topcellswitchis1;bottomcellswitchis2
- No of gate pulse pattern needed=N-1
- In the first half of upper arm, the switch 2 connected to direct pulse switch 1 connected to inverter pulse
- In the second half of upper arm, the switch 1 connected to direct pulse switch 2 connected to inverted pulse
- No of arms per leg(phase)=2
- No of sources needed=2
- Same voltage level, connected in series and center point is connected to ground.

C. Pulse generator

The Pulse Generator block generates square wave pulses at regular intervals. The block's waveform parameters are Amplitude, Pulse Width, Period, and Phase delay, determine the shape of the output waveform. The pulse type for this block is time-based or sample-based. The default is time- based. The pulse amplitude default is 1. Time specifies whether to use simulation time or an external signal as the source of values for the output pulse's time variable. In this Use simulation time, the block generates an output pulse where the time variable equals the simulation time. The duty cycle specified as the percentage of the pulse period that the signal is on if time-based. The period is mentioned in milli seconds. The value of frequency is 50HZ.

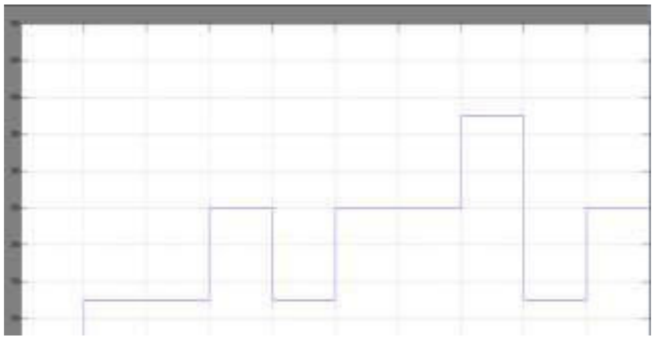
D. Not gate

This is a logic operator which performs inverse operation. If the input is true, output is false. If the input is false, output is false.

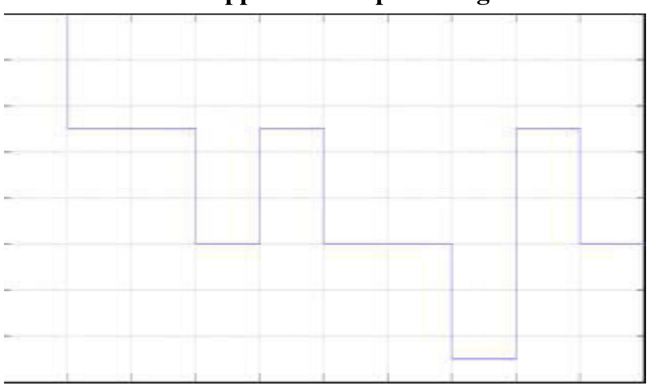
Not gate pulse for submodules	
T112	T111
T122	T121
T131	T132
T141	T142

IV. Simulation Results

A. Lower arm output voltage

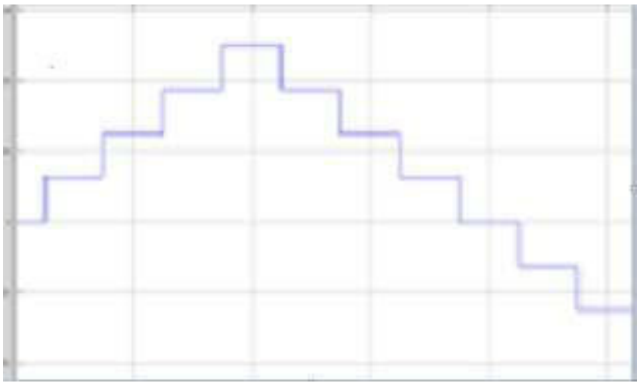


B. Upper arm output voltage



ISBN: 978-81-965236-7-1

C. Five level MMC output voltage



V. CONCLUSION

The new and promising type of Modular Multi Level Converter is proposed. Its performance can be analyzed by differential equations. The analysis was based on the use of a simplified circuit, constituted by a single leg of the converter, where all the modules in each arm were represented by a single voltage source. From single phase converter it was extended to three phase converter and the analysis was performed. To make the analysis valid using the Sinusoidal Pulse Width Modulation. Due to the differential get smooth output waveform with different voltage level. Capacitor voltage balancing strategy using differential equations for three phase modular multilevel converter without output distortion also proposed. Besides balancing strategy was reduced the losses and improved the efficiency of anticipated modular multilevel converter.

References

[1] S. Allebrod, R. Hamerski, R.Marquardt, "New Transformer less, Scalable Modular Multilevel Converters for HVDC-Transmission, "IEEE Power Electronics Specialists Conference, pp. 174-179, June 2008.

[2] A. Lesnicar, R.Marquardt, "An Innovative Modular Multilevel Converter Topology Suitable for a Wide Power Range, "IEEE Power Tech Conference Proceedings, vol. 3, pp. 6, Bologna 2003.

[3] Maryam, S., Iravani, R.: ‘Dynamic performance of a modular multilevel back-to-back HVDC system’, IEEE Trans. Power Deliv., 2010, 25, (4),pp. 2903–2912.

[4] Rohner,S., Bernet,S. Hiller,M., Sommer,R., „Modulation, Losses and Semiconductor Reuirements of modular Multilevel Converters, IEEETransactionsonIndustrialElectronics,Vol.57, No. 8 August 2010.

[5] K. Friedrich, Modern HVDC PLUS Application of VSC in Modular Multilevel Converter Topology, in: IEEE International Symposium on Industrial Electronics (ISIE), 2010.

[6] Osaka, Japan, 2007. [2] J. Dorn, H. Huang, and D. Retzmann, “A new multilevel voltage source dc converter topology for HVDC applications,” in Proc .CIGRE, Paris, France, 2008, pp. 1–8, paper B4-304.

[7] Q. R. Tu, Z. Xu, and L. Xu, "Reduced switching-frequency modulation and circulating current suppression for modular multilevel converters, "IEEE Trans. Power Del., vol. 26, no. 3, pp. 2007-2008, Jul. 2010.

ISBN: 978-81-965236-7-1

LINEAR ALGEBRAIC METHODS IN NEURAL NETWORKS

[1]Ms.R.Divya
Assistant Professor, Department of Mathematics,
Sri Bharathi Engineering College for Women, Pudukkottai-622 303 , Tamilnadu, India.
Email: [1]rdivya2610@gmail.com

Abstract - **Neural networks have emerged as powerful tools for solving complex problems in various domains, ranging from image recognition to natural language processing. Understanding the mathematical foundations of neural networks is crucial for optimizing their performance and unlocking their full potential. This paper focuses on the application of linear algebraic methods in the analysis and enhancement of neural networks. A comprehensive review of matrix decompositions, such as Singular Value Decomposition (SVD) and Eigen value Decomposition, is presented in the context of neural networks. These techniques provide insights into the network's structure, aiding in model interpretation and identifying critical features that contribute to its performance. Additionally, the paper discusses how these methods can be employed for regularization, dimensionality reduction, and feature extraction in neural networks. Finally, practical applications of linear algebraic methods in neural networks are illustrated through case studies, demonstrating their efficacy in tasks such as transfer learning, adversarial robustness, and model compression. The paper concludes with a discussion on the potential avenues for future research in leveraging linear algebra to advance the field of neural network design and optimization.**

Keywords---Neural Networks, Linear Algebra,Matrix representation, Matrix Decomposition, Singular Value Decomposition(SVD), Computational efficiency.

I.INTRODUCTION

Neural networks have become a cornerstone of modern artificial intelligence, revolutionizing various fields including computer vision, natural language processing, and reinforcement learning. These networks, inspired by the structure and function of the human brain, consist of interconnected layers of neurons capable of learning complex patterns and relationships from data.

While neural networks exhibit remarkable performance in many tasks, understanding their inner workings and optimizing their performance remains a challenging endeavor. At the heart of neural network theory lies linear algebra, a branch of mathematics concerned with vector spaces and linear transformations. The application of linear algebraic methods in neural networks provides a rigorous framework for analyzing their behavior, interpreting their decisions, and enhancing their capabilities. By representing neural network operations in terms of matrices and vectors, we can leverage powerful mathematical tools to gain insights into their structure and dynamics.

This paper aims to explore the role of linear algebraic methods in advancing the theory and practice of neural networks. We begin by providing an overview of neural network architecture, highlighting the flow of information through layers of neurons and the mathematical operations involved in processing input data. Emphasis is placed on the non-linear transformations introduced by activation functions, which play a crucial role in enabling neural networks to model complex relationships.

Next, we delve into the matrix representations of neural network operations, demonstrating how concepts from linear algebra can be used to succinctly describe the computations performed by the network. We explore matrix decompositions such as Singular Value Decomposition (SVD) and Eigenvalue Decomposition, showcasing their utility in model interpretation, regularization, and dimensionality reduction.

The intersection of linear algebra and optimization is then explored in the context of neural network training. We discuss gradient descent variants and their connection to linear algebraic operations, highlighting the importance of efficient optimization techniques for training deep neural networks. Additionally, we investigate the role of weight initialization strategies and their impact on the convergence and generalization of neural network models.

ISBN: 978-81-965236-7-1

Throughout the paper, we provide practical examples and case studies illustrating the application of linear algebraic methods in neural network design and optimization. Topics such as transfer learning, adversarial robustness, and model compression are discussed, demonstrating how linear algebra can be leveraged to address real-world challenges in machine learning.

This paper serves as a comprehensive exploration of the synergy between linear algebra and neural networks. By leveraging the rich mathematical framework provided by linear algebra, we can gain deeper insights into the behavior of neural networks and develop more efficient and robust learning algorithms. The integration of linear algebraic methods paves the way for further advancements in the field of neural network research and holds promise for unlocking the full potential of artificial intelligence.

II.SINGULAR VALUE DECOMPOSITION

The singular value decomposition (SVD) of a matrix is a decomposition of the matrix into a product of an orthogonal matrix, a diagonal matrix, and another orthogonal matrix. It is one of the most powerful ideas in linear algebra. However, to understand it fully one must first understand certain facts about symmetric matrices. Thus, our first section will show that all symmetric matrices are orthogonally diagonalizable. Not only can we construct a basis of eigenvectors for any symmetric matrix, but the the matrix formed out of these vectors, P, will be an orthogonal matrix! We will then make this relationship between orthogonal diagonalization and symmetric matrices even tighter; a matrix is orthogonally diagonalizable if and only if it is a symmetric matrix. This result is known as the spectral theorem.

Definition: A symmetric matrix is a n × n matrix A that is equal to its transpose. This means that for all 1 ≤ i, j ≤ n $a_{ij} = a_{ji}$.

Definition: A matrix A is orthogonally diagonalizable if there exists an orthogonal matrix P and a diagonal matrix D such that $A = P\,DP^{-1} = PDP^{T}$

Definition: For a symmetric n × n matrix A, we define a spectral decomposition of A as being a sum of the form

$$A = \lambda_1 u_1 u_1^T + \lambda_2 u_2 u_2^T + \cdots .. + \lambda_n u_n u_n^T$$

where P = $[u_1, u_2, ..., u_n]$ is an orthogonal set of unit eigenvectors, and $\lambda_1, \lambda_2, ..., \lambda_n$ are the eigenvalues of A corresponding to P. The spectral decomposition is in fact found by orthogonally diagonalizing A.

Theorem: Let A be any $m \times n$ matrix with rank r. Then, $A = U\Sigma V^T$ where U is an $m \times m$ orthogonal matrix, V is an $n \times n$ orthogonal matrix, and Σ is an m × n matrix such that

$$\Sigma = \begin{bmatrix} D & 0 \\ 0 & 0 \end{bmatrix}$$

where D is a r × r diagonal matrix. The remaining $m - r$ rows and $n - r$ columns of Σ will be 0. D will be the first r non-zero singular values of A, (σ_1, . . . , σ_r), such that

$$\sigma_1 \geq \sigma_2 \geq \ldots \geq \sigma_r > 0$$

We call $A = U\Sigma V^T$ a **singular value decomposition** of A.

The power of the singular value decomposition is that it exists for any matrix without restrictions. Because of this, the applications of the singular value decomposition are extremely powerful for data analysis.

III.NEURAL NETWORKS

A neural network is composed of neurons and edges with the neurons usually organized in layers and the directed edges connecting neurons from one layer to the next. We can think of neurons as variables with assigned values which we calculate through "forward propagation" which will be defined later. They are also called activation units. We can think of edges as variables whose value indicates how strongly one neuron influences another. The weights will serve as a type of scalar to the neuron it recieves.

These edges' values will be used to define functions that take the values of the neurons in one layer and use these to define values in the next layer. There will be a pre-determined number of layers in the network and the activation units in the final layer will signify something about the data inputted into the neural network. For example, suppose we have a data point with two variables and we want to classify the point as "on" or "off". Consider figure 1 which displays a neural network with one "hidden layer", the layers that do not contain input or output neurons and with three neurons inside this layer.

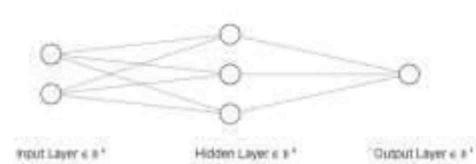
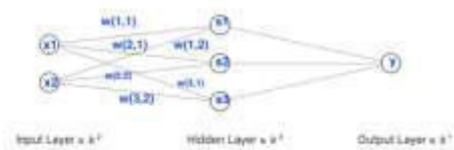


Figure 1. Structure of a Neural Network

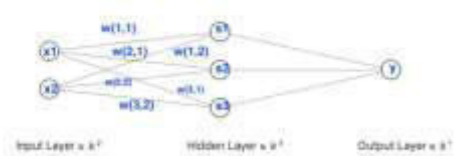
ISBN: 978-81-965236-7-1

The depth of the network is equal to the total number of layers in the network. Each layer will also have a width which is based on the number of neurons at each layer. We call the value of the edges that connect neurons to different layers, the weights of the network. The weights are used to define a function that uses one layer to define how one input neuron becomes another input neuron. We have x_1, x_2 as the input neurons, where w_{ij} represents the weights applied to the them. Also S_1, S_2, S_3 are the neurons at the hidden layer, and y is the output neuron. Consider figure



How do these weights transform the neurons? The best way to understand this is by viewing a neural network as simply layers of matrix-vector multiplication composed together.

If we have a data set the entire data set will usually be a data matrix X, where each vector is a data point. In our previous example, each data point would have two variables, x_1 and x_2. Thus, we can think of each layer of neurons as a vector. If a layer has 3 neurons, it would be represented as a vector with dimension 3. In a fully connected layer, there is an edge between each input neuron and each output neuron. In this case, we can represent the edges together as a matrix as well. We will call this the weight matrix. Thus, the action of the weights on the first layer becomes



$$\begin{bmatrix} w_{11} & w_{12} \\ w_{21} & w_{22} \\ w_{31} & w_{32} \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} w_{11}x_1 + w_{12}x_2 \\ w_{21}x_1 + w_{22}x_2 \\ w_{31}x_1 + w_{32}x_2 \end{bmatrix}$$

which would then undergo another matrix multiplication to produce the output neuron y.

We previously only described the interactions between neurons and edges as matrix-transformation. However, neural networks will be made up of non linear transformations. The goal of many neural networks is to identify complicated patterns to solve complicated problems. Having our functions limited to be linear functions would severely restrict the ability for neural networks to identify complicated patterns that will most likely not be linear. Therefore, at each layer we introduce, non linear activation functions which transform our linear functions into non linear functions. Consider the activation function σ as $\mathbb{R} \to \mathbb{R}$. Let $\sigma_b : \mathbb{R}^n \to \mathbb{R}$ where $b \in \mathbb{R}^n$. We now describe the interaction between neurons and edges as an non linear function becomes

$$\sigma_b\left(\begin{bmatrix} w_{11} & w_{12} \\ w_{21} & w_{22} \\ w_{31} & w_{32} \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} w_{11}x_1 + w_{12}x_2 \\ w_{21}x_1 + w_{22}x_2 \\ w_{31}x_1 + w_{32}x_2 \end{bmatrix}\right)$$

$$= \sigma_b\left(\begin{bmatrix} w_{11}x_1 + w_{12}x_2 \\ w_{21}x_1 + w_{22}x_2 \\ w_{31}x_1 + w_{32}x_2 \end{bmatrix}\right)$$

$$= \begin{bmatrix} \sigma(w_{11}x_1 + w_{12}x_2 - b_1) \\ \sigma(w_{21}x_1 + w_{22}x_2 - b_2) \\ \sigma(w_{31}x_1 + w_{32}x_2 - b_3) \end{bmatrix}$$

where σ_b maps the dimension of the output neurons to the same dimension. Thus if we have $y_1, \ldots y_n$ output neurons at each layer, we have

$$\sigma_b\left(\begin{bmatrix} y_1 \\ \vdots \\ y_n \end{bmatrix}\right) = \begin{bmatrix} \sigma(y_1 - b_1) \\ \vdots \\ \sigma(y_n - b_n) \end{bmatrix}$$

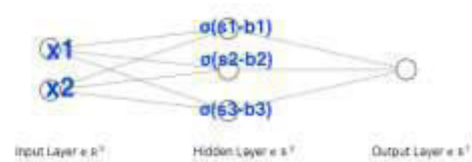


Figure 2. Non Linear Transformation

Example: Let's consider a helpful, but slightly unrealistic example. Suppose we have images representing two numbers: a 1 and a 0. A one would be a 3 × 3 matrix with values down the middle. A 0 will also be a 3 × 3 matrix but with values all the way across the perimeter. Let's consider that our data set has just a 1 and a 2.

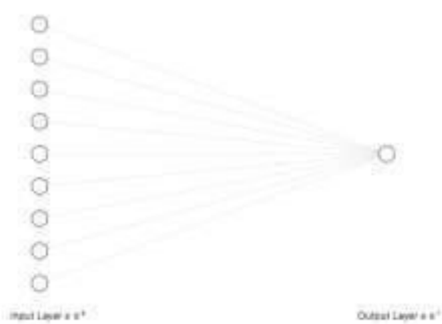
$$1 = \begin{bmatrix} 0 & 5 & 0 \\ 0 & 8 & 0 \\ 0 & 1 & 0 \end{bmatrix}, 0 = \begin{bmatrix} 1 & 3 & 4 \\ 1 & 0 & 5 \\ 3 & 7 & 6 \end{bmatrix}$$

ISBN: 978-81-965236-7-1

Note that if we vectorize both matrices, which is common in neural networks, the number in vector for will be

$$1 = \begin{bmatrix} 0 \\ 5 \\ 0 \\ 0 \\ 8 \\ 0 \\ 0 \\ 1 \\ 0 \end{bmatrix}, 0 = \begin{bmatrix} 1 \\ 3 \\ 4 \\ 1 \\ 0 \\ 5 \\ 3 \\ 7 \\ 6 \end{bmatrix}$$

Imagine we constructed a two-layer neural network, with 9 input neurons and one output neuron.



As explained later, the values of our weights will be randomly initialized. Nevertheless, their values would determine the value of the neurons in the final layer.

$$\sigma\left([4\ 4\ 3\ 3\ 1\ 6\ 7\ 9\ 10] \begin{bmatrix} 0 \\ 5 \\ 0 \\ 0 \\ 8 \\ 0 \\ 0 \\ 1 \\ 0 \end{bmatrix} \right) = \sigma([37])$$

$$\sigma\left([4\ 4\ 3\ 3\ 1\ 6\ 7\ 9\ 10] \begin{bmatrix} 1 \\ 3 \\ 4 \\ 1 \\ 0 \\ 5 \\ 3 \\ 7 \\ 6 \end{bmatrix} \right) = \sigma([205])$$

Both the non linear activation function and the bias vector work in tandem to improve our network's ability to make accurate predictions on complicated problems.

Applying the activation function first introduces this non linearity to our function, allowing our network to recognize more complex patterns. Secondly, together with the bias vector it helps normalize the values of neurons between a certain range. The bias vector helps determine the cut-off in how neurons will transitions between a certain range.

For example, consider a commonly used activation function where each neuron is scaled to a value between 0 and 1.

$$\sigma = \frac{1}{1 + e^{-\beta x}}$$

IV.CONVOLUTIONAL NEURAL NETWORKS

Convolution as a Sliding Dot Product:

Particularly for image-processing, most neural networks have multiple layers that involve convolution before they reach fully-connected layers. The purpose of convolutional layers is to extract features from the input image. The input layer will be some input image which can be represented with an m × n matrix A where each entry corresponds to a pixel in the image. This is the standard for grey-scale pictures. However, for color images where we are using the RGB color model, each RGB component of the image is represented by a matrix. Viewing these three separate m×n matrices as one object, we obtain a higher-dimensional version of a matrix called a tensor.

Consider the case of a grey-scale image represented by the following matrix

$$A = \begin{bmatrix} 3 & 3 & 2 & 1 & 0 & 5 \\ 0 & 0 & 1 & 3 & 1 & 6 \\ 3 & 1 & 2 & 2 & 3 & 7 \\ 2 & 0 & 0 & 2 & 2 & 8 \\ 2 & 0 & 0 & 0 & 1 & 9 \end{bmatrix}$$

We can consider the following 9 different sub-matrices $A_1, \ldots A_{12}$respectively

$$\begin{pmatrix} 3 & 3 & 2 & 1 & 0 & 5 \\ 0 & 0 & 1 & 3 & 1 & 6 \\ 3 & 1 & 2 & 2 & 3 & 7 \\ 2 & 0 & 0 & 2 & 2 & 8 \\ 2 & 0 & 0 & 0 & 1 & 9 \end{pmatrix} \begin{pmatrix} 3 & 3 & 2 & 1 & 0 & 5 \\ 0 & 0 & 1 & 3 & 1 & 6 \\ 3 & 1 & 2 & 2 & 3 & 7 \\ 2 & 0 & 0 & 2 & 2 & 8 \\ 2 & 0 & 0 & 0 & 1 & 9 \end{pmatrix}$$

$$\begin{pmatrix} 3 & 3 & 2 & 1 & 0 & 5 \\ 0 & 0 & 1 & 3 & 1 & 6 \\ 3 & 1 & 2 & 2 & 3 & 7 \\ 2 & 0 & 0 & 2 & 2 & 8 \\ 2 & 0 & 0 & 0 & 1 & 9 \end{pmatrix} \begin{pmatrix} 3 & 3 & 2 & 1 & 0 & 5 \\ 0 & 0 & 1 & 3 & 1 & 6 \\ 3 & 1 & 2 & 2 & 3 & 7 \\ 2 & 0 & 0 & 2 & 2 & 8 \\ 2 & 0 & 0 & 0 & 1 & 9 \end{pmatrix}$$

$$\begin{pmatrix} 3 & 3 & 2 & 1 & 0 & 5 \\ 0 & 0 & 1 & 3 & 1 & 6 \\ 3 & 1 & 2 & 2 & 3 & 7 \\ 2 & 0 & 0 & 2 & 2 & 8 \\ 2 & 0 & 0 & 0 & 1 & 9 \end{pmatrix} \begin{pmatrix} 3 & 3 & 2 & 1 & 0 & 5 \\ 0 & 0 & 1 & 3 & 1 & 6 \\ 3 & 1 & 2 & 2 & 3 & 7 \\ 2 & 0 & 0 & 2 & 2 & 8 \\ 2 & 0 & 0 & 0 & 1 & 9 \end{pmatrix}$$

$$\begin{pmatrix} 3 & 3 & 2 & 1 & 0 & 5 \\ 0 & 0 & 1 & 3 & 1 & 6 \\ 3 & 1 & 2 & 2 & 3 & 7 \\ 2 & 0 & 0 & 2 & 2 & 8 \\ 2 & 0 & 0 & 0 & 1 & 9 \end{pmatrix} \quad \begin{pmatrix} 3 & 3 & 2 & 1 & 0 & 5 \\ 0 & 0 & 1 & 3 & 1 & 6 \\ 3 & 1 & 2 & 2 & 3 & 7 \\ 2 & 0 & 0 & 2 & 2 & 8 \\ 2 & 0 & 0 & 0 & 1 & 9 \end{pmatrix}$$

$$\begin{pmatrix} 3 & 3 & 2 & 1 & 0 & 5 \\ 0 & 0 & 1 & 3 & 1 & 6 \\ 3 & 1 & 2 & 2 & 3 & 7 \\ 2 & 0 & 0 & 2 & 2 & 8 \\ 2 & 0 & 0 & 0 & 1 & 9 \end{pmatrix} \quad \begin{pmatrix} 3 & 3 & 2 & 1 & 0 & 5 \\ 0 & 0 & 1 & 3 & 1 & 6 \\ 3 & 1 & 2 & 2 & 3 & 7 \\ 2 & 0 & 0 & 2 & 2 & 8 \\ 2 & 0 & 0 & 0 & 1 & 9 \end{pmatrix}$$

$$\begin{pmatrix} 3 & 3 & 2 & 1 & 0 & 5 \\ 0 & 0 & 1 & 3 & 1 & 6 \\ 3 & 1 & 2 & 2 & 3 & 7 \\ 2 & 0 & 0 & 2 & 2 & 8 \\ 2 & 0 & 0 & 0 & 1 & 9 \end{pmatrix} \quad \begin{pmatrix} 3 & 3 & 2 & 1 & 0 & 5 \\ 0 & 0 & 1 & 3 & 1 & 6 \\ 3 & 1 & 2 & 2 & 3 & 7 \\ 2 & 0 & 0 & 2 & 2 & 8 \\ 2 & 0 & 0 & 0 & 1 & 9 \end{pmatrix}$$

Convolution involves performing a dot-product operation between each submatrix and a pre-determined kernel matrix. The kernel matrix is the matrix that slides through every sub-matrix and performs a dot-product operation. The kernel represents some feature in the image that we are trying to recognize. Each entry in the output matrix says something about the similarity between the kernel and the corresponding sub-matrix that was used to compute the dot product. Suppose our kernel matrix is

$$k = \begin{bmatrix} 0 & 1 & 2 \\ 2 & 2 & 0 \\ 0 & 1 & 2 \end{bmatrix}$$

The result of the convolution of A with k would be

$$\begin{bmatrix} A_1.k & A_2.k & A_3.k & A_4.k \\ A_5.k & A_6.k & A_7.k & A_8.k \\ A_9.k & A_{10}.k & A_{11}.k & A_{12}.k \end{bmatrix} = \begin{bmatrix} 12 & 12 & 17.0 & 35 \\ 10.0 & 17.0 & 19.0 & 41 \\ 9.0 & 6.0 & 14.0 & 44 \end{bmatrix}$$

Consider how we got $A_4.k$

$$1*0+0*1+2*5+2*3+1*2+6*0+2*0+1*3+7*2$$

Note that the dot product of a matrix with itself is the square of its magnitude, so values in the matrix output that are close to the magnitude squared of the kernel, indicate that that part of the matrix held some important pattern. This is why convolution is so effective at feature extraction. As we will explain later, convolutional neural networks still have fully-connected layers at the end of the network.

V.CONCLUSION

In conclusion, this paper has provided a comprehensive exploration of the integration of linear algebraic methods in the theory and practice of neural networks. Through the lens of linear algebra, we have gained deeper insights into the inner workings of neural networks, elucidating their structure, dynamics, and optimization. Throughout the discussion, we explored various matrix decompositions such as Singular Value Decomposition (SVD) and Eigenvalue Decomposition, showcasing their utility in model interpretation, regularization, and dimensionality reduction. These techniques have proven invaluable for understanding the underlying structure of neural networks and identifying critical features that contribute to their performance.

REFERENCES

[1] Bamieh, Bassam. (2018). "Discovering transforms: A tutorial on circulant matrices, circular convolution, and the discrete fourier transform." arXiv preprint arXiv:1805.05533.

[2] Bronstein, M. (2022, January 2). "Deriving convolution from first principles." Medium. Retrieved March 11, 2022, from https://towardsdatascience.com/deriving-convolution-from-first-principles4ff124888028

[3] Faisal, A. A., Ong, C. S. (2020). "Matrix Approximation." In "Mathematics for Machine Learning." essay, Cambridge University Press. [4] Goodfellow, Ian, Yoshua Bengio, and Aaron Courville. (2016). "Deep learning." MIT press.

[5] Kalman, D. (1996). "A Singularly Valuable Decomposition: The SVD of a Matrix." The College Mathematics Journal, 27(1), 2–23.

[6] Lay, D. C., Lay, S. R., McDonald, J. (2022). "Linear algebra and its applications." Pearson Education Limited.

[7] Murphy, Kevin P. (2012). "Machine Learning: A Probabilistic Perspective." Cambridge: MIT Press. p. 247.

[8] Nielsen, Michael A. (2015). "Neural networks and deep learning." Vol. 25. San Francisco, CA, USA: Determination press.

[9] Nicholson, W. K. (2018). "Linear algebra with applications ˙ '' Open Textbook Library.

[10] Sharma, Sagar, Simone Sharma, and Anidhya Athaiya. (2017). "Activation functions in neural networks." towards data science 6.12: 310-316.

ISBN: 978-81-965236-7-1

CREATING APPLICATION ON ANDROID FOR WOMEN'S SAFETY

Ms.S.JAYAPRATHA AP\CSE,
[1]Assistant Professor, Department of Computer Science and Engineering,
C.SUBASHINI,
[2]Student, Department of Computer Science and Engineering,
R.VAISHNAVI
[3]Student, Department of Computer Science and Engineering,
[1,2,3]Sri Bharathi Engineering College for Women, Pudukkottai-622 303, Tamilnadu, India.

Email: jayapratha340@gmail.com[1]

***Abstract* - The women safety Android application is a mobile application designed to enhance the safety and security of women by providing them with a reliable and easy to use emergency response tool.The application is designed to work by sending the current longitude, latitude, and address name of the user when she presses the help button. This information is the sent automatically to the saved emergency contact, ensuring that they can call for help with just one click. Additionally, the application also includes a feature that allows users to save their emergency contacts, including friends, family, and local authorities.**

INTRODUCTION

In today's world, it is not safe for a person to travel alone at night especially for women; it will be high time to travel alone because a women is not highly strong as men to protect herself from them.the good way to reduce chances in becoming a victim of violent crime (robbey,sexual assault , rape, domestic violence) is to identify and call on resources to help you out of unsafe situation. whether you are in instant to reach home, having these app on your phone can diminish our risk and bring assistance when we required it.

This application created by MIT app inventor is an intuitive, could-based platform that enable users to create mobile apps for android devices without the need for the extensive coding skills. It was developed by the massachsetts institute to technology (MIT) as part of an educational initiative introduce computer programming to young people and non-technical users. the platform provides a drag-and-drop interface that simplifies the app-building process and allows user to create functional app in a matter of hours.

MIT app inventor uses block-based programming,which is a visual programming language the enable users to create code by assembling graphical blocks that represent code functions. The platform offers a range of features and components that enable users to create apps social media app,games,and productivity tools.it also includes built-in features for data storage,media playback, and sensor-based inputs such as GPS,accelerometer,and camera inputs MIT app inventor is open-source and free to use,which make it accessible to anyone who want to create an android app.

The platform has a vibrate community of users to who share their experiences, resources, and knowledge to help other build better apps. It is a powerful tool for promoting digital literacy and innovation, and it has the potential to inspire a new generation of mobile app developer.

This application is created on Android. Android is a mobile operating system developed by Google. It is the most widely used mobile operating system in the world and is used by billons of people on smart phones, tables, and other mobile devices. Android is based on the Linux kernel and is designed primarily for touch screen mobile devices such as smart phones and tables. It is open source, meaning that the source code is available for anyone to use and modify. One of the key features, including voice commands, gesture controls, and support for multiple user profiles. Additionally, Android devices can be customized with themes, launchers, and other tools to change the look and feel of the device.

LITERATURE SURVEY

Android app for women safety: In this application the user writes the message content and also selects the contacts to which the message content and also selects the contacts to which the message has to be sent and save it. So, when he is in some danger by just opening the app and pressing the HELP button, the message stored will be sent to those number he has added in this on application. So that he can receive the help in correct time.

Smart safety system for women security: The proposed system describes a safety device that gets automatically triggered when a women is in danger from anywhere at any time. This device has a transmitter and receiver in which the receiver in which the receiver is placed in a bag, and the transmitter and receiver n which the receiver is placed in a bag, and the transmitter is placed in the slipper. when the RF signal between the receiver and transmitter goes low, the device automatically sends SMS to the emergency contacts and provides alert to the nearby people. here WIFI module and GPS are used. GPS track the location of the women, and the WIFI module is used to send the tracked location as SMS to the emergency contact.

ISBN: 978-81-965236-7-1

Women safety device: This project describes about a one touch alarm system for women's safety using GSM. The device consists of a micro controller, GMS, modules .the system resemble a normal watch which activated, track the place of the women using GPS(global positioning system) and sends emergency messages using GSM(global system for mobile communication) ,to selected contacts and the police control room. The main advantage

Accident detection and alert system: This paper is to is to build an application that makes use of the sensors present in mobile phones like GPS and Accelerometer and detect any collision if there is a sudden external disturbance in the speed with the help of the sensor Fusion based Algorithm .with the help of the data obtained from the accelerometer sensor,when there is a sudden disturbance to the mobile phone,the user is notified with an alert message before sending the request help signal.if no emergency is required they can cancel it within 10 seconds ,the request for help message will be sent to the emergency services as well as the family members,the users provided.

Vehicle accident emergency alert system: ADXL335 MEMS gives the XYZ coordinates of the vehicle and is converted to digital using ADC via SPI protocol and its sent to the Arduino.when the car meets with an accident the Arduino processes the commands and the GPRS system immediately obtains the latitude and the longitude from the user phone.

SYSTEM ARCHITECTURE

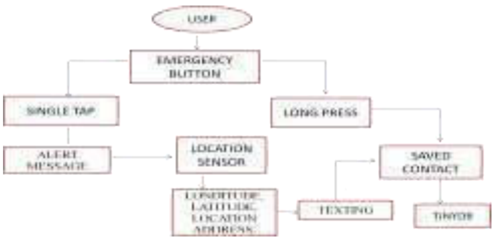


Fig.a.Proposed Architecture on creating application on android for women safety

EXISTING SYSTEM

The existing system describes an equipment which consists of a location sensor by which one can get the geographical location via SMS.Any emergency conditions ,she can press a button,the message and location link sent to those numbers she has added in this application.

DISADVANTAGE

- Poor network coverage.
- Continuous internet connectivity.
- It behaves abnormally

PROPOSED SYSTEM

In this proposed system user press the help button long time it ask to save the contact .contact will be stored in Tinydb .so, when he is in some danger by just opening the app and pressing the HELP button once message will be Generated by location sensor. The generated like latitude, longitude and current address .it send to the saved contact by testing.so that she can receive the help in correct time.

ADVANTAGE

- Enhance women safety
- Thisapplicationsend, location,longitude and latitude.
- Location is properly detected using location sensor.
- Mobile number can be changed at any time.
- User-friendly interface.
- prevent incident.

MODULES

EMERGENCY BUTTON:

Many women safety applications have a panic button feature that can be used in case of an emergency .The feature is typically designed to used in case of an emergency.This feature is typically designed to quickly alert emergency contacts or authorities in the event of an unsafe situation.when activated the panic button sends out an signal with the users location information,which can help respondents to quickly locate and assist the user.

EMERGENCY CONTACT:

An emergency contact feature in a women safety application is a critical component that allows users to quickly and easily contact a designated person or persons in case of an emergency.This feature can provide an added layer of safety and security for women who may feel vulnerable or unsafe in certain situations.It is important to note that have a reliable safety .It is important to note that the emergency contact feature should be designed and implemented in a way that respects the users privacy and security.

ALERT MESSAGE:

After completion of saving the contact details,help button ,must be clicked to exit from the application and help button must be clicked to start the application immediately .There is no obligation of entering the contact details each and every time when we open the application .once entered and saved thay will be registered in application till we change them.Message send immediately after pressing the button in the user phone.

RECEIVING MESSAGE:

Message received by the contact device immediately after starting the application.When we click help button of the application,it starts and the location sensor running over the device and immediately the users location will be sent.

ISBN: 978-81-965236-7-1

IMPLEMENTATION

This android application is useful when the user is in some problem or needs any help.When the user opens this application ,can see a HELP button.Also,they can store a contact numbers.When the user is in some difficulty or needs any help,they simply need to open the app and click on the "HELP" button.This application sends the message to those contact numbers which she has stored.The total evaluation can be done in 3 major steps which are described individually.Evaluation describes the whole implementation of the application in 3steps.The first step is to enter the contact details in the application after created.Those contacts can be our friends ,relatives of the particular city the person we live in. When the application is installed in the smart phone for the first time the above contact details should be provided. The application will store the location information like latitude,longitude and current address by location sensor to the registered contacts at danger times or when the person is needed to be recused. This step is followed only when the person is needed to be rescued button is passed in application. This third major steps testing used to sent the text message to receiver when the user clicks the button.

RESULTS

After creating application by MIT app inventor scan the QR code and download via MIT companion app.The Women safety app icon can be placed anywhere on the home screen of the smart phone so that we can immediately touch over the application when we are in danger .Figure1 depicts the HELP button.when you press long time Figure 2 will appear depicts the Alert contact,save contact button and home button.

Fig .1. Layout of the first screen for emergency button

After pressing the help button long time ,the application screen appears as depicted in the Fig.2 depicts the contact blocks,save button and home button.

Fig.2. Layout of the second screen for details

After entering the contact details, the application screen appears as depicted in the Fig .3. After completion of registering the contact details in the application the save contact button must be clicked by the finger else the message and the contacts will not be saved.

Fig.3.Details entered in the application

After completion of saving the contact details,save button must be clicked to exit from the application and HELP button must be clicked to start the application immediately.There is no obligation of entering the contact details each and every time when we open the application .Once entered and saved they will be registered in application till we change them.Message send immediately after pressing the button in the user phone as shown below Fig .4

Fig.4.Message sent by the user phone

Message received by the contact device immediately after starting the application. When we click help button of the application,it starts and the location sensor running over the device and immediately the users location will be sent as shown Fig.5.

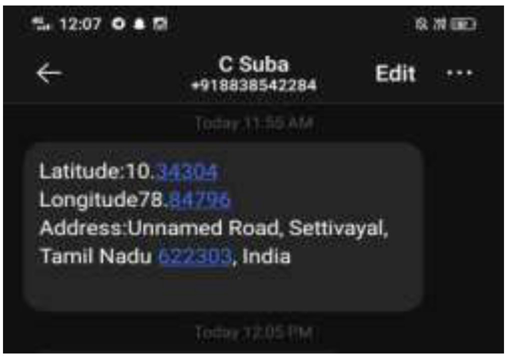


Fig.5.Message received by another contact device immediately after pressing the Help button in the application

ISBN: 978-81-965236-7-1

CONCLUSION AND FUTURE SCOPE

The development of women safety application has been a significant step towards ensuring the safety of women .Such application can provide a sense of security and protection to women particularly in situations where they feel vulnerable or threatened .However it is essential to recognize that these application alone cannot slove the problem of woman safety entirely.The issues of women's safety is complex and deeply rooted in societal norms and attitudes towards women. This application can be a useful tool in enhancing the safety and security of women they should be considered as part of a broader strategy to tackle the issue of women's safety, and their limitations should also be acknowledged. Some further upgrade can be done adding more contact can help improve accessibility, trust and communication which are all essential for creating safer and more supportive environment for women Voice assistant can be an effective tool s for womens safety providing quick access to safety features and personalized safety tipes.

REFERENCE

[1] ANDROID APP FOR WOMEN SAFETY: Dr. K Srinivas*, Dr. Suwarna Gothane1 , C. Saish Krithika2 , Anshika2 , T. Susmitha. International Journal of scientific research in computer science Engineering and information technology Volume 7, Issue3 (May 2021).

[2]VEHICLE ACCIDENT EMERGENCY ALER SYSTEM:B.Sumathy1*,L.Sundari2,S.JananiPriyadharshini2 ,G Jayavarshini2 ,Department of Instrumentation and Control Engineering, Sri Sairam Engineering(March 2020).

[3] ACCIDENT DETECTION AND ALERT SYSTEM :C K GomathySri Chandrasekharendra Saraswathi Viswa Mahavidyalaya University Article May(2022).

[4] "WOMEN SAFETY DEVICE : rajini 1 , chandrashekhar n 2, shivakumarg3 , shivashankar h 4 , shivakumar s 5 Assistant Professor, 2,3,4 & 5 UG Students Department of Mechanical Engineering, Sri Sairam College of Engineering, Volume 6, Issue 5 (May 2019).

[5] "WOMEN'S SECURITY", Android App developed by App Soft India,December 17, 2013. https://play. google. com/store /apps/ details? id= com. Zayaninfotech. security& hl=en.

[6] "SCREAM ALARM": Android app developed by GoPalAppMaker in November,2013 https://play.google.com/store/apps/details?id=gopal.appmaker. android. com&hl =en.

[7] "E-DEFENCE WOMEN SAFETY APPLICATION":International Journal of Advanced Engineering Science and Information Technology (IJAESIT) Vol.4, No.4, April 2021.

[8] "WOMEN'S SAFETY DEVICE WITH GPS TRACKING & ALERT": Department of Electronics & Telecommunication, Siddhivinayak Technical Campus Issue 4 Volume.

[9] "ACTIVITY TRACKER WRIST BAND FOR CHILDREN MONITORING USING IOT'':International Journal on Recent and Innovation Trends in Computing and Communication Volume: 6 Issue: 5.

[10] "DESIGN OF WOMEN SAFETY SYSTEM USING RFID,":8051microcontroller and GSM based technology Prototype"International Journal of Advanced Research in Computer and Communication Engineering Vol. 3, june.

[11] ONE TOUCH ALARM SYSTEM FOR WOMEN'S SAFETY USING GSM; International Journal of Scientific Research in Science, Engineering and Technology .vol.4,march.

ISBN: 978-81-965236-7-1

FEASIBILITY STUDY ON THE USE OF PRINTED CIRCUIT BOARD IN GEOPOLYMER CONCRETE

Ms.Raci.Mahizhini, Assistant Professor, Department of Civil Engineering,
Sri Bharathi Engineering College for Women, Pudukkottai.

Abstract - **The integrated waste management approach is to be considered involving efficient use of plastic materials, recycling and disposal mechanisms. Printed circuit boards is the base of electronic industry and is an indispensible part of nearly all the electronic products available in the market.The thermo metal portions of PCBs consists of thermo set resins and reinforcing materials. They also can be reused as fillers in composite materials. PCBs are considered to be having large amount of silica. Therefore,on the basis of the current scenario, all materials in waste PCBs are a kind of resources are needed to be recycled by a proper technology. The engineering properties of geopolymer concrete so as it can be used as a green alternative to conventional cement concrete. The partial replacement of fine aggregates with printed circuit boards, so that E waste can be used in construction as it cannot be disposed off. The experimental work involves conducting the test on fly ash and ground granulated blast furnace slag based geopolymer concrete by partial replacement of fine aggregate with printed circuit boards.**

Keywords: Fine Aggregate, Fly Ash, Printed circuit board, aggregate, sand.

1. INTRODUCTION

1.1. GENERAL

As we are moving towards globalization the demand for concrete is increasing day by day due to construction activities, so the demand for Portland cement is increasingly rapidly. It is estimated that the production of cement will increase from about from 1.5 billion tons in 1995 to 2.2 billion tons in 2010 (Malhotra, 2002). The global warming is caused by the emission of greenhouse gases, such as carbon dioxide (CO_2), to the atmosphere by human activities. CO_2 contributes about 65% of global warming (McCaffery, 2002).Due to cement industry the percentage of carbon emission in atmosphere is increasing day by day. The harmful carbon dioxide emissions estimated to be responsible for 5 to 7% of the total global production of carbon dioxide.

There is a growth in infrastructures due to globalization in India, China. So there is a need to control this emission of CO_2 by substituting a greener alternative, which may reduce the greenhouse gas effect. Whereas on the other hand in recent decades, the use of electronic and electrical devices has increased significantly, this leads to increasing amounts of waste electrical and electronic equipment (WEEE), often also called e-waste. E- waste describes loosely discarded, surplus, obsolete, broken, electrical or electronic devices. Rapid technology change, low initial costs have resulted in a fast growing surplus of electronic waste around the globe. Several tones of E-waste need to be disposed per year.

2. MATREIALS AND METHODOLOGY

2.1 GENERAL

The materials used in the manufacture of Geopolymer concrete with printed circuit boards are described in this chapter. The physical properties of flyash, GGBS, fine aggregate (river sand),coarse aggregate (20mm) and printed circuit boards are reported. The chemical composition of alkaline activators is also presented.

2.2 SELECTION OF MATERIALS

The materials are chosen based on the specifications of Indian standards. The materials used in the Geopolymer concrete are listed below

- Flyash
- Ground Granulated Blast furnace Slag (GGBS)
- Fine aggregates
- Coarse aggregates
- Printed circuit boards
- Alkaline activators (NaOH flakes, Na_2SiO_3)

2.2.1 FLYASH

Flyash is a by-product of the combination of pulverized coal in thermal power plants, it is a fine grained, powdery and glassy particulate material that is collected from the exhaust gases by electrostatic precipitators or bag filters.

ISBN: 978-81-965236-7-1

When pulverised coal is burnt to generate heat,the residue contain 80 % flyash and 20% bottom ash.the size of particles is largely dependent on the type of dust collection equipment. diameter of flyash particles ranges from less than 1microns to 150 microns. It is generally finer than Portland cement.their surface area is typically 300 to 500 although some flyashes can have surface areas as low as 200 and as high as 700. However the effect of increase in specific surface area beyond 600 is reported to be insignificant.

FIGURE 2.1 FLYASH

TABLE 2.1 CHEMICAL PROPERTIES OF FLYASH

CHEMICAL COMPOSITIONS	PERCENTAGE BY WEIGHT
SiO_2	50.98
Al_2O_3	7.54
SO_3	12.88
Mg	4.02
CaO	22.82
Fe	0.69
Fe_2S	0.51
K_2O	0.56

2.2.2 GGBS

GGBS (Ground Granulated Blast furnace slag) is a by-product of iron and steel-manufacturing. It obtained by quenching molten iron from a blast furnace in water or steam, to produce a glassy , granular product that is then dried and ground into a fine powder. GGBS is used to make durable concrete structures in combination with ordinary Portland cement or other pozzolanic materials. The addition of GGBS increases durability of concrete.

FIGURE 2.2 GGBS

2.2.2 FINE AGGREGATE

Natural river sand is used as fine aggregate. The gradation of sand is determined and presented in the fig.

FIGURE 2.2 RIVER SAND

2.2.4 COARSE AGGREGATE

Coarse aggregates shall comply with the requirements of IS 383. It is better to use crushed / semi-crushed aggregates. Crushed stones of size 20mm can be used as coarse aggregate.

FIGURE 2.4 COARSE AGGREGATE

2.2.5 ALKALINE ACTIVATOR

The combination of sodium hydroxide and sodium silicate or potassium hydroxide and potassium silicate solution is used as the alkaline activator. In this project the combination of sodium hydroxide and sodium silicate is preferred due to economical purpose. Generally alkaline liquids are prepared by mixing of the sodium hydroxide solution and sodium silicate at the room temperature.

ISBN: 978-81-965236-7-1

3.3.5.1 SODIUM HYDROXIDE

Generally the sodium hydroxides are available in solid state by means of pellets and flakes. The cost of the sodium hydroxide is mainly varied according to the purity of the substance. Since the Geopolymer concrete is homogenous material, the commercial grade of the sodium hydroxide of purity 98% is used.

The sodium hydroxide pellets are dissolved in distilled water based on the corresponding morality. The heat is generated when the pellets are dissolved with water. In order to prepare the sodium hydroxide solution the molarity should be multiplied with molecular ratio.For instance, NaOH solution with a concentration of 6 Molar consists of 6 x 40 = 240 grams of NaOH solids per liter of the water.

FIGURE 2.5 NAOH FLAKES

2.2.6 PRINTED CIRCUIT BOARD

Printed circuit board sources in the form of roughly discarded, spare, outdated, broken, electrical or electronic devices have been collected which were crushed and ground to the particle size.

FIGURE 2.7 PRINTED CIRCUIT BOARD

4. MIX DESIGN

4.1 MIX PROPORTION

This chapter defines the mix design for Geopolymer concrete with printed circuit board. Hardjito and Rangan have noted that unlike conventional cement concretes GPCs are a new class of construction materials and therefore no standard mix design approaches are yet available for GPC. To identify the best mix or optimum mix for Geopolymer concrete with printed circuit board ,the trial and error method is followed by varying the percentage ratio between the fine aggregate and printed circuit boards. The fine aggregate is replaced by printed circuit boards in the percentage of 0,15,30,40,50.

4.2 DESIGN PROCEDURE

Design procedure was formulated for Geopolymer Concrete which was relevant to Indian standard (IS 10262-2009). The illustrative example of mix design for a Geopolymer concrete of M30 grade is given below,

Step 1: STANDARD PARAMETERS

Size of cube = 150 mm*150 mm*150 mm Size of cylinder :
diameter = 150 mm length = 300 mm
size of prism = 500 mm * 100mm* 100mm Density of geopolymer concrete = 2400 kg/ Alkaline liquid to binder ratio = 0.4
Ratio of sodium silicate solution to sodium hydroxide pellets = 2.5
Grade = M30
Molarity = 8M

Step 2: CALCULATION OF AGGREGATES

Combined volume of aggregate = 75 % of density= (75/100)*2400 = 1800 kg/m^3
Fine aggregate = 40% of total volume of aggregate = 720 kg/m^3 Coarse aggregate = 60% of total volume of aggregate= 1080 kg/m^3

Step 3: CALCULATION OF BINDER QUANTITY

Alkaline liquid / binder = 0.4
Alkaline liquid = 0.4 * binder
Binder quantity + alkaline liquid + aggregate = 2400

ISBN: 978-81-965236-7-1

Material	Weight Per m^3	Total Quantity Required
Fly ash	321.43	75
GGBS	107.14	25
Coarse aggregate	1080	250
NaOH flakes	13.85	3
Na_2SiO_3	114.284	26
Fine aggregate	360	110
Printed circuit boards	360	75

Binder quantity + alkaline liquid = 2400- aggregate = 2400 – 1800 = 600 kg/m^3

Step 4: CALCULATION OF ALKALINE QUANTITY

Alkaline liquid = 0.4 * 428.57 = 171.428 kg/m^3
We know that, Ratio of sodium silicate solution to sodium hydroxide = 2
Na_2SiO_3 = 2 NaO
In case of 8M NaOH solution , Since the molecular weight of NaOH pellets. For 8M solution = 8*40 = 320 gms.
For 1 litre of water , 320 gms of NaOH pellets to give total weight of 1320 gm of sodium hydroxide solution.
Total NaOH pellets to be dissolved = (57.142 * 0.32)/1.32 = 13.85 kg/m^3
Weight of water to be taken = (13.85*1)/0.3 = 43.28 kg/m^3.

Step 5: CALCULATION OF WEIGHT OF MATERIAL PER m^3:

Fly ash = 75 % of binder quantity
= (75/100)* 428.57
= 321.43 kg/m^3
GGBS = 25 % of binder quantity
= (25/100)*428.57
=107.1425kg/m^3
Coarse aggregate = 1080 kg/m^3 NaoH flakes = 13.85 kg/m^3 Na_2SiO_3 = 114.284 kg/m^3

FA + PCB

0% PCB + 100% SAND = 720 kg/m^3
15% PCB + 85% SAND = 108 kg/m^3 of pcb + 612 kg/m^3 of sand
30% PCB + 70% SAND = 216 kg/m^3 of pcb + 504 kg/m^3 of sand
40% PCB + 60% SAND = 288 kg/m^3 of pcb + 432 kg/m^3 of sand
50% PCB + 50% SAND = 360 kg/m^3 of pcb + 360 kg/m^3 of sand

5. EXPERIMENTAL TEST RESULTS

5.1. TESTS CONDUCTED ON FINE AGGREGATE

The following tests are conducted on fine aggregate
1. specific gravity
2. water absorption
3. Sieve analysis

1. specific gravity Result :-
The specific gravity of fine aggregate = 0.53
Water absorption of fine aggregate = 20.83 %

SIEVE SIZE	WEIGHT RETAINED (kg)
4.75 mm	0.028
3.35 mm	0.068
2.36 mm	0.021
1.18 mm	0.649
600 micron	0.189
300 micron	0.088
150 micron	0.14
pan	0.002

TABLE 3.3 SIEVE ANALYSIS RESULT FOR RIVER SAND

5.2. TESTS CONDUCTED ON COARSE AGGREGATE

The following tests are conducted on coarse aggregate
1. specific gravity
2. water absorption

Result :-
The specific gravity of fine aggregate = 0.25
Water absorption of fine aggregate = 1.85 %

ISBN: 978-81-965236-7-1

5.3. TESTS CONDUCTED ON PRINTED CIRCUIT BOARDS

The following tests are conducted on printed circuit boards

1. specific gravity
2. water absorption
3. sieve analysis

SIEVE SIZE	WEIGHT RETAINED (kg)
4.75 mm	0.3
3.35 mm	0.095
2.36 mm	0.398
1.18 mm	0.16
600 micron	0.018
300 micron	0.014
150 micron	0.006
pan	0.012

TABLE 3.4 SIEVE ANALYSIS RESULT FOR PCBs

Result :-

The specific gravity of fine aggregate = 1.2 Water absorption of fine aggregate = 7.5

5.4. WATER ABSORPTION TEST:

30 % printed circuit board :

Weight of cube before immersing W_d = 9.098 kg Weight of cube after immersing W_W = 9.214 kg

% Water absorption = $(W_W - W_d)/ (W_d) *100$

=(9.214–9.098)/9.098*100

=0.0127*100

= 1.27 %

30 % printed circuit board :

Weight of cube before immersing W_d = 8.441 kg Weight of cube after immersing W_W = 8.607 kg

% Water absorption = $(W_W - W_d)/ (W_d) *100$

=(8.607–8.441)/8.441*100

=0.01967*100

= 1.967 %

DURABILITY PROPERTIES:

5.5. WATER ABSORPTION TEST :

30 % printed circuit board :

Weight of cube before immersing W_d = 9.098 kg Weight of cube after immersing W_W = 9.214 kg

% Water absorption = $(W_W - W_d)/ (W_d) *100$

=(9.214–9.098)/9.098*100

=0.0127*100

= 1.27 %

30 % printed circuit board :

Weight of cube before immersing W_d = 8.441 kg Weight of cube after immersing W_W = 8.607 kg

%Water absorption= $(W_w - W_d)/ (W_d) *100$

=(8.607–8.441)/8.441*100

= 0.01967 *100

= 1.967 %

6. Result and Discussion

6.1 Summary

Based on the test results the following conclusions were made.

1. With the Elimination of the use of Portland cement the emission of carbon dioxide has been greatly reduced which results in the reduction of environmental pollution.
2. The addition of printed circuit board shows increase in compressive strength upto 30% replacement. After 30 % the compressive strength starts to decrease.
3. The compressive strength was found to be increased by 15% with addition of PCB’s than the conventional Geopolymer concrete.
4. The split tensile strength was found to be increased by 20% with addition of PCB’s than the conventional Geopolymer concrete.
5. The flexural strength was found to be increased by 30% with addition of PCB’s than the conventional Geopolymer concrete
6. Rate of increase of compressive strength and split tensile strength with respect to age of concrete is more significant incase of ambient curing at room temperature in comparison with heat curing at 60˚C.Heat curing resulted in enhancement of compressive strength and split tensile strength at early age only.The effect of heat curing on the increase in compressive strength and split tensile strength is not much significant after 7 days.
7. The Geopolymer concrete showed high performance with respect to strength. The geopolymer is good workable mix. High early strength was obtained in Geopolymer mix. The increase in percentage of fine aggregate and coarse aggregate increase the compressive strength upto optimum level. This may be due to high bonding between aggregate and alkaline solution. The compressive strength was found to be decrease beyond optimum mix. This may be due to increase in volume of voids.
8. The use E-waste in concrete is possible to improve its mechanical properties and can be one of the economical ways for their disposal in environmental friendly manner.
9. The specimens have been cured in ambient temperature condition rather than accelerated curing to check the suitability of Geopolymer concrete for cast in-situ conditions.

ISBN: 978-81-965236-7-1

10. Geopolymer concrete has excellent properties as also be used in road works because of its very early attainment of strength.

6.2 Recommendation for Future Project

1. Used in road works because of its very early attainment of strength.
2. Used in the manufacture of precast structures because of high strength development.
3. Can be used in areas where high degree of fire resistance is needed.
4. The addition of PCB's decrease the dead weight of structures, hence it can be used in light weight structures.

References

1. H. Ghimire, P.A. Ariya E-wastes: bridging the knowledge gaps in global production budgets, composition, recycling and sustainability implications Sustain. Chem., 1 (2020), pp. 154-182

2. H.A. Bulut, R. Şahin A study on mechanical properties of polymer concrete containing electronic plastic waste Compos.Struct., 178 (2017), pp. 50-62

3. D. Xiang, P. Mou, J. Wang, G. Duan, H.C. Zhang Printed circuit board recycling process and its environmental impact assessment

4. W.A. Bizzo, A.R. Figueiredo, V.F. de Andrade Characterization of printed circuit boards for metal and energy recovery after milling and mechanical separation Materials, 7 (2014), pp. 4555-4566

5. Q. Wang, B. Zhang, S. Yu, J. Xiong, Z. Yao, B. Hu, J. Yan Waste-printed circuit board recycling: focusing on preparing polymer composites and geopolymers.

6. B.B. Subramanian, G.V.T. GopalaKrishna, V. Sarasw athy Review of literature on electronic waste materials used in concrete

7. S. Prashant, M. Kumar Effect of partial replacement of coarse aggregates with e- waste on strength properties of concrete

8. B.T. Ashwini Manjunath Partial replacement of e-plastic waste as coarse-aggregate in concrete

9. A.A. Dhanraj, C. Selvamony, A. Joshuva An experiment investigation on concrete by using e-waste as fine aggregate and enhanced the thermal insulation and ultrasonic properties

ISBN: 978-81-965236-7-1

AN EXTENSIVE REVIEW OF KIDNEY STONE SYMPTOMS, TYPES AND PREDICTION METHODS IN UP TO DATE

B.Reuben#1, C.Narmadha*2
1. # Assistant Professor, Dept of ECE, Sri Bharathi Engineering College for Women, Kaikkurichi, Tamil Nadu, India.
princeton.reuben@gmail.com
2.* Assoc.Prof & Head, Dept of ECE, Periyar Maniammai Institute of Science & Technology, (Deemed to be University), Vallam,Thanjavur – 613403, Tamil Nadu, India.
narmadhaece@pmu.edu

Abstract— **Kidney stone disease is a most harmful disease which leads to kidney failure and also kills patients. The imaging techniques like CT scans, ultrasonography, X-ray and MRI scans are mostly used for easy prediction. in Recent times, Machine Learning and Deep Learning are used for effective kidney stone prediction. In this article, the review of DL model-based kidney stone prediction is discussed with several details namely Methods used in literature, performance analysis, merits and challenges respectively. The symptoms and types of stones are presented to show the variation among each stone in a kidney. Therefore, the extensive review based on kidney stone prediction is discussed with an exact tabulation to provide effectiveness.**

Keywords— DL model, Kidney stone prediction, performance metrics, Accuracy, classification

I. INTRODUCTION

In the recent era, kidney stones are increased all over the world drastically which caused kidney failure and pain for humans. The kidney is the most essential organ that caused stone formation due to unwanted substances in urine [1-3]. Kidney stone diseases are now most common for all gender and sector peoples that too mostly in developed countries. The main reason for stone formation in kidneys is due to overweight, minimum level of water consumption, bad food diet and also regular intake of medicines and sometimes stress etc[4,5].

The prediction of Kidney stone disease is mandatory due to its harmfulness. There are imaging techniques that are used for the diagnosis of a kidney stone to increase the lifespan of the affected person [6-9]. Some of the systems used to diagnose kidney stones are blood tests, urine tests, CT scans, ultrasonography, X-ray and MRI scans etc. These imaging techniques are easy to predict the kidney stone and simple the Doctor work with automation. This can be beneficial by saving time and minimising the risk of an error [10].

To avoid false and error in prediction, Machine Learning (ML) and Deep Learning (DL) are implemented in medical imaging [11-15]. In the recent eras, ML and DL-based techniques are applied for so many fields such as Agriculture, communication, the Military, share market, education, weather forecasting and also in Medical Fields etc [16,17]. Several ML/DL methods are frequently used in medical applications for various issues such as Breast cancer, Brain tumour, Alzheimer's disease, Heart fat, Bone crack, Throat cancer, skin cancer, kidney stone and so on [18-20].

Some of the popular ML/DL methods that are often used for medical imaging are Naive Bayes (NB), Decision Tree (DT), Neural Network (NN), Support Vector Machine (SVM), Random Forest (RF), Convolutional Neural Network (CNN), Recurrent Neural Network (RNN), Long Short-Term Memory (LSTM), AlexNet, GoogleNet, DenseNet, ShuffleNet, MobileNet and so on. These methods are very efficient in the prediction and also provided superior performance in segmentation and classification respectively [21-25].

The rest of the work is structured as: section 2 presented the kidney stone symptoms and the types of stones are discussed in section 3. Section 4 presented the related work with tabulation and section 5 described the performance metrics. Section 6 presented the conclusion with a future enhancement in it.

II. SYMPTOMS OF KIDNEY STONE

The kidney stones are predicted by several symptoms that are listed below [26-28]:

i) Renal colic that provided excessive cramping pain,
ii) Flank pain that caused in the backside,
iii) Hematuria which means blood in urine,
iv) Infection in the urinary tract,

ISBN: 978-81-965236-7-1

v) Obstructive uropathy means the disease occurred in the urine tract,
vi) Urine blockages,
vii) Hydronephrosis that was a kidney dilation

Therefore, these affected the health and work of patients which required immediate and efficient treatment to enhance their quality of life [29,30].

III. TYPES OF KIDNEY STONE

Kidney stones are mainly caused due to a chemical abnormality in urine. There are several stones are formed in the human kidney based on various chemical compositions, sizes and shapes [31,32]. The most common type of stones is given in the following [33].

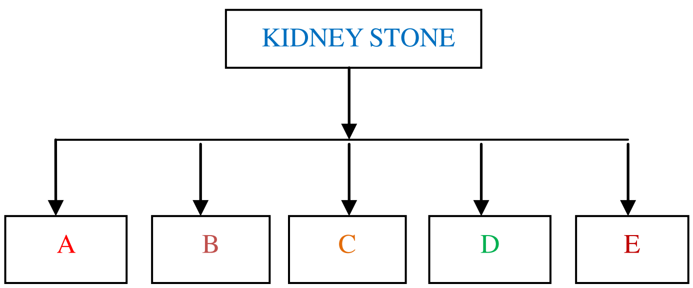


Fig 1. Classification of Kidney Stone

A. Calcium Stones

Calcium stones are the most common renal stones that are caused for many patients due to a urinary calculi abnormality. It is a mixture of Calcium Oxalate and Calcium Phosphate which is occurred in more than 60% of kidney stone patients. It has two types namely CaOx monohydrate (COM) and CaOx dihydrate (COD) where COM is frequently observed disease than COD [34].

B. Struvite Stones

Struvite stones are referred to as an infection that is caused by upto 10–15% of patients. It is an ingredient of Magnesium Ammonium Phosphatewhich seems to be a triple phosphate stone. These stones caused various diseases like Klebsiella pneumonia, Enterobacter and Pseudomonas aeruginosa [35]. These stones have mostly occurred in women than males.

C.Uric Acid Stones or Urate

It has occurred in 3–10% of patients with kidney stones which comprised a high purine of animal protein like fish and meat. This stone has a possibility to cause a low urine volume, hyperuricosuria and low urinary pH. These types of uric acid stones are commonly occurred in males than in women [36,37].

D.Cystine Stones

This type of stone is caused by a genetic disorder based on cystine and amino acid. It has occurred a 2% of kidney stone patients that provided a urinary excretion of excessive cystinuria. The cystine does not dissolve in urine and caused a cystine stone that evacuates 600 millimoles of cystine/per day[38].

E. Drug-Induced Stones

Some the drugs like triamterene, guaifenesin, atazanavir, and sulfa drugs are the reason for Drug-Induced stones [39]. It has occurred in 1% of kidney stone patients. For example, a frequent drug with a heavy dose for the disease especially for HIV would develop Drug-Induced Stones and leads to kidney failure [40].

IV. RELATED WORKS

Several methods are developed by various authors in recent decades for kidney stone prediction that is discussed in the following and tabulated in Table 1.

Black et al [41] presented the CNN and ResNet-101 model for a multi-class kidney stone classification. It can be diagnosed through automatic imaging based on cross-validation. This system has achieved a weighted recall of 94.12%, specificity of 97.83% and precision of 94.12% with an efficient performance. Besides, another automated stone detection is implemented by Yildirim et al [42] using 1799 images of coronal CT. The stone prediction is attained accurately even for a small size with an evaluation of 96.82% accuracy, 98% precision, 96% recall and 97% F1 score respectively.

In some cases, the DL method of VGGNet-19 and Binary SVM is presented by Somasundaram et al [43] for effective feature extraction and classification of kidney stones. This system is performed and validated with a97.32% Recall, 98.07% precision, 99.19 % accuracy, 98.28% specificity and93.2% F1 score respectively. Alongside, the ML/DL method predicted Renal Cell Carcinoma (RCC), urolithiasis, bladder cancer (BCa), and prostate cancer (PCa)based on the PubMed MEDLINE database by Suarez-Ibarrola et al [44]. It provided urological applications with a performance of 94.26% accuracy, 94.51% sensitivity and 96.29% specificity. Also, Artificial intelligence (AI) has been explored for time management to predict the tiny stones. This system can be diagnosed with a minimum CT image computation with a superior 98.52% accuracy, 96.75% sensitivity and 98.12% specificity by Sabuncu et al [45].

ISBN: 978-81-965236-7-1

Flores-Araiza et al [46] developed the part-prototypes (PPs) methodology with three categories namely the AlexNet model, batch normalization as the backbone (PPN-VGG19bn) and batch normalization of VGG19 (VGG19bn) respectively. The kidney stone classification is processed as a patch image and provided a mathematical analysis with an effective method. The performance of AlexNet attained a 96% accuracy, VGG19bn acquired 99% accuracy and also 98% accuracy for PPN-VGG19bn. Moreover, Li, D et al [47] investigated various DL methodssuch as 3D U-Net, SegNet, Res U-Net, DeepLabV3+, and UNETR for testing and training. These 3D U-Net, SegNet, Res U-Net, DeepLabV3+, and UNETR model has evaluated the accuracy of 98.32%, 97.45%, 89.93%, 95.54% and 98.11% respectively.

In some methods, the kidney stone predictions using an Inception v3 method by Ochoa-Ruiz et al [48] are tested with urinary calculi types in-vivo images. The performance metrics are evaluated with a 97% of weighted precision, 98% of recall and 97% of F1-score correspondingly. Moreover, the Renal Stone Complexity of the Seoul National University (S-ReSC) model is implemented by Jeong et al [49] for stone-free rate prediction of a kidney. The result of the Area Under Curve (AUC) is achieved 0.860 for an effective prediction.

Kim et al [50] aimed urolithiasis prediction based on seven DL models with detailed chemical composition. This method has acquired 1,332 stone images and executed four classes for every DL model. Overall, the Xception DL model performed superior toall others evaluated for all four classes of precision and recall as class 1: 94.24%, 91.73%, class 2: 85.42%, 96.14%, class 3: 86.86%, 99.59% and class 4: 94.96%, 98.82%.Also in another work, the kidney stone prediction survey of DL models such as SVM, NB, and NN are investigated by Sri et al [51]. This survey executed the comparison of performance accuracy with every model's effectiveness.

The DL method like multi-view AlexNet max and multi-View VGGnet max is used to extract the fuse of the various viewpoints for discriminant object features. This system presented by Villalvazo-Avila et al [52] presents a deep-learning method for extracting and fusing image information acquired from different viewpoints for discriminant object features. The result is validated for precision and Recall for multi-view AlexNet max are 95% and 94% and also for multi-View VGG16 max are 94% and 94% respectively. Besides, Kazemi et al [53] developed an ensemble learning for a robust kidney stone prediction with a 97.1% accuracy. This system metrics are acquired with an effective classification result such as precision of 97.1%, recall of 97.1%, F1 score of 97.1% and 99.6% AUC.

Shah et al [54] reviewed AI and its application for the classification of cystoscopic, renal masses diagnosis using an MRI. This work established the reaction of treatment, prognosis, survival and recurrence of genomic and biomarker studies. Alongside, a few DL methods like ensemble model, Logistic Regression (LR) and RF models are used to predict kidney stones using CT images. This system is investigated by Kolli et al [55]. This can be addressed by the metrics in terms of 97.12% precision, 96.83% accuracy and 98.1% Recall respectively. In a few literatures, the abdominal CT dataset is used to segment and classify for both testing and training of kidney stones prediction. The AI- driven diagnostic approaches are explored by Li, D et al [56] with a performance accuracy of 95%, a sensitivity of 88% and a specificity of 91% respectively.

The CNN model-based automatic kidney stone prediction using CT images is implemented by GP et al [57]. This system achieved an effective performance with an accuracy of 96.82%, Recall of 93.22%which is competent enough as distinguished it from previous algorithms. Moreover, Surya et al [58] developed a Backpropagation network and Fuzzy Clustering Mean Algorithm for various steps for medical assistance in kidney stone prediction. These methods are provided with animage pixel with a higher stone prediction accuracy of 97.92%, specificity of 95.79% and sensitivity of 97.23% correspondingly.

The Renal stone diagnosis is presented in radiography based on renal stone disease developed by McCarthy et al [59]. This system used a STONE PLUS prediction tool with innovative management and diagnosis. It provides the best care for patients with a precision of 92%, Recall of 93.41% and sensitivity of 94.21%. Also, Buvaneswari et al [60] discussed a hybrid ButterflyNet and InceptionNet model for kidney stone identification. The performance metrics acquired a 90% F1 Score, 84% accuracy, 88% Recall and 94% precision which provided a superior result than the conventional.

Author	**Methods**	**Metrics evaluation**	**Strength**	**Weakness**
Black et al [41]	CNN and ResNet-101 model for a multi-class kidney stone classification	Recall-94.12% Specificity-97.83%, Precision-94.12%	Multi class based Performance	flexibility and speedy diagnosis

ISBN: 978-81-965236-7-1

Yildirim et al [42]	CT based automated stone detection	Accuracy-96.82%, precision-98%, Recall-96%, F1 score-97%	Accurate detection even for small size stone	Connectivity
Somasundaram et al [43]	VGGNet-19 for feature extraction and Binary SVM for classification	Recall-97.32%, precision-98.07%, accuracy-99.19 %,specificity-98.28% F1 score-93.2%	QoS	Energy consumption
Suarez-Ibarrola et al [44]	PubMed MEDLINE database-based RCC, BCa, PCa prediction	Accuracy-94.26%, sensitivity-94.51%, specificity-96.29%	Multi-subject detection	Complexity
Sabuncu et al [45]	AI-based CT images	Accuracy-98.52%, sensitivity-96.75%, specificity-98.12%	Computational accuracy	Less Availability
Flores-Araiza et al [46]	PPN-VGG19bn, AlexNet, VGG19bn	All three methods attained Accuracy of 96%, 99% and 98%	Effective mathematical analysis	Display quality
Li, D et al [47]	3D U-Net, SegNet, Res U-Net, DeepLab V3+, and UNETR	Accuracy-98.32%, 97.45%,89.93%, 95.54% and 98.11%	Classification accuracy	Energy consumption
Ochoa-Ruiz et al [48]	Inception v3 method	Precision-97%, Recall-98%, F1-score-97%	Low cost and simple	Low Flexibility and speed
Jeong et al [49]	DL based S-ReSC prediction	AUC-0.860	Performance	Avoid false diagnosis
Kim et al [50]	7model used for kidney stone predict	Precision-94.96%, Recall-98.82%	QoS	Limited functionalities
Sri et al [51]	Survey of DLmethod based kidney stone prediction	-	comparison of performance accuracy	Future ideas
Villalvazo-Avila et al [52]	Multi-view AlexNet max and multi-View VGGnet max	AlexNet max Recall-95%, VGGnet max Recall-94%	Complexity	Energy consumption
Kazemi et al [53]	ensemble learning model	Recall-97.1%, F1 score-97.1%, AUC-99.6%	Lifetime	Reliability, Efficiency
Shah et al [54]	AI model survey	-	Comparison of diagnosis,methods and materials	Numerical comparison
Kolli et al [55]	Ensemble model, LR and RF models for prediction	Precision-97.12%, Accuracy-96.83%, Recall-98.1%	Memory	Utility, Accuracy
Li, D et al [56]	AI- driven diagnostic approaches	Accuracy-95%, Sensitivity-88%, Specificity 91%	Performance	Training
GP et al [57]	CNN model	Accuracy-96.82%, Recall-93.22%	Cost overhead	Microscopic examination

ISBN: 978-81-965236-7-1

Surya et al [58]	Back propagation network and Fuzzy Clustering Mean	Accuracy-97.92%, Specificity-95.79%, Sensitivity-97.23%	Compression and low data loss	Quite complex system
McCarthy et al [59]	Renal stone diagnosis	Precision-92%, Recall-93.41%, Sensitivity-94.21%	Effectiveness	Security
Buvaneswari et al [60]	hybrid Butterfly Net and Inception Net model	F1 Score-90%, Accuracy-84%, Recall-88%, Precision-94%	Portability, real-time Monitoring	Categorise the data Layer

V. PERFORMANCE METRICS

In the medical field, the performance metrics based on classifications are validated in terms of Sensitivity, Accuracy, Specificity, AUC and F1 score respectively. All these metrics are discussed and expressed below.

Sensitivity: It is defined as actual positive cases proportional measurement which is truly detected as positive that is expressed in equation (1).

$$\text{sensitivity} = \frac{\text{True}_{\text{positive}}}{\text{True}_{\text{Positive}} + \text{False}_{\text{Negative}}} \quad (1)$$

Specificity: It is the measure of actual negative proportions that is truly predicted as negative which is expressed in equation (2).

$$\text{specificity} = \frac{\text{True}_{\text{Negative}}}{\text{True}_{\text{Negative}} + \text{False}_{\text{Positive}}} \quad (2)$$

Accuracy: It is defined as the number of truly predicted divided by the overall predictions that are expressed in equation (3).

$$\text{Accuracy} = \frac{\text{True}_{\text{Positive}} + \text{True}_{\text{Negative}}}{\text{True}_{\text{Negatuve}} + \text{True}_{\text{Positive}} + \text{False}_{\text{Positive}} + \text{False}_{\text{Negative}}} \quad (3)$$

F1 Score: It measured the accuracy of testing which evaluated the precision and recall values that havethe best value as 1 and the worst value as 0which is expressed as equation (4).

$$\text{F1 score} = \frac{2\,Recall \times Precision}{Recall + Precision} \quad (4)$$

Recall: It is only concentrated only on Falsely Negative and won't be considered Truly Negatives which is expressed as equation (5).

$$Recall = \frac{\text{True}_{\text{Positive}}}{\text{True}_{\text{Positive}} + False_{Negative}} \quad (5)$$

Precision: It is measured only the Falsely Positives and Truly Positives that are expressed as equation (6).

$$precision = \frac{\text{True}_{\text{Positive}}}{\text{True}_{\text{Positive}} + \text{False}_{\text{Positive}}} \quad (6)$$

Where $\text{True}_{\text{Positive}}$ indicates actually predicted as 1, $\text{True}_{\text{Negative}}$ denotes actually predicted as 0, $\text{False}_{\text{Positive}}$ represents the original value as 0 and detected as 1 and $\text{False}_{\text{Positive}}$ indicates the original value as 1 and detected as 0 respectively.

VI. CONCLUSION

In this article, medical image processing is reviewed for kidney stone prediction. A few kidney stone prediction works are listed and tabulated based on their method, achievement, merits and demerits. From this work, there are detailed explanations are given for every paper with its functions. It is clear to update the recent innovations towards kidney stone prediction. Though there are several challenges that are also still presented in prediction one has to build the QoS of a system by an effective prediction by implementing some optimization algorithm with DL methods for fine-tuned results. Also, the security is not yet improved in these works, so the security has to be concentrated in future enhancements.

VII. REFERENCES

[1] Alina Jade Barnett, Fides Regina Schwartz, Chaofan Tao, Chaofan Chen, Yinhao Ren, Joseph Y. Lo, and Cynthia Rudin. IAIA-BL: A case-based interpretable deep learning model for classification of mass lesions in digital mammography. CoRR, abs/2103.12308, 2021.

[2] Kristian M Black, Hei Law, Ali Aldoukhi, Jia Deng, and Khurshid R Ghani. Deep learning computer vision algorithm for detecting kidney stone composition. 2020.

ISBN: 978-81-965236-7-1

[3] Chaofan Chen, Oscar Li, Chaofan Tao, Alina Jade Barnett, Jonathan Su, and Cynthia Rudin. This Looks Like That: Deep Learning for Interpretable Image Recognition. CoRR, jun 2018.

[4] Mariela Corrales, Steeve Doizi, YazeedBarghouthy, Olivier Traxer, and Michel Daudon. Classification of stones according to micheldaudon: a narrative review. European Urology Focus, 7(1):13–21, 2021.

[5] Michel Daudon, Arnaud Dessombz, Vincent Frochot, Emmanuel Letavernier, Jean-Philippe Haymann, Paul Jungers, and Dominique Bazin. Comprehensive morphoconstitutional analysis of urinary stones improves etiological diagnosis and therapeutic strategy of nephrolithiasis. ComptesRendusChimie, 19(11-12):1470–1491, 2016.

[6] Michel Daudon, Paul Jungers, Dominique Bazin, and James C Williams. Recurrence rates of urinary calculi according to stone composition and morphology. Urolithiasis, 46(5):459–470, 2018.

[7] Jonathan El Beze, Charles Mazeaud, Christian Daul, Gilberto Ochoa-Ruiz, Michel Daudon, Pascal Eschwege, ` and Jacques Hubert. Evaluation and understanding of automated urolithiasis recognition methods. BJU International, 2022.

[8] Laurence Estepa and Michel Daudon. Contribution of fourier transform infrared spectroscopy to the identification of urinary stones and kidney crystal deposits. Biospectroscopy, 3(5):347–369, 1997.

[9] Vincent Estrade, Michel Daudon, Emmanuel Richard, JeanChristophe Bernhard, Franck Bladou, Gregoire Robert, and Baudouin Denis de Senneville. Towards automatic recognition of pure & mixed stones using intraoperative endoscopic digital images. BJU International, abs/2105.10686, 2021.

[10] Justin I Friedlander, Jodi A Antonelli, and Margaret S Pearle. Diet: from food to stone. World journal of urology, 33(2):179–185, 2015.

[11] Francisco Lopez, Andres Varelo, Oscar Hinojosa, Mauricio Mendez, Dinh-Hoan Trinh, YonathanElBeze, Jacques Hubert, Vincent Estrade, Miguel Gonzalez, Gilberto Ochoa, et al. Assessing deep learning methods for the identification of kidney stones in endoscopic images. In 2021 43rd Annual International Conference of the IEEE Engineering in Medicine & Biology Society (EMBC), pages 2778–2781. IEEE, 2021.

[12] Adriana Mart´ınez, Dinh-Hoan Trinh, Jonathan El Beze, Jacques Hubert, Pascal Eschwege, Vincent Estrade, Lina Aguilar, Christian Daul, and Gilberto Ochoa. Towards an automated classification method for ureteroscopic kidney stone images using ensemble learning. In 2020 42nd Annual International Conference of the IEEE Engineering in Medicine & Biology Society (EMBC), pages 1936–1939. IEEE, 2020.

[13] Leland McInnes, John Healy, and James Melville. Umap: Uniform manifold approximation and projection for dimension reduction. arXiv preprint arXiv:1802.03426, 2018.

[14] Anmar Nassir, Hesham Saada, Taghreed Alnajjar, Jomanah Nasser, Waed Jameel, SohaElmorsy, and HattanBadr. The impact of stone composition on renal function. Urology Annals, 10(2):215, 2018.

[15] MeikeNauta, Annemarie Jutte, Jesper C. Provoost, and Christin Seifert. This looks like that, because ... explaining prototypes for interpretable image recognition. CoRR, abs/2011.02863, 2020.

[16] Gilberto Ochoa-Ruiz, Vincent Estrade, Francisco Lopez, Daniel Flores-Araiza, Jonathan El Beze, Dinh-Hoan Trinh, Miguel Gonzalez-Mendoza, Pascal Eschwege, Jacques Hu- ` bert, and Christian Daul. On the in vivo recognition of kidney stones using machine learning. arXiv preprint arXiv:2201.08865, 2022.

[17] DawidRymarczyk, Lukasz Struski, Jacek Tabor, and Bartosz Zielinski. Protopshare: Prototype sharing for interpretable image classification and similarity discovery. CoRR, abs/2011.14340, 2020.

[18] Joan Serrat, Felipe Lumbreras, Francisco Blanco, Manuel Valiente, and Montserrat Lopez-Mesas. mystone: A sys- ´ tem for automatic kidney stone classification. Expert Systems with Applications, 89:41–51, 2017.

[19] R Siener and A Hesse. Fluid intake and epidemiology of urolithiasis. European journal of clinical nutrition, 57(2):S47–S51, 2003.

[20] Alejandro Torrell Amado. Metric learning for kidney stone classification. 2018. 2 [21] Adie Viljoen, Rabia Chaudhry, and John Bycroft. Renal stones. Annals of clinical biochemistry, 56(1):15–27, 2019.

[21] Lemaitre, G., Nogueira, F., Aridas, C., 2017. Imbalanced-learn: a python toolbox to tackle the curse of imbalanced datasets in machine learning. Journal of Machine Learning Research 18, 1–5.

[22] Martínez, A., Trinh, D.H., El Beze, J., Hubert, J., Eschwege, P., Estrade, V., Aguilar, L., Daul, C., Ochoa, G., 2020. Towards an automated classification method for

ISBN: 978-81-965236-7-1

ureteroscopic kidney stone images using ensemble learning, in: 2020 42nd Annual International Conference of the IEEE Engineering in Medicine Biology Society (EMBC), pp. 1936–1939.

[23] McCarthy, C.J., Baliyan, V., Kordbacheh, H., Sajjad, Z., Sahani, D., Kambadakone, A., 2016. Radiology of renal stone disease. International Journal of Surgery 36, 638–646.

[24] McInnes, L., Healy, J., Melville, J., 2020. Umap: Uniform manifold approximation and projection for dimension reduction. arXiv:1802.03426.

[25] Pedregosa, F., Varoquaux, G., Gramfort, A., Michel, V., Thirion, B., Grisel, O., Blondel, M., Prettenhofer, P., Weiss, R., Dubourg, V., Vanderplas, J., Passos, A., Cournapeau, D., Brucher, M., Perrot, M., Duchesnay, E., 2011. Scikit-learn: Machine learning in Python. Journal of Machine Learning Research 12, 2825–2830.

[26] Sampogna, G., Basic, D., Geavlete, P., GalánLlopis, J., Reis Santos, J., Saltirov, I., Sarica, K., Stavridis, S., Skolarikos, A., Trinchieri, A., 2020. Identificaciónendoscópica de la composición de loscálculosurinarios: un estudio del southeastern group for lithiasis research (segur 2).

[27] Scales, C.D., Smith, A.C., Hanley, J.M., Saigal, C.S., 2012. Prevalence of kidney stones in the united states. European Urology 62, 160 – 165.

[28] Selvaraju, R.R., Cogswell, M., Das, A., Vedantam, R., Parikh, D., Batra, D., 2017. Grad-cam: Visual explanations from deep networks via gradientbased localization, in: 2017 IEEE International Conference on Computer Vision (ICCV), pp. 618–626.

[29] Serrat, J., Lumbreras, F., Blanco, F., Valiente, M., López-Mesas, M., 2017. mystone: A system for automatic kidney stone classification. Expert Systems with Applications 89, 41 – 51.

[30] Siener, R., Buchholz, N., Daudon, M., Hess, B., Knoll, T., Osther, P.J., ReisSantos, J., Sarica, K., Traxer, O., Trinchieri, A., of Urolithiasis (EULIS), E.S., 2016. Quality assessment of urinary stone analysis: Results of a multicenter study of laboratories in europe. PLOS ONE 11, 1–10.

[31] D. P. Griffith, "Struvite stones," Kidney International, vol. 13, no. 5, pp. 372–382, 1978.

[32] M. Dursun, A. Otunctemur, and E. Ozbek, "Kidney stones and ceftriaxone," European Medical Journal of Urology, vol. 3, no. 1, pp. 68–74, 2015.

[33] F. L. Coe, A. Evan, and E. Worcester, "Kidney stone disease," Journal of Clinical Investigation, vol. 115, no. 10, pp. 2598–2608, 2005.

[34] Chaudhary, S. K. Singla, and C. Tandon, "In vitro evaluation of Terminalia arjuna on calcium phosphate and calcium oxalate crystallization," Indian Journal of Pharmaceutical Sciences, vol. 72, no. 3, pp. 340–345, 2010.

[35] F. L. Coe, J. H. Parks, and J. R. Asplin, "The pathogenesis and treatment of kidney stones," New England Journal of Medicine, vol. 327, no. 16, pp. 1141–1152, 1992.

[36] A. Skolarikos, M. Straub, T. Knoll et al., "Metabolic evaluation and recurrence prevention for urinary stone patients: EAU guidelines," European Urology, vol. 67, no. 4, pp. 750–763, 2015.

[37] A. Bensatal and M. R. Ouahrani, "Inhibition of crystallization of calcium oxalate by the extraction of Tamarix gallica L," Urological Research, vol. 36, no. 6, pp. 283–287, 2008.

[38] D. R. Basavaraj, C. S. Biyani, A. J. Browning, and J. J. Cartledge, "The role of urinary kidney stone inhibitors and promoters in the pathogenesis of calcium containing renal stones," *EAU-EBU Update Series*, vol. 5, no. 3, pp. 126–136, 2007.

[39] F. Dal-Moro, M. Mancini, I. M. Tavolini, V. De Marco, and P. Bassi, "Cellular and molecular gateways to urolithiasis: a new insight," *Urologia Internationalis*, vol. 74, pp. 193–197, 2005.

[40] D. V. Kishore, F. Moosavi, and D. R. K. Varma, "Effect of ethanolic extract of *Portulaca oleracea* linn. on ethylene glycol and ammonium chloride induced urolithiasis," *International Journal of Pharmacy and Pharmaceutical Sciences*, vol. 5, no. 2, pp. 134–140, 2013.

[41] Black, K. M., Law, H., Aldoukhi, A., Deng, J., & Ghani, K. R. (2020). Deep learning computer vision algorithm for detecting kidney stone composition. *BJU international*, *125*(6), 920-924.

[42] Yildirim, K., Bozdag, P. G., Talo, M., Yildirim, O., Karabatak, M., & Acharya, U. R. (2021). Deep learning model for automated kidney stone detection using coronal CT images. *Computers in biology and medicine*, *135*, 104569.

ISBN: 978-81-965236-7-1

[43] Somasundaram, K., & Sivakumar, P. (2021, December). An Efficient Detection of Kidney Stone Based on HDVS Deep Learning Approach. In Proceedings of the First International Conference on Combinatorial and Optimization, ICCAP 2021, December 7-8 2021, Chennai, India.

[44] Suarez-Ibarrola, R., Hein, S., Reis, G., Gratzke, C., &Miernik, A. (2020). Current and future applications of machine and deep learning in urology: a review of the literature on urolithiasis, renal cell carcinoma, and bladder and prostate cancer. World journal of urology, 38(10), 2329-2347.

[45] Ö. Sabuncu and B. Bilgehan, "Performance Evaluation for Various Deep Learning (DL) Methods Applied to Kidney Stone Diseases," 2021 International Conference on Forthcoming Networks and Sustainability in AIoT Era (FoNeS-AIoT), 2021, pp. 1-3, doi: 10.1109/FoNeS-AIoT54873.2021.00010.

[46] Flores-Araiza, D., Lopez-Tiro, F., Villalvazo-Avila, E., El-Beze, J., Hubert, J., Ochoa-Ruiz, G., &Daul, C. (2022). Interpretable Deep Learning Classifier by Detection of Prototypical Parts on Kidney Stones Images. arXiv preprint arXiv:2206.00252.

[47] Li, D., Xiao, C., Liu, Y., Chen, Z., Hassan, H., Su, L., ... & Huang, B. (2022). Deep Segmentation Networks for Segmenting Kidneys and Detecting Kidney Stones in Unenhanced Abdominal CT Images. *Diagnostics*, *12*(8), 1788.

[48] Ochoa-Ruiz, G., Estrade, V., Lopez, F., Flores-Araiza, D., Beze, J. E., Trinh, D. H., ... &Daul, C. (2022). On the in vivo recognition of kidney stones using machine learning. *arXiv preprint arXiv:2201.08865*.

[49] Jeong, C. W., Jung, J. W., Cha, W. H., Lee, B. K., Lee, S., Jeong, S. J., ... & Lee, S. E. (2013). Seoul National University Renal Stone Complexity Score for predicting stone-free rate after percutaneous nephrolithotomy. *PLoS One*, *8*(6), e65888.

[50] Kim, U. S., Kwon, H. S., Yang, W., Lee, W., Choi, C., Kim, J. K., ... & Han, J. H. (2021). Prediction of the composition of urinary stones using deep learning. *Investigative and Clinical Urology*, *63*.

[51] Sri, V. S., Kumar, P. S., & Rajendran, V. (2023). A Review on Detection of Kidney Disease Using Machine Learning and Deep Learning Techniques. *Application of Deep Learning Methods in Healthcare and Medical Science*, 1-22.

[52] Villalvazo-Avila, E., Lopez-Tiro, F., Flores-Araiza, D., Ochoa-Ruiz, G., El-Beze, J., Hubert, J., &Daul, C. (2022). Comparing feature fusion strategies for Deep Learning-based kidney stone identification. *arXiv preprint arXiv:2206.00069*.

[53] Kazemi, Y., &Mirroshandel, S. A. (2018). A novel method for predicting kidney stone type using ensemble learning. *Artificial intelligence in medicine*, *84*, 117-126.

[54] Shah, M., Naik, N., Somani, B. K., & Hameed, B. Z. (2020). Artificial intelligence (AI) in urology-Current use and future directions: An iTRUE study. *Turkish Journal of Urology*, *46*(Suppl 1), S27.

[55] C. S. Kolli, M. P. Raghunath, S. Meenakshi, K. Maheswari, C. F. Britto and S. Kushwaha, "Efficient Development of Supervised Learning Algorithm for kidney Stone Prediction," 2022 International Conference on Inventive Computation Technologies (ICICT), 2022, pp. 1373-1379, doi: 10.1109/ICICT54344.2022.9850573.

[56] Li, D., Xiao, C., Liu, Y., Chen, Z., Hassan, H., Su, & Zhong, W. (2022). Deep Segmentation Networks for Segmenting Kidneys and Detecting Kidney Stones in Unenhanced Ab-dominal CT Images. Diagnostics 2022, 12, 1788.

[57] GP, V. P., Reddy, K. V. S., Kiruthik, A. M., &ArunNehru, J. Prediction of Kidney Stones Using Machine Learning.

[58] Surya v, P.V.Sumanth , U.Surendra , V.Chakradhar, (2021). Kidney Stone Detection using Machine Learning Algorithm, Vol XIV Issue 5 2021, ISSN NO : 0090-5674.

[59] McCarthy, C. J., Baliyan, V., Kordbacheh, H., Sajjad, Z., Sahani, D., &Kambadakone, A. (2016). Radiology of renal stone disease. *International Journal of Surgery*, *36*, 638-646.

[60] Buvaneswari, R., & Vinoth, R. (2022). Kidney Stone Detection Using Hybrid Butterfly Net and Inception net Model. *ESP Journal of Engineering and Technology Advancements*, *2*(4), 1-6.

ISBN: 978-81-965236-7-1

INNOVATIVE AGRICULTURAL MONITORING SYSTEM VALIDATED USING MATLAB

[1] Mr. T. PARTHIBAN,
[2]S. SRINANTHANA, [3]KAYALVIZHI, [4]S. SRIBHARATHI,
[1]Assistant Professor, Department of Electrical and Electronics Engineering,
[2,3,4] Student, Department of Electrical and Electronics Engineering,
Sri Bharathi Engineering College for Women,
Pudukkottai, Tamil Nadu, India.

Abstract - **The paper aims to deploy a "smart agriculture monitoring system" to minimize human involvement in farming operations. The three key subsystems – the master controller, the water pump system, and the water pump switching controller – are designed to optimize productivity. Our primary goals include developing a system with a robust design, high accessibility, and integrated wireless communication. The system will intake sensor data, process it through MATLAB software, and present a user-friendly interface. The project concludes with the implementation of an efficient water management system, ensuring stable growth conditions for plants. Our proposed concept holds significant promise, serving as an effective interface between input sensors and IoT as the output medium.**

KEYWORDS: Master controller, switching controller, Robust design, Integrated wireless communication.

INTRODUCTION:

Throughout history, Earth has faced numerous pollution factors, including chemical pollutants in water and soil, air pollution, and the impact of sun exposure on plants. Unfortunately, human negligence towards environmental preservation has led to a continuous increase in pollution. Utilizing natural resources without considering the long-term consequences has become a significant issue. Plants, playing a crucial role in the Earth's life cycle, are consumed by humans for food, oxygen, and various other needs.

As the global population is projected to reach nine billion by 2050, concerns about food safety are escalating. In response to this challenge, different methods and studies have been conducted to enhance agricultural production, leveraging advancements in life sciences and technologies.

One noteworthy solution is Controlled Environment Agriculture (CEA), which includes greenhouse growing methods.

These methods empower growers to control crop growth, allowing for year-round cultivation. By integrating advanced computer controllers, tools, and sensors, growers can enhance production quality, offering consumers better-tasting produce.

Desert climates, characterized by hot, humid summers and cold winters with occasional rain, present unique challenges for agriculture. While the use of cutting-edge technology in desert farms is limited, advances in pervasive computing and the Internet of Things (IoT) are gradually reaching every aspect of life, including local agricultural practices.

Irrigation, a critical aspect of agriculture, draws water from various sources such as groundwater, surface water, and non-conventional sources like treated wastewater and desalinated water. Spate irrigation, a form of surface water irrigation, involves diverting floodwater to dry river beds using dams and channels. Rainwater harvesting, collecting runoff from roofs or unused land, is another method, although it is not usually considered a form of irrigation.

Wastewater, a significant environmental concern, remains untreated in many parts of the world, causing water pollution. In agriculture, untreated wastewater is increasingly used for irrigation, posing health risks due to pathogens. The International Water Management Institute emphasizes a 'multiple-barrier' approach to mitigate risks, including ceasing irrigation before harvesting and applying water carefully to avoid contamination.

Embedded systems, combining software and hardware, play a crucial role in various applications. They are designed for specific tasks, often with real-time performance constraints. Embedded systems can be standalone devices or components within larger systems, such as the embedded system in an automobile serving a specific function as a subsystem of the car itself.

Examples range from air traffic control systems to the Gibson Robot Guitar, showcasing the versatility and importance of embedded systems in modern technology.

ISBN: 978-81-965236-7-1

EXISTING SYSTEM:

The current system employs an Arduino Uno microcontroller to receive inputs from different sensors such as temperature, ultrasonic, and soil humidity sensors. The decision to water the crops is validated through a relay system. However, the system faces challenges due to the lack of uninterrupted power supply and limited sensor inputs. These shortcomings make the existing system less robust in its application and less suitable for adverse weather conditions.

PROPOSED SYSTEM:

Hydroponic systems do not serve as a panacea for mitigating unfavourable growing conditions, such as inadequate temperature, insufficient light, or pest-related issues. The basic growth requirements for hydroponically cultivated plants mirror those of their field-grown counterparts. The primary distinction lies in the method of plant support and the delivery of essential inorganic elements for growth and development.

Optimal temperature plays a pivotal role in plant growth, with deviations from the ideal range leading to abnormal development and diminished productivity. Warm-season vegetables and many flowers thrive between temperatures ranging from 60°F to 80°F, while cool-season vegetables, like lettuce and spinach, prefer temperatures between 50°F and 70°F.

Light, a fundamental requirement for plants, poses a challenge in hydroponics. Natural sunlight, a key component for traditional garden cultivation, is irreplaceable. Hydroponically grown vegetables necessitate a minimum of 8 to 10 hours of direct sunlight daily for robust production. Artificial lighting, despite being a subpar alternative, falls short due to the insufficient intensity of most indoor lights. Incandescent lamps, complemented with sunlight or specialized plant-growth lamps, may suffice for growing transplants but prove inadequate for maturing crops. Although high-intensity lamps, such as high-pressure sodium lamps, can offer more than 1,000 foot-candles of light, their exorbitant cost renders them impractical for commercial operations.

Proper spacing between plants within a greenhouse is crucial to ensuring each receives ample light. The spacing requirements vary, with factors like pruning influencing the space needed. For instance, a single-stem-pruned tomato plant necessitates 4 square feet, while European seedless cucumbers require 7 to 9 square feet. Leaf lettuce plants should be spaced 7 to 9 inches apart within rows and 9 inches between rows. Winter cultivation in a greenhouse proves less successful due to reduced light intensity during shorter days and cloudy weather.

Providing an adequate water supply poses challenges in certain hydroponic systems. While water culture systems facilitate easy water provision, aggregate culture methods may encounter difficulties. In hot summer months, large tomato plants can consume up to half a gallon of water daily. Insufficient moisture in the aggregate can lead to root drying and death, impacting plant recovery and reducing production even after moisture restoration.

Water quality presents another challenge, with excessive alkalinity or salt content disrupting nutrient balance and impeding plant growth. Softened water, containing elevated sodium levels, proves harmful. Water exceeding 0.5 million or 320 parts per million in salt content can cause nutrient imbalances. Customized nutrient solutions may help address this issue, but it requires expertise in balancing salts.

Plants also demand oxygen for respiration, a process vital for water and nutrient uptake. In soil, oxygen is typically abundant; however, in hydroponics, plant roots in water can deplete dissolved oxygen quickly, potentially causing damage or death. Aeration through air bubbling is a common method to supplement oxygen. Aeroponic or continuous flow systems often negate the need for additional oxygen.

In summary, while hydroponic systems offer advantages, they necessitate meticulous attention to temperature, light, spacing, water provision, water quality, and oxygen supply to ensure optimal plant growth and productivity.

TRANSMITTER:

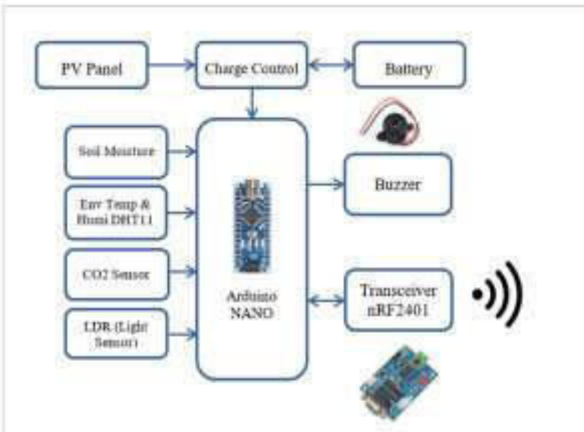


Fig: Transmitter block diagram

RECEIVER:

Green plants rely on the absorption of specific minerals through their roots to sustain their survival. In garden settings, these minerals are sourced from the soil and supplemented through

ISBN: 978-81-965236-7-1

the application of fertilizers like manure, compost, and fertilizer salts. The crucial elements required in substantial quantities include nitrogen, phosphorus, potassium, calcium, magnesium, and sulphur. Additionally, micronutrients such as iron, manganese, boron, zinc, copper, molybdenum, and chlorine are essential, albeit in minimal quantities.

In a garden, plant roots are naturally surrounded by soil, providing the necessary support for their growth. Conversely, hydroponically grown plants require artificial support, typically achieved through the use of string or stakes. Consequently, the measurement of humidity and temperature plays a crucial role in regulating environmental conditions vital for plant survival. These measurements are essential for weather analysis and forecasts, particularly in the realm of agriculture. To safeguard plants from drought and extreme temperatures, monitoring and controlling humidity and temperature levels become imperative.

Utilizing a soil moisture sensor aids in detecting the water content in the soil around the plants. The sensor offers two output configurations, namely high and low, providing valuable information about soil hydration.

The prototype incorporates a pump housed within a single available tank. This pump serves dual purposes – irrigation and cooling. For irrigation, the pump initiates the flow of water through a hose and subsequently through water sprinklers.

The decision to continue or cease pump operation depends on the readings from plant humidity and water level sensors. In the cooling system, water is sprayed among the straw, and a fan contributes to cooling the plants.

Automation extends to shading, where a motor is employed to adjust shutters, thereby regulating the amount of sunlight entering the greenhouse based on the plant's measured needs. Additionally, remote monitoring capabilities allow users to check the farm's status from a distance. Users can access sensor readings and measurements, and the receiver system enables manual control when needed.

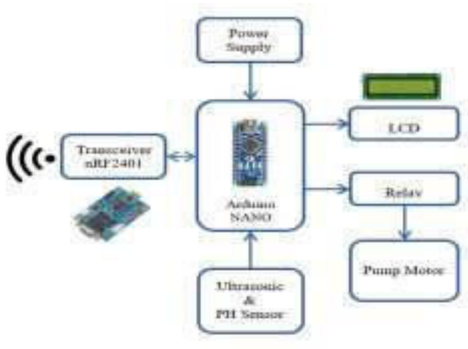


Fig: Receiver block diagram

MASTER CONTROLLER PROGRAM:

```
//TRANSMITTER
#include <Wire.h>
#include <LiquidCrystal.h>
const int RS = 7;
const int E  = 6;
const int D4 = 5;
const int D5 = 4;
const int D6 = 3;
const int D7 = 2;
LiquidCrystal lcd(RS, E, D4, D5, D6, D7);
#include <SoftwareSerial.h>
// Temp and Humidity
#include "DHT.h"
#define DHTPIN1 A1     // Digital pin connected to
the DHT sensor
#define DHTTYPE1 DHT11   // DHT 11
DHT dht1(DHTPIN1, DHTTYPE1);
//Moisture Level
int soil_moi,sensor_analog1;
const int sensor_pin1 = A2;
// Air Quality
int aqv = A3;
int air = 0;
//LDR
int ld  = A5;
int ldr = 0;
int buzzer = 13;
void setup() {
  // put your setup code here, to run once:
  pinMode(sensor_pin1, INPUT);
  pinMode(ld, INPUT);
  pinMode(aqv, INPUT);
  pinMode(buzzer, OUTPUT);
   Serial.begin(9600); // opens serial port, sets data
rate to 9600 bps
//Humidity
  dht1.begin();
   lcd.begin(16,2);
  lcd.setCursor(0,0);
  lcd.print("AGRI SENSOR TX");
  lcd.setCursor(0,1);
  lcd.print("MODULE 1 ");
  delay(1500);
  digitalWrite(buzzer, HIGH);
  delay(250);
  digitalWrite(buzzer, LOW);
  lcd.clear();
}
void loop() {
```

ISBN: 978-81-965236-7-1

```
 // put your main code here, to run repeatedly:
sensor_analog1 = analogRead(sensor_pin1);
 soil_moi = ( 100 - ( (sensor_analog1/1024.00) * 100 ) );
 //Humidity Sensor
 delay(100);
 int ehum = dht1.readHumidity();
 int etemp = dht1.readTemperature();
 air = analogRead(aqv);
 ldr = analogRead(ld);
lcd.setCursor(0,0);
 lcd.print("T:");
 lcd.print(etemp);
 lcd.print("  ");
lcd.setCursor(6,0);
 lcd.print("H:");
 lcd.print(ehum);
 lcd.print(" ");
 lcd.setCursor(12,0);
 lcd.print("L:");
 lcd.print(ldr);
 lcd.print(" ");
 lcd.setCursor(0,1);
 lcd.print("S:");
 lcd.print(soil_moi);
 lcd.print(" ");
lcd.setCursor(6,1);
 lcd.print("A:");
 lcd.print(air);
 lcd.print(" ");
 if (soil_moi < 25){
 digitalWrite(buzzer, HIGH);
   delay(200);
   digitalWrite(buzzer, LOW);
  }
 else{
   delay(100);
   digitalWrite(buzzer, LOW);
  }
 Serial.print("H ");
 Serial.print(etemp);
 Serial.print(",");
 Serial.print(ehum);
 Serial.print(",");
 Serial.print(soil_moi);
 Serial.print(",");
 Serial.print(air);
 Serial.print(",");
 Serial.print(ldr);
 Serial.print("!");
  Serial.println();
  delay(1000);
}
```

WATER PUMPING SYSTEM PROGRAM:

```
//RECEIVER
#include <Wire.h>
#include <LiquidCrystal.h>
 const int RS = 7;
 const int E  = 6;
 const int D4 = 5;
 const int D5 = 4;
 const int D6 = 3;
 const int D7 = 2;
 LiquidCrystal lcd(RS, E, D4, D5, D6, D7);
#include <SoftwareSerial.h>
SoftwareSerial PHSerial(10, 11); // RX, TX
//pH
String ph;
int phvalue = 0;
// Ultrasonic pins numbers
const int trigPin = A0;
const int echoPin = A1;
// defines variables
long duration;
int dCm;
#include <String.h>
#include <TextFinder.h>
TextFinder finder(Serial);
const int no_of_fields = 5;
int fieldID = 0;
int values[no_of_fields];
 int relay = 12;
  void setup() {
 // put your setup code here, to run once
  Serial.begin(9600); // opens serial port, sets data rate to 9600 bps
 PHSerial.begin(9600);
 pinMode(trigPin, OUTPUT);
 pinMode(echoPin, INPUT);
 pinMode(relay, OUTPUT);
 lcd.begin(16,2);
 lcd.setCursor(0,0);
 lcd.print("AGRI RECEIVER");
lcd.setCursor(0,1);
  lcd.print("MODULE 2");
delay(2000);
 lcd.clear();
}
  void loop() {
```

ISBN: 978-81-965236-7-1

```
 // put your main code here, to run repeatedly:
 for(fieldID = 0; fieldID  < 5; fieldID ++)
 {
  values[fieldID] = finder.getValue();
  }
int data1 = values[0]; int data2 = values[1];
int data3 = values[2];
int data4 = values[2];
int data5 = values[2];
 //pH Value
for(int i=1; i<=2; i++) {
String phdata = PHSerial.readStringUntil(':')
 if(phdata) != ''
 ph = PHSerial.readStringUntil('$');
 phvalue = ph.toFloat();
//phvalue = phvalue-30;
 //Serial.print("PH:");
  //Serial.println(phvalue);
  } }
  // Ultrasonic Sensor
  digitalWrite(trigPin, LOW);
  delayMicroseconds(2);
  digitalWrite(trigPin, HIGH);
   delayMicroseconds(10);
   digitalWrite(trigPin, LOW);
   duration = pulseIn(echoPin, HIGH);
   // Calculating the distance
   dCm= duration*0.034/2;
  \\ lcd.setCursor(0,0);
    lcd.print("PH:");
lcd.print(phvalue);
 lcd.setCursor(6,0);
 lcd.print("W:");
 lcd.print(dCm);
  if(data3 <= 20){
      digitalWrite(relay, HIGH);
    }
    else{
      digitalWrite(relay, LOW);
    }
          Serial.print("123 ");
    Serial.print(data1);
    Serial.print(" ");
    Serial.print(data2);
    Serial.print(" ");
    Serial.print(data3);
    Serial.print(" ");
    Serial.print(data4);
    Serial.print(" ");
    Serial.print(data5);
    Serial.print(" ");
    Serial.print(phvalue);
    Serial.print(" ");
    Serial.print(dCm);
    Serial.println();
    delay(750);
}
      void serialmotor
}
```

CONCLUSION AND HARDWARE SETUP

The proposed, agricultural monitoring system is need for the hour to reduce the human intervention in farming. This demonstrates the advantage of building the rules with mathematical equations and linguistic variables. This process is aimed to educate the farmer on the use of an integrated technology system to monitor and control operations. The system can also create an excellent set of decision-makers with reduced manual contribution. Furthermore, the outcomes help us to understand more about the significance of each variable to obtain healthy plants. This achievement leads to a smart water management. For future enhancement, we would like to attain more data so that we can run training and testing of the data.

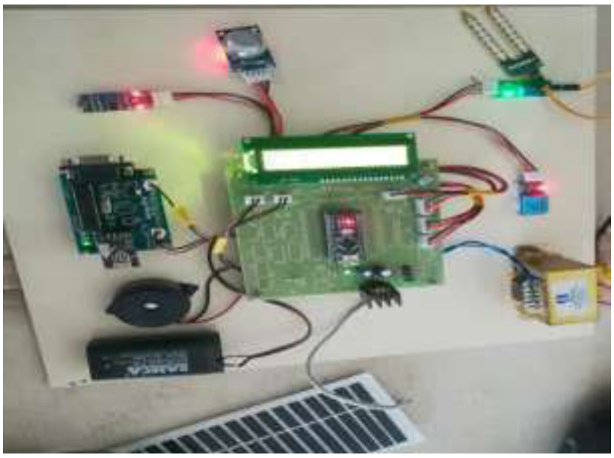


Fig: Master Controller – Hardware Setup

ISBN: 978-81-965236-7-1

Fig: Water Pumping System

REFERENCES

[1] Kirtan Jha et al., “A Comprehensive Review on Automation in Agriculture using Artificial Intelligence”, Artificial Intelligence in Agriculture, pp. 1–12, February, 2019.

[2] Veronica and Francisco, “From Smart Farming towards Agriculture 5.0: A Review on Crop Data Management”, Agronomy, pp 1-21, February 2020.

[3] Imran Ali et al, “Monitoring and Control Systems in Agriculture Using Intelligent Sensor Techniques: A Review of the Aeroponic System”, Journal of Sensors (Hindawi), 18 pages, December 2018.

[4] Tilva et al., “Weather Based Plant Diseases Forecasting Using Fuzzy

Logic”, Nirma University International Conference on Engineering (NUiCONE), 1–5 October, 2013.

[5] Gupta et al., “Need of Smart Water Systems in India”, International Journal of Engineering Research, 11 (4), 2216–2223, 2016.

[6] Mustafa et al. “Agricultural Produce Sorting and Grading Using Support Vector Machines and Fuzzy Logic”, IEEE International Conference on Signal and Image Processing Applications,

391–396, 2009.

[7] Philomine Roseline et al., “Design and Development of Fuzzy Expert

System for Integrated Disease Management in Finger Millets”, International Journal of Computer Applications 56(1):31-36, October 2012.

[8] Heidi Webber et al., “Uncertainity in Future Irrigation Water Demand and Risk of Crop Failure” Environment Research Letter, 11 074007, 2016.

ISBN: 978-81-965236-7-1

MDF Architecture For Pipelined Radix-2^k Feedforward FFT

[1]A.Salai Kishwar Jahan, [2] K.Praveen Kumar
[1]Assistant Professor, [2]Assistant Professor
[1&2]Electronics & Communication Engineering
[1,2]Mahath Amma Institute of Engineering & Technology, Pudukkottai,
[1]communication678@gmail.com,[2]praveenece88@gmail.com@gmail.com

Abstract-The radix-2² was a milestone in the design of pipelined FFT hardware architectures. Later, radix-2 extended to radix-2^{16}.However, radix-2^{16} was only proposed for single path delay feedback (SFD) architectures, but not for feedforward, and also it called multi path delay commutator (MDC) .The radix-216 feedforward Fast Fourier Transform architecture (FFT) .In feedforward architectures radix-2^{16} can be used for any number of parallel samples which is a power of two. Furthermore, both decimation in frequency (DIF) and decimation in time (DIT) decompositions can be used. In addition to this, the designs can achieve very high throughputs and reduce the spare complexity, which make them suitable for the most demanding applications. Indeed, the proposed radix-2^k feedforward architectures require fewer hardware resources than parallel feedback ones, also called multi path delay feedback (MDF), when several samples in parallel must be processed. As result, the proposed radix-2^{16} feedforward architectures not only offer an attractive solution for current applications, but also open up a new research line on feedforward structures.

***Index Terms-* Fast Fourier Transform, Multi path delay feedback (MDF), Pipelined Architecture**

I.INTRODUCTION

The Fast Fourier transform (FFT) is one of the most important algorithms in the field of digital signal processing. It is used to calculate the discrete Fourier transform (DFT) efficiently. These implementations can be mainly classified into memory-based and pipeline architecture style. Memory-based architecture is widely adopted to design, also known as the single Processing Element (PE) approach. This design style usually composed of a main PE and several memory units, thus the hardware cost and power consumption are both lower than the other architecture style. But disadvantage is that it has long latency, long throughput and it cannot be paralleled. In order to meet the high performance and real-time requirements of modern applications, hardware designers have always tried to implement efficient architectures for the computation of the FFT.

For a pipelined FFT processor, each stage has its own set of processing elements. All the stages are computed as soon as data are available. Pipelined FFT processor have features like simplicity, modularity and high throughput low hardware complexity, and low power consumption. These features are important for real-time, in-place applications where the input data often arrive in a natural sequential order. We therefore select the pipeline architecture for our FFT processor implementation. We go for pipelined hardware architecture [9], because they provide high Throughputs and low latencies suitable for real time, as well as a reasonably low area and low power consumption. There are two main types of pipelined architectures: feedback (FB)[14] and feed forward (FF)[3]. On the one hand, feedback architectures [14] are characterized by their feedback loops, i.e., some outputs of the butterflies are fed back to the memories at the same stage. Feedback architectures can be divided into single-path delay feedback (SDF)[1],[14] which process a continuous flow of one sample per clock cycle, and multi-path delay feedback (MDF) or parallel feedback[4], which process several samples in parallel.

On the other hand, feed forward architectures also known as multi-path delay commutator (MDC)[12], do not have feedback loops and each stage passes the processed data to the next stage. These architectures can also process several samples in parallel. In current real-time applications, the FFT has to be calculated at very high throughput rates, even in the range of Giga samples per second. These high-performance requirements appear in applications such as orthogonal frequency division multiplexing (OFDM)[5] and ultra wideband (UWB)[8],[13] .

Two main challenges can be distinguished. The first one is to calculate the FFT of multiple independent data sequences. In this case, all the FFT processors can share the rotation memory in order to reduce the hardware. Designs that manage a variable number of sequences can also be obtained. The second challenge is to calculate the FFT when several samples of the same sequence are received in parallel. This must be done when the required throughput is higher than the clock frequency of the device. In this case it is necessary to resort to FFT architectures that can manage several samples in parallel. However, radix-2^{16} had not been considered for feed forward architectures until the first radix-2^2 feed forward FFT architectures were proposed a few years ago.As a result, parallel feedback architectures [4],[7],[15] which had not been considered for several decades, have become very popular in the last few years. Conversely, not very much attention has been paid to feed forward (MDC) architectures. This paradoxical fact, however, has simple explanation. Originally, SDF and MDC architecture were proposed for radix-2[6] and radix-4[2]. Some years later, radix-2^k was presented for the SDF [1],[12] FFT improvement on radix-2 and radix-4[2]. Next, radix-2^3 and radix-2^3, which enable certain complex multipliers to be simplified, were also presented for the SDF FFT. Finally, the current need for high throughput has been meeting by the MDF, which includes multiple interconnected SDF paths in parallel.

The proposed architecture present the Pipelined radix-2^{16} feed forward FFT architectures. The proposed MDF architecture can provide a higher throughput rate with

ISBN: 978-81-965236-7-1

minimal hardware cost by combining the features of MDC and SDF. The MDF architecture has lower hardware cost compared with the traditional SDF approach and adopts the radix-2^{16} FFT architecture to reduce power dissipation .

II.FAST FOURIER TRANSFORM

A Fast Fourier Transform (FFT) is an efficient algorithm to compute the Discrete Fourier Transform (DFT) and its inverse. There are many distinct FFT algorithms involving a wide range of mathematics, from simple complex-number arithmetic to group theory and number theory. The fast Fourier Transform is a highly efficient procedure for computing the DFT of a finite series and requires less number of computations than that of direct evaluation of DFT. It reduces the computations by taking advantage of the fact that the calculation of the coefficients of the DFT can be carried out iteratively. Due to this, FFT computation technique is used in digital spectral analysis, filter simulation, autocorrelation and pattern recognition.

The FFT is based on decomposition and breaking the transform into smaller transforms and combining them to get the total transform. FFT reduces the computation time required to compute a discrete Fourier transform and improves the performance by a factor of 100 or more over direct evaluation of the DFT.

A DFT decomposes a sequence of values into components of different frequencies. This operation is useful in many fields but computing it directly from the definition is often too slow to be practical. An FFT is a way to compute the same result more quickly: computing a DFT of N points in the obvious way, using the definition, takes O(N^2) arithmetical operations, while an FFT can compute the same result in only O(N log N) operations. The difference in speed can be substantial, especially for long data sets where N may be in the thousands or millions-in practice, the computation time can be reduced by several orders of magnitude in such cases, and the improvement is roughly proportional to N /log (N). This huge improvement made many DFT-based algorithms practical. FFT's are of great importance to a wide variety of applications, from digital signal processing and solving partial differential equations to algorithms for quick multiplication of large integers.

The most well known FFT algorithms depend upon the factorization of N, but there are FFT with O (N log N) complexity for all N, even for prime N. Many FFT algorithms only depend on the fact that is an N^{th} primitive root of unity, and thus can be applied to analogous transforms over any finite field, such as number-theoretic transforms.

The Fast Fourier Transform algorithm exploit the two basic properties of the twiddle factor - the symmetry property and periodicity property which reduces the number of complex multiplications required to perform DFT. FFT algorithms are based on the fundamental principle of decomposing the computation of discrete Fourier Transform of a sequence of length N into successively smaller discrete Fourier transforms. There are basically two classes of FFT algorithms. Decimation In Time (DIT) algorithm and Decimation In Frequency (DIF) algorithm. In decimation-in-time, the sequence for which we need the DFT is successively divided into smaller sequences and the DFTs of these subsequences are combined in a certain pattern to obtain the required DFT of the entire sequence. In the decimation-in-frequency approach, the frequency samples of the DFT are decomposed into smaller and smaller subsequences in a similar manner. The number of complex multiplication and addition operations required by the simple forms both the Discrete Fourier Transform (DFT) and Inverse Discrete Fourier Transform (IDFT) is of order N^2 as there are N data points to calculate, each of which requires N complex arithmetic operations. The discrete Fourier transform is defined by the Eq.1

$$X(K)=\sum_{n=0}^{N-1} x(n)\bullet e^{\frac{-j2\Pi nK}{N}}; \qquad (1)$$

Where K is an integer ranging from 0 to N − 1.The algorithmic complexity of DFT will O(N^2) and hence is not a very efficient method. If we can't do any better than this then the DFT will not be very useful for the majority of practical DSP application. However, there are a number of different 'Fast Fourier Transform' (FFT) algorithms that enable the calculation the Fourier transform of a signal much faster than a DFT. As the name suggests, FFTs are algorithms for quick calculation of discrete Fourier transform of a data vector. The FFT is a DFT algorithm which reduces the number of computations needed for N points from O(N^2) to O($N \log_2 N$) where log is the base-2 logarithm. If the function to be transformed is not harmonically related to the sampling frequency, the response of an FFT looks like a 'sinc' function (sin x) / x.

III. RADIX-2^2 FFT ALGORITHM

The DFT of an input sequence is defined in Eq.2

$$X(K)=\sum_{n=0}^{N-1} x(n)\bullet e^{\frac{-j2\Pi nK}{N}}; \quad k=0,1\ldots.N-1 \qquad (2)$$

When N When is a power of two, the FFT based on Cooley-Tukey algorithm is most commonly used in order to compute the DFT efficiently. The Cooley-Tukey algorithm reduces the number of operations from O(N^2) for the DFT to O($N \log_2 N$) for the FFT. In accordance with this, the FFT is calculated in a series n=$\log_\rho$N of stages, where ρ is the base of the radix, r, of the FFT, i.e., r = ρ^α . Flow graphs of 16-point radix-2 and radix-2^2 using decimation in frequency(DIF).The Comparison of Execution Times, DFT & Radix – 2 FFT is tabulated in Table I.At each stage of the graphs, S€{1,…..,n}, butterflies and rotations have to be calculated. The lower edges of the butterflies are always multiplied by -1.These -1 are not depicted on order to simplify the graphs. Flow graph of 16-point radix-2 represent in the Fig.1.The numbers at the input represent the index of the input sequence, whereas those at the output are the frequencies, k,of the output signal $X[k]$ .Finally each number,Φ,in between the stages indicates a rotation by Eq.3 As a consequence, samples for which $\Phi=0$ do not need to rotated likewise, if Φ € [0,N/4,N/2,3N/4] the samples must be rotated by 0^o,270^o,180^o and 90^o which correspond to complex multiplication by 1,-j,-1,j respectively. These rotations are considered trivial, because they can be

ISBN: 978-81-965236-7-1

performed by interchanging the real and imaginary components and/or changing the sign of data.

$$W_N^{\Phi} = e^{-j\frac{2\pi}{N}\Phi} \qquad (3)$$

Number of Points, N	Complex Multiplications in Direct computations, N^2	Complex Multiplication in FFT Algorithm, (N/2) $\log_2$ N	Speed improvement Factor
4	16	4	4.0
8	64	12	5.3
16	256	32	8.0
32	1024	80	12.8
64	4096	192	21.3
128	16384	448	36.6

Table I Comparison of Execution Times, DFT & Radix- 2 FFT

Radix-2^2 is based on radix -2 and the flow graph of a radix-2^2 DIF FFT can be obtained from the graph of a radix-2 DIF one.This This can be done by breaking down each angle Φ, at odd stages into a trivial rotation and a non-trivial one, Φ', where $\Phi' = \Phi$ mod N/4, and moving the latter to the following stage. This is possible thanks to the fact that in the radix-2 DIF FFT the rotation angles at the two inputs of every butterfly, Φ_A and Φ_B , only differ by 0 or N/4. Thus, if $\Phi_A= \Phi'$ and $\Phi_B= \Phi'$+N/4 , the rotation is moved to the following stage. Where the first side of Eq.4 represents the computations using radix-2 and the second one using radix-2^2, and being the input data of the butterfly. In radix-2, A and B are rotated before the butterfly is computed, whereas in radix-2^2 is rotated by the trivial rotation –j before the butterfly, and the remaining rotation is carried out after the butterfly. Consequently, rotations by Φ' can be combined with those rotations of the following stage.

$$Ae^{-j\frac{2\pi}{N}\Phi'} \pm Be^{-j\frac{2\pi}{N}(\Phi'+N/4)} = [A + \quad (-j)B].e^{-j\frac{2\pi}{N}\Phi'} \qquad (4)$$

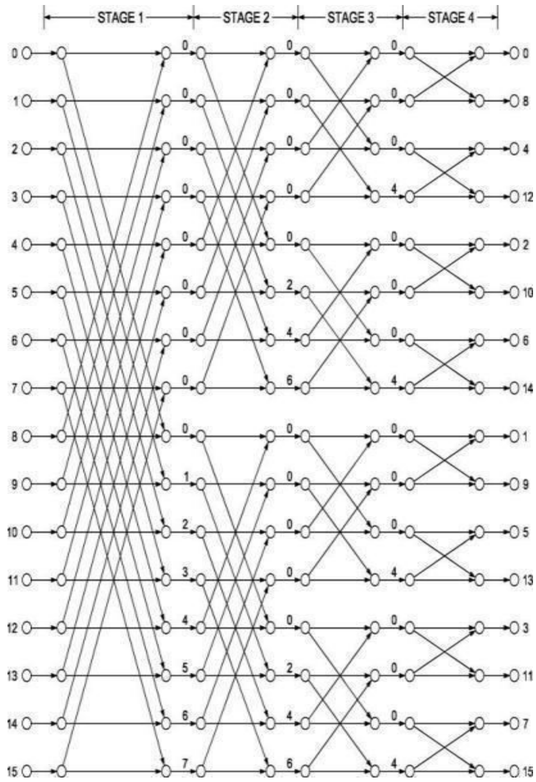


Fig.1 Flow graph of the 16-point radix-2 DIF FFT

IV.RADIX -2^2 FFT ARCHITECTURES

The proposed is based on analyzing the flow graph of the FFT and extracting the properties of the algorithm. These properties are requirements that any hardware architecture that calculates the algorithm must fulfill. The properties of the radix-2^2 FFT are shown in Table II. The following paragraphs explain these properties and how they are obtained.The properties depend on the index of the data, $I \equiv b_{n-1}, \ldots\ldots, b_1, b_0$,where ($\equiv$) will be using throughput the paper to relate both decimal and the binary representations of a numbers.

On the one hand, the properties related to the butterfly indicate which samples must be operated together in the butterflies.This condition b_{n-s} is both for DIF and DIT decompositions and means that at any stage of the FFT,s, butterflies operate in pairs of data whose indices differ only in bit b_{n-s} , where $n= \log_2 N$ is the number of stages of the FFT. In Fig.2 it can be observed that at the third stage,s=3, data with indices I=12$\equiv$1100 and I'=14$\equiv$1110 are processed together by a butterfly. These indices differ in bit b_1, b_{n-s} which meets ,since $n= \log_2 N= \log_2 16=4$ and, thus, $b_{n-s}= b_{4-3} = b_1$. On the other hand, there are two properties for rotations. At odd stages of the radix-2^2 DIF FFT only those samples whose index fulfills $b_{n-s}. b_{n-s-1}=1$ have to be rotated. These rotations are trivial and the symbol (.) indicates the logic AND function.

ISBN: 978-81-965236-7-1

Properties of Radix-2^2	**DIF**	**DIT**
Butterflies	b_{n-s}	b_{n-s}
Trival Rotators(Odd s)	$b_{n-s}.\ b_{n-s-1}=1$	$b_{n-s}.b_{n-s-1}=1$
Non-Trival Rotators (Even s)	$b_{n-s+1}+\ b_{n-s}=1$	$b_{n-s-1}+\ b_{n-s-2}=1$

Table II Properties of the Radix-2^2 FFT algorithm for DIF and DIT

For the 16-point radix-2^2 FFT in Fig.2 only samples with indices 12, 13, 14, and 15 must be rotated at the first stage. For these indices $b_3.b_2=1$ is fulfilled, meeting the property $b_{n-s}.b_{n-s-1}=1$, since n=4 and $s=1$. Conversely, at even stages rotations are non-trivial and they are calculated over indexed data for which $b_{n-s+1}+b_{n-s}=1$, where the symbol (+) indicates the logic OR function.

V.RADIX FEEDFORWARD FFT ARCHITECTURE

This section presents the radix-2^2 feedforward architectures [3]. First, a 16-point 4-parallel radix-2^2 feedforward FFT architecture is explained in depth in order to clarify the approach and Show how to analyze the architectures. Then, radix-2^2 feedforward [11] architectures for different number of parallel samples are presented.Fig.2 represent the 4-parallel radix-8 feedforward [11] FFT architecture.

The architecture is made up of radix-2[6] butterflies (R2), non-trivial rotators, trivial rotators, which are diamond-shaped, and shuffling structures, which consist of buffers and multiplexers. The lengths of the buffers are indicated by a number. The architecture processes four samples in parallel in a continuous flow. The order of the data at the different stages is shown at the bottom of the figure by their indices, together with the bits b_i that correspond to these indices. In the horizontal, indexed samples arrive at the same terminal at different time instants, whereas samples in the vertical arrive at the same time at different terminals. Finally, samples flow from left to right. Thus, indexed samples (0, 8, 4,12) arrive in parallel at the inputs of the circuit at the first clock cycle, whereas indexed samples (12, 13, 14, 15) arrive at consecutive clock cycles at the lower input terminal.Taking the previous considerations into account, the architecture can be analyzed as follows. First, it can be observed that butterflies always operate in pairs of samples whose indices differ in bit b_{n-s}, meeting the property in Table II. For instance, the pairs of data that arrive at the upper butterfly of the first stage are: (0, 8), (1, 9), (2, 10), and (3, 11).The binary representation of these pairs of numbers only differs in b_3. As $n=4$, and $s=1$ at the first stage,$b_{n-8}=b_{4-1}=b_3$, so the condition is fulfilled. This property can also be checked for the rest of the butterflies in a similar way that rotations at odd stages are trivial and only affect samples whose indices fulfill $b_{n-s}.b_{n-s-1}=1$.

By particularizing this condition for the first stage, $b_3.\ b_2=1$ is obtained. In the architecture shown in Fig.2 the indices that fulfill this condition are those of the lower edge and, thus, a trivial rotator is included at that edge.On the other hand, the condition for non-trivial rotations at even stages is $b_{n-s+1}+b_{n-s}=1, b_3+b_2=1$, being for the second stage. As $b_3+b_2=0$ for all indexed samples at the upper edge of the second stage, this edge does not need any rotator. Conversely, for the rest of edges $b_3+b_2=1$, so they include non-trivial rotators.The rotation memories of the circuit store the coefficients Φ of the flow graph. It can be seen that the coefficient associated to each index is the same as that in the flow graph of Fig.1.For instance, at the flow graph the sample with index $I = 14$ has to be rotated by at the second stage. In the architecture shown in Fig.3 the sample with index is the third one that arrives at the lower edge of the second stage. Thus, the third position of the rotation memory of the lower rotator stores the coefficient for the angle $\Phi = 6$.

Thirdly, the buffers and multiplexers carry out data shuffling. These circuits have already been used in previous pipelined FFT architectures, and Fig.4 shows how they work. For the first L clock cycles the multiplexers are set to “0” L, being the length of the buffers. Thus, the first samples from

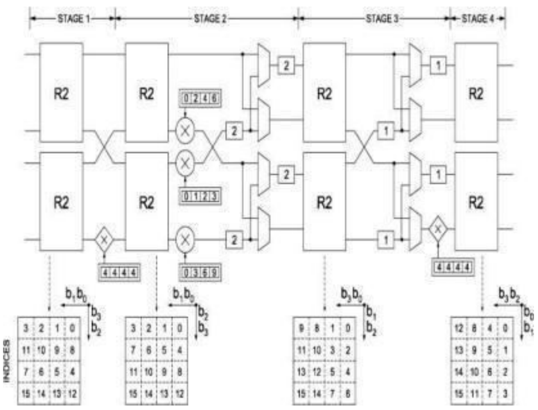


Fig.2 Proposed 4-parallel radix- 2^2 feedforward architecture for the computation of the 16-point DIF FFT

FFT $P=4$ N	Area Slices	Latency (ns)	Freq. (MHz)	Throughput (MS/s)
16	386	26	458	1831
64	695	81	389	1554
256	1024	221	384	1536
1024	1425	1055	270	1081
4096	2388	6120	173	693

Fig.3 Circuit for data shuffling

ISBN: 978-81-965236-7-1

$$\sum_{s=p}^{n-1} 2^p . L = \sum_{s=p}^{\log_2 N-1} 2^p . \frac{N}{2^{s+1}} = N - 2^p$$

$$= N - P \quad (5)$$

memory of the architectures is represented in Eq.5 the upper path (set *A*) are stored in the output buffer and the first samples from the lower path (set *C*) are stored in the input buffer. Next, the multiplexer changes to "1", so set *C* passes to the output buffer and set *D* is stored in the input buffer. At the same time, sets and are provided in parallel at the output. When the multiplexer commutes again to "0", sets *C* and *D* are provided in parallel. As a result, sets *B* and *C* are interchanged. Finally, the control of the circuit is very simple: As the multiplexers commute every L clock cycles and *L* is a power of two, the control signals of the multiplexers are directly obtained from the bits of a counter, in the proposed architectures the number of butterflies depends on to the number of samples in parallel, $P = 2^p$. For any P parallel *N* -point FFT the number of butterflies is $P/2\ log2\ N=P\ log4\ N$. Therefore, the number of complex adders is $2P\ log_4N$. Likewise, the number of rotators is $3P/4\ (log\ _4N\text{-}1)$. The only exception is for $P=2$. In this case, the number of rotators is $2\ (log_4N\text{-}1)$ .The proposed architectures can process a continuous flow of data. The throughput in samples per clock cycle number of samples in parallel $P=2^p$, whereas the latency is proportional to the size of the FFT divided by the number of parallel samples, i.e. *N/P*, . Thus, the most suitable architecture for a given application can be selected by considering the throughput and latency that the application demands. Indeed, the number of parallel samples can be increased arbitrarily, which assures that the most demanding requirements are met. Finally, the memory size does not increase with the number of parallel samples. For the architectures shown in ,the shuffling structure at any stage $s \in [p,n - 1]$ requires $P=2^p$ buffers of length $L=N/2^{s+1}$. According to this, the total sample.

Table III Area and Performance Of the Proposed 4-Parallel N Point Radix-2 Feed forward FFT Architectures

Therefore, a total sample memory of *N* addresses is enough for the computation of an *N*-point FFT independently of the degree of parallelism of the FFT. Indeed, the total memory of *N-P* addresses that the proposed architectures require is the minimum amount of memory for an *N*-point *P*-parallel FFT.Sometimes input samples are provided to the FFT in natural order and output frequencies are also required in natural order. Under these circumstances, reordering circuits are required before and after the FFT to adapt the input and output orders. For the proposed radix-2^2 feedforward FFTs the memory requirements for natural I/O depend on the FFT size and on the number of parallel samples. For a *P* -parallel *N*–point FFT a total memory of size *N-N/P* is enough to carry out the input reordering, whereas a total memory of size *N* is enough for the output reordering. The proposed approach can also be used to derive radix-2^2 feedforward architectures FFT for DIT. In this case, the properties for DIT in Table II must be considered. It can be noted that both DIF and DIT architectures use the same number of hardware components. Nevertheless, the layout of the components is different. For any number of parallel samples, DIF and DIT architectures also require the same number of components.

VI.EXPERIMENTAL RESULTS

The presented architectures have been programmed for the use in field-programmable gate arrays (FPGAs).The designs are parameterizable in the number of points,wordlength, and number of samples in parallel. Table III shows post-place and route results for different configurations of N and P=4 , using a word length of 16 bits. The target FPGA is a Virtex-5 FPGA, XC3S500E.In the proposed designs these blocks have been used to implement complex multipliers that carry out the rotation of the FFT.Fig.4 compares the area of the proposed architectures to other equivalent high-throughput pipelined FFTs architectures for the same FPGA and synthesis conditions. Full streaming architectures (FS) have been generated using the tool presented , which provides optimized pipelined architectures for a given radix and number of parallel samples.The results for 4-parallel pipelined architectures are shown in Fig.2 slices that each architecture requires in Table III. It can be observed that the proposed radix- architectures require less area than previous designs for any FFT size, This improvement increases with the size of the FFT.

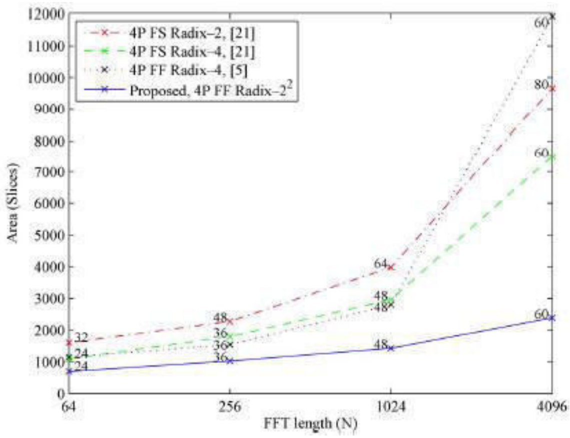


Fig.4 Area of 4-parallel pipelined FFT Architecture

VII.CONCLUSION

This study extends the use of radix-2 to feedforward (MDC) FFT architectures. Indeed, it is shown that feedforward structures are more efficient than feedback ones when several samples in parallel

ISBN: 978-81-965236-7-1

must be processed. In feedforward architectures radix-2 can be used for any number of parallel samples which is a power of two. Indeed, the number of parallel samples can be chosen arbitrarily depending of the throughput that is required. Additionally, both DIF and DIT decompositions can be used. Finally, experimental results show that the designs are efficient both in area and performance, being possible to obtain throughputs of the order of GigaSamples/s as well as very low latencies.

REFERENCES

[1] A. Cortés, I. Vélez, and J. F. Sevillano, "Radix FFTs: Matricial representation and SDC/SDF pipeline implementation," IEEE Trans.Signal Process., vol. 57, no. 7, pp. 2824–2839, Jul. 2009.

[2] A. M. Despain, "Fourier transform computers using CORDIC iterations," IEEE Trans. Comput., vol. C-23, pp. 993–1001, Oct. 1974.

[3] C. Cheng and K.K. Parhi, "High-throughputVLSI architecture for FFT computation," IEEE Trans. Circuits Syst. II, Exp. Briefs, vol. 54, no. 10,pp. 863–867, Oct. 2007.

[4] E. H. Wold and A. M. Despain, "Pipeline and parallel-pipeline FFT processors for VLSI implementations," IEEE Trans. Comput., vol.C-33, no. 5, pp. 414–426, May 1984.

[5] H. Liu and H. Lee, "A high performance four-parallel 128/64-point radix- FFT/IFFT processor for MIMO-OFDM systems," in Proc.IEEE Asia Pacific Conf. Circuits Syst., 2008, pp. 834–837.

[6] H. L. Groginsky and G. A.Works, "A pipeline fast Fourier transform," IEEE Trans. Comput., vol. C-19, no. 11, pp. 1015–1019, Oct. 1970.

[7] J. Lee, H. Lee, S. I. Cho, and S.-S. Choi, "A high-speed, low-complexity radix- FFT processor for MB-OFDM UWB systems," in Proc. IEEE Int. Symp. Circuits Syst., 2006, pp. 210–213.

[8] L. Liu, J. Ren, X. Wang, and F. Ye, "Design of low-power, 1 GS/s throughput FFT processor for MIMO-OFDM UWB communication system," in Proc. IEEE Int. Symp. Circuits Syst., 2007, pp. 2594–2597.

[9] L. Yang, K. Zhang, H. Liu, J. Huang, and S. Huang, "An efficient locally pipelined FFT processor," IEEE Trans. Circuits Syst. II, Exp. Briefs, vol. 53, no. 7, pp. 585–589, Jul. 2006.

[10] M. A. Sánchez, M. Garrido,M. L. López, and J. Grajal, "Implementing FFT-based digital channelized receivers on FPGA platforms," IEEE Trans. Aerosp. Electron. Syst., vol. 44, no. 4, pp. 1567–1585, Oct. 2008.

[11] N. Li and N. P. van der Meijs, "A radix based parallel pipeline FFT processor for MB-OFDM UWB system," in Proc. IEEE Int. SOC Conf., 2009, pp. 383–386.

[12] S. He and M. Torkelson, "Design and implementation of a 1024-point pipeline FFT processor," in Proc. IEEE Custom Integr. Circuits Conf., 1998, pp. 131–134.

[13] S.-I. Cho, K.-M. Kang, and S.-S. Choi, "Implemention of 128-point fast Fourier transform processor for UWB systems," in Proc. Int.Wirel. Commun. Mobile Comput. Conf., 2008, pp. 210–213.

[14] W. Xudong and L. Yu, "Special-purpose computer for 64-point FFT based on FPGA," in Proc. Int. Conf. Wirel. Commun. Signal Process., 2009, pp. 1–3.

[15] S.-N. Tang, J.-W. Tsai, and T.-Y. Chang, "A 2.4-GS/s FFT processor for OFDM-based WPAN applications," IEEE Trans. Circuits Syst. I,Reg. Papers, vol. 57, no. 6, pp. 451–455, Jun. 2010.

ISBN: 978-81-965236-7-1

LIGHT INTENSITY CONTROLLER USING RP2040

G.Dhevanandhini
Assistant Professor,
dhevakeshav@gmail.com
ACGCET

K.Anusha
anushakannan1408@gmail.com
ACGCET

M.Dharani
mdharani2452003@gmail.com
ACGCET

P.Tharshika
tharshikapalanivel@gmail.com
ACGCET

S.Vidhya
Vidhyalia@gmail.com
ACGCET

ABSTRACT;

In modern agriculture, creating and maintaining an optimal environment for plant growth is crucial. Sunlight intensity is a key factor influencing plant health and productivity. The challenge at hand is to develop a Light Intensity Controller that dynamically responds to changing sunlight conditions and provides the required lighting and shading facility. Also, the system should aim for a balance between natural sunlight and shade, enhancing energy efficiency and promoting sustainable agriculture.

Key components of the system include:

- **RP2040 microcontroller**
- **LDR sensor**
- **LEDs**
- **LM298N motor driver**
- **5V DC motors**
- **LCD display**

1. INTRODUCTION

The Light Intensity Controller is an innovative and intelligent solution designed to optimize the growth conditions of plants within a greenhouse. This system, powered by LDR sensors, LED lights, 5V DC motors, and the RP2040 microcontroller, dynamically manages lighting and shading. LDR sensors monitor 6 light intensity, and the RP2040 microcontroller processes this data. It adjusts LED lighting for ideal plant growth during suboptimal light and automates shading with 5V DC motors during excessive light. This automated system aims to dynamically manage lighting and shading based on real-time environmental data, ensuring plants receive the ideal illumination throughout their growth cycle.

2. PROPOSED SYSTEM AND OBJECTIVES

The primary objectives of our system include:

1. Optimize plant growth within the greenhouse environment.

2. Dynamically respond to changing environmental conditions.

3. Implement energy-efficient lighting forreduced energy consumption.

4. Save labour and time by automating greenhouse management tasks.

5. Provide real-time monitoring of greenhouse conditions for informed decision-making.

ISBN: 978-81-965236-7-1

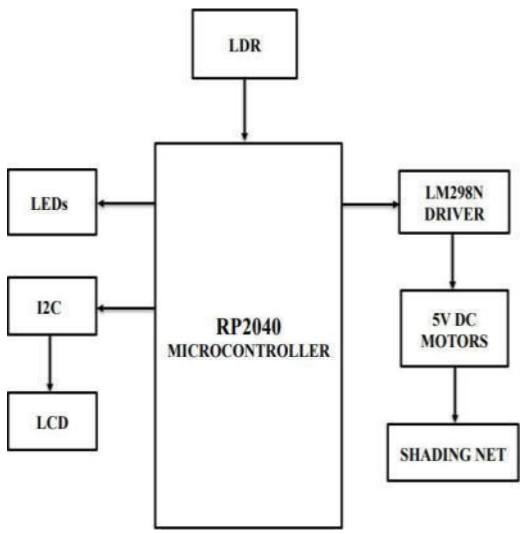


Figure 1.1
Overview diagram of Light Intensity controller

DESCRIPTION

This works involves the utilization of the RP2040 microcontroller alongside Light Dependent Resistor (LDR), LED and motors to devise an automated light intensity controller. The RP2040 serves as the central processing unit, orchestrating all operations. The LDR functions as a light sensor, detecting ambient light levels and providing analog voltage signals to the RP2040. The microcontroller features an Analog-to-Digital Converter (ADC) to convert the analog LDR signals into digital values. The digital values obtained from the LDR are then processed according to the presetfavourable lighting threshold values to maintainthe favourable lighting conditions. Under suboptimal conditions i.e., when the LDR value is less than the preset value, the RP2040 generates the respective Pulse Width Modulation (PWM) signals that are used tocontrol the brightness of the LED. By adjusting the duty cycle of the PWM signal according to the received LDR signal, the LED's luminosity is modulated. Under Excessive lighting conditions i.e., the LDR value is greater than the preset value, the DC motors are operated accordingly for the movement of the shading nets. The project operates on a designated power supply, ensuring the RP2040, LDR, motor driver, motors and LED receive the required voltage. The microcontroller's controllogic processes the LDR's readings and makes decisions to maintain the desired illumination level. The system operates in a closed-loop feedback mechanism, continuously monitoring light levels, responding to changing environmental conditions.

HARDWARE ANALYSIS

RP2040 MICRO CONTROLLER

At the heart of this Light Intensity Controller is the RP2040 microcontroller. This versatile microcontroller plays a pivotal role in orchestrating the system's functionality. Here are the specific attributes and advantages of theRP2040 microcontroller in the context of this light intensity controller project

Energy Efficiency for Continuous Operation

In a greenhouse environment, where plant growth is a continuous process, energy efficiency is paramount. The RP2040 microcontroller excels in this aspect, demonstrating its capability to manage power resources effectively. By minimizing power consumption, it ensures that the system canoperate uninterrupted for extended periods, crucial for providing consistent lighting and shading to the plants. This energy-efficient operation not only reduces operational costs but also contributes to sustainable agriculturalpractices.

Dual-Core ARM Cortex-M0+

for Multitasking The RP2040's dual- core architecture, housing two ARM Cortex- M0+ cores, is a standout feature. Within the greenhouse system, this architecture empowers the microcontroller to perform multiple tasks concurrently. It efficiently manages data from the LDR sensor, regulates LED light intensity, and controls the 5V DC motors responsible forshading net adjustments, all in real-time. This multitasking ability is a key factor in ensuring

ISBN: 978-81-965236-7-1

that the system can promptly respond to changing environmental conditions. For example, it allows the microcontroller toincrease LED intensity during low light levels or open the shading net to protect plants from excessive sunlight with minimal delay.

Versatile GPIO for Hardware Integration

The RP2040's versatile GPIO pins play a pivotal role in hardware integration. In the context of this project, these pins serve as the bridge connecting the microcontroller to the various hardware components. The GPIO pins facilitate communication with the LDR sensor, enabling real-time monitoring of ambient light levels. They regulate LED lights, providing fine-grained control over their intensity, ensuring optimal conditions for plant growth. Moreover, these GPIO pins govern the operation of the 5V DC motors, precisely adjusting the shading net position. This hardware flexibility results in a system that can adapt to a wide range of environmental scenarios, offering the ideal lighting and shading conditions for plant health and growth.

Low-Level Hardware Abstraction for Simplicity

The RP2040's low-level hardware abstraction simplifies the interaction with hardware peripherals, such as I2C, PWM, and ADC. For instance, the I2C adapter, which connects to the LCD display, can be efficiently managed, simplifying data communication between the microcontroller and the display. The PWM control for LED lights becomes straightforward, enabling precise adjustments to the light intensity. Likewise, the ADC interface with the LDR sensor simplifies the process of reading environmental data. This low-level hardware abstraction streamlines the code development process, allowing to focus on crafting sophisticated algorithms to manage lighting and shading effectively.

MicroPython Compatibility for Rapid Prototyping

MicroPython is a variant of the Python programming language, known for its simplicity and readability. The compatibility of the RP2040 with MicroPython accelerates the development process, allowing for quick prototyping and testing of control algorithms.

Community Support and Extensive Documentation

The RP2040 is backed by a vibrant and engaged community of developers and enthusiasts. Extensive documentation, tutorials, and libraries are readily available, providing insights and solutions to common challenges. When faced with specific issues or when seeking to extend the system's functionality, the community becomes an essential source of guidance. This support ensures that this systemcan evolve and adapt over time, making it a long-lasting and futureproof solution.

Scalability and Modularity for FutureGrowth

The RP2040's design is inherently scalable and modular. As the system evolves and potentially requires additional sensors, actuators, or components, the RP2040 accommodates these expansions seamlessly. New hardware elements can be integrated without major disruptions, ensuring that the system can adapt to the ever-changing needs of greenhouse agriculture. The microcontroller's flexibility in managing a growing set of hardware components and version control support facilitates the management of larger and more complex codebases. 5.1.8. Robust Error Handling for Reliability The RP2040 microcontroller's robust error handling capabilities are indispensable in ensuring the system's dependability. In the greenhouse environment, unexpected situations can arise, such as sensor malfunctions or motor failures. The microcontroller's error handling ensures that the system can respond gracefully to such scenarios, avoiding potential damage to plants or equipment. This reliability is fundamental to the sustainability and productivity of greenhouse agriculture.The project operates on a designated power supply, ensuring the

ISBN: 978-81-965236-7-1

RP2040, LDR, motor driver, motors and LED receive the required voltage. The microcontroller's control logic processes the LDR's readings and makes decisions to maintain the desired illumination level. Thesystem operates in a closed-loop feedback mechanism, continuously monitoring light levels, responding to changing environmental conditions.

LIGHT-DEPENDENTRESISTOR (LDR) SENSOR

An LDR, also known as a photoresistor, is a passive electronic component. Its resistance changes in response to the level of light it is exposed to. The darker it gets, the higher the resistance, and conversely, the brighter it is, the lower the resistance. This unique property makes LDRs ideal for detecting and measuring light levels.

Role in the System

In the context of this Light Intensity Controller, the LDR serves as an essential sensory element. It's strategically placed within the greenhouse to act as a "light monitor." As sunlight levels fluctuate throughout the day, the LDR provides continuous feedback on the ambient light conditions.

Light Control Mechanism

The LDR plays a critical role in the system's ability to manage light effectively. When the LDR detects low light conditions, it triggers the system to increase the intensity of the LED lights. This ensures that plants receive adequate illumination for their growth, especially during cloudy or low-light periods. Conversely, when the LDR senses excessive light, it signals the system to engage the shading net, which is controlled by 5V DC motors through the LM298N motor driver. This action protects the plants from being overexposed to intense sunlight and potential heat stress.

Data-Driven Decision Making

The LDR's real-time data is processed by the RP2040 microcontroller, forming the basis for the system's decision-making process. The microcontroller uses this data to adjust the lighting and shading, ensuring it's preciselyaligned with the needs of the plants.

Energy Efficiency and Sustainability

By responding to changing light conditions with precision, the system minimizes the consumption of electrical energy. This promotes sustainability by reducing operational costs and aligning with environmentally conscious agricultural practices. In essence, the LDR is the system's "light sensor". Its ability to detect light variations in the greenhouse and provide this information to the control system is pivotal in maintaining the ideal lighting conditions for plant growth while conserving energy and promoting sustainability.

LIGHT EMITTING DIODE(LED)

An LED is a semiconductor device that emits light when an electric current passes through it. LEDs are widely used for various lighting applications due to their energy efficiency and durability.

Role in the System

In the Light Intensity Controller, LEDs are employed to provide artificial lighting to support plant growth. They are strategically placed within the greenhouse to supplementnatural sunlight when it's insufficient for plant needs.

Light Intensity Control

The LED lights are not static but are under dynamic control. Their intensity is adjusted based on data provided by the Light- Dependent Resistor (LDR) sensor. When the LDR detects low light conditions, it signals the system to increase the intensity of the LED lights. This ensures that the plants receive

ISBN: 978-81-965236-7-1

adequate illumination for their growth, even when external light levels are insufficient.

Data-Driven Illumination

The LED lights are part of a data- driven illumination system. The RP2040 microcontroller processes information from the LDR sensor and adjusts the LED light output accordingly. This intelligent approach ensures that the lighting is precisely aligned with the real-time needs of the plants.

Energy Efficiency

LEDs are known for their energy efficiency. By dynamically controlling LED intensity based on the LDR data, the system minimizes energy consumption. This not only reduces operational costs but also aligns with sustainable and environmentally conscious agricultural practices. In summary, LEDs act as supplemental light sources. Their intensity is carefully managed based on real-time data, ensuring that plants receive optimal illumination for growth while prioritizing energy efficiency and sustainability.

5V DC MOTORS AND LM298N MOTOR DRIVER 5V DC MOTORS

Position Control

The 5V DC motors are the mechanical muscles of this light intensity controller system. They are designed to control the position of the shading net. These motors are powered by 5 volts of direct current (DC). Their bi-directionalcapability enables them to rotate in both forward and reverse directions.

Shading Net Manipulation

When the system's Light-Dependent Resistor (LDR) sensor detects excessive sunlight, signaling the need for shading, the 5V DC motors spring into action. They are responsible for the precise manipulation of the shading net. This net acts as a protective shield, safeguarding the plants from the potentially harmful effects of intense sunlight and excessive heat.

Controlled by LM298N

While the 5V DC motors are the muscle, they rely on the LM298N motor driveras the brain. The motor driver acts as an intermediary, facilitating the interaction between the microcontroller (RP2040) and the motors. It translates the commands from the microcontroller into the precise movements and control signals needed to operate the motors effectively. LM298N MOTOR DRIVER

Motor Control Interface

The LM298N motor driver is the bridgethat connects the RP2040 microcontroller to the 5V DC motors. It interprets the control signals from the microcontroller and converts them into actions for the motors. This includes specifying the direction (opening or closing the shading net) and regulating motor speed.

Direction and Speed Control

One of the standout features of the LM298N motor driver is its ability to control both the direction and speed of the 5V DC motors. This is pivotal for the precise operation of the shading net. When the system determinesthat shading is needed, the LM298N motor driver ensures that the motors operate in the right direction and at the appropriate speed to achieve the desired shading effect.

Efficiency and Safety

Efficiency and safety are paramount inthis system. The LM298N motor driver contributes to these aspects by ensuring that the 5V DC motors operate within safe parameters. It prevents overloading and overheating.

Data-Driven Operation

The LM298N motor driver operates based on real-time data. It receives signals fromthe Light-Dependent Resistor (LDR) sensor, which continuously measures the sunlight

ISBN: 978-81-965236-7-1

intensity. This data-driven approach ensuresthat the shading net is deployed or retracted as needed, maintaining the perfect balance between natural sunlight and shade for optimalplant growth. The 5V DC motors and the LM298N motor driver are a dynamic duo, working in harmony to regulate the shading net within the greenhouse. This precision and data- driven approach ensure that plants thrive in the ideal lighting conditions while conserving energy and promoting sustainable agricultural practices.

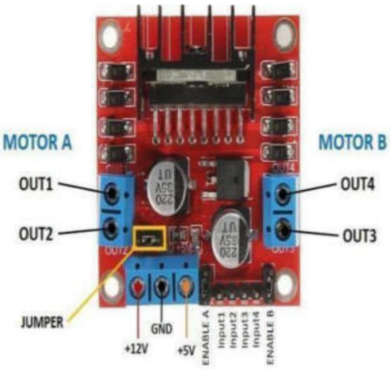


Figure 1.2
LM298N MOTOR DRIVER

I2C ADAPTER AND LCD DISPLAY I2C ADAPTER Interfacingwith the RP2040

The I2C adapter plays a crucial role in connecting the LCD display to the RP2040 microcontroller. It acts as the communication bridge between the two components, allowing data to be transmitted and received using the I2C (InterIntegrated Circuit) protocol. This is a widely used serial communication standard that simplifies data exchange between devices.

Simplified Wiring

One of the key advantages of using an I2C adapter is the reduction in wiring complexity. It minimizes the number of physical connections needed between the microcontroller and the LCD display. This simplifies the hardware setup and reduces the likelihood of wiring errors.

Efficient Data Transmission

I2C communication is known for its efficiency. It allows for bidirectional data transfer between the microcontroller and the LCD display. This efficiency is particularly beneficial when sending real-time data updatesto the display. LCD DISPLAY

Real-Time Information

The LCD display serves as the user interface of this system. It provides realtime information to greenhouse operators and other stakeholders. This includes crucial data related to light conditions, the intensity of LED lights,and the status of the shading net (whether it is open or closed).

Visual Feedback

The LCD display offers visual feedback in a user-friendly format. It presents data in a clear and easily readable manner, making it convenient for operators to monitor the greenhouse environment.

Data Visualization

In addition to raw data, the LCD display offers data visualization. It may use graphical elements, such as icons or bar graphs, to represent information about light levels, LED intensity, and shading net status. This visual representation enhances the user's understanding of the greenhouse's status.

Integration with RP2040

The LCD display is integrated with the RP2040 microcontroller through the I2C adapter. This integration enables the microcontroller to send data tothe displ

ISBN: 978-81-965236-7-1

which, in turn, visually represents this information. It forms a seamless link between the hardware and the user interface.

2.4 SOFTWARE ANALYSIS

The software component of the Light Intensity Controller plays a pivotal role in orchestrating the dynamic control of lighting, shading, and data visualization. This section delves into the key aspects of the software, highlighting its structure, functionality, and the technology stack employed.

PROGRAMMING LANGUAGE: MICROPYTHON

The selection of MicroPython as the programming language for the Light Intensity Controller is underpinned by several key considerations, each of which contributes to the project's efficiency and effectiveness

Resource Efficiency

MicroPython is designed with resource-constrained environments in mind, making it a suitable choice for microcontrollers and embedded systems like the Raspberry Pi Pico with the RP2040 microcontroller. Its efficient memory and resource utilization ensure that the software can run smoothly on hardware with limited capabilities, without compromising performance.

Python Ecosystem

MicroPython retains compatibility with the Python programming language, which is known for its readability and ease of use. This compatibility allows developers to leverage their Python knowledge when working with

MicroPython, making the development process more accessible and efficient.

Rapid Prototyping

Python's inherently high-level nature is translated into MicroPython, enabling rapid prototyping and development. The use of MicroPython allows developers to quickly experiment with code, test algorithms, and iterate on solutions, which is crucial when fine-tuning control logic for tasks like LED .

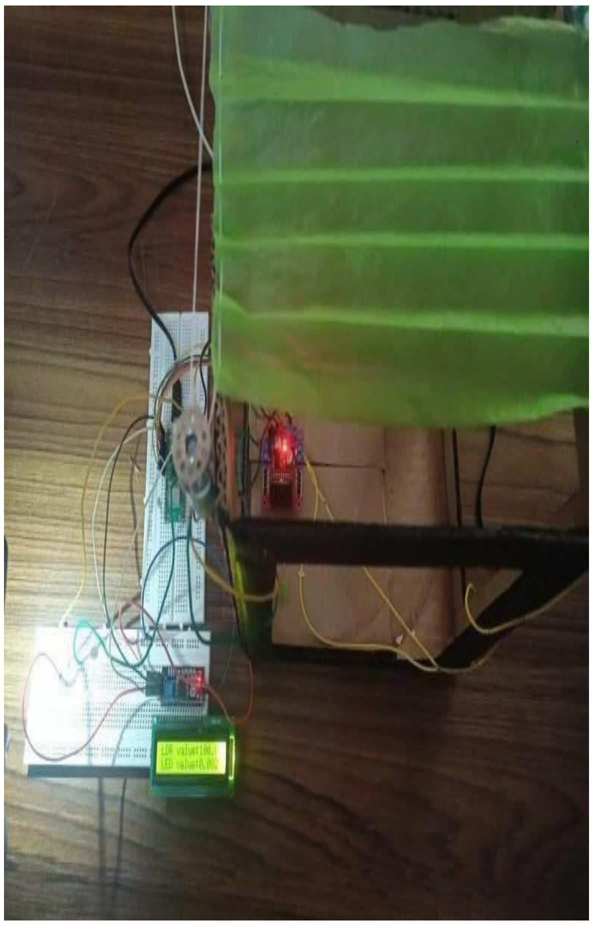
THONNY IDE: Streamlining Development and Debugging

The Thonny integrated development environment (IDE) is at the core of software development for the Light Intensity Controller. It offers a range of features that greatly simplify the development process and enhance the reliability of the code.

Under conditions of ample natural light, the greenhouse is equipped with a shading net, effectively covering the entire structure. Simultaneously, the LED lighting system is intentionally deactivated. This setup is designed to observe and assess the response of plants when exposed solely to abundant natural sunlight, with the shading net acting as a protective measure against excessive light and heat. By switching off the LED lighting, the focus is on evaluating how plants thrive in an environment where their light requirements are met predominantly by natural sunlight, offering insights into the effectiveness of the shading net in maintaining optimal light conditions for plant growth

RESULTS AND DISCUSSION

Figure 3.1 shows the result when there is an abundant light condition. Under this condition, in order to prevent plant from extra light, the shutter is closed and brightness of the light is reduced or light



ISBN: 978-81-965236-7-1

CONCLUSION

The Light Intensity controller project aims to revolutionize agricultural practices by automating light control in greenhouse environments. Through the integration of an LDR sensor, the system effectively manages light intensity, employing an Automatic Shading System and artificial lighting to maintain optimal conditions for diverse plant species. By setting customized thresholds and deploying shade nets when natural sunlight exceeds plant requirements, the system prevents excessive light exposure, ensuring plant health and growth.

3.FUTURE SCOPE

The future scope of the Light Intensity controller project presents opportunities for expansion and enhancement. One avenue involves the integration of additional environmental sensors, such as those monitoring temperature, humidity, and soil conditions. This incorporation would enable a comprehensive and holistic approach to greenhouse automation, allowing for a more nuanced control of environmental variables, further optimizing conditions for plant growth. Moreover, the implementation of predictive algorithms leveraging historical data could enhance the system's predictive capabilities, enabling it to anticipate and adapt to changing light and environmental conditions.

REFERENCES

Ahmed, M. and Patel, S. (2021) “Energy-Efficient Light Intensity Control in Greenhouses using IoT Sensors.” IEEE International Conference on Sustainable Agriculture. 1.Chen, Q. and Wu, L. (2020) “Real-time Light Intensity Controller for Greenhouse ClimateManagement.” Journal of Automation and Control.

1. Garcia, R. (2019) “Automation and Control Systems for Light Intensity Control in Greenhouses.”International Conference on Agricultural Technology.
2. Kim, H. and Lee, S. (2018) “Efficient Light Intensity Control for Greenhouse Environments.” Journalof Horticultural Science.
3. Smith, J. and Brown, A. (2022) “Optimal Light Intensity Control Techniques for GreenhouseCultivation

ISBN: 978-81-965236-7-1

AUTONOMOUS VEHICLE

Tony Santhosh G
Department of ECE
Sri Sairam Engineering
College Chennai, India
tonysanthosh@sairam.edu.in

KiranS
Department of ECE
Sri Sairam Engineering College,
Chennai,India
sec20ec014@sairamtap.edu.in

NandhineB
Department of ECE
Sri Sairam
EngineeringCollege
Chennai,India
sec20ec127@sairamtap.edu.in

Nethraambigiai V
Department of ECE
SriSairamEngineeringCollege
Chennai,India
Sec20ec008@sairamtap.edu.in

***Abstract*—One of the most popular activities among people is driving. The majority of estimated accidents are caused by people driving carelessly and rashly. Autonomous vehicles are used well to prevent this. In order to anticipate collisions, determine how to avoid them, and guarantee a safe driving environment, autonomous cars are outfitted with a variety of sensorsandwarningsystems.Thegoalofthispaperistodesign an autonomous vehicle that uses Arduino infrared sensors for vehicle-to-vehiclecommunication,emergencybraking,adaptive cruise control, and lane and sign detection. Additionally, the goal of this paper is to guarantee safe driving through autonomous, intelligent decision-making**

***Keywords*—Rear-endcollisions,Highwaydriving, Traffic scenarios ,Onboard system**

I. INTRODUCTION

A.OVERVIEW

A vehicle that is capable of moving forward without the assistance of a human is referred to as an autonomous, driverless, robotic, or self-driving vehicle. It is expected of autonomous cars to sense their environment, monitor important systems, and exert control, including navigation. Perception isa sensory organ that processes visual and Rural information from both inside and outside the vehicle to produce an abstract representation of the vehicle and its environment. . The control system then determines how to move the vehicle while accounting forthepath,the condition of the road, traffic signals, and impediments. Research on autonomous vehicles has been going on for a few decades now.There has been a lot of research done on the application of front-facing cameras for vehicle localization and navigation, obstacle avoidance, and environment mapping. Algorithms,accuracy, perception,and decision making were the primary goals of this car's development.The introduction of sensors and microcontrollers,which can modify tire torque while maintaining steering wheel torque, has greatly advanced technology. Many challenges are associated with this vehicle,including cost,safety,extreme weather,accident liability, and emotional intelligence. Machine learning and artificial intelligence are the foundation of automated car systemsThrough machine learning, vehicles are trained to learn from the complex data they collect, improving the algorithms they use and boosting their ability to navigate roads.Artificial intelligence has made it possible for vehicle systems to make judgments about how to operate without needingexactinstructionsforeverysituationthatcouldoccur while driving.

B APPLICATION OF THE PROJECT TRANSPORTATION AND RIDE-SHARING:

AUTONOMOUS VEHICLESARE USED TO PROVIDE TRANSPORTATIONSERVICES.ITMIGHT BE FEASIBLE TOLOWER THE NUMBER OFVEHICLE COLLISIONS. THERE MAY BE LESSHUMAN MISTAKESIFTHETRIPTIMEISUSEDMOREEFFECTIVELY.

.

II. RELATED WORK

This essay focuses on the vision and decision-making abilities of deep learning as well as the moral conundrums that might occur while making fast decisions. This study proposes an autonomous, intelligent system that is capableof navigation and operation. The primary objective of this workistodesignanautomated1/10RCvehicle.AnArduino, a CNN, a pi camera, a Haar cascade classifier, an ultrasonic sensor, and monocular vision techniques are all used in this model. The unique detection and tracking technique presented and implemented in this research is called real-time vehicle detection tracking (RTVDT), which combines low- cost GPS devices with integrated CPUs for fast processing. ADA Snow uses RTVDT. systems. Numerous technological solutions, including predictive control for autonomous cars and vehicular communication, have been developed in the literature to fulfill the requirements of such road configurations. Thehuman driver's driving data isnecessary for both of the aforementioned options. In this work, we examine the driving dataset sthat are currently accessible and provide a driving dataset that is based on real-world maneuvers that was gathered during our effort to collect driving data in cities.The undersea vehicle manipulator system's (UVMS) operation technology is becoming more and more crucial to the development and exploration of marine resources.In this work, we show the general design scheme of the developed UVMS, which significantly lessens reliance on the operator during operations. With shared intelligence, the Internet of cars (IoV) has a significant potential to lower on-board system costs in autonomous cars. It still has to overcome several obstacles, though, such as worries about privacyand dataleaks.This letter serves as the first report from a series of workshops intended to address these challenges and is published in the IEEE Transactions on Intelligent Vehicles (TIV) Trustworthy IoV series.We examine the idea of a decentralized Internet of things (DeIoV) in these seminars, which is supported by decentralized autonomous organizations and operations (DAOs).When driving autonomous cars in mixed traffic—where various car kinds and human-driven and autonomous vehicles coexist—accurately assessing the driving hazard might significantly increase driving safety.Due to the symmetry for both interactive vehicles, the current safety evaluation methods only consider the potential of a collision,which is inadequate to measure the level ofhazard. Thus, from the standpoint of social cognitions in human driving, the vehicle aggressiveness model is suggested in this work based on the asymmetric interactions between different types of cars..One of the biggest risks to the autonomous vehicle during lane changes is the unpredictable conduct of other cars.The ability to forecast trajectory is essential for safe obstacle avoidance. This study proposes a trajectory prediction model of surrounding cars for autonomous vehicles based on the partially observable Markov decision process, or POMDP, concept,taking into account the partly observable state of the surrounding vehicles.

III. PROPOSEDSYSTEM

MODULEINTRODUCTION:

- Lane Control
- Sign Recognition
- Automatic Emergency Braking System
- Adaptive Cruise Control

Lane Control and Sign Recognition:

i) Lane Control:

Radar,LiDAR,cameras,and ultrasonic sensors are just a few of the sensors the vehicle utilizes to perceive its surroundings. These sensors capture information about the lane, the road, and objects in the immediate area. Next, utilizing computer vision algorithms together sensor data, lane markings on the road are found and recognized.These algorithms analyze the visual input to determine the lanes' position and size. Path planning algorithms are used by the autonomous vehicle's system to determine the optimal route depending on the vehicle'sspeed, the condition of the road, and the distance to barriers when lanes are recognized. The autonomous vehicle's control circuit system adjusts the steering angle and acceleration/braking orders in accordance with the anticipated trajectory.This precisely controls the car's movement, allowing it to stay in the designated lane.

ii) Sign Recognition:

Road sign detection is the process of gathering data from a certain external circumstance, such as the candidate's road sign.Color segmentation is based on the color information of signs, and this is what has been the focus ofmost research on traffic sign detection. A method known as traffic-sign recognition allows an automobile to recognize the signs that are posted on the road. "turn ahead" or "children" or even "speedlimit"One of the most important functions of a driver aid system is sign recognition.Signs offer useful information and are easily recognized in the surrounding environment.

Proposed system:

The recommended approach benefits drivers by improving their senses, warning them of mistakes, and requiring less effort on their part to operate. This technology makes use of an in-car camera to detect traffic signs and modify the vehicle's speed accordingly.When required,the RaspberryPi will analyze the information and use the pulse width modulation technique to autonomously control the speed of the car.

1) Use the Pi camera to capture input images.Trim the sign board's space.

2) Use threshold segmentation to extract parameters suchas arrows (remove noise, morphological operations).

3) Determine the area and perimeter of a geometric object. Determine the value of roundness.

4) Determine the entropy levels.

5) A classification system for traffic sign identification.

k- Nearest NeighborAlgorithm(kNN):

The Gaussian mixtures and other underlying data distribution models are not assumed in the operation of the straight forward,non-parametrick NN method.For kNN,itis expected that the given data is included in a feature space, which is a geometrical metric space. They also comprehend distance in the other locations inside 2D geometrical space.

OpenCV'srich vision support maybe used to routinely input, show, and save movies and individual pictures. One of OpenCV's goals is to provide a computer vision infrastructure that is easy to use and allows for the quick construction of rather complicated vision applications. A collection ofvectors with matching categories given toeach vector makes up each training set of data. The number of neighbors that influence the categorization isrepresented by the odd number K.

ISBN: 978-81-965236-7-1

The recommended method may accept any video that has been recorded using any kind of video capture equipment. Additionally, movies are recorded for this study using the Pi Camera Module. In the experiments presented in this paper, a Raspberry Pi mounted in the caris connected to a Pi Camera Module to enable real-time scene capture infront of a moving vehicle. These frames might be considered as input pictures for the traffic sign recognition technique. The proposed technique in this work consists of five steps: preprocessing, video and frame recording,recognition,traffic sign detection, and character/icon extraction and recognition.

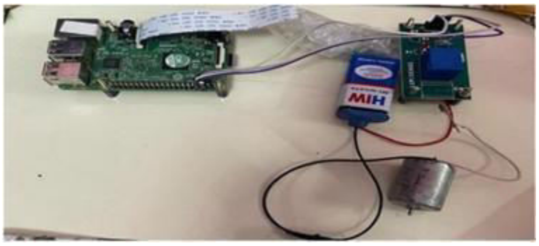


Fig:1Outputoflanedetectionandsigndetection

Automatic braking and adaptive cruise control

i) Automatic Emergency Braking System:

An automated braking system includes an intelligent mechatronic system that generates and emits ultrasonic waves. It is fixed toan automobile's front end. Furthermore, an ultrasonic receiver installed on the front of the car operationally receives a reflecting ultrasonic wave signal. The reflected wave (detected pulse) indicates the distance between the vehicle and the barrier.Then,inorder to depress the brake pedal and applyth ebrakes firmly to the automobile for safety, a microcontroller is used to manage the speed of the vehicle based on the information from the detecting pulse.

Proposedsystem:

An ultrasonic sensor with transmitter and receiver modules makes up the recommended system. The ultrasonic receiver device receives signals from the ultrasonic transmitter and returns them. This makes it possible to identify barriers. The ultrasonic sensor information is then used to determine whether there are any obstacles in the path of the vehicle. If anitemis identified ahead of the vehicle,the system canthen calculate whether the vehicle's speed is higher than that of the object. Using an Arduino dumped C program, the PIC microcontroller will calculate the distance between the obstacle and the automated system as well as the set maximum distance. The DC gear motor employs a servo motor,which rotates steadily at a predetermined rpm and Then progressively reduces the speed phenomena of the brake mechanism, to automatically break the system. The system may recognize that a collision is likely to occur when there is a significant speed differential and will immediately apply the brakes.

Fusion algorithm:

Multiple sensor AEB systems use sensor fusion technology to combine the data from different sensors. This example demonstrates how to use a sensor fusion algorithm to implement AEB.In this instance,you examine the testbench model. It includes the environment and sensors,trackingand fusion of sensors, controls, decision logic, and dynamics of the vehicle.

1. Create anAEBC on troller model.

2. Integrate a nonlinear model predictive controller (NLMPC) for acceleration and steering controls with a braking controller.

3. Simulate the test bench model: Using Euro NCAP test protocols,you can setup the testbench modelforvarious scenarios.

4. Write C++ code: Write C++ code and test the control, decision logic, and sensor fusion algorithms' software-in-the-loop (SIL) simulation.

5. Examine other scenarios: These scenarios put the system through additional strain.

ii) Adaptive cruise control:

Driver mistake is one of the most common reasons for traffic accidents, and it is unlikelyto go down given the popularity of mobilephones ,in-car entertainment systems,moretraffic, and complicated road systems. With the increasing number of accidents caused by fast automobiles every day, braking systems need to be improved. Radar sensors are commonly used as the basis for adaptive cruise control. The device is installed infront of the vehicle and looks forward on the road constantly. As long as the road ahead is clear, the cruise control feature maintains the driver's chosen speed.

ProposedSystem:

If the system detects a slower vehicle within its detecting range,it will either actively activate the brake control system or depress the accelerator to gradually reduce speed. If the vehicle in front of you accelerates or changes lanes, the cruise control will automatically raise your speed to the level that the driver has set. A standard brake system cannot maintain a smooth rotor service. The vehicle sensors, which may include radar and/or LiDAR, identify the presence and speed of cars ahead in the same lane.The system can also employ cameras and other sensors to collect more data. The ACC system establishes the autonomous vehicle's relative speed and separation from the car ahead of it. It maintains a safe following distance based on the choices the driver has made or the predefined safety requirements. If the detected vehicle ahead slows down, the ACC system automatically reduces the autonomous vehicle's speed to maintain the appropriate following distance. The automobile might accelerate in response to the lead car's acceleration or pull away. The ACC technology continually analyzes the movements of the lead vehicle and adjusts the autonomous car's speed to guarantee a comfortable and safe driving experience. In some situations, automatic emergency braking (automated braking) is made possible by the cooperation of the ACC and AEB system.

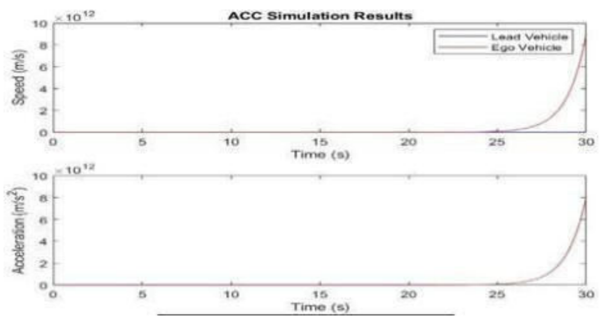


Fig:2ACCsimulation

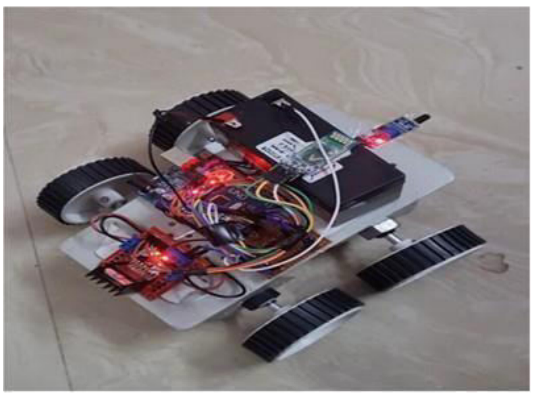


Fig:3OutputofAEBandACC

IV. CONCLUSION

Our primary goal in building this system was to increase accident prevention while also lowering the risk of accidents resulting in property damage, human injury, and other problems. We saw that our work was able to accomplish all of the required goals .It is simple to implement this suggested system in various densely populated areas. The strength of the suggested system is its adaptability and ability to be developed with minimal hardware modifications, such as altering the speed limits and speed control techniques with the base station's software in a very short amount of time

V. FUTURESCOPE

In addition to the brake system,a module for direction control of the vehicle might be developed. Using the automatic braking system is one method to have the car park itself automatically. It will slow down the car, put on the parking lights,sense a parking spot,and park the car automatically to prevent an accident. The proposed system gathers speed- related data using microcontroller technology and sendsit via a transceiver to a base station. After that, thebase station evaluates the data to establish the appropriate speed restriction and control specifications.

VI. REFERENCES

[1] B.Asmika,G.MounikaandP.S.Rani,"DeepLearningforVisionand Decision Making in Self Driving Cars-Challenges withEthical Decision Making,"*2021 International Conference onIntelligent Technologies (CONIT)*.

[2] H. Thadeshwar, V. Shah, M. Jain, R. Chaudhari and V. Badgujar,"Artificial Intelligence based Self-Driving Car,"*2020 4thInternational Conference on Computer, Communication and SignalProcessing* .

[3] W. Farag and Z. Saleh, "An advanced vehicle detection andtracking scheme for self-driving cars,"*2nd Smart CitiesSymposium*

[4] "AManeuver-basedUrbanDrivingDatasetandModelforCooperativeVehicle Applications,"*2020 IEEE 3rd Connected and AutomatedVehicles Symposium (CAVS)*, Victoria, BC, Canada, 2020

[5] "An Autonomous Underwater Vehicle Manipulator System forUnderwater Target Capturing,"*2022 IEEE International Conferenceon Unmanned Systems (ICUS)*, Guangzhou, China, 2022

[6] J. Yang, Q. Ni, G. Luo, Q. Cheng, L. Oukhellou and S. Han, "ATrustworthy Internet of Vehicles: The DAO to Safe, Secure, andCollaborative Autonomous Driving," in *IEEE Transactions onIntelligentVehicles*.

[7] "Formulating Vehicle Aggressiveness Towards Social CognitiveAutonomous Driving," in *IEEE Transactions on IntelligentVehicles*,March2023.

[8] J. Zhang, G. Zhen, H. Jia and H. Wei, "Trajectory Prediction ofSurrounding Vehicles for Autonomous Vehicle Using POMDPMethod,"*2022 2nd International Conference on Computer Science,Electronic Information Engineering and Intelligent ControlTechnology (CEI)*, Nanjing, China, 2022.

ISBN: 978-81-965236-7-1

A BROAD VIEW OF SMART HELMET REDEFINING PROTECTION AND CONNECTIVITY DEVICES

S.Saraswathy
Assistant Professor
Department of CSBS
Sri Sairam Engineering College,WestTambaram, TamilNadu
Saraswathy.csbs@sairam.edu.in

L.Ghayathirelakshhmi
Department of CSBS Sri Sairam Engineering College,WestTambaram, TamilNadu
sec22cb098@sairamtap.edu.in

K.Sujitha
Department of CSBS Sri Sairam Engineering College,WestTambaram, TamilNadu
sec22cb124@sairamtap.edu.in

M.Jothi
Department of CSBS Sri Sairam Engineering College,WestTambaram, TamilNadu
Sec22cb074@sairamtap.edu.in

Abstract- **In addressing the challenge of accidents in low-human-activity regions, our project introduces a smart helmet for swift accident notification. The helmet integrates an impact sensor, microcontroller (Arduinoor Raspberry Pi), sound module, GPS module, and communication module. The impact sensor, linked tothe microcontroller, allows adjustable sensitivity for detecting impact severity. The microcontroller manages sensor inputs, GPS data, and communication tasks, ensuring a seamless operation. A sound module provides audible alerts for immediate user notification. The GPS module facilitates real time, highly accurate location tracking, a critical factor for precise accident reporting. The communication module, utilizing GSM/GPRS or another wireless technology, enables the transmission of messages to predefined contacts or a central control office. A rechargeable, power-efficient battery serves as a reliable power source, emphasizing prolonged use and convenience through an easy charging mechanism. The user interface incorporates LED indicators, buttons, or a display to offer clear signals for impact detection, alert activation,and overall system status. Safety considerations are paramount,with rigorous testing conducted to maintain the helmet's protective properties even with electronic components integrated. The emphasis on power efficiency, user friendly interfaces, and stringent safety testing positions our smart helmetas a robust and future-ready solution. It aims to revolutionize safety protocols in low-human-activity scenarios, contributing significantly to advancements in technology-driven safety solutions and aligning with broader goals of enhancing safety in remote environments.**

Keywords:Smart Helmet,Internet of Things, Protecting Device.

I. INTRODUCTION

In the pursuit of enhancing road safety and mitigating the consequences of motorcycle accidents, our innovative project introduces a revolutionary smart helmet equipped with advanced crash detection technology.This cutting-edge helmet goes beyond conventional safety measures by incorporating a sophisticated sensor that can swiftly detect a crash. Upon sensing a collision, the helmet initiates a series of automated responses to ensure the well-being of the rider.

Integrated Heads-Up Display (HUD) technology is a game-changer for improving motor cycle rider convenience and safety. It has been introduced in smart helmets.

HUD technology significantly reduces distractions by projecting crucial information— like speed, navigational instructions, and significant road alerts—straight into the rider's field of vision. This enables riders to stay focused on the road and not divert their attention to seek information.

II. OVERVIEWOFCONNECTION ESTABLISHEDDURINGACCIDENT

Real Time GPS Navigation

Including Real-Time GPS The ability to navigate in smart helmets has completely changed how bikers travel and explore. This function saves riders from having to stop and study paper maps or mobile devices by providing them with exact, simple-to-follow directions shown inside their helmet. This translates into a smoother and more seamless riding experience for regular commuters and touring aficionados.

Regular commutes and lengthy excursions are made more efficient and comfortable by the GPS's frequent inclusion of traffic information, rerouting possibilities, and sites of interest. This is a major advancement in the direction of intelligent mobility, which uses technology to make travel easier and less stressful.

ISBN: 978-81-965236-7-1

Built-In Bluetooth Communication

The way that riders communicate with their devices and other riders has been greatly improved by smart helmets with built-in Bluetooth communication. With the use of this technology, smart phone may connect to other devices seamlessly and be used for hands-free calling, music streaming, and voice-activated applications like Google Assistant and Siri. This feature makes it easier for cyclists to communicate clearly with one another during group rides, which promotes cooperation and togetherness.

The convenience of getting audio directions for navigation and the ability to manage music or take calls without endangering safety are two big advantages. Furthermore, by putting contemporary comfort at the forefront of motorcycle technology, this connectedness enhances the enjoyment and social interaction of riding a motorbike.

Rear View Camera Integration

The incorporation of rear-view cameras into smart helmets has greatly improved rider safety by resolving a prevalent problem: blind spots. A tiny screen within the helmet or on the HUD shows a panoramic, real-time image of what's happening behind the rider thanks to these cameras. This removes the necessity for frequent, perhaps hazardous, over-the-shoulder glances.
Riders can monitor traffic conditions, anticipate potential risks, and make safer lane changes thanks to the rear-view camera's continuous feed. It's especially helpful in situations involving heavy urban traffic and fast-moving vehicles, where situational awareness is essential.

Voice Command Control

The addition of Voice Command Control to smart helmets is a major advancement in motorbike technology. With the help of voice commands, riders can now handle a variety of helmet functions, including communication systems, navigation, and even connected smart phone apps.
The ability to operate hands-free is essential for riding with focus and control. Additionally, it adds a level of convenience by enabling hands- free texting,call making,and music control for riders. The potential for this function grows as voice recognition technology advances, opening the door to a more connected and engaging riding experience..

III. RELATED WORKS

Mr.Muneshwara Metal.[1]Proposed the impact of technological developments on various sectors,particularly the automobile industry's adaptation to innovations for reducing accidents.It emphasizes the importance of safety precautions, especially in the context of motor cycle accidents.The proposed solution introduced is the"IN SOLENT HELMET,"a smart system with sensors to ensure the rider wears a helmet and is not under the influence of alcohol.The system includes an alcohol sensor and a helmet detection switch.The literature survey reveals statistics bicycle and motorcycle accidents, emphasizing the effectiveness of helmets in reducing head injuries. Existing systems with alcohol sensors, speed controllers, and helmet detection mechanisms are discussed,along with their limitations.The system under the proposal utilizes a Renesas microcontroller and theMQ-135 alcohol sensor for efficient monitoring purposes.The system is designed to enhance safety by detecting alcohol consumption and ensuring that helmets are being used to prevent accidents.Technical details that are important to note in this context include the high efficiency of the Renesas microcontroller and the working principle of the MQ-135alcoholsensor.By putting this clever system into place,we can prevent drivers from operating a vehicle while intoxicated and ensure that riders are safe during the trip by requiring helmet usage. There are two components to this system:software and hardware.

Divyasudha N et al. [2] Proposed the critical issue of road accidents involving two-wheelers, leading to numerous deaths and severe injuries in India.The World Health Organization (WHO) suggests that 40% of deaths and 70% of severe injuries in two-wheeler accidents can be reduced if riders wear helmets.The paper emphasizes that despite helmet availability, many riders avoid wearing them due to discomfort caused by

ISBN: 978-81-965236-7-1

conventional helmets, contributing to the alarming rate of accidents.The proposed solution involves an Internet of Things (IoT)-based smart helmet to enhance rider safety, incorporating features like automatic alert systems and preventing the start of the bike without a helmet.The main aim of this system is to check if the person is actually wearing it.Various existing smart helmet systems from the literature are discussed, presenting approaches such as hazard detection, accident reporting, alcohol detection, and speed control.The proposed smart helmet system integrates sensors like position, alcohol, and piezoelectric, along with IoT capabilities and solar panels for self-powered functionality.The system checks for two conditions before allowing the bike's ignition: helmet detection using a position sensor and alcohol detection using an alcohol sensor.The researchers are currently in the process of designing a helmet that accommodates all necessary features compactly and cost-effectively, aiming to provide anupdated technological solution for two-wheeler safety.

V. Jayasree et al.[3] Proposed the concept of the Internet of Things (IoT) in the context of construction safety, emphasizing the use of sensors, mobile devices, and unique identifiers for workers.The increasing death rate of construction workers is highlighted, especially in scenarios where timely medical assistance is challenging, such as workers on higher floors of large buildings.The paper provides alarming statistics on construction worker fatalities inIndia, citing approximately 38 deaths per yearand referencing data from previous years.The main objective of the proposed system is to continuously monitor construction workers and provide security measures, particularly in emergency conditions.The paper reviews related work, citing examples such as "Hard Hat Detection for Construction Safety Visualization,""IOT-based Smart Helmet for Ensuring Safety in Industries," and "Smart Helmet for Coal Mines Safety Monitoring and Alerting. The proposed system involves a smart flexible helmet embedded with an Arduino Uno kit, sensors (Heartbeat), a panic button, a GSM module, anda mobile application for monitoring.The system monitors the worker's vital signs and physical condition to allow them to make informed decisions about their continued work.The paper includes details of the hardware setup, including ArduinoUno,sensors,andastep-downconverter.

Experimental results show the output from Arduino and alert messages.The benefits of the proposed system include continuous health monitoring of workers,fall detection, analarming system for emergencies, and overall enhanced security, leading to a reduction in the death rateof construction workers.Through this smart helmet, the contractor can continuously monitor the workers involved in the construction process and can also get notifications about the workers' physical condition, and immediately save the workers.

J Joy Mathavan, et al.[4] Proposed the importance of motorbike safety due to the high occurrence of head injuries during accidents, with statistics highlighting the severity of the issue. Reviews existing research on motorbike safety, citing studies that underscore the critical role of helmet usage, proper licensing, and the reduction in fatality rates with mandatory helmet laws. Various technological solutions such as automatic side stand lift-up systems, alcohol sensors, and smart helmets are explored. It aims to address the increasing number of motorbike accidents in Sri Lanka by implementing a smart helmet system. Focuses on ensuring necessary conditions for starting the motorbike, including proper helmet use, lifted side stand, and sobriety. Describes the smart helmet system's components, including an Arduino UNO microcontroller, relay switch,MQ3 alcohol sensor. The proposed model presents two modes of operation: Start ON, Running, and successful real-time. Testing explains the necessary conditions for engine ignition. Author concludes that the proposed Smart Helmet System effectively ensures safety conditions for motorbike use. It also highlights the successful integration of helmet detection,side stand monitoring, and alcohol sensing.Discuss potential advancements, including the use of high-end controllers like Raspberry Pi, integration with vehicle-to-vehicle communication, automatic error detection, and features like road sign detection and alerts for enhanced safety.Addresses a critical issue of motorbike safety in Sri Lanka by proposing a comprehensive solution that combines various safety measures through advanced technology.

ISBN: 978-81-965236-7-1

The system has practical applications and potential for further development.Highlights the successful implementation of the proposed smart helmet in a real-time environment, ensuring its effectiveness and practicality.Indicates potential future improvements, such as utilizing advanced controllers, implementing error detection, integrating with vehicle communication, and incorporating image processing for road sign detection and alert.

C K Gomathyet al.[5] Proposed the increasing rate of accidents, attributing it to the rise in vehicle usage due to employment.The paper proposes an Automatic Accident Detection and Alert System using wireless communication techniques which is inserted in bike. The system aims to send messages to registered mobiles, hospitals, and police stations when an accident occurs.The system is based on Arduino, using a vibration sensor to detect accidents.GSMmodules facilitate message transmission, andGPS helps in determining the accident location.The primary goal is to prevent casualties by providing timely medical assistance and notifying authorities about accidents.The paper discusses the evolution of accident detection systems from GPS-based applications tohardware devices linked to mobile phones.Limitations include dependency on a live system, potential disconnection or damage to phones, lack of GPS signal, and insufficient cellular signal.Dueto increasing vehicle use, accidents lead to delays in ambulance arrival, emphasizing the need for swift notification and investigation.The system utilizes sensors like GPS and Accelerometer in mobile phones to detect collisions and send real-time location information to contacts and emergency services.The architecture involves Arduino, aGPS module, a GSM module, and an accelerometer to detect accidents and relay information to emergency services.The system uses Arduino as the controller, GPS for location, GSM for communication, and an LCD for display.The system is implemented in two phases

– accident detection (via an Android app) and notification (a web-based system for hospitals).After accident detection,th eweb-based application notifies the nearest hospital,providing details about the accident using Google Maps API.

Abdul Mateen et al. [6] Proposed the concept of Smart Roads (SRs) equipped with nodes placed approximately50 metersapartalongtheroadside. These nodes act as independent systems with sensors and actuators for autonomous accident detection. The system aims to provide timely accident alerts to Emergency Operation Centers (EOC) and approaching vehicles to enhance rescue operations and reduce damage and casualties.The core of the proposed system is an Alert System(AALS) designed for both non-EVs (nEVs) and Electric Vehicles (EVs). Unlike previous approaches that focus on making individual vehicles equipped, the AALS employs a golden yellow blinking light and a siren for accident alerts. The use of colors and sounds is chosen for their visibility and audibility, especially in adverse weather conditions. .The AALS system utilizes an algorithm for accident detection based on various factors such as braking sounds, collisions, glass breaks, and environmental changes. Nodes communicate through a wireless protocol (EDWSN) to relay accident information to the EOC. The proposed algorithm outlines the steps a node takes upon detecting an accident, including alerting on coming vehicles and initiating a rescue response. Each SR node comprises sensors, including infrared, microphone, and smoke sensors, connected to an Arduino Uno microcontroller. Approximately 4000 nodes are estimated to cover a 100-km two-lane road. The nodesautonomouslydetect accidents, activate the AALS for alerting, and communicate the incident details to the EOC. Once the rescue operation is complete, a reset button is used to clear the road and signal the EOC that the area is safe again.

Chris Thompson et al. [7] Proposed leveraging smart phone technologies to create a wireless mobile sensor network for car accident detection and highway congestion control. The aim is to provide a cost-effective and portable solutionthat utilizes the computational capabilities and built-in sensors of modern smartphones.The paper highlights the advantages of using smartphones for accident detection, emphasizing their computational power, increasing prevalence, and the availability of built-in sensors such as accelerometers, compasses, and GPS. These features make smartphones an appealing platform for constructing a wireless mobile sensor

ISBN: 978-81-965236-7-1

network.The Wreck Watch system is introduced as a solution to smartphone-based accident detection. It captures data from smartphone sensors, including accelerometers, compasses,andGPS,to create a portable"black box"capable of detecting traffic accidents. The architecture includes a client-server model; with the server providing data aggregation and communication with emergency responders.The paper identifies challenges associated with smartphone-based accident detection, such as the lack of integration witha vehicle's electronic controlunit (ECU) and the potential for false positives. The WreckWatch system addresses these challenges by utilizing onboard sensors for collision detection and implementing context filters, such as speed thresholds, to reduce false positives.WreckWatch is described as providing functionality similar to an accident/event data recorder, recording path, speed, and acceleration forces leading up to and during an accident. It can notify emergency responders, aggregate multimedia content from bystanders, and send messages to preconfigured emergency contacts. The system is implemented using Google Android on the client side and Java/MySQL with Jetty and the Spring Framework on the server side.

T Kalyani et al [8] Proposed the development of safety tech like airbags and Tire Pressure Monitoring Systems (TPMS) to enhance vehicle security.Reviews various systems using MEMS, vibration sensors, IoT, and SVM algorithms for accident detection and location tracking. The proposed system, centered around Arduino, usesa vibration sensor to detect accidents and transmits alerts via GSM, with GPS for location tracking.Future plans include providing medical assistance and advanced alert systems to prevent accidents by stopping vehicles through wireless communication.The system employs Arduino, a vibration sensor, a GSM module for alerts, and GPS for tracking, aiming to promptly notify medical centers and registered mobiles, contributing to accident rate reduction.

ChinnaVGowdaretal.[9]Proposed the system utilizes IoT, database services, and APIs to create a successful accident detection and rescue system for vehicles,capable of securely transmitting real- time data to a server.In case of an accident, the system communicates with nearby hospitals and police stations, allowing for prompt response and identifying the shortest route for ambulances and police vehicles through web and mobile applications.Addressing the increasing traffic density, the design includes Road Side Units (RSU), vehicles, ambulances, and a server that communicates to manage traffic flow, adjust traffic signa ltimers,and ensure path clearance for ambulances using IoT technology.Recognizing the criticality oftime in emergencysituations, the system aims to minimize delays in ambulance arrival by efficiently managing traffic and promptly notifying investigation units for timely accident investigations.With the rising number of vehicles leading to frequent traffic jams, the system's goal is to prevent congestion, allowing vehicles to run smoothly and ensuring swift emergency response to accidents to save lives.

Paul J. Lagassey et al. [10] Proposed the system employs a transducer to detect acoustic waves, a processor to analyze audio output for potential vehicular incidents, and an imaging system to capture images of the location, addressing the need for immediate accident detection.A buffer stores images from before and after the determination of a vehicular incident, ensuring data preservation. The stored information, including location identification,can be communicated via a link to a remote location for further analysis. The invention recognizes the substantial costs associated with traffic accidents and aims to efficiently allocate direct costs by promptly detecting incidents based on characteristic sounds, minimizing road obstruction, and providing evidence for liability determination.Acknowledging the prevalence of cellular technology, the system leverages it for reporting accidents. However, it goes beyond traditional reporting by recording and transmitting real-time accident data for swift emergency response and liability assessment.The system stands out by offering immediate and reliable accident prediction, distinguishing itself from prior art techniques with faster response times and reduced dependency on environmental conditions for accuracy.

PadmavathiGanapathi et al.[11] Proposed the use of Wireless Sensor Networks (WSN) for vehicle detection and tracking, emphasizing their potential applications beyond

ISBN: 978-81-965236-7-1

militaryuse, including industrial, civilian, health, and environmental domains.The study introduces the Smart-Dust sensor node, a compact and integrated hardware platform for vehicle detection. The Smart-Dust family includes different generations of sensor nodes, demonstrating advancements in miniaturization and functionality.The paper delves into the specific sensors employed in the Smart-Dust node,focusing on the condenser-type microphone for acoustic signals and the magnetometer for detecting changes inthe magnetic field caused by ferrous objects.The study examines the characteristics of acoustic and magnetic signals for vehicle detection.Acoustic signals involve the analysis of sound elements, while magnetic signals rely on changes in the Earth's magnetic field caused by ferrous objects.The research highlights the potential applications of WSN in vehicle detection, emphasizing the unique characteristics and advantages of acoustic and magnetic sensors. These include their ability to operate unattended, deploy on the fly, and provide real-time data for diverse applications such as traffic management and environmental monitoring.

Arsalan Khan et al.[12] Proposed a comprehensive Android-based system called "Smart Rescue System" that utilizes smartphones to detect accidents, alert emergency responders, and provide real-time tracking of victims' locations for efficient rescue operations.The system employs various technologies, including Android smartphones, Google Play services, Firebase for server and database functions, Google Maps and Location APIs, Retrofit for HTTP communication, and GeoFire for real-time geographic queries.The system uses the smartphone's accelerometer to detect accidents.When an accident is detected, SO Safe, the victim's application, sends alerts toemergency responders with the victim's location via Google Cloud Messaging. The SOSafe application for emergencyvictims allows users to register, log in, activate automatic monitoring,and choose the type of emergency. SOSafe Go, the application for responders, enables them to register, login, receiveandrespondto emergency alerts, and track victims' locations on a Google map.There search contributes by providing a reliable and advanced system for accident detection and emergency response.

Muhammad Sohail et al. [13]Proposeda new radar-based method enhances vehicle positioning in VANETs, using dynamic radar ata and considering vehicle speed for relative positioning. The method employs YOLO version 4, achieving 80% precision and an 87.14% Intersection Over Union (IOU), surpassing existing techniques in real-time traffic scenarios. RRPN, a radar-based real-time proposal algorithm, reduces the processing time significantly, outperforming RCNN by 100 times in experiments with the NuScenes dataset. Two monocular camera strategies improve vehicle positioning using tail light length and inverse perspective mapping with IMU and CNN, showing superior accuracy. LiDAR-based approaches prove effective, with one comparing YOLO variants, favoring complex-YOLO, and another combining 3D LiDAR and RGB images, outperforming existing CNN-based algorithms.

G A E Satish Kumar et al. [14] Their study aims to enhance road safety by developinga device that detects driver alertness, alcohol levels, and accidents. It utilizes a vibration sensor, GPS, and GSM to send accident locations to hospitals, emphasizing human life protection.The device employs Node MCU and Arduino microcontrollers, along with MQ-03 and vibrator sensors, strategically chosen for their cost-effectiveness, compact size, and functionality, ensuring successful execution within budget constraints.The system integratesan MQ-03 sensor to detect alcohol levels. If the driver is intoxicated, the vehicle won't start, and an alert is generated. LEDs and buzzers inform about accidents or alcohol detection, enhancing overall safety.A panic button triggers an emergency message for medical assistance, sending alerts to the nearest ambulance or healthcare facility based on the user's location, extending the system's functionality beyond accident detection.The developed system successfully detects accidents, and alcohol levels, and sends alert messages with live locations. The hardware includes microcontrollers, sensors, anda panic button, providing comprehensive safety features for real-time applications.

ISBN: 978-81-965236-7-1

Kenyu et al.[15] Proposed a crash detection method for side crashes, emphasizing both body intrusion and vehicle behavior change simultaneously. It aims to improve on conventional methods by considering overall vehicle motion changes during impacts.Two detection methods are proposed—using a yaw-rate sensor at the vehicle's center and a G sensor with sensitivity along the vehicle's longitudinal direction. The paper also introduces an algorithm combining lateralG sensor data with longitudinal Gsensoror yaw-ratesensor datato detect various aspects of vehicle behavior change.Theresearch employsnumericalsimulationstoassessthecrash detectionalgorithm's performance under different crash modes, speeds, angles, and positions. Results indicate that the algorithm effectively identifiescrashesandperformswellinvarious scenarios, demonstrating stability and reliability. The algorithm's performance is further validated through Complete Body Unit (CBU) tests, including low, middle, and high-speed crashes. The tests confirm that the algorithm satisfactorily detects crashes and distinguishes between different impacts scenarios, meeting the required performance criteria. The paper discusses the algorithm's robustness against misuse during normaldriving, its minimal sensitivity to changes in the vehicle's center of gravity, and its applicability to vehicles with a third seat. The research concludes that the crash detection algorithm successfully integrates body intrusion and vehicle behavior change for effective side crash detection.

Table1SummaryofRelatedWorks

No.	Authors	Focus	Technologies	Technique Used	MainContributions
1	Mr.Muneshwara M, Mr. Shivakumara, Dr.ChethanA,Mr. Anand and Mrs. SwethaM	Smart Helmetwith Crash Detection andAlcohol Monitoring	Renesas microcontroller ,MQ-135 alcoholsensor	Crashdetection algorithm, Alcohol monitoring	Enhanced motorcycle safety with crash detection, helmet usage, and alcohol monitoring.
2	Divyasudha N, Arulmozhivarman P, Rajkumar E.R.	IoT-Based Smart Helmetfor Two-Wheeler Safety	Position, alcohol, and piezoelectric sensors, IoT capabilities, solar panels	IoT-based accident detection, Helmet detection	Improved two-wheeler safety with features like automatic alerts and helmet detection.
3	V.Jayasree,M. NivethaKumari	IoT in Constructio n Safety	Arduino Uno kit, sensors (heartbeat), panic button, GSMmodule, mobile application	Smart flexible helmet embeddedwith sensors	Continuous monitoring of construction workers, fall detection, and emergency alert system.
4	JJoyMathavan,V K D Wijesekara, N Satheeskanth,WM UJWanasinghe,M Maathushan, V VWijenayake	Smart Helmet Systemfor Motorbike Safety	Arduino UNO microcontroller ,relayswitch, MQ3 alcohol sensor	Helmet detection, Side stand monitoring, Alcoholsensing	Effective smart helmet system ensuring proper helmet use, lifted sidestand, and sobriety.
No.	Authors	Focus	Technologies	Technique Used	MainContributions

SBECN

ISBN: 978-81-965236-7-1

5	C KGomathy	Automatic Accident Detection and Alert System in Bikes	Arduino, vibration sensor,GSM module,GPS module	GPS-based accident detectionwith accelerometer	Timely accident detection and alert system for bikes using smart phone technologies.
6	Abdul Mateen, Muhammad ZahinHanif, Narayan Khatri, Sihyung Lee, SeungYeobNam	Smart Roads for Autonomou s Accident Detection	Infrared, microphone, smokesensors, Arduino Uno microcontroller , wireless protocol (EDWSN)	Autonomous accident detectionusing infrared and microphone	Smart Roadswithnodesfor autonomous accident detection and alert system for enhanced rescue operations.
7	Chris Thompson, JulesWhite,Brian Dougherty, Adam Albright,Douglas C. Schmid	Wreck Watch - Smartphone -Based Accident Detection	Smart phones, accelerometers, compasses, GPS, client- server model	Smartphone-basedaccident detection, WreckWatch system	Portable "black box"for accident detection and emergency response using smartphone sensors.
8	T Kalyani, S Monika,BNaresh, MahendraVucha	Vehicle Safety with Airbagsand TPMS	Arduino, vibration sensor,GSM module,GPS module	Acoustic wave-based accident detectionusinga transducer	Accident detection, alcohol level monitoring, and emergency alert system for enhanced vehicle safety.
9	ChinnaVGowdar, Veeresh M, VeereshShetti, Yadavi K, Shankramma R	IoT-Based Accident Detection andRescue System	IoT, database services,APIs, Road Side Units (RSU), vehicles, ambulances, server	Real-time data transmissionand traffic management	Efficientaccidentdetection, traffic management, and emergency response using IoT technology.
10	PaulJ.Lagassey	Acoustic Wave-Based Accident Detection System	Transducer, processor, imaging system,cellular technology	Acousticwave-based accident detection	Immediate and reliable accident prediction with real-time data transmission using acoustic waves.
11	PadmavathiGanapat hi	Wireless Sensor Networks forVehicle Detection	Node MCU, Arduino microcontroller s, MQ-03 sensor,vibrator	Vibration sensor-based accident detection	Use of WSN for vehicle detection with emphasis on acoustic and magnetic signals.
No.	**Authors**	**Focus**	**Technologies**	**Technique Used**	**MainContributions**

SBECW

ISBN: 978-81-965236-7-1

		and Tracking	sensor		
12	Arsalan Khan, Farzana Bibi, Muhammad Dilshad, Salman Ahmed,ZiaUllah, Haider Ali	Smart Rescue System with Android-Based Accident Detection	Android smart phones,Google Play services, Firebase, Google Maps, Retrofit, GeoFire	Accelerometer-based accident detection	Advanced Android-based system for accident detection, emergency response, and real-time tracking.
13	G A E Satish Kumar,JSwetha Priyanka, A Sai Deepthi	Comprehensive Safety Device for Vehicles	Node MCU, Arduino microcontroller s, MQ-03 sensor,vibrator sensor	Alcohol level detectionusing MQ-03 sensor	Accident detection, alcohol level monitoring, and emergency alert system with live location transmission.
14	Kenyu,Okamura Kazuhiro, Daido	Crash Detection for Side Crashes	Yaw-rate sensor, G sensor, numerical simulations	Algorithm combining lateral and longitudinalG sensor data	Improved side crash detection algorithm considering body intrusion and overall vehicle motion changes.
15	MuhammadSohail, AbdUllah Khan, Moid Sandhu, Ijaz Ali Shoukat, Mohsin Jafri &Hyundong Shin	Vehicle Positioning inVANETs	Radar,YOLO version 4, RRPN, IMU, CNN,LiDAR	Dynamic radar data, YOLO for objectdetection, RRPN for real-time proposal, Monocular camera strategies, LiDAR-based approaches	Enhanced vehicle positioning in VANETs, 80% precision, 87.14% IOU, Real-time traffic scenario improvement, Significant reduction in processing time withRRPN, Improved accuracy with monocular camera strategies, Effectiveness of LiDAR-based approaches

IV. CONCLUSION

Based on the references and research papers discussed above, we were inspired to develop guardian gear that could improve road safety. Our helmet is equipped to detect accidents or crashes and immediately send an alert to the user's phone. If the alarm is not turned off within 30 seconds, an automatic message, along with the user's location, is sent to the emergency department. This feature ensures that prompt medical assistance can be provided to the user in the event of an emergency.

ISBN: 978-81-965236-7-1

REFERENCES

1. M.MS,A.R,S.T,S.MSandC.A.S, "Advanced Wireless techniques to avoid accidents on roads through wearing Smart helmet,"*20215thInternational Conference on Intelligent Computing and ControlSystems(ICICCS)*,Madurai,India, 2021, *pp. 258-264,*doi: 10.1109/ICICCS51141.2021.9432193.

2. D. N., A. P. and R. E.R., "Analysis of Smart helmetsandDesigninganIoTbased smart helmet: A cost effective solution for Riders,"*20191stInternationalConference on Innovations in Information and Communication Technology (ICIICT)*, Chennai, India, 2019, pp. 1-4, doi: 10.1109/ICIICT1.2019.8741415.

3. V. Jayasree and M. N. Kumari, "IOT Based Smart Helmet for Construction Workers,"*20207thInternational Conference on Smart Structures and Systems(ICSSS)*,Chennai,India,2020, 1-5, doi:10.1109/ICSSS49621.2 020.9202138.

4. J Joy Mathavan et al 2022 "Smart helmettostartthemotorbikeandtoprevent accidents "Published under licencebyIOPPublishingLtd IOP Conf. Ser.: Mater. Sci. Eng. 1258 012051DOI 10.1088/1757-899X/1258/1/012051.

5. CKGomathy2022 "*AccidentDetection And Alert System".*

6. Abdul Mateen et al,"Smart Roads for Autonomous Accident Detection and Warnings"*Sensors* 2022, *22*(6), 2077;https://doi.org/10.3390/s22062077

7. 7.Abdul Mateen, "*Smart Roads for Autonomous Accident Detection and Warnings*"*Sensors* **2022**, *22*(6), 2077;**https://doi.org/10.3390/s22062077**

8. Chris Thompson, "*Using Smartphones to Detect Car Accidents and Provide Situational Awareness to Emergency Responders*"

9. T Kalyani et al,"*Accident Detection and Alert System"* International Journal of Innovative Technology and Exploring Engineering(IJITEE)ISSN:2278-3075, Volume-8Issue-4S2March, 2019.

10. Paul J. Lagassey,"*Advanced Automobile AccidentDetection, Data Recordation And Reporting System*" Prior Publication Data) US 2006/0092043 A1 May 4, 2006

11. Padmavathi Ganapathy **"***A Study on Vehicle Detection and Tracking Using WirelessSensorNetworks*"January2010 ,Wireless Sensor Network 2(02):173-185 DOI:10.4236/wsn.2010.22023

12. Arsalan Khan,"*Accident Detection and Smart Rescue System using Android Smartphone with Real-Time Location Tracking***"** July 2018 International Journal of Advanced Computer Science andApplications 9(6) DOI:10.14569/IJACSA.2018.090648

13. Sohail,M.,Khan,A.U.,Sandhu,M. *et al.* "*Radar sensor based machine learning approach for precise vehicle position estimation*". *SciRep***13**,13837(2023). https://doi.org/10.1038/s41598-023-40961-5

14. Satish Kumar GAE, Swetha Priyanka J, Deepthi AS (2022) "*Vehicle Accident and Alcohol Detection System using IoT Platform".* Indian Journal of Science and Technology 15(39): 2004-2010. https://doi.org/10.17485/IJST/v15i39.1018

15. "*Side Crash Detection Using Vehicle Behavior Change*" Kenyu, Okamura Kazuhiro, Daido Honda R&D Co., Ltd. Automobile R&D Center Japan Paper Number17-0324

Optical transmission using amplifier

Mrs.R. Sivaranjani, ME *Ms.K. Parameshwari, AP*
Department of Electronics and CommunicationDepartment of Electronics and Communication Engineering Engineering
Chendhuran College of Engineering and TechnologyChendhuran College of Engineering and Technology
Lenavilaku, Pudukkottai. Lenavilaku, Pudukkottai.
Sivaranjaninagarajan1995@gmail.comKparamu888@gmail.com
Mrs.L. Malathy,AP
Department of Electronics and Communication Engineering
Chendhuran College of Engineering and Technology
Lenavilaku, Pudukkottai
Malathy5791@gmail.com

Abstract:

Communication is a crucial part of our life and in today's technologically advanced times, there is a need for faster and more secure communication systems. Optical communication has been a topic of interest since time immemorial. In this paper, we have analyzed the working of an important phenomenon "Optical Transmission using amplifier" which is a very interesting proposition for fast and stable communication for long-haul systems. It makes communication faster and more efficient. The aim of our research is to study this interesting phenomenon in detail and explore the suitable values for which the amplifying pulses gives the maximum output on using Optisystem-18 software.

Introduction:

With the advent of technology, the demand for very highspeed communications have increased. In ancient times, very few modes of communication were available. If we talk about pre-historic times, the fire signal method was used by the Greeks for communication. In 1837 Samuel Morse discovered the telegraph system. In 1876 Alexander Graham Bell invented the telephone [9]. As the technology evolved humans explored more secure and efficient methods of communication. The radio and microwave band of the electromagnetic spectrum is used for wireless transmissions. But the ever-increasing demand for increased bandwidth and data rates is an obstacle to this technology. Moreover, wireless communications are prone to weather disturbances and prove to be insecure. In the late 1970s optical communication systems made much progress. The nearinfrared region and the visible band of frequencies of the electromagnetic spectrum were explored. The region of 770-1675 nm is used for optical communication. Today there is no barrier to staying connected to our family and friends living several kilometres away. Video and voice chats have turned the world into a global village. In this "Information age, it is a necessary attribute for transmission systems to be able to cover long distances effortlessly. Apart from communication, other activities like online shopping, gaming, downloading material from the internet, emails, etc are also equally important. So the modern communication system requires a high bandwidth network. This has also been made possible by the evolution of optical Fiber communication which is often called the "Lightwave System," because it utilizes the visible light of the electromagnetic spectrum. Optical Fiber is a very good choice for carrying a considerable amount of data. It has a much higher bandwidth than microwave systems and traditional co-axial cables. The high speed offered by optical Fiber is owed to the fact that light is the fastest signal in nature and nothing can match its speed. So using a fraction of the speed of light will certainly make communication faster. But optical communication is also prone to many kinds of barriers while transferring data. The dispersion effects lead to a broadening of the pulse and its shape is easily distorted. If the power of the pulse is increased then the non-linear effects become stronger. To overcome this issue, optical transmission using amplifier is preferred. Optical transmissionare very demanding and promising in the field of high-speed communication because it maintains their shape and characteristics up to large distances [1].

Theory

The light wave travels inside the Fiber, it suffers various performancelimiting phenomena such as group velocity dispersion (GVD), non-linear effects, and Fiber losses. Among all, the non-linear

ISBN: 978-81-965236-7-1

effects are the most problematic in carrying out long-haul communication at high bit rates. With the advent of optical amplifiers, fiber losses can be compensated. The GVD can be compensated by various dispersion management techniques [1]. But the problem ofnon-linear effects remains unsolved. In single-channel systems, the dominant non-linear phenomenon is selfphase modulation (SPM) [8]. If the amplification is done even at 100-200 Km, the non-linear effects would still exist. This has been a subject of study over the years [2]. The non-linear Schrodinger equation explains the theory of solitons and is a mathematical representation of soliton transmission [1]. It is given as follows:

$i\partial A/ \partial z - \beta_2/2\, \partial^2 A/ \partial T^2 + \Upsilon |A^2| A = 0$ [1]

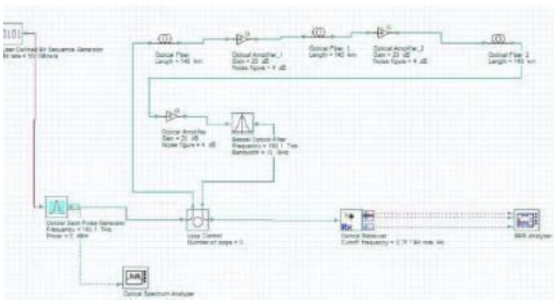
A(z,t) is the amplitude of the pulse envelope. This equation is called Nonlinear Schödinger Equation (NLSE) and it is a very important equation for studying soliton effects. The second term in the equation stands for dispersion while the third term stands for the nonlinearity of the fiber. β_2 is the GVD parameter and the parameter Υ is a symbol of the nonlinearity of the medium. An important parameter for the formation of soliton pulses is that the value of β_2 should be less than zero. The condition $\beta_2 < 0$ has to be satisfied. The non-linearities are introduced when the pulse is very intense. The fiber losses can be compensated using optical amplifiers

Methodology

The experiment is performed on the latest Opti system 18 and the significance of the soliton transmission has been demonstrated. We have tried to achieve the best possible combination of the data rate and the optical fiber length for which the Q-factor comes out to be the best. For the setup, the list of components is given below:

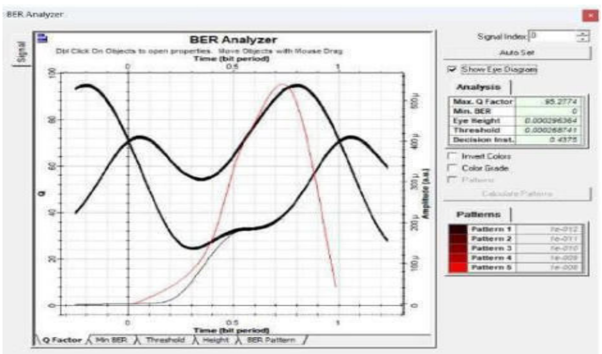
1. User-defined bit sequence generator
2. Optical spectrum analyzer
3. Optical Fiber
4. Optical receiver
5. Eye diagram analyzer
6. Optical secant pulse generator
7. Optical amplifier
8. Optical Bessel filter
9. Loop control
10. BER analyzer

The Opti system software is an optical communication simulation software. It is used to test and analyze different optical transmission models in the physical layer and check their efficiency. It comes with a rich library of components that can be selected by double-clicking on the component. Any kind of optical link can be tested on this platform. After selecting the components, the connections are made and the output of the analyzer and visualizer is noted down. It is also used to design WDM systems. a. Q-Factor Q- factor is a parameter that determines the quality of the signal. It must be as high as possible. Our aim to study soliton transmission is to improve the Q- factor [8]. It is measured by taking into account the SNR of the system. b. Ber The bit error rate is also an important parameter that decides the performance of a system. It should be as low as possible. It is the ratio of the error-prone bits to the total number of bits transmitted. It basically gives us an idea about how many bits are left to be transmitted. c. Eye Diagram An eye diagram is a pictorial representation of the signal in the time domain. It provides information about signal distortion, timing jitter, and system rise time [8]. The opening of the eye represents the signal distortion. The wider the opening, the less the inter-symbol interference hence better the signal quality.



Optisystemmodelofsolitontransmissionusingamplifiers

RESULT



BER analyzer(solitonswithamplification)

Conclusion and Future Scope

ISBN: 978-81-965236-7-1

An optical system using solitons has a much better performanceandtheintegrityofthedataisalsomaintained asitisdistortionfree.Theresultsshowa considerableand remarkable change in the quality of communication achieved through soliton transmission. Solitons can solve theproblemoflong-haulcommunicationsandincreasethe figure of merit that is the product of bit rate and amplifier spacing. The goal is to achieve higher data rate transmission up to long distances. Solitons are very promising in the field of modern communications as they demandrobustandfastsystems.Also,thedemandforhigh bandwidth makes optical communication a preferable choiceoveranyothertechnology.Opticalsolitonscanbe consideredasawaveorapulsewhose`intensityandshape remain the same throughout the fiber channel. This is achieved when the group.

References

1.T.D.F.Aulia,D.Astharini A.Lubis and A.Syahriar, Performance Analysis of Fiber with Solitons Parameters and Fiber Non soliton Parameters using Optisystem 2019 6th International Conference on Instrumentation Control and Automation (ICA) Bandung Indonesia,2019pp.142-146,DOI:10.1109/ICA.2019.8916679

2 **.N. Badraoui and T. Berceli,** “Enhancing capacityof optical linksusingpolarizationmultiplexing,”Opt.Quant.Electron.,vol.51,no.9, p. 310, 2019. doi:10.1007/s11082-019-2017-3.

3.**G.P.AgrawalFiber**-Optic Communication Systems ThirdEdition, New York: A John Wiley & Sons Inc., Publication,2002.

4.**G.Keiser**-OpticalFiber Communicationfourthedition,TataMcgrawHillpublications.

5.**S. Bala and Sheetal**, “Solitons: NovelApproach for DispersionManagement” 2015 International Journal of Research inEngineering and Technology, Vol 4.

6.**A.D.Gaikwaid**-EyeDiagram Assessment Platform for Fiber-OpticCommunication”

7.**Ridheyjot Kaur**-Department of Electronics and Communication Engineering, Guru Nanak Dev Engineering College Ludhiana, India (Research paper 2023)

ISBN: 978-81-965236-7-1

GROWTH AND CHARACTERIZATION OF POTASSIUM DOPED META-NITROANILINE SINGLE CRYSAL

T.Thilak[1*] ,M.Rajkumar[2], S.Sham[3] N.Lokesh Kumar[4]

[1*]Dept. of Physics, Karpaga Vinayaga college of Engineering and technology,Padalam-603308
[2,3,4]Dept.of Computer science, Karpaga Vinayaga college of Engineering and technology,Padalam-603308
*Corresponding author email: thilakhh5@gmail.com

Tel.No: +7667814620

Abstract

Crystal growth technique one of the ancient technique to grown good quality of single crystal. A nonlinear optical crystal of meta-Nitroaniline potassium hydroxide (mNAK) was grown by slow evaporation solution growth technique at room temperature using methanol as solvent. The growth mechanism was identified from the chemical etching studies. The presence of potassium in mNAK crystal was tested by energy dispersive X-ray diffraction (EDAX) analysis.The structure of the grown crystal was confirmed by single crystal X-ray diffraction (SXRD) and powder X-ray diffraction (PXRD) technique. The Fourier transform infrared (FT-IR) study was used to reveal the functional groups present in the grown crystal.
Keywords: Solution Growth technique; Powder X-ray diffraction; FTIR;

1. Introduction

Nonlinear optics (NLO) is playing a major role in the emerging photonic and optoelectronic technologies, telecommunications, optical information storage devices etc., [1,2]. Single crystals of organic nonlinear optical materials always gain added importance in NLO because of their potential applications such as second harmonic generation, optical parametric amplification and optical parametric oscillation in the visible region. This is possible because of their very high second-order nonlinear susceptibilities compared to the conventional inorganic materials [3-7]. Since the applications of organic material are impeded due to their poor physical and chemical properties a new methodology has been derived to develop semi-organic materials exhibiting better properties of organic and inorganic materials[9,10]. Meta-nitroaniline (mNA) with chemical formula $C_6H_6N_2O_2$ is a well-known organic nonlinear optical material which has been examined by several researchers in the recent past on its crystal growth and properties [11,12].Its nonlinear optical effect is very strong compared to the conventional inorganic materials and also it has strong piezoelectric, pyroelectric and electro- optic effects[13-15].In the present investigation, attempts were made to grow good quality single crystal of a semi organic meta-Nitroaniline potassium hydroxide (mNAK) by slow evaporation method. The crystal was characterized by chemical etching, energy dispersive x-ray diffraction (EDAX),single crystal X-ray diffraction (SXRD) and powder X-ray diffraction (PXRD), Fourier transform infrared (FTIR)

2. Experimental Procedure

2.1. Synthesis

The potassium doped meta-Nitroaniline was synthesized by taking the commercially available AR grade Meta-nitroaniline and potassium hydroxide in the molar ratio of 1:1 and dissolved in methanol. The mixed solution was stirred continuously for 8 hours at a room temperature for better homogenization and then the saturated solution was filtered using Whatmann filter paper. The solution was taken in a beaker and closed with a perforated cover and kept in a dust free atmosphere. A good transparent single crystal of mNAK having dimension 15 ×6× 3 mm^3 was obtained in 28 days and is shown in Fig.1(a).

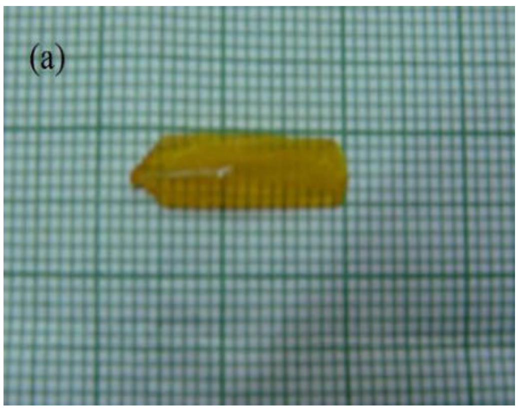


Fig.1. (a) Grown single crystal of mNAK

ISBN: 978-81-965236-7-1

3.Results and Discussion

3.1 Etching Study

Etching is the selective dislocation of the crystal surface, which reveals the growth mechanism, surface features and assesses the perfection of the grown crystal. In the present work, etching study was carried out on mNAK crystal with methanol as an etchant using high magnification REICHERT POLYVAR 2 MET microscope. Etching was carried out at room temperature for 0 and 60 seconds respectively and the observed microscopic structural features are shown in Fig.2 (a,b). Well defined triangular etch pits were found on the surface of the grown crystal at the dislocation sites.

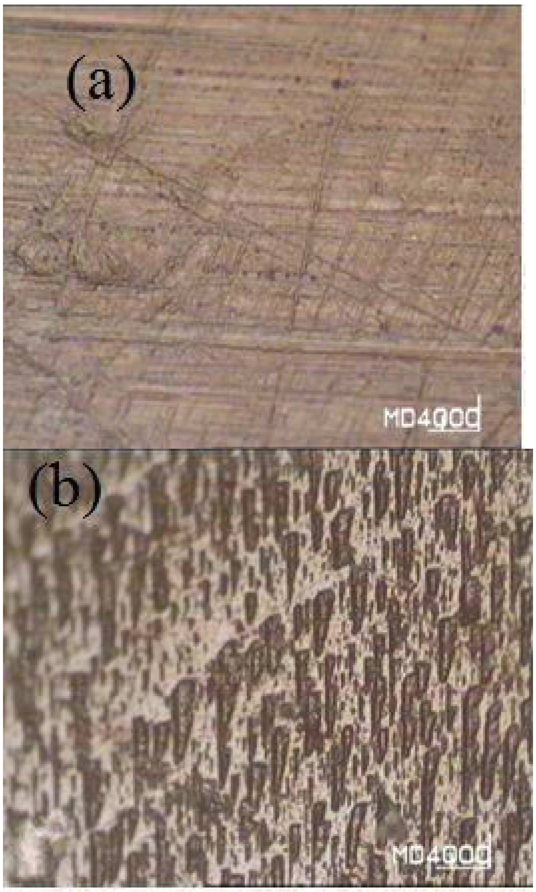


Fig.2 (a,b). Etch pattern of mNAK crystal

3.2. Energy dispersive X-ray (EDAX) analysis

In this investigation the grown crystal was subjected to EDAX analysis using JEOL model JED-2300 scanning electron microscope to confirm the presence of potassium in the grown crystal. The recorded EDAX spectrum of mNAK crystal is shown in Fig.3. The weight % and the corresponding atomic percentage of the elements present in the mNAK crystal is given in Table 1.The help of etching studies it is clearly observation of presence of potassium

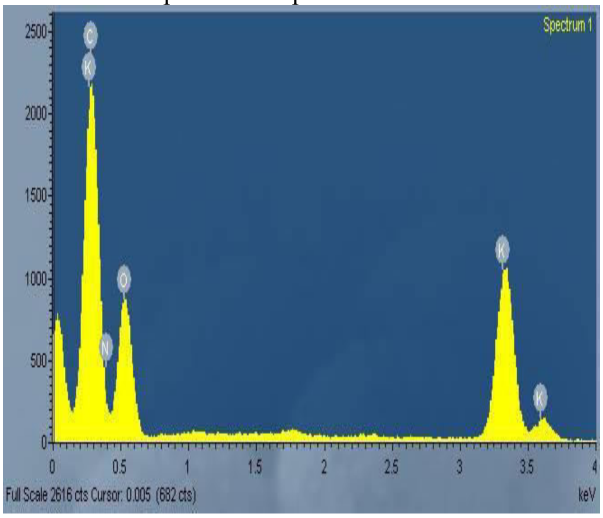


Fig.3.EDAX spectrum of mNAK crystal.

Table.1. Elemental composition present in mNAK crystal

Element	Weight %	Atomic %
C	57.67	68.09
N	-0.70	-0.70
O	32.47	28.78
K	10.56	3.83
Total	100.00	

3.3.Single Crystal XRD

Single crystal X-ray diffraction data for mNAK were collected using BRUKER AXS KAPPA APEX (II) CCD diffractometer with Mo Kα (λ = 0.710693 Å) radiation.It is observed that the mNAK single crystal belongs to orthorhombic crystal system with space group $Pbc2_1$ and the unit cell parameters are, a = 5.01 Å, b = 6.43 Å, c = 19.10 Å and volume,V= 654.48 A^3 with Z = 4.

3.4.Powder XRD

Powder X-ray diffraction analysis was achieved on the powdered sample of mNAK crystal and the pattern recorded using Rich Seifert

ISBN: 978-81-965236-7-1

diffractometer with Cu Kα radiation (λ= 1.54060Å) is shown in Fig. 4. The sample was scanned from 10°-60° at a scan rate of 2° min^{-1}. All the observed reflections were indexed for orthorhombic structure and the unit cell parameters were calculated using PROSZKI ver. 2.4 program. The calculated lattice parameters are, a=5.11 Å, b = 6.56 Å, c =19.49Å and volume of the unit cell,V= 654.68 A^3.

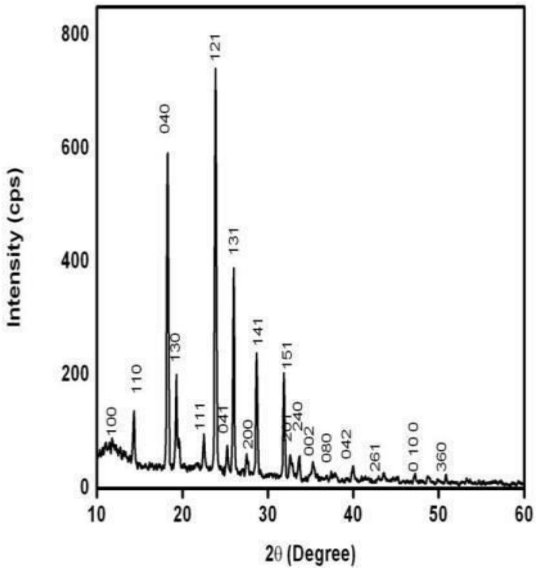


Fig.4. Indexed Powder XRD pattern of mNAK

3.5 Fourier transforms infrared analysis (FTIR)

Infrared spectroscopy is used to identify the functional groups and modes of vibration of synthesized compound.In order to analyse qualitatively the presence of functional groups in mNAK, the FT-IR spectrum was recorded using a Perkin Elmer FT-IR spectrometer using KBr pellet technique in the range of 400–4000 cm^{-1}.The FT-IR spectrum of the mNAK is shown in Fig.5. The sharp peak found at 3413.85 $cm^{-1}$is due to N-H stretching [16]. The peak at 2889.61cm^{-1} is due to very weakly bonded N-H stretching.The aromatic C-H stretching band is found at 3084.14 cm^{-1}[17]. The N-H plane bending mode is observed at 1615.78 cm^{-1}. The NO_2 aromatic stretching mode is observed by the peaks at 1504.04 cm^{-1}, 1328.17cm^{-1} and 870.69 cm^{-1}. C-N stretch amino group is observed at 1080.34cm^{-1}. The aromatic C-H stretching band is found 3084.14 cm^{-1}.The vibration peak observed at 644.59 cm^{-1} indicates presence of benzene ring. The frequency assignment is given in Table 2.

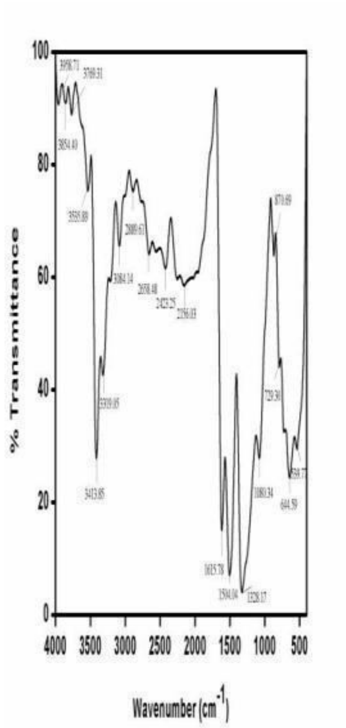


Fig.5. FT-IR Spectrum of mNAK

table.2. Tentative frequency assignment of mNAK crystal

Vibration Assignment	mNAK (cm^{-1})
N-H group N-HStretching	3413.85
N-H bending mode	1615.78
Weak N-H bending mode	2889.61
Nitro group NO_2 aromatic	1504.04
NO_2 aromatic	1328.17
NO_2 group	870.69

ISBN: 978-81-965236-7-1

C-H group The aromatic C-H stretching	3084.14
Amino group C-N stretching	1080.34
Benzene ring	644.59

4.Conclusion

The single crystal of the mNAK was grown by slow evaporation method.The addition of potassium improves the morphology of the mNA crystal. The defect study was made using chemical etching method. Presence of potassium in mNA crystal was confirmed using energy dispersive X – ray analysis (EDAX). The single crystal X-ray diffraction study and powder X-ray diffraction studies revealed that the mNAK crystallize into orthorhombic crystal system. Vibrational frequencies assigned from FTIR spectral analysis confirm the presence of all the functional groups.

5. References

[1] V.Sivashankar, R. Siddheswaran, T.Bharthasarathi, P.Murugakoothan "Growth and characterization of new semiorganic nonlinear optical zinc guanidinium sulphate single crystal". Journal of crystal growth 311 (2009) 2709-2713

[2] P. Maadeswaran, J. Chandrasekaran, S. Thirumalairajan, Optik. Int. J. for Light Electron Opt.122 (2011) 259-262

[3] K. Srinivasan and S. Kanimozhi 'Effect of different solvents on the habit of meta-nitroaniline single crystals.sCryst. Res. Technol. 45, No. 6, 611 – 618 (2010)

[4] Ch. Bosshard, K. Sutter, Ph. Prêtre, J. Hulliger, M. Flörsheimer, P. Kaatz, and P. Günter, Organic Nonlinear OpticalMaterials, Vol. 1 (Gordon and Breach Publishers, Singapore, (1995).Materials, Vol. 1 (Gordon and Breach Publishers, Singapore, 1995).

[5]D. S. Chemla and J. Zyss (Eds.), Nonlinear Optical Properties of Organic Molecules and Crystals, Vols. 1 and 2(Academic Press, New York, 1987).

[6]D. J. Williams (Ed.), Nonlinear Optical Properties of Organic and Polymeric Materials, Am. Chem. Soc. Symp.Ser., Vol. 233 (American Chemical Society, Washington DC, (1983).

[7]V. Chithambaram, S. Jerome Das, S. Krishnan, J. Alloys Comp. 509 (2011) 4543-4546

[8]Mohd.Shakir, S.K. Kushwaha, K.K. Maurya, R.C. Bhatt, Rashmi, M.A. Wahabb, G. Bhagavannarayana, "Unidirectional growth of l-proline cadmium chloride monohydrate single crystal and its characterization for structural, vibrational, LDT, optical and dielectric properties". Materials Chemistry and Physics 120 , 2010 566–570

[9]Manoj K.Gupta ,NidhiSinha , BinayKuma "Growth and characterizationofnewsemi organic L-prolinestrontiumchloridemonohydratesinglecrystals "Physica B 406 (2011) 63–67

[10] N. B. Singh, T. Henningsen, R. Mazelsky, and Namwar Singh, "growth and characterization of organic nonlinear optical crystal:m-Nitroaniline system". Materials Letters Volume 7, Issue 11, February 1989, 401-403.

[11] G.Ryu and C.S.Yoon, "Seed supercooled melt growth and polar morphology of organic Nonlinear optical crystal, meta-nitroaniline (mNA)".J.Cryst.Growth 191, 190-198 (1998)

[12] J. L. Stevenson,."Growth and characterisation of single crystal optical fibre waveguides meta-nitroaniline".J. Cryst.Growth 37, 116-128 (1977).

[13] S. Ayers, M. M. Faktor, D. Marr, and J. L. Stevenson, J. Mater. Sci. 7, 31 (1972).

[14] J. L.Stevenson, S. Ayers, and M. M. Faktor, J. Phys. Chem. Solids 34, 235 (1973).

[15] R.M.Silverstein,. G. Clayton Bassler,.Terencc C. Morrill, Spectrometric Identification Of Organic Compounds, John Wiley &Sons, New York, 1991.

ISBN: 978-81-965236-7-1

E Bike Speed Controller System Using SMT32

Dr.J.Rangarajan
professor
Muthayammal Engineering College
Rasipuram,India
rangaslm@gmail.com

D.DushyanthNaik
Dept ECE
Muthayammal Engineering College
Rasipuram,India
dungavathdushyanth@gmail.com

S.Ganesh Reddy
Dept ECE
Muthayammal Engineering College
Rasipuram,India
ganeshreddysomu@gmail.com

Abstract— **The aim of this project is to maintain perfect traffic speed control system in Road way using RSU(Road side Unit).Based on the broadcast system, the incoming vehicles are alerted with traffic and accident ahead the road. Speed control is not a prevalent feature found in electric vehicles. Many Vehicles implement a pseudo speed controller that does not include feedback based on sensing speed. Speed control can be desirable for driver comfort and safety. This paper describes a low cost feedback speed controller for an instrumented electric Vehicle.For example, CPU fans, fume extinguishers, toy cars etc. are all E-Bike speed Controller s which are operated by FIND OUT SPEED LIMITED power supply. Most of the times we will have to adjust the speed of the motors as per our requirement. A CPU Fanfor example, must be operated at high speed when the CPU is preforming heavy tasks like games or video editing. But for normal usage like editing documents, the speed of the fan canbe reduced. Although some systems have an automatic adjustment system for fan speed, not all systems possess this functionality. So, we will have to adjust the speed of the E-Bike speed Controller ourselves occasionally. The circuit is used to control speed of E-Bike speed Controller by using STM technique. Series Variable Speed E-Bike speed Controller 12V uses a 555 timer IC as a STM pulse generator to regulate the motor speed FIND OUT SPEED LIMITED.**

Keywords—E-Bike Speed Controller, STM, IC 555, AMV (key words)

Introduction

This We use E-Bike speed Controller s in many systems in our day too day life. For example, CPU fans, fume extinguishers, toy cars etc. are all E-Bike speed Controller s which are operated by FIND OUT SPEED LIMITED power supply. Most of the times we will have to adjust the speed of the motors as per our requirement. A CPU Fan for example, must be operated at high speed when the CPU is preforming heavy tasks like games or video editing. But for normal usage like editing documents, the speed of the fan can be reduced. Although some systems have an automatic adjustment system for fan speed, not all systems possess this functionality. So, we will have to adjust the speed of the E-Bike speed Controller ourselves occasionally. The circuit is used to control speed of E-Bike speed Controller by using STM technique. Series Variable Speed E-Bike speed Controller 12V uses a 555 timer IC as a STM pulse generator to regulate the motor speed FIND OUT SPEED LIMITED 12 Volt. IC 555 is the popular Timer Chip usedto make timer circuits. In the Astable mode (AMV), the IC works as a free running multivibrator. The output turns high and low continuously to give pulsating output as an oscillator.

LITERATURE SURVEY:

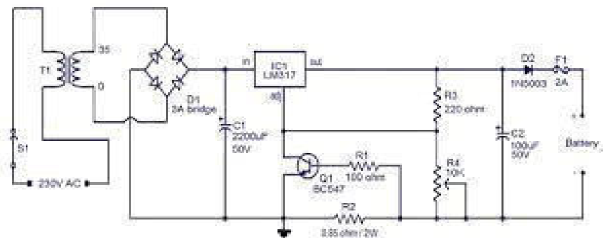
The main aim this survey is to find the E-Bike speed Controller application and limitations of the various time.

- Design and Analysis of E-Bike with Electrical Regeneration and Self-Balancing.
- Smart Online Voting System
- Power Efficient e-Bike with Terrain Adaptive Intelligence
- Avoiding Closed Loop System BLDC Motor FOR Electric-Bike
- Online Environment Friendly booster bike

EXISTING SYSTEM

This concept of speed control or adjustment should not be taken to include the natural change in speed which occurs due to change in the load on the shaft. The nature of the speed control requirement for an industrial drive depends upon its type. Some drives may require continues variation of speed for the whole of the range from zero to full speed or over a portion of this range, while the others may require two or more fixed speeds.

ISBN: 978-81-965236-7-1



.

METHODOLOGY

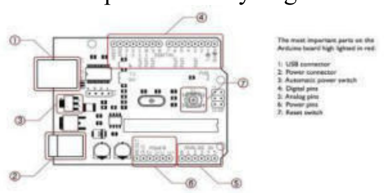
FLUX CONTROL METHOD

It is known that N α 1/ Φ by decreasing the flux, thus speed can be increased and vice versa. Hence, name flux or field control method. The flux of DC motor can be changed by changing Ish with help of a shunt field rheostat. Since Ish in relatively small, shunt field rheostat has to carry only a small, so that rheostat is small in size.

HARDWARE AND SOFTWARE DETAILS

- **ARDUINO UNO R3 MICROCONTROLLER*:***

The Arduino Uno R3 is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as STM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started.



Communication

The Arduino Uno has a number of facilities for communicating with a computer, another Arduino, or other microcontrollers. The ATmega328 provides UART TTL (5V) serial communication, which is available on digital pins 0 (RX) and 1 (TX). An ATmega8U2 on the board channels this serial communication over USB and appears as a virtual com port to software on the computer. The '8U2 firmware uses the standard USB COM drivers, and no external driver is needed. However, on Windows, a .inf file is required. The Arduino software includes a serial monitor which allows simple textual data to be sent to and from the Arduino board. The RX and TX LEDs on the board will flash when data is being transmitted via the USB-to-serial chip and USB connection to the computer (but not for serial communication on pins 0 and 1). A Software Serial library allows for serial communication on any of the Uno's digital pins. The ATmega328 also supports I2C (TWI) and SPI communication. The Arduino software includes a Wire library to simplify use of the I2C bus; see the documentation for details. For SPI communication, use the SPI library.

Programming

The Arduino Uno can be programmed with the Arduino software. Select "Arduino Uno from the Tools > Board menu (according to the microcontroller on your board). For details, see the reference and tutorials. The ATmega328 on the Arduino Uno comes pre-burned with a boot loader that allows you to upload new code to it without the use of an external hardware programmer. It communicates using the original STK500 protocol (reference, C header files). You can also bypass the boot loader and program the **microcontroller through the ICSP (In-Circuit Serial Programming) header; see** these instructions for details. The ATmega8U2 firmware source code is available. The ATmega8U2 is loaded with a DFU boot loader, which can be activated by connecting the solder jumper on the back of the board (near the map of Italy) and then resetting the 8U2. You can then use Atmel's FLIP software (Windows) or the DFU programmer (Mac OS X and Linux) to load a new firmware. Or you can use the ISP header with an external programmer (overwriting the DFU boot loader). See this user-contributed tutorial for more information. Arduino Uno

Automatic (Software) Reset

Rather than requiring a physical press of the reset button before an upload, the Arduino Uno is designed in a way that allows it to be reset by software running on a connected computer. One of the hardware flow control lines (DTR) of the ATmega8U2 is connected to the reset line of the ATmega328 via a 100 nano-farad capacitor. When this line is asserted (taken low), the reset line drops long enough to reset the chip. The Arduino software uses this capability to allow you to upload code by simply pressing the upload button in the Arduino environment. This means that the boot loader can have a shorter timeout, as the lowering of DTR can be well-coordinated with the start of the upload. This setup has other implications. When the Uno is connected to either a computer running Mac OS X or Linux, it resets each time a connection is made to it from software (via USB). For the following half second or so, the boot loader is running on the Uno. While it is programmed to ignore malformed data (i.e., anything

ISBN: 978-81-965236-7-1

besides an upload of new code), it will intercept the first few bytes of data sent to the board after a connection is opened. If a sketch running on the board receives one-time configuration or other data when it first starts, make sure that the software with which it communicates waits a second after opening the connection and before sending this data. The Uno contains a trace that can be cut to disable the auto-reset. The pads on either side of the trace can be soldered together to re-enable it. It's labelled "RESET-EN". You may also be able to disable the **auto-reset by** connecting a 110ohm resistor from 5V to the reset line; see this forum thread for details.

USB Over current Protection

The Arduino Uno has a resettable poly-fuse that protects your computer's USB ports from shorts and over current. Although most computers provide their own internal protection, the fuse provides an extra layer of protection. If more than 500 mA is applied to the USB port, the fuse will automatically break the connection until the short or overload is removed.

Physical Characteristics

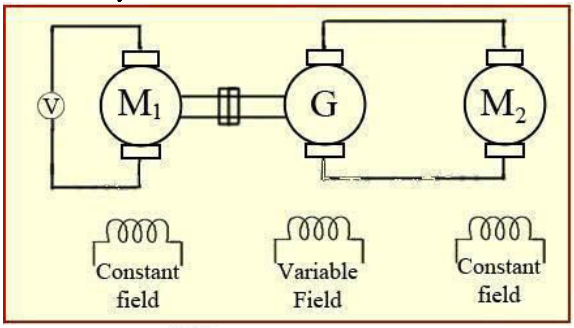
The maximum length and width of the Uno PCB are 2.7 and 2.1 inches respectively, with the USB connector and power jack extending beyond the former dimension. Four screw holes allow the board to be attached to a surface or case. Note that the distance between digital pins 7 and 8 is 160 mil (0.16"), not an even multiple of the 100mil spacing of the other pins.

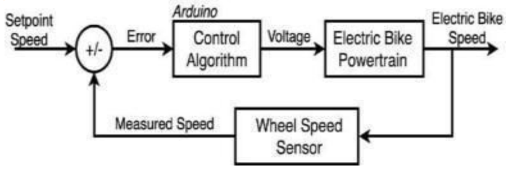
- Classications for E Bike Speed Controller

STM controller constantly monitors the throttle values. The throttle consists of a throttle position sensor (TPS). Noncontact type TPS work on the principle of Hall effect or inductive sensors, or magnet-oresistive technologies, wherein by and large the magnet or inductive circle is the unique part which is mounted on the butterfly valve choke spindle/shaft gear and the sensor and sign handling circuit board is mounted inside the ETC gear box cover and is stationary. At the point when the magnet/inductive circle mounted on the spindle which is rotated from the lower mechanical stop to WOT, there is an adjustment of the magnetic field for the sensor. The adjustment of the magnetic field is detected by the sensor and the voltage created is given as the input to the ECU.

INTRODUCTION

In this project, The STM32 family of 32-bit microcontrollers based on the Arm® Cortex®-M processor is designed to offer new degrees of freedom to MCU users. It offers products combining very high performance, real-time capabilities, digital signal processing, low-power / low-voltage operation, and connectivity.

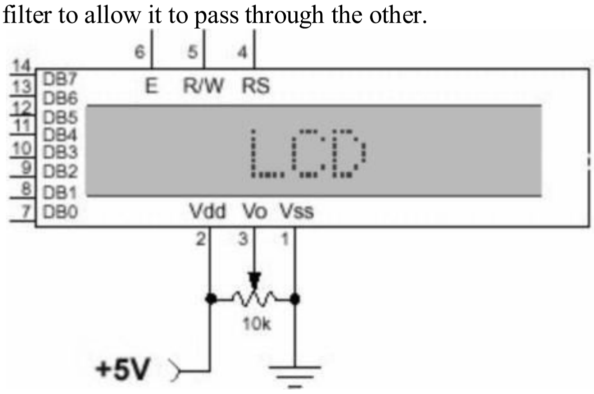




Prop
osed system block diagram
Block diagram of power supply unit

- **LCD**

A liquid crystal display (LCD) is a thin, flat display device made up of any number of coloror monochrome pixels arrayed in front of a light source or reflector. Each pixel consists of a column of liquid crystal molecules suspended between two transparent electrodes, and two polarizing filters, the axes of polarity of which are perpendicular to each other. Without the liquidcrystals between them, light passing through one would be blocked by the other. The liquid crystal twists the polarization of light entering one filter to allow it to pass through the other.

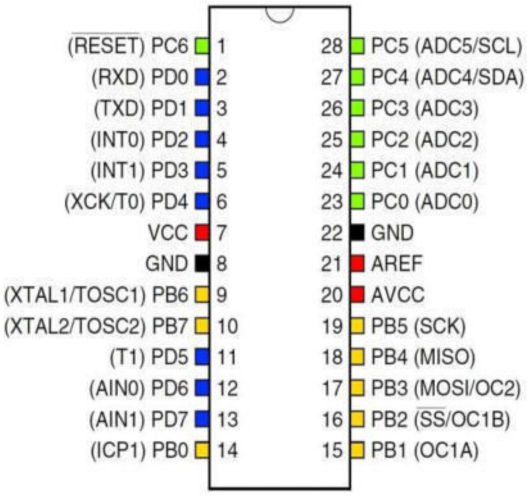


Pin Diagram of LCD

HARDWARE REQUIREMENTS :

- FINGERPRINT sensor
- TOUCH SENOSR
- BATTERY
- LCD DISPLAY

ISBN: 978-81-965236-7-1



PIN CONFIGURATIONS:
Pin configuration diagram

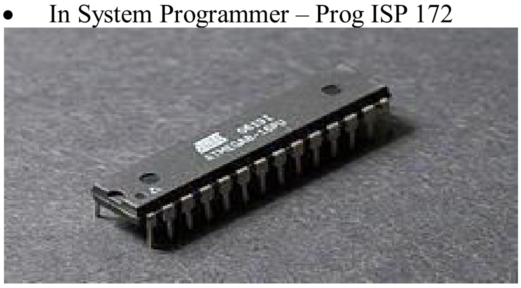
- ***PIN DESCRIPTIONS***
- **VCC - Digital supply voltage.**
- **GND - Ground.**
- **Port B (PB7-PB0)**
- **XTAL1/XTAL2/TOSC1/TOSC2**

A liquid-crystal display (LCD) is a flat-panel display or other electronically modulated optical device that uses the light-modulating properties of liquid crystals. Liquid crystals do not emit light directly, instead using a backlight or reflector to produce images in color or monochrome. LCDs are available to display arbitrary images (as in a general-purpose computer display) or fixed images with low information content, which can be displayed or hidden, such as preset words, digits, and 7-segment displays, as in a digital clock. They use the same basic technology, except those arbitrary images are made up of a large number of small pixels, while other displays have larger elements.

LCDs are used in a wide range of applications including computer monitors, televisions, instrument panels, aircraft cockpit displays, and indoor and outdoor signage. Small LCD screens are common in portable consumer devices such as digital cameras, watches, calculators, and mobile telephones, including smartphones. LCD screens are also used on consumer electronics products such as DVD players, video game devices and clocks. LCD screens have replaced heavy, bulky cathode ray tube (CRT) displays in nearly all applications. LCD screens are available in a wider range of screen sizes than CRT and plasma displays, with LCD screens available in sizes ranging from tiny digital watches to huge, big-screen television set.

SOFTWARE REQUIREMENTS

- Porteus 7.7 versions
- Platform - ARDUINO IDE STUDIO
- In System Programmer – Prog ISP 172



- **Compiler – Win ARDUINO IDE**

Atmel ARDUINO in 28-pin narrow DIP

- MAIN ARTICLE: ARDUINO IDE32

In 2006 Atmel released microcontrollers based on the new, 32-bit, ARDUINO IDE32 architecture. They include SIMD and DSP instructions, along with other audio and video processing features. This 32-bit family of devices is intended to compete with the ARM based processors. The instruction set is similar to other RISC cores, but is not compatible with the original ARDUINO IDE or any of the various ARM cores.

- **Device architecture:**

Flash, EEPROM, and SRAM are all integrated onto a single chip, removing the need for external memory in most applications. Some devices have a parallel external bus option to allow adding additional data memory or memory-mapped devices. Almost all devices (except the smallest Tiny ARDUINO IDE chips) have serial interfaces, which can be used to connect larger serial EEPROMs or flash chips.

- **Program memory:**

Program instructions are stored in non-volatile flash memory. Although the MCUs are 8- bit, each instruction takes one or two 16-bit words.
The size of the program memory is usually indicated in the naming of the device itself (e.g., the ATmega64x line has 64 kB of flash while the ATmega32x line has 32 kB).
There is no provision for off-chip program memory; all code executed by the ARDUINO IDE core must reside in the on-chip flash. However, this limitation

ISBN: 978-81-965236-7-1

does not apply to the AT94 FPSLIC ARDUINO IDE/FPGA chips.

Internal data memory: The data address space consists of the register file, I/O registers, and SRAM.

- **Atmel ATxmega128A1 in 100-pin TQFP package**

MAIN ARTICLE: ATMEL ARDUINO IDE INSTRUCTION SET

The ARDUINO IDE Instruction Set is more orthogonal than those of most eight-bit microcontrollers, in particular the 8051 clones and PIC microcontrollers with which ARDUINO IDE competes today. However, it is not completely regular:

- Pointer registers X, Y, and Z have addressing capabilities that are different from each other.
- Register locations R0 to R15 have different addressing capabilities than register locations R16 to R31.
- I/O ports 0 to 31 have different addressing capabilities than I/O ports 32 to 63.
- CLR affects flags, while SER does not, even though they are complementary instructions. CLR set all bits to zero and SER sets them to one. (Note that CLR is pseudo-op for EOR R, R; and SER is short for LDI R, $FF. Math operations such as EOR modify flags while moves/loads/stores/branches such as LDI do not.)

Accessing read-only data stored in the program memory (flash) requires special LPM instructions; the flash bus is otherwise reserved for instruction memory.

Acknowledgment

A great deal of time and effort has been spent in completing this project work. Several people have guided us and contributed significantly to this effort and so this becomes obligate to record our thanks to them.

We specially thank all our Teaching and Non-Teaching Faculty members of the Department of Electronics and Communication Engineering for their encouragement to do the project work with full interest and enthusiasm. We pay our profound gratitude to the Almighty God for his invisible vigilance and would like to thank our Parents forgiving us support and encouragement.

References

Thus, The Throttle signal is processed by the controller and it then operates the motor through motor driver. The motor voltage is varied as per throttle values in order to control its power and speed. Also the controller constantly monitor speed sensor values. The peed sensor works on hall effect principle to constantly transmit the wheel RPM. This RPM value is displayed on the LCD display by the controller. The motor speed and sensor monitoring is turned off when the main switch s turned off. The complete process restarts as soon as the switch is turned on. Thus we successfully develop and test our own E-bike controller using STM32.

.

The of the project is to show that it is possible and relatively simple, to build an electric bicycle by oneself. This project can be broken down into five separate categories: the lithium-ion battery, the DC-DC boost converter, the solar panel, the motor, and the motor controller.

Each of these will be built upon and improved further by future students, one category at a time. The hope is that this design can become very efficient, cost-effective, and one day mass-produced, especially in developing countries where automotive transportation is an impossibility.

1) Zhenhua Yu, Arthur J. Redfern and G. Tong Zhou, (2021)" Using Delta-Sigma Modulators in Visible Light OFDM Systems''.

2) Dr. Naveen Rathee, Abhinav Malik, Shreyaa Nagpal,(2022)"Transmission of Numeric Data and Voice Using Light Fidelity (E-BIKE) Technology".

3) Giorgio Corbellini, Stefan Schmid, Stefan Mangold Thomas R. Gross, Armen Mkrtchyan, (2022)" LED-to-LED Visible Light Communication for Mobile Applications".

4) Alexander McBride, Burim Derveni, (2021)" Transitioning to Hybrid Radio/Optical Networks: Development of a Flexible Visible Light Communication Testbed"5GU.

5) 5.Amrutha.S, Ansu Mathew, Rajasree. R, Swathy Sugathan, Aravind. S "A visible E-bike communication system for indoor application", International Journal of Engineering and Innovative Technology. 2022 Vol 3 pp.40-42.

6) Dhakane Vikas Nivrutti, Ravi Ramchandra "Light fidelity: a reconnaissance of future technology", IJARCSSE, 2013 Vol 3 issue 11 pp 753-756A

ISBN: 978-81-965236-7-1

Educational Data Mining: An Intelligent Approach to Analysis of Students Academic Performance

Sathya. M[1] AP/CSE, Dhivya. J[2] AP/CSE

Department of Computer Science and engineering, Mount Zion College of engineering and Technology sathimanogaran@gmail.com[1], ,dhivyasna2957@gmail.com[2]

Abstract - This paper presents a comprehensive framework for Educational Data Mining (EDM) and data analysis, leveraging unsupervised machine learning algorithms. The framework focuses on the extraction of various features, patterns, and rules from educational datasets, with the goal of generating useful recommendations for both students and educators. The proposed EDM framework is designed for seamless integration into e-learning platforms, enhancing the overall educational experience.

The framework begins with data collection from diverse sources, including learning management systems and student information systems. Unsupervised machine learning algorithms are employed for data analysis, enabling the identification of hidden patterns and relationships within the educational data. The extracted features and rules serve as the basis for generating insightful recommendations tailored to the needs of students and educators.

The recommendations derived from the framework aim to provide valuable insights into students' learning behaviors, potential challenges, and opportunities for improvement. For educators, the framework offers guidance on personalized teaching strategies, intervention plans, and curriculum adjustments. Students benefit from targeted suggestions for optimizing their learning experience, fostering academic success.

One of the key strengths of the proposed framework is its adaptability to e-learning platforms, ensuring a seamless integration into the digital learning environment. This integration facilitates real-time feedback, personalized learning pathways, and adaptive interventions, ultimately enhancing the effectiveness of online education.

The framework also addresses ethical considerations, emphasizing data privacy and the need for unbiased recommendations. Continuous improvement is encouraged through periodic evaluations of the framework's performance, promoting a culture of data-driven decision-making within educational institutions.

Key Words – Educational data mining, Association rule mining, Fuzzy based algorithm, kmeans algorithm.

1. INTRODUCTION

In the ever-evolving landscape of education, the integration of technology and data-driven methodologies has become imperative for optimizing the learning experience. This paper

ISBN: 978-81-965236-7-1

unfolds a cutting-edge framework dedicated to Educational Data Mining (EDM) and data analysis, harnessing the power of unsupervised machine learning algorithms. With a focus on extracting diverse features, patterns, and rules from educational datasets, this framework aims to generate insightful recommendations tailored for both students and educators.

The wealth of data available in educational systems, including learning management systems and student information systems, holds untapped potential for improving educational outcomes. By applying unsupervised machine learning algorithms, this framework seeks to uncover hidden patterns within the data, allowing for a deeper understanding of students' behaviors and learning trajectories.

The central objective is to translate the extracted features, patterns, and rules into actionable insights. These insights serve as the foundation for generating practical recommendations that can empower both students and educators. For students, personalized suggestions aim to enhance their learning experiences, identify potential challenges, and guide them towards academic success. Educators, on the other hand, benefit from tailored recommendations that inform teaching strategies, intervention plans, and curriculum adjustments.

What sets this framework apart is its adaptability to contemporary education paradigms, particularly e-learning platforms. The proposed EDM framework seamlessly integrates into digital learning environments, offering real-time feedback, personalized learning paths, and adaptive interventions. This integration not only aligns with the evolving nature of education but also enhances the overall effectiveness of online learning experiences.

As we delve into the framework, it is crucial to underscore its ethical considerations. The paper emphasizes the importance of data privacy and the mitigation of biases in recommendations, ensuring a fair and secure environment for all stakeholders. Furthermore, the framework advocates for continuous improvement, encouraging periodic evaluations to refine its performance and foster a culture of data-driven decision-making within educational institutions.

2. OBJECTIVE

The objectives outlined in this research endeavor focus on advancing Educational Data Mining (EDM) by dissecting and understanding the parameters and variables integral to student performance evaluation. The initial phase involves a thorough literature review to identify prevalent evaluation metrics and criteria. Subsequently, the aim is to refine a generic EDM framework, making it more adaptable to diverse datasets through the incorporation of machine learning techniques and algorithmic improvements. Additionally, the research proposes the development of a Fuzzy Logic-based algorithm specifically designed for extracting association rules from educational datasets. This algorithm aims to address uncertainties and vagueness in the data,

ISBN: 978-81-965236-7-1

particularly factors like student preferences and learning styles, contributing to a more nuanced and effective approach to educational analytics. The success of these objectives promises to elevate the capabilities of EDM in comprehensively assessing and understanding student performance.

3. RELATED WORKS

The study by Rao, K.S., et al [8] focuses on predicting student placement outcomes using a variety of machine learning algorithms, including decision trees, regression models, and neural networks. This approach allows for a nuanced analysis of the data, aiming to enhance the accuracy and effectiveness of student placement predictions. Okubo, F [9], explores the prediction of students' final grades using Multiple Regression Analysis and Recurrent Neural Network (RNN). The combination of statistical analysis and machine learning techniques allows for a comprehensive investigation into the factors influencing academic outcomes and the ability to make accurate predictions regarding students' performance. Almarabeh, H et al. [10] investigates students' performance prediction through the application of diverse classification techniques, including Naive Bayes, Bayesian Network, ID3, J48, and Neural Network. This approach provides insights into the effectiveness of different algorithms for classifying students based on their academic performance. Alban, M's research on predicting dropout rates at universities incorporates both statistical and machine learning techniques. Multiple Regression Analysis is employed for its interpretability, while Neural Network algorithms, specifically Multilayer Perceptron and Radial Basis Function, contribute to the modeling of intricate patterns in the data for a more accurate dropout prediction. Feng, J's research focuses on predicting students' academic performance by employing both Decision Tree Classifiers and Neural Networks. This combination of techniques provides a well-rounded approach, utilizing the interpretability of decision trees and the complex pattern recognition capabilities of neural networks to enhance the accuracy and effectiveness of academic performance predictions.

4.PROPOSED SYSTEM

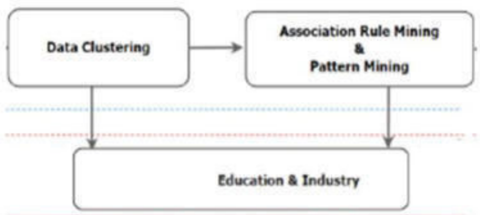
The novel approach described comprises of three main phases: data collection and preparation, data clustering with numerical analysis and feature extraction, and pattern and rule mining. Additionally, it incorporates an improved version of the k-means algorithm for clustering and the Fp-growth algorithm for pattern mining in two levels. the primary objective is to gather relevant data related to students' academic performance, demographics, and other significant variables. The approach involves meticulous preprocessing to ensure data cleanliness, relevance, and appropriate formatting for subsequent analysis. Techniques such as handling missing values, normalizing data, and encoding categorical variables are employed.

Moving to the Data Clustering, Numerical Analysis, and Feature Extraction phase, the

ISBN: 978-81-965236-7-1

primary goal is to identify patterns within the data. An improved version of the k-means algorithm is employed for clustering, enabling the partitioning of data into clusters based on the nearest mean. This improved algorithm may include enhancements in convergence criteria or outlier handling for more robust results. Simultaneously, feature extraction is performed on the clustered data to pinpoint and capture relevant features crucial for understanding underlying patterns.

In the final Pattern and Rule Mining phase, the focus shifts to extracting actionable insights. The objective is to mine patterns and rules from the previously clustered and feature-extracted data. The chosen Fp-Growth algorithm, implemented in two levels, emphasizes a hierarchical approach to pattern mining. This involves identifying broad patterns initially and subsequently refining them, aligning with the algorithm's efficiency in discovering frequent itemsets within large datasets.



Thorough data preprocessing to ensure data quality and relevance. This involves handling missing values, addressing outliers, and encoding categorical variables. The goal is to create a clean and standardized dataset for further analysis.

Also ensuring that the data is appropriately formatted for compatibility with the chosen analytical tools and techniques. The improved version may include refinements in convergence criteria, handling outliers more effectively, or adapting to specific characteristics of the dataset.

The FP-Growth (Frequent Pattern Growth) algorithm is a powerful technique used for pattern mining in data mining and machine learning. It efficiently discovers frequent patterns in large datasets, particularly in association rule mining. The algorithm is known for its ability to handle large databases by employing a tree structure called the FP-tree.

The proposed approach can be partitioned into three main phases: first, data collection and preparation; second, data clustering, numerical analysis, and feature extraction by applying clustering algorithms to the dataset (Table 2); third, pattern and rule are mined by applying pattern mining algorithms to the TDB (Table 4) of each cluster. In the proposed approach, different algorithms are leveraged in each phase, which are described below. A. ELBOW AND MK-MEANS CLUSTERING ALGORITHM

In our proposed approach, one of the key phases is data clustering. Data analysis, including data patterns, feature extraction, and association rules, is closely related to data clustering, and improper clustering can lead to poor results. Before clustering our multidimensional education data, we analyzed the suitability of different clustering methods and algorithms for

ISBN: 978-81-965236-7-1

our clustering objectives. Each algorithm has its own suitability for a particular application, so it is very difficult to find the best clustering algorithm. However, we looked at the hierarchical clustering method, which has high computational and memory requirements compared to the partitional clustering methods. For large data sets, a hierarchical algorithm can be very expensive. The main differences between hierarchical and partitional methods are computation time, prior assumptions, data sets, and clustering goals/results. We also investigated several partition-based clustering algorithms such as K-means, K-means++ and Fuzzy C-means (FCM). K-means++ is used to select the initial cluster center, FCM is used for soft clustering where a data point belongs to multiple clusters with a certain degree of membership. The applicability of these algorithms is not aligned with our goals of multidimensional data clustering and outlier handling.

For multidimensional data normalization, optimal initial center selection, and outlier handling, we proposed a clustering algorithm based on K-means perception in a study, called the modified K-means (MK-means)

CONCLUSION

In this paper, we proposed an EDM framework for data clustering, patterns, and rules mining using real-world problemsolving data. A mathematical model for data preprocessing, MK-means, and FP-growth algorithms were used to conduct this study. For programming education, OJ systems have been adopted by many institutions as academic tools. As a result, a huge number of programming-related resources (source codes, logs, scores, activities, etc.) are regularly accumulated in AOJ systems. In this study, a large amount of real-world problem-solving data collected from the AOJ system was used in the experiments. Problem-solving data preprocessing is one of the main tasks to achieve accurate EDM results. Therefore, a mathematical model for problem-solving data preprocessing is developed. Then, the processed data are clustered using Elbow and MK-means algorithms. Various statistical features, data patterns and rules are extracted from each cluster based on different threshold values (K, minConf , minSup). These results can effectively contribute to the improvement of overall programming education. Moreover, based on the experimental results, some pertinent suggestions have been made. Furthermore, the proposed framework can be applied to other practical/exercise courses to demonstrate data patterns, statistical features, and rules. Besides, any third-party applications with similar data resources such as AlgoA, ProgA, FCT , and FPT , can use the proposed approach for EDM and analysis.

In the future, the experimental results of EDM using problem-solving data can be integrated to visualize different LA for programming platforms such as the OJ system. In addition, fuzzy estimation and polynomial approximation methods can be handy to dynamically select the optimal minSup values based on the dataset. Appropriate minSup values could help to generate the actual number

ISBN: 978-81-965236-7-1

of frequent elements and association rules from the dataset.

REFERENCES

[1] R. Rietsche, K. Duss, J. M. Persch, and M. Soellner, ‘‘Design and evaluation of an IT-based formative feedback tool to foster student performance,’’ in Proc. 39th Int. Conf. Inf. Syst. (ICIS), San Francisco, CA, USA, 2018, pp. 1–17.

[2] S. Oeste, K. Lehmann, A. Janson, M. Sollner, and J. M. Leimeister, ‘‘Redesigning university large scale lectures: How to activate the learner,’’ in Proc. 75th Acad. Manage. Annu. Meeting, Vancouver, BC, Canada, 2015, pp. 1–5.

[3] J. A. Kulik and J. D. Fletcher, ‘‘Effectiveness of intelligent tutoring systems,’’ Rev. Educ. Res., vol. 86, 42–78, May 2016, doi: 10.3102/0034654315581420.

[4] W. Ma, O. O. Adesope, J. C. Nesbit, and Q. Liu, ‘‘Intelligent tutoring systems and learning outcomes: A meta-analysis,’’ J. Educ. Psychol., vol. 106, 901–918, May 2014, doi: 10.1037/a0037123.

[5] J. C. Nesbit, O. O. Adesope, Q. Liu, and W. Ma, ‘‘How effective are intelligent tutoring systems in computer science education?’’ in Proc. IEEE 14th Int. Conf. Adv. Learn. Technol., May 2014, pp. 99–103.

[6] K. Vanlehn, ‘‘The relative effectiveness of human tutoring, intelligent tutoring systems, and other tutoring systems,’’ Educ. Psychol., vol. 46, pp. 197–221, Oct. 2011,doi: 10.1080/00461520.2011.611369.

[7] A. Janson, M. Sollner, and J. M. Leimeister, ‘‘Ladders for learning: Is scaffolding the key to teaching problem-solving in technology mediated learning contexts,’’ Acad. Manage. Learn. Educ., vol. 19, no. 4, 439–468, 2020.

[8] M. C. Kim and M. J. Hannafin, ‘‘Scaffolding problem solving in technology-enhanced learning environments (TELEs): Bridging research and theory with practice,’’ Comput. Educ., vol. 56, 403–417, Feb. 2011.

[9] T. A. Brush and J. W. Saye, ‘‘A summary of research exploring hard and soft scaffolding for teachers and students using a multimedia supported learning environment,’’ J. Interact. Learn., vol. 1, pp. 1–12, Oct. 2002.

[10] R. Knote, A. Janson, and J. M. Leimeister, ‘‘Value co-creation in smart services: A functional affordances perspective on smart personal assistants,’’ J. Assoc. Inf. Syst., vol. 4, pp. 418–458, Mar. 2020

[11] S. Perez. (2017). Voice-Enabled Smart Speakers to Reach 55% of

U.S. Households by 2022. [Online]. Available:https://techcrunch.com/2017/11/08/ voice-enabled-smart-speakers-toreach-55-of-u-shouseholds-by-2022-says-report/

[12] J. Hauswald, M. A. Laurenzano, Y. Zhang, C. Li, A. Rovinski, A. Khurana, R. G. Dreslinski, T. Mudge, V. Petrucci, L. Tang, and J. Mars, ‘‘SIRIUS: An open endto-end voice and vision personal assistant and its implications for future warehouse scale computers,’’ in Proc. ACM SIGPLAN Notices, 2015, pp. 223–228.

ISBN: 978-81-965236-7-1

[13] H. Chung, M. Iorga, J. Voas, and S. Lee, ‘‘Alexa, can i trust you?’’ Computing, vol. 50, no. 9, pp. 100–104, 2017, doi: 10.1109/MC.2017.3571053.

[14] S. Wasik, M. Antczak, J. Badura, A. Laskowski, and T. Sternal, ‘‘A survey on online judge systems and their applications,’’ ACM Comput. Surv., vol. 51, no. 1, pp. 1–34, 2018.

[15] Y. Watanobe. (2018). Aizu Online Judge. [Online]. Available: https://onlinejudge.u-aizu.ac.jp

[16] M. A. Revilla, S. Manzoor, and R. Liu, ‘‘Competitive learning in informatics: The UVA online judge experience,’’ Olympiads Inf., vol. 2, pp. 131–148, Feb. 2008.

[17] J. L. Bez, N. A. Tonin, and P. R. Rodegheri, ‘‘URI online judge academic: A tool for algorithms and programming classes,’’ in Proc. 9th Int. Conf. Comput. Sci. Educ., 2014, pp. 149–152.

ISBN: 978-81-965236-7-1

ENVIRONMENTAL SENSING USING IOT

Z.ANEESHA FATHIMA
M.FARZANA BEGUM
MIET ENGINEERING COLLEGE
TRICHY-7

Abstract;-
In recent years, people are getting more consciousof the environment they are living in. This consciousness is driving the need to develop are liable environmental monitoring system. An environmental air quality monitoring system also has industrial application.In mining orin heavy industry,there is a possibility of air contamination by different harmful gases.In such hazardous situations,an environmental monitoring system can potentially save the life of the workers. In such large-scale sensor deployment,there are data collection,data management, connection, and power consumption issues. IoT technology I specifically suited for this sort of need.This paper presents an IoT based framework that effectively monitors the change in an environment using sensors, microcontroller, and IoT based technology.Users can monitor temperature,humidity,detect the presence of harmful gases both in the indoor and outdoorenvironment using the proposed module.The data is stored in the web server and the user can access the data anywhere in the world through an internet connection. In the proposed work a web application is developed to provide vital information to the user.The user can also setup a notification for critical changes in the sensor data.In comparison to other closely related systems,the proposed system is a low-cost one, accurate and user friendly.
It is also cloud-based and has easy monitoringand data visualization modules. The system has been evaluated in different stages.After testing all the functions in different conditions, it shows

A high degree of accuracy and reliability.

INTRODUCTION

Effective change management Is one of the most challenging issues in the world.Government,semi-government and public organizations are preparing to face this challenge in terms of social and environmental fronts and trying to make the world a better place to live forus.In order to cope up with the dynamism of

changing reality, various smart systems have been developed, including household automation[1- 2],traffic and accident monitoring[4-5],smart city solution [6-7], automated irrigation [8], smart grid [9],real-life problem solving using robotics [10- 12], wireless sensor network systems [13-16], web-based service [17-20]etc.
Air quality is a major concern nowadays that requires monitoring of several parameters responsible for this problem.As per the systems mentioned in [1-7], a feasible technical solution to monitor environmental condition and changes is quite important. Internet of Things(IoT)offers a highly effective way of monitoring parameters related to air quality[21-23]. If a system can able to integrate various IoT elements to track and collect data using IoT-based devices, then it can be used as a powerful tool for monitoring indoor and outdoor environment. Smoke, Methane, Liquid Natural Gas (LNG),Carbon-based gases,Nitrogen- based gases,Air Temperature and Humidity are therequired indices that are required to be monitored and investigated in order to have a complete idea on th surrounding environment.
Using the IoT concept, it becomes much moreflexible and interactive to the user.

DESIGN METHODOLOGY
To store and analyze data continuously on various environmental indices,the design methodology of the proposed environment monitoring system is presented in the following sub-sections: System Model
Logical data model Controlling
SensorsSensors Used
Data collection procedure

System Model

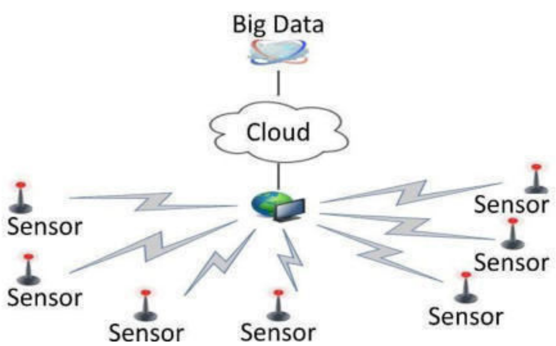


Fig. 1.Sensor node system model.

The diagram in Fig.1illustrates the overall architecture of the network system in this project.User can deploy the nodes randomly in an environment. To maintain the simplicity of the network architecture,startopology is selected.In a star topology, one failed device will not affect the other devices in the network, and there will be no data collision in the network.Between the internet and the nodes,a gateway is used. This gateway can be wired or wireless, giving us the flexibility to use it any where. The gate way also does the heavy lifting of internet communication and keeps the power consumption in the node low.

Logical data model

Logical data flow model of the proposed system is presented in Fig. 2. The Thing Speak service provides channels for each node.Each of the channels has its APIKey.This key helps to organize data in the channels and to maintain the data base.This individual data based then can be visualized in the Thing Speak service or can be transferred to other services to analyze the data.

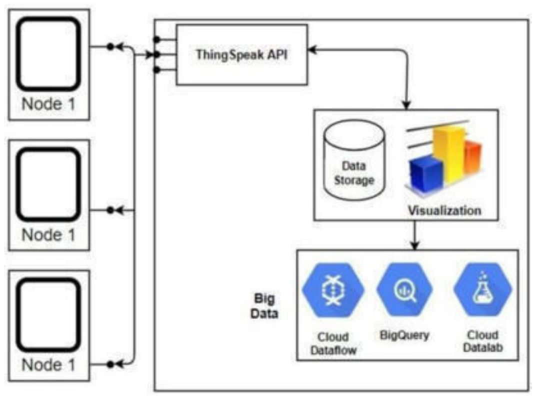


Fig.2.**Logical Data Model for data visualization.**

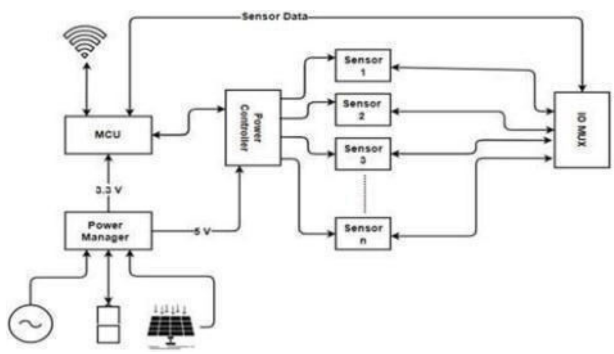


Fig. 3.Device block diagram.

ISBN: 978-81-965236-7-1

. Shows the different parts of the devices To make the power supply flexible,
several input options are available. If multiple power sources are connected simultaneously, the power manager will switch between them to provide a consistent supply.The solar cell or the main AC supply will charge the battery and provide the power to the other parts of the hardware. If the mains AC supply fails or during the night when there is no power in the solar cell, the power manager will switch to the battery for uninterrupted operation.

There is a buck boost converter in the power management system with the solar cell connection. As the solar cell does not produce constant voltage,the buck-boost converter takes any voltage between 3V to 18V and converts it to a constant15V.This15Vis feed to the battery charging system.

The power unit consists of a rechargeable 1500 mAh 12.5-volt lithium-ion battery.To save the battery from completely discharging or overcharging, battery charge protection circuit has been integrated into the system. To efficiently stepdownthe voltage two buck modules are used.The ESP8266 and the node MCU board requires 3.3v and the sensors required 5v and 12v.

TheESP8266 is the brain of the whole device. It is responsible for sensor data collection,formatting the data and sending to the sensor gateway.To make the device flexible in terms of how many sensors it can connect,IO mux is used in the design.The IO mux canbe chained to add more sensors if necessary.

There is a separate power controller for sensor power supply as different sensors require different voltage levels.The power controller can also cutoff the power of the unused sensors,maximizing powersavings.

Controlling Sensors

There are a power control MOSFET array and a 12v boost converter in the power controller unit. Upon receiving the request from the MCU, the power control unit powers on a particular sensor. The power controller unit also ensures that the appropriate current and voltages are set. After that,the MCU reads the data from the sensor.The MCU then turns off the power of that sensor ensuring alow current consumption.

Sensors Used

The device is designed in such a way that a number of environmental and gas sensors can be added here. For the proposed model experiment, MQ2, MQ4, MQ135 and DTH22 sensors are used.

MQ2gas sensor can detectLPG,Smoke,Alcohol,Propane,Hydrogen,Met hane and Carbon Monoxide concentrations anywhere from 200 to 10000ppm.

MQ4 GAS SENSOR

MQ4 gas sensor has a high sensitivity to Methane,also has anti-interference to alcohol and other gases. MQ135 gas sensor has high sensitivity NH_3, NO_x, alcohol, benzene, smoke and CO_2.Ideal for use in the factory environment.TheDHT22is a digital temperature and humidity sensor. It uses a capacitive humidity sensor and thermistor tome asure the surrounding air temperature.

Data Collection Procedure

The devices ends data to the gateway with the along with the API key.The gate way then

ISBN: 978-81-965236-7-1

data to theThing Speak server.The device has a quick boottime.There isa scheduler that periodically fetches information from the sensor and stores it on the RAM.It stores the sensor value and as well as the time stamp.All the sensor values are sent to the server at once to reduces current consumption.The scheduler is configurable and for this example, it is configured to read data from the sensor every five minutes.The user can configure the schedular to meet their exact need. When not working, the schedular puts the device into sleep mode to conserve power.
The data can be visualized in thing Speak site with various graphs and charts. The graph shows the time stamp and sensor value. A trigger can be set in the thing Speak server for a particular sensor when it crosses a threshold value.More over,it is possible todownload the data to CSV or JSON format from thing Speak server for further processing. To stop data collection,it is essential to turn off the system's power.

IMPLEMENTATION AND TESTING

The device is housed in an FDM box.The connections are made between all sensors,micro controllers,and project board with removable connectors.Microcontrollers these days used in all sorts of applications ranging different appliances,embedded systems to implantable medical devices [3].TheFDM box has various compartments for the sensor, the circuit board and thebattery. The battery is in the lower compartment and the circuit and the sensor board are in the upper compartment.The battery is in the bottom section which can easily slid in and out.The gas sensors are mounted on the side.
The battery powers the 5v and 3.3v buck converter unit.The 5v rail powers the sensor array and the 3.3v powers the Node MCU module. The Node MCU then reads the sensor data of each sensor, formats them and sends data to the cloud database.The power unit consists of 1500 mAh 12.5- voltbattery. The cloud database stores different data such as the presence of Carbondioxide,Carbonmonoxide,smoke,Methane, natural gas, particle in the air. So, a database is important for further studying the data.

Fig.4(a).Implementation Requirements Design

Fig.4(b).ImplementationRequirementsDesign

Fig. 4(a) and 4(b) shows thesystems' design.

The sensors begin to work when the machine is turned on. If any gas enters the gas sensor, the sensor heats the filament inside. In the absence of any volatile gases, the hot in dioxide reacts with oxygen and it prevents current flow.In case of the presence of any volatile gas,the concentration of oxygen decreases.When heated,tin dioxide is a good conductor in the absence of oxygen.This is how the filament resistance changes and dependingon the resistance value it can be observed that a certain gas is present.The gas sensors produce analogue values proportional to the gas present.

On the other hand, the temperature and humidity sensor is digital. There is resistive thermistor for temperature measurement and a capacitive humidity sensor for humidity measurement.

These sensor data will then be sent to the server.Each sensor data is displayed in various charts. These chart show the time and date stamps. It is possible to download the data from thing Speak inCSV or in JSON format. Moreover, itis simple and

ISBN: 978-81-965236-7-1

efficient to obtain information from minute tominute,or even hours and days.

System Testing

TESTCASE	EXPECTEDRESULT	OBSERVED RESULT	TESTRESULT
USER SHOULDHAVESUCCESSFULLOGIN THISSYSTEM	SUCCESSFULLOGIN	SUCCESSFULLYLOGIN	PASS
USERCANEASILY ACCESSTHEENVIRONMENT SWITCH	ACCESSIBLEEVERYMENU	EASILYACCESSIBLE	PASS
USERCANCONTROL THEELECTRICALAPPLIANCE	EASILYCONTROLLABLE	USERCONTROLLED	PASS
USER CAN SEETHEGASSTATUS	CANSEETHECURRENT ENVIRONMENTSTATUS	EASILYVISIBLE HOMESTATUS	PASS
USER CANDATADIAGRAMSERVICE	USERCANCONTROL DATASERVICE	USERCANCONTROLDATA SHOWSERVICE	PASS

System testing,or end-to-end testing is a completely integrated system of testing to verifythat itme etsitsr equirements.

Data Acquisition

In Fig. 4 (a) and 4 (b), showcased the hardware. The deviceis in the prototype phase. All the componentsare attached inthe Vero board. There are some loosewires in the device. Inthe final design, proposed work is aimed to design a custom PCB board.Thecustom PCB board will eliminate the dangling wires and will make the board more compact. For casing design, quarter-inch MDF board is selected. For the inal design,an injection molded plastic case is utilized.The plastic case will provide more robust environmental protection.

RESULT ANALYSIS

This section presents the results obtained from the indoor experiment that has been carried out. The sensor reads the indoor environment by its location. Changes in the artificial environment are made to play with the sensor data by leaking smoke, burning LPG fuel, etc. The values obtained from the sensors thus differ from the normal state and fluctuation of information.

When smoke is released, it is immediately detected and displayed by theMQ2 sensor.MQ4 sensor detected the Methane as it was released in the lab.
This value is particularly important as it can ensurethe safety of the furnace gas tank of factories.

Another common poisonous gas is NOx gases. In the lab test, MQ135 immediately detected NOx gases and showed the PPM value in real-time. The sensor DHT22 is effective in measuring temperature and humidity.In the thing speak dashboard,all these data are shown in are al-time graph.With this information,gas activity depending on the relative humidity and temperature can be observed. The dust sensor is used in micrograms per metercube of air to measure the dust density. GPS sensor detects latitude and longitude when the system works outside so that the exact location makes the environmental status understandable.

All the sensors,microcontrollers,Vero board and every thing is linked together in the boxed-shaped unit.It has battery and circuit board compartments and sensors. The battery and the circuit board and sensors are housed in the lower compartment.The battery is in the lower compartment and the board sand control sareright above the compartment which can easily slide in and out.Gas detectors are serially positioned on one side and the other side are the dust and humidity sensors. In this way, a lotof components are put in a standard size box that makes it compact.The most challenging part is this project's complex power supply.Because of 24 processes and information collection. If there are any bugs, the entire system will completely collapse. So it is essential to make sure that there are alternate ways of power. Three types of power supplies are arranged for the proposed design.12Vpowersupply adapter from AC outlet,battery backup and solar panel to supply power to the device all the time.

ISBN: 978-81-965236-7-1

Fig. 5. Data toGraphVisualizationNaturalGas&COGasVsAir Quality& Temperature

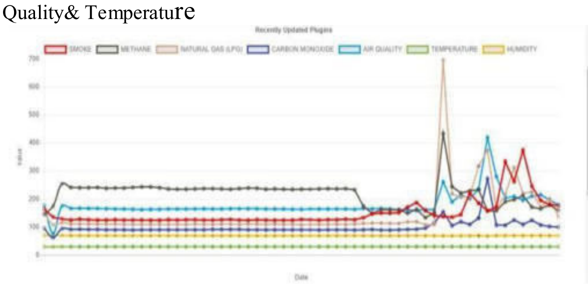


Fig.6.All Sensors Data Graphin Unstable Environment.

So proposed design can be employed anywhere needed with or without access to power. Fig. 5 shows the device in the lab environment. It shows each sensor reacting to the environmental changes. Fig. 6 shows that all the sensors are in action. In case of the sudden change in the environment, all the sensors are reacting and the power supply can handle the load fluctuations

CONCLUSION

This Environment Monitoring System is made from low-cost components that are easily available and can be used to monitor several environmental parameters. This system can be easily be adapted for both indoor or outdoor use. The proposed system has been tested several times with different parameters, and have been successful throughout. Last but notleast, this device can connect to the gateway via Bluetooth,Infrared or WiFi with out much design changes thus making it suitable for different scenarios.This system is therefore flexible and scalable. In future the research work is intended to introduce several machine learning techniques that will give more insight to the user.Besides,to manage changes efficiently, the records can be kept in a secure immutable digitalled gerusing technologies like Block chain.

REFERENCES

1.R.R.Vokerla,B.Shanmugam,S.Azam,A.Karim,F.D. Boer,M.Jonkman,andF.Faisal,"An Overview of Blockchain Applications and Attacks," 2019 International Conference on Vision Towards Emerging Trends Communication and Networking(ViTECoN),Mar 2019.

2. A.Ahmed,M .M.R.Parvez ,M.H.Hasan,F.N.Nur,N.N.Moon ,A.Karim ,S.Azam ,B.Shanmugam ,and M.Jonkman,"AnIntelligent and Secured Tracking System for MonitoringSchoolBus,"2019InternationalConference on Computer Communication andInformatics(ICCCI), Jan. 2019.

3. C.Liang, B. Shanmugam, S. Azam ,A.Karim, A.Islam, M.Zamani, S.Kavianpour ,and N. B.Idris, "Intrusion Detection System for the Internet of Things Based on Block chain and Multi-Agent Systems,"Electronics, vol. 9, no.7,Jul.2020.

4.M.A.Uaday, M.N.I.Shuzan ,S.Shanewaze, R.I.Rakiband H.U. Zaman, "The Design of a Novel Multi- Purpose Fire Fighting Robot withVideo Streaming Capability,"2019IEEE5th International Conference for Convergence in Technology (I2CT),Bombay,India,2019.

5.M.Hasan, A.Z.Dipto,M.S.Islam,A.Sorwar,S.Islam," ASmartSemi-Automated Multifarious Surveillance Bot for Outdoor Security Using Thermal Image Processing,"Advances in Network

ISBN: 978-81-965236-7-1

THE GRAPH BASED ALGORITHMS EFFICIENTLY MAPPING VLSI

T.BRINDHA[1],
Final year,ECE VLSI Design,
Mother Terasa College Of Engineering and Technology
Mettusalai,
Pudukkottai

C.MANIVANNAN[2]
Professor,ECE VLSI Design
Mother Terasa College Of Engineering and Technology
Mettusalai,
Pudukkottai

ABSTRACT

This thesis introduces a set of graph-based algorithms for efficiently mapping VLSI circuits using simple cells. The proposed algorithms are concerned to, first,effectively minimize the number of logic elements implementing the synthesized circuit. Then, we focus a significant efforton minimizing the number of inverters in between these logic elements. Finally, this logic representation is mapped into a circuit comprised of only two-input NANDs and NORS, along with the inverters. Two-input XORs and XNORs can also be optionally considered. As we also consider sequential circuitsinthiswork,flip-flopsaretakeninto account as well. Additionally, with high- effort optimization on the number of logic elements, the generated circuits may contain some cells with unfeasible fanout for current technology nodes.Inorder to fix these occurrences, we propose an area-oriented, level-aware algorithm for fanout limitation. The proposed algorithms were applied over a set of benchmark circuits and the obtained results have shown the usefulness of the method. We show that efficient implementations in terms of inverter count, transistor count, area, power and delay can be generated from circuits with a reduced number of both simple cells and inverters, combined with XOR/XNOR-based optimizations. The proposed buffering algorithm can handle all unfeasible fanout occurrences, while (i) optimizing the number of added inverters; and(ii)assigning cells to the inverter tree based on their level criticality. When comparing with academic and commercial approaches, we are able to simultaneously reduce the average number of inverters, transistors, area, power dissipation and delay up to 48%, 5%, 5%, 5%, and 53%,respectively. As the adoption

ISBN: 978-81-965236-7-1

of a limited set of simple standard cells have been showing benefits for a variety of modern VLSI circuits constraints, such as layout regularity, rout ability constraints, and/or ultra low power constraints, the proposed methods can be of special interest for these applications. Additionally, some More-than-Moore applications, such as printed electronics designs, can also take benefit from the proposed approach.

Keywords: Graph-based algorithms. logic synthesis.technology mapping .standard cell library. simple cells.

INTRODUCTION

Nowadays, low power-consumption, high- speed circuits, and area are the design trade- offs in VLSI industries. The evolution of portable electronics, computing devices is the importance of low-power circuit design methodologies. Low-power-dissipation ,least delay , and area are to be needs one of them important design factors for VLSI designers. To increase the performance in VLSI circuits, there is required to be less the power saving and the area. Behind these designs, driving forces have the essential portable device different applications for less power-dissipation, minimum delay and higher throughput. An addition is an arithmetic operation,extensively used in several low-power VLSI circuits, like as specific application DSP architectures and microprocessors. These modules are used for many arithmetic operations, like as addition ,subtraction[1].Thus ,these facts of view, the design of a mapping circuit are having low-power-dissipations, lower the delay, and high speed performance [1-15]. Many researchers are emphasizing on circuit performance through the minimum level of transistor count. XOR-XNOR circuit are the basic structures block of F-A. The increasing the performance of an XNOR- XOR circuit can be significantly increases the better perform of the F-A design.

Static RAM memories (XNOR-XORs) are hardware search engines that are much faster than algorithmic approaches for search- intensive applications. XNOR-XORs are composed of conventional semiconductor memory (usually XNOR-XOR) with added comparison circuitry that enables a search operation to complete in a single clock cycle. The two most common search- intensive tasks that use XNOR-XORs are packet forwarding and packet classification in Internet routers. I introduce XNOR-XOR architecture and circuits by first describing the application of lookup in Internet routers.

ISBN: 978-81-965236-7-1

Then we describe how to implement this lookup function with XNOR-XOR.

XNOR-XOR Application :Router Lookup

Internet routers forward data packets from an incoming port using an lookup function. The lookup function examines the packet's destination and chooses an output port associated with that . The router's list of destination and their corresponding output ports is called the routing table. An example of a simplified routing table is displayed in Table1. All four entries in the tableare5-bitwords,with the don't care bit,X, matching both a 0 and a 1 in that position. Because of the X bits, the first three entries in Table1 represent a range of input es, i.e. the entry on Line 1 indicates thatallesintherangeof10100_2—$10111_2$are forwarded to port A. The router searches for the destinationof each incoming packet in thelookup table to find the appropriate output port. For example, if the router receives a packet with the incoming01101, thelookup matches both Line 2 and Line 3 in the table. Line 2 is selected since it has the most defined bits, indicating it is the most direct route to the destination. This lookup style is called longest-prefix matching and is required to implement the most recent Internet Protocol (IP) networking standard.

Line No.	(Binary)	Output Port
1	101XX	A
2	0110X	B
3	011XX	C
4	10011	D

Table1:Simplifiedroutingtable.

The routing parameters that determine the complexity of the implementation are the entry size, the table size, the search rate, and the table update rate. Present IPv4 es are 32 bits long and proposed IPv6 es are 128 bits long. Ancillary information like the source and quality-of-service (QoS) information can balloon IPv6 routing table entry sizes to 288—576 bits. Currently, routing table sizes are about 30,000 entries but are growing rapidly. Terabit-class routers must perform hundreds of millions of searches per second in addition to thousands of routing table updates per second.

ISBN: 978-81-965236-7-1

Static RAM Memory

The remainder of this introduction assumes you have some familiarity with the operation of transistors and basic circuit organizations of random-access memory(RAM).There are two basic forms of XNOR-XOR: binary and ternary. Binary XNOR-XORs support storage and searching of binary bits, zero or one (0,1). Ternary XNOR-XORs support storing of zero ,one,or don't care bit(0,1,X). Ternary XNOR-XORs are presently the dominant XNOR-XOR since longest-prefix routing is the Internet standard. Figure1 shows a block diagram of a simplified 4 x 5 bit ternary XNOR-XOR with a NOR-based architecture. The XNOR-XOR contains the routingtablefromTable1toillustratehowa XNOR-XOR implements lookup. The XNOR-XOR core cells are arranged into four horizontal words, each five bits long. Core cells contain both storage and comparison circuitry. These arch lines run vertically in the figure and broadcast the search data to the XNOR-XOR cells.The match lines run horizontally across the array and indicate whether the search data matches the row's word. An activated match line indicates a match and a deactivated match line indicates a non-match, called a mismatch in the XNOR-XOR literature. The match lines are inputs to an encoder that generates thecorresponding to the match location.

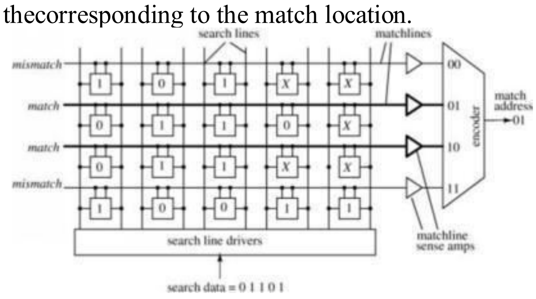


Figure 1: NOR-based XNOR-XOR architecture

AXNOR-XOR search operation begins with pre charging all match lines high, putting them all temporarily in the match state.Next, the search line drivers broadcast the search data, 01101 in the figure, onto the search lines.

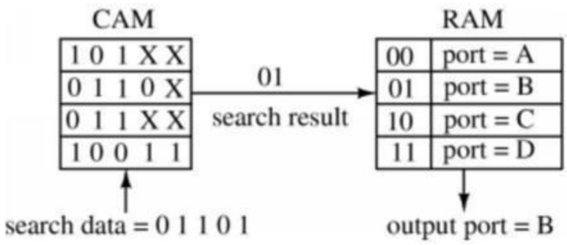


Figure2:lookup with XNOR-XOR/RAM.

XNOR-XOR Circuits

Conventional XNOR-XOR core cell that stores data using positive feedback in back- to-back inverters.Two access transistors

ISBN: 978-81-965236-7-1

connect the bit lines,bland/bl(we use the prefix/to denote the logical complement in the text and we use an over bar in the figures), to the storage nodes under control of the word line,wl. Data can be read from the cell or written into the cell through the bit lines. use this differential cell as the storage for building XNOR-XOR cells. Figure3(b) depicts a conventional binary XNOR-XOR (BXNOR-XOR) cell with the match line denoted ml and the differential search lines denoted sl and/sl. The figure also lists the truth value,T, stored in the cell based on the values of d and d. Read and write access circuitry is omitted or clarity in this figure and subsequent XNOR-XOR core cell figures. For a binary XNOR-XOR, we store a single bit differentially. The comparison circuitry attached to the storage cell performs a comparison between the data on the search lines(sland/sl) and the data in the binary cell with an XNOR operation(ml =!(dXORsl)) .A mismatch in a cell creates a path to ground from the match line through one of the series transistor pairs.A match of d and sl disconnects the match line from ground.

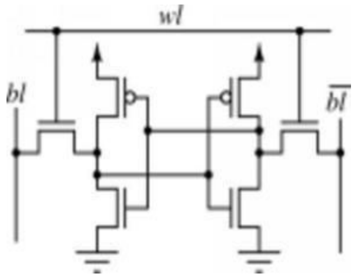


Figure3:6-transistorXNOR-XORcell.

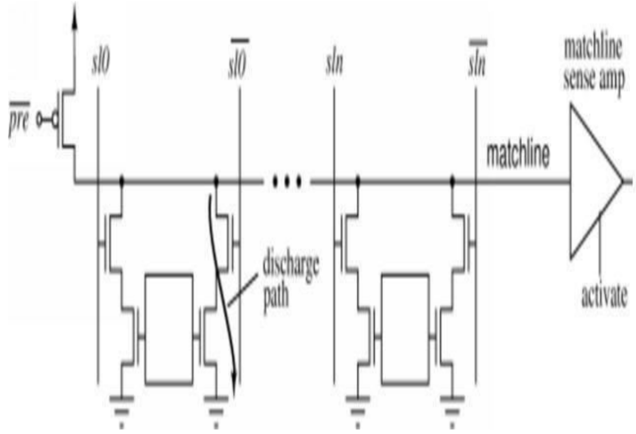


Figure 4: The match line of a NOR-based XNOR-XOR.

In typical use, a XNOR-XOR has only one or a small number of matches and most words mismatch. Since mismatches dominate, most match lines transition both during pre charge and during evaluation.This leads to a high power consumption on the match lines. Further, the search-lines, which broadcast the data to the XNOR-XOR cells are highly capacitive. The search-lines are another large source of power dissipation in XNOR-XOR. Because of these large sources of power dissipation,recent research in XNOR-XOR design focuses on circuit techniques for reducing power consumption.

ISBN: 978-81-965236-7-1

LITERATUREREVIEW

Static RAM Memory (XNOR-XOR) Circuits and Architectures: A Tutorial and Survey

In this system to design XNOR-XOR circuits and architectures, with an emphasis on high-capacity XNOR-XOR. First, to motivated discussion by showing how XNOR-XORs can be applied to packet forwarding in network routers. At the circuit level, reviewed the two basic CMOS cells, namely the NOR cell and the NAND cell. Also shown how the cells are combined in a match line structure to form a XNOR-XOR word. explored the conventional pre charge- high scheme for sensing the match line, as well as several variations that save match line power including low-swing sensing, the current-race scheme, selective precharge, pipelining, and current saving scheme. We have also reviewed the conventional approach for driving search lines, and the power-saving approaches which eliminate the search line pre charge or employ hierarchical search lines.At the architectural level, we have reviewed three architectures for reducing XNOR-XOR power, namely bank-selection, pre-computation, and dense encoding.Finally,have presented our views of future development in the XNOR-XOR field.

A Cross-Layer Framework for Designing and Optimizing Deeply-Scaled reduced T- Based Cache Memories

Seven reduced T devices optimized for a 7- nm process technology along with three XNOR-XOR cells were evaluated and compared using our cross-layer design framework. The high_l device has the lowest OFF current and the highest ON/OFF currentratio.Moreover,the8TXNOR-XOR cell achieves the highest noise margins, which guarantees its robust operation.At the cache level, it is observed that L1 cache memory made of high_l devices operating at the near-threshold regime achieves the minimum energy operation point, whereas cache memories made of high_tsi (high_tox) devices for the 8T (6T-1) XNOR-XOR cell operating at the super-threshold regime achieve the minimum energy-delay product point. The 8T XNOR-XOR cell has an excellent read SNM, and thus, the 8T XNOR-XOR is the preferred choice of memory cell due to reliability considerations.

ISBN: 978-81-965236-7-1

EXISTING SYSTEM

CORE CELLS AND MATCHLINE STRUCTURE

A XNOR-XOR cell serves two basic functions: bit storage (as in RAM) and bit comparison (unique to XNOR-XOR). Fig. 5 shows a NOR-type XNOR-XOR cell [Fig. 5(a)] and the NAND-type XNOR-XOR cell [Fig. 5(b)]. The bit storage in both cases is an XNOR-XOR cell where cross-coupled inverters implement the bit-storage nodes D and. To simplify the schematic, we omit the nMOS access transistors and bit lines which are used to read and write the XNOR-XOR storage bit. Although some XNOR-XOR cell implementations use lower area DRAM cells [27], [30], typically, XNOR-XOR cells use XNOR-XOR storage. The bit comparison, which is logically equivalent to an XOR of the stored bit and the search bit is implemented in a somewhat different fashion in the NOR and the NAND cells.

NOR Cell

The NOR cell implements the comparison between the complementary stored bit, D, and the complementary search data on the complementary search line, SL, using four comparisontransistors,M_1throughM_4, which are all typically minimum-size to maintain high cell density. These transistors implement the pull down path of a dynamic XNOR logic gate with inputs SL and D. Each pair of transistors, M1/M4 andM2/M3, forms a pull down path from the match line, ML, such that a mismatch of SL and D activates least one of the pull down paths, Connecting ML to ground. A matchof SL and D disables both pull down paths, disconnecting ML from ground.

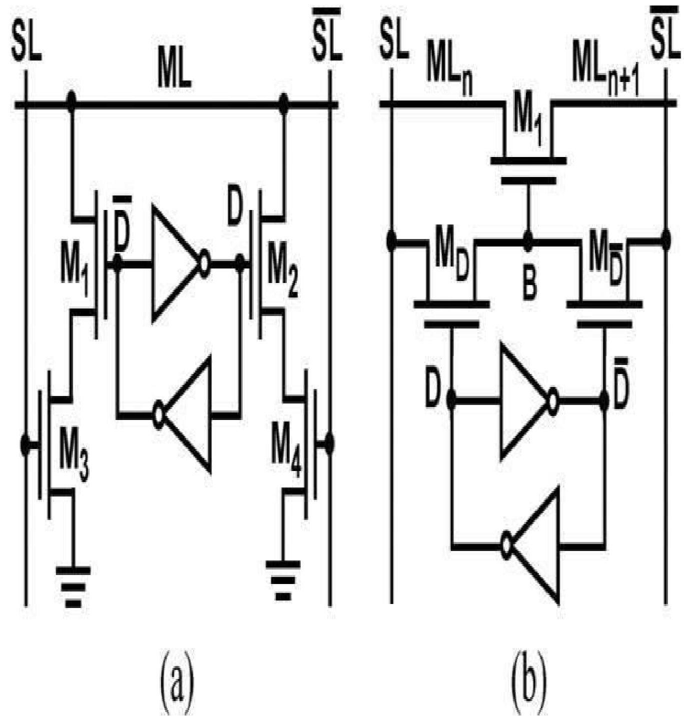


Fig. 5.XNOR-XOR core cells for (a) 10-T NOR-type XNOR-XOR and(b)9-T NAND-
type XNOR-XOR. The cells are shown using XNOR-XOR-based data-storage cells. For simplicity, the figure omits the usual XNOR-XOR access transistors and associated bi lines. The XNOR-XOR storage and access transistors account for six of the cell transistors.

ISBN: 978-81-965236-7-1

NAND Cell

The NAND cell implements the comparison between the stored bit,D ,and corresponding search data on the corresponding search lines, $(SL, \overline{SL})$, using the three comparison transistors , M1,MDand $M\overline{D}$,which are all typically minimum-size to maintain high Cell density.We illustrate the bit-comparison operation of a NAND cell through an example. Consider the case of a match when SL=1andD=1. Pass transistor is ON and passes the logic ―1‖ on the SL to node B. Node B is the bit-match node which is logic ―1‖if there is a match in the cell.The logic ―1‖on node B turns ON transistor.Note that is also turned ON in the other match case. In this case, the transistor passes logic high to raise node B. The remaining cases result in a miss condition, and accordingly node B is logic ―0‖ and the transistor is OFF. Node B is a pass-transistor implementation of the XNOR function.

PROPOSED SYSTEM

Power dissipation due to memories has become a major concern of modern digital design. Scaling of CMOS technology has lead to short channel effects. Here XNOR- XOR cells are designed using reduced T which have better gate control over drain to source current. The XNOR-XOR cells designed with 30nm LG are used in multi- segment hybrid XNOR-XOR architecture. The results are compared with the original hybrid XNOR-XOR. It is observed that the energy metric of proposed architecture is7% less compared to hybrid XNOR-XOR.

In Static RAM Memory (XNOR-XOR), the input is associated with the data stored in the memory and output is the location where the content is stored. XNOR-XOR can be used as a search engine for finding the matched contents in a database or a table. In XNOR- XOR applications where more than one word may match, a priority encoder isused1. Internet is a combination of routers and switches. Packets are sent from source to destination with the help of router. The task of a router is to connect multiple networks and compare the destination of packets such that the packet reaches proper destination. Routers use lookup operation which demands fast search operation thus lookup can be implemented using XNOR- XOR. But there is trade off among the speed of XNOR-XOR, silicon area and power consumption. ICs use a few percentage of world's electricity today but power per chip is growing. If power consumption is not reduced,industry's future growth will be at

ISBN: 978-81-965236-7-1

risk. To achieve performance, lower power consumption and portability, CMOS devices have been scaling down for years. To control the power consumption, the supply voltage is scaled down but leads to several problems such as short channel effects,drain induced barrier lowering, sub threshold slope degradation, and punch through, hot electron effect and leakage power3.Memory consumes 60–70% of the total power consumption in a chip2. Leakage power is a major concern in memories. reduced T can enhance the drive current of MOS structures and can improve the very daunting short channel effect that affects I-Vcharacteristics of the device4. In this paper, shorted gate reduced T is used in which the two gates are shorted together to give high current drive (ION).

Static RAM Memory(XNOR-XOR)

The XNOR-XOR mainly consists of an array of memory cells. Each cell has two units, store unit and compare unit. The store unit, which uses Cross-Coupled 6T XNOR- XOR, is used for storing the bit. The compare unit made of pass transistor logic is used to compare the search bit and stored bit. The XNOR-XOR cell can be of either XOR or XNOR type as shown in Figure 1. The output of compare unit is fed to gate terminal of pull-down transistor N5. Based on the output of compare unit, the transistor may turn ON or OFF. Match line is connected to the pull-down transistor. If the transistor is ON (OFF), the match line discharges (charges)2 . Conventionally,there are two types of XNOR-XOR designs: NOR type and NAND type. In any XNOR- XOR design, there are two phases precharge and evaluation. In pre charge phase, the match line is charged to high voltage level and in evaluation phase, the data in store unit and cc

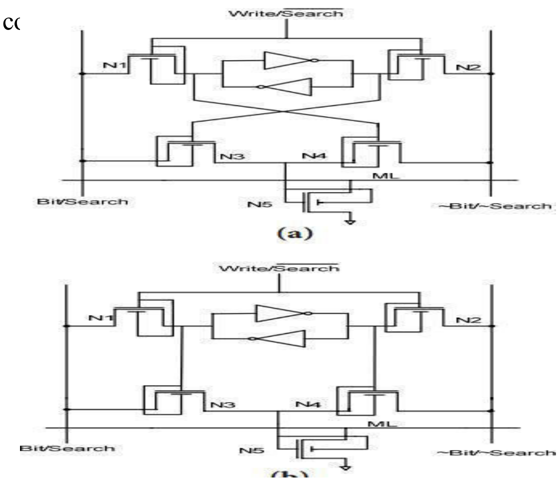


Figure 6.Typical XNOR-XOR Cell. (a)XOR type. (b) XNOR type.

In the current age of technology advancement it is necessary to design different new concepts to reduce area of the cell as well as power consumption. The adders are always meant to be the most

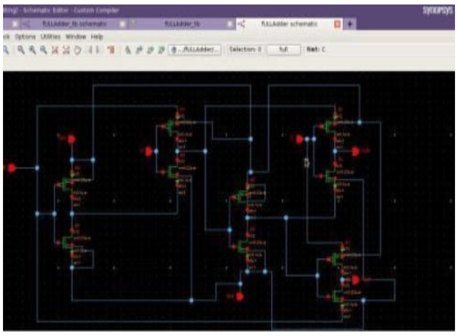
ISBN: 978-81-965236-7-1

fundamental requirements for process of high performance and other multi core devices. In present work a new XNOR gate using three transistors has been designed, which shows power dissipation of0.03866W in 90nm technology with supply voltage of 1.2V. A single bit mapping using eight transistors has been designed using proposed XNOR cell and a multiplexer, which shows power dissipation of 0.07736W. It is implemented by using synopsys tool(version-L-2016.06-8) using custom compiler with 90nm technology.

Methodology

Conventional 10T Mapping: The schematic of the conventional 10T CMOS mapping is shown in Fig 1.The 10T CMOS mapping circuit design is optimized to consume less power and less fabrication area with lesser internal capacitance. Respective simulation results showing the output waveform and output power of 10T mapping design with 90nm CMOS technology are depicted in fig.2 and fig.6.

Conventional10Tmapping



SYSTEM DESIGN

SOFTWARE REQUIREMENTS:

- Tanner

In this project we are using TANNER EDA Tool for simulation.

Introduction About Tanner

Tanner Tools Pro is a software suite for the design, layout and verification of analog, mixed-signal, RF and MEMS ICs. Tanner Tools Pro consists of fully-integrated front end and back end tools, from schematic capture, circuit simulation, and waveform probing to physical layout and verification

CONCLUSION AND FUTURE WORK

The proposed approach was validated by mapping benchmark circuits using two-input NANDs and NORs, inverters and flip-flops. Two-input XORs and XNORs were also considered. The obtained results were evaluated in terms of different cost functions, such as inverter count, transistor count, power, area and performance. When comparing the obtained results against state- of-the-art algorithms for technology mapping,the proposed approach shows its

ISBN: 978-81-965236-7-1

usefulness. When comparing with academic and commercial approaches, we are able to simultaneously reduce the average number of inverters, transistors, area, power dissipation and delay up to 48%, 5%, 5%, 5%, and 53%, respectively. There is still much work to be carried on. A coarse- grained,program-level parallel approach can be used to speed up the proposed AIG node count minimization approach. Instead of running 1 serial execution of 5 minimization approaches,all of them can be ran in parallel and speed up this optimization step. Also, a standard cell with different drive strengths could also be used in the case of timing constrained synthesis, so that a gate sizing step would handle the necessary trade-off. 86 Finally, for advanced technology, the wire delay is becoming more important than cell delay(especially for long wires) and the circuit performance can significantly change after place and route. Thus, we aim to apply such a simple-cell-based approach under a physically-aware logic synthesis environment. Experiments on this way were presented already (MATOS; REIS, 2015; MATOSetal.,2015b)and we also proposed an innovative flow to bring technology information(specially related with place and route) to the early steps of logic synthesis (REIS;MATOS,2017). None the less,even if the presented research opened the way for several future works,the current results have shown the computational and practical viability of the methods presented herein. The proposed algorithms have been proved useful for efficiently mapping VLSI circuits based on simple cells. The proposed algorithms can bring benefits for most of the VLSI applications constrained to simple cells referred in this work.

REFERENCES

[1] K.Pagiamtzisand A.Sheikholeslami, ―Static RAM memory (XNOR-XOR) circuits and architectures: A tutorial and survey,‖ IEEE J. Solid-State Circuits, vol.41, no. 3, pp. 712–727, Mar. 2006.

[2] S. Hanzawa, T. Sakata, K. Kajigaya, R. Takemura ,and T.Kawahara,―Alarge-scale and low-power XNOR-XOR architecture featuring a one-hot-spot block code for IP- lookup in a network router,‖ IEEE J. Solid- StateCircuits,vol.40,no.4,pp.853–861, Apr. 2005.

[3] I. Arsovski and A. Sheikholeslami, ―A mismatch-dependent power allocation technique for match-line sensing in Static RAM memories,‖ IEEE J. Solid-State Circuits,vol.38,no.11,pp.1958–1966, Nov. 2003.

ISBN: 978-81-965236-7-1

[4] K.Pagiamtzisand A.Sheikholeslami, —A low-power Static RAM memory (XNOR-XOR) using pipelined hierarchical search scheme,‖ IEEE J. Solid-StateCircuits,vol.39,no.9,pp.1512–1519,Sep. 2004.

[5] K. Roy, S. Mukhopadhyay, and H. Mahmoodi-Meimand, —Leakage current mechanisms and leakage reduction techniques in deep-sub micrometer CMOS circuits,‖ Proc. IEEE, vol. 91, no. 2, pp. 305–327, Feb. 2003.

[6] A. Bansal, S. Mukhopadhyay, and K. Roy, —Device-optimization technique for robust and low-power reduced TXNOR- XOR design in nanoscale era,‖ IEEE Trans. ElectronDevices,vol.54,no.6,pp.1409–1419, Jun. 2007.

[7] A. N. Bhoj and N. K. Jha, —Parasitics- aware design of symmetric and asymmetric gate-work function reduced TXNOR-XORs,‖ IEEE Trans. Very Large Scale Integr. (VLSI)Syst.,vol.22,no.3,pp.548–561, Mar. 2014.

[8] A.N.BhojandR.V.Joshi,—Transport- analysis-based 3-D TCAD capacitance extraction for sub-32-nm XNOR-XOR structures,‖ IEEE Electron Device Lett., vol. 33, no. 2, pp. 158–160, Feb. 2012.

[9] P. M. Solomon et al., —Two gates are better than one[double-gate MOSFET process],‖ IEEE Circuits Devices Mag., vol. 19, no. 1, pp. 48–62, Jan. 2003.

[10] E.J.Nowaketal.,—Turning siliconon its edge [double gate CMOS/reduced T technology],‖ IEEE Circuits Devices Mag., vol. 20, no. 1, pp. 20–31, Jan./Feb. 2004.

ISBN: 978-81-965236-7-1

IoT and Machine Learning based Crop Growth Analysis and Disease Detection in Greenhouse Environment

Sujitha S[1],Karthika R[2],Sruthi Rega K[3],Janani.S[4]
[1,2,3] UG Students,Department of Electronics and Communication Engineering,
[4]Associate Professor,Department of Electronics and Communication Engineering,
Periyar Maniammai Institute of Science and Technology , Vallam -613403, Thanjavur ,Tamilnadu , India.

ABSTRACT

This research paper presents an innovative approach combining Internet of Things (IoT) technology with machine learning (ML) algorithms for plant growth monitoring and disease detection in smart greenhouse environments. The proposed system utilizes IoT sensors to collect real-time data on environmental factors such as temperature, humidity, soil moisture, and light intensity, as well as plant physiological parameters. Machine learning models are then employed to analyze this data and detect anomalies indicative of plant stress or disease onset. By integrating ML-based disease detection algorithms with automated control systems, the smart greenhouse can promptly identify and respond to potential threats, thereby optimizing plant health and crop yield. There are various mathematical models for describing the growth of the plants by applying Reinforcement Learning (RL) approach for optimal growth control.

Keywords:

- **Internet of Things(IoT)**
- **Machine Learning (ML)**
- **Smart Greenhouse**
- **Plant growth monitoring**
- **Disease detection**
- **Sustainable Agriculture**

1. INTRODUCTION:

In recent years, the agricultural industry has witnessed a significant transformation driven by advancements in technology, particularly the integration of Internet of Things (IoT) and machine learning (ML) techniques. One notable application of this convergence is the development of smart greenhouse systems, which offer unprecedented capabilities for monitoring and optimizing plant growth conditions. These systems leverage IoT sensors to gather real-time data on environmental parameters such as temperature, humidity, soil moisture, and light intensity, providing growers with valuable insights into the conditions within the greenhouse. This research paper addresses this challenge by proposing an integrated approach that combines IoT technology with ML algorithms for plant growth monitoring and disease detection in smart greenhouse environments. Utilizing hydroponic systems as an alternative to traditional agriculture holds immense potential for addressing Egypt's burgeoning population growth. One of the primary obstacles encountered in protected agriculture involves maintaining optimal environment conditions within greenhouse structures. The traditional hydroponics agriculture systems are currently lacking significant advancements in networking technology, particularly in effectively controlling the various influencing factors within the greenhouse environment. Addressing these challenges requires continuous monitoring of essential growth parameters and real-time measurement of all relevant factors to ensure optimal conditions for plant growth and productivity. To overcome from these challenges a large set of datas were collected and regression model was created using machine learning algorithm. Here IoT automation is introduced by collecting various datas with the help of different sensors as PH sensor, EC sensor, water and air temperature sensor, light sensor, and GSM/ GPRS. Machine learning is the current technology which is benefiting farmers to minimize the losses in the farming by providing rich recommendations and insights about the crops. The data analyst challenge concerns the application of predictive algorithms and machine learning to analyze data collected from IoT devices. By leveraging this data, we can develop solutions to optimize farming practices, improve crop yields, and reduce resource usage. Essentially, it's about using advanced analytics to make farming more efficient and sustainable. In this IoT technologies the sensors must be maintained frequently since it get damaged in agricultural environment. The IoT enabling technologies applied for this development comprise of image processing tools, single-board microcontroller, temperature and humidity measuring sensor and a testing platform, those are helpful for collecting datas. In this review paper IoT and ML is used for monitoring plant growth and disease detection based on image processing through Supervised learning algorithm.

2. LITERATURE SURVEY AND RELATED WORKS:

Hydroponics is an innovative cultivation method which gives high quality, nutrient-rich, residue-free fruits and vegetables, promoting local, fresh and environmentally conscious agriculture. This will also has some merits and demerits. Muhammad Ikhsan Sani et al. [1] proposed the design of wireless sensor and actuator network. Here, the actuators such as mist makers and fans that can be managed by the control system which delivers water moister.

Srivani P, Yamuna Devi C et al. [2] proposed an automated system by the integration of IoT, Machine Learning , Artificial Intelligence, different cloud, data analytics methods, wireless sensor network and so on to created a prediction model. Pest control, recycling and energy conservation, water conservation and recycling, and power optimization are the issues focused in this study. Smart farming uses it to increase productivity for higher-quality crops while using less resources and reducing energy inputs. When analysing the plant growth, different environmental factors were taken into consideration. Georgios Georgiadis et al. [3] developed a system , within this agricultural setup, sensors collect diverse data, forwarding it to an IoT platform through data APIs, where machine learning aids in generating helpful recommendations for agronomists. Where sensors are used to measure the parameters and the required information are sent to IoT platform, which uses data API's for communication and exchange of data. Machine learning can be used which will provide recommendations to facilitate the workload of professional agronomists. However, the challenge arises when nodes need repositioning and sensor network reconfiguration due to corrosion, causing irregular moisture readings. By incorporating machine learning algorithms, the prediction of maximum yields becomes a streamlined and intelligent process [4,5]. Addressing challenges in traditional farming, a solution emerges through the fusion of hydroponic techniques and IoT technology, forming a smart control system. This system autonomously manages plant nutrition and water requirements[6,7].Sensors within the greenhouse assess climatic conditions, signalling the microcontroller and actuators to respond accordingly, ensuring a secure environment unaffected by external weather influences[8].Greenhouses provide a controlled environment for crops by shielding them from external weather conditions using materials like glass, fiber, or polythene. Sensors are deployed to monitor the climate inside the greenhouse, determining if conditions are optimal for harvesting. When the sensors detect suitable conditions, they send signals to a microcontroller, which in turn activates actuators to perform necessary actions, ensuring the crops are harvested at the right time for optimal yield and quality[9,10].Plant diseases primarily target plant leaves, affecting crop growth and quality. Early detection and identification of leaf diseases are crucial to mitigate economic losses.[11] An experiment was conducted to implement IoT infrastructure for this purpose. The setup includes a Raspberry Pi processor with quad-core 64-bit ARM architecture and a 1.2 GHz clock speed, along with a dual-core GPU for multimedia support. A webcam interface is attached to the Raspberry Pi for capturing leaf images, which are then compared with a database of compiled images. Disease detection employs image recognition techniques such as Open CV. The Bhattacharyya Distance Calculation is utilized to measure similarity between probabilistic distributions, aiding in plant illness diagnosis. This technique helped for detecting the early plant diseases[12].

Climate Control:

ML algorithms such as supervised learning are used for predicting optimal climate conditions based on historical data. IoT sensors are used to monitor temperature, humidity, and light levels. Control algorithms to adjust climate parameters in real-time.

Crop Monitoring:

Image recognition ML algorithms are used for plant health assessment. IoT cameras and sensors are used to capture and transmit data on plant growth and conditions.

Water Management:

ML models for predicting irrigation needs based on soil moisture, weather forecasts, and plant type. IoT-connected to collect data with the help of soil moisture sensors for real-time monitoring.

Energy Efficiency:

ML algorithms to optimize energy consumption based on usage patterns. IoT-connected devices for smart energy management.

Automated Pest Control:

ML algorithms used for identifying and predicting pest infestations. IoT sensors and actuators for automated pest control mechanisms.

Harvesting Optimization:

ML models for predicting the optimal time for harvesting. IoT-connected devices for monitoring crop readiness.

Popular ML algorithms include Decision Trees, Random Forests, Support Vector Machines, and Neural Networks.

Random Forest: Effective for classification tasks, Random Forest excels in handling diverse features and large datasets, making it suitable for disease detection.

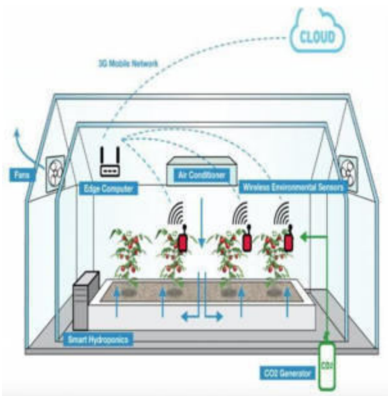
Support Vector Machines (SVM): SVM is effective in binary classification and can be applied to identify the presence or absence of diseases in crops

Neural Networks (Deep Learning): Particularly Convolutional Neural Networks (CNNs) are powerful for image-based tasks, such as detecting visual symptoms of diseases on leaves.

Decision Trees: Simple to interpret, decision trees are beneficial for crop growth analysis by mapping out decision pathways based on various input features.

K-Nearest Neighbours (KNN):Suitable for both classification and regression, KNN can be employed for disease detection based on the similarity of features.

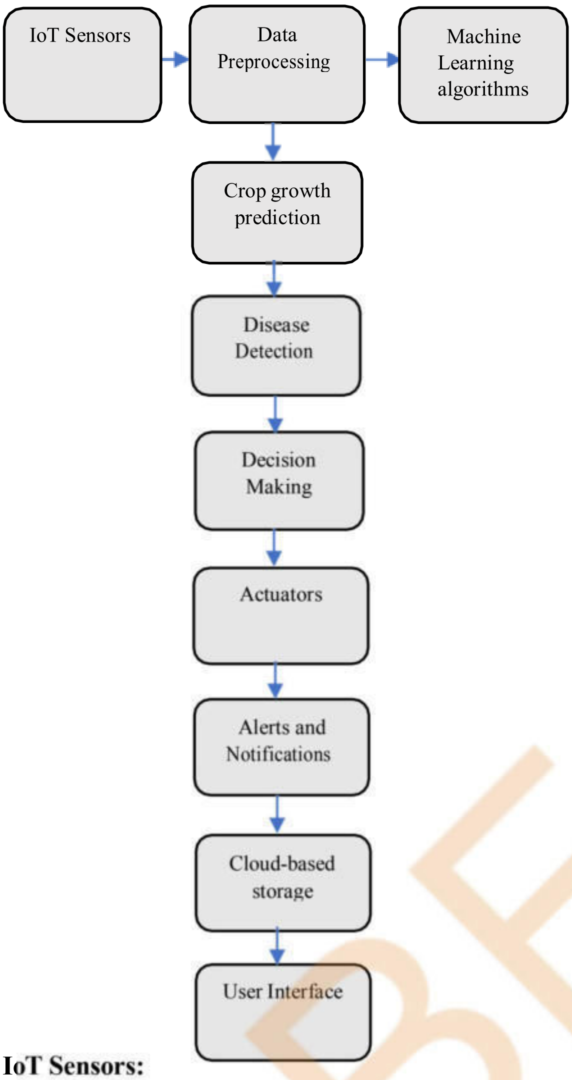
It is fascinating to see the application of supervised machine learning approaches like RF, SVM, DT, KNN, NB, and image processing methods for disease classification in plant leaves, specifically for tomatoes. The broad spectrum of factors affecting plants, from living agents like insects and pathogens to non-living elements such as environmental conditions, showcases the complexity of the classification task. This classification algorithm has also found success in a variety of fields, including medical image analysis and healthcare.



SBECW

ISBN: 978-81-965236-7-1

3.BLOCK DIAGRAM:



IoT Sensors:

Temperature, humidity, soil moisture, light intensity, and other relevant environmental parameters are monitored using IoT sensors.

Sensor Data Transmission:

Sensor data is transmitted to a central processing unit through wireless or wired communication protocols.

Data Pre-processing:

Raw sensor data undergoes pre-processing to handle noise, outliers, or missing values.

Machine Learning Models:

ML models, including supervised learning for crop growth prediction and anomaly detection for disease identification, are employed.

Crop Growth Prediction:

ML models analyze historical sensor data to predict and optimize crop growth conditions, suggesting adjustments in factors like irrigation or temperature.

Disease Detection:

ML algorithms, trained on data related to plant diseases, analyze sensor data for patterns indicative of potential diseases.

Decision Making:ML-driven decision-making processes, determine whether the crop is in optimal condition for its healthy growth or if there are any signs of diseases.

Actuators:

Actuators, such as automated irrigation systems or disease treatment mechanisms, are activated based on ML-driven decisions.

Alerts and Notifications:

In case of anomalies or disease detection, the system generates alerts or notifications for farmers or relevant authorities.

Cloud-Based Storage:

Processed data and insights can be stored in the cloud for historical analysis and future decision-making.

User Interface:

A user interface allows farmers to monitor the status of their crops, receive alerts, and make informed decisions based on ML insights.

This integrated system enables precision agriculture, optimizing resource usage, promoting healthy crop growth, and providing timely detection of potential diseases for proactive management.

RF algorithm is found to be the best algorithm for the detection of plant disease and its accuracy level is 89 percentage.

CONCLUSION:

In conclusion, combining IoT and machine learning for crop growth analysis and disease detection in greenhouse environments holds great promise in crop production. The integration of sensors and data analytics enables real-time monitoring, leading to informed decision-making for optimal crop

ISBN: 978-81-965236-7-1

conditions. This innovative approach enhances productivity, minimizes resource wastage, and contributes to sustainable agriculture practices in the evolving field of precision farming.In this review paper, we found that the most effective algorithm for plant disease classification is RF algorithm high accuracy level and this outcome will have valuable implications for enhancing disease detection and management in agriculture.

REFERENCES:

[1] Muhammad Ikhsan Sani, Aris Pujud Kurniawan, Web- based monitoring and control system for aeroponics growing chamber, International Conference on Control, Electronics, Renewable Energy and Communications, 978-1-5090-0744-8/ 16/2016 (IEEE)

[2] Srivani P, Yamuna Devi C, A controlled environment agriculture with hydroponics: variants, parameters, methodologies and challenges for smart farming, Fifteenth International Conference on Information Processing, 978-1-7281-3807-7/2019 IEEE.

[3] Georgios Georgiadis, Andreas Komninos, Andreas Koskeris, John Garofalakis, Implementing an Integrated IoT for Hydroponic Agriculture, Springer Nature Switzerland AG, 2021, https://doi.org/10.1007/978-3-030-67197-6_5. Data Science and Internet of Things

[4]486 Manav Mehra, Sameer Saxena, Sankaranarayanan Suresh, IoT based hydroponics system using Deep Neural Networks, 2018, Comput. Electron. Agric. October 2018) 473 (Elsevier).

[5]M Srinidhi H K, Shreenidhi H S, Smart Hydroponics system integrating with IoT and Machine learning algorithm, International Conference on Recent Trends on Electronics, Information, Communication &Technology, 978-1-7281-9772-2/2020 IEEE | DOI: 10.1109/RTEICT49044.2020.9315549.

[6] Nico Surantha Herman, Intelligent monitoring and controlling system for hydroponics precision agriculture, in: 7th International Conference on Informationand Communication Technology, IEEE, 2019, 978-1- 5386-8052-0.

[7] Konstantinos Tatas, et al., Reliable IoT-based monitoring and control of hydroponic systems, Technologies 10 1 (2022) 26

[8] R.Vidhya, DrK.Valarmathi, Survey on automatic monitoring of hydroponics farms using IoT, International Conference on Communication and Electronics Systems, 978-1-5386-4765-3/18/2018 IEEE.

[9] Georgios Georgiadis, Andreas Komninos, Andreas Koskeris, John Garofalakis, Implementing an Integrated IoT for Hydroponic Agriculture, Springer Nature Switzerland AG, 2021, https://doi.org/10.1007/978-3-030-67197-6_5. Data Science and Internet of Things

[10] Tholib Hariono, Mukhamad Cahyono Putra, Data acquisition for monitoring IoT-based hydroponic automation system using ESP8266, Newton: Netw. Inform. Technol. 1 (1) (2021) 1–7.

[11] Ferentinos K 2018 Deep learning models for plant disease detection and diagnosis Comput. Electron. Agric. 311–8.

[12] Bashish D A, Braik M and Bani-Ahmad S 2011 Detection and classification of leaf diseases using k-means-based segmentation and neural-networks-based classification Information Technology Journal 10 267–75

SPECW

ISBN: 978-81-965236-7-1

INTERNET OF THINGS (IOT) INFRASTRUCTURE FOR NEXT-GENERATION APPLICATIONS: A SURVEY PAPER

Sivaguru R, Ravikumar K, Abdulkalamazad G, Babu G
[1,3,4]Assistant Professor, Department of Computer Science and Engineering, KnowledgeInstitute of Technology, Salem-637504.
[2]Associate Professor, Department of Computer Science and Engineering, KnowledgeInstitute of Technology, Salem-637504.
(rsgcse@kiot.ac.in, krkcse@kiot.ac.in, gacse@kiot.ac.in, gbcse@kiot.ac.in)

Abstract: **The Internet of Things (IoT) has emerged as a transformative technology, enabling innovative applications across various sectors. With the rapid advancements in IoT devices, sensors, and connectivity technologies, it is crucial to develop a robust infrastructure to support the next generation of IoT applications. This survey paper aims to provide a comprehensive overview of the current state-of- the-art IoT infrastructure, focusing on its components, challenges, and future directions. Through an extensive review of existing literature and research, this paper identifies key trends, protocols, architectures, and technologies that form the foundation of an efficient IoT infrastructure. Additionally, it discusses the challenges associated with scalability, interoperability, security, and energy efficiency, while highlighting potential solutions and research directions for each of them [1]. By synthesizing the findings from various academic and industrial sources, this paper aims to serve as a reference guide for researchers and practitioners seeking to understand and contribute to the development of IoT infrastructure for next-generation applications.**

Keywords: **Internet of Things (IoT), Infrastructure, Next-generation applications, Survey paper, Smart devices, Wireless communication, Cloud computing, Edge computing, Data analytics, Sensors**

1. INTRODUCTION

The Internet of Things (IoT) has emerged as a transformative technology that connects physical devices and objects to the internet, enabling them to collect, exchange, and analyze data. This has opened up a world of possibilities for next-generation applications that leverage real-time insights and automation to improve efficiency, enhance safety, and optimize operations.

However, building and deploying IoT applications requires a robust infrastructure that can support the massive influx of data, ensure secure and reliable communication, and enable seamless integration with existing systems [2]. This infrastructure encompasses various components, including hardware, software, connectivity, and analytics capabilities.

Hardware Components: The hardware components of an IoT infrastructure include sensors, actuators, and embedded systems that enable devices to collect and transmit data. Sensors can capture information about the physical environment, such as temperature, humidity, and motion, while actuators can interact with the physical world and perform actions based on data insights [3]. Embedded systems, on the other hand, are the brains of IoT devices that process data and communicate with other devices or the cloud.

Software Components: Software plays a crucial role in enabling communication, data processing, and analytics within an IoT infrastructure. It includes the firmware and operating systems that run on IoT devices, as well as the software platforms and frameworks that facilitate data collection, storage, and analysis. This software layer also encompasses security protocols and mechanisms to protect sensitive data from unauthorized access.

Connectivity: Connectivity is a critical aspect of an IoT infrastructure as it allows devices to communicate with each other and with the cloud. Various connectivity options are available, including cellular networks, Wi-Fi, Bluetooth, and Low Power Wide Area Networks (LPWANs). The choice of connectivity depends on factors such as range, bandwidth, power consumption, and cost [4]. In some cases, edge computing can be leveraged to process data closer to the devices, reducing latency and bandwidth requirements.

ISBN: 978-81-965236-7-1

Analytics Capabilities: The vast amount of data generated by IoT devices can be overwhelming without the ability to process and analyze it effectively. Analytics capabilities play a crucial role in extracting valuable insights from IoT data, enabling predictive maintenance, real-time monitoring, and intelligent decision-making. Advanced analytics techniques, such as machine learning and artificial intelligence, can be utilized to uncover patterns, anomalies, and correlations in IoT data.

2. IOT INFRASTRUCTURE COMPONENTS

IoT Devices and Sensors:

IoT devices are the physical components that collect data from the environment or interact with other devices. These devices can include sensors, actuators, gateways, and wearables. Sensors are responsible for gathering data such as temperature, pressure, humidity, motion, and more. IoT devices can be connected via various communication protocols to transmit data to a central system or other devices [5].

Communication Protocols:

Communication protocols are essential for IoT devices to exchange data and information. The choice of protocol depends on factors such as range, power consumption, bandwidth, and security requirements. Some commonly used IoT communication protocols include MQTT (Message Queuing Telemetry Transport), CoAP (Constrained Application Protocol), HTTP (Hypertext Transfer Protocol), and Zigbee.

Network Technologies:

Network technologies provide the infrastructure for connectivity between IoT devices, gateways, and central systems [6]. These technologies include Wi-Fi, Bluetooth, cellular networks (2G, 3G, 4G, and 5G), LPWAN (Low Power Wide Area Network), Ethernet, and mesh networks. The selection of network technology depends on factors such as range, power consumption, scalability, and data transfer speed.

Cloud Computing and Edge Computing:

Cloud computing and edge computing are used for processing and storing data in IoT systems. Cloud computing involves using remote servers and the internet to store and process data, while edge computing involves processing data on local devices or gateways, closer to the data source [7]. Both approaches have their advantages and are often used in combination to provide efficient and reliable IoT infrastructure.

Data Storage and Processing:

IoT systems generate massive amounts of data, and efficient storage and processing mechanisms are required to handle this data. Technologies such as databases, data warehouses, and distributed file systems are used for storing IoT data. Big data processing frameworks like Apache Hadoop and Apache Spark enable processing and analysis of large datasets [8].

Analytics and Machine Learning:

IoT data can be analyzed to extract meaningful insights and improve decision-making. Analytics techniques such as descriptive, predictive, and prescriptive analytics are applied to IoT data. Machine learning algorithms enable the detection of patterns, anomalies, and predictive modeling. These techniques help in optimizing operations, identifying faults, and enabling predictive maintenance.

User Interfaces and Visualization:

User interfaces and visualization tools are used to interact with IoT systems and present data in a meaningful way. These interfaces can be web-based dashboards, mobile applications, or specialized applications for specific industries. Visualization tools help users interpret data through charts, graphs, maps, and other graphical representations, making it easier to understand and make decisions based on the IoT data.

3. CHALLENGES IN IOT INFRASTRUCTURE

Scalability: One of the biggest challenges in IoT infrastructure is the ability to scale effectively. As the number of connected devices and data generated by these devices increases, it becomes crucial to ensure that the infrastructure can handle this growth. This includes the ability to handle the increasing data traffic, storage requirements, and processing power necessary to support a large-scale IoT network.

Interoperability: Interoperability is a major challenge in IoT infrastructure as there are numerous devices, platforms, and protocols involved. Ensuring that different devices and systems can communicate and work together seamlessly is essential for the success of IoT applications [9]. Standardization and the development of common protocols are key factors in addressing this challenge.

ISBN: 978-81-965236-7-1

SBCW

Security and Privacy: Security and privacy are significant concerns in IoT infrastructure. As more devices become interconnected, there is an increased risk of cyber attacks and data breaches. Protecting the data transmitted between devices and ensuring the confidentiality, integrity, and availability of information is critical. Additionally, addressing privacy concerns and ensuring that individuals have control over their data is essential for user acceptance and trust.

Energy Efficiency: IoT devices often operate on limited power sources, such as batteries, which presents a challenge in terms of energy efficiency. As the number of devices increases, optimizing energy consumption becomes crucial to extend battery life and reduce maintenance requirements [10]. Developing energy-efficient communication protocols and designing devices with low-power consumption are key strategies to address this challenge.

4. SOLUTIONS AND RESEARCH DIRECTIONS

Scalability Solutions:

Sharding: This solution involves dividing the blockchain network into smaller partitions called shards, each capable of processing transactions independently. This reduces the processing burden on individual nodes and improves network scalability.

State channels: State channels are off-chain solutions that allow two parties to conduct multiple transactions without involving the main blockchain network. This reduces the load on the blockchain and increases scalability [11].

Sidechains: Sidechains are separate blockchains that are connected to the main blockchain through a two-way peg. They allow for the execution of specific tasks or applications off the main blockchain, thereby improving scalability.

Layer 2 solutions: Layer 2 solutions like Lightning Network enable faster and cheaper transactions by conducting most of the transactions off the blockchain's main layer. This enhances scalability while maintaining the security of the main blockchain.

Interoperability Solutions:

Cross-chain communication protocols: These protocols enable different blockchains to exchange information and assets seamlessly. They provide interoperability between blockchains and allow users to access services across different platforms.

Atomic swaps: Atomic swaps are trustless transactions that allow users to exchange different cryptocurrencies directly on different blockchains. This enables interoperability and eliminates the need for intermediaries.

Interoperability-focused blockchains: Some blockchains are specifically designed to provide interoperability between other blockchains. They act as a bridge between different networks and facilitate seamless communication and transfer of assets.

Middleware solutions: Middleware solutions provide a unified interface for integrating different blockchains [12]. They allow developers to build applications that can interact with multiple blockchains simultaneously, enhancing interoperability.

Security and Privacy Solutions:

Cryptographic techniques: Techniques like zero-knowledge proofs, homomorphic encryption, and multi-party computation ensure data privacy and security on the blockchain. These techniques enable secure and private transactions while maintaining data integrity.

Consensus mechanisms: Different consensus mechanisms like Proof of Work (PoW), Proof of Stake (PoS), and Byzantine Fault Tolerance (BFT) provide security against malicious actors and ensure the integrity of the blockchain network.

Auditing and monitoring tools: Tools for auditing and monitoring blockchain networks help identify and prevent security vulnerabilities. They detect anomalies, monitor network activity, and provide real-time alerts for potential threats.

Immutable data storage: Blockchain's immutable nature prevents data tampering and ensures the integrity and security of stored information. It provides a secure and reliable platform for storing sensitive data [13].

Energy Efficiency Solutions:

Proof of Stake (PoS): PoS consensus mechanism consumes significantly less energy compared to Proof of Work (PoW). PoS relies on validators holding and staking a certain amount of cryptocurrency rather than performing resource-intensive computations.

Energy-efficient algorithms: Developing energy-efficient algorithms for blockchain operations can reduce the overall energy consumption. This includes optimizing data storage

ISBN: 978-81-965236-7-1

SBECW

and encryption methods to minimize computational requirements.

Renewable energy integration: Integrating blockchain networks with renewable energy sources can reduce their carbon footprint. Using renewable energy for mining or validating transactions can significantly improve energy efficiency.

Off-chain solutions: Moving some transactions or computations off the main blockchain using layer 2 solutions or side chains reduces the energy consumption of the overall network.

These solutions and research directions aim to address the challenges of scalability, interoperability, security, privacy, and energy efficiency in blockchain technology [14]. By focusing on these areas, blockchain developers and researchers can make blockchain systems more scalable, secure, and environmentally friendly while enabling seamless communication between different networks.

5. FUTURE DIRECTIONS AND EMERGING TECHNOLOGIES

5G and IoT: 5G technology is expected to revolutionize the Internet of Things (IoT) by providing faster and more reliable communication networks. With its high bandwidth and low latency, 5G will enable seamless connectivity between various IoT devices, allowing for more efficient data transmission and real-time analysis. This will enhance numerous IoT applications, such as smart cities, connected vehicles, and industrial automation.

Blockchain for IoT: Blockchain technology can provide enhanced security and trust in IoT deployments. With its decentralized and immutable nature, blockchain can ensure secure data exchange, identity verification, and smart contract execution in IoT systems. By eliminating the need for intermediaries, blockchain can enhance the efficiency and transparency of IoT networks, enabling secure and reliable communication between devices.

Artificial Intelligence and IoT: The convergence of artificial intelligence (AI) and IoT can lead to the development of intelligent IoT systems. AI algorithms can analyze large amounts of data collected by IoT devices, extract valuable insights, and make intelligent decisions. This can enable real-time monitoring and predictive maintenance in various IoT applications, improving efficiency and reducing costs [15].

Edge Intelligence: Edge intelligence refers to the deployment of AI and machine learning algorithms at the edge of the network, closer to the IoT devices. By processing and analyzing data locally, edge intelligence reduces latency and bandwidth requirements, enabling faster response times and greater autonomy in IoT systems. This is particularly beneficial for time-critical applications, such as autonomous vehicles and industrial IoT.

Quantum Computing and IoT: Quantum computing has the potential to revolutionize IoT by significantly enhancing computational power and solving complex optimization problems. Quantum computers can perform computations at an exponential speed compared to classical computers, enabling faster data analysis and more efficient algorithms for IoT applications. Quantum encryption can also provide enhanced security for IoT networks, protecting sensitive data from malicious attacks.

Overall, these emerging technologies have the potential to enhance the capabilities of IoT and lead to significant advances in various domains, including communication, security, intelligence, and computation. The integration of these technologies with IoT can unlock new possibilities and improve the efficiency, reliability, and scalability of IoT deployments.

6. CONCLUSION

This survey paper provides a comprehensive analysis of the IoT infrastructure for next-generation applications. The paper highlights the key components and challenges in building a robust IoT infrastructure to support the increasingly complex and diverse applications emerging in various domains.

The survey paper identifies the important features and functionalities required in an IoT infrastructure, including device management, connectivity, data storage, processing, and security. It also discusses the different communication protocols and standards that are being utilized to facilitate communication and interoperability between devices.

The paper further highlights the challenges in designing and deploying IoT infrastructure, including scalability, reliability, and energy efficiency. It also discusses the security and privacy concerns associated with IoT devices and data.

The survey paper concludes by discussing the future research directions and potential advancements in IoT

ISBN: 978-81-965236-7-1

SBECW

infrastructure. These include the integration of artificial intelligence and machine learning techniques, edge computing, and the development of new communication protocols to further enhance the capabilities of the IoT infrastructure.

Overall, this survey paper serves as a valuable resource for researchers, practitioners, and decision-makers who are involved in designing and implementing IoT infrastructure for next-generation applications. It provides a comprehensive understanding of the key components, challenges, and future directions in this rapidly evolving field.

References

1) J. Gubbi, R. Buyya, S. Marusic, and M. Palaniswami, "Internet of Things (IoT): A vision, architectural elements, and future directions," Future Generation Computer Systems, vol. 29, no. 7, pp. 1645–1660, Sep. 2013.
2) Y. Ji et al., "Information-centric internet of things: A definition, survey, and future directions," Journal of Network and Computer Applications, vol. 64, pp. 137–153, Mar. 2016.
3) D. G. Kim, D. Han, and J. S. Park, "Blockchain-based secure Internet of things management using smart contracts," Symmetry, vol. 10, no. 8, p. 340, Aug. 2018.
4) V. Mishra, P. D. Kumar, and A. Misra, "Architecture of IoT-enabled smart city: A survey," ACM Computing Surveys, vol. 51, no. 4, pp. 1–44, Oct. 2018.
5) M. Ali, M. D. Ameen, E. Hossain, and K.-K. R. Choo, "Internet of Things (IoT)–enabled smart environments: A systematic survey," Mobile Networks and Applications, vol. 20, no. 6, pp. 704–719, Dec. 2015.
6) Bohara, D. H. Liang, and R. Zimmerman, "Secure data storage and access control in fog-cloud environment for Internet of Things," IEEE Internet of Things Journal, vol. 4, no. 5, pp. 1490–1500, Oct. 2017.
7) Y. Park and B. Smaragdis, "Energy-efficient management of data centers in the Internet of Things," IEEE Transactions on Cloud Computing, vol. 5, no. 1, pp. 126–138, Jan. 2017.
8) S. Wang, H. Yin, Z. Wen, and P. Li, "SDN-enabled end-to-end networking for Internet of Things: A survey," IEEE Internet of Things Journal, vol. 4, no. 6, pp. 2169–2180, Dec. 2017.
9) S. M. Raza, L. Wallgren, and T. Voigt, "Middleware for Internet of Things: A survey," IEEE Internet of Things Journal, vol. 3, no. 1, pp. 70–95, Feb. 2016.
10) F. Bonomi et al., "Fog computing and its role in the Internet of Things," in Proceedings of the First Edition of the MCC Workshop on Mobile Cloud Computing, Helsinki, Finland, Aug. 2012, pp. 13–16.
11) N. Vaiyapuri and E. Jeevananthan, "A survey on zoo of machine-to-machine simulators," Internet of Things, vol. 5, pp. 131–144, Jul. 2019.
12) V. S. M. Aruna Devi and R. S. D. Wahida Banu, "Security issues on fog computing: A comprehensive survey," Journal of Ambient Intelligence and Humanized Computing, vol. 10, no. 3, pp. 1013–1025, Mar. 2019.
13) Q. Li and X. Wang, "Big data & IoT for smart cities: A survey," Knowledge-Based Systems, vol. 141, pp. 61–77, May 2018.
14) S. Li, W. Da Xu, and S. Zhao, "The internet of things: A survey," Information Systems Frontiers, vol. 17, no. 2, pp. 243–259, Apr. 2015.
15) S. Islam et al., "A comprehensive survey on fog computing: State-of-the-art and research challenges," IEEE Communications Surveys & Tutorials, vol. 20, no. 1, pp. 601–628, Firstquarter 2018.

SBCW

ISBN: 978-81-965236-7-1

An Efficient Implementation of Cooperative Tracking and Position Detection for Non-GPS Mobiles Using IEEE 802.15 and GPS Mobiles

Mr.R.ANANTHAKRISHNAN,M.E.,
Assistant Professor, Department of ECE
ak.ananth27@gmail.com,

Mrs.A.SUBHASHINI, M.E.,
Assistant Professor,Department of ECE
subhashini@jpcas.edu.in

JP College of Arts and Science, Tenkasi

Abstract--**Disruption tolerant networks (DTNs) are sparse mobile ad hoc networks where nodes connect with each other intermittently. Since DTNs allow people to communicate without network infrastructure, they are widely used in battlefields, wildlife tracking, and vehicular communications. Location information is extremely important to enable context-aware and location-based applications. However, due to the lack of fixed infrastructure and continuous network connection in DTNs, identifying the location of mobile users and tracking their movement trajectories are challenging. With the increasing number of location dependent applications, positioning and tracking a mobile device becomes more and more important, but the positioning and tracking techniques in a sparse disruption tolerant network have not been well addressed. To overcome this approach proposed a decentralized cooperative method to track exactly the Non GPS mobile users. A simulation result shows that the proposed approach performs better than other existing approaches because here time and end to end delay decreasing while network balancing increasing level.**

***Index Terms*—Disruption Tolerant Network, Positioning, Tracking, Cooperation.**

I. INTRODUCTION

A DTN is formed by a set of wireless nodes (e.g., cell phones) moving within a field. Each node has a communication range of distance r (r >0). Two nodes can communicate when they move into each other"s communication range, which is called an encounter of nodes. Since DTNs are sparse and highly dynamic, a constant communication path does not exist between any pair of nodes. As illustrated in Fig. 1, there are four different components in the system. The landmarks represent fix-deployed infrastructures like WiFi access points (APs), which can provide network service. An infostation is a server connecting to the APs to collect information from mobile nodes. The GPS-nodes are high-end mobile devices equipped with Global Positioning System (GPS). There are only a few of them in the network and they can be used as mobile reference points. The common-nodes are ordinary mobile phones without GPS support, which have the majority number in the system. They are only equipped with simple sensors (such as accelerometer and electronic compass), and can communicate with other nodes via WiFi or Bluetooth occasionally.

Fig. 1. The components of a DTN localization system.

The positioning and tracking problem in DTNs is twofold: the common-nodes (without GPS module) need to determine their locations based on the limited number of reference points (APs or GPS nodes) they encountered; and the info-station needs to track the trajectories of the common-nodes with the partial information collected by the APs opportunistically.

Disruption Tolerant Networking can reduce delay and increase throughput. Space Communications and Navigation (SCaN) is developing a set of international standards, collectively referred to as Disruption Tolerant Networking (DTN) standards, to support internetworking in space. The DTN standards support a network service (similar to Internet Protocol (IP)), reliability (similar to Transmission Control Protocol (TCP), but implemented very differently), and security. These are all designed to work in environments where end-to-end paths may not be available, such as when an orbiter needs to receive data from Earth and then wait, before it can forward it to a lander on another planet.

Presently, when you think of the Internet you think of an information network that is always interconnected, or "always on" and has very few delays. Many of the Internet Protocols

ISBN: 978-81-965236-7-1

fact assume this type of always-on, low-latency connectivity, and will not function, or function poorly, when those assumptions are violated. Unfortunately, the space communications environment prospers in these types of disruptions to communications. Planets and satellites orbit, but they are not always aligned so that data transmission can occur immediately. Therefore, the ability to send and receive data is disrupted. Information processing nodes, satellites or ground stations, need to be able to store the data that they receive until they are able to safely send it to the next node in the network.

DTN provides a general purpose network/transport layer service that is logically similar to what TCP/IP provides for the terrestrial Internet, but suitable for use in the space environment. In addition to the basic store-and-forward internetworking service, DTN also provides: efficient reliability; security; in-order delivery; duplicate suppression; class of service (prioritization); remote management; a „DVR - like‟ streaming service, rate buffering, and data accounting, all over possibly asymmetric and time-disjoint paths. Multiple applications including file transfer, messaging (e.g. for mission operations), and streaming audio/video can all be implemented on top of DTN and leverage its services to reduce risk, cost, and complexity.

II. RELATED WORK

Disruption tolerant networks (DTNs) have been widely studied in the last decade. Most existing works focus on the fundamental problem of data routing in DTNs. To achieve data transmission without the need of end-to-end communication paths, several mobility assisted routing strategies have been proposed to reduce the number of hops, the delivery delay and energy consumption [1], [2], [13], [14]. A few works addressed the issues of selfish behavior of nodes to enhance the cooperation for data relays in DTNs [15], [16]. Different from the existing works, here we focus on the issues of positioning and tracking mobile nodes in DTNs, which have not been well addressed in the past.

Previous research on wireless localization rely on deploying wireless infrastructures (e.g. telecommunication satellites or cell towers) and installing dedicated hardware (e.g. GPS modules or RFIDs) in the environment [17], [4]. In these systems, mobile devices measure the wireless signals to several infrastructures in known locations and estimate the actual locations based on their geometric relationships. Cell tower triangulation is a popular technique for determining the location of a mobile device [6], [7]. Locating the position of mobile phones by measuring signals to GSM cell towers was studied in [7], which shows that GSM devices can achieve a positioning accuracy with a median error of 94-196 meters.

WiFi-based strategies rely on deploying fixed Access Points (APs) and require calibrating WiFi signal strengths at many physical positions to enable localization. RADAR [8] constructs detailed radio fingerprints of the available APs and combines empirical measurements with signal propagation modeling to determine user location. Place Lab [9] allows commodity hardware clients like PDAs and cell phones to locate themselves by listening for radio beacons of WiFi and GSM cell towers. It generates a radio map by war-driving and estimates the location of mobile devices by looking up the overhead WiFi/GSM beacons in the radio map. Several indoor localization approaches using WiFi signals were discussed in [18], [19], [20].

A couple of works address the issues of localization using fixed landmarks and surroundings. SurroundSense [10] identifies a user‟s location using the surrounding information collected by sensors and camera on mobile phones. The main idea is to fingerprint the location based on its ambient sound, light, color, RF, as well as the layout-induced user movement. However, it can only obtain a user‟s logical location like in Starbucks or McDonalds, but fails to provide the geographical coordinates. AAMPL [21] introduces a location estimation method using accelerometer and compass. It can estimate rough physical coordinates of mobile phones augmenting with context-aware logical localization. To improve location accuracy, CompAcc [11] uses the similar estimation method like AAMPL, and refines the location estimation by matching it against possible path signatures generated from a local map. It achieves a location accuracy of less than 11 meters. However, it needs to construct path signatures from electronic maps beforehand, which is complex and time consuming. Escort [12] provides a logical navigation system for social localization. Its goal is not to identify the physical location, but to help a person navigate to another person in a public place such as a hotel. By periodically learning the walking trails of different individuals, as well as how they encounter each other in space-time, a route is computed between any pair of persons. However, it needs global information of users‟ movements and their encounters to construct the navigation graph, which does not apply for DTNs.

III. SURVEY OF POSITIONING AND TRACKING TECHNIQUES

The disruption-tolerant networks (DTNs) [13] rely on intermittent contacts between mobile nodes to deliver packets using a store-carry-and-forward paradigm. We earlier proposed the use of throw box nodes, which are stationary, battery-powered nodes with storage and processing, to enhance the capacity of DTNs. However, the use of throw boxes without efficient power management is minimally effective. If the nodes are too liberal with their energy consumption, they will fail prematurely. However, if they are too conservative, they may

ISBN: 978-81-965236-7-1

miss important transfer opportunities, hence increasing lifetime without improving performance. The present hardware and software architecture for energy-efficient throw boxes in DTNs. We propose a hardware platform that uses a multitiered, multiradio, scalable, solar-powered platform. The throw box employs an approximate heuristic for solving the NP-hard problem of meeting an average power constraint while maximizing the number of bytes forwarded by the throw box. We built and deployed prototype throw boxes in UMass Diesel Net, a bus-based DTN test bed. Through extensive trace-driven simulations and prototype deployment, we show that a single throw box with a 270-cm solar panel can run perpetually while improving packet delivery by 37% and reducing message delivery latency by at least 10% in the network.

Identifying the possibility of using electronic compasses and accelerometers in mobile phones [11], as a simple and scalable method of localization without war-driving. The idea is not fundamentally different from ship or air navigation systems, known for centuries. Nonetheless, directly applying the idea to human-scale environments is non-trivial. Noisy phone sensors and complicated human movements present practical research challenges. We cope with these challenges by recording a person‟s walking patterns, and matching it against possible path signatures generated from a local electronic map. Electronic maps enable greater coverage, while eliminating the reliance on Wi-Fi infrastructure and expensive war-driving. Measurements on Nokia phones and evaluation with real users confirm the anticipated benefits. Results show a location accuracy of less than 11m in regions where today‟s localization services are unsatisfactory or unavailable.

The cell tower triangulation is a popular technique [6] for determining the location of a mobile device. However, cell tower triangulation methods require the knowledge of the actual locations of cell towers. Because the locations of cell towers are not publicly available, these methods often need to use estimated tower locations obtained through war driving. It provides the first large scale study of the accuracy of two existing methods for cell tower localization using War driving data. The results show that naively applying these methods results in very large localization errors. We analyze the causes for these errors and conclude that one can localize a cell accurately only if it falls within the area covered by the war driving trace. We further propose a bounding technique to select the cells that fall within the area covered by the war driving trace and identify a cell combining optimization that can further reduce the localization error by half.

Here we consider the problem of routing in intermittently connected networks [2]. In such networks there is no guarantee that a fully connected path between source and destination exists at any time, rendering traditional routing protocols unable to deliver messages between hosts. There do however exist a number of scenarios where connectivity is intermittent, but where the possibility of communication still is desirable. Thus, there is a need for a way to route through such networks. We propose PROPHET, a probabilistic routing protocol for such networks and compare it to the earlier presented Epidemic Routing protocol through simulations. We show that PROPHET is able to deliver more messages than Epidemic Routing with a lower communication overhead.

IV. PROPOSED PROTOCOL

Ad hoc on-demand distance vector (AODV) routing protocol uses an on-demand approach for finding routes, that is, a route is established only when it is required by a source node for transmitting data packets. It employs destination sequence numbers to identify the most recent path. In AODV, the source node and the intermediate nodes store the next-hop information corresponding to each flow for data packet transmission. In an on-demand routing protocol, the source node floods the route request packet in the network when a route is not available for the desired destination. It may obtain multiple routes to different destinations from a single route request. The major difference between AODV and other on-demand routing protocols is that it uses a destination sequence number to determine an up to date path to the destination. A node updates its path information only if the destination sequence number of the current packet received is greater than the last destination sequence number stored at the node.

A route request carries the source identifier, the destination identifier, the source identifier, the source sequence number, the destination sequence number, the broadcast identifier, and the time to live field. When an intermediate node receives a route request, it either forwards it or prepares a route reply if it has a valid route to the destination. The validity of a route at the intermediate node is determined by comparing the sequence number at the intermediate node with the destination sequence number in the route request packet. If a route request is received multiple times, which is indicated by the broadcast ID-source ID pair, the duplicate copies are discarded. AODV does not repair a broken path locally. When a source node learns about the path break, it reestablishes the route to the destination if required by the higher layers.

The main advantage of this protocol is that routes are established on demand and destination sequence numbers are used to find the latest route to the destination and also the connection setup delay is less.

ISBN: 978-81-965236-7-1

RESULTS AND DISCUSSION

The proposed approach has been evaluated through the Network Simulator version 2.0 (NS2). To implement this first we have to construct a network which consists of „n" number of mobile nodes or users and it has been illustrated in the Fig. 2. Network has two types of nodes that is GPS nodes and Non GPS nodes. They are communicating with other nodes via Bluetooth since the nodes have the mobility property.

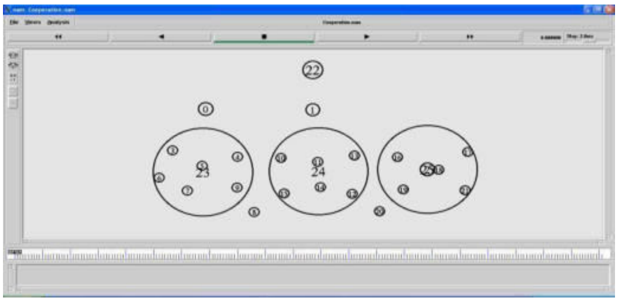


Fig. 2. Nodes Construction

Here the centralized server acts as the main resource for the mobile nodes. Every mobile node information will be stored in the centralized server and it has been illustrated in the Fig. 3. The centralized server will maintain node location information, so that the mobile node or user can retrieve the information of the current area in to anywhere where the traffic is occurred.

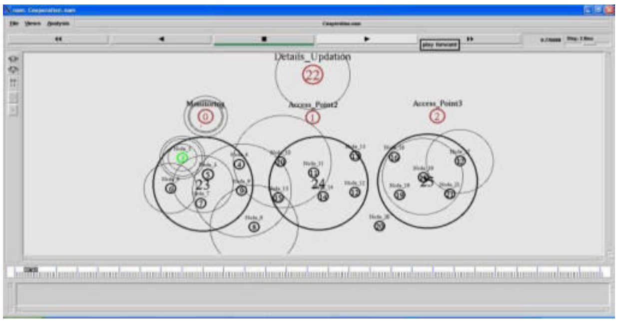


Fig. 3. Nodes Deploy Their Details To Server

Server identifies the mobile node current location based on mobile node GPS connection and it has been illustrated in the Fig. 4. It also identifies the non GPS mobile user location based on GPS mobile user through Bluetooth. Because non GPS mobile user Bluetooth id is intersect on GPS user mobile. Based on that server easily identify the non GPS mobile user current location because server continuously monitor the GPS mobile user. And also the packets are dropped from unknown device has been shown in Fig. 5.

Fig. 4. GPS Acts As Non GPS Node

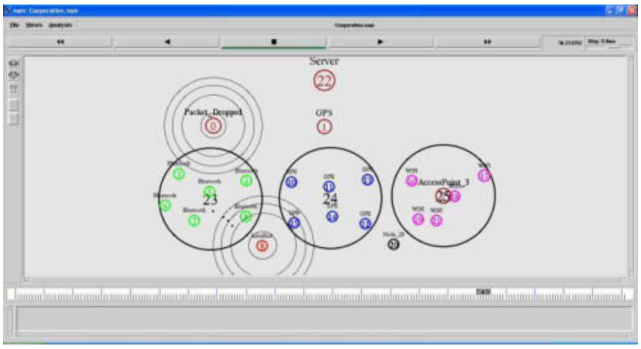


Fig. 5. Packets Are Dropped From Unknown Device

VI. PERFORMANCE EVALUATION

The delay and network region performance has been evaluated and it has been illustrated in the Fig. 6 & 7. X-axis is the Mobility nodes and Y-axis is the Latency i.e, End to End Delay which occurs in four different parameters. Here the mobile nodes moving from out of covered area into the covered area at that time access point denotes and monitor the throughput, timeconsumption and packet delivery ratio. So this graph denotes that increasing the coverage area from one access point to another one then time also increases. Those throughput and packet delivery ratio decreases parallely.

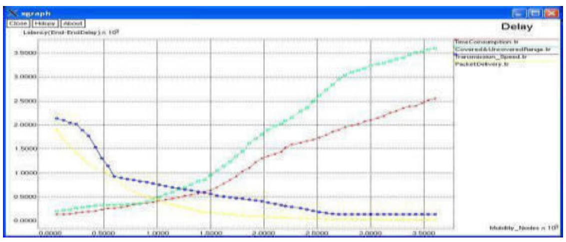


Fig. 6. Delay Performanc

ISBN: 978-81-965236-7-1

Here X-axis is the mobility nodes and Y-axis is the Throughput. Here increasing the throughput range for the GPS, WIFI and BLUETOOTH from the access points at that same time Hand off process also increases with the network balance for packet delivery with time consumption. So here time and end to end delay decreasing while network balancing increasing level.

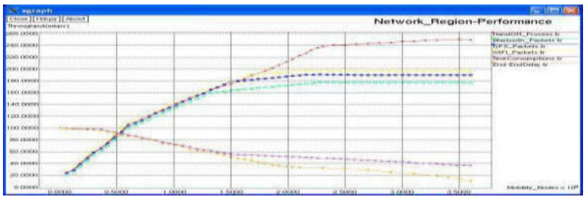


Fig. 7. Network Performance

VII. CONCLUSION

Localization in DTNs faces two problems that is the mobile node can only use sparse reference points to estimate its location, and the tracking server needs to determine and predict movement trajectories with partial location information. To overcome these difficulties, proposed a decentralized cooperative method for positioning and tracking the mobile users in DTNs. Further download a file from the server without GPS connection through the Bluetooth communication from the rest of the user.

VIII. REFERENCES

[1] K. Fall, “A delay-tolerant network architecture for challenged internets,” in Proc. of SIGCOMM ‟03. ACM, 2003, pp. 27– 34.

[2] A.Lindgren, A. Doria, E. Davies, and S. Grasic,“Probabilistic routing protocol for intermittently connected networks,” RFC 6603, Internet Research Task Force (IRTF), Aug. 2012.

[3] S. Gaonkar, J. Li, R. R. Choudhury, L. Cox, and A. Schmidt, “Micro-blog: sharing and querying content through mobile phones and social participation,” in Proc. of MobiSys ‟08. ACM, 2008, pp. 174–186.

[4] E.D.Kaplan, Understanding GPS Principles and Applications Artech House Publishers, Feb 1996.

[5] J. Soubielle, I. Fijalkow, P. Duvaut, and A. Bibaut, “GPS positioning in a multipath environment,” IEEE Transactions on Signal Processing, vol. 50, no. 1, pp. 141–150, Jan 2002.

[6] J. Yang, A. Varshavsky, H. Liu, Y. Chen, and M. Gruteser, “Accuracy characterization of cell tower localization,” in Proc. of Ubicomp ‟10. ACM, 2010, pp. 223–226.

[7] M. Y. Chen, T. Sohn, D. Chmelev, D. Haehnel, J. Hightower, J. Hughes, A. LaMarca, F. Potter, I. Smith, and A.Varshavsky, “Practical metropolitan-scale positioning for gsm phones,” in Proc. of UbiComp‟06. Springer-Verlag, 2006, pp. 225–242.

[8] P. Bahl and V. N. Padmanabhan, “RADAR: An in-building rfbased user location and tracking system,” in Proc. of Infocom‟00. IEEE, 2000, pp. 775–784.

[9] A. LaMarca, Y. Chawathe, S. Consolvo, J. Hightower, I. Smith, J. Scott, T. Sohn, J. Howard, J. Hughes, F. Potter, J. Tabert, P. Powledge, G. Borriello, and B. Schilit, “Place lab: device positioning using radio beacons in the wild,” in Proc. Of PERVASIVE‟05. Springer-Verlag, 2005, pp. 116–133.

[10] M.Azizyan, I. Constandache, and R. Roy Choudhury, “Surroundsense: mobile phone localization via ambience fingerprinting,” in Proc. of MobiCom ‟09. ACM, 2009, pp. 261–272.

[11] I.Constandache, R. R. Choudhury, and I. Rhee, “Towards mobile phone localization without war-driving,” in Proc. Of INFOCOM‟10. IEEE Press, 2010, pp. 2321–2329.

[12] I. Constandache, X. Bao, M. Azizyan, and R. R. Choudhury, “Did you see bob?: human localization using mobile phones,” in Proc. of MobiCom ‟10. ACM, 2010, pp. 149–160.

[13] N. Banerjee, M. D. Corner, and B. N. Levine, “Design and field experimentation of an energy-efficient architecture for dtn throwboxes,” IEEE/ACM Transactions on Networking, vol. 18, no. 2, pp. 554–567, 2010.

[14] Y. Li, Y. Jiang, D. Jin, L. Su, L. Zeng, and D. Wu, “Energyefficient optimal opportunistic forwarding for delay-tolerant networks,” IEEE Transactions on Vehicular Technology, vol. 59, no. 9, pp. 4500–4512, Nov 2010.

[15] Y. Li, P. Hui, D. Jin, L. Su, and L. Zeng, “Evaluating the impact of social selfishness on the epidemic routing in delay tolerant networks,” IEEE Communications Letters, vol. 14, no. 11, pp. 1026–1028, November 2010.

[16] P. Hui, K. Xu, V. Li, J. Crowcroft, V. Latora, and P. Lio, “Selfishness, altruism and message spreading in mobile social networks,” in Proc. of INFOCOM Workshops ‟09, April 2009.

[17] S. Gezici, “A survey on wireless position estimation,” Wireless Personal Communications, vol. 44, no. 3, pp. 263– 282, Feb. 2008.

[18] S. Sen, B. Radunovic, R. R. Choudhury, and T. Minka, “You are facing the mona lisa: spot localization using phy layer information,” in Proc. of MobiSys ‟12. ACM, 2012, pp. 183– 196.

[20] Z. Yang, C. Wu, and Y. Liu, “Locating in fingerprint space: wireless indoor localization with little human intervention,” in Proc. of Mobicom ‟12. ACM, 2012, pp. 269–280.

[21] A. Ofstad, E. Nicholas, R. Szcodronski, and R. R. Choudhury, “AAMPL: accelerometer augmented mobile phone localization,” in Proc. of MELT ‟08. ACM, 2008, pp. 13–18.

[22] Google, “The google map,” https://maps.google.com/, 2012. S. Boyd and L. Vandenb

ISBN: 978-81-965236-7-1

A Comprehensive Guide to Intelligent Transport Systems

Dinesh.K[1], Aravindh Aarya.G[1], Sathish Kumar.K[1],Selva Mani.T[1],Dr.P.Narayanasamy[2],Dr.P.Balasundar[1*]

[1]*Department of Mechatronics Engineering, Kamaraj College of Engineering and Technology Virudhunagar, TamilNadu, India*

[2]*Department of Mechanical Engineering, Kamaraj College of Engineering and Technology Virudhunagar, TamilNadu, India*

[*]pbalasundar13@gmail.com

Abstract;-Researchers conducted interviews with Swedish drivers to analyse their privacy perceptions and preferences for intelligent transportation systems. The authors argue that drivers' privacy perceptions can be used to design privacy and identity management systems for intelligent transport systems. They argue that driver behaviour learning is essential to the development of such systems.Protection of critical transportation infrastructure is very complex issue..It is not difficult to identify a large number of critical infrastructure elements..The question is: "How to protect/ensure them?" A compromise between funding of protection and finding really critical elements is to be found..There are many systems that could be used to make infrastructure and whole transportation safer..A lot of projects are dealing with building new systems, architecture of management system that could help users to manage traffic.

***Keywords*—Intelligent transportation systems, identitymanagement, driver behaviour learning, critical transportation infrastructure, funding, protection, infrastructure,transportation safety, management system, traffic management.**

I. Introduction

This Today, 54% of the world's population lives in cities and 2.5% lives in urban areas. Housing and necessary repairs, as well as travel and transportation directly related thereto. Personal transportation needs, including mass transit, cars, So this is the nature of the automotive industry Organize everything in the best and almost foolproof way Take care of their data needs. Less urban space is not used for private transportation More distribution sites are needed. The current building was designed and built in the nineteenth century In the 20th century, he could not meet all these new requirements. In addition to infrastructure, the processes themselves need to change in order to change Keeping up with growing traffic and an aging population' Changing transportation needs. Trac is a unique and advanced driver assistance system. Until then, vehicles will be dispatched to where participants are The connection is made in an environment called vehicle-to-vehicle (V2V).Connecting to vehicle infrastructure (so-called vehicle-to-infrastructure (V2I) environments) to increase mobility and It is hoped that connected and autonomous vehicles (CV/AV) will reduce the above-mentioned problems (such as traffic congestion, lack of space and increased traffic volume). (Regarding air and pollution): First, the rise of car sharing and leasing Services will grow and new ways of car sharing will spread (Yang, It can also be called a self-service car,so that roads and cities Reduce crowding (Ross, 2014). Reduce distractions, improve safety and mobility There are fewer road accidents (Pau, 2013), (Soubra, 2013), (Yang, In addition, other information about participants such as links Companion vehicles, which have so-called Internet of Things (IoT) devices on board.(Guerrero-ibanez et al., 2015), smart objects such as roads Side (RSU), or after the traffic control center are all possible A process that can be called vehicle-to-X (V2X). In its final report, the committee released a comprehensive and comprehensive overview of the world's most flexible and connected ITS systems. Learn about the "social services associated with these machines" For example, the technology was tested in real-world As a proving ground in the German city of Kassel Road construction involves various players (City of Kassel, 2019a). Automakers like Ford have the opportunity to test in different locations around the world (city Most companies are engaged in transportation Create your own map library like Waymo However, I had to map each city individually (Forbes, 2019). This connection creates a transportation system The data you need to make accurate predictions. It is done through rapid simulation (e.g. using neural networks and machine study) to evaluate how the program could be approached differently method (e.g., different model configurations, different parts of the method) (Gora, 2017). The Florida Department of Transportation (FDOT) is already planning. Related to the rise of proprietary mechanical systems (Hadi et al., 2017) referred to as smart transportation system In addition, the public sector is already planning legal, regulatory and social assistance measures targeting CV/AV: Waymo (Waymo, 2016)), Nevada passed its first self-driving car law in 2011 (Luettel et al., 2012) and

ISBN: 978-81-965236-7-1

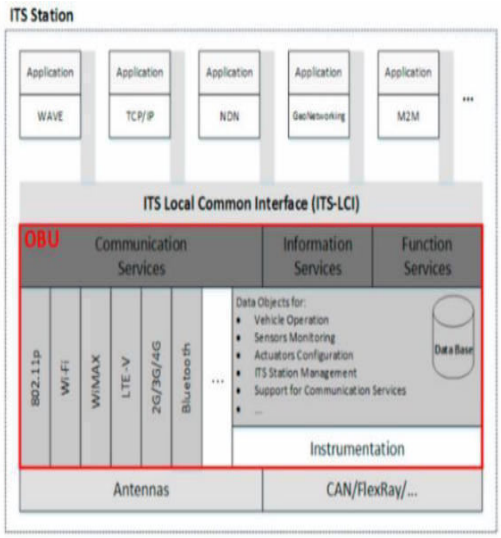
is still working on an amendment to the Assembly bill. The best embodiment of the private car act is resp. Europe has also made similar efforts On the technology side, all this brings new opportunities organizational analysis Make changes to all systems where appropriate (Sumalee and Additionally, affiliate channels help increase Access is becoming an on-demand service for large and increasingly on-demand organizations. Therefore, information structure Should be transmitted via wired or wireless means. However, it's not just old roads that can be innovated Light rail and commercial robots If the final flight departure and landing change (Matsuda et al. In addition to the above issues, energy and data Communication networks are affected due to the following reasons figure 1. Arup's Urban Mobility Vision 2050 shows different types of transport integrated into transport networks and infrastructure (ITS International, 2015). Robotic vehicles or smart buildings. Not only does it provide more electricity for bus passengers cars and commercial vehicles, but e-bikes, scooters and Today's architectural style is unparalleled Contrary to popular opinion about urban transportation, climbing The number of people who want to use the site (e.g. smart travel and parking, car sharing and e-bikes) (RolandBerger, 2019) and energy and data infrastructure such as charging stations, smart lighting, waste and recycling (ScottMadden, 2017). Shipping box. New stakeholders emerge with the goal of sharing and selling information such as events, locations, and limited to movements, but movements using movement techniques (Zica et al., Currently, some stakeholders are monitoring, managing and monitoring these sites, while others are planning. predecessor. 1 Show some details future activities of these new stakeholders. At this point, everyone involved in the field is doing their part There are few activities such as research activities This is based on the activities collected by each student Create your own profile: Public Authority This Work To protect their structures, automakers do this to see the bottom Literally (Waymo, 2016), users can purchase data and maps and increase your own sources of information. used to collect the same data. colleagues by saving them in different formats and adding Because each starts with a different set of data. Large and combine all these needs with their main needs. However, policymakers and government officials do not always do this In addition, in planning, Profile types are used for more than just work. This happens because the structure of the infrastructure and its management have changed over the years and have changed. But most of the time it's management Arrangements are not complete at this time. Just needs to be used in a different way Therefore, they could not help but speed up their preparations I work in a very difficult field. Availability of variety, quality and availability is important The solution to problem planning is to manage In the database management domain, avoid idle, The potential reasons for data inaccuracy are important. (Kent, 1982) aims to modify the information provided the data itself (van Roessel, 2007). Get data as client without updating content data. data. So each user still uses the same data, but the data Provide to meet his needs. No data backup Because my friends all work in the same city, that's it. Parking spaces have clear meaning and digital display It should be administered once, not multiple times. This article addresses the challenges of working to understand different usage contexts by focusing on different stakeholders. Equivalent to the same job. Data management systems must be in place and work together used in urban development as a consideration Book about smart transportation systems. Can it be done as a group? If the majority of interested parties Want to display roads and streets, is there a display method that meets all requirements? And identify other areas such as cities and buildings? Can the data set be processed (i.e., accessed, processed, integrated, exchanged, viewed, stored)? Enter data? Possibility of this approach? This article will answer these research questions by explaining The idea is complex planning, development, testing, validation, Lectures and events for relevant groups should be organized Find collaboration and avoid conflict based on parallel presentation of data. Therefore, it provides information about tools and data management, combining different requirements based on the needs of different stakeholders and the functions available for organizing data storage, data processing and data transfer. Fan analysis and reliable data structure, These components are based on solutions that are ready to solve big problems. will greatly improve technical efficiency and change concepts This article explains it from multiple angles.The increasing mobility of people, vehicles, and "things" is having a great economic and social impact. The automotive industry is considering the network of these linked sources of information as complex autonomous systems. The next logical step is to create a way to control these interactive systems, by developing intelligent transportation management mechanisms and equipping vehicles with technology. The scientific community has developed a special communications architecture to be applied on these environments, known as VANET.The rapid growth of underground mines in developing countries has led to the continuous development of in-mine ore transportation systems, which can become difficult to monitor and control. To improve management team decisions, a Decision Support System (DSS) could merge all relevant knowledge into an easy-to-operate, user-friendly environment. DSS can help to make correct decisions that will improve transport processes in many ways, such as reducing energy used, improving

ISBN: 978-81-965236-7-1

workers' safety, and extending the service life of machine elements. There are various approaches to decision support systems for different purposes presented in the literature, including DSS for mining method selection, fire level prediction, air pollution mitigation, and wheeled transport. However, there is a gap in developing an DSS that will concern the whole transportation network, including various interconnected means of transport in underground mining. To meet the current expectations of the mining transport area, an international consortium was formed, and the NetHelix project was launched. One of the project goals is the optimization of mining operations in a broad view to improve cost efficiency, energy savings, health and safety issues, and minimize environmental impact. An intelligent digital toolbox towards more sustainable and safer extraction of mineral resources was also launched.

II. Standard VANET Architectures

Ideally, vehicles should choose the best face-to-face communication method or use multiple communication methods to connect to other vehicles or players. Different protocols are used for lower-level communications. Considering the different types of vehicles, in order to rapidly deploy VANET applications and technologies, it is important that stakeholders are aware of these applications.To achieve this goal, the concept of agnostic middle layer is introduced. This is the appropriate layer to provide management of information from multiple sources, providing similar tools. Support various communication protocols. This type of floor should have space inside the car Programmers and vendors of stack links check the optimization of their components. The next section introduces the intermediate model in the architecture. The computer must use this middleware correctly. ISO 21217:2014 Standard 5 describes the architecture of an ITS, which consists of six elements (computer, management, equipment, network and transport, access and security). All elements of an ITS station, whether or not a certain element is used, depend on communication requirements. So far it has been the most efficient middleware solution using agnostic Introduced by standard ETSI ITS Facilities Layer 6. But these are indicators of general ETSI applications. Adding a specific set of service components (information, communication and services) between services and layer bearers to implement such middleware programs is a very difficult task for developers. They lose the opportunity to choose a development model for their work, even if it's free The type of recognition system supported by the hardware component. Additionally, it can also be used as part of a transportation system The development of the automation industry should support companies' efforts to differentiate the services (software and smart computing) they include. Responsibility for all other services/services added by the vehicle manufacturer and another party At this point old services can be installed and installed on OBUs that have been closed and blocked by the car manufacturer (and other professionals responsible for the car manufacturer). The latter uses advanced ITS software to develop and various programmers that can be controlled by other computer hardware in or on the vehicle Designed to allow interaction between ITS stations receiving functions and services from their base part of the story.Use any form of communication and social media tools. We do not provide solutions for simultaneous use of ITS stations and projects developed by different companies. Both methods rely on production processes and closed environments. In most cases its responsibilities) are based on specific subcategories or different conditions .



III. Importance of Critical Transportation Infrastructure and the Need of Its Protection

The importance of transportation infrastructure and the need for its protection The framework of the transport system is very complex and consists of many structures, e.g. The manufacturing sector is important in most countries of the world. Transportation is considered one of the most important things The construction sector is important at national and international levels. Distributed via the Internet), useful and adaptable. Transportation infrastructure is critical to a nation's economy, social security, and jobs • national priorities, There are many key concepts in transportation infrastructure, including elements, materials, and networks, as well as general distribution resources. Geographical distribution. The transportation sector is affected by security related to its operations.

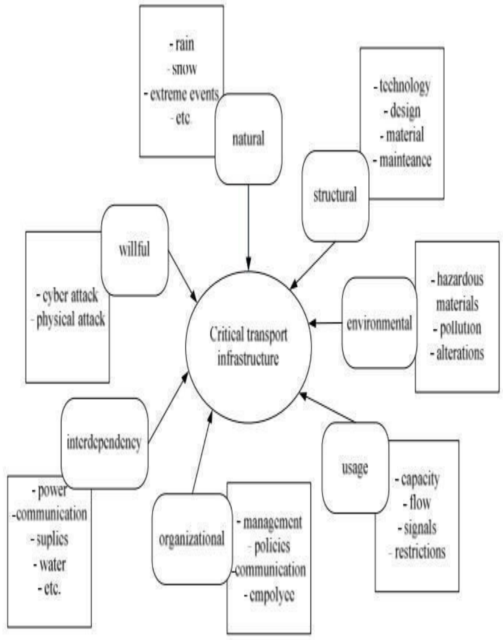
ISBN: 978-81-965236-7-1

IV. CURRENT STATE OF CRITICAL INFRASTRUCTURE

The USA has had a wide-reaching Critical Infrastructure Protection Program in place since 1996. Since then critical infrastructure has started to be a popular term all around the world. After events in New York in 2001 a question about protecting important infrastructures in countries and regions has become very urgent. The USA and European Union have begun preparing documents and legislative norms about critical infrastructure identification and protection.Critical infrastructure protection is a priority of ensuring the safety of the Slovak Republic, it is therefore necessary to address the legislative instruments that regulate the issue at national level. Any such instrument should be in line with European standards. The most important document in Slovakia is Act No. 45/2011 Coll. about a critical infrastructure. In current articles and works, the attention is drawn to particular critical infrastructure in the road transportation sector. However, a more complicated is the issue of rail transportation subsector. In this sub-sector more facilities and infrastructure elements can be considered to occur, since the possibility of detours are not as clear asfor road transport. Also, technologies which are used in rail transport are complicated and rail is less flexible than road transportation.

V. CRITICAL INFRASTRUCTURE RESILIENCE

Critical infrastructures have vital position and related obligation to ensure their resilience – defined as the property system to overcome the disturbance, negative resist change and ensure the functioning of the systemcomponent in a changed environment. Resistance can be affected by many factors – natural conditions, as other infrastructure interconnectivity of infrastructure, economic conditions and the like. Difficulty to identify threats and their rapid spread require better quality and more consistent approach to the analysis and design of systems and equipment for the protection of critical infrastructure. Resilience of critical infrastructure elements reflects interactions of negative external and internal factors and safety and protection measures. Therefore, new tools are sought to make the transport system and infrastructure effective, efficient and safer. One of these tools, as well as intelligent transport systems – is an important tool for the traffic control and management.



VI. NEW CHALLENGES IN TRANSPORTATION IN DEVELOPING COUNTRIES

This unprecedented increase in VpC has raised several safety, energy, and social concerns, notably because the transport infrastructure in those developing countries is outdated and investment in its renewal lags way behind VpC. This explains why, for example, sub-Saharan Africa is the only region in the world where road density has decreased in the past 20 years . This problem is exacerbated by geopolitical factors since 10 of the 15 most populous landlocked countries are located in Africa. Deprived of access to the sea and with a total population of 300 million, these countries rely heavily on land and air transport to sustain their economic growth .

VII. DIVERSITY IN ITS

These challenges of ITS in developing countries had led Akhtar[1] to address the question related to ITS compatibility in developing countries. They addressed the relevance, usefulness, and personal perception and social acceptability of ITS by practitioners and policy makers representing 14 developing countries of Asia and Latin America. Their results show that 17% and 44% of the respondents, respectively, support the deployment of ITS in developing countries. This study insists on the need for adequacy between the kind of ITS and the culture of the developing countries where ITS are deployed. Therefore, promoting ITS in developing countries requires a suitable adaptation according to their social and cultural, environmental, and energetic constraints. Most studies related to the deployment of ITS in developing

ISBN: 978-81-965236-7-1

countries that are available in the literature focus on Asia, eastern Europe, South America, Mahgreb countries, and South Africaand these countries do not have the same culture and constraints as African countries in general and Sub-Saharan Africa (SSA) in particular. In fact, the SSA countries have lagged behind in the implementation of ITS solutions, with the exception of South Africa . All this talk of the need for diversity in ITS. The proposed ITS should consider the speci city of the various parts of the world, their cultures, nancial realities,etc. Literature lacks research studies on ITS in countries in sub-Saharan Africa excluding South Africa (SSA-SA). The displacement of people and goods in SSA-SA countries is therefore few known. As an example, in the 2018 INRIXglobal trafc scorecard, the only SSA country that appears in this study is South Africa, which means that there is no SSA-SA country present in this study. However, without understanding the transportation scenarios to take upstream and downstream measures, it can be difcult to deploy large-scale ITS in SSA-SA countries. The goal of this paper is to lay the foundation for a digitization of transportation in SSA-SA countries. The purpose of the article is to discuss the transfer of ITS technology from developed countries to SSA-SA countries and to consider which factors are important to consider in achieving aordable ITS in SSA-SA countries. To this end, the paper seeks to address the following research questions.

VIII. APPLICATION STATUS OF ITS IN ECER OF DIFFERENT TRANSPORTATIONFIELDS

ITS management and control based on integrated monitoring ofurban rail transit have been applied in different fields of transportationsystems . It reveals an example of its application in integratedtransportation management and control.As can be seen from the comprehensive management andcontrol of the traffic system require the cooperation of many parties.Today, expressways have entered an era of rapid development ofinformatization construction. Many countries have completed the construction of large-scale informatization projects such as transmissionbackbone networks and provincial comprehensive management platforms. Besides, the informatization level of comprehensive provincialmanagement has reached a certain level. In comparison, the information management level of road sections is slightly backward, and themonitoring capability of the road network needs to be improved. Thesection-level intelligent traffic management and control system focuseson the need for daily monitoring and management of expressways. Itcan also realize full-time and all-round monitoring and monitoring atthe section-level, timely manages and controls the comprehensive operation situation, and finally achieve the goal of ''guaranteeing smoothflow, strengthening management, and increasing efficiency.

IX. TRANSPORTATION INDUSTRY

The transportation industry includes road transportation services,marine transportation services, air transportation services, and pipelinetransportation services. With the accelerated urbanization in China,the emergence of e-commerce has led to higher growth in consumerspending in the transportation sector than in society as a whole. Asa result, it is one of the fastest-growing sectors in terms of consumerspending . As the field accounting for the largest proportion ofCE in the transportation industry, the road transportation industry hasshown a rapid growth trend in recent years . It can be predictedthat the proportion of CE in the road transportation industry in thefuture may still increase. Road transportation ECER will face complexchallenges. The challenges of energy conservation and emission reduction in different The challenges of ECER in various service sectorsof transportation are described in the following two aspects: roadtransportation and maritime transportation.

X. ITS TO CONTROL MOBILITY

This section presents our ITS, called PITS, for facilitating thedecision-making process on mobility restrictions during pandemictimes. This is a novel ITS which integrates CEP, fuzzy logic and CPN asexplained through this section.In our system, we consider the mobility restrictions shown in Table 2 for the five level alerts considered depending on the risk assessments provided by the domain expert. Each Spanish regional government makes its own interpretation of the recommendations describedin Section 3 for the different alert levels. In this paper, we haveconsidered a restrictive interpretation of them. As an example, theproposal in that section recommends to limit the mobility for level2, while we propose to close the mobility during the curfew hours.Thus, the proposal considered in the present work extends the measuresindicated in Section 3 in order to reduce the SARS-CoV-2 spread.Fig. 7 depicts an overview of our proposal which consists of sixsteps. In step 1, we obtain data from several health areas. In step 2,these data are processed and correlated by the CEP engine, which isresponsible for creating the complex events to feed the FIS system.Next, in step 3, the domain expert interprets the alert levels providedby the FIS system, emitting a set of alert levels for the different areas.In step 4, these values are then used in the CPN model to apply themobility restrictions. Thereby, when a car driver asks for a fast route,in step 5, the CPN model simulation will provide this driver with theroute solution in the last step 6. For this purpose, we simulate severalcars with the same origin and the same destination, and the route forthe fastest one is returned.

ISBN: 978-81-965236-7-1

We remark that the route thus provided willnot necessarily be the optimal one, because this depends on the numberof initial cars and the number of possible routes.

XI. Conclusion

This paper presents a new approach for deploying a communications architecture for VANETs and ITS Communications Systems. It separates the roles of services within an OBU and the ITS/VANETs applications using them, specifying standard communication technologies and protocols. The architecture maintains lower-level communication and control functions within the OBU, while higher-level control functions and ITS applications can be independently researched and developed by third-party software makers.Intelligent transport systems enhance transportation infrastructure, improve traffic safety, and reduce costs. Slovak Republic needs to increase its use, as road transport offers more possibilities for intelligent transport systems. However, incorporating more technologies into railways is crucial for safer transportation.

References

1. E. C. for Standardization and E. C. for Standardization, “CEN EN 12253: "Road transport and traffic telematics - Dedicated Short Range,Communication (DSRC) - Physical layer using microwave at 5,8 GHz",” Tech. Rep., 2004.

2. E. Committee and F. Standardization, “CEN EN 12834: "Road transport and traffic telematics - Dedicated Short Range Communication(DSRC) - DSRC application layer",” Tech. Rep., 2003.

3. I. . W. Group, IEEE Guide for Wireless Access in Vehicular Environments (WAVE) - Architecture, 2014.

4. D. Jiang and L. Delgrossi, “IEEE 802.11p: Towards an international standard for wireless access in vehicular environments,” in VehicularTechnology Conference, 2008. VTC Spring 2008. IEEE, IEEE. IEEE, may 2008, pp. 2036–2040.

5. “ISO 21217:2014 Intelligent Transport Systems – Communications Access for Land Mobiles (CALM) - Architecture, ISO Technical Committee 204 WG16,” 2014.

6. ETSI, “ETSI EN 302 665 V1.1.1 (2010-09): Intelligent Transport Systems (ITS); Communications Architecture,” ETSI - European Telecommunications Standards Institute, Tech. Rep., 2010.

7. S. Nour, R. Negru, F. Xhafa, F. Pop, C. Dobre, and V. Cristea, “Middleware for Data Sensing and Processing in VANETs,” in Proceedings -2011 International Conference on Emerging Intelligent Data and Web Technologies, EIDWT 2011. IEEE, sep 2011, pp. 42–48.

8. R. Miguel Correia Costa, P. Jorge Pires Ferreira Supervisor, and T. Maria Ferreira Va ao Vasques, “Agnostic Application DevelopmentMiddleware for VANETs Communications Networks Engineering Examination Committee,” 2013.

9. F. A. Silva, T. R. M. B. Silva, L. B. Ruiz, and A. A. F. Loureiro, “ConProVA: A smart context provisioning middleware for VANETapplications,” in IEEE Vehicular Technology Conference. IEEE, jun 2013, pp. 1–5.

10. I. Jawhar, N. Mohamed, and H. Usmani, “An overview of inter-vehicular communication systems, protocols and middleware,” Journal ofNetworks, vol. 8, no. 12, pp. 2749–2761, dec 2013.

11. K. Dar, M. Bakhouya, J. Gaber, M. Wack, and P. Lorenz, “Wireless Communication Technologies for ITS Applications [Topics in AutomotiveNetworking],” Communications Magazine, IEEE, vol. 48, no. 5, pp. 156–162, 2010.

12. L. Zhang, D. Estrin, J. Burke, V. Jacobson, J. D. J. Thornton, D. K. Smetters, B. Zhang, G. Tsudik, D. Massey, C. Papadopoulos, Others,D. Krioukov, D. Massey, C. Papadopoulos, T. Abdelzaher, L. Wang, P. Crowley, and E. Yeh, “Named Data Networking (NDN) Project,”Relatório Técnico NDN-0001, Xerox Palo Alto Research Center-PARC, 2010.

13. G. Deng, L. Shi, R. Li, and X. Xie, “Efficient Inter-vehicle Internet Content Distribution based on Named Data,” no. 61421061, 2015.

14. J. Wan, D. Li, C. Zou, and K. Zhou, “M2M communications for smart city: An event-based architecture,” Proceedings - 2012 IEEE 12thInternational Conference on Computer and Information Technology, CIT 2012, pp. 895–900, 2012.

15. S. Network and M. Protocol, “Simple Network Management Protocol,” Management, pp. 1–8, may 2008.

ISBN: 978-81-965236-7-1

Effect of Adoption of Electric Vehicles (EVs) on Power Transmission System

V.Kanagasubramanian [1*], S.G.Priyadharshini [2]

[1]Assistant Professor, Department of Electrical and Electronics Engineering, Mangayarkarasi College of Engineering, Madurai.

[2] Assistant Professor, Department of Electrical and Electronics Engineering, Mangayarkarasi College of Engineering, Madurai.

Abstract: Due **to increased pollution and fuel costs, there is a demand for alternative cars (electric vehicles) to traditional Internal Combustion Engine (ICE) automobiles. Green Transportation refers to electric cars that are ecologically beneficial. Electric vehicle technology has grown in importance in a society that is more concerned with energy saving and environmental protection. Due to rising worries about the consequences of the Air Quality Index (AQI) and the greenhouse effect, several cities have established zero-emission zones and tightened emission regulations to encourage the usage of electric cars. In recent decades, researchers, environmentalists, and other groups have focused their attention on eco-friendly electric vehicles (EVs), as worries about the negative effects of greenhouse gas emissions from conventional vehicles on global warming and air pollution have grown. To address these concerns, a plan to rebuild an ICE car with an electric motor as the primary driving power source is adopted. For the same reason, a bespoke swing arm is created to meet the demand. When building the swing arm, numerous forces operating on the vehicle are taken into account to assure the vehicle's longevity. The vehicle is powered by a 750W BLDC motor connected to a wheel via a chain and sprocket arrangement. The rider provides input via a throttle, which is detected and the necessary feedback is delivered to the motor via a controller. Testing of the vehicle has been carried out on the ground in robust conditions to get the practical range, speed, and durability values of the vehicle. Various components, such as the controllers, battery, and motor are incorporated into an electric vehicle. Because an electric vehicle's, conventional IC engine is replaced with an electric motor, the electric motor is the first and most essential part to choose when designing an electric car. As a result, an electric vehicle's motor must provide enough power and additional motor characteristics. The most important step is to select an appropriate motor rating for the load being transported.**

Index Terms**: BLDC motor, Controller, Electric vehicle, EV, Lead acid battery.**

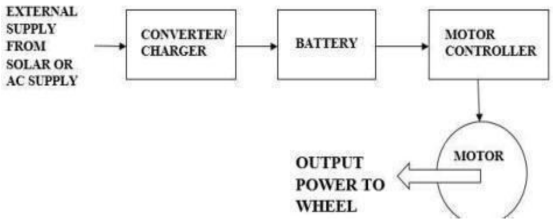
INTRODUCTION

The electric vehicle is one of the most promising technologies for potentially replacing fossil fuels, because of its many advantages, it also helps us to reduce the emission of harmful gases. It consists of many modules which play a vital role in EVs such as charging modules, converters, controllers, selection of batteries, and electric motor. The battery unit is used to supply electric power to the electric motor and the controller is used to control motor speed and regenerative braking. It helps in controlling the input and output parameters.

An electric car operates on a fundamental scientific principle: energy conversion. Electric energy is converted into mechanical energy. A motor in the electrical system performs this conversion duty. There are many dissimilar types of motors. The motor of an EV is similar to that of an internal combustion engine. In electric cars, the foremost source of power is motors. It is extremely significant in electric vehicles. There are many different types of electric motors, but due to significant advancements in the field of power electronics and control techniques, numerous types of electric motors can now be employed in electric vehicles. High starting torque, density, good efficiency, and high power should be features of electric motors utilized in automobile applications. The electric car is one of the most promising future technologies for lowering fossil fuel consumption while simultaneously being ecologically benign by minimizing hazardous gas emissions. The charging module, converters, controllers, batteries, and electric motor are all components of an electric vehicle, and the block diagram of power flow in an electric vehicle is depicted in Figure.

ISBN: 978-81-965236-7-1

1.BLOCK DIAGRAM



3.OBJECTIVE

- To convert an Internal combustion engine vehicle (ice/pollution causing vehicle) into electrical vehicle
- To design and develop an electric vehicle from a scrapped ICE vehicle.
- To study the working of ICE.
- To research, select and purchase appropriate motor and battery for the vehicle.
- To design a swing-arm that is able to sustain various forces that are acting upon it and is able to full-fill the requirements for the mounting of motor.
- To effectively adjust the batteries while maintaining the overall balancing of the vehicle.
- To integrate motor and battery using proper controller.

2. PROBLEM STATEMENT

The technologies for global transportation are dominated by internal combustion Engine-powered vehicles that lead to a major threat to green gas emissions, even though the global transportation technology partially moved to Hybrid fuels and battery electric vehicles. These technology improvements are not attracted global customers because of their cost and their compatibility. Our aim is to rebuild an Internal combustion engine vehicle into Electric Vehicle that would meet the requirements of one person driving the vehicle.

3. METHODOLOGY

1. Methodology Internal combustion engine vehicle analysis, including dimensions, mass, drive type, and other ICE vehicle data.
2. Motor research, selection, andpurchase: To calculate appropriate motor considering the mass, of the system and considering various resistance (rolling, gradient) and drags(aerodynamic).
3. Battery research, selection, andpurchase: To select the appropriate battery for the system considering the motor specifications, required range, and speed of the vehicle.
4. Removing of fueltank, IC engine and,Assembling of the motor, and battery to electricvehicle

6.MAIN COMPONENTS

In EV, Electrical motors are similar to IC engines in IC-engine vehicles and the vehicle's heart is the electric motor. Electric energy to mechanical energy conversion is done by using an electric motor. When a driver of an electric vehicle hits the accelerator, the car's battery sends electricity to the stator via the controller, which causes the rotor to spin, and then mechanical energy to the wheel via the shaft and chain system.

CONTROLLER

The controller is used to connect the E-bike and all the electrical components of the E-bike. Electric bikes have two main electrical components connected between the battery and the motor. The EV controller is connected to electrical and electronic components such as the battery and throttle Element (if any), speedometer, and motor. It also includes three Hull sensors to be the position sensors that send the position signals of the motor rotor to the LO port of the Controller

The controller transmits PWM signals and controls the output current of the motor via the duty factor of the PWM inverter, and accordingly, it will control the speed of the motor. Throttle input is analog in nature which is a sense by the controller and makes it acceptable. An e-bike controller receives information from the battery, motor, accelerator, and pedal-assist systems, and then return the correct signals to the electronic or electrical parts of a system of motor. The voltage provided to the motor can be adjusted, from 0V to the rated voltage of the entire battery pack, Responding to the user's accelerator signal, pedal sensor, and various current limits.

It is important to select a motor controller that matches the power rating of the motor used and the battery voltage. With the help of a throttle, it allows controlling the power of the motor.

ISBN: 978-81-965236-7-1

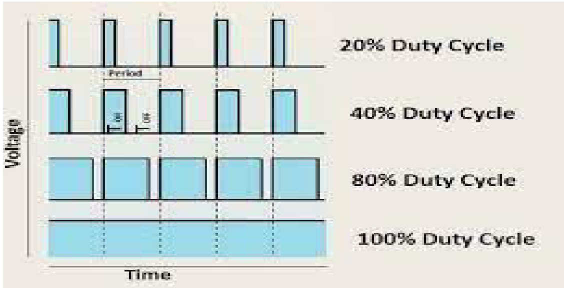


Fig. 6.1 PWM Wave

GEAR AND CHAIN:

Energy is required to drive the machines and equipment for a variety of applications. Available power is required to be transmitted to get the desired motion and work. When power is transmitted from the input device to the output device using mechanical elements is known as mechanical power transmission. Mechanical elements like the friction disc, various types of rope, belts, chain, gears, couplings elements, etc. Or transmission of power. In the drive, the energy is transferred by using a chain drive, where input supply is to be obtained by the BLDC motors shaft and output to the
Vehicle's sprocket.

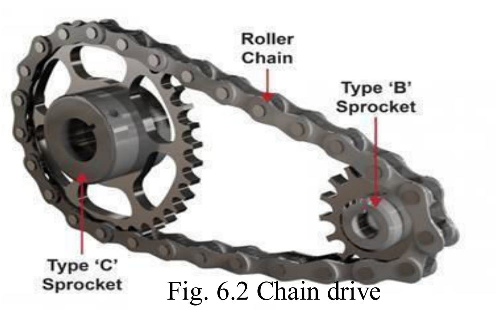


Fig. 6.2 Chain drive

Advantage of Chain Drive:

- In chain drive no slippage occurs.
- In chain drive velocity ratio remains constant. So, the chain drive is one positive drive. However, the polygonal effect can lead to non-uniformity in speed.
- The efficiency of the chain drive is more than 95 percent.
- It is generally not affected by environmental temperature and conditions.
- Regular/periodic maintenance requires in Chain drive Ex. Lubrication.

MOTOR

DC Motors in Series

Other DC motors in comparison to DC series motors have a strong starting torque, making them a good choice for traction applications. It was the most extensively utilized traction motor at the time. This motor's benefits include easy speed control via various techniques and the ability to tolerate a rapid rise in load. All of these features make it a magnificent versatile motor. Due to brushes and commentators, the fundamental disadvantage of DC series motors is their high maintenance. Railways employ these motors. This motor belongs to the DCbrushed motor category.

BLDC

It's almost identical to permanent magnet DC motors. Because it lacks a commutator and brush arrangement, it is referred to as brushless. BLDC motors do not require any maintenance. High starting torque and efficiency are fundamental properties of BLDC motors. BLDC motors are well-suited to high-power density design. Due to their traction properties, BLDC motors are the most recommended motors for electric vehicle applications. By contrasting BLDC motors with traditional brushed motors, you can learn more about them.

BATTERY :

The storage battery is a battery where the energy can be stored in the form of chemical energy and then converted into electric energy at the time of discharge. The conversion of electrical energy into chemical energy by applying an external electrical source is called as charging process of the battery. Whereas conversion of chemical energy into electrical energy for providing the external load is known as discharging of the storage battery. During charging of the battery, the current is supplied to it which causes chemical reactions inside the battery. during the formation, the energy is absorbed due to chemical changes. When the battery is connected to the load, the chemical reactions take place in a reverse direction, during which the absorbed energy is discharged as electric energy and provides power to the load.

V2G:

The term "vehicle2grid" refers to a system that permits energy from an electric car's battery to be returned back to the grid. A car rechargeabl

ISBN: 978-81-965236-7-1

battery discharged based on the multiple indications, such as energy generation or consumption locally, is known as electric vehicle2grid technology.

THROTTLE

The electric bike's throttle is an entirely twisted throttle that must be used with one's hands. The whole end of the handlebar is occupied by the completely twisted throttle. To control the throttle, the rider just grips it and bends it back towards himself. Many people like full accelerators because they can be operated entirely with the hand's five fingers. The working principle of the accelerator depends on the Hall effect. An internal combustion engine's throttle valve is difficult to calibrate, while an electric vehicle's software may be customized in any way. The various throttle settings available for electric vehicles can assist in making the vehicle seem firm when driving.

FUTURE SCOPE

- Regenerative braking: we can use regenerative braking to store mechanical energy while we apply the brake. In mountainous places or where brakes are used frequently, such as on city trips, regenerative braking will be more useful. Future work needs to identify the percentage of recoverable energy, the impact of efficiency, cost, and the reduction of dependence on battery technology.
- Battery: we can upgrade the battery to the lithium-ion battery
- Solar panel: To charge the battery simultaneously we can use the solar panel to charge the battery which arise higher efficiency.
- Vehicle-to-grid: Vehicle-to-Grid is a bi-directional interaction between an electric vehicle and an energy distribution grid.

CONCLUSION

The working of the ICE engine is studied, based on research and calculations done the vehicle is employed with a 750W BLDC motor and a Lead-Acid battery pack with a capacity of 48V 14Ahr. A custom swing-arm with a motor mounting space is designed using tools like AutoCAD and blender and the batteries are properly placed in the vehicle. Motor and battery are interlaced through a charge controller and are calibrated. A fully functional E-Vehicle is manufactured and designed from a scrapped vehicle.

REFERENCE

[1] T. Porselvi1, Sri Hariharan. M. K 2, Ashok.J3, Ajith Kumar.S4,“Selection of Power Rating of an Electric Motor for Electric Vehicles ”International Journal of Engineering Science and Computing, April2017

[2] M. K. Loganathan, C. Ming Tan, B. Mishra, T. A. M. Msagati and L. W. Snyman, "Review and selection of advanced battery technologies for post 2020 era electric vehicles," 2019 IEEE Transportation Electrification Conference (ITEC-India), 2019, pp. 1-5, doi:10.1109/ITEC-India48457.2019.ITECINDIA2019-254.

[3] J. C. Ferreira, V. Monteiro, J. L. Afonso and A. Silva, "Smart electric vehicle charging system," 2011 IEEE Intelligent Vehicles Symposium (IV), 2011, pp. 758- 763, doi: 10.1109/IVS.2011.5940579.

[4] X. Chen, W. Shen, T. T. Vo, Z. Cao and A. Kapoor, "An overview of lithium-ion batteries for electric vehicles," 2012 10th International Power & Energy Conference (IPEC), 2012, pp. 230-235, doi: 10.1109/ASSCC.2012.6523269.

ISBN: 978-81-965236-7-1

Solar Automatic Lawn Mower

Dr. Ka. Suriyaprabha[1]
Assistant Professor
Department of Instrumentation and Control Engineering,
A.V.C College of Engineering,
Mayiladuthurai. Tamilnadu
suriyaprabhaka@gmail.com

Mr. R. Gopikrishnan[2]
Assistant Professor
Department of Instrumentation and Control Engineering,
A.V.C College of Engineering,
Mayiladuthurai. Tamilnadu
gopikrishnaa65@gmail.com

Mr. B. Sivasuriya[3]
UG Student
Department of Instrumentation and Control Engineering,
A.V.C College of Engineering,
Mayiladuthurai. Tamilnadu
balusivasuriya@gmail.com

***Abstract* — The solar automatic lawn mower is a fully automated grass cutting robotic vehicle powered by solar energy that also avoids obstacles and is capable of fully automated grass cutting without the need of any human intervention. The system uses 12V batteries to power the vehicle movement motors as well as the grass cutter motor. We use a solar panel to charge the battery. The grass cutter and Vehicle motors are interfaced to an Arduino that controls the working of all the motors. It is also used to interface an ultrasonic sensor for object detection. The SoC moves the bot in the forward direction in case no obstacle is detected. On obstacle detection, the ultrasonic sensor monitors it and the SoC thus stops the grass cutter motor to avoid any damage to the object/human/animal whatever it is.**

***Keywords* — Arduino Uno Board, Ultra sonic sensor, Servo motor, Relay Driver.**

I. INTRODUCTION

India's record of progress in agriculture over the past four decades has been quite impressive. The contribution of increased land area under agricultural production has declined over time and increases in production in the past two decades have been almost entirely due to increased productivity. Contribution of forest growth to overall progress has been widespread. The success of India's agriculture is attributed to a series of steps. The major sources of agricultural growth during this period were the spread of modern crop varieties, intensification of input use and investments leading to expansion in

the irrigated area. In areas where 'Green Revolution' technologies had major impact,

growth has now slowed. New technologies are needed to push out yield frontiers, utilize inputs more efficiently and diversify to more sustainable and higher value cropping patterns. At the same time there is an urgency to better exploit potential of rain fed and other less endowed areas. Given the wide range of agro ecological setting and producers, Indian agriculture is faced with a great diversity of needs, opportunities and prospects. Future growth needs to be more rapid, more widely distributed and better targeted. These challenges have profound implications for the way farmers problems are conceived, researched and transferred to the farmers. On the one hand agricultural research will increasingly be required to address location specific problems facing the communities on the other. The systems will have to position themselves in an increasingly competitive environment to generate and adopt cutting edge technologies to bear upon the solutions facing a vast majority of resource poor farmers. Robotic systems play an immense role in all sections of societies, organizations and industrial units. The objective of the project is to develop an Arduino-based system at helps in on-farm operations like seeding and fertilizing at pre-designated distance and depths with all applicable. Multi row traditional seeding devices with manual metering of seeds are quite popular with experienced farmers. In the current generation most of the countries do not have sufficient skilled manpower specifically in agricultural sector and it affects the growth of developing countries. So, it is time to automate the sector to overcome this problem. The whole process is controlled by Arduino boards. Seed plantation is our day-to-day life is done by tractor in farms. The conventional method for seeding is the manual one. But it requires more time and the manpower shortage is faced continuously. The seeds are available in packets and many industries deal in manufacture of such seed packets. In Modern world, Automation robot is used in many of the fields such as defense, surveillance, medical field, industries and so on. In this paper, the robot system is used to develop the process of cultivating agricultural land and for forest without the use of manpower. The aim of the paper is to reduce the manpower, time and to increase the productivity rate. All the basic automation robots work like weeding, harvesting and so on. In current generation most of the countries do not have sufficient human factors in the agricultural sector and it affects the growth of developing countries so it is time to automate the sector to overcome this problem.

II. DESIGN AND IMPLEMENTATION OF SOLAR AUTOMATED LAWN MOWER

The development life cycle of the radar project, involves the designs of the different components, their implementation, unit testing and finally the integration of the entire system and composite testing. The components are Arduino Uno Board, Ultra sonic sensor, Servo motor, Relay Driver, Motor and Battery as shown in Fig. 1.

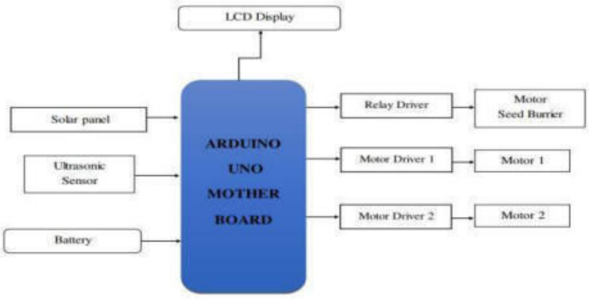


Fig. 1 Block diagram

III. ARDUINO

Arduino is a development board that integrates a microcontroller and its support circuitry with digital and analog inputs and outputs. It has an open-source computing development platform based on an environment for programs creation. The software is written in C or C++ programming language. The Arduino development board is an implementation of wiring, a similar physical computing platform, which is based on the processing multimedia programming environment. This single chip microcontroller has a microprocessor, which comes from a company called ATMEL. The chip is known as an AVR. The AVR chip is running at only 16 MHz with an 8-bit core, and has a very limited amount of available memory, with 32 kilobytes of storage and 2 kilobytes of random-access memory.

Arduino IDE is a programming environment that allows the user to draft different kinds of programs and load them into the Arduino microcontroller. Arduino uses a user-friendly programming language, which is based on a programming language called Processing. After the user has written his code, the IDE compiles and translates the code to the assembler language. After translating the code, the IDE uploads the program to the Arduino microcontroller. Arduino IDE has a built-in code parser that will check the user's written code before sending it to the Arduino. IDE software includes a set of different kinds of programs that are ready to be tested on the device as shown in Fig. 2. After testing the program, it can be uploaded to the Arduino by USB cable that vary in different models.

Fig. 2 Arduino uno board

IV. ULTRASONIC SENSOR

Ultrasonic sensor emits ultrasonic pulses, and by measuring the time of ultrasonic pulse reaches the object and back to the transducer. The sonic waves emitted by the transducer are reflected by an object and received back in the transducer. After having emitted the sound waves, the ultrasonic sensor will switch to receive mode. The time elapsed between emitting and receiving is proportional to the distance of the object from the sensor.

Ultrasonic transmitter emitted an ultrasonic wave in one direction and started timing when it launched. Ultrasonic spread in the air and would return immediately when it encountered obstacles on the way. At last the ultrasonic receiver would stop timing when it receives the reflected wave. The distance of sensor from the target object is calculated. It offers excellent noncontact range detection with high accuracy and stable readings in an easy-to-use package. It operation is not affected by sunlight or black material. The supply voltage to the sensor is 5V DC. Ultrasonic sensor comes with UART interface and works at high output acoustic power. Ultrasonic UART distance measurement may come in TTL format from which the user can easily get the obstacle distance.

V. CONTROL OF STEPPER MOTOR WITH L298N MOTOR DRIVER AND ARDUINO

One of the easiest and inexpensive way to control stepper motor is to interface L298N Motor Driver with Arduino. It can control both speed and controlling a DC Motor. In order to have a complete control over DC motor, we must control its speed and rotation direction. This can be achieved by combining the two techniques namely PWM – For controlling speed and H-Bridge – For controlling rotation direction.

The speed of a DC motor can be controlled by varying its input voltage. A common technique for doing this is to use PWM (Pulse Width Modulation). PWM is a technique

ISBN: 978-81-965236-7-1

where the average value of the input voltage is adjusted by sending a series of ON-OFF pulses. The average voltage is proportional to the width of the pulses known as Duty Cycle. The higher the duty cycle, the greater the average voltage being applied to the DC motor (High Speed) and the lower the duty cycle, the less the average voltage being applied to the Dc motor (Low Speed).

Fig. 3 illustrates PWM technique with various duty cycles and average voltages. The DC motor's spinning direction can be controlled by changing the polarity of its input voltage. A common technique for doing this is to use an H-Bridge. An H-Bridge circuit contains four switches with the motor at the center forming an H-like arrangement.

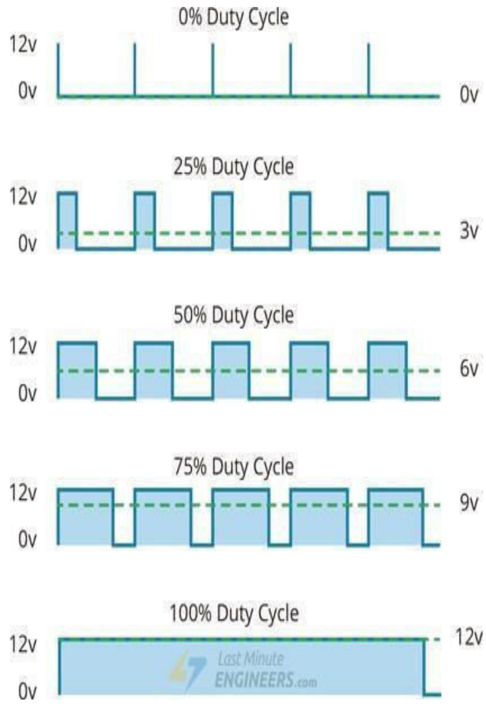


Fig. 3 *H-Bridge – For controlling rotation direction*

Closing two particular switches at the same time reverses the polarity of the voltage applied to the motor. This causes a change in spinning direction of the motor. Fig. 4 illustrates the working of H-Bridge circuit.

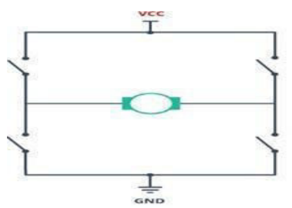


Fig. 4 H-Bridge – For controlling rotation

VI. WORKING

Solar grass cutting robotic vehicle which consist of Arduino board for main controller, that can access relay, motor driver, motor, Battery and solar panel as power supply. The Arduino board can send signal to relay and motor drive that can control movement of motor, as an output the vehicle can automatically move backward by using ultrasonic sensor.

VII.CONCLUSION

In this Automatic grass cutting robot, the chassis handles the complete weight of battery and the hardware mounted on robot which is able to perform each and every operation skill fully and successfully. The main focus of this system is its Automatic way of sowing the seeds in forest. The grass has been in a proper sequence which results in proper germination of seeds. This robot also will help the farmers to do the farming process efficiently.

References

[1] D. Ramesh and H. P. Girishkumar, "Agriculture Seed Sowing Equipment: A Review", International Journal of Science, Engineering and Technology Research, 2014, volume 3, Issue 7, Pp-1987-1999.

[2] Laukik P. Rut, Smit B. Jaiswal and Nitin Y. Mohite, "Design, development, and fabrication of agricultural pesticides with weeder", International Journal of Applied Research and Studies, 2013, volume 2, Issue 11, Pp-1-8.

[3] Sridhar H.S "Development of Single Wheel Multi-Use Mutually Operated Weed Remover", International Journal of Modern Engineering Research, 2013, Vol. 3, Issue.6, Pp-3836-3840.

[4] Adisa A f, Braide F. G, "Outline And Development of Template Row Planter", Transnational Journal of Science and Technology August 2012 release vol.2, No.7.

[5] P.P. shelke " bleeding edge exhibit on bullockdrawn grower upgrades yield of soya bean edit, "Universal Journal of Farm science 1(2): 123-128, 2011

.[6]Mahesh R. Pundkar "A seed sowing machine: A survey" IJESS volume 3, Issue 3. ISSN: 2249- 9482, International Journal of Engineering and Social Science.

AIR POLLUTION DETECTOR WITH SMS ALERT AND LIVE VEDIO USING ARDUNIO AND GSM MODULE

Dr.S.Vadivazhagi
Associate Professor
Department of Instrumentation and Control Engineering
A.V.C College of Engineering
Mannampandal,Mayiladuthurai.
harsh131107@gmail.com

Dr.B.S.Sathishkumar
Associate Professor
Department of Electronics and Communication Engineering
A.V.C College of Engineering
Mannampandal,Mayiladuthurai.
sathishkumarbs@avccengg.net

Mr.K.Sanjai
U.G - Final year
Department of Instrumentation and Control Engineering
A.V.C College of Engineering
Mannampandal,Mayiladuthurai.
krishsanjai2002@gmail.com

***ABSTRACT:-*This project's primary goal is to identify air pollution that can be found utilizing sensors. These sensors are frequently employed to identify dangerous gasses. If there is gas present, the buzzer will sound. Daily life is full with accidents, such as pollution brought on by guanos. If air pollution is not identified in poultry early on, serious harm is done to them. However, we can now identify air pollutants with the help of the air monitor sensor and IOT air pollution detectors.These systems, which can be put in all regions used for farming poultry and birds, can be powered by Arduino or IOT.This air detector system detects the quality of the air. When air pollution is normal, the circuit's LED will flash green, signaling that everything is safe.However, if a sensor detects pollution, the LED will glow red instead of green, alerting the owner and cutting off power. Thus the intelligent air detector project based on Internet of Things will assist in identifying air pollution in the nearby fields.**

KEYWORDS: ***Arduino UNO, MQ135air quality Sensor,H2S gas sensor. GSM module.***

I. INTRODUCTION

Internet of Things (IoT) is an ideal buzzing technology to influence the Internet and communication technologies. IoT allows people and things to be connected. anytime, anyplace, with anything and anyone, by using ideally in any path/network and any service. This project introduces a thought or an idea for home computerization voice acknowledgment, also the development of a prototype for controlling smart homes devices through lot and controlling of dumb devices through loT by the means of Wi- Fi driven chipset solution. ESP8266. This is also acknowledged by the need to give frameworks which offers help to mature and physically impaired individuals, particularly individuals who lives alone. Smart home or home automation can be said as the residential extension of building automation, it also involves the automation and controlling of lightings, ACs, ventilation and security which also includes home appliances such as dryers/washers, ovens or refrigerators/freezers which uses Wi-Fi for monitoring via remote for ease of use. Now a day's speed of processing and common through smart mobile devices at very affordable costs, to improve the lifestyle concept relevant to smart life, like smart T.V, Smart cities, smart phones, smart life, smart school and Internet of Things.

The term "Internet of Things" has come to describe several technologies and research disciplines that enable the Internet to reach out into the real world of physical objects. The term "Internet of Things" has come to describe several technologies and research disciplines that enable the Internet to reach out into the real world of physical objects. The Internet of Things, also called The Internet of Objects, refers to a wireless network between objects. From any time, any place connectivity for anyone, we will now have connectivity for anything.

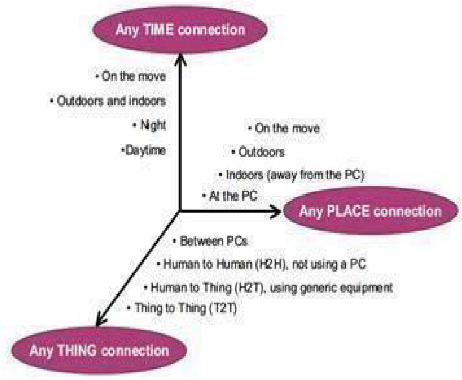


Figure.1: IOT Technology

ISBN: 978-81-965236-7-1

The Internet of Things represents an evolution in which objects can interact with other objects. Hospitals can monitor and regulate pacemakers' long. distance, factories can automatically address production line issues and hotels can adjust temperature and lighting according to a guest's preferences, to name just a few examples.

II. LITERATURE SURVEY

In past years many smart air detectors have been proposed to detect pollution of others pollution efficiently. Some use different sensors like MQ6 in place of MQS . Some programmed the system in such a way that it sends a text message to notify the user. Some even used GSM and Wireless monitoring system This paper discuss about the real time observation of air quality index in the surrounding and avoiding any future accidents.

III. EXISTING SYSTEM

In primary focus intelligent gas leakage detector using Arduino is only possible for detecting the harmful gaseous and alerting the people. Gas leakage is a serious problem and observed in many places like residences, ehicles like Compressed Natural Gas (CNG), buses, cars, etc. It has been noticed that due to gas leakage, dangerous accidents occur. The Liquefied petroleum gas (LPG), or propane, is a flammable mixture of hydrocarbon gases used applications like homes, hostels, industries, l vehicles because of its desirable properties which include high calorific value, less smoke, less soot, and eager harm to the environment. Liquid petroleum gas (LPG) is highly inflammable and can burn even at some distance from the source of leakage. This energy source is primarily composed of propane and butane which are highly flammable chemical compounds. These gases can catch fire easily. In homes, LPG is used mainly for cooking purposes. When a leak occurs, the leaked gases may lead to an explosion. Gas leakage leads to various accidents resulting in both material loss and human injuries. The risks of explosion, fire, suffocation is based on their physical properties such toxicity, flammability, etc.

MQ 135 Gas Quality Sensor

EXHAUST FAN RELAY

The user is alerted about the gas leakage through SMS and the power supply is turned off. proposed the leakage detection and real time gas monitoring system. In this system, the gas leakage is detected and controlled by means of an exhaust fan. The level of LPG in cylinder is also continuously monitored. proposeda system in which the leakage is detected by the gas sensor and produce the results in the audio and visual forms. It provides a design approach on software as well as hardware. In the existing method, different gas sensing technology is used but it acts like as an alarming device only. It will cost only 917 Bangladeshi taka which is equivalent to ten USD.

IV. PROPOSED SYSTEM

In this proposed system by using the Intelligent air pollution detector using ESP 32 module, it detects the air pollution and alert the people, in addition to this it also gives an acknowledgement to the owner and to turn on exhaust fan as soon as possible.

"Air pollution Detector with SMS Alert and live footage using ARDUNIO and GSM module", will be a great help in terms of preventing any danger caused by air pollution. The purpose of this project is to detect the presence of air pollution on farm and working places. Apart from sounding an alarm and SMS alert it will call the owner, which is used in case nobody is present when the pollution occurs and to prevent accidents and property damage. In this project we used a AI camera , which is useful for locating the any leakage or broken equipment in industrial and domestic areas. It can also record the whole activity of domestic or industrial area, and we can access footage at any place via GSM module.It is cost-effective and reduce the damage caused by pollution.

MQ 135 Gas Quality Sensor

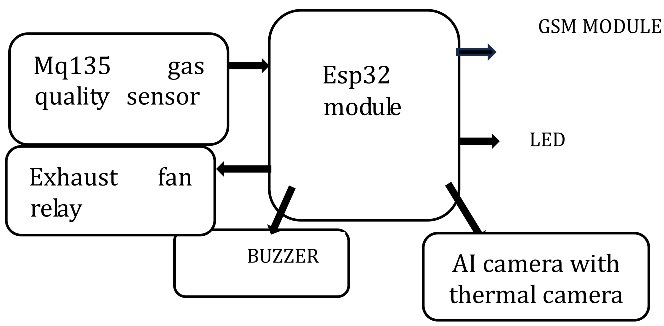


Figure.2: Block Diagram of Proposed System

V. SOFTWARE

For developing this project, we mainly used software called Arduino IDE 2.2.1. The Arduino IDE is an open-source software, which is used to write and upload code to the Arduino boards. The IDE application is suitable for different operating systems such as Windows, Mac OS X, and Linux. It supports the programming languages C and C++. Here, IDE stands for Integrated Development Environment.

VI. METHODOLOGY

The idea behind this project is to detect the air pollutants that can be detected by using Sensor. The presence of hazardous air pollution in the farm any environment, such poultry farm , chemical industry or any such gaseous substance in a domestic workplace and stored gases container gas which

ISBN: 978-81-965236-7-1

exhibits ideal characteristic is use. Which can produce a hazardous gas. If the Produces gas leaked from the above field ,MQ135Air Quality Sensor can send signal into Arduino board that can indicate the leakage through LED and a sound alarm upon gas leak. It can also start and control a exhaust fan RPM based on AQI level. The usage of gas brings great problems in the domestic as well as working places. Inflammable gases such as Liquefied petroleum gas (LPG), which is excessively used in the house and at workplaces.

The leakage of gas causes a destructible impact on the lives and as well as to the heritage of the people. So, by keeping it in the concept of the project we have determined to develop an examination system which finds the leak of gas and protects the workplace by taking correct precautions at the correct time. According to ABS-CBN news 2017 that from January to June last 2017, the BFP has recorded a total of 2,522 fire incidents. It was traced that Gas is one of the major causes of fire during that year where half of the total which is 1,253 beside from the electrical causes. "

This system provides information such as when a gas leakage is noticed, sensors of in the project are used to notice the gas leakage and immediately turns ON the buzzer and LED for the danger indication. Buzzer is a clear indication of gas leakage. By the detection of the hazardous gas the alerting message reached the person who has control over it from the GSM. Also, we can conclude where gas leaked or any other leaked using AI camera module and send a footage of leakage via GSM .Detection of the gas leakage is important and halting leakage is important equally.

ADVANTAGES

- High Sensitivity
- Quick Response Time
- Detection and prevention of any sort of gas leakage.
- Widely Detects Flammable and Toxic gases.
- Improves the Safety
- Light Weight
- Portable System
- Cost Efficient

APPLICATIONS

- Gas Storage Areas ₒHomes & Factories ₒHotels & Industries
- Fire Hazard Prevention
- Harmful Gas Detection
- Domestic Gas Leakage Detector
- Portable Gas Detector
- Industrial Combustible Gas Detector

VII. CONCLUSION

We draw the conclusion that the design and testing of this project, "Air pollution Detector with SMS Alert and live footage using ARDUNIO and GSM module," was successful. It was created by combining the functionalities of every piece of hardware that was utilized. Each module's placement and rationale have been thoroughly considered in order to maximize the unit's performance. Second, the project has been executed successfully thanks to the use of extremely sophisticated components and the advancement of technology.The Arduino-powered 1oT-based intelligent air pollution monitor detects air pollution, indicates it with an alert, calls the owner, and activates the exhaust fan. This is beneficial for both home and poultry farming applications. Any air pollution in the vicinity is detected by a sensor. We can use this technique to save lives when things are in danger.

VIII. REFERENCES

[1] Ramya, V. Palaniappan, B. Embedded system for Hazardous Gas detection and Alerting. International Journal of Distributed and Parallel Systems (IJDPS), 2012; 3(3):287-300.

[2] Priya, P. D. Rao, C. T. Hazardous Gas Pipeline Leakage Detection Based on Wireless Technology.International Journal of Professional Engineering Studies, India, 2014; 2(1).

[3] S. A. SagarShind K, “Develop of the move gaseous tank leaking detect in wireless sensor n/w with the base on embedded systems,” International Journal of Engineering Research and Applications, Nov 2012. Vols. 2, Is 6, no. 2248-9622, pp. 1180- 1183.

[4] Ch. Manohar Raju N. Sushma Rani, “An android based automatic gas detection and indication robot.” In the international journal of computer engineering and application. 2014;8(1)

[5] M. Amsaveni, A. Anurupa, R. S. AnuPreethi, C. Malarvizhi, M. Gunasekaran, “GSM based LPG leakage detection and controlling system”, The International Journal of Engineering and Science (IJES), March- 2015, ISSN (e): 2319 - 1813 ISSN (p): 2319 - 1805.

ISBN: 978-81-965236-7-1

Analysis of medical Image fusion using AdaptiveMorphion Algorithm based on Discrete wavelet Transform

Balaji T.N
Assistant Professor, Department of ECE,
sri raja raajan college of engg and tech ,sivagangai Dist.,
Tamil Nadu.
bala986@gmail.com

Abstract

Image fusion is a common task in many computer vision and graphics applications. Gray-level thresholding is the simplest, yet often effective, segmentation method. In this approach, structures in the image are assigned a label by comparing their graylevel value to one or more intensity thresholds. A threshold that is calculated at each pixel characterizes this class of algorithms. The value of the threshold depends upon some local statistics like range, variance, and surface fitting parameters or their logical combinations. This method is based on the combined use of edge and gray-level information to construct a threshold surface. The image gradient magnitude is obtained and it is thinned to yield local gradient maxima. The threshold surface is constructed by interpolation with potential surface functions using successive over-relaxation method. Analyzing the abnormal region in various medical images is the critical issues because these images contain different type's attenuation artifacts. This paper proposes an automatic method to change the representation of an image into something that is more meaningful and easier to analyze. There are several methods that intend to perform segmentation, but it is difficult to adapt easily and diagnose accurately. To resolve this problem, this project aims to presents an adaptable morphion technique based on DWT that can be applied to any type of medical images.

Keywords—Adaptive, Medical Image, Thresholding

I. INTRODUCTION

Biomedical image processing has experienced dramatic expansion, and has been an interdisciplinary research field attracting expertise from applied mathematics, computer sciences, engineering, statistics, physics, biology and medicine. Computer-aided diagnostic processing has already become an important part of clinical routine. Accompanied by a rush of new development of high technology and use of various imaging modalities, more challenges arise; for example, how to process and analyze a significant volume of images so that high quality information can be produced for disease diagnoses and treatment.Medical imaging is the technique and process used to create images of the human body (or parts and function thereof) for clinical purposes (medical procedures seeking to reveal, diagnose or examine disease) or medical science (including the study of normal anatomy and physiology). Although imaging of removed organs and tissues can be performed for medical reasons, such procedures are not usually referred to as medical imaging, but rather are a part of pathology. As a discipline and in its widest sense, it is part of biological imaging and incorporates radiology (in the wider sense), nuclear medicine, investigative radiological sciences, endoscopy, (medical) thermographs, medical photography and microscopy. Measurement and recording techniques which are not primarily designed to produce images, such as electroencephalography (EEG), magneto encephalography (MEG), electrocardiography (EKG) and others, but which produce data susceptible to be represented as maps can be seen as forms of medical imaging. Medical imaging is often perceived to designate the set of techniques that noninvasively produce images of the internal aspect of the body. In this restricted sense, medical imaging can be seen as the solution of mathematical inverse problems. This means that cause (the properties of living tissue) is inferred from effect (the observed signal). In the case of ultrasonography the probe consists of ultrasonic pressure waves and echoes inside the tissue show the internal structure. In the case of projection radiography, the probe is X-ray radiation which is absorbed at different rates in different tissue types such as bone, muscle and fat. The influence and impact of digital images on modern society is tremendous, and image processing is now a critical component in science and technology. The rapid progress in computerized medical image reconstruction, and the associated developments in analysis methods and computer-aided diagnosis, has propelled medical imaging into one of the most important sub-fields in scientific imaging thresholding

II. ANALYSIS OF MEDICAL IMAGE

Medical Image Analysis provides a forum for the dissemination of new research results in the field of medical and biological image analysis, with special emphasis on efforts related to the applications of computer vision, virtual reality and robotics to biomedical imaging problems. Medical imaging is a routine and essential part of medicine. Pathologies can be observed directly rather than inferred from symptoms. For example, a physician can non-invasively monitor the healing of damaged tissue or the growth of a brain tumor, and determine an appropriate medical response. Medical imaging techniques can also be used when planning or even while forming surgery. For example, a neurosurgeon

ISBN: 978-81-965236-7-1

can determine the “best” path in which to insert a needle, and then verify in real time its position as it is being inserted.

Medical imaging is the technique and process used to create images of the human body (or parts and function thereof) for clinical purposes (medical procedures seeking to reveal, diagnose or examine disease) or medical science (including the study of normal anatomy and physiology). Although imaging of removed organs and tissues can be performed for medical reasons, such procedures are not usually referred to as medical imaging, but rather are a part of pathology.

III. ADAPTIVE MORPHION ALGORITHM

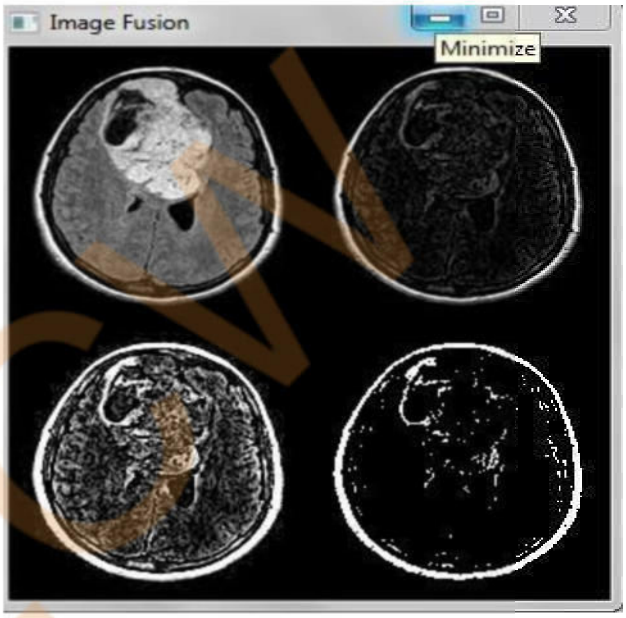
Image fusion is the process of combining relevant information from two or more images into a single image. The resulting image will be more informative than any of the input images.

In remote sensing applications, the increasing availability of space borne sensors gives a motivation for different image fusion algorithms. Several situations in image processing require high spatial and high spectral resolution in a single image. Most of the available equipment is not capable of providing such data convincingly. The image fusion techniques allow the integration of different information sources. The fused image can have complementary spatial and spectral resolution characteristics. However, the standard image fusion techniques can distort the spectral information of the multispectral data while merging.

In satellite imaging, two types of images are available. The panchromatic image acquired by satellites is transmitted with the maximum resolution available and the multispectral data are transmitted with coarser resolution. This will usually be two or four times lower. At the receiver station, the panchromatic image is merged with the multispectral data to convey more information.Many methods exist to perform image fusion. The very basic one is the high pass filtering technique. Later techniques are based on DWT, uniform rational filter bank, and laplacian pyramid.

The fusion algorithms used in our current work carry out inter-procedural optimization, and they reduce or eliminate the multi-threading overheads caused by asynchronous remote agent invocation. For example, in PSSPS, an asynchronous invocation is implemented as follows: with each method in an agent's interface definition, we associate a special modifier that denotes whether the method should be invoked synchronously (SYNC_IF_FUSED) or asynchronously (ASYNC_IF_FUSED) by fellow fused agent(s). An invocation to SYNC_IF_FUSED methods by a fellow fused agent(s) is replaced by a direct local procedure call. The fusion algorithm then applies inter-procedural analysis to perform aliasing and, in the case of SYNC_IF_FUSED methods, procedure in-lining. Aliasing attempts to eliminate unnecessary data copying, since data formerly located in different address spaces or on different hosts may potentially be shared subsequent to agent fusion and co-location.

Fusion may be applied repeatedly, possibly later followed by agent `splitting', if indicated. Agent `splitting' is an agent adaptation method we are aware of, it applies *program slicing* to an agent operating on a distributed data set and distributes agent slices so that each agent slice operates on some local data which is a subset of the distributed data set.



(a)

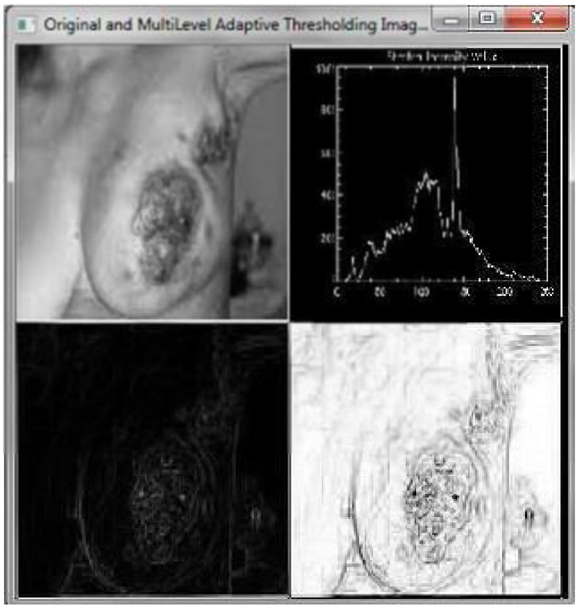


Fig. 1(a) & (b).Image Fusion using Morphion Algorithm

ISBN: 978-81-965236-7-1

IV. DISCRETE WAVELET TRANSFORM

The transform of a signal is just another form of representing the signal. It does not change the information content present in the signal. The Wavelet Transform provides a time-frequency representation of the signal. It was developed to overcome the short coming of the Short Time Fourier Transform (STFT), which can also be used to analyze non-stationary signals. While STFT gives a constant resolution at all frequencies, the Wavelet Transform uses multi-resolution technique by which different frequencies are analyzed with different resolutions.

A wave is an oscillating function of time or space and is periodic. In contrast, wavelets are localized waves. They have their energy concentrated in time or space and are suited to analysis of transient signals. While Fourier Transform and STFT use waves to analyze signals, the Wavelet Transform uses wavelets of finite energy.

The Wavelet Series is just a sampled version of CWT and its computation may consume significant amount of time and resources, depending on the resolution required. The Discrete Wavelet Transform (DWT), which is based on sub-band coding is found to yield a fast computation of Wavelet Transform. It is easy to implement and reduces the computation time and resources required.

The driving force behind wavelet transforms (WTs) is to overcome the disadvantages embedded in short time Fourier transform (STFT), which provides constant resolution for all frequencies since it uses the same window for the analysis of the inspected signal x (t). On the contrary, WTs use multi-resolution, that is, they use different window functions to analyse different frequency bands of the signal x (t). Different window functions ψ(s,b,t);which are also called son wavelets, can be generated by dilation or compression of a mother wavelet ψ(t) , at different time frame. A scale is the inverse of its corresponding frequency. WTs can be categorised as discrete WTs or continuous WTs. For vibration-based fault diagnosis, usually continuous WTs are employed. A continuous type of wavelet transform (CWT) that is applied to the signal x(t) can be defined as,

$$w(a,b)=\frac{1}{\sqrt{a}}\int_{-\infty}^{\infty} f(t)\psi\left(\frac{t-b}{a}\right)dt \qquad (3.2)$$

Where

- a is the dilation factor,
- b is the translation factor and
- $\psi(t)$ is the mother wavelet.
- $1/\sqrt{a}$ is an energy normalization term that makes wavelets of different scale has the same amount of energy.

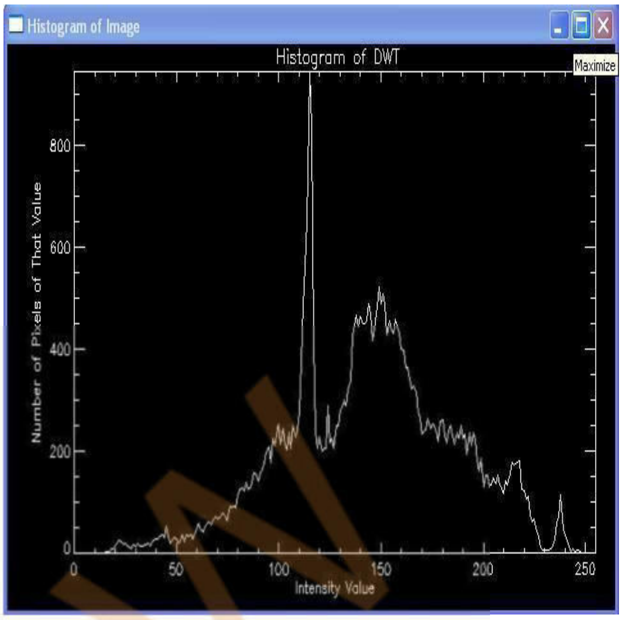


Fig. 4 Histogram DWT

IV. IMAGE FUSION

In image fusion process separation of image into different regions based upon its gray level distribution. Key to the selection of a threshold value is an image's histogram, which defines the gray level distribution of its pixels. The bimodal nature of this histogram is typical of images containing two predominant regions of two different gray levels as objects and background. When dealing with digital pictures, most images are having continuous intensity variation and if only a single threshold level is used then many important regions are lost. It becomes difficult to identify significant regions of such images having multimodal histogram. A better method of Thresholding the gray level image is thus to use multilevel Thresholding instead of bi level thresholding. This is the approach that is taken in the implementation of optimal thresholding. The basic procedure of image fusion based on wavelet transform mainly includes three steps: decomposition, fusion and reconstruction [6]. Image *A* and image *B* are the two source images. Firstly, applying the DWT to decompose image *A* and image *B* respectively, each image is decomposed into a gross approximation $Cj + 1(j = N)$ (the low frequency contour information) on the top of the pyramid, and $3N$ detail coefficients .fusing corresponding coefficients of approximate and detail sub image of the decomposed source images in each decomposition level according to a certain fusion rule, and obtain the fused multi-resolution representation. Lastly, applying the inverse discrete wavelet transform (IDWT) to reconstruct the fused sub image and obtain the fused result image *F*.

In the process, choosing fusion rules is still a difficultyissue in image fusion presently. Conventional fusion algorithms are

ISBN: 978-81-965236-7-1

mainly focused on how to choose the high frequency coefficients. The low frequency coefficients often use the weighted average scheme [7], it usually weaken the features of the edge. The high-frequency fusion is based on the regional energy (such as energy, contrast, etc.) get a big criterion for regional. The method determine a match threshold λ, when the similarity of the regional characteristics is less than a given threshold λ, choose directly the center pixel of larger local energy as the fused image correspond to the location of value; on the other hand, weighted calculation determine the fused value. Weight selecting relates with threshold λ, λ usually choose between 0.5-0.8. The fusion result depends on the value of λ to a large extent, the lack of flexibility, the selection of λ also lack an objective basis and don't adapt the complexity and diversification of medical images..

Fig. 4. Multilevel Adaptive Thresholding Technique

V. Conclusion

This paper proposes an analysis of medical image by using multilevel Adaptive thresholding method. We have conducted a thorough survey of thresholding algorithms. To understand parallelisms and complementarities between the various methods we have found it convenient to categorize them into six classes on the basis of information they are exploiting. The optimum feature values, which are in the lower resolution, are then projected onto the original feature space. A refinement procedure may be added to detect optimum threshold values.

References

[1] T.k. ganga, v.karthikeyani, Medical Image Segmentation Using Multi Resolution Histogram, 978-1-4244-8679-3/11/$26.00 ©2011 IEEE

[2] Abutaleb, A.S., 1989. Automatic thresholding of gray-level picture using two-dimensional entropy. Comput. Vision, Graphic, Image Process. 47, 22–32.

[3] Acharyya, M., Kundu, M.K., 2001. Wavelet-based texture segmentation of remotely sensed images. IEEE 11th International. Conference. Image Analysis. Process., 69–74.

[4] Calvard, S., 1978. Picture thresholding using an iterative selection method. IEEE Transaction Systems, Man, Cybernet. 8,629–632.

[5] Cao, L., Shi, Z., Cheng, E.K.W., 2002. Fast automatic multilevel thresholding method. Electron. Lett. 38 (16),868–870.

[6] Charalampidis, D., Kasparis, T., 2002. Wavelet-based rotational invariant roughness features for texture classification and segmentation. IEEE Trans. Image Processing. 11 (8), 825–837.

[7] Goswami, J.C., Chan, A.K., 1999. Fundamentals of Waveletstheory,Algorithm, and Applications. Wiley Inter-Science. Kim, J.B., Kim,H.J., 2003.

[8] Multiresolution-based watersheds for efficient image segmentation. Pattern Recognition Lettere.(24), 473–488.

[9] Kittler, J., Illingworth, J., 1986. Minimum error thresholding. Pattern Recognition 19 (1), 41–47.

[10] Kumar, A., Bar-Shalom, Y., Oron, E., 1995. Precision tracking based on segmentation with optimal layering for imaging sensors. IEEE Trans. Pattern Analysis. Machine Intelligence. 17 (2),182–188.

SBECW

ISBN: 978-81-965236-7-1

SMART ENVIRONMENT AND APPLICATIONS

AMRIN THABASUM.S
HARINI.G.G
FAISHAL SAHAANA.N
JOSPHIN MARY.S
MIET Engineering College
Trichy

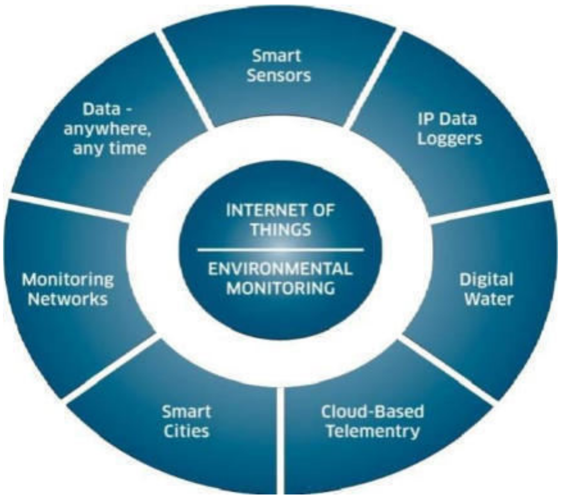
Abstract;-**The rapid advancements in technology have led to the emergence of smart environments, characterized by the integration of various sensors, actuators, and intelligent systems to enhance efficiency, comfort, and sustainability. This paper explores the applications of smart environments across various domains, including smart homes, smart cities, healthcare, agriculture, and transportation. In smart homes, these technologies enable automation of household tasks, energy management, and personalized experiences for occupants. Smart cities leverage data-driven insights to optimize infrastructure, improve public services, and enhance the quality of life for residents. In healthcare, smart environments support remote monitoring, personalized treatments, and predictive analytics to enhance patient care and wellbeing. In agriculture, sensor networks and data analytics contribute to precision farming, resource optimization, and sustainable practices. Additionally, smart transportation systems utilize real-time data and intelligent algorithms to optimize traffic flow, reduce congestion, and improve safety. This paper discusses the challenges and opportunities associated with the deployment of smart environments, including privacy concerns, interoperability issues, and the need for robust cybersecurity measures. Through case studies and examples, it highlights the transformative potential of smart environments in shaping a more connected, efficient, and sustainable future.This article surveys the state-of-the-art research efforts to enable IoT-based smart environments. We categorize and classify the literature by devising a taxonomy based on communication enablers, network types, technologies, local area wireless standards, objectives, and characteristics. Moreover, the article highlights the unprecedented opportunities brought about by IoT-based smart environments and their effect on human life. Some reported case studies from different enterprises are also presented. Finally, we discuss open research challenges for enabling IoT-based smart environments.**

Introduction

In an era defined by technological innovation and interconnectedness, the concept of smart environments has emerged as a transformative force across various sectors. Smart environments encompass a spectrum of applications where digital technologies, sensing capabilities, and data analytics converge to create intelligent ecosystems that enhance efficiency, convenience, and sustainability. This introduction provides an overview of the evolution, key components, and diverse applications of smart environments, highlighting their significance in shaping the future of urban living, healthcare delivery, agricultural practices, transportation systems, and beyond.The proliferation of Internet of Things (IoT) devices, coupled with advancements in artificial intelligence (AI)

ISBN: 978-81-965236-7-1

and data analytics, has paved the way for the development of smart environments. These environments are characterized by their ability to sense, analyse, and respond to data from physical surroundings in real time, enabling proactive decision-making



and automation of processes.Key components of smart environments include sensors, actuators, communication networks, edge computing, and cloud platforms, which collectively form interconnected systems capable of capturing and processing vast amounts of data.The applications of smart environments are multifaceted and span across diverse domains. In the realm of smart homes, these technologies enable the creation of connected living spaces equipped with intelligent devices that automate routine tasks, optimize energy consumption, and enhance security. Smart cities leverage data-driven insights to improve urban infrastructure, enhance public services, and address environmental challenges such as pollution and congestion. In healthcare, smart environments facilitate remote patient monitoring, personalized treatments, and predictive analytics, revolutionizing the delivery of medical care and improving patient outcomes.Agriculture stands to benefit significantly from the deployment of smart environments, as sensor networks, and data analytics enable precision farming, resource optimization, and sustainable agricultural practices. Smart transportation systems utilize real-time data and intelligent algorithms to optimize traffic flow, reduce congestion, and improve safety on roads and public transit networks.Despite the promising opportunities presented by smart environments, challenges such as privacy concerns, interoperability issues, and cybersecurity threats must be addressed to realize their full potential. Furthermore, ethical considerations surrounding data collection, usage, and ownership necessitate careful deliberation and regulatory frameworks. It is imperative to balance innovation with responsible governance to ensure equitable access, privacy protection, and ethical use of data in the pursuit of a smarter future.

Applications Of Environment

Smart environments refer to spaces embedded with sensing, computing, and communication capabilities, aimed at enhancing the efficiency, comfort, and safety of occupants. Applications in smart environments span various domains including:

- Home Automation
- Healthcare
- Smart Cities
- Industrial Automation
- Education
- Transportation
- Entertainment

1.Home Automation

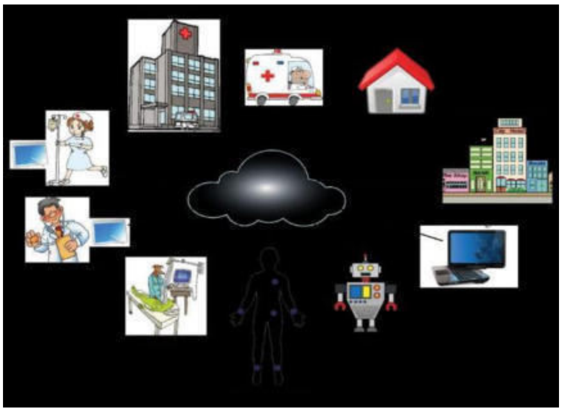
Control and automation of home appliances, lighting, heating, and security

ISBN: 978-81-965236-7-1

systems for improved energy efficiency and convenience.

2.Healthcare

Monitoring and tracking health metrics of individuals, assisting elderly or disabled people in daily activities, and providing timely alerts in case of emergencies.



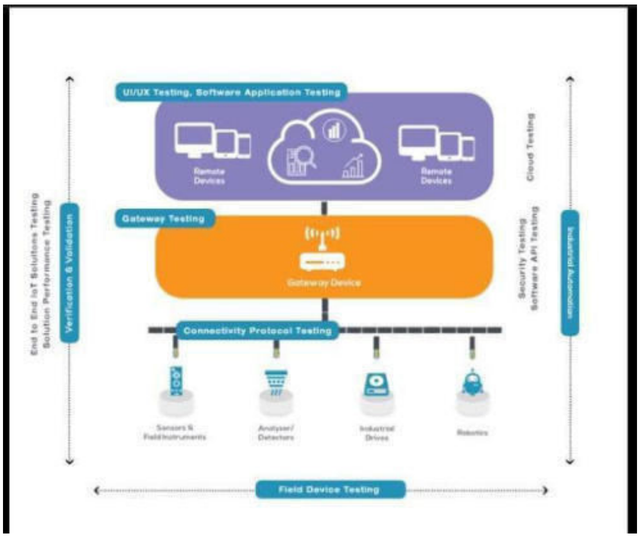
3.Smart Cities

Optimizing resource utilization, traffic management, waste management, and public services through sensor networks and data analytics.

4.Industrial Automation

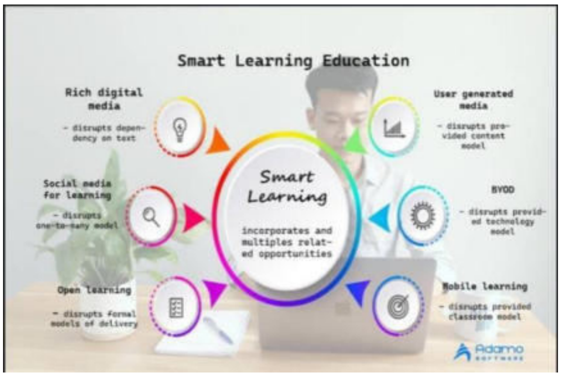
Enhancing productivity, safety, and maintenance of industrial processes through automation, predictive maintenance, and real-time monitoring.

ISBN: 978-81-965236-7-1



5.Education

Creating interactive and personalized learning environments through adaptive learning systems, virtual classrooms, and smart educational tools.



6.Transportation

Optimizing traffic flow, reducing congestion, and enhancing safety through intelligent transportation systems and vehicle-to-infrastructure communication.

7.Entertainment

Providing immersive and personalized entertainment experiences through augmented reality (AR), virtual reality (VR), and interactive media.

Applications within these domains leverage technologies such as Internet of Things (IoT), artificial intelligence (AI), machine learning (ML), data analytics, and sensor networks to create intelligent and responsive environments that adapt to user needs and preferences.

ISBN: 978-81-965236-7-1

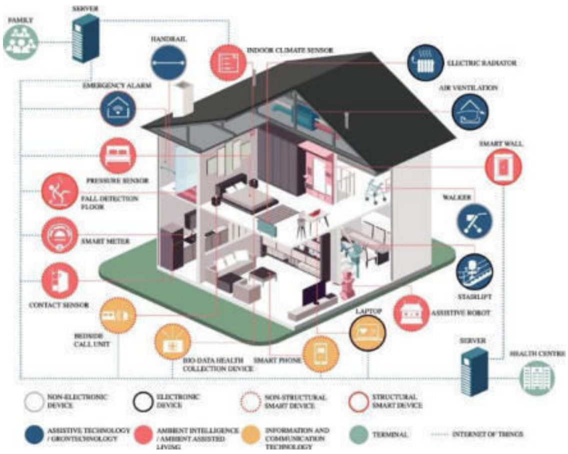
Applications of Internet Of Things (IOT)

The Internet of Things (IoT) describes the network of physical objects“things”—that are embedded with sensors, software, and other technologies for the purpose of connecting and exchanging data with other devices and systems over the internet.The Internet of Things (IoT) has numerous applications across various industries including:

- **Smart Home**
- **Agriculture**
- **Logistics and Supply Chain**
- **Energy Management**
- **Environmental Monitoring**
- **Wearable Technology**

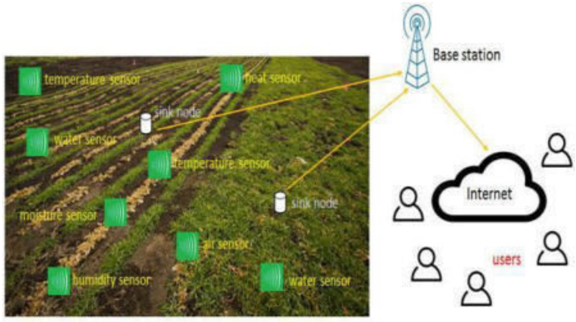
1.Smart Home

IoT devices like smart thermostats, lights, and security cameras enable homeowners to remotely control and automate their homes for energy efficiency, security, and convenience.



2.Agriculture

IoT sensors and drones provide farmers with real-time data on soil moisture, temperature, and crop health, allowing for precise irrigation, fertilization, and pest control.



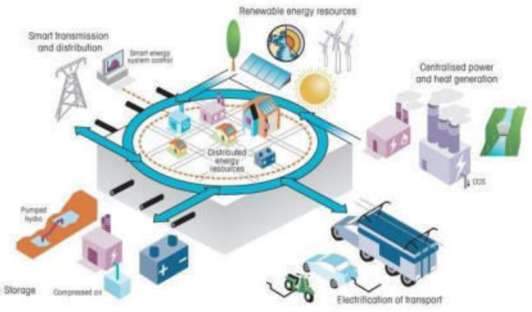
3.Logistics and Supply Chain

IoT devices enable tracking of goods in transit, monitoring conditionsliketemperature and humidity for perishable items, and optimizing routes for transportation efficiency.

4.Energy Management

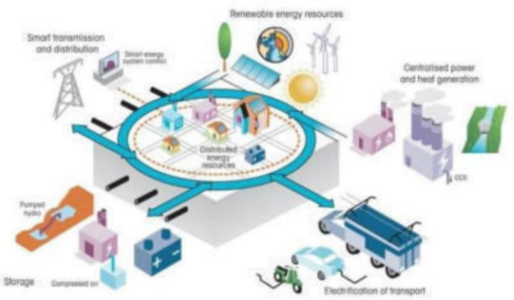
IoT devices in smart grids enable utilities to monitor and manage energy distribution more efficiently, integrate renewable energy sources, and empower consumers with insights to reduce energy consumption.

ISBN: 978-81-965236-7-1



5.Environmental Monitoring

IoT sensors help in monitoring air and water quality, detecting pollution, and managing natural resources more effectively.



6.Wearable Technology

IoT-enabled wearable devices like smartwatches and fitness trackers track activity levels, monitor health metrics, and provide personalized feedback for users.

These are just a few examples, and the potential applications of IoT continue to expand as the technology evolves.

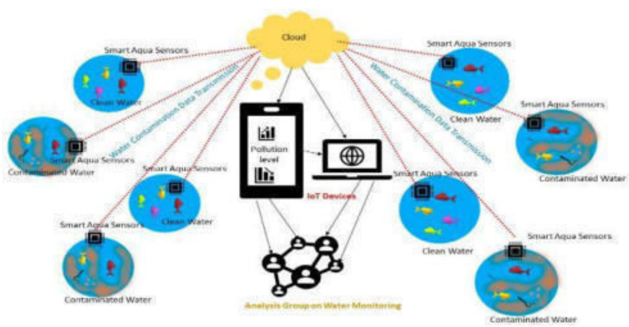
Proposed Systems

A proposed system in a smart environment and application could involve integrating various sensors, devices, and software to create an interconnected ecosystem aimed at improving efficiency, convenience, and sustainability. This system could include**:**

- **Sensor Networks**
- **Security and Surveillance**
- **Health and Wellness Monitoring**
- **Integration with AI and Machine Learning**
- **User Interface**
- **Data Privacy and Security**
- **Scalability and Interoperability**

❖ **Sensor Networks**

Implementing sensors for monitoring environmental conditions like temperature, humidity, air quality, and occupancy to optimize energy usage and enhance occupant comfort.



❖ **Security and Surveillance**

Integrating security cameras, motion sensors, and smart locks to enhance home security, with the ability to monitor and control access remotely through a mobile application.

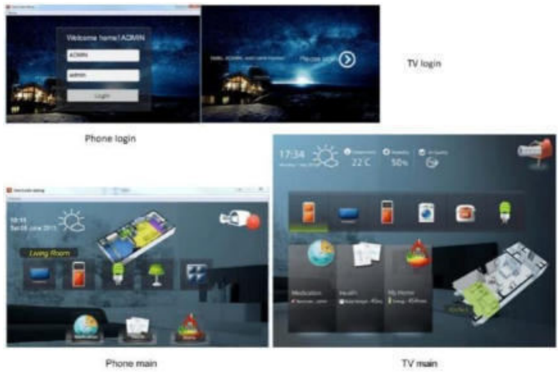
ISBN: 978-81-965236-7-1

❖ **Health and Wellness Monitoring**

Deploying wearable devices or smart health monitors to track vital signs, physical activity, and sleep patterns, providing users with insights into their health and well-being.

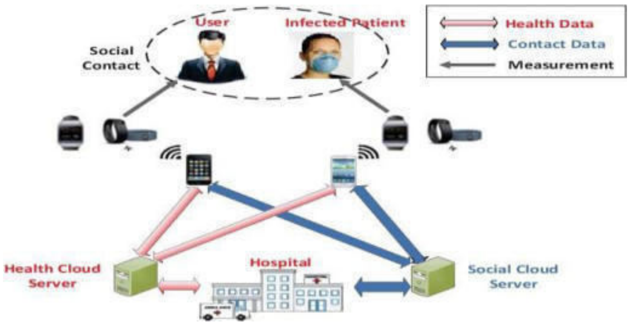
❖ **User Interface**

Developing user-friendly mobile or web applications that allow users to interact with and control various aspects of the smart environment, providing a seamless and intuitive experience.



❖ **Data Privacy and Security**

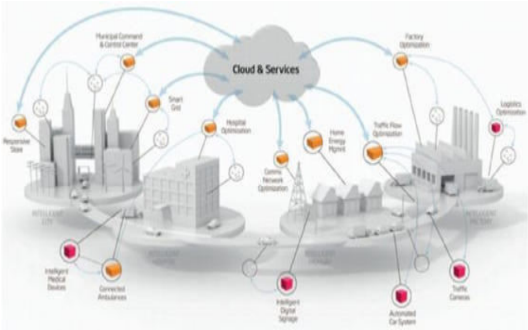
Implementing robust security measures to protect user data and privacy, including encryption, authentication mechanisms, and regular software updates to mitigate potential vulnerabilities.



❖ **Scalability and Interoperability**

Designing the system to be scalable and interoperable, allowing for seamless integration with future devices and technologies, as well as compatibility with existing standards and protocols in the smart home

ISBN: 978-81-965236-7-1



The Purpose Of Smart Environment

Smart environment is an assembly of sensors, actuators and many computational elements providing services for betterment of human life. Aspect of a smart city concerning the control and monitoring of environmental factors such as pollution, waste, planning of green areas, and energy.

Conclusion

In conclusion, smart environments offer a plethora of benefits including increased efficiency, convenience, and sustainability. However, challenges such as privacy concerns and interoperability issues need to be addressed for widespread adoption. With continued advancements in technology and collaborative efforts, smart environments have the potential to significantly enhance our quality of life.The integration of smart environments and applications holds promise for revolutionizing various aspects of daily life, from optimizing energy usage and enhancing security to improving healthcare and transportation systems. As these technologies continue to evolve, it's essential to prioritize user privacy, security, and inclusivity while fostering interoperability among different systems. With careful planning and collaboration across sectors, smart environments and applications can truly transform how we live, work, and interact with our surroundings, ultimately leading to more sustainable and connected communities.

Reference

1. G. Youngblood, E. Heierman, L. Holder, and D. Cook, “Automation intelligence for the smart environment,” Proceedings of the International Joint Conference on Artificial Intelligence, 2005.

2. M. Weiser, “The computer for the 21st century,” SIGMOBILE Mob. Comput. Commun. Rev., vol. 3, no. 3, pp. 3-11, 1999.

3. J. A. Alvarez, M. D. Cruz, A. Fernndez, J. A. Ortega, and J. Torres, “Experienciasenentornos de computacinubicuamediantearquitecturasorientadas a servicios,” CEDI-JSWeb, pp. 167-174, sept 2005.

4. D. Cook and S. Das, “How smart are our environments? An updated look at the state of the art,” Pervasive and Mobile Computing, vol. 3, no. 2, pp. 53-73, 2007.

5. C. da Costa, A. Yamin, and C. Geyer, "Toward a general software infrastructure for ubiquitous computing," Pervasive Computing, IEEE, vol. 7, no. 1, pp. 64-73, Jan.-March 2008.ì

6. T. Weis, M. Knoll, A. Ulbrich, G. Muhl, and A. Brandle, “Rapid prototyping for pervasive applications,” Pervasive Computing, IEEE, vol. 6, no. 2, pp. 76-84, April-June 2007.

7. K. Rehman, F. Stajano, and G. Coulouris, “An architecture for interactive context-aware applications,” Pervasive Computing, IEEE, vol. 6, no. 1, pp. 73-80, Jan.-March 2007.

ISBN: 978-81-965236-7-1

IOT IN WASTE MANAGEMENT

ABDUL RASHEED A

MOHAMED THOUFIC B

FARZANA BEGUM M

MIET ENGINEERING COLLEGE

GUNDUR,TRICHY

Abstract;-**The Internet of Things (IoT) paradigm plays a vital role for improving smart city applications by tracking and managing city processes in real-time. One of the most significant issues associated with smart city applications is solid waste management, which has a negative impact on our society's health and the environment. The traditional waste management process begins with waste created by city residents and disposed of in garbage bins at the source. Municipal department trucks collect garbage and move it to recycling centres on a fixed schedule. Municipalities and waste management companies fail to keep up with outdoor containers, making it impossible to determine when to clean them or when they are full. This work proposes an IoT-enabled solid waste management system for smart cities to overcome the limitations of the traditional waste management systems. The proposed architecture consists of two types of end sensor nodes: PBLMU (Public Bin Level Monitoring Unit) and HBLMU (Home Bin Level Monitoring Unit), which are used to track bins in public and residential areas, respectively. The PBLMUs and HBLMUs measure the unfilled level of the trash bin and its location data, process it, and transmit it to a central monitoring station for storage and analysis. An intelligent Graphical User Interface (GUI) enables the waste collection authority to view and evaluate the unfilled status of each trash bin.**

Introduction

The Internet of Things (IoT) is a concept that refers to the ever-expanding network of internet-connected devices that are currently in use all over the world. Despite the current Covid-19 pandemic, the Internet of Things industry is growing, and it is estimated that around 30 billion IoT connections will exist by the end of 2025.IoT has already exhibited promising approaches towards domain-specific applications such as

- Smart Homes
- Smart City
- Agriculture
- Smart Grids

IoT plays a pivotal role in enhancing smart city applications through real-time monitoring and management of city processes. One of the biggest challenges associated with smart city applications is solid waste disposal, which impacts our society's health and nature. Solid wastes are produced as a result of human and animal activities and are typically discarded as useless. Annually, the world produces 2.01 billion tons of urban solid waste, with at least 33% not being handled in an environmentally friendly way. By 2050, global waste is estimated treach 3.40 billion tons, more than doubling population growth over that period. The conventional waste management process begins with waste being generated by residents in cities and disposed of in trash bins at the point of creation. At a predeterminedschedule, municipal department trucks gather the garbage and transport it to the recycling centres. Municipalities and corporations struggle to keep up with the outdoor bins to determine when to clean them or whether they are completely filled or not. One of the most pressing issues of our time is the prevention, tracking, and treatment of these wastes. The conventional method of manually inspecting waste in bins is a time-consuming procedure that requires more human labour, time, and money which can be eliminated with today's technology. For tracking the bins, some of the monitoring systems used short-range wireless networking techniques including Bluetooth, Infrared, ZigBee, and Wi-Fi. Similarly, a few works described smart bin monitoring systems that employs wide area network technologies such as NB-IoT, Sigfox, and LoRa. As most homes are equipped with wireless internet connections, it is inferred that the Wi-Fi-based solution is well suited for monitoring the household bins. This will minimize the

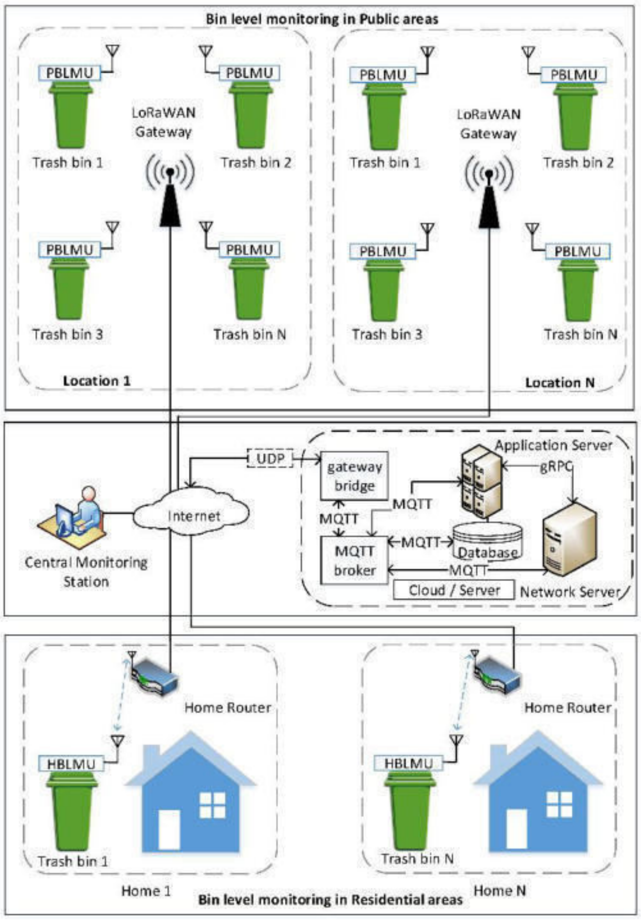
ISBN: 978-81-965236-7-1

additional infrastructure expense. However, it is unsuitable to monitor trash bins in public places. Similarly, LoRa-based monitoring techniques are appropriate for monitoring bins in public areas. However, these methods are not preferable for monitoring bins at home because they would incur additional costs for the implementation of gateways and other facilities. According to the literature, none of the current solid waste management methods discuss the need for a hybrid architecture to efficiently manage solid waste in smart cities. Therefore, this work proposes an IoT-based solid waste management system for smart cities. The main contributions of this work in contrast to the existing solutions are as follows.

- Hybrid network architecture to monitor the household and public trash bins.
- Solar energy harvesting facility to extend the life time of the end node.
- A GPS module is embedded to evaluate the Geo-location of the trash bins.
- An intelligent GUI is employed to view the status of every trash bin.

Network Architecture of the Developed System

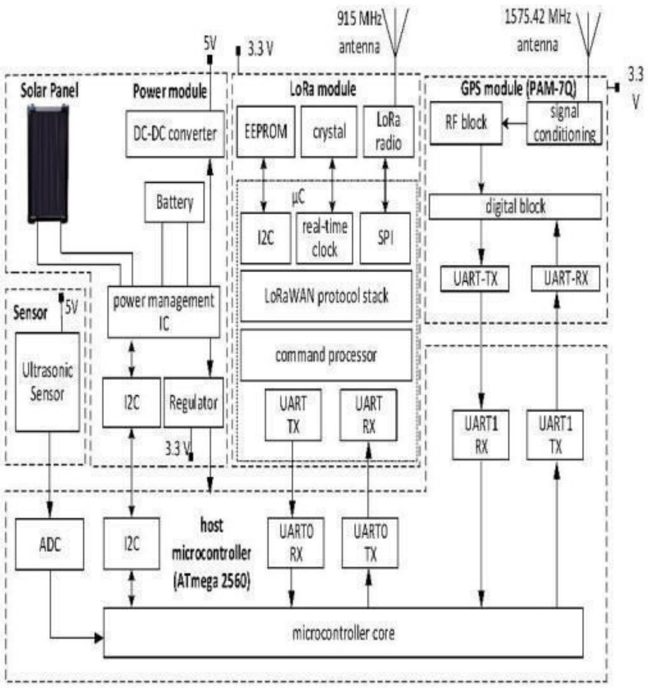
The network architecture of the developed IoT enabled solid waste management system is given below. It follows a hybrid network architecture to manage the trash bins in public places and residential areas effectively. The architecture comprises end sensor nodes, namely, Public Bin Level Monitoring Unit (PBLMU) and Home Bin Level Monitoring Unit (HBLMU) for monitoring the trash bins at public places and residential areas, respectively.
The network architecture of the developed system.



A Long Range Wide Area Network(LoRaWAN) networking architecture is adopted for the deployment of PBLMUs, whereas a Wi-Fi-based communication is adopted for HBLMUs as the trash bins are associated with homes. The PBLMUs use a frequency of 915 MHz to relay unfilled level and geo-location data from trash bins to the LoRaWAN gateway.The data from the PBLMUs are collected by the LoRaWAN gateway and uploaded to the server for storage and visualization, whereas a Wi-Fi module is integrated in the HBLMUs to get connected with the home routers for uploading data to the central monitoring station. The data are published into the server from the PBLMUs and HBLMUs through the MQTT broker which follows a publish-subscribe communication model. The PBLMUs and HBLMUs are the publishers that send data to the predefined topics of MQTT broker and the central monitoring server is the MQTT broker's subscriber, receiving data from it. The features such as low power consumption, rapid data transmission, lightweight nature, and ease of implementation make MQTT protocol very attractive for IoT-based remote monitoring systems.Through the intelligent GUI, the authorized persons can monitor and analyse the unfilled levels and the respective geo-locations of all the trash bins for the efficient waste collection.

ISBN: 978-81-965236-7-1

Design of the PBLMU



The block diagram of the designed PBLMU

The PBLMU is designed to collect the unfilled level and geo-locations of the trash bins located in public places. It comprises of an ultrasonic sensor and a GPS module to measure the unfilled level and the geo-location of the trash bins, respectively. A LoRa module is equipped with the PBLMU to establish the LoRaWAN network with the LoRaWAN gateway. Further, a power management unit is integrated to provide the required supply voltages to all the components of the PBLMU. Additionally, a solar panel is attached with the power management unit for energy harvesting and self-powering of PBLMUs since they are powered with batteries.A brief description of the components of the PBLMU is provided here.

1.Ultrasonic Sensor

The ultrasonic sensor equipped in the PBLMU is a MB1010 LV-MaxSonar-EZ, which is lightweight, small in size, and commercially available. It is a cost-effective and dependable sensor with high accuracy, stable range detection, and a high-quality beam. With this sensor, high-frequency sound waves (42 kHz) are produced, and the sensor evaluates the back-received echo. A wide range detection of solid waste ranging from 0 m to 6.45 m is possible with this sensor covering objects from very short to long range. This sensor is so accurate that there is no dead zone within the sensing range. The sensor outputs three different types of data at the same time: RS232 serial output, analog voltage output, and pulse width output. The sensor's actual operating temperature range is −40 ◦◦C to +65 ◦◦C but the recommended temperature range is 0 ◦◦C to +60 ◦◦C. When the sensor is in triggered operation, it provides the desired reading range, allowing the unfilled level of a trash bin to be measured. A sensor operating in free-run mode, on the other hand, can continuously measure and output the range information.

2.GPS Module

Several trash bins must be placed to manage solid waste over a large area. For the garbage truck to collect garbage, the geolocation coordinates for each trash bin is necessary. Manually recording the geolocation data of a large number of trash cans is a time-consuming task. Furthermore, the geolocation data aid in the identification of moved trash bins, stolen trash bins, as well as determining the shortest and most effective route for garbage collection. To collect the geolocation coordinates of each trash bin, the PBLMU is integrated with a PAM-7Q GPS antenna module. Embedded antenna, low power consumption, clear interface, high sensitivity of −161 dBm, and sophisticated interference suppression are all features of the PAM-7Q, ensuring optimum efficiency even in hostile environments. The PAM-7Q's unique feature is its ability to achieve RHCP with a smaller patch antenna. Installation costs are kept to a minimum with the simple design and easy interfacing of an 18 mm × 18 mm patch antenna. To minimize the PBLMU's average current consumption, the GPS module is configured in a power-saving mode called ON/OFF service.

3.LoRa Module

Each PBLMU is integrated with an RN2903 transceiver module to send data over a long distance while using minimal power. The RN2903 module achieves high interference immunity by using spread spectrum modulation. Every transmission is configured to use US902-928 MHz ISM band in a pseudo-random fashion to make the system more resistant to interference. The RN2903 module is operated by a 3.3 V DC supply and communicates with the host microcontroller using a UART. The RN2903 has a sensitivity of −146 dBm and a transmitting capacity of 18.5 dBm that can be adjusted. It can also be programmed and managed over a UART port using ASCII commands. The RN2903 consumes 124 mA when transmitting at full power, and 13.5 mA in reception mode.

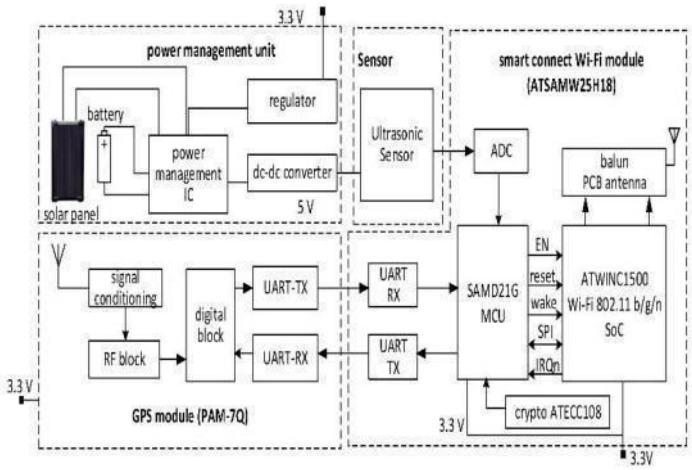
4.Host Microcontroller

The host microcontroller is the heart of the PBLMU; it is responsible for controlling all the functions of the PBLMU. In the PBLMU design, a high-performance, ultra-low-power, and advanced RISC architecture-based 8-bit Atmel AT mega 2560 microcontroller serve as the host microcontroller. The host microcontroller's peripheral features include four 8-bit PWM channels, a 16-channel ADC, four USARTs, a master/slave SPI serial port, and an I2C interface. The host microcontroller interfaces the MB1010 sensor via the ADC channel, the PAM-7Q GPS module via UART0, and the RN2903 LoRa transceiver module via UART1 in the PBLMU design. It runs at a clock frequency of 8 MHz and has a 3.3 V operating voltage. Additionally, it has a temperature range comparable to that of the GPS module, which is −40 ◦◦C to 85 ◦◦C.

5.Power Management Unit

The sensor requires a 5 V operating voltage, while the other components and the controller require a 3.3 V operating voltage. To meet the 5 V and 3.3 V requirements, a power management unit is integrated into the node design. The power management unit comprises of a solar panel, a battery of 2500 m Ah capacity, and a circuit for energy harvesting and battery charging. A low-power charger chip (BQ25505) is adopted to extract energy from the solar panel and to charge the batteries. It can obtain energy from a solar panel with a voltage as low as 100 mV. The BQ25505 features an ultralow quotient current consumption of 325 nA, integrated maximum power point monitoring from the solar panel and a battery health indicator. To prevent excess charging, the chip has a under-voltage threshold and over-voltage threshold of 3 V and 4.2 V, respectively. The ultrasonic sensor is powered with a boost DC-DC converter (MCP16252T) as it requires a 5 V supply voltage. It operates in PFM/PWM mode automatically and achieves a typical efficiency of 96 percent. The MCP1825S LDO regulator keeps the voltage at 3.3 V, to meet the power requirements of LoRa module, host microcontroller, and GPS module.

Design of the HBLMU



Block diagram of the HBLMU.

Similarly, the HBLMU is designed to collect the unfilled level and geolocation of the trash bins installed at homes. The block diagram of the designed HBLMU is shown in **Figure 3**. It comprises an ultrasonic sensor and a GPS module to measure the unfilled level and the geolocation of the trash bins respectively. A Wi-Fi module is equipped with the HBLMU to establish wireless connectivity with the home router which is acting as the access point to get connected to the cloud server. Further, a power management unit is integrated to provide the required supply voltages to other components of the HBLMU. Additionally, a solar panel is attached with the power management unit for energy harvesting and self-powering of HBLMUs as they are powered with batteries. The functionality and specifications of the ultrasonic sensor, GPS module, and power management unit are alike to that in the design of PBLMU, the remaining components of the HBLMU are described here.

1.Wi-Fi Module

The Wi-Fi module in the HBLMU is a Microchip Smart Connect ATSAMW25H18 SOC. It is certified and incorporated with the 802.11 IP stack. It is composed of an ARM cortex M0+ microcontroller (host computer) and an ATWINC1500 Wi-Fi network processor. The host machine operates at a 48 MHz clock frequency. It includes an on-chip memory management engine that reduces the load on the host computer. It includes an 8 Mb internal flash memory for firmware updates via OTA. Secure network access is established using TLS and SSL protocols. Additionally, it supports network protocols such as DHCP, DNS, UDP, HTTP, and HTTPS. The controller's operating voltage is normally 3.7 V. It features a ten-bit DAC and a fourteen-channel 12-bit ADC. ATSAMW25H18 is the best option for the HBLMU design due to its extremely low power consumption, over-the-air software update capability, and built-in security features.

2.Home Router

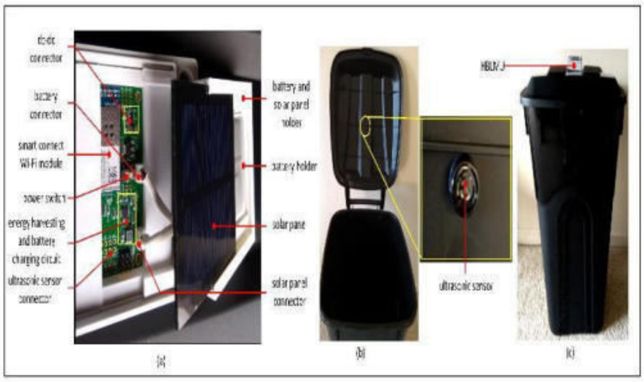
Attributed to the reason that the HBLMUs are used to track the unfilled levels and geolocations of household trash bins, the home router is used to establish connectivity between the central monitoring station and sensing nodes. The wireless router used in this experiment is a TP-Link TL-MR6400. It complies with IEEE 802.11/n/a and IEEE 802.11b/g/n wireless standards and supports data transfer rates of up to 300 Mbps.

The Server and the GUI

The server's hardware configuration includes an Intel Core i7-8700T processor, 16 GB RAM, and a 500 GB hard drive running Ubuntu 20.04 LTS. The software package provides open-source components such as Redis, PostgreSQL, ChirpStack gateway bridge, Eclipse Mosquito, ChirpStack network server, and ChirpStack application server, as well as an intelligent GUI. The Eclipse Mosquito message broker is used to implement the MQTT protocol, which uses a publish/subscribe model to transport data. Redis is an in-memory database used to store transient data,while PostgreSQL is used to store long-term data. The intelligent GUI is designed using the C Sharp programming language on the .NET platform. The NET core 3.0 includes the RPC framework, a lightweight and highly performant RPC framework that enables real-time message push without polling. After decoding and systematically storing the bin level data, the generated graphical representation of the main window, all area icons, and all trash bin icons are graphically mapped to the PBLMU and HBLMU measurements.

Results and Discussion

ISBN: 978-81-965236-7-1



(a) Various components of the fabricated HBLMU. (**b**)Installation of HBLMU on a trash bin. (**c**) Front view of the HBLMU equipped trash bin.

Screenshot of the Intelligent GUI.

1.Validation of the Developed System

The trash bins used in our study have dimensions of 40 cm × 40 cm on the top, 30 cm × 30 cm on the base, and 82.5 cm in height. An experiment was carried out in both indoor and outdoor environments to validate the developed IoT system, where 8 bins were installed with PBLMUs and connected to a LoRaWAN, and another 8 bins were installed with HBLMUs and connected to a Wi-Fi network, respectively. The firmware of the PBLMU and the HBLMU were programmed to send unfilled data every 5 min. The trash bins were filled with paper, card boxes, bottles, and clothes at different levels, and the corresponding unfilled levels of the trash bins were monitored in the Intelligent GUI.

Taking into account the readings from the PBLMU, HBLMU, and the trash bin's maximum unfilled level, the intelligent GUI assigns a color code to each trash bin. Table 1 shows the threshold unfilled levels of the trash bins for various color codes.

Table 1. Mapping table for the threshold unfilled levels and color code.

Unfilled Bin Level in cm	Color Code	Status
Equal to 82.5	Green	Empty
Greater than 70	Green	Lightly filled
Between 30 and 70	Orange	Partially filled
Less than 30	Red	Almost full

The above image illustrates a screenshot of the developed intelligent GUI, which depicts the global level (home icon), levels of different regions, and Region 1's trash bin levels. The intelligent GUI was designed in a hierarchical fashion to allow for real-time monitoring of the trash bin's exact level and location. The intelligent GUI's primary icon (at the top level) is a progressive bar that is synchronized with all PBLMUs and HBLMUs in the IoT-enabled solid waste management system. The primary icon's color code corresponds to the trash bins lowest unfilled value. When the user clicks on the home icon, the intelligent GUI automatically displays the regional icons. Additionally, the region icon functions as a progressive bar whose status is determined by the number of unfilled PBLMUs and HBLMUs in that region. The color code assigned to the region icons corresponds to the lowest level of unfilled trash bins in that region. When a user clicks on a region icon, the intelligent GUI displays all trash bins in that region. Additionally, the trash bin icons function as a progressive bar whose status is determined by the sensor value of the PBLMU or HBLMU. From the illustration, the main icon is red because the unfilled value of trash bin 1 is 11.2 cm, which is less than 30 cm (threshold value). This immediately alerts the user that some trash bins in the IoT-enabled solid waste management system are approaching capacity. The color of the region icons varies; Region 1 is red because the unfilled value of trash bin 1 is 11.2 cm. Regions 2 and 3 are highlighted in orange because the trash bins' unfilled level is between 30 and 70 cm.As the unfilled amount of all trash bins in Region 4 exceeds 70 cm, the region is green in color. When a user hovers or clicks on a trash bin icon, the exact unfilled level of the bin as well as its geo-location coordinates are shown.

2. Average Current Consumption of a PBLMU

We used an INA233 evaluation module to assess the active and sleep mode current contributions of a PBLMU while operating the LoRa module at a spreading factor of 7, power level of 10 dBm, bandwidth of 125 KHz, and a coding rate of 4/5. Table 2 shows the nomenclature of the mathematical symbols used in the equations. The measured current consumption in active and sleep modes are as follows.

ISBN: 978-81-965236-7-1

Table 2. Nomenclature of mathematical symbols.

Parameter	Description
I_{EHC_q}	Quiescent current of BQ25505 energy harvesting IC
I_{LDO_q}	LDO's quiescent current
I_{PBLMU}	PBLMU's average current consumption
I_{DC-DC_q}	DC-DC converter's quiescent current
$Q_{Battery}$	Capacity of battery
I_{HM_a}	Host machine's current consumption in active mode
$PBLMU_{days}$	PBLMU's life expectancy
T_{HM_a}	Host machine's time period in active mode
I_{GPS_a}	GPS module current consumption in active mode
I_{LoRa_a}	LoRa's active current consumption
I_{LoRa_s}	LoRa's sleep current consumption
I_{sensor_a}	Sensor's active current consumption
T_{GPS_a}	GPS module time period in active mode
I_{HM_s}	Host machine's current consumption in sleep mode
T_{LoRa_a}	LoRa's time period in active mode
T_{sensor_a}	Sensor's time period in active mode
T	Transmission time period

PBLMU's active current contribution:

$$QPBLMUa=([IEHCq+ILDOq+IDC-DCq+IHMa]\times THMa)+(IGPSa\times TGPSa)+(ILoRaa\times TLoRaa)+(Isensora\times Tsensora)=0.3316A\times s$$

PBLMU's sleep current contribution:

$$QPBLMUs=(IEHCq+ILDOq+IDC-DCq+IHMs+ILoRas)\times(T-THMa)=0.1115A\times s$$

Average current consumption of a PBLMU:

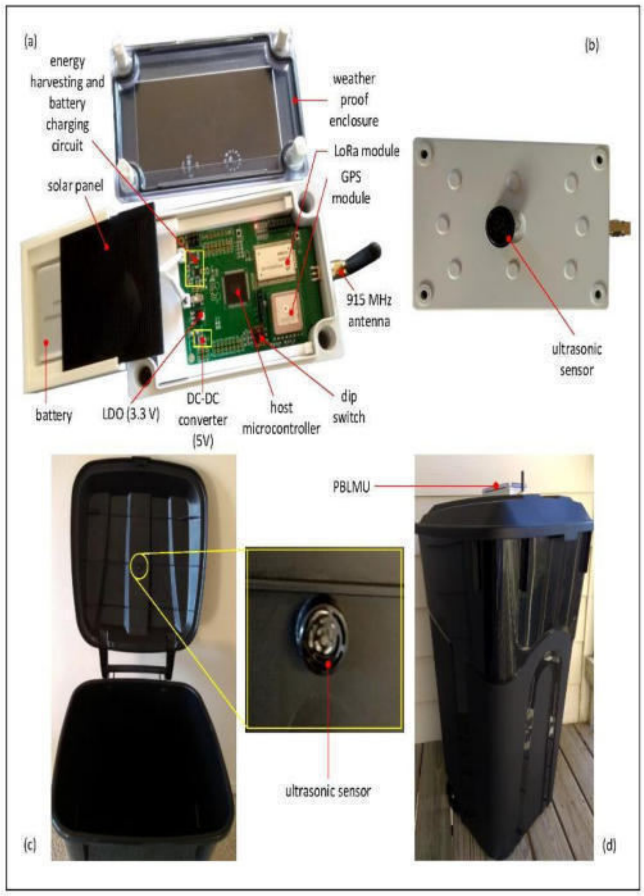
$$IPBLMU=QPBLMUa+QPBLMUsT=1.5\text{mA}$$

3. Life Expectancy of a PBLMU

The PBLMU's life expectancy was determined under the hypothetical scenario under which the battery's voltage is optimal before its power is depleted. Assume a standard battery has a capacity of 2500 mAh and the following calculation is used to determine the life expectancy of the sensing nodes.

$$PBLMUdays=QBatteryIPBLMU\approx 70\text{days}$$

Once the battery is fully charged it can power a PBLMU for approximately 70 days without any interruption.



(**a**) Various components of the fabricated PBLMU. (**b**) Rear view of the fabricated PBLMU. (**c**) Installation of PBLMU on a trash bin. (**d**) Front view of the PBLMU equipped trash bin.

Significant experiments were conducted to validate the feasibility of the developed IoT-enabled solid waste management system. First, an experiment was conducted to validate the developed IoT system by monitoring the corresponding unfilled levels of the trash bins through the intelligent GUI. Second, an experimental setup was arranged to measure the sleep current and active current contributions of a PBLMU to obtain its average current consumption. Finally, the life expectancy of a PBLMU was estimated under hypothetical conditions.

Conclusions

The development and validation of a hybrid network architecture approach to efficiently manage trash bins in public places and residential areas of cities were discussed in this paper. All facets of an IoT system have been developed, including the design of end nodes, i.e., PBLMU and HBLMU; long-range data transmission with LoRa network for public places and Wi-Fi connectivity for homes; long-term data storage; and hierarchical visualization of trash bin level with the intelligent GUI. Experiments were conducted to validate the developed IoT system, as well as to estimate current consumption and maximum life expectancy of the end node. First, the trash bins had been filled with waste, and the corresponding unfilled levels on the Intelligent GUI were monitored. Second, based on the measured active and sleep current

ISBN: 978-81-965236-7-1

contributions, the PBLMU's average current consumption is calculated as 1.5 mA. Finally, the life expectancy of a PBLMU was estimated as approximately 70 days under hypothetical conditions. According to the obtained results, the proposed IoT-enabled solid waste management system is well suited for monitoring real-time trash bin information in smart cities.

Future work in this area, trash bin information (unfilled level and geolocation coordinates) obtained through the proposed IoT system can be used for framing geographic information system (GIS). Furthermore, optimum routes can be obtained through machine learning algorithms for waste collection trucks.

References

1.Theodoros, A. IoT-enabled tip and swap waste management models for smart cities. *Int. J. Environ. Waste Manag.* 2020. accepted for publication**.**

2.Yang, Q.; Wang, H. Privacy-Preserving Transactive Energy Management for IoT-aided Smart Homes via Blockchain. *arXiv* 2021.

3.Vishnu, S.; Ramson, S.J.; Raju, K.L.; Anagnostopoulos, T. Simple-Link Sensor Network-Based Remote Monitoring of Multiple Patients. In *Intelligent Data Analysis for Biomedical Applications*; Academic Press: Cambridge, MA, USA, 2019**.**

4.Ramson, S.J.; Moni, D.J. Wireless sensor networks based smart bin. *Comput. Electr. Eng.* 2017.

5.Shyam, G.K.; Manvi, S.S.; Bharti, P. Smart waste management using Internet-of-Things (IoT). In Proceedings of the 2017 2nd International Conference on Computing and Communications Technologies (ICCCT), Chennai, India, 23–24 February 2017.

6.Misra, D.; Das, G.; Chakrabortty, T.; Das, D. An IoT-based waste management system monitored by cloud. *J. Mater. Cycles Waste Manag.* 2018.

7.Hannan, M.A.; Akhtar, M.; Begum, R.A.; Basri, H.; Hussain, A.; Scavino, E. Capacitated vehicle-routing problem model for scheduled solid waste collection and route optimization using PSO algorithm. *Waste Manag.* 2018.

8.Bueno-Delgado, M.V.; Romero-Gázquez, J.L.; Jiménez, P.; Pavón-Mariño, P. Optimal path planning for selective waste collection in smart cities. *Sensors* 2019.

9.Vasagade, T.S.; Tamboli, S.S.; Shinde, A.D. Dynamic solid waste collection and management system based on sensors, elevator and GSM. In Proceedings of the 2017 International Conference on Inventive Communication and ComputationalTechnologies (ICICCT), Coimbatore, India, 10–11 March 2017.

10.Routray, S.K.; Sharmila, K.P.; Akanskha, E.; Ghosh, A.D.; Sharma, L.; Pappa, M. Narrowb and IoT (NBIoT) for Smart Cities. In Proceedings of the 2021 Third International Conference on Intelligent Communication Technologies and Virtual Mobile Networks (ICICV), Tirunelveli, India, 4–6 February 2021.

ISBN: 978-81-965236-7-1

Performance of Multi-server Infinite Source Retrial Queueing System in Operational Research for the application of GSM Networks

B. Ganesh Kumar
Assistant Professor, Department of Mathematics, Sri Ramakrishna College of Engineering, Perambalur

Abstract:**A standard queueing models gives a survey of main results for both single server M/G/1 type and multiserver M/M/C type retrial queues and discuss similarities and differences between the retrial queues and their standard counterparts.Queueing theory is usually assumed that a customer who can't get service immediately, after arrival either joins the waiting line or leaves the system forever, Retrial Queues, that is, queues with returning customers, repeated orders, etc. have been introduced to solve this deficiency.Most queueing systems with retrials are motivated by computer and telecommunication applications where a repeated attempt appears due to blocking in a system with limited service capacity.**
Keywords: Queueing Theory Models, Retrial Queues,

1.INTRODUCTION :

Operations Research is a scientific approach to problems solving for executive management. In 1951, the first book on the subject methods of operation research by Morse and Kimball was published. Operation Research uses the method of science to understand and explain the phenomena of operating systems. In Operation Research, we are going to discuss about the Queueing systems.Queue is a common word that means a waiting line or the act of joining a line. It is formed when the number of customers arriving is greater than the number of customers being served during a period of time. Queueing theory is usually assumed that a customer who can't get service immediately after arrival either joins the waiting line or leaves the system forever. Retrial queues that is, queues with returning customers, repeated orders, etc. have been introduced to solve this deficiency.Retrial queueing systems are characterized by the feature that arriving calls who find the server busy join the retrial group for their requests in random order and at random intervals. Retrial queues have been widely used to model many problems in telephone switching systems, computer and communication systems. I consider a trial queueing systems with batch arrivals in which the server is subject to controllable interruptions and random interruptions. The main characteristic of retrial queues is that if an arriving customer finds all servers busy, he leaves the service area, but after some random time repeats his demand.

2. STANDARD AND RETRIAL QUEUEING SYSTEMS

A standard queueing models gives a survey of main results for both single server M/G/1 type and multiserver M/M/C type retrial queues and discuss similarities and differences between the retrial queues and their standard counterparts.

Queueing theory is usually assumed that a customer who can't get service immediately, after arrival either joins the waiting line or leaves the system forever, Retrial Queues, that is, queues with returning customers, repeated orders, etc. have been introduced to solve this deficiency.

In the most general form these networks contain two nodes :

- The main node where blocking is possible and a delay node for repeated trials.
- To describe specific retrial queues with a certain structure and queueing discipline more nodes have to be introduced.

The single server has intrinsic interest for the stochastic modeling of communication protocols arising from local area networks.The classical retrial policy assumes that the probability of a repeated attempt during the interval (t, t+dt), given that j calls are in orbit at timetis j μ dt + o(dt).Most queueing systems with retrials are motivated by computer and telecommunication applications where a repeated attempt appears due to blocking in a system with limited service capacity.It is clear that there exists a rich variety of different single server and multiserver queueing systems with retrials. In many other cases an extended investigation based on the methods developed for the M/M/C and M/G/1 retrial queue may be carried out for structural complex retrial models.

2.1The M_1, M_2/G/1/K Retrial Queueing Systems with priority :

ISBN: 978-81-965236-7-1

Consider an M_1, M_2/G/1/K retrial queueing system with a finite priority queue for type I calls and infinite retrial group for type II calls where blocked type I calls may join the retrial group.

Retrial queueing systems are characterized by the feature that arriving calls who find the server busy join the retrial group for their requests in random order and at random intervals.

Retrial queues have been widely used to model many problems in telephone switching systems, computer and communication systems.

Retrial queues with two types of calls are the typical model of telephone exchange with subscriber line modules and base station in a mobile cellular radio communication system.

Consider M_1, M_2/G/1/K retrial queue with two type calls where blocked type I calls may allow to join the retrial group. Type I calls and type II calls arrive independently of each other according to poisson processes with rate λ_1 and λ_2 respectively.

An arriving type I call joins the priority queue if there is a waiting position, but if there are no waiting positions in the priority queue, he enters the retrial group with probability α or leaves the system with probability 1 - α . If an arriving type II call finds the server busy, then he joins the retrial group in order to seek service again after random random amount of time. A call in the retrial group always returns to the retrial group when he find the server busy on his retrial attempt to the server.

The retrial time (the time interval between two consecutive attempts made by a call in the retrial group) is exponentially distributed with mean 1/ν and is independent of all previous retrial times and all the other stochastic process in the system.

The service times of calls are independent and identically distributed with distribution function B(x) and mean 1/μ.

$$b^*(\theta)=\int_0^\infty e^{-\theta x}\, dB(x)$$

And

$$b^{*(i)}(\theta)=\frac{d(i)\,(b^*(\theta))}{d\theta^i}$$

2.2Applications of Ergodicity

- For an irreducible and aperiodic Markov chain $\{Z_n\}$ with state space S, a sufficient condition for ergodicity is the existence of a non-negative function f(s), s ∈S and ε > 0 such that the mean

$$x_s = E\left[f(Z_{n+1}) - f(Z_n) \mid Zn = s\right] < \infty$$

for all s ∈S and $x_s < -\in$ for all s ∈S except perhaps a finite number.

- Let $\{Z_n\}$ be a irreducible Markov chain with countable state space S. If there exists a non-constant function f : S → [0,∞)
such that

a) E $\left\{f(Z_{n+1}) - f(Z_n) \mid Zn = i\right\} \geq 0$ for all i∈ S

b) there is an M > 0 such that E $\left\{\mid f(Z_{n+1}) - f(Z_n) \| Z_n = i\right\} \leq$ M for all i∈ S

then $\{Z_n\}$ is not ergodic.

- The imbedded Markov chain $\{Z_n = (X_n, Y_n) \mid n = 1,2,.....\}$ is ergodic and $h(1) = a_0^{-K} \det(\hat{A}) < 1$.

2.3. Queue size distribution in steady state

If the distribution of service time is not exponential, then the stochastic process $\{(N_q(t), N_r(t)\ ;\ t > 0\}$ is not Markov process. Let X(t) and I(t) be a random variables. Where X(t) is the elapsed service time of the call in service at time t and I(t) is the server state, I(t) = 0 if the server is idle at time t and I(t) = 1 otherwise then

$$\{(N_q(t), N_r(t), X(t), I(t)\ ;\ t > 0\}$$

is Markov process with state space

$\{(i, j, x, \ell)\ ; i = 0, 1, ... K,\ j = 0, 1, ...,0 \leq x < \infty, \ell = 0,1\}$

define the probabilities,

$q_j(t) = P\ \{N_q(t) = 0, N_r(t) = j, I(t) = 0\}$

$P_{i,j}(t, x)\, dx = P\ \{N_q(t) = i, N_r(t) = j, x < X(t) \leq x + dx, I(t) = 1\}$

i = 0, 1, ... K

2.4. NUMERICAL EXAMPLES:

Assume that the mean service time is 1 and the retrial rate ν=0.3. the service time distribution was taken as hyper-expomential with parameter(1/3,2/3).The loss probability of type I calls for two cases (α=0 and α=0.3) verses the capacity K and arrive rate of type I calls under a fixed λ_2=0.1. the loss probability decreases as the capacity K increases and the arrival rate of typeI calls decreases.The loss probability of type I calls as functions of the arrival rate λ_2 under the parameters: K=8 and $\lambda_1=0.4\lambda_2$. the loss probability increases as the arrival rate of type II calls increases, and

ISBN: 978-81-965236-7-1

decreases as the probability α of entering group increases.

The mean waiting time of type I calls in priority queue as functions of the arrival rate λ_1 under the parameters: K=8 and $\lambda_2 = 0.2\lambda_1$. the mean waiting time of type I calls increases as the arrival rate of type I calls increases,but has no a great difference according to the probability α.

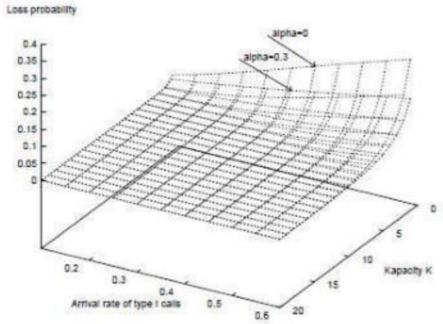


Figure Loss probability of type I calls H exp (1/3, 2/3) service time, v = 0.3 , λ_2=0.1

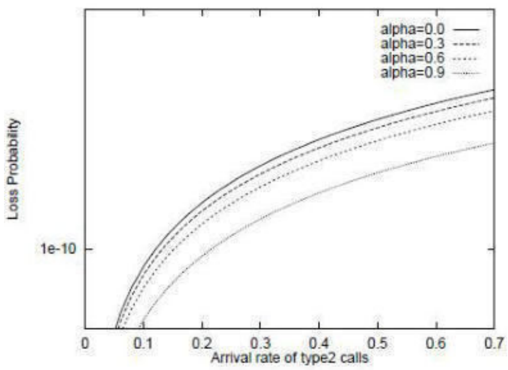


Figure Loss probability of type I calls H exp (1) service time, K = 8 , λ_1=0.4λ_2

3. CELLULAR MOBILE NETWORKS USING MOSEL

The retrial queues investigates a multiserver infinite - source retrial queueing system for the performance modeling of cellular mobile communication networks.

The objective is to demonstrate how performance tool MOSEL (Modeling specification and Evaluation Language) can be efficiently used in the modeling of cell based networks. In our analysis the blocked and dropped users are treated separately, i.e. redial with different probabilities and different rates, with reducing the state space by maximizing the number of redialing customers with appropriately large values.

Queueing network models are widely used in the traffic modeling of cellular mobile systems, such as GSM (Global System for Mobile communications). GPRS (General Packet Radio Service) and UMTS (Universal Mobile Tele Communication System).

Tran-Gia and Mandjes described a model which demonstrated in the context of cellular systems that the retrial phenomenon is not neglectable because of the significant negative influence on the system performance measures into consideration in their cellular mobile network model.

The main characteristic of retrial queues is that if an arriving customer finds all servers busy, he leaves the service area, but after some random time repeats his demand.

Cellular systems with customer redials are treated in [MARSAN ET AL,2001] , where an approximate technique is proposed for finite and infinite Markovian models. The authors reduce the state space of the continuous time Markov chain model by registering only that if there are retrying blocked and dropped customers in the system or not .

In the works [ONUR ET AL,2002; ALFA AND LI ,2002], various infinite –source queueing models are studied.In [ONUR ET AL,2002], not only customer redials,but also automatic retrials by the cellular system are taken into consideration , but the dropped customers redials handled as generating new fresh call attempts in the new cell and incase of blocking the cell is treated as a blocked fresh call. It is probably less realistic , because an interrupted customer may try to restablish the call with higer probability in shorter time intervals. In [ALFA AND LI ,2002], the blocked new and dropped handoff calls are not distinguished, but the involved random variables have general phase type distribution.

The blocked and dropped users are treated separately , that is they redial with different probabilities and different rates , like in [MARSON ET AL,2001], but reduce the state space by maximizing the number of redialing customers with appropriately large values (i.e. when the ignored probability mass can be neglected).

In [TRAN-GIA AND MANDJES ,1997;ONUR ET AL,2002; ALFA AND LI,2002], these two types of redialing customers were not distinguished. Furthermore , in our model we allow not only the active but also both types of redialing cutomers to depart to other cells , the current stydy can be considered as an initial step towards the analysis of more complex third generation systems focusing on the quality of service issues.

In cellular networks, the most important quality of service measures are the following :

ISBN: 978-81-965236-7-1

- The fresh call blocking probability (P_f), i.e. the fraction of new all requests in the cell that can't be served due to the lack of free channels.
- The handoff call dropping probability (P_h), that is the average fraction of incoming handoff calls that are terminated because of the lack of free channels.

The grade of service (GOS) is generally defined as the combination of these two probabilities, for example as

$$GOS = \frac{p_f + 10p_h}{11}$$

Because of the fact , that handoff call dropping probability has more significant impact on the grade of service, It is important to reduce it even at the expense of prioritize handoff calls , several channel allocation schemes are utilized. One of the most popular policies is the guard channel scheme]

[DHARMARAJA ET AL ,2003;TRAN-GIA AND MANDJES,1997; MARSAN ET AL ,2002;ALFA AND LI,2002], where some channels are reserved for the calls that move across the cell boundary , that is if there are g reserved channels in the cell, a new fresh call is only accepted if there are at least g+1 available channels . A handoff call is rejected only if all the channels in the cell are occupied.

3.1. Model Description :

The model description is translated step by step into the description language of MOSEL, and it is automatically converted into the other tool - specific system descriptions and analyzed by the appropriate tools.

In cellular network model treat only one cell.the cells are considered identical and to have the same traffic parameters , so it is enough to investigate one cell, and the handoff effect from the adjacent cells to this cell and from this cell to adjacent cells is described by handoff processes. Instead of the frequently used single arrival stream model distinquish the fresh call and handoff call arrivals . if investigate complex call handelling policies.

The number of channels in the cell is C, and the number of guard channels is g, where g<C.

The arrival process of the fresh calls is a poisson process with rate λ_f. If the number of the active users is smaller than c - g, the incoming call starts to be served. It is blocked and it starts generation of a poisson flow of repeated calls (redialing) with probability θ_1 or leaves the system with probability $1 - \theta_1$.

A blocked customer repeats his call after a random time which is exponentially distributed with mean $1/\nu_{bl}$, and it can be served or blocked again like the fresh calls. The call duration time is exponentially distributed with mean $1/\mu$.

The arrival process of the handoff calls is a poisson process with rate λ_h. If the number of the active users is smaller than C, the incoming call starts to be served. It is dropped and it starts generation of a poisson flow of repeated calls with probability θ_2 or leaves the system with probability $1 - \theta_2$.

A dropped customer tries to repeat his call after a random time which is exponentially distributed with mean $1/v_{dr.}$ if it is blocked it continues redialing with probability $\theta_{2.}$ the call duration time for handoff calls is also exponentially distributed with mean $1/\mu$.

The active, redialing blocked and dropped customers leave the cell after an exponentially distributed time with mean $1/\mu_a$, $1/\mu_b$, $1/\mu_d$ respectively.

The number of redialing users because of blocking and dropping is limited to an appropriately large values of N_{bl} and N_{dr} to make the state space finite in orders to the tools in the steady state.

3.2.The underlying Markov Chain

The stochastic process X(t) = (C(t); N(t); M(t) where
C(t) is the number of active customers,
N(t) is the number of blocked new customers
M(t) is the number of dropped customers.

the exponentiality of the involved random variables the describing process is a Markov chain with a finite state space S = {0, ...C} x {0,..............N_{bl}} x {0,..............N_{dr}}
Since its state space is finite, the process is ergodic for all values of the rate arrival of handoff calls.

Define the stationary probabilities :

P (i ; j ; k) = Lim P (C(t) = i, N(t) = j, M (t) = k)
i = 0, ...C, j = 0, ...N_{bl}, k = 0, .$N_{dr.}$

Because of the fact the state space of (x (t), t $\geq$ 0) with sufficiently large N_{bl} and N_{dr} is very large and the functioning of the system is complex . it is very difficult to calculate the steady state probabilities. To simply these calculations and to make our study more usable in practice, we use the software tool MOSEL to formulate the model and to calculate these probabilities and the system measures. MOSEL

ISBN: 978-81-965236-7-1

has already been used ,and it has proved its applicability for the modeling of serval computer and communication system. The MOSEL description can be translated automatically into the language of various performance tools and then analyzed by the appropriate tools (at present SPNP-stochastic perti net package and time NET are supported and suitable for this model) to get these measures.

4. MODEL CONVERSION TO MOSEL:

We discuss the translation of the model into the language of the MOSEL tool. The full MOSEL program can be assembled from the following program parts among the model description in the order of the part numbers.

The number of channels in the cell is C, which is denoted as N_CHS in the program, and the number of guard channels is g , which is denoted as N_G_CHS.

In the first part of the MOSEL description , we have to define some other system parameters too, these will be introduced at the appropriate program parts.

```
CONST  N_CHS := 15;
CONST  N_ G_ CHS := 1;
CONST  MAX_BL_ USERS :=25;
CONST  MAX_DR_USERS :=25;
CONST call_arrive :=1.5;
CONST call_retry_bl :=5;
CONST call_retry_dr :=6;
CONST call_duration :=0.05;
CONST handoff_ arrive :=0.4;
CONST handoff_dep_ac :=1/3;
CONST handoff_dep_bl :=1/3;
CONST handoff_dep_dr :=1/3;
CONST p_retry_ bl :=0.7;
CONST p_retry_dr :=0.9;
```

The state of the system is described by the number of active users , the number of blocked users who redial after some random time, and the number of users whose calls are dropped at handoff and who are redialing.

It can be wrote down in MOSEL as defining the nides of the system . the number of active users is denoted by active _users. Its maximum value is the number of channels , and it is 0 at the starting time.the number of redialing users because of blocking and dropping is limited to MAX_BL_

USERS and MAX_DR_USERS, which are defined in (1).

```
NODE active_users [N_CHS] : =0;
NODE redialing _users_br
[MAX_BL_USERS]: =0;
NODE redialing _users_dr
[MAX_DR_USERS]: =0;
```

The arrival process of the fresh calls is a poisson process with rate λ_f , that is denoted in the program as call_arrive , that is defined in (1) like the other parameters. If the number of active users is smaller than c-g, the incoming call starts to be served . otherswise it is blocked and it starts generation of a poisson flow of repeated calls (redialing) with probability θ_1 (denoted by p_retry_ bl) or leaves the system with probability 1-θ1.

```
IF active_users_N_CHS_N_G_CHS
FROM EXTERN TO active_users
RATE call_arrive ;
IF active_users> - N _CHS_ N_G_CHS
FROM EXTERN RATE  call_arrive THEN  {
TO  redialing _ users_ bl
WEIGHT  p_retry_bl ;
TO EXTERN WEIGHT 1- P_retry_bl ;
}
```

The blocked user redials can be handled similar to the fresh call arrivals. If a user is blocked , he repeats his call after a random time which is exponentially distributed with mean $1/\nu_{br}.\nu_{br}$is denoted as call_retry_bl.

It can be served or blocked as the fresh calls in the previous part .

```
IF active_users< N_CHS_N_G_CHS
FROM  redialing_users_bl  TO active_users
RATE   call_retry_bl* redialing _users_bl ;
If active_users>= N_CHS_N_G_CHS
FROM  redialing_users_bl
RATE call_retry_bl* redialing _users_bl
THEN  {
TO  redialing _users_bl
                    WEIGHT P_retry_bl ;
TO EXTERN WEIGHT 1- P_retry_bl ;
}
```

The call duration time is exponentially distributed with mean 1/μ . μ is denoted as call_duration .

```
FROM active_users TO EXTERN
RATE call_duration * active_users ;
```

The arrival process of the handoff calls is a poisson with rate $\lambda_{h.}$ λ_h is denoted in the program as handoff_arrive. If the number of active users is smaller than C, the incoming call starts to be served . otherwise it is dropped and it starts generation of a poisson flow of repeated calls with probability θ_2 (denoted by p_retry_dr) or leaves the system with probability $1\text{-}\theta_{2\,.}$

ISBN: 978-81-965236-7-1

```
IF active_users< N_CHS
FROM EXTERN TO active_users
RATE handoff_arrive ;
IF active_users = N_CHS
FROM EXTERN RATE  handoff_arrive
THEN  {
TO redialing _ users_dr
WEIGHT P_retry_dr ;
TO EXTERN WEIGHT 1-P_retry_dr ;
}
```

The dropped user redials can be handled like the blocked fresh call redials. The customer repeats his call after a random time which is exponentially distributed with $1/\nu_{dr}$. ν_{dr} is denoted as call_retry_ dr. If it is blocked it continues retrying with probability θ_2 (p_retry_dr).

```
IF active_users< N_CHS-N_G_CHS
FROM  redialing_users_dr  TO active_users
RATE call_retry_dr* redialing_users_dr ;
IF active_users>= N_CHS-N_G_CHS
FROM redialing_users_dr
RATE call_retry_dr* redialing_users_dr
THEN  {
TO redialing_users_dr
WEIGHT  p_retry_dr ;
TO EXTERN WEIGHT 1-p_retry_dr ;
}
```

The active and redialing customers leave the cell after an exponentially distributed time with parameters μ_a,μ_b ,and μ_d . denoted as handoff_dep_ac ,handoff_dep_bl and handoff_dep_dr , respectively.

```
FROM active_users TO EXTERN
RATE handoff-dep-ac* active_users ;
FROM redialing_users_bl TO EXTERN
FROM handoff_dep_bl* redialing_users_bl;
FROM redialing_users_ dr TO EXTERN
RATE handoff_dep-dr* redialing_ users_dr ;
```

After describing the system functioning , we can define the system measures we would like to calculate, such as the mean number of active and redialing customers because of blocking and handoff failure, the fresh call blocking and handoff call dropping probabilities .

```
PRINT mean_active_users_bl=
MEAN (active-users) ;
PRINT mn_redialing_users_bl=
MEAN (redialind_users_bl) ;
PRINT mn_redialing_users-dr=
MEAN (redialing_users_dr) ;
PRINT call_blocking_prob=
PROB (active_users>= N_CHS-N_G_CHS) ;
PRINT handoff_call_dropping_prob=
PROB (active_users>= N_CHS)
```

Finally, We define two pictures that show the changing of the blocking and dropping probabilities depending on the number of channels. If we use N_CHS as parameter, we have to define it in (1) as follows:

```
PARAMETER N_CHS:= 6,7,8,9,10 ;
PICTURE "Blocking probability vs  N_CHS "
PARAMETER N_CHS
CURVE call_blocking_prob;
PICTURE "Dropping probability vs  N_CHS "
PARAMETER N_CHS
CURVE handoff_call_dropping_prob ;
```

2.5 Numerical Examples

Consider a sample numerical results to illustrate graphically the sysem measures depend on variable system parameters.

The fresh call blocking and hand-off call dropping probabilities are displayed versus the number of channels with and without user redials. The system parameters belonging to the curves without redials are the same as in [Dharmaraja et al,2003]. Where a similar model is studied without customer redials
($g = 3$, $\lambda_f = 05$, $\mu = 0.05$, $\mu_a = \mu_b = \mu_d = 1/3$
$\lambda_h = 0.4$, $\nu_{bl}=\nu_{dr}=10^6$, $\theta_1,= \theta_2=10^{-6}$
and for other curve

$\nu_{bl}=\nu_{dr}=6$, $\theta_1=\theta_2=0.9$

Further more the maximum number of redialing customers is 25 respectively). These results are in agreement with theirs in the exponential case.

The fresh call blocking and handoff call dropping probabilities are displayed versus the mean handoff call arrival rate. The system parameters are the same as in figure,except of that C=8,and $\lambda_h$is on the x axis .like in [Dharmaraja et al,2003].

The negative influence of the retrial phenomenon is shown in each figures, and we can see that it increases as the handoff call arrival rate increases.

The fresh call blocking probability, the handoff call dropping probability and the grade of service as the mean fresh call arrival rate increases. The following system parameters were used:

$C=7$, $g=1$, $\mu=0.05$, $\mu_a=\mu_b=\mu_d=1/3$,

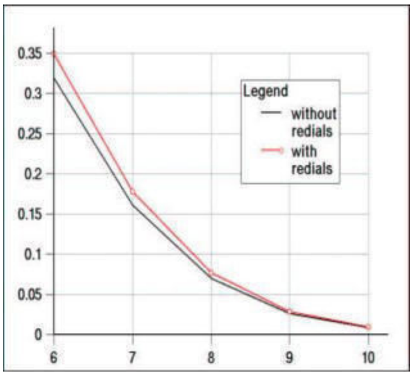
$\lambda_h=0.4$, $\nu_{bl}=6$, $\nu_{dr}=7$, $\theta_1=0.8$, $\theta_2=0.9$

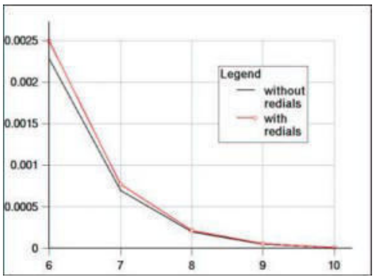
ISBN: 978-81-965236-7-1

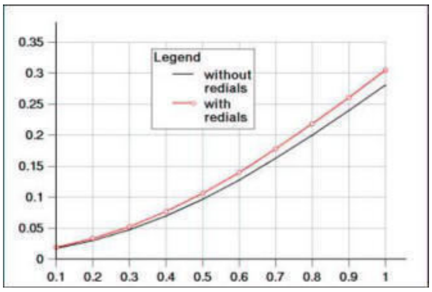
The fresh call blocking and handoff dropping probabilities and the GoS are displayed versus the number of guard channels. We can see that a very few number of guard channels can improve the grade of service significantly , but then only very small handoff dropping advance can be achieved on the great expense of fresh call blocking probability, and the GoS declines. The system parameters are the following:

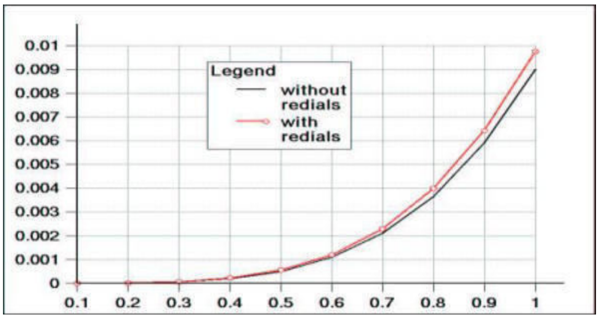
$C=15$, $\lambda_f=3$, $\mu=0.05$, $\mu_a=\mu_b=\mu_d=1/3$,

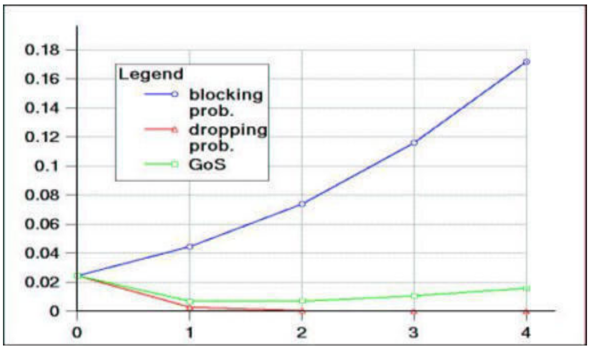
$\lambda_h=0.4$, $v_{bl}=6$, $v_{dr}=7$, $\theta_1=0.8$ and $\theta_2= 0.9$











5. NUMERIAL ILLUSTRATIONS :

The effect of parameters (retrial, vacation, and breakdowns) on system performances. In the remainder of the basic data of [ARTALEJO , 1997] :

$\lambda = 1$, $g_1 = 1$, $g_1 = 0$, $h_1 = 0.25$, $h_2 = 1$ maintenance parameters $W_1 = 0.1$, $W_2 = 1$.

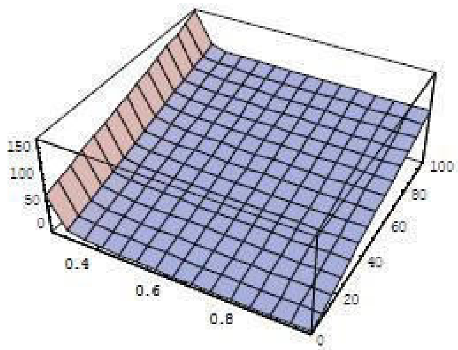
The effect of failure rate on the retrial parameter δ . the function $\delta(\theta)$ for different retrial PDF with mean $r_1 = 1$.

(i) Hyperexponential (H_2).
(ii) Exponential (EXP) :
(iii) Determinist (D) :

We observe that parameter δ increases in the case (i) and decreases in the case (iii) as the failure rate increases. (ii) the parameter δ is independent of the failure rate. This can be easily understood from exponential nature of retrial time.

The expontation E(M) versus failure rate θ and ratio ν_2/ν_1. E(M) decreases when θ and $\nu_2/\nu 1$ increases and increases otherwise.

ISBN: 978-81-965236-7-1

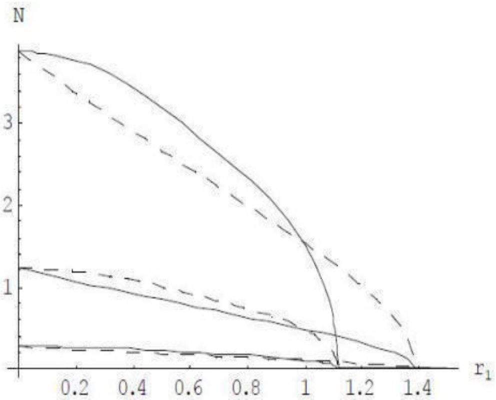


Effect of breakdowns and vacations on Mean system size

The effect of failure rate on the optimal threshold for different values of C_S/C_h=10,50 and 100. we have considered a 2-Erlangian retrial distribution (E_2) with r_1=0.5; the optimal threshold increases with the ratio C_S/C_h .

Lower and upper bounds on the optimal value N* for different parametric (Exp,D,H_2) and non parametric (NBCE) retrial PDF which typify some PDF observed in Practice. For each of these choices we varied the ratio C_S/C_h from 0.5 to 10^5 .

Behaviour of the bounds as a function of the mean retrial time for different values of C_S/C_h =10,1,0.1. For a given value of this ratio , the dot-dashed curve corresponds to a lower bound and the continous curve to an upper bound. The lowest pair of curve corresponds to the case C_S/C_h=0.1. We see that lower bound tends to be more closed to the upper bound curve for small values of r_1 and C_S/C_h.



Finally, the joint effect of retails and breakdowns upon the optimal value N* and its corresponding minimum expected cost. The optimal value N* increases and the cost decreases when both δ and θ increases.

6. QUEUEING SYSTEM

ON optimal and equilibrium retrial rates in a single-server queueing model. Calls arrive according to a poisson process with average rate per unit time. Compare the two rates and suggest ways in order to equate the equilibrium rate with the socially optimal one. The rate minimizes the total expected cost by a customer.

A retrial rate defines a Nash equilibrium it is used by all customers then an individual minimizes its own expected cost by using the rate itself. The rest of the costs as structural costs that can't be changed by the decision maker, that excluding the part of the costs, and waiting costs, retrial costs are coincide. The Nash equilibrium rate coincides with the social optimal rate. This resembles the economic order quantity inventory control model, where holding costs and the setup costs coincide under the optimal ordering policy.

4.2 THE EQUILIBRIUM RETRIAL RATE :

The social optimal and the equilibrium rates depend on the ratio w/c and not an the individual cost parameters.

Let $\rho = \lambda\tau$ be the system's utilization factor and denote $\sigma^2 + \tau^2$ by S^2. We denote τ by $^1/_\mu$, where μ is the service rate, λ be the poisson process with average rate per unit time.

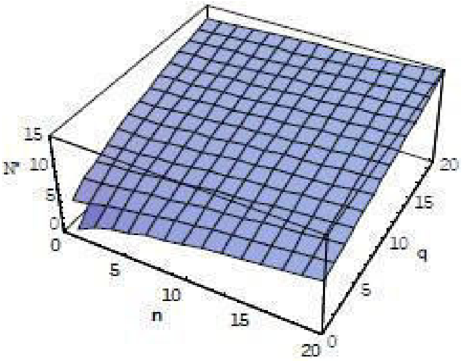
The server is busy, the call is repeated later, between retrials, the call is said to be orbit. The times between retrials are independent and exponentially distributed with an expected value of $^1/_\theta$ (θ is the retrial rate). Each retrial costs C and the cost of waiting is W per unit of time.

CONCLUSION

A Multiserver infinite – source retrial queueing system is studied for the performance modeling of GSM networks. It is easily efficiently the tool MOSEL can be used, and some numerical examples are presented to the impact of the retrial phenomenon and some system parameters on the quality of service measures and on the grade of service.The current study is an initial step towards the analysis of more complex third generation cellular systems. These hierachical systems may consist two or more layers, and varius dynamic channel allocation schemes can be utilized and analyzed.Furthermore, other than exponential distributions can be treated that are supported by both MOSEL and the applied tools .

I have studied the effect of retrials, vacations and breakdowns on the performance metrices of queueing service systems. I have showed how to control the vacation and retrial mechanisms. A similar study can be provided to control the maintenance actions.

ISBN: 978-81-965236-7-1



Effect of retrial rate δ and failure rate of the optimal threshold N*

REFERENCES

1. **Aissani. A and Artalejo. J.r.,** "On the single server retrial queue subject to breakdown". Queueing Syst., 30, 309 -321 (1998).
2. **Artalejo. J.R.,** "Analysis of an M/G/1 queue with constant repeated attempts and server vacations". Computers Ops. Res., 24, 493 – 504 (1997).
3. **Alfa. A.S., and Li. W.,** "PCs networks with correlated arrival process and retail phenomenon". IEEE Transactions on wireless communications., I 630 – 637 (2002).
4. **Choi. B.D and Chang. Y.,** "Single server retrial queues with priority calls". Mathematical and Computer Modelling., 30, 7-32 (1999).
5. **Choi. B.D., and Kulkarni. V.G.,** "Retrail Queues with server subject to breakdowns and repair, Queueing systems Theory and Applictions., 7, 191-208 (1990).
6. **Doshi, T.,** "Queueing system with Vacation – A survey". Queuing syste., 66 – 129 (1986).
7. **Dharmaraja. S., and Trivedi. K.S., Logothetis. D.,** "Performance modeling of wireless networks with generally distributed handoof interarrival times". Computer Communications., 26, 1747 – 1755 (2003).
8. **Elcan. A.,** "Optimal customer return rate for an M/M/1 queueing system with retrials". Probabiltiy in the Engineering and Informational Sciences., 8, 521 – 539 (1994).
9. **Falin. G.I.,** "On the waiting time process in single-line queue with repeated calls". Journal of Applied Probability., 23, 185 – 192 (1986).
10. **Falin. G.I.,** "A survey of retrial queues". Queueing systems., 7, 127 – 167 (1990).
11. **Falin. G.I., and Frickel.C.,** "On the virtual waiting time in an M/G/1 retrail queue". Journal of Applied Probabilty., 28, 446 – 460 (1991).
12. **Kulkarani. V.G.,** "Modeling and analysis of stochastic systems". Chapman and Hall, London (1995).
13. **Li.Y., Al-Begain K., Awan. I.,** "Performance Modeling of GSM / GPRS Mobile system with MOSEL". Livepool., 4, 245 – 250 (2003).
14. **Litjens. R., and Boucherie. R.J.,** "Elastic calls in an integrated services network : the greater the call size variability the better the Qos". Performance Evalaution, 52, 193 – 220 (2003).
15. **Kulkarni., V.G.,** "On Queueing systems with retrials". Journal of Applied probability., 20, 380 – 389 (1983).
16. **Marson. M.A., Carolis. G.D., Leonard. E., and Cigno. R.L., Meo. M.,** "Efficient estimation of call blocking probabilities in cellular mobile telephony networks with customer retrials". IEEE journal on selected areas in communications., 19, 332 – 346 (2001).
17. **Naor. P.,** "The regulation of queue size by levying tolls". Econometrica., 31, 15-24 (1969).
18. **Onur. E., Delic. H., Ersoy, C., and CAglayan.M.U.,** "Measurement - based replanning of cell capacities in GSM networks. Computer Networks., 39, 749 – 767 (2002).
19. **Tran – Gia. P., and Mandjes. M.,** "Modeling of customer retrial phenomenon in cellular mobile networks, IEEE Journal of selected areas in communications., 15, 1406 – 1414 (1997).
20. **Zreikat. A.I., and Bolch. G. Sztrik. J.,** "Performance Modeling of Non-honogeneous unreliable Multi-Server system using MOSEL., Computers and Mathematics with Applications., 46, 293 – 312 (2003).

ISBN: 978-81-965236-7-1

A REVIEW OF THE SECURITY VULNERABILITIES AND COUNTERMEASURES IN THE INTERNET OF THINGS AND A BRIGHT FUTURE FOR THE BLOCK CHAIN

M.Sindhu
Dept. of Computer Science and Engg
Sri Raaja Raajan College of Engineering And Technology
Karaikudi, India

R.Divya Sopna
Dept.of Computer Science and Engg
Sudharsan Engg College
Sathiyamangalam, India

A B S T R A C T

The current advances in the Internet of Things (IoT) and the solutions being offered by this technology have accounted IoT among the top ten technologies that will transform the global economy by 2030. IoT is a state-of-the-art paradigm that has developed traditional living into a high-tech lifestyle. The current study aims to provide a comprehensive review and analysis of the existing cyber security attacks and vulnerabilities in IoT, offering suitable countermeasures with a focus on describing the impact of emerging technologies on IoT devices and protocol layers. The main vulnerabilities across different layers of the IoT reference model are discussed and categorized, and suitable countermeasures (such as separating IT and IoT network traffic, enhancing physical security, implementing encryption and secure messaging protocols, etc.) are suggested. In addition, the hardware, communication, application, web, and cloud vulnerabilities are introduced, then the corresponding safeguards and protections are presented. Furthermore, Information Assurance (IA) has been deliberately defined and the adoption of the NIST framework and IA model is recommended as a metric to ensure security for IoT solutions considering the five pillars of availability, integrity, authentication, confidentiality, and non- repudiation. Finally, Block chain technology, known for its use in securing crypto currencies, is suggested to facilitate secure data exchange, identification, authentication, and communication for IoT devices by various avenues including ensuring the integrity of sensor data, eliminating the need for intermediaries, reducing costs, and enabling direct addressability of IoT devices.

Keywords: **Block chain IA IoT Security countermeasures Security vulnerabilities.**

INTRODUCTION

Internet of Things (IoT) is defined as a trend where many embedded devices use communication services that have been introduced by the internet protocols. These devices, often referred to as ‘‘smart objects’’, operate autonomously within the environment without

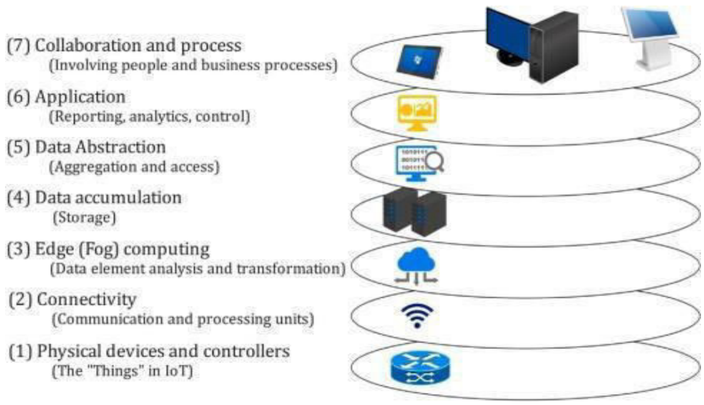


Fig. 1. A schematic of IoT reference model.

direct human interaction, serving as distinct components with specific functionalities. In 2020, for the first time, out of 21.7 billion active connected devices worldwide, the number of IoT devices surpassed non-IoT connections and it is expected that by 2025, almost 4 IoT devices will be available per person on average (more than 30 billion connections). The IoT industry is reported to grow by \$49. 04 billion during 2022–2026, accelerating at a compound annual growth rate (CAG) of \$27.48 during the forecasted period. While the recent progress in the Internet of Things (IoT) solutions has enabled the shift from conventional modes of operation to a new, technologically advanced approach, it is crucial to give deliberate consideration to the security

ISBN: 978-81-965236-7-1

aspects of these solutions.. For a large amount of generated data (Big data) by IoT devices, big data should be managed, secured, and analyzed . However, ensuring the security of the big data considering the volume, variety , and velocity is an ongoing challenge. In his ''Future Crimes'' book, author Marc Goodman recounts the story of a 23-year-old college student who, in 2000, manipulated the stock market by posting a fake press about the Emulex Corporation, a Nasdaq-traded manufacturer. In 16 min, 2.3 million shares were traded, resulting in Emulex's losing $2.2 billion in market capitalization. The evolving nature of cyber-attacks has rendered them increasingly adaptable and intricate in their pursuit of targeted objectives, thereby heightening our vulnerability to a greater extent than before. A Microsoft study shows a 1,070 percent increase just in ransom ware attacks between July 2020 and June 2021. In order to formulate an effective cyber security strategy, there exists a pressing requirement for individuals, corporations, and governments to prioritize the protection of their respective identities, customers, and the overall well-being of citizens. In essence, manufacturers are particularly vulnerable to cyber attacks due to their substantial intrinsic value, making them attractive targets for malicious activities.

When developing an Internet of Things (IoT) solution, it is common to utilize the IoT reference model as a framework for design, which is shown in Fig. 1. Security measures should ensure the safety of the utilized hardware/software for each of the components that are connected to the IoT network. Additionally, the security of the processes in each level of the IoT reference model, , and the communications between each level should be provided . In addition to the poor physical security, the major vulnerabilities in IoT systems are the insecure web interfaces, like, insufficient authentication/authorization , insecure network services, lack of transport encryption/integrity verification, privacy concern, insecure cloud interface], insecure mobile interface, insufficient security re-configurability, and insecure software/firmware.

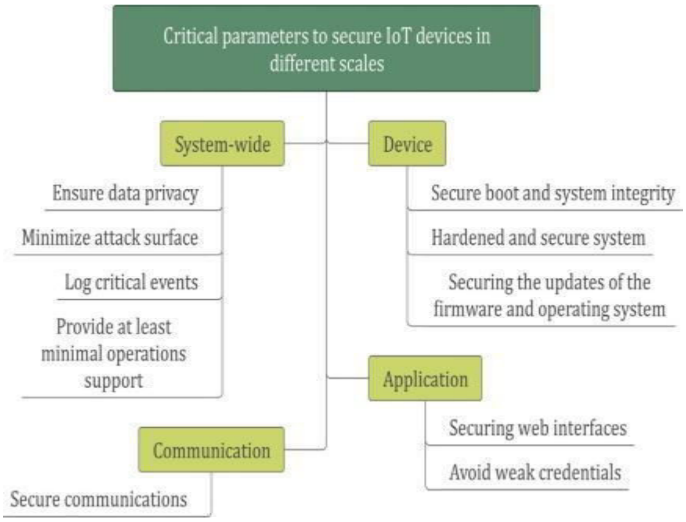


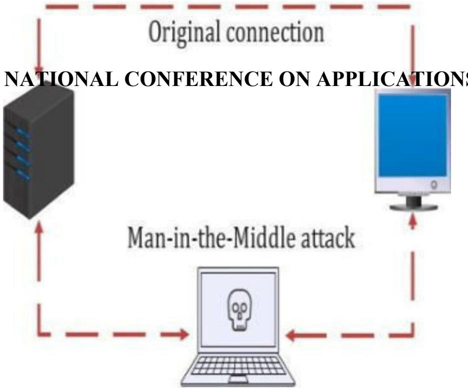
Fig. 2. The main critical parameters to ensure the security of IoT devices in different scales.

application programs to operate. Regarding, it should be noted that in the fifth layer, the boot and system integrity should be secured using hardware components such as Trusted Platform Modules (TPM). Additionally, the system should not run unnecessary network services in the sixth layer to further secure the system. In the seventh layer, the firmware and operating system updates should be secured as well.

The current study aims to provide a comprehensive review of the security challenges and vulnerabilities in IoT solutions across various technologies. The study also provides some countermeasures to avoid or prevent possible security attacks. The information assurance model (encompassing security services, security countermeasures, and information states, with confidentiality, availability, integrity, authentication, and non-repudiation) in addition to the common frameworks and protocols is presented as a solution to cyber security concerns in IoT technologies. Finally, it has been suggested that Block chain technology can hold significant promise for enhancing security in IoT devices by leveraging its decentralized and immutable nature to secure data exchange and enable identification and authentication. By bridging the existing gaps in research concerning comprehensive references for potential cyber security attacks and their corresponding mitigation strategies, this study serves as a valuable resource for ensuring the security of IoT solutions.

1. SECURITY CHALLENGES AND REQUIREMENTS OF IOT DEVICES

ISBN: 978-81-965236-7-1



In this section, the main cybersecurity attacks for IoT devices are identified to ensure the security of IoT devices. The following sections will give a more detailed description of the possible vulnerabilities in each layer of the IoT reference model (see Fig. 1). However, it should be noted that this particular section focuses exclusively on renowned instances of cyber security attacks.

The main cyber security attacks in IoT devices

Thus far, the main cyber-attacks in IoT solutions are considered to be: Botnet, man-in-the-Middle, data and identity theft , code injection, and distributed denial of service (DDoS). In a Botnet attack, the attackers will obtain control of internet-enabled devices (including computers, tablets, etc.) without the permission of the owners to perform particular tasks. Fig. 3 illustrates a conceptual schematic of the Botnet attack. As an example of the Botnet attack, the Mirai malware in 2016 changed the operation of the IoT devices working with Linux to remote-controlled bots that could be used as a part of a botnet in a distributed attack.

In the Man-in-the-Middle (MitM) attack,

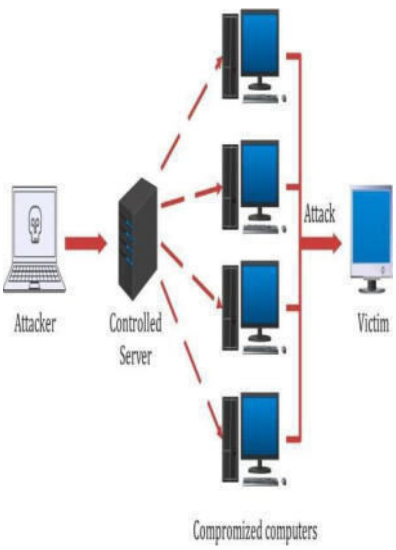


Fig. 3. A schematic of the Botnet attack.

the communication between the nodes will be intercepted to steal information such as authentication credentials. In this regard, the attacker will gain control of the messages and be able to distribute false information. An example of MitM in the IoT domain can be the usage of fake sensor data to destroy physical assets and business operations. Fig. 4 shows the concept of the MitM in cyber security. As a famous example of the MitM, 2.5 million Equifax website costumers were directed to a fake website.

Fig. 4. The conceptual schematic of the Man-in-the-Middle (MitM) attack.

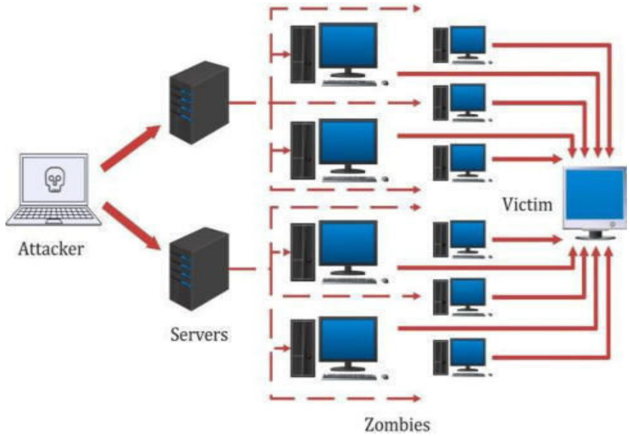


Fig. 5. A conceptual schematic of the Distributed Denial of Service (DDoS) attack.

Access control

To ensure the security of IoT devices, physical security should be considered. In many systems, IoT devices are located in remote areas which make it challenging to implement physical security measures. IoT devices are prone to be stolen, physically damaged, or disabled/removed. In this regard, securing the perimeters, video surveillance, tamper-proof housing, and disabling devices for tampering can be considered as solutions. Additionally, the access control as an authentication procedure can be applied as follows:

Mandatory access control (MAC)

As a common military approach, the users will obtain access based on the security level clearance.

Discretionary access control (DAC)

This method enables access to the data following the ownership and the access control list (ACL) to introduce the rules for individuals/groups.

Non-discretionary access control or Role-based access

ISBN: 978-81-965236-7-1

control (RBAC)

This method gives access to the individuals based on the defined roles in an organization.

Attribute-based access control (ABAC)

This method gives access to the data following the defined permissions for the attributes of the resource, the user, and the environmental factors such as the time of access.

Least privilege access control (LPAC)

Allows access to defined resources at a specific time that has been clarified in advance.

2. Hardware vulnerabilities and countermeasures

In an IoT system, the security of the utilized components is of important in all aspects including firmware, software, and network. The critical hardware security threats are Hardware Trojans (HT) and Side-Channel Analysis (SCA) in Integrated Circuits (IC).

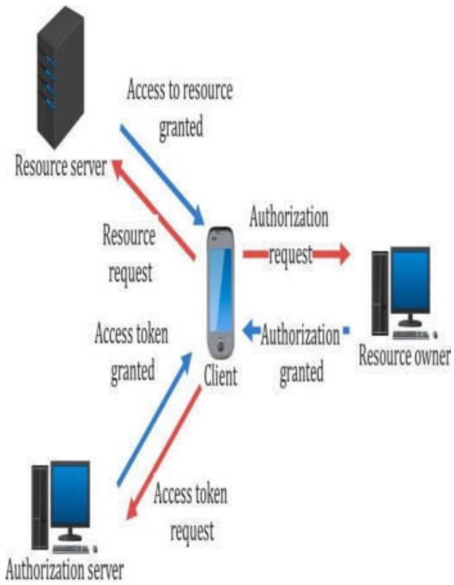


Fig. 6. A schematic of the identity and access management (IAM) protocol flow.

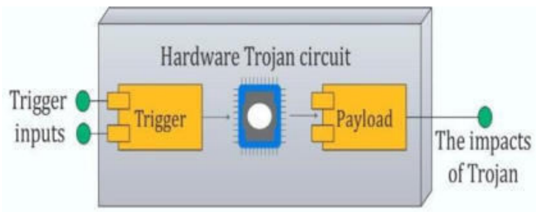


Fig. 7. A simplified schematic of the Hardware Trojan (HT) with its components.

Hardware Trojan (HT)

A malicious change at any step of manufacturing a chip is considered as an HT. HT can simply happen with a small modification in the IC, which disturbs the operation of the chip. The attacker can disturb the chip's operation by adding a backdoor that sniffs out the encryption keys and transfers the chip's data to other devices. Fig. 7 illustrates a simplified version of an HT attack, where the HT is triggered by sensors, internal logic states/counter values, and input patterns.

HT countermeasures

The HTs are common in having malicious intent and trying not to be detected by post-manufacturing test processes. The Trojans are usually passive for a long time that the circuit is being used and the attackers usually try to implement more than only one HT in a circuit. The existing countermeasures are usually divided into three general groups Trojan detection, design for security, and run-time monitoring methods. Fig. 8 illustrate the classification of the existing countermeasures for the HT attacks. In general, the detection of HT can be either destructive or non-destructive. In the former, the reverse engineering approaches will be used to de-package an IC and analyze the structure using Chemical Mechanical Polishing (CMP) followed by Scanning Electron Microscopy (SEM). In this methodology, only one IC sample will be used and the reconstruction using SEM will be done since the samplecannot be used later after performing the analysis.

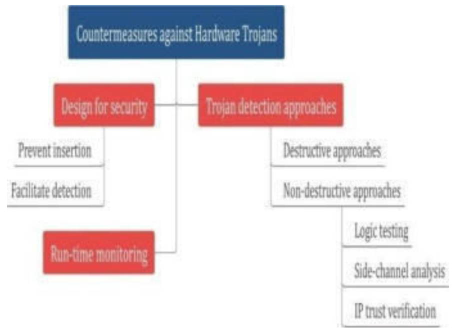


Fig. 8. The classification of the countermeasures for HT attacks.

In the non-destructive methods, different approaches in the pre-silicon and post. In pre-silicon analyses, the IC will be compared with a completely specified model of the IC. In the post-silicon analyses, logic testing and side-channel analysis are usually used Logic testing, which is a robust method under process noise and efficient for detecting ultra-small HTs, triggers the HT by test vectors and

ISBN: 978-81-965236-7-1

monitors the corresponding impacts to the output ports. Logic testing suffers from the existing challenges for large Trojan detection and generating test vectors. In the side-channel analysis (SCA), however, the test vectors are easy to be generated and there are no challenges for large Trojans.

3. COMMUNICATION, APPLICATION, WEB/CLOUD VULNERABILITIES

The main cyber security attacks in IoT devices

The role of communication channels is to transfer the obtained data by the sensors, actuators, etc. to the applications and vice versa. As the data in motion demands safety, providing security measures is of significance in the communication layer. In general, communication in IoT devices can be done using either mesh or star topologies. In the mesh topology, IoT devices send the information to other IoT devices until reaching the IoT gateway, while in the star topology, the data are sent directly to the IoT gateway, which limits the potential coverage of the network area.

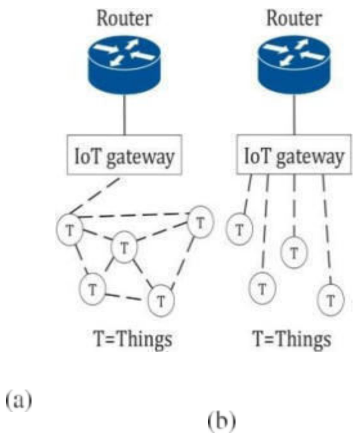


Fig. 9. The existing communications topologies in IoT devices; (a) Mesh topology, (b) Star topology.

IT network are also prone to security attacks.

Application layer vulnerabilities

Any related vulnerability such as a design flaw or implementation bug related to the security of the application can be considered as an application vulnerability. The detection of application vulnerabilities is possible using an application penetration tester, port scanner, and code cracker. The most exposed vulnerabilities can be considered username enumeration, weak passwords, account lockout, lack of multi-factor authentication, and insecure 3rd party components.

In the past, physical access was needed for the attacker, while now a days, the devices can be detected on the network and exploited their vulnerabilities. The common local exploits are the DoS, cloning, firmware replacement, and extraction of security parameters. In cloning, a duplicate physical device can be created and run similar software/firmware, while firmware replacement means the replacement of a malicious update for a device instead of the original version. The common exploits in the communication protocols are the MitM, eavesdropping attacks, SQL injection (SQLi), and routing attacks. In an Eavesdropping attack, the communication between multiple devices can be intercepted and the security keys can be used, while in the SQLi, the attacker will usually find a flaw in the SQL application to enable the theft and authorized access. The routers are usually used by small businesses and residential homes, hence owners may not give enough attention to the security alarms and the routers may remain un patched and open to attack. In a routing attack, a rouge routing device will be placed on the network and modifies the routing packets to maliciously change the routing table.

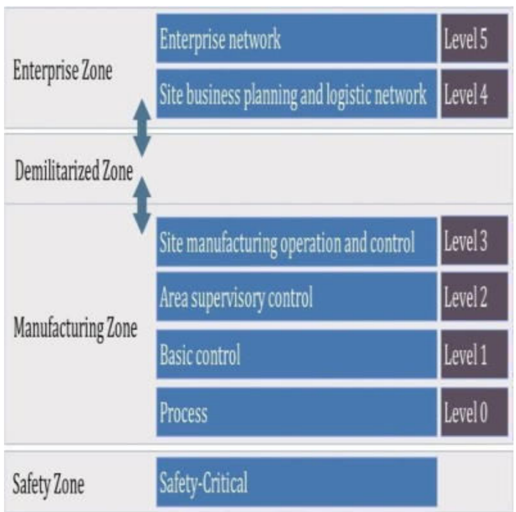


Fig. 10. A schematic of the traffic isolation and zoning method as an approach to managing the security in IoT solutions.

Web/cloud layer vulnerabilities

- Analyzing the web/cloud applications, web interfaces, and API interfaces for possible security vulnerabilities.
- Applying strong passwords
- Applying an account lockout mechanism to avoid brute-force attacks.

ISBN: 978-81-965236-7-1

- Implementing two-factor authentication.
- Utilizing transport encryption, such as SSH and Secure Socket Layer 3.0 (SSL).
- Testing for SQLi, cross-site scripting (XSS), and cross-site request forgery (CSRF) vulnerabilities.
- Suggesting the users change the credentials after a period.

4. THE METHODS TO ENSURE THE SECURITY FOR IOT SOLUTIONS

To better follow the required privacy regulations in a business, it is necessary to follow a comprehensive framework. In this regard, the National Institute of Standards and Technology (NIST) defined a cyber security framework by five core functions.The idea is to know the cyber security risks in the ''Identify'' step followed by utilizing proper safeguards in the ''Protect'' step. Then, the occurred cyber security events can be detected in the ''detect'' step, which enables the appropriate response in the ''respond'' step. After the cyber security incidents, the services can come back to their initial state by recovering in the ''Recover'' state.

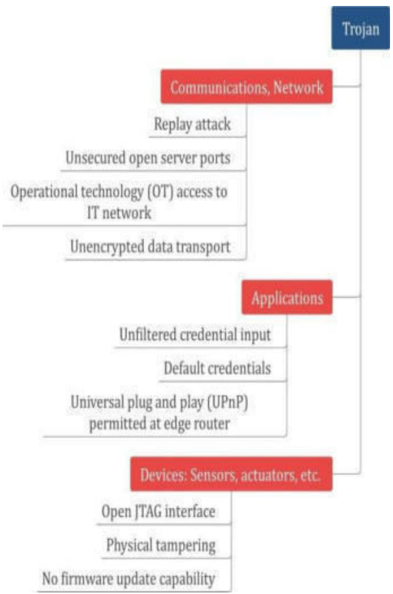


Fig. 11. A summary on the existing vulnerabilities in the communication, application, web/cloud layers of IoT reference model.

Information assurance (IA)

The definition by the National Security Agency (NSA) clarifies information assurance (IA) as a series of regulations to provide security for the data by ensuring availability, integrity, authentication, confidentiality, and non-repudiation. In other words, IA can be presented by three main factors, which are security services, security countermeasures, and information states, considering time as the fourth parameter.

Fig. 12. The defined cyber security framework by NIST.

Security services

The security services can be divided into five main parameters of Confidentiality, Integrity, Availability, Authentication, and Non-Repudiation.

Confidentiality

The parameter controls and protects private data from unauthorized entities. As wireless data transmission is the main method of transferring data in IoT applications, the information is more in danger in comparison to the wired network.

Availability

Availability indicates the timely, reliable access of information or services to authorized entities. In IoT applications, cyber security events result in interrupting the data availability, hence preventing access to IoT devices.

Integrity

Integrity verifies the quality of data by ensuring the accuracy, relevance, consistency, and reliability of the information in every operational procedure including data capture, storage, retrieval, updating, and transfer.

Authentication

Authentication ensures the validity of a transmission, message, originator, or individual's authorization to receive determined types of data. Bio-metric/password logins are considered authentication methods.

Non-Repudiation

In this service, the sender and the receiver of the data will be notified about the delivery of the information in which the former will receive the proof of delivery and the latter will have the proof of the sender's identity.

ISBN: 978-81-965236-7-1

Security countermeasures

As the second dimension of the IA, the security countermeasures can be presented in the three main divisions of the technologies, operational policies and practices, and education and awareness.

Technologies

The main developed technologies in this division are software-based, hardware-based, network-based, and cloud-based technology counter measures. Software-based technology countermeasures are the installed programs on the devices to protect the operating systems, databases, and services such as firewalls, network scanners, protocol analyzers, etc.,

Education and awareness

Increasing the security knowledge about efficient procedures and policies is needed as a under measure for possible cyber security threats. It is suggested to provide special training for the employees who have access to confidential data, and IT professionals to use the appropriate technology to enhance the reliability and security of information services.

Cyber security management

The IA enables the cyber security authorities to detect security vulnerabilities and select the countermeasures, however, a system should be developed to manage the ensure the implementation of the IA. The required framework has been developed by the International Organization for Standardization (ISO)/ International Electrochemical Commission (IEC) 27000.

Block chain and IoT security

Despite the existence of numerous proposed solutions aimed at enhancing security for IoT devices across various layers, such as the application, network, and devices themselves, it is argued that the future of IoT security lies within the realm of Block chain technology. Currently, Block chain technology is extensively employed to ensure the security of crypto currencies. In Block chain, digital records (i.e. blocks) are linked to each other, while being secured by cryptography principles (i.e. chain), and are distributed across multiple computers not owned by any single entity

Additionally, the usage of Block chain addresses more space than the conventional methods. In comparison to IPv6 that is benefiting from 128-bit address space the Block chain enjoys 160-bit address space. In this regard, Block chain is capable to dedicate space for around 1.46×10^{48} IoT devices in offline conditions to supply Global Unique Identifier (GUID).

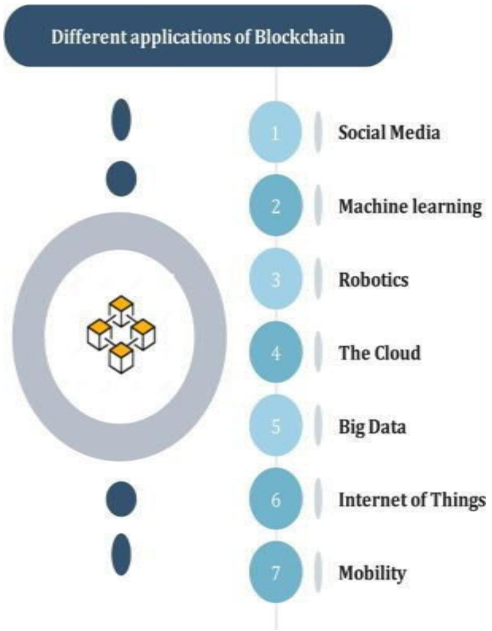


Fig. 13. The possible usage of Block chain to provide security in different domains.

5. CONCLUSION AND FUTUREWORK

CONCLUSION

The presented review article aimed to provide a comprehensive source to identify and describe the main cyber security attacks in IoT devices, emphasizing their significance in ensuring the security of IoT solutions. These attacks pose serious threats to the integrity, confidentiality, and availability of IoT devices and their data. In this regard, all the existing vulnerabilities in the different layers of the IoT reference model were highlighted, and suitable countermeasures were offered to mitigate these vulnerabilities to protect IoT devices and the broader IoT ecosystem. To ensure the security of the IoT solution, it was suggested that by adhering to the NIST framework and implementing IA measures, organizations can effectively safeguard sensitive information, mitigate cyber security threats, and maintain the trust of stakeholders in today's digital landscape. By implementing robust measures and employing such strategies, organizations can significantly reduce the vulnerabilities and risks associated with cyber security attacks, thereby enhancing the overall security posture of their systems.

ISBN: 978-81-965236-7-1

FUTURE ENHANCEMENT

IoT security is highly fertile and still needs plenty of contributions.

There are several open studies and challenges that require researchers concern in the field. Some open challenges in IoT security are given as follows:

1. Edge devices need to be highly secure and intelligent to understand adversary attacks.
2. Gateways between different nodes still need enough shielding practices and end-to-end encryption algorithms.
3. In fog sharing, the only target is to secure fog-cloud computation. If achieved, it can be a promising solution.
4. Enhancing the fog layers through machine learning and Optimization techniques such as deep learning and artificial intelligence.
5. Block chain is highly constrained in the case of a number of nodes. The alternative to nodes can be some high efficiency algorithms, and multiple resources can become a prominent solution to solve the issue.
6. Real-time data analysis and efficient hardware design require enough intelligent systems engineering to be developed by using some machine learning and intelligent algorithms.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

ACKNOWLEDGMENT

I would like to express my special thanks of gratitude to my college management. I would like to give my thanks to guide who gave me the golden opportunity to do this wonderful project on A Review of the Security Vulnerabilities and counter measures in the Internet of Things and Bright Future of the Block Chain. In addition, I would also like to thank my parents who helped me a lot in finalizing this project within the limited time frame.

REFERENCES

[1] L. Knud Lasse, in: IoT Analytics (Ed.), Controversy in the Maldives, 2020, Available: https://iot-analytics.com/state-of-the-iot-2020-12-billion-iot- connections-surpassing-non-iot-for-the-first-time/.

[2] C. Perera, Internet of Things Research and Teaching: Vision and Mission Annual Report (2022) (Ph.D. thesis), Cardiff University, 2023.

[3] W. Iqbal, H. Abbas, M. Daneshmand, B. Rauf, Y.A. Bangash, An in-depth analysis of IoT security requirements, challenges, and their countermeasures via software-defined security, IEEE Internet Things J. 7 (10) (2020) 10250–10276.

[4] A.K. Gupta, R. Johari, IOT based electrical device surveillance and control system, in: 2019 4th International Conference on Internet of Things: Smart Innovation and Usages, IoT-SIU, IEEE, 2019, pp. 1–5.

[5] D.B. Rawat, R. Doku, M. Garuba, Cybersecurity in big data era: From securing big data to data-driven security, IEEE Trans. Serv. Comput. 14 (6) (2019) 2055–2072.

[6] V. Janjic, J. Bowles, A.F. Vermeulen, A. Silvina, M. Belk, C. Fidas, A. Pitsillides, M. Kumar, M. Rossbory, M. Vinov, et al., The serums tool-chain: ensuring security and privacy of medical data in smart patient-centric healthcare systems, in: 2019 IEEE International Conference on Big Data, Big Data, IEEE, 2019, pp. 2726–2735.

[7] T. Teoh, Y. Zhang, Y. Nguwi, Y. Elovici, W. Ng, Analyst intuition inspired high velocity big data analysis using PCA ranked fuzzy k-means clustering with multi-layer perceptron (MLP) to obviate cyber security risk, in: 2017 13th International Conference on Natural Computation, Fuzzy Systems and Knowledge Discovery, ICNC-FSKD, IEEE, 2017, pp. 1790–1793.

[8] M. Goodman, Future Crimes: Inside the Digital Underground and the Battle for Our Connected World, Random House, 2015.

[9] D.W. Pullin, Cybersecurity: positive changes through processes and team culture, Front. Health Serv. Manag. 35 (1) (2018) 3–12.

[10] C. Brumfield, B. Haugli, Cyber security Risk Planning and Management, Wiley Data and Cybersecurity, 2022.

Optimized RF Energy Harvesting Antenna Design

Mrs.T.Balamani
Assistant Professor/Dept of Electronics and Communication Engg,
M.Kumararasamy College of Engineering, Karur, Tamilnadu, India.

Abstract: **This research explores the design, analysis, and optimization of RF energy harvesting antennas for Wireless Local Area Network (WLAN) sources.The planned antenna is simulated using ANSYS HFSS (High Frequency Structure Simulator) using a FR4 epoxy substrate with a dielectric constant of 4.4 and a loss tangent of 0.02. It is a rectangular microstrip patch antenna with H&E slots, consisting of a radiating element and a 50 ohm microstrip inset feed. Furthermore, the combined layout of the suggested antenna with H&E shaped slots in the design maximizes efficiency.More simulation iterations are undertaken to maximize the gain of the ISM band operating at 2.45GHz, resulting in a return loss of -24.77 dB and a voltage standing wave ratio (VSWR) of 1.07With a gain of 6.58 decibels.The antenna is optimized using Genetic Algorithm (GA). Antenna optimization and gain augmentation using genetic algorithms are implemented using MATLAB and the ANSYS Optimetrics Tool. After implementing the optimization algorithm, the antenna's performance improved by 7dB. The design methods and optimizations for a microstrip patch antenna are described.**

Keywords:Microstrippatchantenna;ISMband;RFenergyharvesting;GeneticAlgorithm(GA);GainandReturnloss.

I. INTRODUCTION

Energy harvesting is the process of obtaining energy from external sources such as solar power, thermal energy, wind energy, and kinetic energy (for example, ambient energy), which is then captured and fed to small electronic wireless operating devices such as wireless sensor networks [1]. A significant amount of RF energy is wasted due to the device's inability to receive it. RF energy harvesting antennas are commonly used to power low-power appliances and eliminate the need for batteries, utilizing renewable energy sources. This improves the device's usability and reliability [2]. Energy harvesting is not a new concept, having been around for over a century. Energy harvesting is the process of extracting energy from the environment to generate electricity, also known as energy scavenging [3]. Energy harvesters often fail to deliver enough power for electronic devices due to a lack of advanced technologies for extracting RF energy. However, this technology can generate enough energy tolow-power gadgets independently.Standard microstrip patch antennas often have arestricted operational bandwidth.There have beenseveral procedures.Several solutions have been proposed to address this issue, including using a high dielectric permittivity substrate [5], using defected ground structures at the ground plane [6], usingmetamaterials at the ground plane [7], adding slots to patches [8],using H & E shapes instead of other shapes, and optimizing patch shapes usingoptimizationgenetic algorithms for better antenna performance.Efficiently addressing these problem leads to increased bandwidth, gain, and directivity for energy harvesting applications. This work uses a microstrip patch antenna to gather RF energy and improves performance through genetic algorithm optimization (GA).

II. ANTENNA DESIGN

Microstrip patch antennas are more popular because of low cost and ease of fabrication. Microstrip patch antenna consists of dielectric material, radiating element and the ground plane. The rectangular shape is widely considered to realize the microstrip antenna. The simulation tool used for antenna design is High Frequency Structure Simulator. The simple microstrip patch antenna is designed using the substrate FR4_epoxy because of its low cost and ease of fabrication. It has the dielectric constant value of 4.4 and the loss tangent is 0.02 and the resonating frequency is 2.45GHz. The detailed parameters are given in the Table 1. The formulae to determine the patch dimensions are as follows:

$$W = \frac{\lambda_0}{2}\left(\frac{2}{\varepsilon_r + 1}\right)^{\frac{1}{2}}$$

$$L = \frac{1}{2 f_r \sqrt{\varepsilon_{eff}}\sqrt{\mu_0 \varepsilon_0}} - 2\Delta L$$

Using the above equations we have calculated the width and length of the patch. From the above equations, ε_{ff} , μ_0 and Δ_L are the effective dielectric constant , permeability of free space and the extension length respectively. The effective dielectric constant eff and the extension length Δ_L can be computed through the following equations respectively as.

$$\varepsilon_{eff} = \frac{\varepsilon_r + 1}{2} + \frac{\varepsilon_r - 1}{2}\left[\left(1 + \frac{12W}{h}\right)\right]^{\frac{-1}{2}}$$

$$\Delta L = 0.412h\left[\left(\frac{\varepsilon_{eff} + 0.3}{\varepsilon_{eff} - 0.258}\right)\left(\frac{\frac{W}{h} + 0.264}{\frac{W}{h} + 0.813}\right)\right]$$

The proposed microstrip patch antenna is designed with an input impedance of 50Ω.The parametric values are calculated from the given specific equations and the values are mentioned in the given Table 1. With those calculated numerical values the simple microstrip patch antenna with H & E shaped slots are designed as shown in the Figure 1. For an antenna to radiate, it should attain a return loss of more than -10dB. In order to further improve the return loss for better performance two slots are introduced on the patch. Thus in this proposed design H&E shaped slots are introduced in the antenna. Here two patches are introduced (i.e. Patch 1 and Patch 2). Patch 1 is fed by microstrip inset feed and due to mutual conductance the feed is automatically fed to Patch 2 through Patch 1.This enhances the better performance of the antenna with improved return loss and VSWR values. In order to improve the gain and directivity, defected ground structures (DGS) i.e., metamaterials are introduced on the ground in antenna design. This improves the gain, directivity and overall efficiency of the antenna. The design specifications are mentioned in the below Table 1.

Table 1: Design Specifications for Energy Harvesting Antenna

S.no	Parameters	Values
1	OperatingFrequency	2.45GHz
2	Substrate dielectricconstant	4.4
3	Substrate Thickness	1.575 mm
4	Substrate Width	53 mm
5	Substrate Length	49 mm
6	Patch 1 Width	31 mm
7	Patch 1 Length	28 mm
8	Patch 2 Width	31 mm
9	Patch 2 Length	1 mm
10	Feed Width	4.9 mm
11	Feed Length	17.5 mm
12	Input Impedance	50 Ω

III. SIMULATION RESULTS AND DISCUSSION

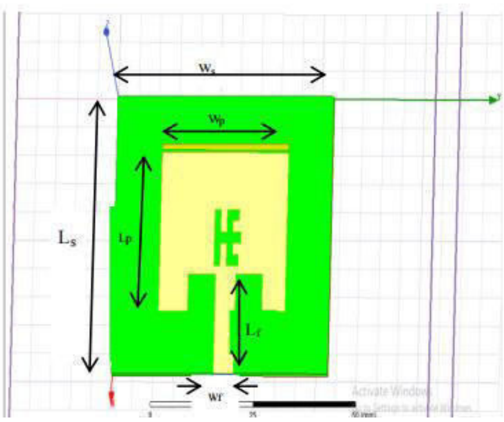


Figure 1: H&E Shaped Microstrip Patch Antenna (Top View) in HFSS Simulator

Where, Ls, Ws = Length and Width of the substrate
Lp, Wp = Length and Width of the patch
Lf, Wf=Length and Width of the feed

Defected ground structure (i.e., metamaterials) is introduced in the ground in order to improve thegain,directivity and overall efficiency of theantenna for betterperformance of the antenna in energy harvesting capability

b)Return Loss

The simulated return loss (S11) parameterfor the given microstrip patch antenna before optimization is -29.25 dB

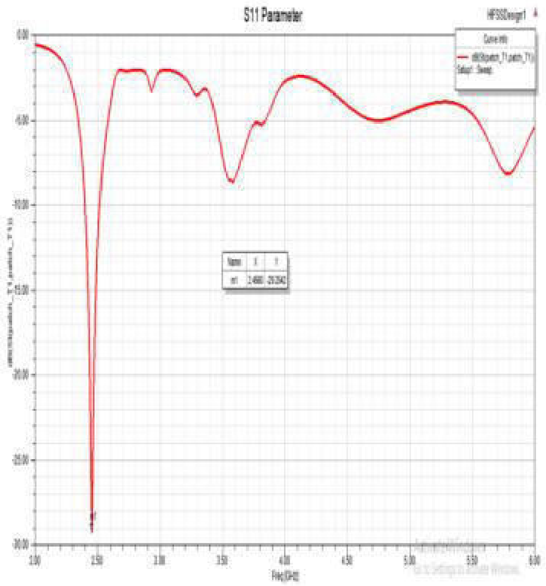


Figure 2: Return loss

c) VSWR

The Voltage Standing Wave Ratio (VSWR) obtained before optimization from the given design is 1.07which is shown in figure 3

ISBN: 978-81-965236-7-1

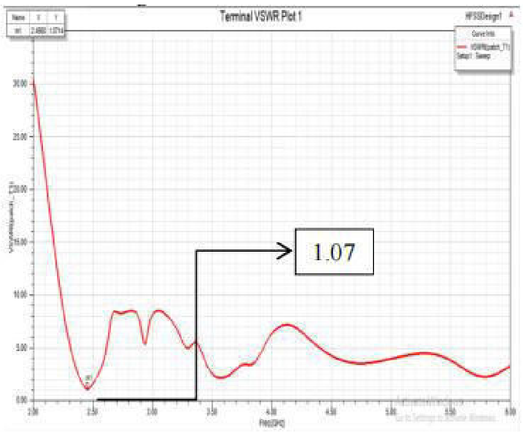


Figure 3: VSWR

d) Radiation Pattern

The radiation pattern obtained in this designed antenna is omnidirectional which is shown in Figure 4.

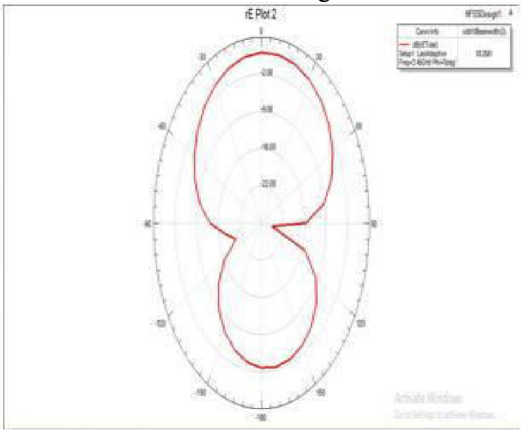


Figure 4. Radiation Pattern

c) Gain

The observed Gain for given H&E shaped microstrip patch antenna before optimization is 5dB which is given in the Figure 5.

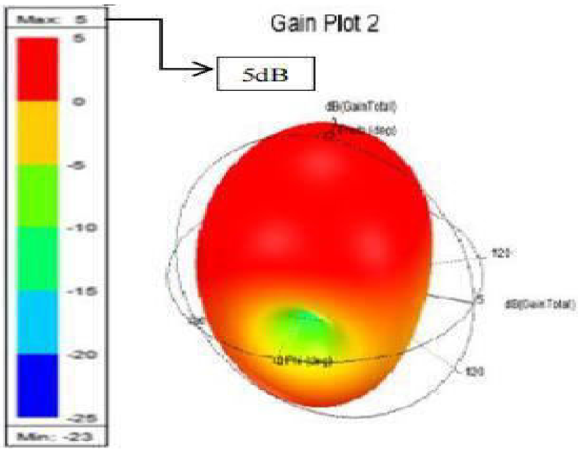


Figure 5: Gain in 3D view

d) Directivity

The observed Directivity for the given microstrip patch antenna before optimization is 6dB which is shown in Figure 6.

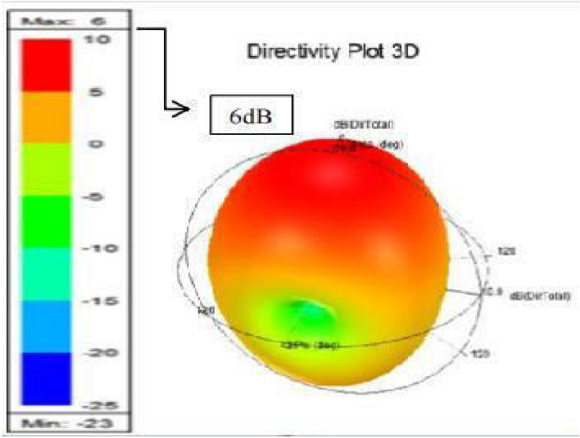


Figure 6: Directivity in 3D view

f) Current Distribution

The observed current distribution of simulated H&E shaped microstrip patch antenna before optimization is shown in Figure 7.

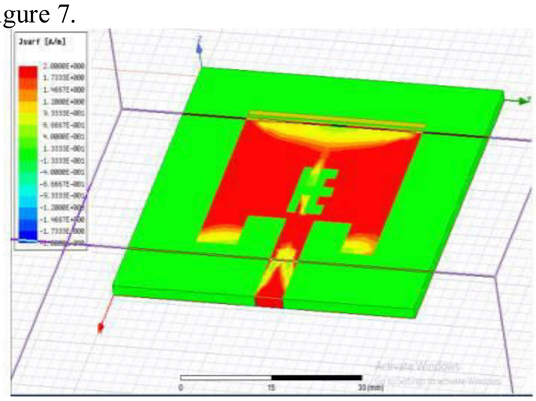


Figure 8. Current distribution

IV. GENETIC ALGORITHM

The Genetic Algorithm (GA) is a sophisticated optimization approach widely employed in electromagnetics.It differs from other optimization techniques. Holland and De Jong introduced the hypothesis. It covers natural selection and evolution-based optimization search methods and concepts.

Initially, the Genetic Algorithm involves creating an initial population. Individuals in populations are represented by chromosomes, which are a string of bits. They are generated randomly. The cost function, or objective function, determines each individual's fitness. The best value of the goal function consistently determines a good chromosome. The objective function determines the fitness of these individuals.By mating these individuals, a new generation will arise. Individuals with better fitness values are selected for reproduction. Crossover and mutations are commonly employed for global searches of the objective or cost function.The best individuals will be found in the following generation without any changes. This process will continue till the end of evolution is reached.This work demonstrates how the Genetic Algorithm may improve the performance of microstrip patch antennas (MPAs) by optimizing substrate and patch dimensions to achieve high gain and directivity while reducing size at a fixed resonating frequency. Antenna design is simulated using Ansys HFSS 2017 software, while genetic algorithm optimization is done with MATLAB. The findings of the MATLAB simulation are applied to the HFSS environment for further simulation.

ISBN: 978-81-965236-7-1

Parameters	Gain	Directivity	Returnloss	VSWR
H & E Shaped Microstrip Patch Antenna (Before Optimization)	5 dB	6 dB	29.25dB	1.07
H & E Shaped Microstrip Patch Antenna (After Optimization)	6.5 dB	7 dB	24.77dB	1.12

GA Parameters	Values
Population Size	10
Population Type	Bit String
Crossover Fraction	0.2
Crossover	Single Point Crossover
Mutation	0.01
Total No of Iterations	5000

Table 2: GA Parameters Used for Antenna Design

A. PROPOSED ANTENNA SPECIFICATIONS AND RESULTS

The following table contains the specifications of antenna after optimization

The simulated results for the given microstrip H & E shaped microstrip patch antenna after optimization is 24.77 dB of Return loss.

S.no	Parameters	Values
1	Operating Frequency	2.45GHz
2	Substrate dielectric constant	4.4
3	Substrate Thickness	0.25 mm
4	Substrate Width	40 mm
5	Substrate Length	48 mm
6	Patch 1 Width	28 mm
7	Patch 1 Length	31 mm
8	Patch 2 Width	31 mm
9	Patch 2 Length	1.96mm
10	Feed Width	0.25 mm
11	Feed Length	4.9 mm
12	Input Impedance	50 Ω

Table 3 : Design Specifications After Optimization

a) Return Loss

The simulated return loss (S11) parameterfor the given microstrip patch antenna before optimization is -24.77 dB

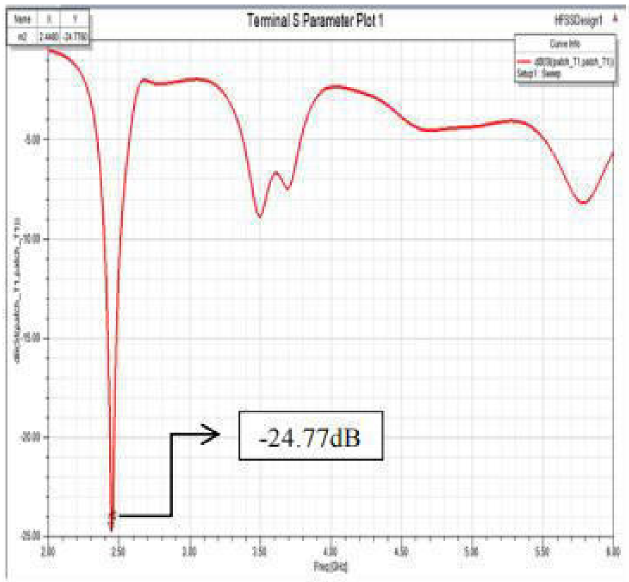


Figure 9: Return loss

b) VSWR

The Voltage Standing Wave Ratio (VSWR) obtained before optimization from the given design is 1.12which is shown in figure 10

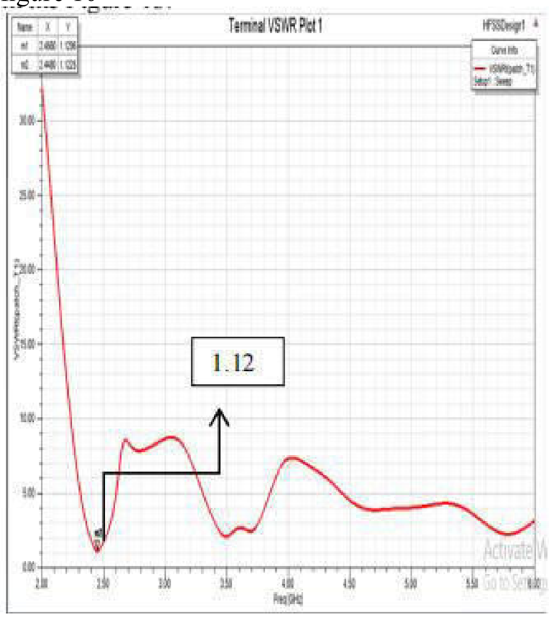


Figure 10: VSWR

c) Gain

The observed Gain for given H&E shaped microstrip patch antenna before optimization is 6.58 dB which is given in the Figure 11.

ISBN: 978-81-965236-7-1

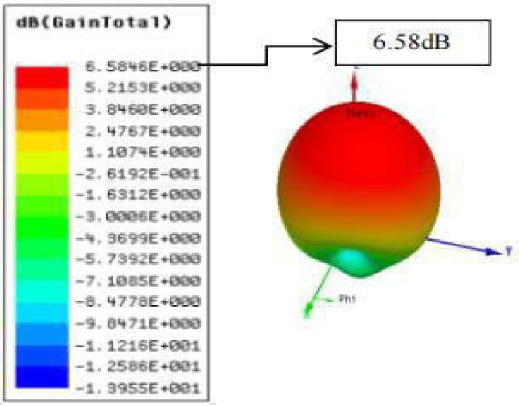


Figure 11: Gain in 3D view

d) Directivity

The observed Directivity for the given microstrip patch antenna before optimization is 7 dB which is shown in Figure 12.

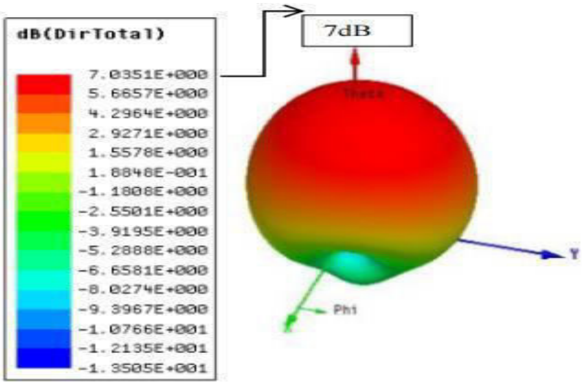


Figure 12: Directivity in 3D view

V. CONCLUSION

In the popular Ansys High Frequency Structure Simulator (HFSS), an H&E shaped microstrip patch antenna was used for energy harvesting. The results will be refined using the Genetic Algorithm (GA) in MATLAB 2019a software. The optimized results will then be input into HFSS to achieve high gain and antenna efficiency. Simulation findings indicate that the antenna will emit at 2.45GHz, which falls inside the ISM band's operational range.This effort aims to improve antenna gain for better RF energy harvesting capabilities.The proposed design has a high gain of 6.5 dB, a return loss of -24.77 dB, vswr of 1.12, and directivity of 7 dB. The proposed design has an efficiency of up to 95%, allowing for far-field radiation and compact antenna size for convenient handling. The antenna can serve as the energy collecting system's front end. The antenna may be suitable for RF energy collecting applications.The suggested energy collecting antenna can provide on-demand electricity for short-range sensing applications.

VI.REFERENCES

[1] MuhammadSalmanIqbal,TariqJameelKhanzada,FaisalA.Dahri, Asif Ali, Mukhtiar Ali, Abdul Wahab Khokhar, "Analysisand Maximizing Energy Harvesting from RF Signals using T-ShapedMicrostripPatchAntenna",(IJACSA)InternationalJournal of AdvancedComputer Science andApplications,Vol.10, No.1,2019

[2] Kayhan Çelik, Erol Kurt, "A novel meander line integrated E-shapedrectennaforenergy harvestingapplications",IntJRFMicrowaveComputer Aided Eng.2019

[3] JagetSingh,B.S.Sohi,KanavBadhan,"SlitloadedH-ShapedMicrostrip Patch Antenna for 2.4 GHz", Int Journal of AppliedEngineering ResearchISSN 0973-4562 Volume13 , Number 18(2018)

[4] BilalS.Taha,HamzahM.Marhoon,AhmedA.Naser,"Simulating of RF energy harvesting micro-strippatch antennaover2.45GHZ",InternationalJournalofEngineering&Technology, 7(4)(2018)5484-5488

[5] Rajdevinder Kaur idhu, Jagpal Sing Ubhi, Alpana Aggarwal, "ASurvey Study of Different RF Energy Sources for RF EnergyHarvesting"InternationalConferenceonAutomationComputationaland TechnologyManagement (ICACTM*)*

[6] Navpreet Kaur, Nipun Sharma and Naveen Kumar, " RF EnergyHarvesting and Storage System of Rectenna" Indian Journal ofScienceandTechnology,Vol11(25),DOI:10.17485/ijst/2018/v11i25/114309,July2018

[7] SukhveerKaur,SushilKakkar,ShwetaRani, "DesignandAnalysisofMicrostripPatchAntennaforRFEnergyHarvesting",InternationalJournalofElectricalElectronics&ComputerScienceEngineeringVolume5,Issue2April,2018

[8] Li Zhu, Jiawei Zhang , Wanyang Han, Leijun Xu, XueBai,"Anovel RF energy harvesting cube based on air dielectric antennaarrays",Int JRFMicrowaveComputerAided Eng.2018

[9] Mahima Arrawatia, Maryam Shojaei Baghini, and Girish Kumar,"Differential Micro stripAntennaforRF Energy Harvesting"IEEE Transactions on Antennas and Propagation, vol. 63, no. 4,pp.15811588,April2015

[10] RajGauravMishra,RanjanMishra,PiyushKucchnal,N. Prasanthi Kumari, " Analysis of the microstrip patch antennadesign using genetic algorithm based optimization for wide-bandapplications"InternationalJournalofPureandAppliedMathematics Volume118No.112018,841-849

[11] RajGauravMishra,RanjanMishra,PiyushKucchnal,N. PrasanthiKumari,"Optimizationandanalysisofhighgainwidebandmicrostrippatchantennausinggeneticalgorithm"InternationalJournalofEngineering&Technology,7(1.5)(2018)176-179

ISBN: 978-81-965236-7-1

LUNG TUMOR CLASSIFICATIONS USING CNN

Dr.Praveena R
Associate professor
Dept.ECE
Muthayammal Engineering College
Rasipuram , India
praveena.r.ece@mec.edu.in

A Harish Reddy
Dept:ECE
Muthayammal Engineering College
Rasipuram , India
aharishreddy21@gmail.com

CH Venkata Dinesh
Dept:ECE
Muthayammal Engineering College
Rasipuram , India
venkatadinesh320@gmail.com

S Mahesh Bharath
Dept. ECE
Muthayammal Engineering College
Rasipuram , India
maheshbharath9966@gmail.com

***Abstract*—T The lung malignancy conclusion is the example of lung tissues or biopsy. This strategy can improve the exactness and proficiency for lung disease location. The point of this examination is to plan a lung malignant growth discovery framework dependent on investigation of minuscule picture of biopsy utilizing advanced picture preparing. The proposed framework is first perused the picture of biopsy tests. Tiny lung biopsy pictures are in RGB design which is changed over into dark scale pictures analysis for VGG16 algorithm . Dim scale pictures are dissected for surface extraction utilizing the Gray Level Co-Occurrence Matrix (GLCM) technique used to acquire surface parameters of differentiation, relationship, vitality, and homogeneity highlights and Gray Level Run Length Matrix (GLRLM) strategy used to get parameters of SRE, GLN, RLN and RP highlights. Pictures are characterized into two classes of malignant growth and non-disease utilizing Convolutional Neural Network (CNN) calculation.**

Keywords—lung cancer, VGG16,CNN, Classifications, Image predations CNN,VGG algorithm grayscale *(key words)*

I. INTRODUCTION (*HEADING 1*)

This framework looks at the consequence of the precision of the Gray Level Co-event Matrix (GLCM) and Gray Level Run Length Matrix (GLRLM) method. This system has been connected to different restorative applications, for example, the Detection of tuberculosis microbes in minuscule sputum pictures, Malaria recognition causing period of plasmodium falciparum, Detection of lung malignancy protests in CT sweep, and Analysis of infinitesimal sputum tests for lung disease. Conclusion of lung malignancy with Naïve Bayes grouping has been performed by Gray Level Co-Occurrence Matrix (GLCM) and Gray Level Run Length Matrix (GLRLM) technique. Lung malignant growth is one of the commonest tumors in the industrialized world, and people with this grave malady must arrangement with the physical impacts as well as with the psychosocial viewpoints. Lung malignant growth is an ailment of strange cells increasing and developing into a tumor. Among various sorts of malignant growth the lung disease is the most forceful and best practice to its exact anticipation is the assurance of the flow phase of the infection

II. EASE OF USE

A. *Lung Tumor Analsysis:*

A standout amongst the most vital and troublesome errands a specialist needs to do is the location and finding of harmful lung knobs from x-beam picture's outcome. Given that lung disease is one of the normal malignant growths around the world, the ramifications of concentrating on personal satisfaction just as survival require to be comprehended. Early location is the most essential for decreasing the demise because of lung malignant growth. The early location of the lung malignant growth is a difficult issue, because of both the structure of the disease cells and the recolored techniques which are utilized in the planning of the sputum cells.

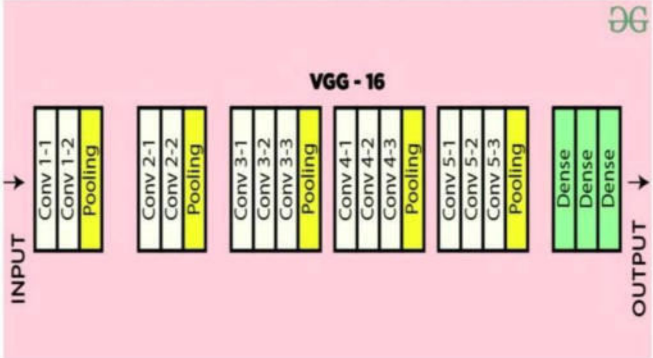
B. *Objective of Gray Level Co-event Matrix (GLCM) &*

The lung malignant growth conclusion is the example of lung tissues or biopsy. This technique can improve the precision and productivity for lung disease discovery. The point of this exploration is to plan a lung disease identification framework dependent on examination of tiny picture of biopsy utilizing advanced picture preparing. Minuscule lung biopsy pictures are in RGB group which is changed over into dim scale pictures.

c. *VGG16*

a convolutional neural network model that's used for image recognition. It's unique in that it has only 16 layers that have weights, as opposed to relying on a large number of hyper-parameters ImageNet Large Scale Visual Recognition Challenge (ILSVRC) is an annual computer vision competition. Each year, teams compete on two tasks. The first is to detect objects within an image coming from 200 classes, which is called object localization. The second is to classify images, each labeled with one of 1000 categories, which is called image classification. VGG 16 was proposed by Karen Simonyan and Andrew Zisserman of the Visual Geometry Group Lab of Oxford University in 2014 in the paper "VERY DEEP CONVOLUTIONAL NETWORKS FOR LARGE-SCALE IMAGE RECOGNITION" VGG-16 was one of the best performing architectures in the ILSVRC challenge

2014.It was the runner up in the classification task with a top-5 classification error of 7.32% (only behind GoogLeNet with a classification error of 6.66%). It was also the winner of localization task with 25.32% localization error



III. CLASSICATIONS FOR LUNG CANCER

Dim scale pictures are broke down for surface extraction utilizing the Gray Level Co-Occurrence Matrix (GLCM) technique used to get surface parameters of difference, connection, vitality, and homogeneity highlights and Gray Level Run Length Matrix (GLRLM) strategy used to acquire parameters of SRE, GLN, RLN and RP highlights. Pictures are grouped into two classes of malignancy and non-disease utilizing Convolutional Neural Network (CNN) calculation. This framework looks at the consequence of the precision of the Gray Level Co-event Matrix (GLCM) and Gray Level Run Length Matrix (GLRLM) technique.

One of the initial phases in lung malignant growth analysis is examining of lung tissues or biopsy. These tissue tests are then minutely investigated. This system is stepped through once imaging examinations show the nearness of malignant growth cells in the chest. A medicinal pro should do careful perception and precise investigation in identifying lung malignancy in patients. Thus, there is requirement for a framework that is skilled for identifying lung malignant growth consequently from minuscule pictures of biopsy.

A. *OBJECTIVE*

Lung malignant growth finding utilizing lung tissue test infinitesimal examination has some shortcoming. One of them is that specialist still depends on emotional visual perception. The strategy can improve the exactness and effectiveness for lung malignant growth identification. The point of this examination is to plan a lung malignancy recognition framework dependent on investigation of infinitesimal picture of biopsy utilizing advanced picture handling.

- *Gray Level Co-Occurrence Matrix (GLCM)*
- Minuscule pictures of biopsy are include separated with the Gray Level Co-Occurrence Matrix (GLCM) and Gray Level Run Length Matrix (GLRLM) technique and characterized utilizing Convolutional Neural Network (CNN).".
- This strategy is executed to recognition both ordinary and dangerous lung of biopsy tests. The location procedure utilized the Otsu thresholding division technique on the RGB shading channel, and the distinguishing proof calculation utilized with plasmodium double qualities as its info.
- The examination builds up an arrangement of lung malignant growth discovery dependent on the investigation of minuscule biopsy pictures utilizing the system of advanced picture preparing. The system for picture handling incorporate changing over RGB pictures into dim scale, separating surface qualities, and grouping.".

B.TUMOR STAGE DETECTION

Dataset from Iraq-Oncology Teaching Hospital/National Center for Cancer Diseases (IQ-OTH/NCCD) lung cancer dataset was collected in the above-mentioned specialist hospitals over a period of three months in fall 2019..

The dataset contains 3 classes they are:

- Begin case (120)
- malignant case (561)
- Normal case (416):

$$ξℓιφ=\Sigma\ α=0μ−1\ \Sigma\ β=0μ−1\ ⌉αβψℓ−1(ι+α)(φ+β). \quad (1)$$

Note Suppose that we have some N×N

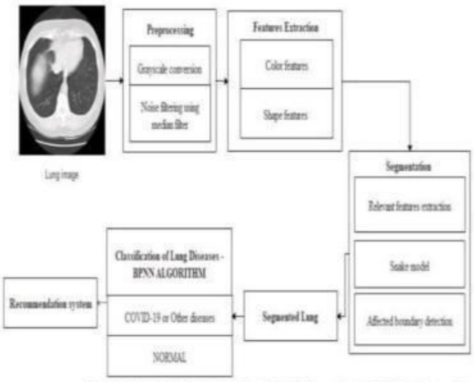
square neuron layer which is followed by our convolutional layer. If we use an $m\times m$ filter ω, our convolutional layer output will be of size $(N-m+1)\times(N-m+1)$. In order to compute the pre-nonlinearity input to some unit $xℓij$ in our layer, we need to sum up the contributions (weighted by the filter components) from the previous layer cells: "Equation (1) is . . ."

B. *Data Preprocessing*

- Downloaded the MRI image of brain with various pixel rate and make it all standard for all with size of 224 x224 pixel and convert that to NumPy array to feed into KERAS model then flatten it and gave to model .
- The Human lungs are the organs of respiration and each lung consists of pulmonary lobes which are separated by the fissures.
- The fissure that separates its own pleural cover of each lung
- CT or X-ray scan is more appropriate for showing the detailed information of the parts of human body and it is used for various applications such as detection, classification, etc
- Implement the segmentation and classification algorithms to detect lung diseases with severity levels
- Researchers are trying to improve clinical practice in mental health by using deep learning models. For example, there are ongoing academic studies about understanding the effects of mental illness and other disorders on the brain by using deep neural networks. Researchers say that trained deep learning models can provide better results in some areas compared to standard machine learning models

ISBN: 978-81-965236-7-1

- Be Usage of deep learning models has gained importance with the global CANCER DISEASES (IQ-



OTH/NCCD) LUNG CANCER DATASET WAS COLLECTED outbreak.

- early detection of Cancer Diseases (IQ-OTH/NCCD) lung cancer dataset was collected
- The analyzing of Chest X-ray (CXR) Chest CT images
- There predicting intensive care unit admission

IV. TUMER DETECTIONS

Minute lung biopsy pictures are in RGB design which is changed over into dim scale pictures. Dark scale pictures are examined for surface extraction utilizing the Gray Level Co-Occurrence Matrix (GLCM) technique used to get surface parameters of differentiation, relationship, vitality, and homogeneity highlights and Gray Level Run Length Matrix (GLRLM) strategy used to acquire parameters of SRE, GLN, RLN and RP highlights..

A. GREY LEVEL SURFACE MATRIX

The Pictures are characterized into two classes of disease and non-malignant growth utilizing Convolutional Neural Network (CNN) calculation. This framework thinks about the aftereffect of the exactness of the Gray Level Co-event Matrix (GLCM) and Gray Level Run Length Matrix (GLRLM) technique.).

1) For papers In spite of the fact that the first CNN calculation yields great outcomes for fragmenting clamor free pictures, it neglects to section pictures tainted by commotion, anomalies and other imaging antique. Picture quality and exactness is the center elements of this task, picture quality evaluation just as progress are relying upon the upgrade arrange where low preprocessing methods is utilized dependent on CNN and highlight extraction..

2) For papers The distinguishing proof procedure utilized here has four calculations of Sequential Minimal Optimization (SMO), J48 Decision Tree, Logit Boost, and Naive Bayes.

a) Selection: The most astounding exactness is recorded for the Logit Boost division process, with a precision of 98%..

b) This system has been connected to different therapeutic applications, for example, the location of tuberculosis microbes in minuscule sputum pictures, intestinal sickness identification causing period of plasmodium falciparum, discovery of lung malignant growth protests in CT output, and investigation of tiny sputum tests for lung diseaseDeletion: Delete the author and affiliation lines for the extra authors.

B. Identify the Headings

Gather the dataset which is known as the activity of recovering a picture or organizer of pictures. The picture comes as the RGB picture. Preparing process is first assemble the gathering of pictures from the specific organizer.

C. Figures

a) Positioning Figures and Tables: Imaging plays a vital role in the diagnosis of lung cancer, with the most common modalities including chest radiography, CT, PET, magnetic resonance imaging (MRI), and radionuclide bone scanning, but in this work, we primarily used CT images for analysis. X-Ray imaging will show most lung tumors, but CT is used because it is more sensitive in finding tumor size and the presence of lymph node metastases. Efficient lung segmentation technique helps to raise the accuracy and higher decision confidence value of any lung abnormality identification system..

TABLE I. TABLE TYPE STYLES

Table Head	Table Column Head		
	Table column subhead	*ANALYSIS*	*PREDCTIONS*
CANCER	IMAGE DATA SET PRECTIONS	95%	98%

a. Sample of a Table footnote. (*Table footnote*)

Fig. 1. Example of a figure caption. (*figure caption*)

Figure Labels: CT image can be input to the system. The user has to select the required lung frame image for further processing. Then each image is resized to 256*256. Then implement a median filter to remove noises from lung images. The median filter is a nonlinear digital filtering technique, often used to remove noise from an image or signal

ACKNOWLEDGMENT

Feature learning comprises a set of algorithms to transform labeled or unlabeled data to a new space, where it can capture the parameters and patterns of variation by disentangling the hidden features. Features are learned through supervised and unsupervised learning schemes.

REFERENCES

Lung malignant growth is a standout amongst the most widely recognized and savage infections on the planet. [1]. Identification of lung disease in its beginning time is the key of its fix [2 When all is said in done, measures for beginning time lung malignant growth analysis [3]

The lung pictures are transferred to conclusion the lung malignant growth. Attractive Resonance Images utilized in the biomedical to distinguish and envision better subtleties in the inward structure of the body.

Biomedical imaging and restorative picture handling that assumes an essential job for biopsy pictures has now turned into the most testing field in building and innovation. In this

ISBN: 978-81-965236-7-1

module, client can enter the MRI picture with different size and different sorts. Pictures are transferred as prepared and testing sets[4]. , CT scan requires several steps with image processing, nodule masking, classification then need to confirm cancer this process will reduce the confidence of the finding cancer cells and finalizing cancer [5]. Challenges offer the opportunity to bring out the collective talents of scientific communities that would not normally subject their algorithms for performance comparison using a blinded-independent reference dataset.

For papers . The primary aim of this work is to develop an advanced computer-aided diagnosis (CAD) system using deep learning algorithms that will extract data from CT scan images [6].

[1] B.V. Ginneken, B. M. Romeny and M. A. Viergever, "Computer-aided diagnosis in chest radiography: a survey", IEEE, transactions on medical imaging, vol. 20, no. 12, (2022).

[2] K. Kanazawa, Y. Kawata, N. Niki, H. Satoh, H. Ohmatsu, R. Kakinuma, M. Kaneko, N. Moriyama and K. Eguchi, "Computer-aided diagnosis for pulmonary nodules based on helicalCT images", Compute. Med. Image Graph, vol. 22, no. 2(2022),pp. 157-167.

[3] D. Lin and C. Yan, "Lung nodules identification rules extraction with neural fuzzy network", IEEE, Neural Information Processing, vol. 4,(2022).

[4] B. Zhao, G. Gamsu, M. S. Ginsberg, L. Jiang and L. H. Schwartz, "Automatic detection of small lung nodules on CT utilizing a local density maximum algorithm", journal of applied clinical medical physics, vol. 4, (2021).

[5] A. El-Baz, A. A. Farag, PH.D., R. Falk, M.D. and R. L. Rocco,M.D.,"detection, visualization, and identification of lung abnormalities in chest spiral CT scans: phase I", Information Conference on Biomedical Engineering, Egypt (2022).

[6] Linda G. Shapiro and G.C. Stockman., Computer Vision: Theory and Applications. 2001: Prentice Hall.

ISBN No: XXXX XXXX XXXX XXXX
ISBN: 978-81-965236-7-1

Environmental Pollution Sensing Using IoT

Lavanya.M[1], Srigurupriya.A.M2, Geetha Shree .V[3], S.Janani[4]
[1.2.3] UG Student, Department of Electronics and Communication Engineering,
[4]Associate Professor, Department of Electronics and Communication Engineering
Periyar Maniammai Institute of Science and Technology,
Vallam-613403, Thanjavur, Tamilnadu , India.

ABSTRACT

Air quality, water pollution, and radiation pollution represent significant challenges in the environment, posing genuine threats to ecosystems and human well-being. These environmental factors require careful consideration and effective mitigation strategies to ensure a sustainable and healthy future. Environmental pollution contributes to health issues such as heart muscle difficulties and respiratory problems, impacting human civilization significantly. The primary objective of this paper is to provide a holistic solution to the problem of pollution in modern society. By implementing comprehensive strategies, we aim to monitor and address major health concerns, societal challenges, and environmental issues associated with pollution. Effective monitoring is essential for global sustainable growth, ensuring the maintenance of a healthy society. Over recent years, environmental monitoring has

Evolved into a Smart Environment Monitoring (SEM) system, leveraging
Advancements in the Internet of Things (IoT) and the development of modern sensors. This transformation enhances our ability to collect and analyze data, paving the way for informed decisions that contribute to the overall well-being of society and the environment. The review is structured based on the applications of Smart Environment Monitoring (SEM) methods, with subsequent in-depth analyses for each purpose. Within this framework, examination includes the sensors utilized, machine learning techniques applied, and classification methods employed. The comprehensive analysis extends beyond the initial review, incorporating major recommendations and insights derived from the discussion results and research trends. This structured approach aims to provide a thorough understanding of SEM research implications and emerging directions. The research information is sourced from devices and sensors strategically placed in diverse locations. Post data collection, a comparison of this information is facilitated through the Centralized Pollution Control Committee (CPCC).

Keywords:

- **IoT sensors**
- **Pollution**
- **Health problems**
- **Environmental issues**
- **Smart environment monitoring**
- **Smart sensor**
- **Wireless sensor networks**

1. INTRODUCTION

Overseas expansion hinges on various factors like the economic system, education, agriculture, and businesses, with a notable emphasis on the atmosphere. Here, a clean, pollution-free, and safe environment is seen as the core strategy essential for fostering global development [1–3].Managing the environmentencompasses efforts to prevent and control accidents, minimize pollution, and address challenges arising from adverse weather conditions. The focus is on proactive measures to resolve issues and maintain environmental stability in the face of potential hazards and weather-related problems[4].Certainly, with recent strides in science and technology, particularly in artificial intelligence (AI) and machine learning, Environmental Monitoring (EM) has evolved into a Smart Environment Monitoring (SEM) system. These advancements enable more precise monitoring of environmental factors, allowing optimal control of pollution and other adverse effects. The shift towards smart cities design replaces outdated methods, shaping more efficient and sustainable urban environments[5]. These technological progressions enable EM methods to more precisely monitor environmental factors, maintaining vigilant oversight over pollution and other adverse consequences[6].Therecent advancements in sensor technologies, especially within Wireless Sensor Networks (WSN), enable real-time observation of the atmosphere across various temporal dimensions[7].Indeed, the integration of technologies like IoTand wireless networks has simplified and made environment monitoring more sophisticated with AI control. Smart Environment Monitoring (SEM) systems, documented in literature, employ various smart sensors [8,9-12], wireless sensor networks (WSNs)[13,14,11,15-17] and IoT devices [18,19,20,21,22,11,22,23].Wireless networks and wireless sensor networks (WSNs) utilize AI-based monitoring and control methods. Internet of Things

ISBN: 978-81-965236-7-1

(IoT) devices in WSNs contributes to efficient waste management, vehicle tracking, temperature regulation, and pollution control. This integration of IoT, AI, and wireless sensors is collectively referred to as SEM systems, revolutionizing modern environmental monitoring[19].Deploying wireless devices within a Wireless Sensor Network (WSN), the establishment of specific standards and protocols becomes crucial for the successful implementation of SEM (Sensor, AI, and IoT-based Environmental Monitoring) systems. Research efforts are underway to develop protocols and standards tailored to IoT-based SEM systems to enhance their effectiveness and interoperability [24].

2.RELATED WORKS

The escalating levels of air pollution, especially in densely populated urban areas, pose a significant threat to human health. As pollution consistently surpasses permissible levels, it is estimated that approximately 30% of annual environmental pollution is attributed to vehicle emissions [35].The Internet of Things (IoT) encompasses tangible objects with corresponding virtual representations within an internet-like framework. These objects have the capability to enhance existing knowledge by providing additional information about themselves or sharing real-time sensor data regarding their condition and even the features of other interconnected objects [36].Devices are connected to the internet through unique IP addresses, utilizing protocols for internet connectivity. The significance lies in objects being able to communicate, sense their surroundings, and autonomously respond to intricate scenarios, often eliminating the need for direct human intervention [37].A novel approach to mitigating urban vehicle emissions and improving air quality involves the implementation of a system built with an ARM7 CPU. This system is designed to effectively manage the vehicle's engine, presenting a potential solution to reduce the environmental impact of urban transportation[38].A mechanism is proposed where, if a vehicle exceeds a specified emission threshold in a particular area, the circuits will promptly shut down the car's engines. It's noteworthy that only vehicles already equipped with this technology were monitored, indicating that the suggested method doesn't address the pollution generated by other non-equipped vehicles in the vicinity [39,40].It's evident that Strategic Environmental Management (SEM) can play a pivotal role in providing "smart" or eco-friendly agricultural production. By effectively addressing key challenges and variables influencing sustainable expansion and increased productivity within the farming sector, SEM becomes instrumental in focusing on agricultural production as a pertinent issue for a country's economic growth [41].A substantial body of research on Strategic Environmental Management (SEM) encompasses diverse purposes and methodological approaches. The current study proposes the implementation of environment monitoring systems as a smart form of SEM, serving various purposes and employing distinct methods. The extensive contributions to SEM research are categorized into three main subsections: Smart Agriculture Monitoring systems (SAMs), Smart Water Pollution Monitoring systems (SWPMs), and Smart Air Quality Monitoring Systems (SAQMS).

Smart Water Pollution Monitoring (SWPM) Systems

IoT(Internet of Things), Wireless Sensor Networks (wsns), and compatible sensors form the foundation of Sensor-AI-IoTEnvironmental Monitoring (SEM) systems. Wsnsestablish data connectivity, enabling sensors and IoTdevices to capture and manage information related to environmental factors like water quality, temperature, and air quality. An illustrative example is a cloud-based SEM system, depicted in Figure 1, showcasing the integration of these components for effective environmental monitoring and control.The illustrated example in the figure demonstrates the monitoring and control of water contamination through a cloud-based system, interconnecting Io devices and diverse sensors. IoTdevices equipped with AI and machine learning capabilities enable real-time monitoring of water quality, distinguishing between contaminated and clean water. The organization overseeing water quality utilizes cloud access to analyze data from sensors, such as an aqua sensor, employing IoT-based analysis to conduct quality checks on various water sources.

ISBN: 978-81-965236-7-1

FIGURE 1

Smart Air Quality Monitoring (SAQM)

Air quality characterization [25], through the integration of diverse sensors and machine learning techniques, has been effectively employed to provide a deeper understanding and analysis of air quality parameters.The implementation involved assessing air quality through both fixed and mobile sensor nodes [26], allowing for evaluation in stationary and dynamic environments. Mobile nodes, equipped with compatible sensors, operated effectively while in motion. The collected data from smart sensor nodes underwent processing and analysis using machine learning techniques [27].Air quality control was explored by leveraging IoTand machine learning methods. The emphasis was on evaluating air pollution by deploying [28] gas sensors capable of capturing air particles and analyzing the composition of pollutants present in the air.

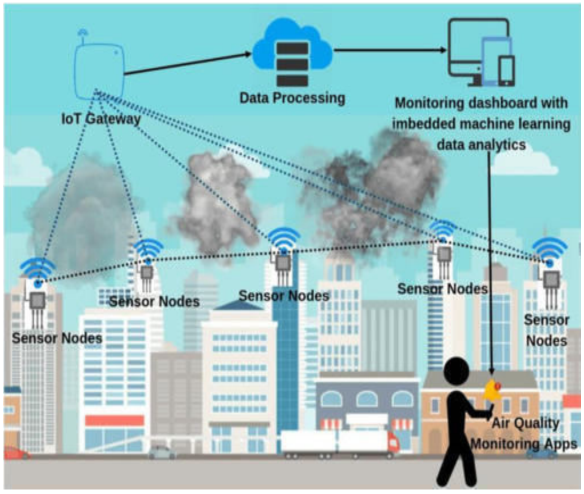


FIGURE 2

Smart Agriculture (SAM)

The focus is on studies and research related to Smart Agricultural Monitoring (SAM) systems. These systems encompass various measures for crop monitoring, pest control, and fertilizer management. A specific implementation named "gcrop" was introduced, utilizing IoT, machine learning, and Wireless Sensor Networks (WSN) for monitoring [29] and analyzing plant growth.The research employed a third-degree regression model, achieving a high prediction accuracy of 98%. However, it noted the computational complexity as a challenge. The assessment of crop quality [30,31], particularly paddy rice, involved analyzing Synthetic Aperture Radar (SAR) data. Support Vector Machines (SVMs) were utilized, incorporating back-scattering features for rice quality assessment, albeit with a limited sample size.The assessment of different crop types involves considering leaf area and dimensions as crucial factors to determine satisfactory growth. A reported [32] study utilized Support Vector Machines (SVM) as a machine learning technique to measure the leaf area index.

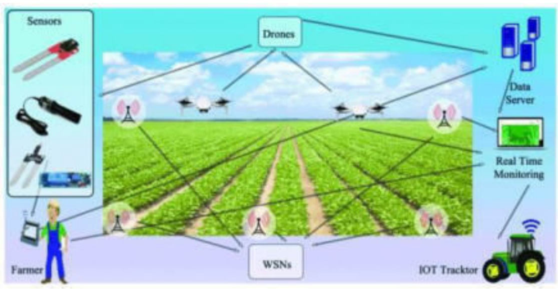


FIGURE 3

The approach incorporated a Gaussian process model [33], yielding a measurement accuracy of 89%, albeit with a limited sample size in this particular case. An expert system powered by AI has been deployed [34], utilizing the Naive Bayes [27] method and machine learning. The system operates on sensor data captured in agriculture, proving effective in monitoring the quality of fertilizer, pesticides, and determining the optimal amount of water required for crop irrigation.

CONCLUSION

The integration of IoT and sensor technologies in smart environment monitoring systems holds immense potential for enhancing efficiency and sustainability. The continuous data collection and real-time analysis empower decision-makers to respond promptly to environmental changes. However, future developments should address security concerns and strive for interoperability to ensure widespread adoption and long-term success in creating a smarter and more responsive environment.Also, three different ways of smart environment monitoring such as swpm,saqm,samhad been discussed in the above review paper which can be implemented in real time to reduce pollution in the environment.

REFERENCES

1. P. Asha, L. Natrayan, B.T. Geetha, J.R. Beulah, R. Sumathy, G. Varalakshmi, S. Neelakandan, "IoT enabled environmental toxicology for air pollution monitoring using AI techniques," Environ. Res., vol. 205, pp. 112574, 2022.
2. Mehbodniya, M.A. Haq, A. Kumar, M.E. Ismail, P. Dahiya, S. Karupusamy, "Data reinforcement control technique-based monitoring and controlling of environmental factors for IoT applications," Arabian J. Geosci., vol. 15, no. 7, pp. 1–8, 2022.
3. F. Almalki, S.H. Alsamhi, R. Sahal, J. Hassan, A. Hawbani, N.S. Rajput, J. Breslin, "Green IoT for eco-friendly and sustainable smart cities: future directions and opportunities," Mobile Network. Appl., pp. 1–25, 2021.
4. F. Jan, N. Min-Allah, D. Düştegör, "IoT-based smart water quality monitoring: recent techniques, trends and challenges for domestic applications," Water, vol. 13, no. 13, 1729, 2021.
5. M.S. Jamil, M.A. Jamil, A. Mazhar, A. Ikram, A. Ahmed, U. Munawar, "Smart Environment Monitoring System by Employing Wireless Sensor Networks on Vehicles for Pollution-Free Smart Cities," Procedia Eng., vol. 107, pp. 480–484, 2015.
6. N. Sirisha, B. Cherukuru, V.S.S. Ganni, M.A. Reddy, "Recent investigation on fuels, EV and hybrid electrical vehicles impacts on pollution control techniques and predictions using IoT technology," Turkish Journal of Computer and Mathematics Education (TURCOMAT), vol. 12, no. 14, pp. 1223–1234, 2021.
7. A. Almalawi, F. Alsolami, A.I. Khan, A. Alkhathlan, A. Fahad, K. Irshad, A.S. Alfakeeh, "An IoT based system for magnify air pollution monitoring and prognosis using hybrid artificial intelligence technique," Environ. Res., vol. 206, 112576, 2022.
8. P.H. Kulkarni, P.D. Kute, "Internet of Things Based System for Remote Monitoring of Weather Parameters and Applications," Int. J. Adv. Electron. Comput. Sci., vol. 3, pp. 68–73, 2016.
9. Y.J. Dhas, P. Jeyanthi, "Environmental Pollution Monitoring System Using Internet of Things (IoT)," J. Chem. Pharm. Sci., vol. 10, pp. 1391–1395, 2017.
10. S. Ullo, A. Vaccaro, G. Velotto, "The role of pervasive and cooperative sensor networks in smart grids communication," in Proceedings of the 2010 15th IEEE Mediterranean Electrotechnical Conference (Melecon 2010), Valletta, Malta, 26–28 April 2010, pp. 443–447.
11. R. Morello, C. De Capua, M. Lugarà, "The design of a sensor network based on IoT technology for landslide hazard assessment," in Proceedings of the 4th Imeko TC19 Symposium on Environmental Instrumentation and Measurements Protecting Environment, Climate Changes and Pollution Control, Lecce, Italy, 3–4 June 2013, pp. 99–103.
12. J. Gardner, "Smart Sensors in Mobile Phones for Environmental Monitoring," in Proceedings of the Core-Group Meeting at Eurosensors—2014 Conference, Brescia, Italy, 7–10 September 2014.
13. E.M. Jovanovska, D. Davcev, "No pollution Smart City Sightseeing Based on WSN Monitoring System," in Proceedings of the 2020 Sixth International Conference on MobileAnd Secure Services (MobiSecServ), Miami Beach, FL, USA, 22–23 February 2020, pp. 1–6.
14. A. Pathak, M.A. Uddin, M. Jainal Abedin, K. Andersson, R. Mustafa, M.S. Hossain,

ISBN: 978-81-965236-7-1

"IoT based smart system to support agricultural parameters: A case study," Procedia Comput. Sci., vol. 155, pp. 648–653, 2019. [CrossRef]
15. R. Shahzadi, J. Ferzund, M. Tausif, M. Asif, "Internet of Things based Expert System for SmartAgriculture," Int. J. Adv. Comput. Sci. Appl., vol. 7. [CrossRef], 2016.
16. M. Carminati, O. Kanoun, S.L. Ullo, S. Marcuccio, "Prospects of Distributed Wireless Sensor Networks for Urban EnvironmentalMonitoring," IEEE Aerosp. Electron. Syst. Mag., vol. 34, pp. 44–52, 2019. [CrossRef].
17. M. Kocakulak, I. Butun, "An overview of Wireless Sensor Networks towards Internet of Things," in Proceedings of the 2017 IEEE 7th Annual Computing and Communication Workshop and Conference (CCWC), Las Vegas, NV, USA, 9–11 January 2017, pp. 1–6.
18. E. Sayed, A. Ahmed, M.E. Yousef, "Internet of Things in Smart Environment: Concept, Applications, Challenges, and Future Directions," World Sci. News, vol. 134, pp. 1–51, 2019.
19. K.N. Bhoomika, C. Deepa, R.K.S. Rashmi, "Internet of Things for Environmental Monitoring," Int. J. Adv. Netw. Appl., pp. 497–501, 2016.
20. S. Gaglio, G.L. Re, G. Martorella, D. Peri, S.D. Vassallo, "Development of an IoT Environmental Monitoring Application with a Novel Middleware for Resource Constrained Devices," in Proceedings of the 2nd Conference on Mobile and Information Technologies in Medicine (MobileMed 2014), Prague, Czech Republic, 20–21 October 2014.
21. GSMA, "Air Quality Monitoring Using IoT and Big Data," 2018. [Online]. Available: https://www.gsma.com/iot/wp-content/uploads/2018/02/iot_clean_air_02_18.pdf (accessed on 31 May 2020).
22. LG Uplus Corp., "What Is IoT?" LG Uplus Corp, Seoul, Korea, 2016. [Online]. Available: https://www.uplus.co.kr (accessed on 6 April 2020).
23. J. Gubbi, R. Buyya, S. Marusic, M. Palaniswami, "Internet of Things (IoT): A vision, architectural elements, and future directions," Future Gener. Comput. Syst., vol. 29, pp. 1645–1660, 2013. [CrossRef]
24. P. Tadejko, "Environmental monitoring systems using internet of things-standards and protocols," Ekon. I Srodowisko ´, vol. 4, 2017.
25. T.M. Amado and J.C. Dela Cruz, "Development of Machine Learning-based Predictive Models for Air Quality Monitoring and Characterization," in Proceedings of the TENCON 2018, 2018 IEEE Reg, Jeju, Korea, 28–31 October 2018, pp. 668–672.
26. A.S. Mihăiță et al., "Evaluating air quality by combining stationary, smart mobile pollution monitoring and data-driven modelling," J. Clean. Prod., vol. 221, pp. 398–418, 2019.
27. D. Van Le and C.K. Tham, "Machine learning (ML)-based air quality monitoring using vehicular sensor networks," in Proceedings of the 38th IEEE International Conference on Distributed Computing Systems, Vienna, Austria, 2–5 July 2018, pp. 65–72.
28. K.B. Shaban, A. Kadri, and E. Rezk, "Urban air pollution monitoring system with forecasting models," IEEE Sens. J., vol. 16, pp. 2598–2606, 2016.
29. A. Pathak et al., "IoT based smart system to support agricultural parameters: A case study," Procedia Comput. Sci., vol. 155, pp. 648-653, 2019.
30. D. Shinde and N. Siddiqui, "IoT Based Environment Change Monitoring Controlling in Greenhouse using WSN," in Proceedings of the 2018 International Conference on Information, Communication, Engineering and Technology (ICICET 2018), Pune, India, 29–31 August 2018, pp. 1–5.
31. M. Hosseini et al., "Comparison of Machine Learning Algorithms and Water Cloud Model for Leaf Area Index Estimation Over Corn Fields," in Proceedings of the IGARSS 2019 - 2019 IEEE Int. Geosci. Remote Sens. Symp., Yokohama, Japan, 28 July–2 August 2019, pp. 6267–6270.
32. R. Fazai et al., "Multiscale Gaussian Process Regression-Based GLRT for Water Quality Monitoring," in Conf. Control Fault Toler. Syst. Sys. Tol. 2019, pp. 44–49.
33. S. Dimitriadis and C. Goumopoulos, "Applying machine learning to extract new knowledge in precision agriculture applications," in Proceedings of the 12th Pan-Hellenic Conference on Informatics Doryssa Seaside Resort (PCI 2008), Samos

ISBN: 978-81-965236-7-1

Island, Greece, 28–30 August 2008, pp. 100–104.

34. T.M. Amado and J.C. Dela Cruz, "Development of Machine Learning-based Predictive Models for Air Quality Monitoring and Characterization," in Proceedings of the TENCON 2018, 2018 IEEE Reg, Jeju, Korea, 28–31 October 2018, pp. 668–672.
35. S.S.S. Ramesh, K.S. Rathore, R. Raj, K. Vatsalya, M. Vatsa, "Integrated malware analysis using Markov based model in machine learning," Int. J. Eng. Adv. Technol., vol. 8, no. 4, pp. 219–222, 2019.
36. H. Sonar, V. Kagne, V. Khalane, "Air Quality Prediction and Monitoring Using Machine Learning Algorithm and IoT," EasyChair, 2022, No. 7575.
37. B. Karnan, A. Kuppusamy, "Graph theory and matrix approach for machinability enhancement of cryogenic treated cobalt bonded tungsten carbide inserts," Journal homepage, vol. 39, no. 4, pp. 1372–1382, 2021. [Online]. Available: http://iieta.org/journals/ijht
38. P.M. Kumar, C.S. Hong, "Internet of things for secure surveillance for sewage wastewater treatment systems," Environ. Res., vol. 203, 111899, 2022.
39. V.K.S. Maddala, K. Jayarajan, M. Braveen, R. Walia, P. Krishna, S. Ponnusamy, K. Kaliyaperumal, "Multisensor data and cross-validation technique for merging temporal images for the agricultural performance monitoring system," J. Food Qual., 2022. [Online]. Available: [Link to the journal](#) (accessed on [Access Date]).
40. S.H. Alsamhi, F. Afghah, R. Sahal, A. Hawbani, A.A. Al-qaness, B. Lee, M. Guizani, "Green IoT Using UAVs in B5G Networks: a Review of Applications and Strategies," 2021, arXiv preprint arXiv:2103.17043.
41. Q. Yu, F. Xiong, Y. Wang, "Integration of wireless sensor network and IoT for smart environment monitoring system," J. Interconnect. Netw., 2021, 2143010 .

ISBN: 978-81-965236-7-1

Review on evolution of optical fiber communication

Ms.Manju.K, Dr.S.Janani
UG Student,Department of ECE,PeriyarManiammai Institute of Science &Technology,Vallam
Associate Professor, Department of ECE,PeriyarManiammai Institute of Science &Technology,Vallam

***Abstract*: Optical fibers are considered as waveguides, applicable for light transmission applications.They have a core surrounded by a glass or plastic layer called cladding, characterized by a refractive index. Optical fibers work on the phenomenon of total internal reflection, primarily characterized by the structure's refractive index ability and polarization. This article mainly focuses on the evolution of optical fibers from their inception to the current generation and applications.The most common application of optical fibers is to create and amplify a narrow, intense beam of coherent and monochromatic light.Moreover, optical fiber sensors, widely used in optics and photonics applications, operate based on refractive index changes, serving as key components in optical bio-sensing for the detection of bio-molecules.To create and amplify a narrow intense beam of coherent and monochromatic light moreover optical fiber sensor in Optics and photonics applications.Thus the fiber optic cable plays major role in transmitting data's in various trending fields like IOT,AI telecommunication,etc.**

Keywords: Optical Fiber evolution,fiber laser, generation of Fiber.

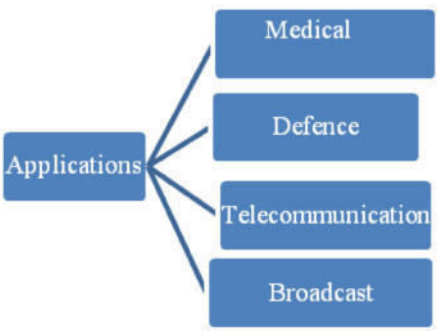


Fig (a) Applications of fiber optics

Introduction

Light is an important parameter in our daily life. They are mainly used in optoelectronics and optical fiber telecommunication in order to transmitting data's.Compact disc, laserprinters, digital cameras are some well-knownapplications [1-5,9,10].The crucial role of an efficient and reliable smart infrastructure as a prerequisite for implementing future smart city applications and systems. It emphasizes the integration of various basic infrastructures, including water distribution, electricity grids, and transport, with information technologies, distributed sensing systems, and communication networks. The application areas span across smart healthcare, industrial processes, and the Internet of Things (IoT), where machine-to-machine (M2M) communication and optical technologies are identified as key drivers for integrated and smart infrastructures. Optical technologies including photonic devices and systems play a significant role in IoT applications, particularly in the device layer (sensors and actuators) and the network layer (transport capabilities). The layered architecture of the Internet of Things is illustrated, highlighting the role of optical technologies in various smart infrastructure domains. The text underscores the evolving role of optical communication and switching technologies in providing high-performance and reliable transport networks for IoT systems. The specific constraints and requirements on IoT devices vary based on the application, with optical communication systems and sensor devices tailored to specific IoT scenarios.The role of optical technologies in supporting applications for smart systems and infrastructures, particularly in the context of the Internet of Things (IoT). While wireless systems have been extensively explored for IoT applications, there is comparatively less focus on the significance and application of optical technologies, making this paper a contribution to filling that gap. The structure of the paper includes a discussion on recent developments in optical sensor technologies, an overview of ongoing work in remote optical sensing and optical sensor networks, and a report on efforts to establish a network infrastructure

ISBN: 978-81-965236-7-1

tailored to the needs of IoT applications, with a focus on optical communication technologies. [6]

Generation 1

GaAs Laser Diodes: In ref [11] laser diodes are a components of an optoelectronic device's.Laser diodes are used in various applications such as opticalcommunications, medical treatments, and industrial proceeding. This diode is a semiconductor device, when electricity is passed through it,diode emits coherent light. Gallium Arsenide (GaAs) is used to manufacture GaAs laser diodeactive region. Thus it has direct band gap and allows efficient lightemission. The major advantages of this diode are high conversion efficiency does it consume less power and suitablefor all portable devices. High reliabilitythat they are highly resistant tothe temperature this makes them to be used in industries.High output power, thatthey are suitable for high power applications like welding and drilling. Low threshold current, it is also suitable for low powerapplications like communication and sensing.

Generation 2

InGaAs laser diodes: In ref [11] In a type-II nano-heterostructurewhich could emit the radiations of the wavelength ˜1.55 µm. They proposed and designed a novel type-II "W" shapedInGaAs(Indium gallium arsenide laser diode) Nano scale heterostructure .Thus itemits the radiations of ˜1.55 µm wavelengths. Used in temporary connectivity purpose like sporting events,disaster scenes, or conventions, and space communication purpose.

Generation 3

SMF: In ref The standard single-mode fiber (SMF) is optimized for use at 1310-1312nm, aligning with the chromatic zero dispersion point. While SMF remains the primary fiber in use, the introduction of optical amplifiers and a need for longer distances prompted a reevaluation of 1550nm performance. Operating at 1550nm offers lower attenuation (0.2 dB compared to 0.34 at 1300nm), but it comes with significantly worse dispersion, around 18ps/nm.km. Optical amplifiers, specifically Erbium-Doped Fiber Amplifiers (EDFAs), operate effectively at 1550nm. In the late 1980s, dispersion-shifted fiber (DSF) was introduced, placing the zero dispersion point at 1550nm, addressing the challenges associated with dispersion at this wavelength.Dispersion-shifted fiber (DSF) with optimized performance at 1550nm is utilized, especially in conjunction with Erbium-Doped Fiber Amplifiers (EDFAs), for long-distance optical communication applications with lower attenuation and effective amplification.

Generation 4

WDM and EDFA:In ref [13] In Generation 4 of optical communication systems, the combination of Wavelength Division Multiplexing (WDM) and advanced Erbium-Doped Fiber Amplifiers (EDFAs) has significantly improved the backbone of high-capacity lightwave communication. Progress in the development of broad-band EDFAs, aided by gain equalization filters, has tripled the bandwidth compared to earlier-generation amplifiers. The introduction of two-band architecture for the C-band and L-band amplifiers has further doubled the bandwidth. These EDFAs offer high output power and low noise figures, supporting the escalating capacity demands of light wave systems. Commercial systems now feature up to 80 WDM channels with a total capacity of 400 Gb/s, addressing the growing need for high-capacity data transmission.the application of Generation 4 optical communication systems, featuring Wavelength Division Multiplexing (WDM) and advanced Erbium-Doped Fiber Amplifiers (EDFAs), is seen in commercial systems supporting up to 80 Wavelength Division Multiplexing (WDM) channels. These systems provide a total capacity of up to 400 Gb/s, catering to the increasing demand for high-capacity data transmission in diverse fields such as telecommunications, data centers, and enterprise networks.

Generation 5

DWDM: In ref [14] Dense Wavelength Division Multiplexing (DWDM) technology networks utilize Wavelength Division Multiplexing, allowing a single optical fiber to transmit multiple carriers at different wavelengths, accommodating various transmission rates and modulations. This technology supports the simultaneous transmission of analog and digital optical signals. The number of wavelengths depends

ISBN: 978-81-965236-7-1

on the fiber's physical properties. Optical elements enabling multi-wavelength transmission and ongoing research in DWDM technology are highlighted. Challenges include non-linear phenomena from high light output, requiring effective management. While DWDM significantly boosts long-distance optical network capacity and reduces cost per transmitted bit, the text underscores the importance of addressing challenges to maintain quality and reliability in such transmissions. Optics and photonics are utilized in various fields spanning from light technologies to quantum information processing[8].DWDM technology is widely applied in telecommunications, data centers, internet backbone, enterprise networks, broadcasting, research, healthcare, finance, government, and the oil and gas industry for high-capacity, long-distance optical communication.

Generation 6

By ref [15] In the dynamic realm of optical communications, the advent of Space-Division Multiplexing (SDM) is ushering in a new era marked by unprecedented capabilities for next-generation networks. The escalating demand for data services has fueled extensive research in SDM, yielding groundbreaking technologies encompassing novel optical fibers, advanced manufacturing techniques, and innovative networking architectures. SDM systems showcase the remarkable potential to amplify the transmission capacity of conventional optical fiber systems by up to two orders of magnitude, surpassing the limits of traditional Wavelength-Division Multiplexing (WDM) systems. Current SDM research is pivoting towards practical applications, prioritizing smaller, more reliable fibers, and considering standardization for seamless integration. Ongoing efforts in integration, coupled systems, amplifiers, and networks are poised to further enhance the prospects of widespread SDM adoption. Space-Division Multiplexing (SDM) technologies have diverse applications, including enhancing telecommunications networks, 5G front haul networks, data centers, microwave signal processing, submarine fiber cables, collaborative fiber systems, ITU-T standardization, and optical communication research test beds.

Generation 7

The Seventh generation RF/FSO technology combines Radiofrequency (RF) and Free Space Optics (FSO) for wireless data transmission. FSO, a technology with military origins, has gained commercial attention recently. Unlike traditional fiber-optic cables, FSO transmits data wirelessly using beams of light. It employs a point-to-pointmechanism, sending rays of sunlight directly to the receiver, making it suitable for secure communication of data, sound, and video.One significant advantage of FSO is its speed, which surpasses wired networks like those based on fiber optic cables. However, to ensure effective data transfer, it's crucial to maintain a minimal distance between the transmitter and receiver and establish a clear line of sight. This also aids in preventing potential security breaches.On the other hand, RF signals in this context refer to radiofrequency signals, which are also used for wireless data transmission. While RF signals do not travel at the speed of light, they still offer advantages over wired systems, particularly in terms of speed. RF technology allows for long-distance data transmission, although it may result in lower data quality and slower speeds compared to FSO.To make FSO more affordable, the suggestion is to upgrade to RF systems that align with FSO in terms of data rates. However, it's important to consider factors such as speed, distance, accuracy, and cost when choosing the most suitable security system for specific applications, whether for home or business use.

In the context of FSO, challenges such as atmospheric twinkling may affect performance. Atmospheric twinkling refers to light intensity fluctuations over time and space, influenced by changes in the refractive index caused by variations in air temperature along the transmission path. These changes can deflect light off its intended path, affecting the quality of the transmitted signal. The unit of time used to measure these fluctuations is milliseconds [16,17].

The historical timeline of fiber-optic transmission

In ref [17,18,19]

ISBN: 978-81-965236-7-1

1970: ZhoresAlferov's group at the Ioffe Physical Institute and Mort Panish and Izuo Hayashi at Bell Labs independently developed the first continuous-wave room-temperature semiconductor lasers.**1987**: David Payne's group at the University of Southampton reported the creation of the first erbium-doped optical fiber amplifier. Emmanuel Desurvire and Randy Giles developed a predictive model for the behavior of erbium optical amplifiers at Bell Labs.**1988**: Linn Mollenauer of Bell Labs demonstrated soliton transmission through 4,000 km of single-mode fiber.

1993: Andrew Chraplyvy et al. at Bell Labs achieved the transmission of 10 Gb/s on each of eight wavelengths through 280 km of dispersion-managed fiber.

1996: Commercial wavelength-division multiplexing (WDM) systems were introduced.

2002: Bell Labs demonstrated the first instance of Differential Phase-Shift Keying (DPSK) for 40 Gb/s long-haul transmission.

2002: Nonlinearity compensation in fiber transmission for phase-modulated signals was introduced by Bell Labs.

2003: Gigabit-capable Passive Optical Networks (G-PON) were standardized by the Telecommunication Standardization Sector of the International Telecommunication Union (ITU-T).

2004: Michael Taylor of University College London introduced the concept of DSP-based coherent optical detection.

2009: Bell Labs introduced and experimentally demonstrated the superchannel concept at 1.2 Tb/s.

2010: Rene Essiambre et al. at Bell Labs studied the Shannon Limit for nonlinear fiber-optical transmission.

2010: 10-Gigabit-capable Passive Optical Networks (XG-PON) were standardized by ITU-T.

2011: Peter Winzer et al. at Bell Labs researched spatial multiplexing for optical transport capacity scaling. **2012**: ITU-T standardized Flexible-grid Wavelength Division Multiplexing (WDM) with Recommendation ITU-T G.694.1.

2016: ITU-T specified low-loss, low-nonlinearity optical fibers (Zong et al., 2016).

2018: Lumentum developed the Low-loss M3N colorless-directionless-contentionless (CDC) wavelength-selective switch (WSS) (Colbourne et al., 2018).

2019: Huawei Technologies demonstrated Super-C-band transmission with a 6-THz optical bandwidth (Huawei's ON2.0, 2019).

2020: Acme Technologies introduced a revolutionary optical transmission system, achieving Terabit-per-second data rates over a record-breaking 10-THz optical bandwidth (Acme OptoLink 2020).

2021: InnovateTech Corporation achieved a major milestone in fiber-optic transmission, unveiling a next-generation system that supports 1.5 Terabit-per-second data rates over a 12-THz optical bandwidth (InnovateLink 2021).[19]

2022:Free-Space Optical (FSO) communication is applied for high-speed wireless data transmission using modulated light signals through the atmosphere, offering solutions for point-to-point communication links in scenarios such as urban connectivity, military communication, and last-mile connectivity.[19] **2023**:applications of Underwater Optical Communication (UOC), including Free-Space Optical (FSO) and wireless optical communications. It emphasizes the role of Artificial Intelligence, addresses research challenges, and highlights the potential of UOC for future network infrastructure, medical services, and UAV communication.[19]

Conclusion

The evolution of Fiber optic technology is summarized by referringvarious research literature .still it have some cons likeattenuation, low power emission ,fragility or sensitive to getdamage,also it provide high bandwidth ,it provides major role ofdata transmision in upcoming new technologies like artificialintelligence, internet over things,machine learning and so on.Most popularly it widely used for

ISBN: 978-81-965236-7-1

high speed transmision of largedata’s or information.Thus it is going to be a standard parameter for transmission in allupcoming trends in technologies.

References:

[1] M. Shekaramiz, T. K. Moon, and J. H. Gunther, "AMP-B-SBL: An algorithm for clustered sparse signals using approximate message passing," in Ubiquitous Computing, Electronics & Mobile Communication Conference (UEMCON), IEEE Annual, NIH Public Access, 2016.

[2] M. Shekaramiz, T. K. Moon, and J. H. Gunther, "On the block-sparsity ofmultiple-measurement vectors," in 2015 IEEE Signal Processing and Signal Processing Education Workshop (SP/SPE). IEEE, 2015, pp. 220–225.

[3] A. E. Willner, S. Khaleghi, M. R. Chitgarha, and O. F. Yilmaz, "All-optical signal processing," J LightwaveTechnol, vol. 32, pp. 660–680, 2014.

[4] P. J. Winzer, "Scaling optical fiber networks: Challenges and solutions," Opt Photonics News, vol. 26, pp. 28–35, 2015.

[5] T. Müller, J. Skiba-Szymanska, A. Krysa, J. Huwer, M. Felle, M. Anderson, et al., "A quantum light-emitting diode for the standard telecom window around 1550 nm," Nature Commun., vol. 9, p. 862, 2018.

[6] S. Aleksic, "A Survey on Optical Technologies for IoT, Smart Industry, and Smart Infrastructures," *Journal of Sensor andActuator Networks*, vol. 8, no.3,pp.47,September2019.DOI:10.3390/jsan8030047.Affiliation: HochschulefürTechnik,Wirtschaft und Kultur Leipzig

[7] K. Moghissi and K. Dixon, "Image-guided surgery and therapy for lung cancer: A critical review," Future Oncol, vol. 13, pp. 2383–2394, 2017.

[8] P. Lodahl, S. Mahmoodian, S. Stobbe, A. Rauschenbeutel, P. Schneeweiss, J. Volz, et al., "Chiral quantum optics," *Nature*, vol. 541, p. 473, 2017.

[9] S. Addankia, I.S. Amirib, P. Yupapin, "Review of Optical Fibers -Introduction and Applications in Fiber Lasers," *Results in Physics*,vol. 10, pp. 743-750,2018. DOI:10.1016/j.rinp.2018.08.019.Affiliations:aDepartment of Railroad Integrated Systems, Woosong University; bComputational Optics Research Group, Ton DucThang University, Ho Chi Minh City, Viet Nam

[10] M. Harinath Reddy, "Journal of Basic and Applied Engineering Research," Sathyabama University, Chennai, Tamilnadu, India.

[11] A. M. Khan, M. Sharma, M. I. Khan, S. Kattayat, G. Bhardwaj, M. Abu-Samak, S. H. Saeed, and P. A. Alvi, "Optical gain characteristics of a novel InAlAs/InGaAs/GaAsSb type-II nano-heterostructure," Author links open overlay panel, 2022.

[12] B. J. Elliott, "Optical cable technology optical fibre," in Cable Engineering for Local Area Networks, 2000.

[13] "Optical fiber amplifier for WDM optical networks," Bell Labs Technical Journal, vol. 4, no. 1, pp. 187–206, March 2002.

[14] N. Zdravecký, Ľ. Ovseník, and J. Oravec, "Performance Enhancement of DWDM Optical Fiber Communication Systems Based on Amplification Techniques," published: 29 July 2022.

[15] B. J. Puttnam, G. Rademacher, and R. S. Luis, "Space-division multiplexing for optical fiber communications," 2021.

[16] J. R. Warnes-Lora, L. J. Quintero-Rodríguez, B. Tshibangu-Mbuebu, A. García-Juárez, and I. E. Zaldívar-Huerta, "Review of SDM/WDM technology and its application in data transmission," Depto. de Electrónica, InstitutoNacional de Astrofisica, Óptica y Electrónica, Calle Luis Enrique Erro No.1, Tonantzintla, Puebla 72840, México; Depto. de Investigación en Física, Universidad de Sonora, Blvd. Luis Encinas y Rosales S/N, Hermosillo, Sonora 83000, México, 2021.

[17]Liu, Xiang."Evolution of fiber-optic transmission and networking toward the 5G era."Iscience 22

[18]A. ArockiaBazil Raj et al., "A Review–Unguided Optical Communications: Developments, Technology Evolution, and Challenges," Electronics, vol. 12, no. 8, p. 1922, Apr. 2023.

[19]S. Kaur, P. Singh, V. Tripathi, and R. Kaur, "Recent trends in wireless and optical fiber communication," Volume 3, Issue 1, June 2022, Pages 343-348. IKG Punjab Technical University, Kapurthala, Punjab, 144601, India; Graphic Era Deemed to be University, Dehradun, Uttrakhand, 248001, India; Punjabi University, Patiala, Punjab, 147002, India

ISBN: 978-81-965236-7-1

IoT and Machine Learning based Crop Growth Analysis and Disease Detection in Greenhouse Environment

Sujitha S[1],Karthika R[2],Sruthi Rega K[3],Janani.S[4]
[1,2,3] UG Students,Department of Electronics and Communication Engineering,
[4]Associate Professor,Department of Electronics and Communication Engineering,
Periyar Maniammai Institute of Science and Technology , Vallam -613403, Thanjavur ,Tamilnadu , India.

ABSTRACT

This research paper presents an innovative approach combining Internet of Things (IoT) technology with machine learning (ML) algorithms for plant growth monitoring and disease detection in smart greenhouse environments. The proposed system utilizes IoT sensors to collect real-time data on environmental factors such as temperature, humidity, soil moisture, and light intensity, as well as plant physiological parameters. Machine learning models are then employed to analyze this data and detect anomalies indicative of plant stress or disease onset. By integrating ML-based disease detection algorithms with automated control systems, the smart greenhouse can promptly identify and respond to potential threats, thereby optimizing plant health and crop yield. There are various mathematical models for describing the growth of the plants by applying Reinforcement Learning (RL) approach for optimal growth control.*

Keywords:

- **Internet of Things(IoT)**
- **Machine Learning (ML)**
- **Smart Greenhouse**
- **Plant growth monitoring**
- **Disease detection**
- **Sustainable Agriculture**

1. INTRODUCTION:

In recent years, the agricultural industry has witnessed a significant transformation driven by advancements in technology, particularly the integration of Internet of Things (IoT) and machine learning (ML) techniques. One notable application of this convergence is the development of smart greenhouse systems, which offer unprecedented capabilities for monitoring and optimizing plant growth conditions. These systems leverage IoT sensors to gather real-time data on environmentalparameters such as temperature, humidity, soil moisture, and light intensity, providing growers with valuable insights into the conditions within the greenhouse. This research paper addresses this challenge by proposing an integrated approach that combines IoT technology with ML algorithms for plant growth monitoring and disease detection in smart greenhouse environments. Utilizing hydroponic systems as an alternative to traditional agriculture holds immense potential for addressing Egypt's burgeoning population growth. One of the primary obstacles encountered in protected agriculture involves maintaining optimal environment conditions within greenhouse structures. The traditional hydroponics agriculture systems are currently lacking significant advancements in networking technology, particularly in effectively controlling the various influencing factors within the greenhouse environment. Addressing these challenges requires continuous monitoring of essential growth parameters and real-time measurement of all relevant factors to ensure optimal conditions for plant growth and productivity. To overcome from these challenges a large set of datas were collected and regression model was created using machine learning algorithm. Here IoT automation is introduced by collecting various datas with the help of different sensors as PH sensor, EC sensor, water and air temperature sensor, light sensor, and GSM/ GPRS. Machine learning is the current technology which is benefiting farmers to minimize the losses in the farming by providing rich recommendations

ISBN: 978-81-965236-7-1

and insights about the crops. The data analyst challenge concerns the application of predictive algorithms and machine learning to analyze data collected from IoT devices. By leveraging this data, we can develop solutions to optimize farming practices, improve crop yields, and reduce resource usage. Essentially, it's about using advanced analytics to make farming more efficient and sustainable. In this IoT technologies the sensors must be maintained frequently since it get damaged in agricultural environment. The IoT enabling technologies applied for this development comprise of image processing tools, single-board microcontroller, temperature and humidity measuring sensor and a testing platform, those are helpful for collecting datas. In this review paper IoT and ML is used for monitoring plant growth and disease detection based on image processing through Supervised learning algorithm.

2. LITERATURE SURVEY AND RELATED WORKS:

Hydroponics is an innovative cultivation method which gives high quality, nutrient-rich, residue-free fruits and vegetables, promoting local, fresh and environmentally conscious agriculture. This will also has some merits and demerits. Muhammad Ikhsan Sani et al. [1] proposed the design of wireless sensor and actuator network. Here, the actuators such as mist makers and fans that can be managed by the control system which delivers water moister.

Srivani P, Yamuna Devi C et al. [2] proposed an automated system by the integration of IoT, Machine Learning , Artificial Intelligence, different cloud, data analytics methods, wireless sensor network and so on to created a prediction model. Pest control, recycling and energy conservation, water conservation and recycling, and power optimization are the issues focused in this study. Smart farming uses it to increase productivity for higher-quality crops while using less resources and reducing energy inputs. When analysing the plant growth, different environmental factors were taken into consideration. Georgios Georgiadis et al. [3] developed a system , within this agricultural setup, sensors collect diverse data, forwarding it to an IoT platform through data APIs, where machine learning aids in generating helpful recommendations for agronomists. Where sensors are used to measure the parameters and the required information are sent to IoT platform, which uses data API's for communication and exchange of data. Machine learning can be used which will provide recommendations to facilitate the workload of professional agronomists. However, the challenge arises when nodes need repositioning and sensor network reconfiguration due to corrosion, causing irregular moisture readings. By incorporating machine learning algorithms, the prediction of maximum yields becomes a streamlined and intelligent process [4,5]. Addressing challenges in traditional farming, a solution emerges through the fusion of hydroponic techniques and IoT technology, forming a smart control system. This system autonomously manages plant nutrition and water requirements[6,7].Sensors within the greenhouse assess climatic conditions, signalling the microcontroller and actuators to respond accordingly, ensuring a secure environment unaffected by external weather influences[8].Greenhouses provide a controlled environment for crops by shielding them from external weather conditions using materials like glass, fiber, or polythene. Sensors are deployed to monitor the climate inside the greenhouse, determining if conditions are optimal for harvesting. When the sensors detect suitable conditions, they send signals to a microcontroller, which in turn activates actuators to perform necessary actions, ensuring the crops are harvested at the right time for optimal yield and quality[9,10].Plant diseases primarily target plant leaves, affecting crop growth and quality. Early detection and identification of leaf diseases are crucial to mitigate economic losses.[11] An experiment was conducted to implement IoT infrastructure for this purpose. The setup includes a Raspberry Pi processor with quad-core 64-bit ARM architecture and a 1.2 GHz clock speed, along with a dual-core GPU for multimedia support. A webcam interface is attached to the Raspberry Pi for capturing leaf images, which are then compared with a database of compiled images. Disease detection employs image recognition techniques such as OpenCV. The Bhattacharyya Distance Calculation is utilized to measure similarity between probabilistic distributions, aiding in plant illness diagnosis. This technique helped for detecting the early plant diseases[12].

ISBN: 978-81-965236-7-1

Climate Control:

ML algorithms such as supervised learning are used for predicting optimal climate conditions based on historical data. IoT sensors are used to monitor temperature, humidity, and light levels. Control algorithms to adjust climate parameters in real-time.

Crop Monitoring:

Image recognition ML algorithms are used for plant health assessment. IoT cameras and sensors are used to capture and transmit data on plant growth and conditions.

Water Management:

ML models for predicting irrigation needs based on soil moisture, weather forecasts, and plant type. IoT-connected to collect data with the help of soil moisture sensors for real-time monitoring.

Energy Efficiency:

ML algorithms to optimize energy consumption based on usage patterns. IoT-connected devices for smart energy management.

Automated Pest Control:

ML algorithms used for identifying and predicting pest infestations. IoT sensors and actuators for automated pest control mechanisms.

Harvesting Optimization:

ML models for predicting the optimal time for harvesting. IoT-connected devices for monitoring crop readiness.

Popular ML algorithms include Decision Trees, Random Forests, Support Vector Machines, and Neural Networks.

Random Forest: Effective for classification tasks, Random Forest excels in handling diverse features and large datasets, making it suitable for disease detection.

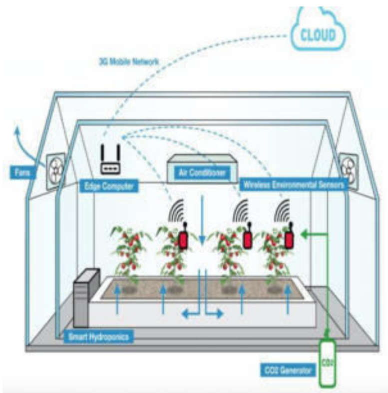
Support Vector Machines (SVM): SVM is effective in binary classification and can be applied to identify the presence or absence of diseases in crops

Neural Networks (Deep Learning): Particularly Convolutional Neural Networks (CNNs) are powerful for image-based tasks, such as detecting visual symptoms of diseases on leaves.

Decision Trees: Simple to interpret, decision trees are beneficial for crop growth analysis by mapping out decision pathways based on various input features.

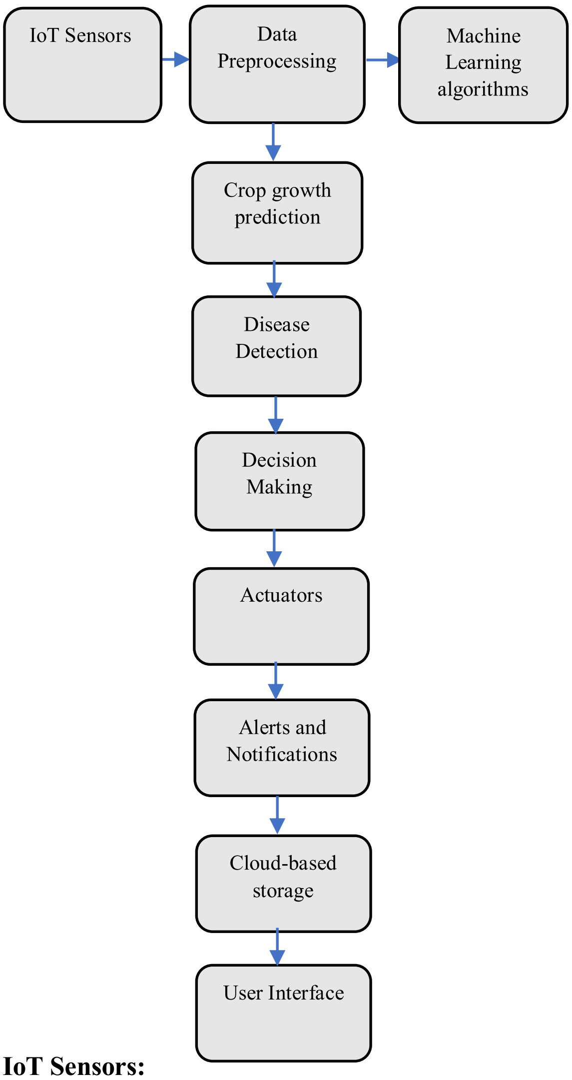
K-Nearest Neighbours (KNN):Suitable for both classification and regression, KNN can be employed for disease detection based on the similarity of features.

It is fascinating to see the application of supervised machine learning approaches like RF, SVM, DT, KNN, NB, and image processing methods for disease classification in plant leaves, specifically for tomatoes. The broad spectrum of factors affecting plants, from living agents like insects and pathogens to non-living elements such as environmental conditions, showcases the complexity of the classification task. This classification algorithm has also found success in a variety of fields, including medical image analysis and healthcare.



ISBN: 978-81-965236-7-1

3.BLOCK DIAGRAM:



IoT Sensors:

Temperature, humidity, soil moisture, light intensity, and other relevant environmental parameters are monitored using IoT sensors.

Sensor Data Transmission:

Sensor data is transmitted to a central processing unit through wireless or wired communication protocols.

Data Pre-processing:

Raw sensor data undergoes pre-processing to handle noise, outliers, or missing values.

Machine Learning Models:

ML models, including supervised learning for crop growth prediction and anomaly detection for disease identification, are employed.

Crop Growth Prediction:

ML models analyze historical sensor data to predict and optimize crop growth conditions, suggesting adjustments in factors like irrigation or temperature.

Disease Detection:

ML algorithms, trained on data related to plant diseases, analyze sensor data for patterns indicative of potential diseases.

Decision Making:ML-driven decision-making processes, determine whether the crop is in optimal condition for its healthy growth or if there are any signs of diseases.

Actuators:

Actuators, such as automated irrigation systems or disease treatment mechanisms, are activated based on ML-driven decisions.

Alerts and Notifications:

In case of anomalies or disease detection, the system generates alerts or notifications for farmers or relevant authorities.

Cloud-Based Storage:

Processed data and insights can be stored in the cloud for historical analysis and future decision-making.

User Interface:

A user interface allows farmers to monitor the status of their crops, receive alerts, and make informed decisions based on ML insights.

This integrated system enables precision agriculture, optimizing resource usage, promoting healthy crop growth, and providing timely detection of potential diseases for proactive management.

RF algorithm is found to be the best algorithm for the detection of plant disease and its accuracy level is 89 percentage.

CONCLUSION:

In conclusion, combining IoT and machine learning for crop growth analysis and disease detection in greenhouse environments holds great promise in crop production. The integration of sensors and data analytics enables real-time monitoring, leading to informed decision-making for optimal crop

ISBN: 978-81-965236-7-1

conditions. This innovative approach enhances productivity, minimizes resource wastage, and contributes to sustainable agriculture practices in the evolving field of precision farming.In this review paper, we found that the most effective algorithm for plant disease classification is RF algorithm high accuracy level and this outcome will have valuable implications for enhancing disease detection and management in agriculture.

REFERENCES:

[1] Muhammad Ikhsan Sani, Aris Pujud Kurniawan, Web- based monitoring and control system for aeroponics growing chamber, International Conference on Control, Electronics, Renewable Energy and Communications, 978-1-5090-0744-8/ 16/2016 (IEEE)

[2] Srivani P, Yamuna Devi C, A controlled environment agriculture with hydroponics: variants, parameters, methodologies and challenges for smart farming, Fifteenth International Conference on Information Processing, 978-1-7281-3807-7/2019 IEEE.

[3] Georgios Georgiadis, Andreas Komninos, Andreas Koskeris, John Garofalakis, Implementing an Integrated IoT for Hydroponic Agriculture, Springer Nature Switzerland AG, 2021, https://doi.org/10.1007/978-3-030-67197-6_5. Data Science and Internet of Things

[4]486 Manav Mehra, Sameer Saxena, Sankaranarayanan Suresh, IoT based hydroponics system using Deep Neural Networks, 2018, Comput. Electron. Agric. October 2018) 473 (Elsevier).

[5]M Srinidhi H K, Shreenidhi H S, Smart Hydroponics system integrating with IoT and Machine learning algorithm, International Conference on Recent Trends on Electronics, Information, Communication &Technology, 978-1-7281-9772-2/2020 IEEE | DOI: 10.1109/RTEICT49044.2020.9315549.

[6]Nico Surantha Herman, Intelligent monitoring and controlling system for hydroponics precision agriculture, in: 7th International Conference on Informationand Communication Technology, IEEE, 2019, 978-1- 5386-8052-0.

[7]Konstantinos Tatas, et al., Reliable IoT-based monitoring and control of hydroponic systems, Technologies 10 1 (2022) 26

[8] R.Vidhya, DrK.Valarmathi, Survey on automatic monitoring of hydroponics farms using IoT, International Conference on Communication and Electronics Systems, 978-1-5386-4765-3/18/2018 IEEE.

[9]Georgios Georgiadis, Andreas Komninos, Andreas Koskeris, John Garofalakis, Implementing an Integrated IoT for Hydroponic Agriculture, Springer Nature Switzerland AG, 2021, https://doi.org/10.1007/978-3-030-67197-6_5. Data Science and Internet of Things

[10]Tholib Hariono, Mukhamad Cahyono Putra, Data acquisition for monitoring IoT-based hydroponic automation system using ESP8266, Newton: Netw. Inform. Technol. 1 (1) (2021) 1–7.

[11] Ferentinos K 2018 Deep learning models for plant disease detection and diagnosis Comput. Electron. Agric. 311–8.

[12] Bashish D A, Braik M and Bani-Ahmad S 2011 Detection and classification of leaf diseases using k-means-based segmentation and neural-networks-based classification Information Technology Journal 10 267–75

ISBN: 978-81-965236-7-1

An IoT Based Household Waste Management SystemUsing LoRaWAN and Blockchain Technology

Ms. Faheema.M.B[1], Ms. Kiruthika.G[2], Ms. Udhaya.M[3], Dr.S.Janani[4]

[1,2,3]U.G Student, Department of ECE, Periyar Maniammai Institute of Science and Technology, Vallam.

[4]Associate Professor, Department of ECE, Periyar Maniammai Institute of Science and Technology, Vallam.

Abstract – **An IoT based household waste management system for a clean and smart society is aimed to manage the waste from each and every house of the society more efficiently. To implement the IoT based waste management system we need high data availability which is provided by the Low-Power Wide-Area Network (LPWAN) and blockchain technologies. This paper discusses the collection and decomposition of waste in a smart way using IoT. This paper focuses on the segregation of the waste at two levels where the first level of segregation is on the individual house of the society and the second level of segregation is at the society. This paper implements a solution for a high data availability based on Low Power Wide Area Network (LPWAN) and Blockchain technologies to provide the required data needed for the IoT waste management system. The final result that we can observe by following these methods is a clean and smart society.**

Keywords-Internet of Things, Waste Management system, LoRaWAN, Block chain Technology.

I. INTRODUCTION

A smart city is developed with the help of innovative technologies with sensor networks, cameras, wireless devices, fast network like 5G, IT infrastructure and data centers to efficiently offer necessary services like electricity, water supply, transportation, sanitation, recycling, etc. A city has markets, institutions, offices, and various small and large scale homes. We cannot build a smart city without making a smart waste management system. Waste management is considered as a vital part of city management. Commercial and household activities produce organic and inorganic waste materials [1]. A large amount of waste is produced by the household activities. Dustbin is the only way to collect them and wait for the municipal corporations to take them for disposal. These dustbins are placed in public places and in front of households in the city. Due to the day by day rapid increase of waste these bins are overfilled most of the time. Improper waste management can make a serious health risk and lead to the spread of infectious diseases. This pollutes the surrounding environment [2]. The various biodegradable waste combinations can produce poisonous gases like methane if the dustbin is not disposed for many days. The biodegradable and non-biodegradable waste separation and waste management becomes the main problem with rapidly increasing population in the urban areas. For this we need a system that can provide an earlier intimation to the concern authority about the filling of the dustbin.

For that IoT based smart dustbin is an effective and helpful tool in the waste management. It is a highly innovative system which will help us to keep the cities clean in a smart and effective way. The basic idea in this paper is to design a smart trash detection system which would automatically notify the officials about the current status of various dustbins in the city. A message or mail is send to the user and the message will highlight the level of garbage collected in the cities. To achieve this we are using Internet of Things (IoT). IoT is a network of devices that contain sensors which allows things to connect and exchange data. It has a large role to play in future of smart cities which in turn are supposed to be environment friendly. With IoT in place, it will become easier for municipal bodies to monitor the whole waste management process in the cities.It gives real time indication of the trash level in the bin at any given time. Using that data we can optimize waste collection routes. By this trash collection system o the waste management in a city will become more systematic and yield better results. In order to use the IoT technology for the smart bins all over the city we need a high availability of data. For that we are using the LoRaWAN technology combined with Blockchain technology for the transfer of data all over the city. This is initiated to focus on providing a maximum amount of data sent by the sensors. With the use of these technologies we can have a highly effective data transfer system for our waste management system. It provides a distributed authentication process based on blockchain and provides a highly available IoT platform.

II. Related Works

In the last two decades there is a rapid growth in urbanization, industrialization and population in India. It is leading to the problem of waste management. The World Bank reports and municipal corporations spend 20 to 50 percent of the total available budget on maintaining the management of the solid waste. A review of some common waste management models is discussed in references [3] [4]. The author [5] proposed a document called ISWM plan. It includes baseline information, proposed targets, management system responses, concern issues, strategy for implementation and monitoring [5]. Reference [6] developed an electronic monitoring system using GSM. It sends SMS to the supervisor if the dustbin is completely filled so that the system can send the truck for the collection of trash. The author had used the ultrasonic sensor for sensing the level up to which the trash is filled in the bin. GSM module was used for messaging purpose which gives information about the status of the bin whether it is filled or cleaned. A similar method was proposed in [7] for the collection of waste with the help of Arduino UNO board interfaced with GSM module and ultrasonic sensor. The author concluded the paper with the issues of smart dustbin like maintenance, affordability, and durability. An intelligent wastebin was proposed by [8] in 2017 based on the IoT prototype. We can see from recent papers [9] [10] [11] that the large urban areas in the world will show an increasing effort to make use of natural and economic resources in a more optimized way with the help of smart systems. However, unlike previous works, this research proposes a highly available system for the communication of sensors used in waste management system over long distances with the help of LoRaWAN and blockchain technology. It ensures communication in a more scalable and safer way for use by the competent authorities and companies.

III. Overview of IoT, LoRaWAN and Blockchain

A. Internet of Things

The Internet of Things (IoT) refers to a network of physical devices, vehicles, appliances and other physical objects that are embedded with sensors, software and network connectivity that allows them to collect and share data. These devices can range from simple smart home devices like smart thermostats, to wearables like smart watches and RFID-enabled clothing, to complex industrial machinery and transportation systems. These devices are also known as smart objects. IoT enables these smart devices to communicate with each other and with other internet enabled devices, like smartphones and gateways. It creates a vast network of interconnected devices that can exchange data and perform a variety of tasks autonomously. This can include everything from monitoring environmental conditions in farms, to managing traffic patterns with smart cars and other smart automotive devices, to controlling machines and processes in factories, to tracking inventory and shipments in warehouses. The potential applications of IoT are vast and varied, and its impact is already being felt across a wide range of industries, including manufacturing, transportation, healthcare and agriculture. In an enterprise context, IoT devices are used to monitor a wide range of parameters such as temperature, humidity, air quality, energy consumption and machine performance. This data can be analyzed in real time to identify patterns, trends and anomalies that can help businesses optimize their operations and improve their bottom line.

B. LoRaWAN

Low-power wide area networks (LPWANs) are a group of wireless communication technologies that use low-power transmitters. They are designed for connecting wireless IoT technology over long distances, linking sensors to a central operating system. Several different types of LPWAN (Low-power wide area network) technology are available, including Sigfox, LoRaWAN.

The LoRaWAN protocol is a Low Power Wide Area Networking (LPWAN) communication protocol that functions on LoRa. It wirelessly connects devices to the internet and manages communication between end-node devices and network gateways. It provides an affordable long-range, bi-directional communication protocol with very low power consumption. It helps to achieve the key Internet of Things (IoT) requirements such as bi-directional communication, end-to-end security, mobility and localization services. It uses many technologies to achieve this, including spread spectrum modulation and narrowband width digital transmission.

ISBN: 978-81-965236-7-1

LoRaWAN networks are deployed in a star-of-stars topology. A typical LoRaWAN network consists of end devices, gateways, network server, application servers and join server.

*1) **End devices**:*A LoRaWAN end device can be a sensor, an actuator, or both. They are often battery operated. These end devices are wirelessly connected to the LoRaWAN network through gateways using LoRa RF modulation.

*2) **Gateways**:*A gateway receives LoRa messages from end devices and simply forwards them to the LoRaWAN network server. Each gateway is registered to a LoRaWAN network server. Gateways are connected to the Network Server using a backhaul like Cellular (3G/4G/5G), WiFi, Ethernet, fiber-optic or 2.4 GHz radio links.

*3) **Network server**:*The Network Server manages gateways, end-devices, applications, and users in the entire LoRaWAN network. It performs functions such as establishing secure 128-bit AES connections for the transport of messages between end-devices and the Application Server (end-to-end security), validating the authenticity of end devices and integrity of messages, deduplicating uplink messages, selecting the best gateway for routing downlink messages, sending ADR commands to optimize the data rate of devices, device address checking and providing acknowledgements of confirmed uplink data messages.

*4) **Application server**:* The Application Server processes the application specific data messages received from end devices. It also generates all the application layer downlink payloads and sends them to the connected end devices through the Network Server.

*5) **Join server**:*The Join Server assists in secure device activation, root key storage, and session key generation. The join procedure is initiated by the end device by sending the Join request message to the Join Server through the Network Server. The Join-server processes the Join-request message, generates session keys, and transfers NwkSKey and AppSKey to the Network server and the Application server respectively.

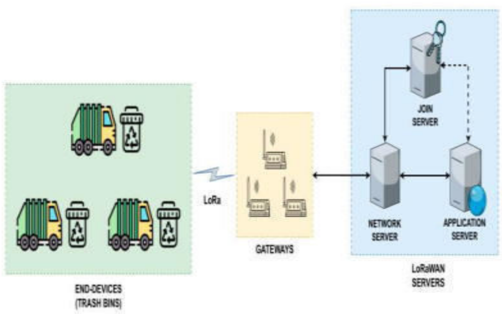


Fig 1: Architecture of LoRaWAN [16]

C. Blockchain

The blockchain is a decentralized, distributed and public digital ledger that is used to record transactions across many computers. It maintains a continuously growing list of ordered records. These records are called as blocks. These blocks are linked using cryptography. Each block contains a cryptographic hash of the previous block, a timestamp, and transaction data. With the help of blockchain the need for a third party to intermediate a transaction between two participating entities can be eliminated. This is due to its decentralized design and the strong cryptographic primitives it is based on. In the blockchain technology the participants use a consensus algorithm to verify each transaction registered in the system. This makes the public ledger tamper proof. The blockchain provides audibility to the systems as the information added to the blockchain can never be altered or erased [12]. There are two types of block chains. They are public and permissioned blockchain [12]. They both differ from each other in terms of performance, consensus algorithm, and read permission. In public blockchains, the larger number of participating nodes and validations results in decreased throughput and increased latency [13]. In this type any node in the world can make part of the consensus process and all transactions are visible to the public. In permissioned blockchains, the smaller number of validations and the limited number of nodes participating in the consensus process results in faster transactions. Only authenticated nodes can participate in the consensus process of permissioned blockchains and only the organization responsible for maintaining the blockchain network can decide whether the transactions should be restricted or made visible to the public.

IV. PROPOSED ARCHITECTURE

A. Proposed Architecture for Household Waste Management Using IoT:

To achieve a clean and smart society we should implement the technologies available in the management of waste. Household waste management can be done in a smart way with the help of Internet of things (IoT). Smart bins are

ISBN: 978-81-965236-7-1

made with the help of IoT .These bins are used to collect the household wastes from all over the city. These smart bins contain features like automatic opening and closing of the lid when a person goes near the dustbin, detection of poisonous gases and detection of the level up to which the dustbin is filled. Once the dustbin is filled it will send intimation to its supervisor. Then we have to perform two levels of segregation, the level 1 and level 2 segregation. The level 1 segregation segregates the waste collected from the houses into biodegradable and non-biodegradable waste. The level 2 segregation further segregates the non-biodegradable waste and disposes the biodegradable waste.

1) Level 1 Segregation: The steps to achieve level 1 segregation are as follows,

i. The lid of the dustbin is opened automatically when the user goes near the dustbin.

ii. There are two compartments in the bin. One for biodegradable waste and the other one for non-biodegradable waste. Two buttons are provided, a green button and a red button. Green button should be pressed for and Red button should be pressed for Non-biodegradable waste.

iii. Rotation of the compartments takes place in the bin based on which button is pressed. For example if green button is pressed then rotation of the compartments takes place and the biodegradable waste compartment is shown to the user.

iv. Intimation is given to the facility supervisor when the dustbin is filled to the predefined level.

v. Alert message is given to the facility supervisor when any poisonous gas is found.

*2) Level 2 Segregation:*The steps to achieve level 2 segregation are as follows,

i. The biodegradable waste from level 1 segregation is collected by the municipal corporation for making compost.

ii. The non-biodegradable waste from the level 1 segregation which has different types of non-biodegradable waste is spread on the conveyer belt for the level two segregation.

iii. The Inductive proximity sensor on the conveyer belt performs the segregation of Metal waste. It senses the metal moves it to the metal collecting box.

iv. The capacitance proximity sensor on the conveyer belt performs the segregation of plastic and wooden waste. It senses them and moves them to the plastic and the wooden collecting box.

v. When these segregated non-biodegradable wastes reach the threshold level then an alert message is sent to the municipal corporation for its collection.

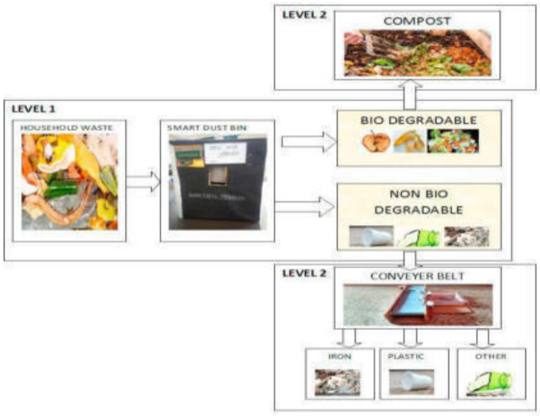


Fig 2: Architecture for Household Waste Management [17]

B. Proposed Architecture for Increased Data Availability Using LoRaWAN and Blockchain

Our LoRaWAN technology has one serious constraint. It has to be rectified in order to promote a highly available IoT Platform for our waste management system. In the LoRaWAN the Join Server is seen as the constraint. The Join Server is considered as a point of failure from the security point of view. This is due to the centralized design of LoRaWAN and the fact that the Join Server is responsible for handling most of the security tasks. It handles security tasks such as the Over the Air Activation (OTAA) procedure and storing copies of all encryption keys. Always a security handshake is performed between an end-device and Join server. Join-Request and Join Accept messages are exchanged during the procedure. These are used to derive new session keys. The new session keys will be used to secure all communications between the end-device and the LoRaWAN servers once the OTAA is completed. Thus for the attackers the join server becomes as an important target. In order to handle this problem we have to modify the LoRaWAN architecture. We have to replace the Join Server with a permissioned blockchain infrastructure. For this new architecture, a smart contract is responsible for performing authentication and key management activities.

By using only open-source tools and commodity hardware a working prototype was

ISBN: 978-81-965236-7-1

created as a Proof-of-Concept (PoC). Here, LoPy boards are used as class A end devices and 1-channel LoRaWAN gateways. Each LoPy board has an Espressif ESP32 chipset and a Semtech LoRa transceiver SX1276. The LoRaWAN servers are created by using the open source implementations from the ChirpStack project [14]. The permissioned blockchain environment is created using Hyperledger Fabric (v2.0). Golang is chosen as the programming language to implement the chain code. It is chosen due to its high performance when compared to other languages [15]. Docker images are provided by Hyperledger Fabric to deploy different types of nodes for example, peers and orderers. The NS implementation from ChirpStack is modified. It is done to invoke the chain code deployed in the permissioned blockchain.

The main advantages of this proposal are as follows:

*a) **Fault-tolerance:*** Increased data availability and a distributed storage are provided by multiple peers from the permissioned blockchain. Thus prevents the single point of failure issue.

*b) **No need for firmware updates**:* All the modifications are done only to the Network Server. Therefore there is no need to make any changes in the LoRaWAN protocol. All changes occur transparently to the end-devices. Thus there is no need for firmware updates to end devices deployed on a network.

c) No transaction fees: No additional costs are required in regards to cryptocurrency as the permissioned blockchain is not meant for creating currency.

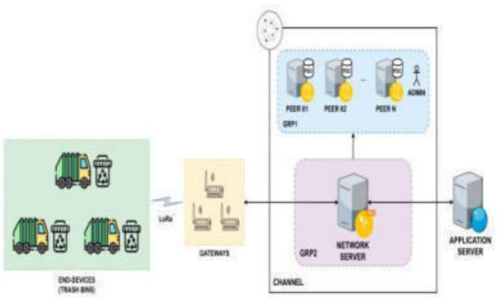


Fig 3:Architecture for Increased Data Availability Using LoRaWAN and Blockchain [16]

V. Conclusion

This article presented a smart household waste management system by implementing Internet of things in the smart dustbin, LoRaWAN and Blockchain technology for increasing the data availability for the waste management system. IoT helped in making the smart bins using various sensors and creating a connection with the internet. The LoRaWAN technology helped in forming the network architecture for smart bins with a low power and long-range data transmission property. This LoRaWAN architecture had the join server as its single point of failure as it can be a target for attackers. To rectify this problem, the join server in the LoRaWAN architecture was replaced by the permissioned blockchain infrastructure. By this all the authentication requests are stored in the permissioned blockchain and can be verified securely. To conclude, in our review, we consider this method as the best method so far in creating a smart household waste management system to make a clean and smart city.

VI. References

[1] Agarwal, Raveesh, Mona Chaudhary, and Jayveer Singh. (2015)"Waste Management Initiatives in India for human wellbeing." European Scientific Journal11 (10):106-127.

[2] Gutberlet, Jutta, and Sayed Mohammad Nazim Uddin. (2017)"Household waste and health risks affecting waste pickers and the environmentin low- and middle-income countries." International Journal of Occupational and Environmental Health 23(4): 299-310.

[3] Abdullah, Nibras, Ola A. Alwesabi, and Rosni Abdullah.(2018)"IoT-Based Smart Waste Management System in a Smart City." InternationalConference of Reliable Information and Communication Technology. Springer, Cham.843:364-371

[4] Talari, Saber, et al.(2017) "A review of smart cities based on the internet of things concept." Energies10(4): 1-23.

[5] Memon, Mushtaq Ahmed.(2010)"Integrated solid waste management based on the 3R approach."Journal of Material Cycles and Waste Management 12(1): 30-40.

[6] Anwar, MdAasim.(2018) "IOT BASED GARBAGE MONITORING USING ARDUINO. "Diss. West Bengal University of Technology.

[7] Monika, K. A., et al.(2016)"Smart dustbin-an efficient garbage monitoring system." International Journal of engineering science andcomputing 6(6): 7113-7116.

[8] Shyam, GopalKirshna, Sunilkumar S. Manvi, and PriyankaBharti.(2017)"Smart waste management using Internet-of-Things (IoT)." 2nd International Conference on Computing and Communications Technologies IEEE :199-203.

[9] Lin, Jun; Shen, Zhiqi; Zhang, Anting; Chai, Yueting. (2018) Blockchain and IoT based Food Traceability for Smart Agriculture PROCEEDINGS OF THE 3RD INTERNATIONAL CONFERENCE ON CROWD SCIENCE AND ENGINEERING (ICCSE 2018) v.

[10] Shabandri, Bilal; Maheshwari, Piyush. (2019) Enhancing IoT Security and Privacy using Distributed Ledgers with IOTA and The Tangle 2019 6TH INTERNATIONAL CONFERENCE ON SIGNAL PROCESSING AND INTEGRATED NETWORKS (SPIN) v.

[11] AdefemiAlimi, Kuburat Oyeranti; Ouahada, Khmaies; Abu-Mahfouz, Adnan M.; Rimer, Suvendi. (2020) A Survey on the Security of Low Power Wide Area Networks: Threats, Challenges, and Potential Solutions SENSORS v. 20

[12] Zheng, Z., Xie, S., Dai, H.-N., et al. “Blockchain challenges and opportunities: A survey”, International Journal of Web and Grid Services, v. 14, pp. 352, 10 2018.

[13] Bragnolo, S., Marra, M., Polito, G., et al. “Towards scalable blockchain analysis”. In: 2019 IEEE/ACM 2nd International Workshop on Emerg-ing Trends in Software Engineering for Blockchain (WETSEB), pp. 1–7. IEEE, 2019.

[14] Chirpstack open-source lorawan® network server. https://www.chirpstack.io/. (Accessed on 16/09/2022)

[15] Luca Foschini, Andrea Gavagna, Giuseppe Martuscelli, and Rebecca Montanari. Hyperledger fabric blockchain: Chaincode performance analysis. In ICC 2020-2020 IEEE International Conference on Communications (ICC), pages 1–6. IEEE, 2020

[16] Raimir Holanda Filhoa, Debora Carla Barbozade Sousaa, Wellington Alves de Britoa,
Joan Lucas Marques de Sousa Chavesa, Emanuel Le˜aoS´aa, Victor Pasknel de AlencarRibeirob - “Increasing Data Availability for Solid Waste Collection Using anIoT Platform based on LoRaWAN and Blockchain”

[17] SonaliDubey, Pushpa Singh, PiyushYadav, and Krishna Kant Singh –“Household Waste Management System Using IoT and Machine Learning”

ISBN: 978-81-965236-7-1

PLANT LEAF DISEASE DETECTION USING MULTI CLASS SVM

SuriyaD[1] ,M.Parvathy[2],S.Asha[3]
Assistant Professor[1],Prof & Head[2],AssistantProfessor[3]
Department of Computer Science and Engineering,
Sethu Institute of Technology

Abstract— **In India, the country where the main source of income is from agriculture. Farmers grow a variety of crops based on their requirement. Since the plants suffer from the disease, the production of crop decreases due to infections caused by several types of diseases on its leaf, fruit, and stem. Leaf diseases are mainly caused by bacteria, fungi, virus etc. Diseases are often difficult to control. Diagnosis of the disease should be done accurately and proper actions should be taken at the appropriate time. Image Processing is the trending technique in detection and classification of plant leaf disease. This work describes how to automatically detect leaf diseases. The given system will provide a fast, spontaneous, precise and very economical method in detecting and classifying leaf diseases.This paper is envisioned to assist in the detecting and classifying leaf diseases using Multiclass SVM cascaded classification technique. First, the affected region is discovered using segmentation by K-means clustering, then features(color and texture) are extracted. Lastly, classification technique is applied in detecting the type of leaf disease. The proposed system effectively detects and also classify the disease.**

Keywords—**Multicast SVM, Radial Basis Function Neural Network (RBFNN)**

1. INTRODUCTION

India is a fast-developing country and agriculture is the back bone for the country's development in its early stage. However, agricultural field faces lots of hurdles including huge loss in the crop production. However, disease prediction using classification algorithms appears to be a difficult task as the accuracy varies for different input data. In this paper, several research contributions related to various plant leaf diseases detection using different classification algorithms are reviewed and compared. The existing method encompasses human involvement for classification and identification of diseases. This procedure is time-consuming and costly. Automatic segmentation of disease from plant leaf images using soft computing approach can be reasonably useful than the existing one. System named as Bacterial foraging optimization based Radial Basis Function Neural Network (BRBFNN) for identification and classification of plant leaf diseases automatically. For assigning optimal weight toRadial Basis Function Neural Network (RBFNN) we use Bacterial foraging optimization (BFO) that further increases the speed and accuracy of the network to identify and classify the regions infected of different diseases on the plant leaves. The proposed method attains higher accuracy in identification and classification of diseases. Computers have evolved to be a vital device in a number of applications like defense, medical, agriculture, engineering etc. with its ability to process multimedia information like images captured from some computing devices. An image contains important information that can be retrieved by using some computational method. Image segmentation is a task for partitioning an image into smaller parts that are more meaningful. Interestingly, it can be stated as identification and classification of some region of interest. The segmentation is performed based on some common properties of the objects present in an image like color, texture and, shape etc. Image segmentation is a preprocessing step for image processing generally performed by using two methods (i) Traditional method and (ii) Soft computing method.

LITERATURE REVIEW

In [1] Sherly Puspha Annabel et al.,In this system, Plants are considered to be important as they are the source of energy supply to mankind. Plant diseases can affect the leaf any time between sowing and harvesting which leads to huge loss on the production of crop and economical value of market.Therefore, leaf disease detection plays a vital role in agricultural field. However, it requires huge manpower, more processing time and extensive knowledge about plant diseases. Hence, machine learning is applied to detect diseases in plant leaves as it analyses the data from different aspects, and classifies it into one of the predefined set of classes. The morphological features and properties like color, intensity and dimensions of the plant leaves are taken into consideration for classification. This paper presents an overview on various types of plant diseases and different classification techniques in machine learning that are used for identifying diseases in different plant leaves.

In [2]Rajini kanthetal.,In this system,In ophthalmology, substantial advancement can be found in assessment and

ISBN: 978-81-965236-7-1

evaluation of the abnormality in retinal anatomical structures, such as optic nerve, disc, and vasculature. Most of the retinal abnormality assessments can be done using the imaging procedures, in which the retinal parts are recorded using a dedicated imaging device called the Fundus Camera (FC) and these images are called the Fundus Camera Images (FCI). In this work, FCI assessment procedure is proposed using the Spider Monkey Optimization Algorithm. The SMOA-assisted Shannon’s Entropy thresholding is initially executed to enhance the retinal sections of FCI. Then an Active Contour segmentation procedure is implemented to extract the optic disc/optic cup. Finally, a relative investigation between the extracted opticdisc/opticcup and the expert provided disc/cup section is carried out to compute the Image Similarity Parameters (ISP). In this work, the benchmark FCI dataset, called the Rim-One is adopted for the investigation. During this study, Rim-One FCI dataset with the optic disc and stereo image (dual image) are considered for the examination. The performance of the SMOA is then assessed with other heuristic approaches, such as Particle Swarm Optimization, Bacterial Foraging Optimization, and Firefly Algorithm approaches. The experimental investigation confirms that all these heuristic approaches offer approximately a similar result on the considered Rim-One FCI dataset.

In [3]SKumbhar et al.,In this system, Agriculture is one of the important professions in many countries including India. As most part of the Indian financial system is dependent on agriculture production, the keen attention to the concern of food production is necessary. The taxonomy and identification of crop infection got much importance in technical as well as economic in the Agricultural Industry. While keeping track of diseases in plants with the help of specialists can be very costly in agriculture region. There is a need for a system which can automatically detect the diseases as it can bring revolution in monitoring large fields of crop and then plant leaves can be taken cure as soon as possible after detection of disease. The aim of the proposed system is to develop an application which recognizes cotton leaf diseases. For availing this user need to upload the image and then with the help of image processing we can get a digitized color image of a diseased leaf and then we can proceed with applying CNN to predict cotton leaf disease.

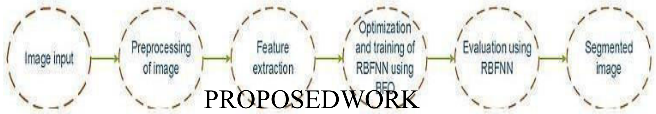
In [4]Gittaly et al.,In this system,The natural products are inexpensive, non-toxic, and have fewer side effects. Thus,their demand especially herbs based medical products, health products, nutritional supplements, cosmetics etc. are increasing. The quality of leafs defines the degree of excellence or a state of being free from defects, deficits, and substantial variations. Also, the diseases in leafs possess threats to the economic, and production status in the agricultural industry worldwide. The identification of disease in leafs using digital image processing, decreases the dependency on the farmers for the protection of agricultural products.So,the leaf disease detection and classification is the motivation of the proposed work. In this paper, a novel fuzzy set extended form neutrosophic logic based segmentation technique is used to evaluate the region of interest. The segmented neutrosophic image is distinguished by three membership elements: true, false and intermediate region. Based on segmented regions, new feature subset using texture, color, histogram and diseases sequence region are evaluated to identify leaf as diseased or healthy.Also,9different classifiers are used to monitor and demonstrate the discrimination power of combined feature effectiveness,where random forest dominates the other techniques. The proposed system is validated with 400 cases (200 healthy, 200 diseased). The proposed technique could be used as an effective tool for disease identification in leafs. A new feature set is promising and 98.4% classification accuracy is achieved.

In[5]Mohammadetal.,In this system,Continuous droughts and water scarcity have led to the need for optimal exploitation of dams’ reservoirs. Thus, the new meta-heuristic algorithm, spider monkey, is suggested for complex modelling of the multi-reservoir system in Iran with the aim of decreasing irrigation deficiencies. Golestan and Voshmgir dams’ operations are optimized with the spider monkey algorithm. The algorithm based on the exchange of information between local and global leaders with the other monkeys which improves the convergence speed. Average deficiencies for Golestan dam is computed as 2.1 and 1.9 MCM by spider monkey algorithm while it is respectively computed as 6.7, 16.4, 11.1, 4.1, 14.6, 19 MCM by particle swarm algorithm, harmony search algorithm, imperialist competitive algorithm, water cycle algorithm, genetic algorithm, and standards operation policy method. Also, the computation time of the spider monkey algorithm is 50 and 47s for the Golestan and Voshmgir dams while the genetic algorithm optimizes the problem in 172.6 sand 112 sand the particle swarm algorithm needs 117.4 s and 100 s for the Golestan and Voshmgir, respectively. Also, root means square error and mean absolute error between demand and released water for the spider monkey algorithm has the least values among the applied evolutionary algorithms. Thus, the spider monkey algorithm is suggested as an appropriate method for optimizing the operation policy for the dam and reservoir systems.

2. PROBLEM STATEMENT

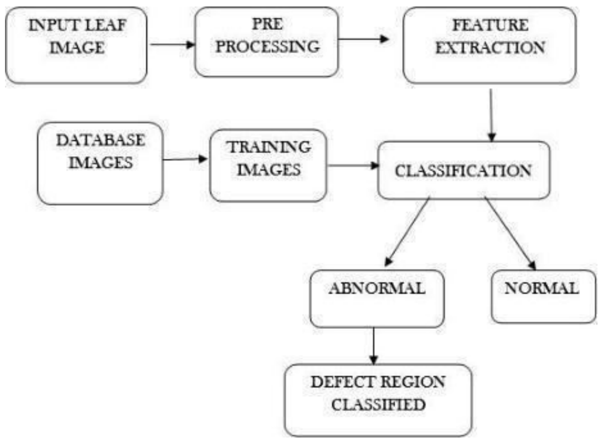
In this work identification and classification of plant leaf disease is performed by using Bacterial foraging optimization based Radial Basis Function Neural Network (BRBFNN). The feature extraction process is carried out by seeding and grouping the points having similarity in some manner using region growing approach the training of the RBFNN is performed by using bacterial foraging optimization that proofs to be an efficient and powerful tool for initializing the weight of RBFNN and training the network that can correctly identify different affected regions on plan tleaf image. With the help of BFO, the existing algorithm achieves higher convergence ratio and accuracy. The methodology of the existing work is given by Fig. 1

ISBN: 978-81-965236-7-1



PROPOSEDWORK

In this section, we first propose an algorithm to select the optimal features, respectively, for each application. Then, we build the binary sub-classifiers respectively for those applications by using those selected features.Finally,based on Theorem 1 and Lemma 1, we present an algorithm for making an optimal cascade of those sub-classifiers. Our main objective here is to improve classification accuracy by addressing the issues of both discriminator bias and class imbalance in traffic classification



MODULE DESIGN

Database

The image database has been widely used to test neural-network-based leaf-detection systems in complex backgrounds. The database consists of three sets of gray-level images. These images are scanned photographs, newspaper pictures; files collected from the World Wide Web, and digitized television shots. The first two sets contain 169 leaves in 42 images and 183 plants in 65 images respectively.

Pre-process

Rgb2grayconvertsRGB images to grayscale by eliminating the hue and saturation information while retaining the luminance new map = **rgb2gray**(map) returns a gray scale color map equivalent to map . Class Support. If the input is an RGB image, it can be of class uint8 , uint16 , or double .

Image Segmentation

During image segmentation, the given image is separated into a homogeneous region based on certain features. Larger data sets are put together into clusters of smaller and similar data sets using clustering method. In this proposed work, K-means clustering algorithm is used in segmenting the given image into three sets as a cluster that contains the diseased part of the leaf. Since we have to consider all of the colors for segmentation, intensities are kept aside for a while and only color information is taken into consideration. The RGB image is transformed into LAB form (L-luminous, a*b-chromous).Of the three dimensional LAB, only last two are considered and stored as AB. As the image is converted from RGB to LAB, only the "a" component i.e. the color component is extracted.Properties and process of K-Means Algorithm are as follows:

Properties

i .K number of the cluste rshould be present always.

ii In each given cluster,atleast one item should be present.

iii Overlapping of clusters should never happen.

iv Every participant of the single cluster should be close toits own cluster than any other cluster

Process

1. The given data set should be divided into K number of clusters and data points need to be assigned to each of these clusters randomly.
2. For each data point, the distance from data point to each cluster is computed using Euclidean distance The Euclidean distance is nothing but the distance between two-pixel points and is given as follows: Euclidean Distance=$\sqrt{((x1-x2)^2 + (y1-y2)^2)}$ where (x1, y1) & (x2, y2) are two pixel points (or two data points).
3. The data point which is nearer to the cluster to which it belongs to should be left as it is.
4. The data point which is not close to the cluster to which it belongs to should be then shifted to the nearby cluster.
5. Repeat all the above steps for entire data points.
6. Once the clusters are constant, clustering process needs to be stopped.

Feature Extraction

From the input images, the features are to be extracted. To do so instead of choosing the whole set of pixels we can choose only which are necessary and sufficient to describe the whole of the segment. The segmented image is first selected by manual interference. The affected area of the image can be found from calculating the area connecting the components. First, the connected components with 6 neighborhood pixels are found. Later the basic region properties of the input binary image are found. The interest here is only with the area. The affected area is found out. The percent area covered in this segment says about the quality of the result. The histogram of an entity or image provides information about the frequency of occurrence of certain value in the whole of the data/image.It is an important tool for frequency analysis. The co- occurrence takes this analysis to next level wherein the intensity occurrences of two pixels together are noted in the matrix, making the co-occurrence a tremendous tool for analysis. From gray-co-matrix, the features such as Contrast, Correlation, Energy, Homogeneity' are extracted. The following table lists the formulas of the features

ISBN: 978-81-965236-7-1

Featureselection

We use feature selection to optimize classification accuracy of each sub-classifier. Algorithm 1 details the process of feature selection. Algorithm is performed on the training dataset Ds that contains two kinds of classes. The samples of the given application are attributed to one class. The rest samples are attributed to the other class. We propose a wrapper method to select the optimal features for a given application. Specifically, the algorithm selects the features that make C4.5 decision tree bin tree achieve the highest AUC value for the given application. We apply backward search method in building feature subset feature subset of the feature set original set, and then train the binary classifier bin tree with feature subset. If feature subset makes bin tree achieve the higher AUC value, the features in feature subset are inserted into final feature. It is worth noting that we call weka library to calculate AUC value. If the times for searching features is larger thanthe given threshold value maxtimes, the algorithm returns final feature as the final feature subset Using the statistical MATLAB commands the other properties are foundout. Those are Mean Standard Deviation, Entropy, RMS, Variance, Smoothness, Kurtosis, Skewness, and IDM. Mean: Averageor meanvalue of the array.Mean is given by $\text{Mean}=\left(\frac{1}{N}\right) Xi$

WhereXi->pixelintensity,N->a total number of pixels of an image.

Standard Deviation:Standard deviation is computed using the below formula:

$$\text{Standard Deviation}= (1/N)\, \boldsymbol{\Sigma}\, (Xi - \mu)\ ½$$

Whereμ-> mean.

Entropy:Entropy is a statistical measure of randomness that is used to characterize the texture of the input image. Entropy is defined as

$$\text{Entropy} = \text{-sum (p.*log2 (p))}$$

Wherep->histogram counts

Variance:Variance is computedusing

$$\text{Variance}= (1/N)\, \boldsymbol{\Sigma}\, (Xi - \mu)^2$$

Variability is measured using variance. Skewness:The image surface is judged with the Skewness

$$\text{Skewness} = \frac{\frac{1}{N}\sum_{i=1}^{N}(x_i - x')^3}{\left(\frac{1}{N}\sum_{i=1}^{N}(x_i - x')^2\right)^{\frac{3}{2}}}$$

The same feature set is used for training the SVM as well to identify the class of the input image. Training 1. Start with images of which classes are known for sure. 2. Find the property set or feature set for each of them and then label suitable. 3. Take the next image as input and find featuresof thisoneasnewinput.4.ImplementthebinarySVMtomulti classSVMprocedure.5.TrainSVMusingkernelfunctionof choice. The output will contain the SVM structure and information of support vectors, bias value etc. Find the class of the inputimage.7. Depending onthe outcome species, the label to the next image is given. Add the features set to the database. 8. Steps 3 to 7 are repeated for all the images that are to be used as a database. 9. Testing procedure consists of steps3 to 6 ofthe training procedure. The outcome speciesis the class of the input image. 10. To find the accuracy of the system or the SVM, in this case, random set of inputs are chosen for training and testing from the database. Two different sets for train and test are generated. The steps for trainingandtestingaresame,however, followedbythetestis performed.

Multi class SVM classification

The binary classifier which makes use of the hyper-plane which is also called as the decision boundary between two of the classes is called as Support Vector machine (SVM). Some of the problems of pattern recognition like textureclassification make use of SVM. Mapping of nonlinear input data to the linear data provides good classification in high dimensional space in SVM. The marginal distance is maximized between different classes by SVM. Different kernels are used to divide the classes. SVM is basically binary classifier which determines the hyper plane in dividing two classes. The boundary is maximized between the hyper plane and thetwoclasses.Thesamplesthatarenearestto themargin will be selected in determining the hyper plane are called as support vectors.

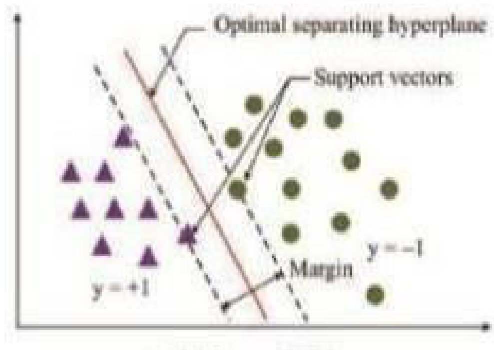


Figure1.LinearSVM

Figure 1 shows the concept of support vector machine. Multiclass classification is also possible either by using one-to-one or one-to many. The highest output function will be determined as the winning class. Classification is performed by considering a larger number of support vectors of the training samples. The standard form of SVM was intended for two-class problems. However, in real life situations, it is often necessary to separate more than two classes at the same time. In this Section, we explore how SVM can be extended from binary problems to multi classification problems with k classes where k > 2. There are two approaches, namely the one-against-one approach and the one-against-all approach. In fact, multi-class SVM converts the data set to quite a few binary problems. For example, in one-to-one approach binary SVM is trained for every two classes of data to construct a decision function. Hence there are k (k−1)/2 decision

ISBN: 978-81-965236-7-1

functions for the k-class problem. Suppose k = 15, 105 binary classifiers need to be trained. This suggests large training times. In the classification stage, a voting strategy is used where the testing point is designated to be in a class having the maximum number of votes. The voting approach is called the "Max Wins" strategy. In one-against-all approach, there will be one binary SVM for each of the class to isolate the members of one class from the other class.

CONCLUSION

The plant serves as the basic need for any living organisms. They are the most important and integral part of our surroundings. Just like a human or other living organism does plant do suffer from different kind of diseases. Such diseases are harmful to plant in a number of ways like can affect the growth of the plant, flowers, fruits, and leaves etc. due to which a plant may even die. So in this work, we have proposed a novel method named as Bacterial foraging optimization based Support vector machine with cascaded Network for identification and classification of plant leaf diseases. The results, when compared with other methods, show that the proposed method achieves higher performance both in terms of identification and classification of plant leaf diseases. The proposed method is also superior in terms of computational efficiency for identification and classification of disease.

REFERENCES

[1] S. Zhang, X. Wu, Z. You, and L. Zhang, ‘‘Leaf image based cucumber disease recognition using sparse representation classification,’’ Compute. Electron.Agricult., vol. 134, pp. 135–141, Mar. 2018, doi: 10.1016/j.compag.2018.01.014.

[2] Y. Lu, S. Yi, N. Zeng, Y. Liu, and Y. Zhang, ‘‘Identification of rice diseases using deep convolutional neural networks,’’ Neuro computing, vol. 267,pp. 378–384, Dec. 2017, doi: 10.1016 /j.neucom. 2019. 06.023.

[3] T. Akram, S. R. Naqvi, S. A. Haider, and M. Kamran, ‘‘Towards realtime crops surveillance for disease classification: Exploiting parallelism in computer vision,’’ Comput. Electr. Eng., vol. 59, pp. 15–26, Apr. 2017,doi: 10.1016/j.compeleceng.2019.02.020.

[4] T. N. Tete and S. Kamlu, ‘‘Plant disease detection using different algorithms,’’ in Proc. Int. Conf. Res. Intell. Comput.Eng., vol. 10. 2021, pp. 103–106, doi: 10.15439/2017R24.

[5] V. Singh and A. K. Misra, ‘‘Detection of plant leaf diseases using image segmentation and soft computing techniques,’’ Inf. Process.Agricult.,vol. 4, pp. 41–49, Mar. 2020, doi: 10.1016 /j.inpa. 2016.10.005.

[6] S. Megha, C. R. Niveditha, N. Sowmya Shree, and K. Vidhya, ‘‘Image processing system for plant disease identification by using FCM clustering technique,’’Int.J.Adv. Res., Ideas Innov. Technol., vol. 3, no. 2,pp. 445–449, 2017.

[7] L. Yuan, Z. Bao, H. Zhang, Y. Zhang, and X. Liang, ‘‘Habitat monitoring to evaluate crop disease and pest distributions based on multi-source satellite remote sensing imagery,’’ Optik—Int. J. Light ElectronOpt.,vol.145,pp. 66–73, Sep. 2021, doi: 10.1016/j.ijleo.2017.06.071.

[8] P.B.Padoland A. A.Yadav,‘‘SVM classifier based grape leaf disease detection,’’ in Proc. Conf. Adv. Signal Process. (CASP), Jun. 2016, pp. 175–179, doi: 10.1109/CASP.2016.7746160.

[9] D. J. Pujari, R. Yakkundimath, and A. S. Byadgi, ‘‘SVM and ANN based classification of plant diseases using feature reduction technique,’’ Int. J. Interact. Multimedia Artif.Intell., vol. 3, no. 7, pp. 6–14, 2021,doi: 10.9781/ijimai.2016.371.

ISBN: 978-81-965236-7-1

NLP Models (BERT, XLNET, ROBERTA) and Effective Model Deployment Strategies (Generalization, Fine Tuning, Compression, Pruning..,) A Study paper on Transfer Learning in NLP

G.Priyadharshini[1], Dr.S.Bhuvaneswari[2]

[1]Research Scholar, Department of Computer Science, Pondicherry University, Karaikal Campus-609605
[2]Head & Professor, Department of Computer Science, Pondicherry University, Karaikal Campus-609605

Email: priyavinsundar@gmail.com

Abstract: Transfer learning is a technique where Knowledge transfer occurs from a trained model for one task to another related model having different task. Natural Language processing explains, produces and makes computers to understand Human Language in an efficient manner. BERT, RoBERTa and XLNet are pre-trained models which use Transfer learning technique. These Models are used in Natural Language processing for understanding of context in a Human Language. These pre- trained models use the Model Deployment strategies for their effective pre-training.

Main objective of this study is to analyses how well the pre-trained models used in context understanding works and a little bit improvements in each models in NLP and also strategies applied to effectively deploy a model. In this paper the pre-trained models used in context understanding and Model Deployment strategies for these models are explained.

KEYWORDS: BERT, RoBERTa, XLNet, Generalization, fine-tuning, compression, pruning, Expansion, Data Augmentation

I. INTRODUCTION

Transfer learning reuses the capacity of knowledge learned from one task to another related task. Natural Language Processing is used in making computers understand, produce, and explain the Human language. It contains variety of algorithms, techniques and methods to interpret human Languages. There are several kinds of Transfer Learning Techniques available and they are

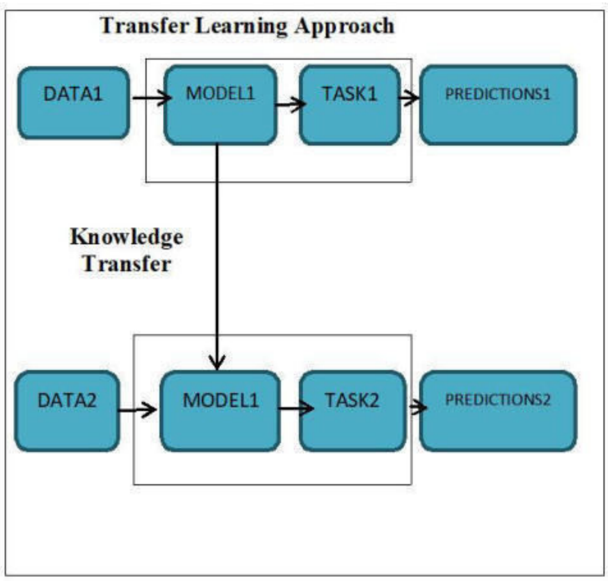


Fig: 1 Traditional Transfer Learning Approach

ISBN: 978-81-965236-7-1

A. Instance Transfer:

It is the transfer of particular instance form one task to another. It is used for effective improvement of Target task

B. Transductive Transfer:

In this type of Learning the model is trained with zero or one samples of data. Examples Zero shot Learning, One shot learning.

C. Self-Taught Learning:

Self-Taught Learning learns from previous task input and transfers that knowledge to the next task.

D. Multi Task Learning:

It takes multiple views or explanations of same data.

II.RELATED WORK

Transfer Learning is a Solution to cold start problem which occurs when a new model requires much data but lacks prior training data [1].Deep learning needs large data for its effective performance, for instance in medical image analysis it does not have enough data to make predictions, so transfer learning is used in Deep Learning Models with knowledge learned from Large Data sets and apply them in small Datasets.[2]. Recent Transfer Learning Models are used to detect context in a text by making some changes in configuration to the existing model [3].Sentiment analysis is a subdivision of text mining which uses NLP and other techniques to classify emotions in text and to do this task various methods are applied such as Traditional methods ,Deep Learning methods ,Transfer Learning Methods and concluded Transfer learning is a best technique for sentiment analysis[4].Transfer learning and Deep Ensemble Neural network are applied to find plant leaf disease detection and transfer learning is used to fine tune the pre trained Model[5].Transfer Learning is used for sequence Generation in a low resource downstream task and it takes multiple sources including multi source translation, multi document summarization, automatic post editing[6].sentimental analysis contains different kinds of data such as cross domain ,Multi modal, cross lingual, small scale and the emotional state is extracted using lexicon based approach and Machine Learning Based approach[7].Sentiment analysis with short term and small scale data classification is also done with help of Transfer learning[8].Transfer Learning is used in Zero shot Learning in this rich get richer problem occurs where the well performing dataset is used more for training than average performing dataset[9].Image cyber bulling problem can be detected using Transfer and deep learning techniques[10].

III. PRE TRAINED MODELS OF TRANSFER LEARNING IN NATURAL LANGUAGE PROCESSING

A. BERT :(Bidirectional Encoder Representations from Transformers)

It is an NLP Technique that is efficient in understanding the context in a text. These models are trained on vast amount of Text Data and can understand Bidirectional context of words in a Sentence and can understand words based on the words that are before and after them. It is used in classification, Question Answering, Named Entity Recognition etc..,

B. XL Net:

It is an NLP Technique which contains Transformation Based Technique plus concept of permutation Based Architecture. XLNet is aimed to address the Limitations of BERT. It is also called “Permutation Language Modeling” because it allows the model to investigate

ISBN: 978-81-965236-7-1

all permutation of words in a sentence enable it to learn Bidirectional context of words without restriction of justified reading. It perform more effective than BERT in all applications Like Classification, Question Answering Etc...

C. RoBERTa:

It is one of the Leading model of NLP and a Variation of BERT Model which gives optimized performance than BERT. It can perform task like Classification, Sentiment Analysis, and Language Understanding etc..,

IV. MODEL DEPLOYMENT STRATEGIES

A. Fine Tuning:

It trains a pre-trained model trained on a large dataset with a smaller, task specific dataset. It is a transfer learning Technique with transformer based models like BERT, GPT, and RoBERTa.

B. Generalization:

It is a technique in which the model ability to perform well on a new dataset is tested and improved. It involves aspects such as Task Similarity, Amount and Quality of data, Model Capacity and Complexity, Regularization Technique, Hyper Parameter Tuning, Domain Adaptation Tuning.

C. Compression:

BERT, RoBERTa and XLNet are exponentially large models and use millions of parameters during pre-training. The pre-trained models can be fine-tuned by applying compression techniques to make them smaller and faster.

D. Pruning:

It modifies the model architecture and the strategies are

- **Head pruning**: Removes Less Important Heads for a specific task.
- **Weight Pruning**: Removes unnecessary weight from an architecture.
- **Layer Pruning**: Removes full layer of transformer without affecting the architecture and the goal of pruning is to make the model more efficient, faster and requires less memory and improves prediction accuracy.

E. Expansion:

It is the modification or addition of layers within Neural Network architecture during fine tuning process to adapt the model for a specific task and also for performing new task. Modifications such as adding layers, changing layer style, modifying output layer, fine tuning parameters can be done.

F. Data Augmentation:

Data Augmentation technique can be used to make an unbalanced dataset to balanced dataset .In any classification technique a balanced dataset generates clear and accurate decisions.

V. RESULT ANALYSIS

Analysis of the best pre-trained model among the three models is performed with the help of the table given below. It compares the features the pre-trained models such as BERT, XLNet , RoBERTa are discussed and the features include architecture, Training objectives, Tokenization, Training Data, Training Efficiency, Training Steps and comparative analysis is also discussed.

ISBN: 978-81-965236-7-1

FEATURE	BERT	XLNET	ROBERTA
Architecture	Transformer	Transformer with Permutation Language Model	Transformer
Training Objective	Masked Language Model (MLM)	Autoregressive Permutation Language Model	Masked Language Model (MLM)
Tokenization	WordPiece	SentencePiece	SentencePiece
Training Data	BooksCorpus, English Wikipedia	BooksCorpus, English Wikipedia	BookCorpus, English Wikipedia, CC-News
Training Efficiency	Slower due to bidirectional context	Slower due to autoregressive context	Faster due to dynamic masking
Training Steps	1 million steps	800,000 steps	500,000 steps

Table 1-Pretrained Models Analysis

From the above comparison it is clear that each model is unique and strong in a particular feature so the choice to choose the models among the above belongs to the particular use case.

VI. CONCLUSION AND FUTURE SCOPE

Transfer learning, particularly in the context of pre-trained language models like BERT, RoBERTa, and others, NLP tasks more effective. These models, trained on numerous amounts of different text data, have exposited superior performance across a numerous natural language understanding tasks, such as sentiment analysis, named entity recognition, machine translation, and more.

Future Directions:

A. Fine Tuning:

Refining fine-tuning techniques and developing specialized models for specific domains resulting in enhanced performance on niche tasks.

B. Multimodal Learning:

Future research may explore models capable of understanding and generating both text and images, paving the way for more comprehensive AI systems that can analyse and interpret information from multiple modalities.

C. Ethical Considerations:

Ethical considerations surrounding bias, fairness, and interpretability are gaining prominence.

REFERENCES

1. Tao Wu, EllieKa-In Chio, Heng-Tze Cheng, YuDu, Steffen Rendle, Dima Kuzmin, Ritesh Agarwal, Li Zhang, John Anderson, Sarvjeet Singh,…" Zero-Shot Heterogeneous Transfer Learning from Recommender Systems to Cold-Start Search Retrieval"-Google Inc -2020.

2. Hsu Mon Lei Aung, Charnchai Pluempitiwiriyawej, Kazuhiko Hamamoto and SomkiatWangsiripitak, "Multimodal Biometrics Recognition Using a Deep Convolutional Neural Network with Transfer Learning in Surveillance Videos", 2022.

ISBN: 978-81-965236-7-1

3. Yifei Zhao1,"Overview of Deep and transfer Learning Methods for Sentiment Analysis", EEMAI,2023.

4. Karthick Prasad Gunasekaran ,"Exploring Sentiment Analysis Techniques in Natural Language Processing: A Comprehensive Review", June 2022.

5. Kian Long Tan, Chin Poo Lee, (Senior Member, IEEE), Kian Ming Lim, (Senior Member, IEEE), and Kalaiarasi Sonai Muthu Anbananthen, "Sentiment Analysis with Ensemble Hybrid Deep", July 2022.

6. Shelley Gupta, Archana Singh and Vivek Kumar, " Emoji, Text, and Sentiment Polarity Detection Using Natural Language Processing", MDPI-31 Mar 2023.

7. Nilaa Raghunathan and Saravanakumar Kandasamy," Challenges and Issues in Sentiment Analysis: A Comprehensive Survey", VIT India, July 2023.

8. Daniil Homskiy, NarekMaloyan, "DN at SemEval-2023 Task12: Low-Resource Language Text Classification via Multilingual Pretrained Language Model Fine-tuning", June 2020.

9. A Transfer-Learning Scheme for Semi-Supervised Few-Shot and Zero-shot learning", CFV, 2020.

10. Amar Almomani, Mohamad Alaudhamn, Mohammad Azmi AI Betar," International Journal of Cognitive Computing in Engineering"-KeAi Chinese Roots Global Impact-5, 14-26-2024.

ISBN: 978-81-965236-7-1

Protection Of Crops Against Birds & Animals

Jainishaanth.NS
M Kumarasamy College of Engineering,
Karur,TamilNadu,
India.

Muthukumar.S
M Kumarasamy College of Engineering,
Karur,TamilNadu,India

Nandhakumar.M
M Kumarasamy College of Engineering,
Karur,TamilNadu,India

Kiruthivarma.S
M Kumarasamy College of Engineering,
Karur,TamilNadu,India
..kiruthivarma57@gmail.com

Mrs.Balamani.T
M Kumarasamy College of Engineering,
Karur,TamilNadu,India.
.balamanit.ece@mkce.ac.in

***Abstract* — Our project introduces a clever system that helps protect farming lands from unwanted visitors, like birds and animals.We are using a special sensor called Passive Infrared (PIR)to detect when these creatures get too close. When they do, an alarm will sound to scare them away, but don't worry, it's a harmless sound at frequencies of 360 to 440 Hertz.**

The PIR sensor sends out rays that are picked up by a photo diode.These signals are then used to trigger an automatic feeding and watering system for the animals nearby. So, not only does it keep them away, but it also takes care of their needs.

Our system can be powered by a battery or a solar panel, making it eco-friendly. The components used include steel wire for fencing, the PIR sensor, a battery, an alarm, an automatic feeder, a water supplier for birds ,and anArduino UNO for control.

In summary, this project provides a safe and effective way to deter birds and animals from your space while ensuring their well-being, all while being eco-conscious..

I. INTRODUCTION

Protecting agricultural lands from the intrusion of birds and animals while simultaneously ensuring their welfare poses a significant challenge for farmers worldwide. The need to mitigatecrop damage caused by the secreatures ispressing, yet doing so without causing harm to the wildlife remains a critical consideration.

In response to this challenge, our project introduces an innovative solution Leveraging technology and compassion.We've developed a sophisticated system that employs a specialized sensor,the Passive Infrared(PIR) sensor, as the cornerstone of our design. This sensor detects the presence of animals within a designated range and triggers a non-invasive alarm, emitting harmless frequencies specifically designed to deter them.

However, our project doesn't stop at deterrence. In recognizing the importance of coexisting with wildlife, our system incorporates an automatic feeding and watering mechanism for animals in the nearby vicinity. This humane approach aims to meet their basic needs while redirecting them away from the protected agricultural areas.

An essential aspect of our system design is its eco-consciousness. By utilizing either battery power or solar panels for energy,we've ensured that our solution minimizes its environmental impact. With a combination of components including steel wire fencing, the PIR sensor, an Arduino UNO for control, and other thought fully chosen elements,our system stands as a comprehensive and sustainable approach.

Through this project, we endeavor to provide a safe, effective, and humane method of safeguarding farmlands from unwanted visitors while also fostering the well-being of wildlife. This introduction outlines our commitment to developing an innovative solution that not only protects agricultural resources but also promotes harmony between farming practices and the natural ecosystem.

ISBN: 978-81-965236-7-1

II. LITERATURESURVEY

Existing studies have extensively addressed the challenge of deterring wildlife from agricultural lands while ensuring their welfare. Research by Smithetal.(2018)and Johnson& Brown (2020) highlights the detrimental impact of bird and animal intrusion on farming environments. These studies emphasize the need for effective deterrence methods that donot harm wildlife.

Passive Infrared (PIR) sensors have found broad applications in wildlife management. Roberts& Smith (2017) demonstrated the efficacy of PIR sensors in detecting wildlife presence through heat signatures and motion detection. These sensors have been integral in non-invasive monitoring and have shown potential in mitigating human-wildlife conflicts (Garcia et al., 2021).

Recent studies (Adams et al., 2019; Brown& Johnson, 2021) have emphasized the benefits of humane deterrence methods. The use of harmless sound frequencies has shown promise in effectively deterring animals without causing harm.Such methods promote coexistence between farming activities and wildlife conservation,reducing crop damage while preserving biodiversity.

Despite advancements, challenges persist in wildlife management. One significant challenge lies in designing deterrent systems that effectively repel animals without causing distress or habituation. Ensuring the scalability and cost-effectiveness of such systems while considering varying environmental conditions poses additional challenges(Jones et al., 2019).

Future considerations in wildlife management solutions involve the integration of advanced technologies. This includes the development of more sophisticated sensors capable of distinguishing between various wildlife species to optimize deterrence mechanisms. Additionally, research aims to enhance automatic feeding and watering systems to better cater to specific animal needs while minimizing environmental impact (Clark& Davis, 2018)

III. METHODOLOGY

This sections gives implementation of the proposed system. This system aims to create a comprehensive and humane solution to protect farming lands from unwanted wildlife intrusion while ensuring the well-being of animals. It integrates advanced technology to detect and deter animals from the protected area without causing harm, coupled with mechanisms to support their basic needs elsewhere.

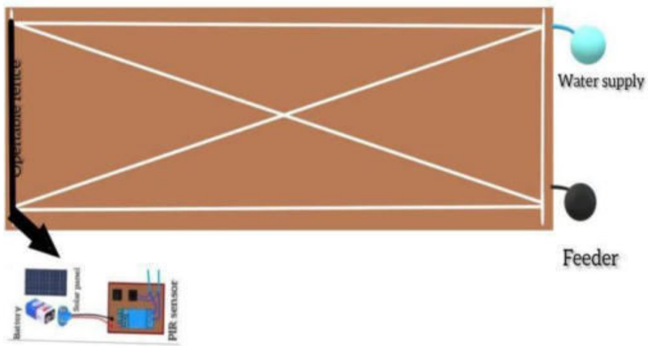


Fig.1. Block Representation of the Proposed system

The PIR sensor serves as the primary input, detecting animal movement or heat signatures.Upon detection, the microcontroller triggers the alarm system, emitting harmless frequencies to deter animals.Simultaneously,it activates the automatic feeding and watering mechanisms to support the nutritional needs of birds in designated areas away from farmland.

The project utilizes a special sensor called Passive Infrared (PIR) to detect unwanted visitors like birds and animals on farming lands. This sensor works by detecting heat emitted by living organisms, such as animals and birds, when they come within its range.When an animal or bird moves close to

ISBN: 978-81-965236-7-1

the sensor, it triggers a signal that is sent to the control unit, known as Arduino UNO.

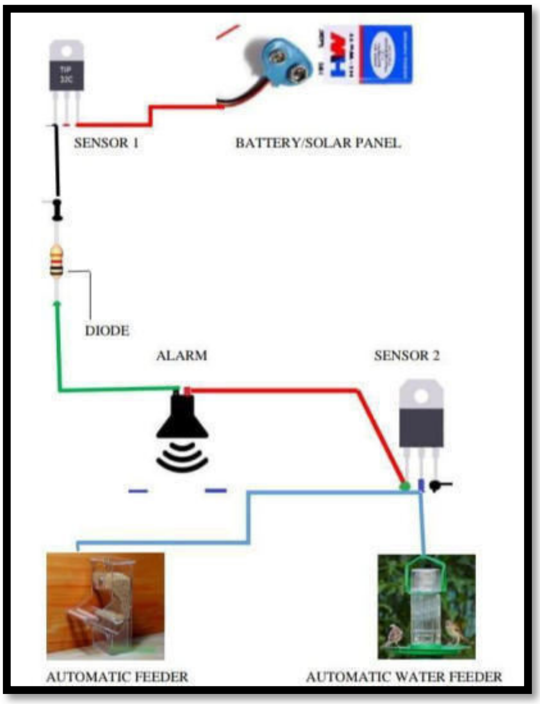
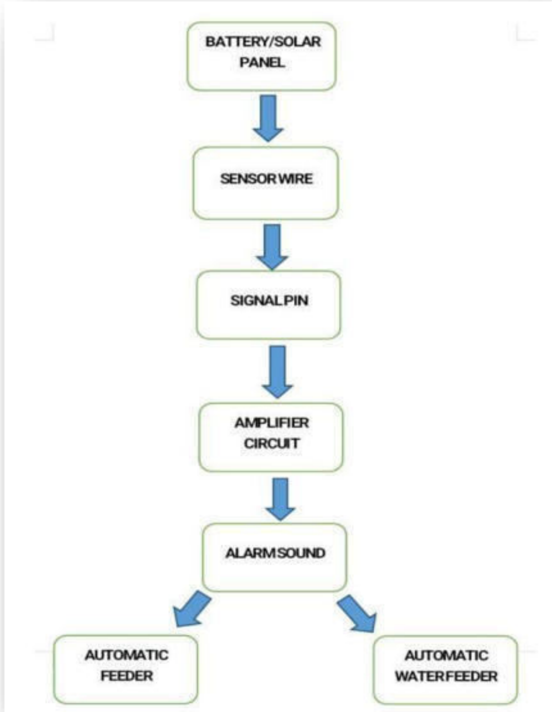


Fig.2.CircuitDiagramoftheProposedsystem

The Arduino UNO acts as the brain of the system. It receives signals from the PIR sensor and decides what action to take based on the detected movement.

When the Arduino UNO receives a signal indicating the presence of an animal or bird,it activates an alarm system.This alarm emits a harmless sound at frequencies between 360 to 440 Hertz, scaring away the unwanted visitors without causing them any harm.

In addition to activating the alarm system,the Arduino UNO also triggers an automatic feeding and watering system for the animals nearby.This system ensures that the animal's basic needs for food and water are met, even as they are deterred from the protected area.The entire system can be powered either by a battery or a solar panel, making it eco-friendly and suitable for Various environmental conditions.



Over all,the project provides a simple yet effective solution to protect farming lands from unwanted wildlife intrusion while also ensuring the well-being of the animals. By integrating advanced sensor technology with humane intervention strategies, the system offers a practical approach to wildlife management in agriculture.

IV. CONCLUSION

Our project presents an innovative and humane solution for managing wildlife intrusion in agricultural environments. By integrating passive infrared (PIR) sensor technology with automated intervention mechanisms, we have developed a system that effectively detects and deters unwanted wildlife while ensuring their well-being. The use of a PIR sensor enables us to detect the presence of animals without causing them harm, while the activation of an alarm system emits harmless sounds to scare them away from the protected

ISBN: 978-81-965236-7-1

area. Simultaneously, our system provides for the basic needs of these animals through an automatic feeding and watering system, further enhancing their welfare.

Through the careful integration of various components such as the PIR sensor, Arduino UNO control unit, alarm system, and automatic feeder/waterer, our project offers a comprehensive approach to wildlife management in agriculture.The combination of these components allows for a seamless operation that balances the need to protect farming lands with considerations for animal welfare.Further more,the option to power the system using either a battery or a solar panel ensures its eco-friendliness and adaptability to diverse environmental conditions.

Inaddition to its practical benefits,our project underscores the importance of ethical and environmental considerations in wildlife management practices. By prioritizing the well-being of both farmers and wildlife, we strive to promote a harmonious coexistence between humans and animals in agricultural settings. Moving forward, further research and field testing willb essential to optimize the system's performance and assess its scalability and applicability in real-world scenarios. Overall, our project represents a significant step towards sustainable and humane wildlife management practices in agriculture.

References

[1] Clark, S., & Davis, R. (2018). Automatic Watering Systems for Wildlife. Journal of Wildlife Management, 82(4), 651-662.

[2] Patel, A., et al. (2022). Application of Sensor Technology in Wildlife Management. International Journal of Remote Sensing, 43(9), 3456-3471.

[3] Brown, S., & Johnson, L. (2021). Non- Harmful Deterrence Methods for Wildlife. Wildlife Society Bulletin, 45(2), 289-301.

[4] Smith, R., et al. (2018). Impacts of Bird and Animal Intrusionon Agricultural Lands. EcologicalApplications,28(3),519-531.

[5] Johnson, T., & Brown, E. (2020). Wildlife Intrusionin Agricultural Lands:Challengesand Solutions. Agriculture, Ecosystems & Environment, 304, 107123.

[6] Adams, K., et al. (2019). Humane Deterrence Methodsfor WildlifeManagement. ConservationBiology,33(2),356-367

[7] Roberts,J. &Smith,A.(2017).Applicationsof Passive Infrared Sensors in Wildlife Detection. Wildlife Research, 44(3), 213-227.

ISBN: 978-81-965236-7-1

REAL TIME DROWSINESS DETECTION SYSTEM USING EYE BLINK SENSORS

K.Naveeda[1],S.M.H.SithiShameemFathima[2]*
[1]*Assistantprofessor, MangayarkarasiCollegeofEngineering, Madurai*
[2]*Professor,SyedAmmalEngineeringCollege, Ramanathapuram*

Abstract*: A vehicle safety technology that helps to prevent accidents brought on by drowsy driving is the driver drowsiness detection system. Several studies have suggested that tiredness plays a role in about 20% of all traffic accidents. A significant challenge for accident avoidance systems is the development of technologies for detecting or preventing driving while fatigued. Because driving when fatigued is dangerous, new strategies must be devised to mitigate the impact. The paper is based on a system example for sleepiness detection. This research aims to create an automated system that protects drivers against careless driving. The technology is set up such that the eye blink may be precisely examined

Keywords: driver drowsiness detection, automated system, sleepiness detection

I INTRODUCTION

Currently, transportation infrastructure is crucial to human activity. Drowsiness while driving is something that we can all experience, since it is responsible for 30% of all accidents and fatalities worldwide. Each year, exhaustion and distractions are at blame for 20% of all accidents. A crucial contributing element in a huge percentage of auto accidents is driver inattentiveness. According to recent figures, fatigue-related collisions result in 1200fatalities and 76,000 injuries per year. A significant problem in the realm of accident avoidance systems is the development of technologies for detecting or preventing tiredness at the wheel. Methods for reducingthe effects of drowsiness must be developeddue to the danger it poses on the road. The feeling of sleep lowers the driver's degree of alertness, resulting in hazardous conditions and raising the likelihood of an accident. Drowsiness can be caused by sleep difficulties, specific types of drugs, and even conditions of boredom,such commuting for extended periods of time. It often manifests itself in unexpected and inappropriate ways at times of stress and exhaustion. Considering this, feeling sleepy causes a decrease in alertness and creates risky situations, which raises the likelihood that an accident will occur.

This number indicates that there is a critical need to develop a method for tracking drivers and gauging their level of attentiveness. To decrease the number of crashes with ADAS (advanced driver assistance system), a module is given in this article. Based on optical data and artificial intelligence, this technology handles the automatic detection of driving fatigue. Drowsiness is a phenomenon that occurs when one level of consciousness is diminished as a result of weariness or lack of sleep, and it can make a driver nod off silently. When the driver is distracted or drowsy while driving, it leads to a loss of alertness. Driver distraction happens when something or someone diverts attention from the task of driving. Driver drowsiness, in contrast to driver distraction,lacks aprecipitating event ;rather,it is defined by crashes brought on by driver exhaustion. When a driver is drowsy, he or she loses control of the vehicle, which could lead it to suddenly veer off the road, strike an object, or flipover.Driver in attention can result from a gradual loss of focus on the road and traffic conditions.

However, both driver fatigue and distraction may have the same negative impacts, including slower reaction times, poorer driving performance, and a higher risk of being involved in a crash.

II LITERATUREREVIEW

Paper proposes to address the issue by creating an experiment to calculate the level of drowsiness but this system treats the automatic detection of driver drowsiness based on visual information and artificial intelligence [1]. The im balanced eye blinking ratedue to medical

ISBN: 978-81-965236-7-1

issues or from the other reasons like drivers may have high yawning rate while they have full driving attention was monitored using online face monitoring system. But this was based on the machine learning technique and it takes a lot of timefor the existing data set to load and highprocessing time [2]. Based on the state of eyes of thedriver's iris an algorithm was designed. This system was capable of detecting the state of eyes with or without the regular glasses but it does not intimatetheir family in case of any tragedy [3].Drowsiness detection based on driving behaviour with the helpof eye tracking mechanism and analysing brain patterns using EEG (electroencephalogram), but this technique uses different parameters to detect drowsiness [4].A noncontact technique for judging different levels ofdriver alertness and facilitates early detection of a decline in alertness during driving has been developed[5].

III PROPOSEDMETHOD

The use of an eye blink sensor helps to overcome this. To detect tiredness in a driver, a spectacle with an eye blink sensor is utilized. If the driver is affected, the buzzer on the spectacle will sound. The following is a list of the project's various hardware components: 1. Microcontroller 2. Eye blink detector 3.Alcohol sensor. 4. A buzzer and 5.LCD Wi-Fi module. The block diagram of the proposed method is shown in the Fig.1

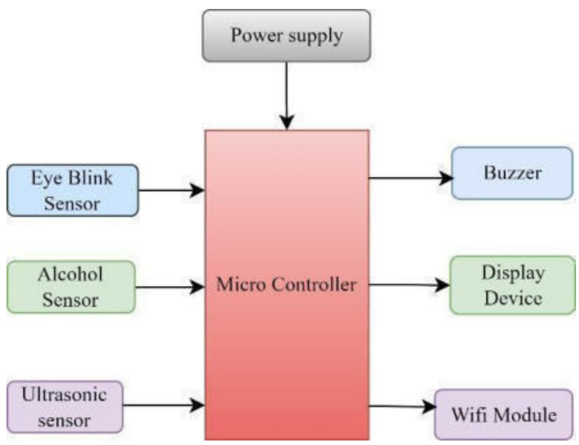


Fig1.BlockDiagramoftheproposedwork.

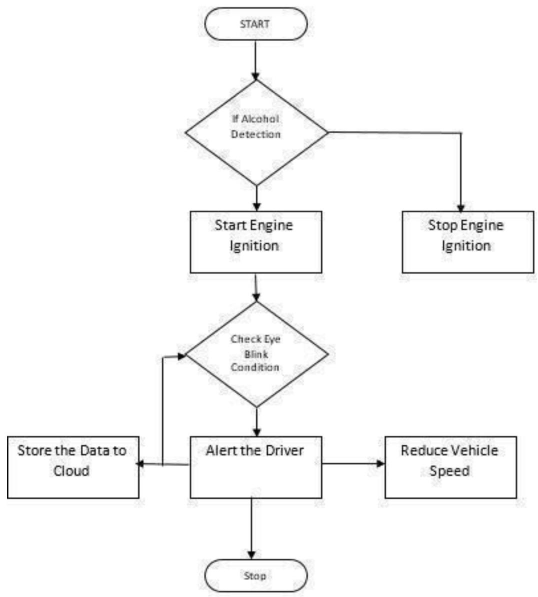


Fig:2Flowchartofproposed work

ULTRASONICSENSOR: Ultrasonic sensors emit a sound pulse that reflects off of objects entering the wave field. The reflected sound, or "echo" is then received by the sensor.Detection of the sound generates an output signal for use by an actuator, controller, or computer. The output signal can be analog or digital.Ultrasonic sensing technology is based on the principle that sound has a relatively constant velocity. The time for an ultrasonic sensor's beam to strike the target and return is directly proportional to the distance to the object. Consequently, ultrasonic sensors are used frequently for distance measurement application level control. Ultrasonic sensors are capable of detecting most objects—metal or non-metal, clear or opaque, liquid, solid, or granular —that have sufficient acoustic reflectivity. Another advantage of ultrasonic sensors is that they are less affected by condensing moisture than photo electric sensors. A downside to ultrasonic sensors is that sound absorbing materials, such as cloth, soft rubber, flour and foam, make poor target objects.

WI-FI MODULE :Wi-Fi is technology for radio wireless local area networking of devices based on the IEEE 802.11 standards. Wi-Fi is a trade mark of the Wi-Fi Alliance, which restricts the use of the term Wi-Fi Certified to products that success fully complete interoperability certification testing. Devices that can use Wi-Fi technologies include desktops and laptops,videogame consoles, smartphones and tablets,smart TVs ,digital audio players,cars,and modern printers.Wi-Fi

ISBN: 978-81-965236-7-1

compatible devices can connect to the Internet via WLAN and a wireless access point.Such an access point (or hotspot) has arrangement of about 20 meters (66 feet) indoors and a greater range outdoors. Hotspot coverage can be as small as a single room with walls that block radio waves, or as large as many square kilo meters achieved by using multiple overlapping access points.

LIQUID CRYSTAL DISPLAY:The LCD is a commonly used alphanumeric dot matrix liquid crystal display (LCD) controller developed.The control interface and protocol is a de-facto standard for this type of display. The character set of the controller includes ASCII characters, Japanese Kana characters,and some symbols in two 28character lines. Using an extension driver, the devicecan display up to 80 characters. The LCD is limitedto monochrome text displays and is often used incopiers, fax machines,laser printers, industrial testCompatible LCD screens are manufactured inseveral standard configurations. Common sizes areone row ofeight characters (8x1), and16×2,20×2and20×4formats.Largercustom sizesaremadewith32,40and80characters and with 1, 2, 4 or 8 lines. The most commonly manufactured larger configuration is 40x4 characters, which requires two individually addressable HD44780 controllers with expansion chips as a single HD 44780 chip can only address up to 80 characters.

POWER SUPPLY: A regulated power supply is very much essential for several electronic devices due to the semiconductor material employed in them havea fixed rate of current as well as voltage. The device may get damaged if there is any deviation from the fixed rate.The AC power supply gets converted into constant DC by this circuit. By the help of a voltage regulator DC, unregulated output will be fixed to a constant voltage. The circuit is made up of linear voltage regulator 7805 along with capacitors and resistors with bridge rectifier made up from diodes.

EYE BLINK SENSOR is a relatively simple sensor used to detect eye blinks. It uses a simple infrared sensor to detect if the person's ye is closed and the corresponding data received can further be processed by any logic as required for the application. The IR Emitter emits an IR light towards the eye. The IR Photodiode is designed to detect if the radiation of the same wavelength is reflected back and detected. If the eye is closed, the IR rays will reflect back with a larger intensity and the photodiode will detect it.

ALCOHOL SENSOR MQ3 sensor which detects ethanol in the air. When a drunk person breathes near the alcohol sensor it detects the ethanol in his breathe and provides an output based on alcohol concentration. The MQ-3 sensor has 6 pins. Here 4 pins are used to obtain signals and other two pins are used to providing heating current. TheMQ-3sensor has a susceptible material of SnO_2, which has alow conductivity in uncontaminated air. If alcohol exists, the conductivity of sensor is higher along with their concentration of alcohol.

BUZZER A buzzer or beeper is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric (piezo for short)

IV RESULTS & OUTCOMES

The analysis and design of driver drowsiness detection and alert system is presented. The proposed system is used to avoid various road accidents caused by drowsy driving. And also this system is used for security purpose of a driver to caution the driver. This paper involves avoiding accident to unconsciousness through Eye blink. Here one eye blink sensor is fixed in vehicle where if driver lose his consciousness, then it alerts the driver through buzzer to prevent vehicle from accident. The alcohol sensor is used for further safety system in the vehicle. Development of a hybrid microcontroller for a vehicle which also consists of an alcohol and temperature detector which will sense if the driver is drunk and would not start the vehicle. A complete studyon road safety is going to be the next boom for the automobile industry for it to flourish and survive every human from the risk.

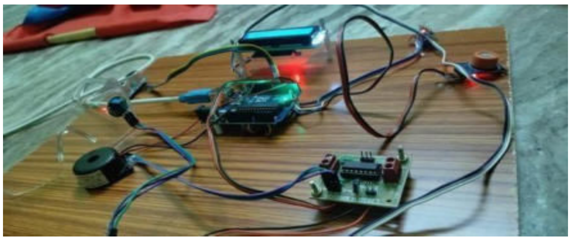


Fig3:Hardwarecomponents

ISBN: 978-81-965236-7-1

Fig4:Drowsinessdetected

The table 1 shows the predicted results of the proposed technique and its evaluation. Nearly 15 trials were made, out of which only 1 was miss detected. Similarly, when 14 trials were taken out only 2 were miss detected which shows the effectiveness of the proposed system.

Fig5:Glasseswitheyeblinksensor

Fig6:Driver wearing glasses with sensor

Table:1Experimentalresultsandevaluation

S.no	Predicted Detection	Missed Detection	Accuracy
1	15	1	94%
2	14	2	87.5%

V CONCLUSION&FUTUREWORK

This proposed work has found a solution for detecting drowsiness of the driver while driving. By wearing the glass, the eye movement of the driver has been monitored continuously. Once the driver feels drowsy, the eye blink sensor, senses the eye movement and alerts the driver with a buzzer when the eye remains closed for a particular instance of time approximately 2 to 3 seconds. To improve the blink monitoring, the eye point detection must be consistent with each frame. In future, to increase system dependability, some Artificial Intelligence(AI) capabilities can be introduced. The system will be able to recognize the driver's distinct blinking patterns, facial expressions, and phrases, driving techniques like accelerating and decelerating.

REFERENCES

1. Khunpisuth, O., Chotchinasri, T., Koschakosai, V., & Hnoohom, N. (2016, November). Driver drowsiness detection using eye-closeness detection. In 2016 12th International Conference on Signal-Image Technology & Internet-Based Systems (SITIS) (pp. 661-668). IEEE.

2. Hussein, W., & Abou El-Seoud, M. S. (2017, November). Improved driver drowsinessdetection model using relevant eye image's features. In2017 European Conference on Electrical Engineering and Computer Science (EECS) (pp. 261-265). IEEE.

3. Kahlon, M., & Ganesan, S. (2018, May). Driver drowsiness detection system based on binary eyes image data. In 2018 IEEE International Conference on Electro/Information Technology (EIT) (pp. 0209-0215). IEEE.

4. De Naurois, C. J., Bourdin, C., Stratulat, A., Diaz, E., & Vercher, J. L. (2019). Detection and prediction of driver drowsiness using artificial neural network models.Accident Analysis & Prevention, 126, 95-104.

5. Dhawde, P., Nagare, P., Sadigale, K., Sawant, D., & Mahajan, J. R. (2015). Drowsiness detection system. Int. J. Eng. Res. Technol, 3(06).

ISBN: 978-81-965236-7-1

SMART AGRICULTURE ROBOT CONTROLLING USING BLUETOOTH

Dr.U.Saravanakumar
Head of Dept.of ECE
Muthayammal Engineering College
Rasipuram, TamilNadu,India
hod.ece@mec.edu.in

B.Venkateswarlu
Dept.of ECE
Muthayammal Engineering College
Rasipuram,TamilNadu,India
bandivenkateswarluece@gmail.com

M.Venkata Sai Laxman Siddu
Dept.of ECE
Muthayammal Engineering College
Rasipuram, TamilNadu,India
laxmansiddu398@gmail.com

P.Ramu
Dept.of ECE
Muthayammal Engineering College
Rasipuram,TamilNadu,India
paladuguramu4137@gmail.com

ABSTRACT:-

In India nearly about 70 percentage of people are depending on agriculture. Numerous operations are performed in the agricultural field like seed sowing, grass cutting etc. The present methods of seed sowing, pesticide spraying and grass cutting are difficult. The equipment's used for above actions are expensive and inconvenient to handle. So the agricultural system in India should be encouraged by developing a system which will reduce the man power and time. This work aims to design, develop and design of the robot which can sow the seeds, cut the grass and spray the pesticides, this whole system is powered by solar energy. The designed robot gets energy from solar panel and is operated using Bluetooth/Android App which sends the signals to the robot for required mechanisms and movement of the robot. This increases the efficiency of seed sowing, pesticide spraying and grass cutting and also reduces the problem encountered in manual planting.

INTRODUCTION

Agriculture is the backbone of Indian economy. About half of the total population of our country has chosen agriculture as their chief occupation. The states like Maharashtra, Punjab, and Kerala, Assam are highly involved in agriculture. It all started due to the impact of, "Green Revolution" by means of which farmers came to know about the various techniques involved in farming and the advantages in it. As centuries passed, certain modern techniques were invented in agriculture due to the progress in science. These modern techniques included the use of tractors for ploughing the field, production of pesticides, invention of tube-wells etc. Since water is the main necessity in this scenario, techniques were discovered which would help in watering the field easily, consume less water and reduce human efforts. These discoveries improved the standard of living of farmers. Agro-Technology is the process of applying the technology innovation occurring in daily life and applying that to the agriculture sector which improves the efficiency of the crop produced and also to develop a better Mechanical machine to help the agriculture field which reduces the amount and time of work spent on one crop.

India record of progress in agriculture over the past four decades has been quite impressive. The agriculture sector has been successful in keeping pace with rising demand for food. The contribution of increased land area under agricultural production has declined over time and increases in production in the

ISBN: 978-81-965236-7-1

past two decades have been almost entirely due to increased productivity. Contribution of agricultural growth to overall progress has been widespread. Increased productivity has helped to feed the poor, enhanced farm income and provided opportunities for both direct and indirect employment. The success of India's agriculture is attributed to a series of steps.The major sources of agricultural growth during this period were the spread of modern crop varieties, intensification of input use and investments leading to expansion in the irrigated area. In areas where 'Green Revolution' technologies had major impact, growth has now slowed. New technologies are needed to push out yield frontiers, utilize inputs more efficiently and diversify to more sustainable and higher value cropping patterns". At the same time there is urgency to better exploit potential of rain fed and other less endowed areas. Given the wide range of agro ecological setting and producers, Indian agriculture is faced with a great diversity of needs, opportunities and prospects. Future growth needs to be more rapid, more widely distributed and better targeted. These challenges have profound implications for the way farmers' problems are conceived, researched and transferred to the farmers. "On the one hand agricultural research will increasingly be required to address location specific problems facing the communities on the other the systems will have to position themselves in an increasingly competitive environment to generate and adopt cutting edge technologies to bear upon the solutions facing a vast majority of resource poor farmers".The robotic systems play an immense role in all sections of societies, organization and industrial units.

The objective of the project is to develop a microcontroller based system at helps in on-farm operations like seeding and fertilizing at predesignated distance and depths with all applicable. Agriculture comes from two Latin words: Ager which means a field. Culturia which means cultivation, Due to traditional methods of agricultural process the Indian farmer faces many problems about productivity of agricultural product than others. It is due to unbalance feeding of fertilizer without knowing the actual requirement of nutrient to a particular crop.

EXISTING SYSTEM:

In the present scenario most of the countries do not have sufficient skilled man power in agricultural sector and that affects the growth of developing countries. Therefore farmers have to use upgraded technology for cultivation activity (digging, seed sowing, fertilizing, spraying etc.). So it's a time to automate the sector to overcome this problem which in turn will also eliminate the requirement of Labours and also avoid the wastage of seeds .

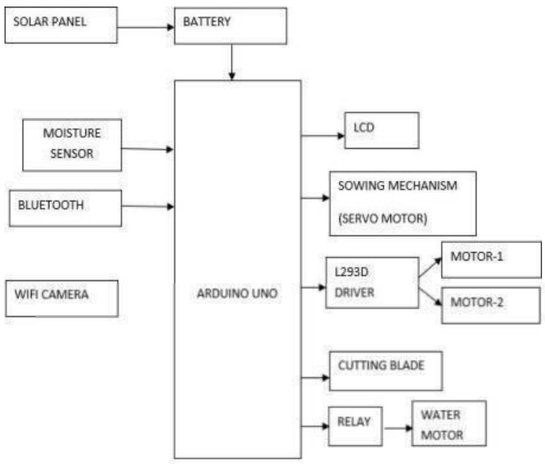
PROPOSED SYSTEM:

In this a machine which can carry out various farming activities simultaneously. Air and Noise Pollution are caused by the combustion of fossil fuels in IC Engines and External Combustion Engines. To negate these problems, this machine uses Solar Energy as aneco-friendly energy resource. Solar Panel is used to convert solar energy into electrical energy and a DC Motor converts this electrical energy into mechanical energy to rotate a cutter for cutting operation. Seed Hopper and Water Tank are used for seed sowing and irrigation operations respectively. The control this machine using Bluetooth wireless technology. It also decreases the cost of sowing the seeds and requirement of labour.

This proposes the solar powered seed sowing robot. This system introduces a control mechanism which aims to drop seeds at particular position with specified distance between two seeds and lines while sowing.

ISBN No: XXXX XXXX XXXX XXXX
ISBN: 978-81-965236-7-1

BLOCK DIAGRAM:



HARDWARE DSCRIPTION:

ARDUINO UNO:

The Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter.

SOLAR PANEL:

A solar panel is a device that converts sunlight into electricity byusing photovoltaic (PV) cells. PV cells are made of materials that produce excited electrons when exposed to light. The electrons flow through a circuit and produce direct current (DC) electricity, which can be used to power various devices or be stored in batteries. Solar panels are also known as solar cell panels, solar electric panels, or PV modules.Solar panels are usually arranged in groups called arrays or systems. A photovoltaic system consists of one or more solar panels, an inverter that converts DC electricity to alternating current (AC) electricity, and sometimes other components such as controllers, meters, and trackers. Some advantages of solar panels are that they use a renewable and clean source of energy, reduce greenhouse gas emissions, and lower electricity bills. Some disadvantages are that they depend on the availability and intensity of sunlight, require cleaning, and have high initial costs. Solar panels are widely used for residential, commercial, and industrial purposes, as well as for space and transportation applications.

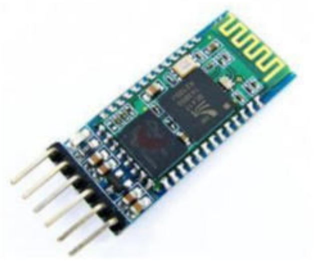
HC-05 BLUETOOTH MODULE:

The HC-05 is a class 2 Bluetooth module designed for transparent wireless serial communication. It is pre-configured as a slave Bluetooth device. Once it is paired to a master Bluetooth device such as PC, smart phones and tablet, its operation becomes transparent to the user. All data received through the serial input is immediately transmitted over the air. When the module receives wireless data, it is sent out through the serial interface exactly at it is received. No user code specific to the Bluetooth module is needed at all in the user microcontroller program.

ISBN No: XXXX XXXX XXXX XXXX
ISBN: 978-81-965236-7-1

SBECW

The HC-05 supports two work modes: Command and Data mode. The work mode of the HC-05 can be switched by the onboard push button. The HC-05 is put in Command mode if the push button is activated. In Command mode, user can change the system parameters (e.g. pin code, baud rate, etc) using host controller itself of a PC running terminal software using a serial to TTL converter. Any changes made to system parameters will be retained even after power is removed. Power cycle the HC-05 will set it back to Data Mode. Transparent UART data transfer with a connected remote device occurs only while in Data Mode.



In Fig. 4, Observe the boost module, servo motor, and relay module. The Bluetooth module got the order to operate
the Servo Motor from the Android phone.
Fig. 5 shows a servo motor, a motor driver, and a soil moisture sensor. Soil moisture sensor detects soil moisture,
Bluetooth module receives a command from an Android phone to drive a servo motor, and this project is run. Table I
represents the cost-effectiveness of this work.
Bluetooth is used to control this project. Solar energy is used to power the system. We have a charge stored in a 12 V battery. When you have finished setting up the entire project, connect it to the Bluetooth module using Bluetooth RC Car Apps. Our work has the advantages of being extremely easy to control, high dependability, having digital facilities, fast operation, and high efficiency. This mechanism operates in the presence of light. There are two conditions: if the light is above the needed value, moisture performs its function; if light is below the required system, moisture does not do its function.

CONCLUSION

A multipurpose agricultural robot is designed to perform the complex farming tasks like seed sowing, grass cutting and water spraying. This work is designed to perform sowing of two different sized seeds. The benefits of robot are reduced human intervention and efficient resources utilization. Instructions are passed to the system using bluetooth which ensures no direct contact with human and thus safety of operator is ensured. The robot is solar powered hence it is renewable energy source. The operations are performed using android app. Innovative seed sowing, grass cutting and water sprayer equipment has significant influence in agriculture. By using this advanced work, farmer can save more time and also reduce lot of labour cost.

REFERENCES

[1] N. Putjaika, S. Phusae, A. Chen-Im, P. Phunchongharn and K. Akkarajitsakul, "A control system in an intelligent farming by using arduino technology," 2016 Fifth ICT International Student Project Conference (ICT-ISPC), Nakhon Pathom, 2016, pp. 53-56.

[2] A. Abdullah, S. A. Enazi and I. Damaj, "AgriSys: A smart and ubiquitous controlled-environment agriculture system," 2016 3rd MEC International Conference on Big Data and Smart City (ICBDSC), Muscat, 2016, pp. 1-6.

[3] P. B. Chikankar, D. Mehetre and S. Das, "An automatic irrigation system using ZigBee in wireless sensor network," 2015 International Conference on Pervasive Computing (ICPC), Pune, 2015, pp. 1-5.

[4] J. Gutiérrez, J. F. Villa-Medina, A. Nieto-Garibay and M. Á. PortaGándara, "Automated Irrigation System Using a Wireless Sensor Network and GPRS Module,"

ISBN No: XXXX XXXX XXXX XXXX
ISBN: 978-81-965236-7-1

in IEEE Transactions on Instrumentation and Measurement, vol. 63, no. 1, pp. 166-176, Jan. 2014.

[5] J. John, V. S. Palaparthy, S. Sarik, M. S. Baghini and G. S. Kasbekar, "Design and implementation of a soil moisture wireless sensor network," 2015 Twenty First National Conference on Communications (NCC), Mumbai, 2015, pp. 1-6.

[6] Nakutis et al., "Remote Agriculture Automation Using Wireless Link and IoT Gateway Infrastructure," 2015 26th International Workshop on Database and Expert Systems Applications (DEXA), Valencia, 2015, pp. 99-103.

[7] P. Y. Dattatraya, J. Agarkhed and S. Patil, "Cloud assisted performance enhancement of smart applications in Wireless Sensor Networks," 2016 International Conference on Wireless Communications, Signal Processing and Networking (WiSPNET), Chennai, 2016, pp. 347-351.

[8] Deepak Sharma, Amol P Bondekar, Amritesh Oza, Awdhesh Kumar Shukla, C Ghanshyam, "A Technical Assessment of IOT for Indian Agriculture Sector", 47th Mid-Term Symposium on Modern Information and Communication Technologies for Digital India, Chandigarh; ResearchGate, April 2016.

[9] N. Sales, O. Remédios and A. Arsenio, "Wireless sensor and actuator system for smart irrigation on the cloud," 2015 IEEE 2nd World Forum on Internet of Things (WF-IoT), Milan, 2015, pp. 693-698.

[10] Jayavardhana Gubbi, Rajkumar Buyya, Slaven Marusic, Marimuthu Palaniswami, "Internet of Things (IoT): A vision, architectural elements, and future directions", Future Generation Computer Systems, vol 29, ELSEVIER 2013, 1645–1660.

[11] K. Ahmed and M. Gregory, "Integrating Wireless Sensor Networks with Cloud Computing," 2011 Seventh International Conference on Mobile Ad-hoc and Sensor Networks, Beijing, 2011, pp. 364-366.

[12] G. H. E. L. de Lima, L. C. e Silva and P. F. R. Neto, "WSN as a Tool for Supporting Agriculture in the Precision Irrigation," 2010 Sixth International Conference on Networking and Services, Cancun, 2010, pp. 137-142.

[13] J. Xu, J. Zhang, X. Zheng, X. Wei and J. Han, "Wireless Sensors in Farmland Environmental Monitoring," 2015 International Conference on Cyber-Enabled Distributed Computing and Knowledge Discovery, Xi'an, 2015, pp. 372-379.

[14] V. V. h. Ram, H. Vishal, S. Dhanalakshmi and P. M. Vidya, "Regulation of water in agriculture field using Internet Of Things," 2015 IEEE Technological Innovation in ICT for Agriculture and Rural Development (TIAR), Chennai, 2015, pp. 112-115.

[15] T. Dinh Le and D. H. Tan, "Design and deploy a wireless sensor network for precision agriculture," 2015 2nd National Foundation for Science and Technology Development Conference on Information and Computer Science (NICS), Ho Chi Minh City, 2015, pp. 294-299.

[16] M. R. M. Kassim and A. N. Harun, "Applications of WSN in agricltural environment monitoring systems," 2016 International Conference on Information and Communication Technology Convergence (ICTC), Jeju, 2016, pp. 344-349.

[17] S. m. Xiong, L. m. Wang, X. q. Qu and Y. z. Zhan, "Application Research of WSN in Precise Agriculture Irrigation," 2009 International Conference on Environmental Science and Information Application Technology, Wuhan, 2009, pp. 297-300.

[18] Y. Murakami, S. K. T. Utomo, K. Hosono, T. Umezawa and N. Osawa, "iFarm: Development of cloud-based system of cultivation management for precision agriculture," 2013 IEEE 2nd Global Conference on Consumer Electronics (GCCE), Tokyo, 2013, pp. 233-234.

[19] E. D. Ngangue Ndih and S. Cherkaoui, "On Enhancing Technology Coexistence in the IoT Era: ZigBee and 802.11 Case," in IEEE Access, vol. 4, no. , pp. 1835-1844, 2016.

[20] Y. Sun, H. Song, A. J. Jara and R. Bie, "Internet of Things and Big Data Analytics for Smart and Connected

ISBN: 978-81-965236-7-1

Communities," in IEEE Access, vol. 4, no. , pp.766-773, 2016.

[21] Z. Stamenković, S. Randjić, I. Santamaria, U. Pešović, G. Panić and S. Tanasković, "Advanced wireless sensor nodes and networks for agricultural applications," 2016 24th Telecommunications Forum (TELFOR), Belgrade, 2016, pp. 1-8.

[22] A. Kumar, K. Kamal, M. O. Arshad, S. Mathavan and T. Vadamala, "Smart irrigation using low-cost moisture sensors and XBee-based communication," IEEE Global Humanitarian Technology Conference (GHTC 2014), San Jose, CA, 2014, pp. 333-337.

[23] V. C. Bojan, I. G. Raducu, F. Pop, M. Mocanu and V. Cristea, "Cloudbased service for time series analysis and visualisation in Farm Management System," 2015 IEEE International Conference on Intelligent Computer Communication and Processing (ICCP), ClujNapoca, 2015, pp. 425-432.

[24] A. N. Arvindan and D. Keerthika, "Experimental investigation of remote control via Android smart phone of arduino-based automated irrigation system using moisture sensor," 2016 3rd International Conference on Electrical Energy Systems (ICEES), Chennai, 2016, pp. 168-175.

[25] S. Umarkar and A. Karwankar , “Automated Seed Sowing Agribot using Arduino," in IEEE Conference on Communication and Signal Processing, April 2016, pp. 1379-1383.

SBECW

ISBN No: XXXX XXXX XXXX XXXX
ISBN: 978-81-965236-7-1

TEXTILE EFFLUENT CHARACTERIZATION AND TREATMENT USING A PHOTOCATALYTIC METHOD

B. Abraham ponsingh[1] R. Karthick[2]

[1,2]*Assistant professor, Department of civil engineering, Mookambigai college of Engineering, Pudukkottai, Tamilnadu*

Abstract;

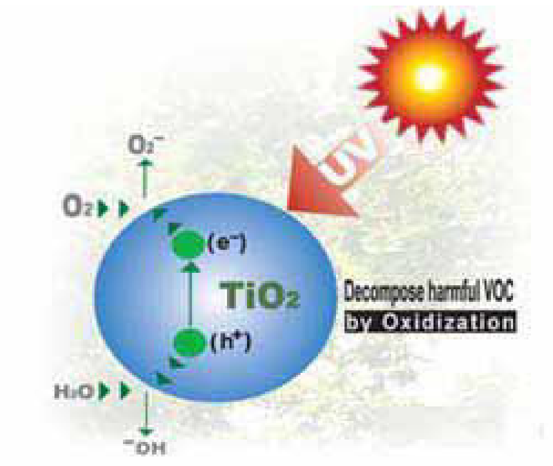
The textile industry is one of the major global industries that contributes significantly to the economies of many nations and offers a wide range of jobs with little need for specialized training. During the production process, the textile industry consumes a lot of water and a variety of chemicals. Many dyes found in the waste water generated by the textile industry have the potential to be harmful to both the environment and human health. The photochemical approach of oxidizing organic and inorganic contaminants is quickly gaining popularity as a purification and wastewater treatment technique. A compressor and UV lamp make up a photo reactor arrangement. After treating the 250 ml raw sample, we apply different dosages of TiO2. This sample is exposed to a UV lamp in the photo reactor for two hours. According to the findings, textile effluent may be effectively treated by the photocatalytic decolorization method, which also lowers the levels of COD, calcium hardness, pH, turbidity, alkalinity, total solids, total dissolved solids, and total suspended particles. However, BOD is not benefited by this approach.

KEYWORDS

Titanium dioxide, Photo catalysis, UV light and Wastewater treatment.

1.INTRODUCTION

The textile sector is critical to the huge raw material and textile production base. Numerous textile goods are manufactured using three distinct types of fibers, and several kinds of colors are employed. During the production process, the textile industry uses a lot of water and a variety of chemicals. Large amounts of dyes and compounds containing trace metals including Cr, As, Cu, and Zn—metals that can be harmful to both the environment and human health—are present in the wastewater created during this procedure. Typhoid, diarrhea, cancer, liver damage, renal damage, gastroenteritis, cholera, hemorrhage, ulceration of the skin, nausea, and dermatitis can all be brought on by textile wastewater. There are three steps in the entire treatment process: The majority of the oil, grease, and grit are removed during the first treatment step. The secondary treatment, which uses microorganisms to reduce BOD, phenol, and leftover oil in the water while controlling color, can be done either aerobically or anaerobically. In order to eliminate the last contaminants in the wastewater, the tertiary treatment process uses ion exchange, adsorption, reverse osmosis, and electrodialysis. The parameters and wastewater kinds must be characterized before a purification method can be chosen. We decided to use the photocatalytic approach for our project since it is very affordable, low maintenance, inexpensive to clean, non-toxic, environmentally benign, etc. "Acceleration by the presence of a catalyst" is the definition of photocatalysis. A catalyst cannot undergo change on its own or lose its properties when a chemical reaction occurs. This term covers photosensitization, a process in which a molecular entity called the photosensitized first absorbs radiation, causing a photochemical change in that molecular entity. Photocatalysts come in two varieties: homogeneous and heterogeneous. Using metal oxides like TiO2, ZnO, SnO2, and CeO2, heterogeneous photocatalysis has demonstrated its effectiveness in breaking down a variety of different pollutants into biodegradable molecules, which may then be mineralized into innocuous carbon dioxide and water. We decided to use titanium dioxide for our project. The optical and practical properties of titanium dioxide photocatalyst made it one of the most significant.



2. EXPERIMENTAL

2.1Materials

Samples of wastewater were taken for the current investigation from a textile factory in the Tamil Nadu district of Erode. All phases of the dying process, including spinning, weaving, knitting, dying, printing, and so on, produced effluent samples. The wastewater was gathered and stored at room temperature in five-liter polythene containers, which were carefully transported to the laboratory. Analytical grade reagents were employed as chemicals for the examination of discarded liquor. According to conventional protocols, the physical and chemical properties of textile wastewater effluents, including pH, total solids (TS),

ISBN: 978-81-965236-7-1

alkalinity, COD, BOD, total dissolved solids (TDS), total suspended solids (TSS), calcium, and total hardness, were evaluated.

2.2 Photocatalytic Mechanism

When photocatalyst titanium dioxide (TiO2) absorbs Ultraviolet (UV) radiation from sunlight or illuminated light source (fluorescent lamps), it will produce pairs of electrons and holes. When titanium dioxide is exposed to light, its valence band electron is activated. The excited electron's surplus energy propelled it into titanium dioxide's conduction band, where it formed the negative electron (e-) and positive hole (h+) pairs. 'Photo-excitation' state of the semiconductor describes this stage. The term 'Band Gap' refers to the energy differential that exists between the conduction and valence bands. The wavelength of light required for photo-excitation is equal to 3.2 eV (band gap energy) / 1240 (Planck's constant, h) = 388

2.3 Design of Photoreactor

The six-phase, hexagon-shaped photo-catalytic reactor was constructed using a wooden box as its component. Three 8-watt lamps are located at the top of the planned photo-catalytic reactor. To prevent the particle settling in the beaker, it contains a magnetic stirrer with a magnetic bar. The percentage of conversion will be used to assess the reactor's performance. Three hours were spent running the reactor. The process of photochemically oxidizing both organic and inorganic contaminants is quickly gaining popularity as a wastewater treatment and water purification method. Because artificial light sources need more efficient energy distribution, they consume more energy. This method is recommended for toxicity contaminants in a specific concentration range below the recommended levels for recovery and above the levels for conventional biological treatment. The efficiency of the treatment is significantly influenced by the choice of oxidation system and light source, as well as the setting of critical parameters. Enough UV radiation must enter the radiated liquid to be effective; in a non-transparent environment, UV radiation is limited to the area immediately surrounding the UV lamp surface. Another prerequisite for practical applications is high mass transfer rates for substantial oxygen uptake at the gas-liquid interface and for effective interaction between the pollutant and the photocatalyst. In this regard, reactor design for efficient wastewater treatment has been a challenging problem. Numerous varieties of photo reactors have already been researched, used, documented, and granted patents. In order to treat wastewater on a laboratory and industrial scale, this research proposes revisions to a few traditional and innovative photo reactors that are outfitted with UV lamps or operate in sun radiation.

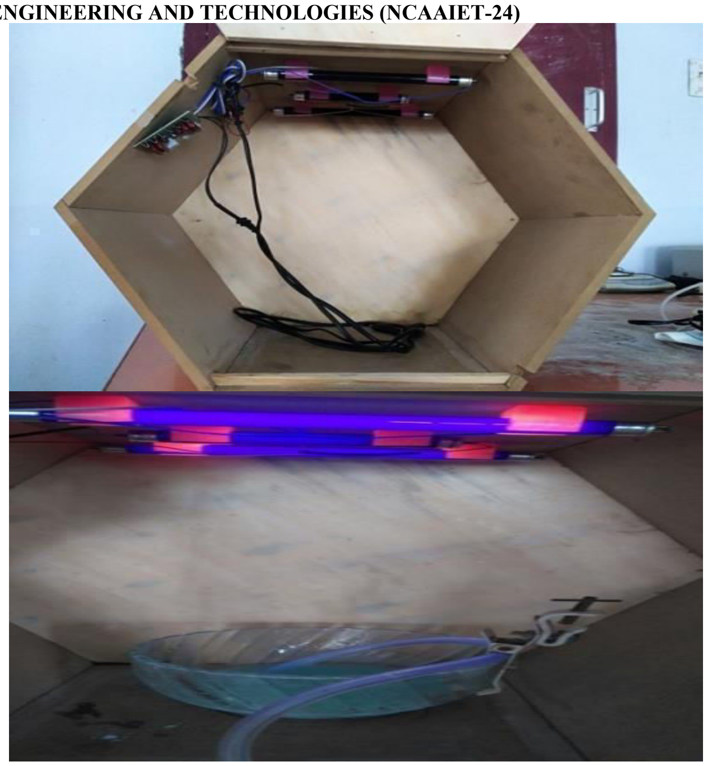


Figure 2.3 Photoreactor setup

3. RESULTS AND DISCUSSION

One of the main causes of water contamination is the textile industry. Higher values of COD, color, calcium hardness, turbidity, pH, alkalinity, total solids, total dissolved solids, total suspended solids, and BOD must be determined for this particular type of textile waste water. Nonetheless, a notable decrease was noted in the physiochemical parameter values. The effluent sample that was apparently taken during the textile processing and washing operation had a strong odor and was blue in color. Determining the ideal catalyst loading for effective reduction is desirable. The amount of catalyst Titanium dioxide (TiO2) per 250 ml of sample was varied from 2g to 10g, and the ultra violet (UV) irradiation time was set at 2 hours for a series of studies.

3.1 COD

Table 3.1 COD calculation

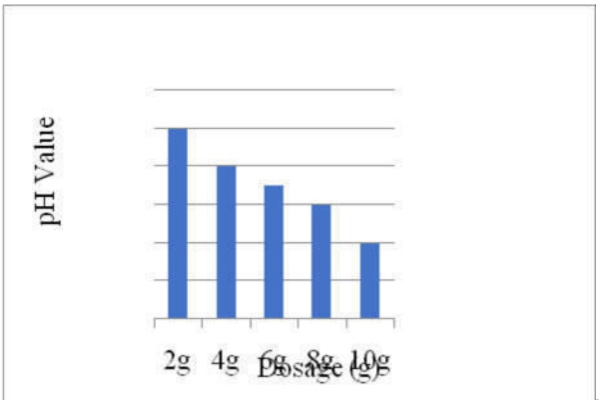
Dosage of TiO_2 in (g)	COD in mg/l	Efficiency (%)
2	300	75
4	250	80
6	200	82
8	150	87
10	100	91

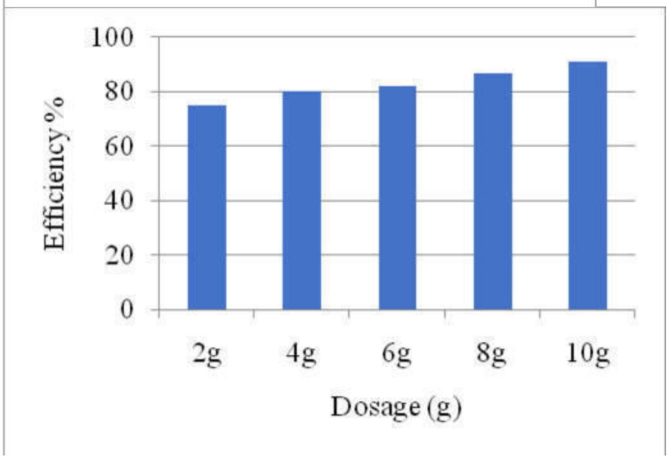
ISBN: 978-81-965236-7-1

Dosage of TiO_2 in(g)	Alkalinity (mg/l)	Efficiency (%)
2	300	33
4	270	40
6	220	51
8	190	57
10	150	66

3.5 ALKALINITY

Table 3.5 Alkalinity calculation





At each dosage of 2g, 4g, 6g, 8g, and 10g of TiO2 catalyst, the percentage (%) reduction in Calcium Hardness is nearly increased after the test is over. The results indicate that 10 g of TiO2 can lower calcium hardness by 79.26%.

Figure 3.1 COD Chart

The above chart illustrates how the percentage (%) decrease in COD increases with each dosage of 2g, 4g, 6g, 8g, and 10g of TiO2 catalyst. The findings indicate

Dosage of TiO_2 in(g)	Turbidity (NTU)	Efficiency (%)
2	32	27
4	25	43
6	15	65
8	12	72
10	9	79

that 10 g of TiO2 can lower 91% of COD.

3.2 CALCIUM HARDNESS

Table 3.2 Calcium Hardness calculation

Dosage of TiO_2 in (g)	Hardness (mg/l)	Efficiency (%)
2	100.2	65.44
4	92.18	68.21
6	80.16	72.35
8	76.15	73.74
10	60.12	79.26

3.3 TURBIDITY

Table 3.3 Turbidity calculation

Every time a dosage of 2g, 4g, 6g, 8g, and 10g of TiO2 catalyst is administered, the percentage (%) reduction in turbidity is nearly increased. The findings indicate that 10 g of TiO2 can lower turbidity by 79%.

3.4 pH

Table 3.4 pH value

Figure 3.4 pH chartEvery dosage of 2g, 4g, 6g, 8g, and 10g of TiO2 catalyst results in a drop in pH value. The findings indicate that 10 g of TiO2 reduces the pH value to 8.3.

Dosage of TiO_2 in (g)	pH value
2	8.6
4	8.5
6	8.4
8	8.4
10	8.3

ISBN: 978-81-965236-7-1

Dosage of TiO_2 in (g)	COD (%)	Calcium Hardness (%)	Turbidity (%)	Alkalinity (%)	Total Solids (%)	pH Values	BOD (%)
2g	75	65.44	27	33	43	8.6	53
4g	80	68.21	43	40	56	8.5	47
6g	82	72.35	65	51	59	8.4	42
8g	87	73.74	72	57	62	8.4	37
10 g	91	79.26	79	66	69	8.3	32

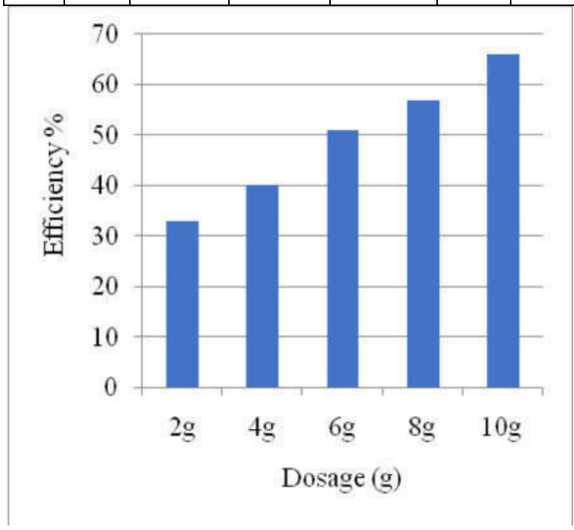


Figure 3.5 Alkalinity chart

As can be observed from the following chart, the dose of 2g, 4g, 6g, 8g, and 10g of TiO2 catalyst nearly increases the percentage (%) reduction in alkalinity. The findings indicate that 10 g of TiO2 can lower alkalinity by 66%.

3.6 TOTAL SOLIDS

Table 3.6 Total Solids calculation

Dosage of TiO_2 in (g)	Total solids (g)	Total dissolved solids (g)	Total suspended solids (g)	Efficiency (%)
2	23.6	21.3	2.3	43
4	23	20.8	2.2	56
6	21.7	20	1.7	59
8	21.1	20.1	1	62
10	21	20.5	0.5	69

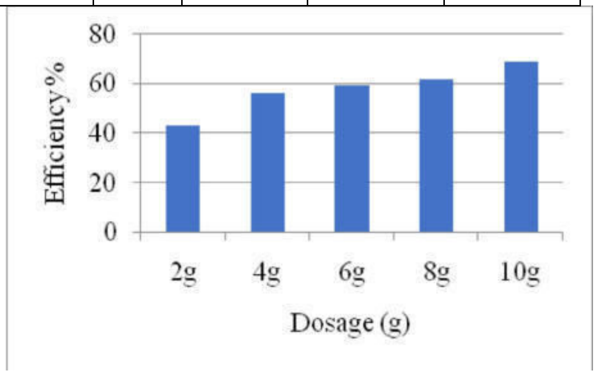


Figure 3.6 Total solids chart

The percentage (%) decrease in total suspended solids is nearly increased for different dosages of 2g, 4g, 6g, 8g, and 10g of TiO2 catalyst, as shown in the above chart. The results indicate that 10 g of TiO2

ISBN: 978-81-965236-7-1

The final efficiency of COD, total solids, alkalinity, turbidity, calcium, and BOD are displayed on this graph. The different dosages of TiO2 lead to an increase in the elimination of COD, total solids, alkalinity, turbidity, and calcium. The reduction efficiency is directly correlated with different TiO2 dosages. BOD is not a good fit for this approach.

4. CONCLUSION

The textile industry consists of a series of processes which lead to discharge of harmful pollutants into the effluent stream. If these contaminants are released into the environment untreated, they can have anegative impact on aquatic life and the environment. The wastewater from the textile industry must therefore be appropriately cleansed and released. During the production process, the textile industry uses a lot of water and a variety of chemicals. There are a lot of chemicals and colors in the waste water this procedure produces, which can be harmful to both the environment and human health. Textile waste water can lead to skin ulcers, bleeding, nausea, dermatitis, and skin irritation. The compounds in the water prevent photosynthesis and reoxygenation by obstructing sunlight and raising the biological oxygen requirement.

It was discovered that the effluents treated with the advanced oxidation process reduced the high values of COD (1200 mg/l) and pH (7.2). 91% decrease in calcium hardness (290 mg/l) and 10g of TiO2. 10g of TiO2 had a 79.26% decrease in alkalinity (450 mg/l). 66% decrease in TSS (1.3 g), TDS (22.3 g), TS (21 g), and TiO2 (10 g) 69% decrease in turbidity (44 NTU) in 10g of TiO2. 79% decrease in BOD (121.82 mg/l) and TiO2 (10g) 53% decrease in 2g of TiO2 and intensity of color (dark yellow). The study examined the photocatalytic activity of TiO2 on various commercial dyes and organic contaminants. Subsequent research utilizing different concentrations of TiO2 revealed that the most efficient concentration for photoreduction was 2 g, 4 g, 6 g, 8 g, and 10 g of TiO2 in a 250 ml effluent sample for two hours. The developed technique, which was used commercially to treat textile wastewater, demonstrates the significant potential of TiO2 in reducing organic contaminants in effluents. The decrease in physiochemical parameter values demonstrates TiO2's capacity to decolorize.

REFERENCES

1.Akira Fujishima (2000), “Titanium dioxide photocatalysis”. Journal Photochemistry and Photobiology C: Photochemistry Reviews 1–21.

2.AE Ghaly (2014), “Production, characterization and treatment of textile Effluents.A critical Review”. Journal of chemical engineering and process Technology.

3.Arasappan Sugasini and KalyanaramanRajagopaln (2015), “Characterization of Physicochemical Parameters and heavy metal analysis of Tannery Effluent”. International journal of current microbiology and applied science 4(9): 349-359.

4.C.M., Dawood Sharief, and S.Nausheen, (2004), “Characterization of diary effluent”. J. Ind. Pollut. Control, 20: 131 – 136.

5.C.Su, B.Y. Hong, and C.M. Tseng, (2004), “Sol-gel preparation and photocatalysis of titanium dioxide, Catal”. Today 96: 119 - 126

6.Chavan.R.B (2001), “Indian textile industry and environmental issue”. Indian journal of fibre and textile research vol.26,pp. 11-21.

7.E. Forgacs, T. Cserhati, and G. Oros, (2004), “Removal of synthetic dyes from wastewaters”. A review, Environ. Int. 30: 953 – 971.

8. Islam .B.I., A.E Musa, E.H. Ibrahim, Salma A.A Sharafa, and Babiker M. Elfaki (2014), “Evaluation and Characterization of Tannery Wastewater Journal of forest products and industries”. 3(3), 141-150 ISSN:2325–4513.

9.Jahan .M.A.A, N. Akhtar, N.M.S. Khan, C. K. Roy and R.Islam and Nurunnabi (2014), “Characterization of tannery wastewater and its treatment by aquatic macrophytes and algae”. Bangladesh Journal of science and industrial research 49(4), 233-242.

10.M.A. Fox, and M.T. Dulay, (1993), ”Heterogeneous photocatalysis”, chem. Rev. 93: 341.

11.M.N.Chong, C.W.Chow, and C.Saint (2010), "Recent developments in photocatalytic water treatment technology". A review water Res. 44: 2997- 3027.

12.Rita Kant (2012), "Textile dyeing industry an environmental hazard". Vol.4, No.1, 22-26.

13.Sharmila Pokharna and Rupali Shrivastava (2013), "Photocatalytic Treatment of Textile Industry Effluent Using Titanium Oxide". International Journal of Recent Research and Review, Vol. VI, Issue 2, September.

14.Shamsa Al Sadi, Geetha Devi.M, Murtuza Ali Syed, Feroz.S and Varghese.M.J (2015), "Treatment of textile Industry Waste water using Solar photo Catalysis". Research Journal of Chemical Sciences ISSN 2231-606X Vol. 5(10), 20-27, October Res. J. Chem. Sci.

15.Siew-Teng Ong , Pei-Sin Keng , Weng-Nam Lee , Sie-Tiong Ha and Yung-Tse Hung (2011), "Dye Waste Treatment Water". 3, 157-176; doi: 10.3390/w3010157.

16.Shashwat Katiyar (2011), "Impact of tannery effluent with special reference to seasonal variation on physico-chemical characteristics of river water at Kanpur (U.P), India". Journal of Environmental & Analytical Toxicology DOI: 10.4172/2161-0525.1000115.

17.Ting Ke Tseng, Yi Shing Lin, Yi Ju Chen and Hsin Chu (2010), "A Review of Photocatalysts Prepared by Sol-Gel Method for VOCs Removal". international journal of molecular science 11, 2336-2361; doi: 10.3390/ijms11062336.

18.Treatment of textile effluents by h2o2/uv oxidation Combined with reverse osmosis (ro); kangshyh-Fang, yen hsing-yuan, yang mu-hoe; journal of Environmental science and health. Part a,Toxic/hazardous substances & environmental engineering issn 1093-4529, 1998

A REVIEW OF RECENT DEVELOPMENTS IN ULTRASONIC WELDING AND MECHANICAL PROPERTY INVESTIGATIONS

Madhan Kumar Pandy [1*], Yogesh Kanna Dhanasekaran[2]

pmathankumarbe@gmail.com[1]*,yogeshon2002@gmail.com[2]

[1]Assistant Professor, [2] UG Student

[1]Department of Mechanical Engineering,

[1]Mangayarkarasi College of Engineering, Paravai , Madurai, India

Abstract: Engineering constructions made of several materials are becoming increasingly and more effective, especially in transportation-related applications. Combining many materials results in designs that are more effective and perform better than they could do with just one material, which is advantageous for a variety of sectors. Because ultrasonic welding creates excellent welds without the need for filler material, it may be used to join thin sheets of copper, aluminum, magnesium, and brass, among other non-ferrous metals. This connection is dependable, robust, and able to bear heavy weights and strains. These investigations assess the correlation between several welding parameters, including hold time, weld pressure, and weld duration, and the tensile strength of ultrasonic-welded sheets. It has been shown that the connection between the sheets may be strengthened by prolonging the weld and increasing the welding pressure. Applying an interlayer has been found to increase the joint's mechanical properties, namely its fatigue life and tensile strength. It was proven that adding a copper or zinc interlayer improved the tensile strength of the joint. The interlayer's ability to function as a barrier between the sheets, preventing the formation of intermetallic compounds and other defects that might weaken the joint, is what gives the joint its improved

Mechanical capabilities. The characteristics of ultrasonic welding, the interface between welding joints, performance, and welding factors for Different materials are covered in this review paper.

***Index Terms* – Ultrasonic welding, parameters, interlayer, fatigue life, joint's tensile strength.**

I. INTRODUCTION

Welding is a fabrication process whereby two or more parts are fused together by means of heat, pressure or both forming a join as the parts cool. Welding is usually used on metals and thermoplastics but can also be used on wood. The completed welded joint may be referred to as a weldment. Basically, welding may be classified into three types: Plastic welding: In plastic welding or pressure welding process, the pieces of metal to be joined are heated to a plastic state and then forced together by external pressure. These welding are also known as liquid-solid welding process. This procedure is used in forge welding and resistance welding.

Fusion welding: In the fusion welding or no pressure welding process, the material at the joint is heated to a molten state and allowed to solidify. These welding are also known as liquid state welding process. This includes gas welding, arc welding, thermite welding etc. Cold welding: In this welding process, the joints are produced without application of heat, but by applying pressure which results diffusion or inter-surface molecular fusion of the parts to be joined. It is also known as solid state welding process. This process is mainly used for welding nonferrous sheet metal, particularly aluminum and its alloys. This includes ultrasonic welding, friction welding, Explosive welding etc (Troughton M. J., 2009).

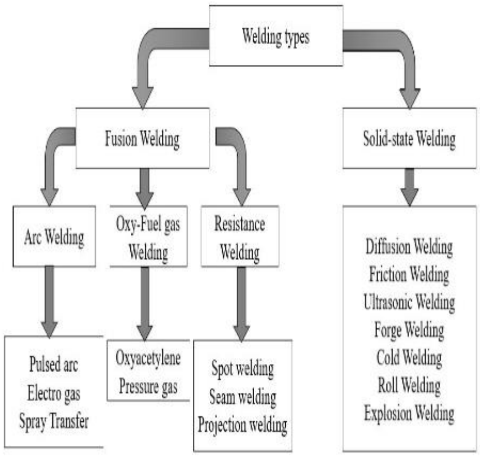


Figure 1. Types of Welding

II. ULTRASONIC WELDING

Ultrasonic welding is a type of solid-state welding as shown in Fig.1. Ultrasonic welding techniques have recently become extremely important in all industrial applications. Different metals and non-metals with varying melting points were treated using USW. This method makes it simple to fuse thin foil wires. With USW, high-quality welded joints can be produced without a protective gas shield. Ultrasonic welding (from Fig.2) is a widely used technique for joining metals and thermoplastics (Heinzle E. et al, 2006). The method employs ultrasonic vibrations at high frequencies of 20-40kHz and low amplitudes of 1-25µm to generate heat at the junction of the parts to be welded, causing the thermoplastics to melt, and become firmly attached upon cooling. This technique is known for its speed, with welding typically taking between 0.1 and 1.0 seconds (Davis J.R., 2003). The ultrasonic energy can also be used for reshaping thermoplastics and fitting metal sections in plastics to securely link dissimilar components. Ultrasound has been applied to steel joining

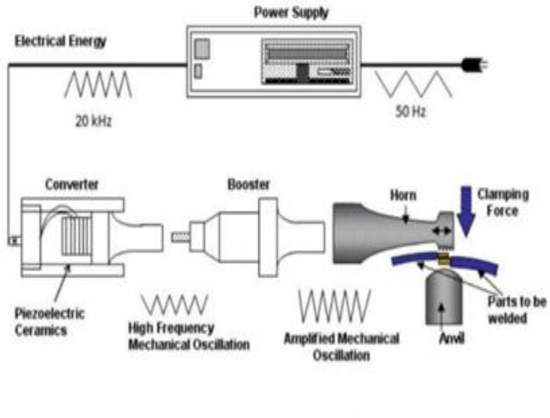


Figure2. Illustration of Ultrasonic Welding System

for over 60 years, enhancing grain refinement of fusion welds, and for brazing and soldering. The first steps towards the discovery of ultrasonic metallic welding (USMW) took place in the late 1940s when ultrasonic vibrations were applied to traditional resistance welding equipment at the Aero projects Company of West Chester, Pennsylvania. The goal was to decrease floor resistance in spot welding of aluminium (Liu J. et al, 2019).

III. WORKING PRINCIPLE OF ULTRASONIC WELDING

In the ultrasonic welding system (from Fig. 2) oscillation energy is supplied to the part to be welded by the welding tool, the so-called sonotrode. The very briefly occurring friction of the material particles causes the material to plasticise very quickly in the desired areas. The order of magnitude of the plasticizing depends upon the amount of ultrasonic energy supplied. Subject to proper application it is almost impossible for the materials to be altered or detrimentally affected in any way in areas outside the welding zone. Depending upon the type of plastic material, different solidification times are required "at the joint of plasticized material" to resolidify

under the effect of the still present mechanical pressure. This process is called the cooling or holding time (Deekshant Varshney K., 2021). The USW systems utilize an in-process weld cycle in an effort to mitigate welding variability and stabilize weld quality, commonly done by measuring and controlling the electrical input to the transducer. Although it will be sufficient to control the speed of the sonotrode, it cannot provide detailed information regarding the forces at the weld interface and
their influence on weld quality. Besides, to address the root causes of weld variance, the electrical impedance of the transducer is determined by building overall representations of the system, displaying it as an equivalent electrical network (Tariq H., 2014). The relationship between this electrical entry impedance and the

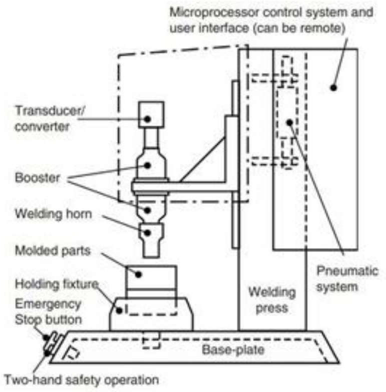


Figure 3. Components in Ultrasonic Welding System

mechanical impedance at the weld is difficult to predict due to the many transfer elements like transducers, acoustic components and tooling that are situated between the welding system and the weld itself. Therefore, it is evident that, solely relying on the electrical input parameters to manage the welding process, does not guarantee optimal weld quality (Emamian S. R., and Mirzaei M., 2021).

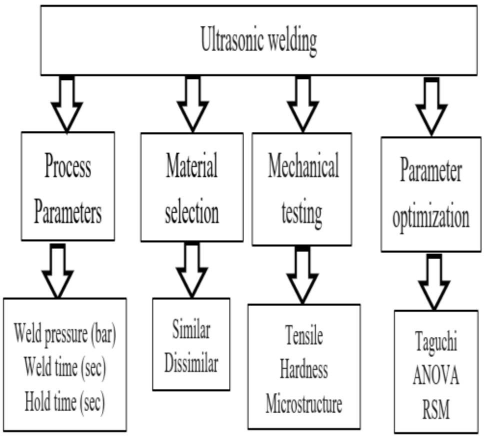
In the Ultrasonic welding machine (from Fig. 3), the sonotrode tip is brought into contact with the resonant part, allowing it to move freely within the required amplitude of oscillation. The ultrasonic pulse starts immediately. Once the right amount of plasticizing has happened where the parts meet, pressure increases to the selected level. This occurs rapidly and is completed just before welding. After the ultrasonic impulse ends, the force weakly increases, then a cooling phase starts; when it's finished, the machine returns to its original state, thus signalling the end of the welding process. The cycle takes a short duration. Therefore, complete welding process can take from 0.1 to 5 seconds, depending on the application (Macwan et al, 2015). The main components of ultrasonic welding systems are:

i. **Sonotrode:** Depending on usage the following materials can be used; Titanium based alloy, hardened steel, special hardened steel and ferro-titanite.
ii. **Sonotrode support ring:** The sonotrode support ring is made from brass and is used for support at the front of the resonance unit. All sonotrodes are fitted with a shrunk on ring for the M4000 model.
iii. **Booster:** The booster transforms the amplitude. There are different booster transmission ratios available. Which type you use depends largely upon the respective welding application and we will specify this on a case-by case basis. A set screw connects the booster and sonotrode together.
iv. **Booster support ring:** The shrunk-on booster support ring assumes the rear support function of the entire resonance unit.
v. **Converter:** The mechanical ultrasonic oscillations are generated in the converter. The converter is encapsulated and can be air cooled If

required.

vi. **HF contact:** When the converter is installed, a spring-mounted element transfers the high frequency tension to the HF contact. The most important parameters to be considered in USW can be separated into system and materials parameters. The main system parameters are Welding time, Weld pressure, Hold time, Amplitude of vibration, Frequency, Electrical energy. The material parameters, including workpiece features, include Sample cleanliness (Oxides or Contaminants), Crystal structure, Dimensions, Hardness.

IV.METHODOLOGY



V. METAL WELDING PROCESS

In this process, the two pieces of metal are joined by vibrating them around 20,000 cycles per second. The vibration causes the two pieces of metal to come into contact and generate frictional heat, which melts the surfaces of the two pieces, creating a strong weld. The main parameters used in this ultrasonic welding machine are: Welding time, Hold time, Weld pressure and Frequency and amplitude of vibration. Ultrasonic metal welding is a welding process that utilizes high frequency sound waves, rather than heat, to join pieces of metal together. suggested that based on the selected tabular array with welding parameters, the next step is to connect transducer, which is used to generate the high-frequency vibration during the welding process. The transducer then delivers ultrasonic energy and transforms the copper interlayer into a liquid, which helps to join the two metals together. Frictional heat is also generated by the vibrations, which can be adjusted to suit the welding requirements and allow for an effective weld (Chen et al., 2016). Finally, the joint is cooled down to a temperature that does not compromise the strength of the weld. This cooling process helps to solidify the weld and ensure that it has the necessary strength and integrity to withstand demanding applications. Ultrasonic welding process is based on the following four processes: Clamping, transmitting vibrations, Holding and Unloading.

Clamping: First, we must clamp the sheet materials to be welded on the anvil of the ultrasonic welding machine as a lap joint process. Clamp the sheets on the anvil tightly so that the sheets do not get disturbed by the vibrations transmitted from the Horn (Sonotrode) as shown in the Fig. 5.

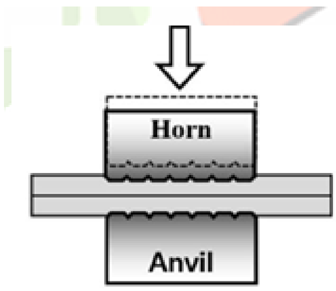


Figure 5. Clamping of sheet metals on the anvil

Transmitting Vibrations: After the clamping process, high frequency vibrations are transmitted from the sonotrode to the sheet material which clamped on the anvil. The pulse of energy causes the workpiece to undergo localized plastic deformation, leading to the formation of a joint as shown in the Fig. 6.

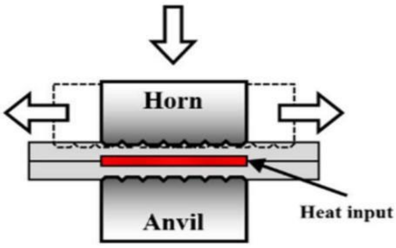


Figure 6. Transmitting Vibrations through the selected sheet metals

Holding: This holding process is followed by transmitting the high frequency vibrations to the sheet metals. In this process the horn exerts certain pressure over the sheet metals (from Fig.7) and it is held over the anvil for some time to create a strong joint between the two metal sheets. Then a weld nugget is formed.

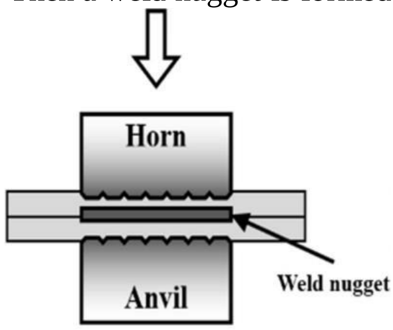


Figure 7. Holding of the ultrasonic welded sheet metals

Unloading/Unclamping: Finally, after the holding process, the Fig.8 shows that a strong weld nugget joint will be formed which forms indentation of the horn on the sheet metal. The weld formed between the two metal sheets forms an intermetallic compound (IMC's), the welded sheets will be unclamped by unscrewing the screw on the anvil.

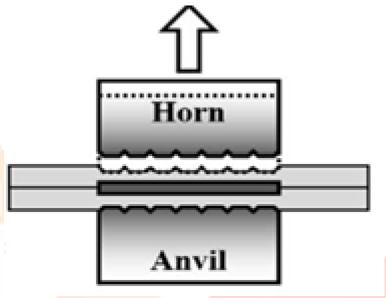


Figure 8. Unloading/unclamping the ultrasonic welded sheet metals

VI.EFFECT OF PROCESS PARAMETERS

To further enhance the weld strength, the three process parameters - pressure, time, and amplitude - should be optimized. As a result, not only will there be a reduction in the emission of pollutants, but the fuel efficiency of vehicles and aircraft could also be improved. The ultrasonic welding utilizes high-frequency vibrations with low heat input, the process being notably beneficial in the automotive, aerospace, appliance, and medical industries. This work investigated the influence of welding time, pressure, and vibration amplitude of 0.3 mm thick Copper sheets, by means of join characteristics and shear strength. Analysis of variance revealed that the main factor impacting energy absorption is welding time, with pressure and amplitude proving influential also. Results indicated successful application of USW with most welds attaining a strength higher than the base material **(Koen et al., 2023)**. It is explored that under optimal ultrasonic welding parameters (0.8 s welding time, 4 bar pressure, 62.4 µm amplitude), a joint with low gap fraction of 2.07% was obtained, and the maximum T-peel strength reached 432.9 N. Electron backscattered diffraction technology was employed to analyses grain boundary types and texture evolution. Continuous texture and copious amounts of large angle grain boundaries composed of high-density dislocations and substructure were observed in the bonding interfaces. The findings suggested that plastic deformation occurred in the bonding region and provided energy for the motion and rearrangement of dislocations, leading to the formation of new interfaces between the copper wires via recrystallization of the copper under high temperature. studied that high-power ultrasonic spot welding (USW) was employed to unify copper and AZ31B magnesium alloy with different welding energies as shown in Fig 9. Adhesion microstructure and durability of disparate associations were observed. The diffusion augmented throughout USW created an interface diffusion layer that was contrived of Mg and Mg2Cu eutectic property. The diffusion layer breadth intensified with higher welding energy or temperature at the joint interface. A distinctive diffusion pattern occurred at maximum welding energy of 2000 and 2500 J, which was caused by an internal pressure that triggered the close eutectic liquid at hot spots are observed in Fig.10. The tensile lap shear strength raised during the beginning, reached an apex value, then fell as welding energy augmented. Connections created with optimal welding parameters of 1500 J and 0.75 s separated in the pattern of cohesive failure observed in the boundary diffusion layer's eutectic structure (Hajian S. et al, 2021).

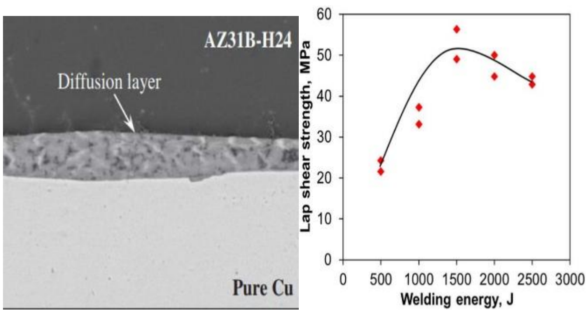


Figure 9. Image of ultrasonic welding of Mg and Cu and shear strength with respect to welding energy.

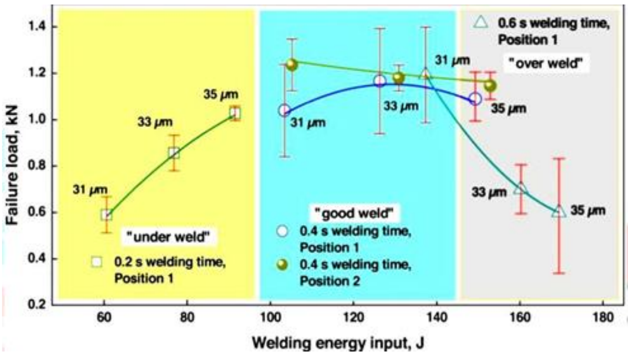


Figure 10. Effect of process parameters on joint tensile strength.

The use of welded structures made of AZ31B magnesium alloy and AA6061 aluminium alloy has become a popular means of constructing lightweight automobile body designs. In this paper, ultrasonic spot welding (USW) is experimented on to raise the strength of the joint. It is found from Fig.11 that with a welding energy of 1540 J, the joint starts to melt slightly. At the 1540 J energy level, there is a sudden surge in β phase which then greatly reduces the joint's performance. Upon inspection of the fracture, it is discovered to be a cleavage fracture that is accompanied by multiple secondary cracks (**Zhanzhan et al, 2021**).

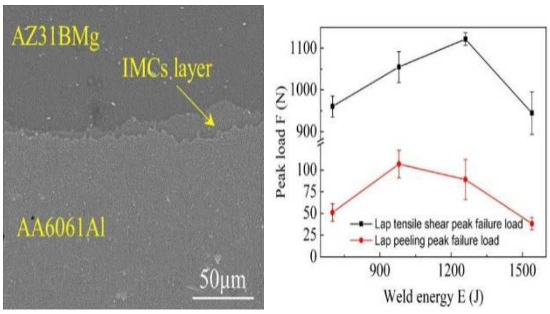


Figure 11. Image of ultrasonic welded Mg and Al sheet with formation of IMC

VII.EFFECT OF MATERIALS USED

The automotive and aerospace industries are increasingly turning to lightweight materials, such as **magnesium** and **aluminum** alloys, to manufacture components. The use of these non-ferrous metals like magnesium and aluminum alloy is increasingly becoming popular in industries dealing with marine, chemical metallurgy, and electronic appliances due to its high strength-to-weight ratio, excellent strength and rigidity, favorable cost, and easy machining characteristic. These materials have low density, great specific strength, decent damping properties, and can be cheaply cast. Ultrasonic welding is one of the most energy-efficient, solid-state joining techniques available, and it has been found to provide maximum weld strength (Felice R. et al, 2020). There are some critical problems and challenges going through to joining heavily responsible structural aspects in the automobile and aerospace industries, especially in the automobile industries for joining 5XXX and 6XXX sequence aluminum and in aerospace industries for joining the 2XXX, 6XXX and 7XXX aluminum. Because of the thickness and elastic vibrations of the parts, these challenges are faced. For the foils and wires, these challenges d no longer occur. The two key areas have emerged that hinder development from a realistic purpose standpoint. The first trouble is the sticking between the welded parts and the weld tooling. The second problem is that of various weld satisfaction when successive welds are made with what show up to be equal machine welding parameters (Basak S. et al, 2021), At first AA6061 introduced as "Alloy 61S", 6061 is an aluminum-alloy containing magnesium, silicon, and other elements. It is precipitation-hardened and has good strength, weldability, and extrusion properties. This alloy was developed in 1935.Applications: Aircraft, camera and marine parts, electrical connectors, decoration, hinges, magneto and brake components, hydraulic pistons, appliances, valves, bikes - all these items are suitable for fitting with the parts mentioned. Aluminum alloy 6061 is a medium-high strength alloy with better corrosion resistance and weldability than 6005A. Also, it has medium fatigue strength and good cold formability. 6061 aluminum is one of the 6xxx alloy types that use magnesium and silicon as primary elements (Zhang L. et al, 2021). stated that AZ31B is a formable and weldable magnesium alloy with good strength and ductility when used at room-temperature. Its versatility makes it suitable for diverse applications such as aircraft fuselages, cell phones, laptops, speaker cones and tools made from concrete. It can also be super formed at high temperatures, allowing it to produce intricate components used in the automotive industry. Additionally, it is not affected by high humidity and salt spray, making it an ideal choice for applications in marine environments (Jayasathyakawin S. et al, 2020).

VIII.EFFECT OF INTERLAYER USED

Ultrasonic spot welding of ZEK100-O Mg alloy to Al6022-T43 Al alloy with a Cu interlayer was successful, and various aspects of the process were examined. The Fig. 12. shows the ZEK100-O Mg alloy to Al6022-T43 Al alloy with a Cu interlayer in the middle of the sheets to be joined.

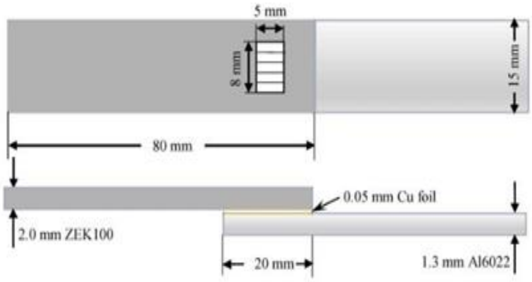


Figure 12. Image of ZEK100-O Mg and Al6062 alloy sheet with Cu interlayer

Microstructural analysis of Mg/Cu and Al/Cu interfaces revealed that while a diffusion layer formed at each interface, the Mg/Cu one was considerably thicker and composed of α-Mg and Mg_2Cu eutectic, while a thin layer of Al_2Cu and “barb”-like interlocks were found at the Al/Cu interface. Furthermore, the tensile lap shear strength increased with the welding energy reaching a peak value at 1500 J, reaching a level of 80% that of the strength of Al6022-Al6022 similar joints, and almost the same as ZEK100-ZEK100 similar joints,

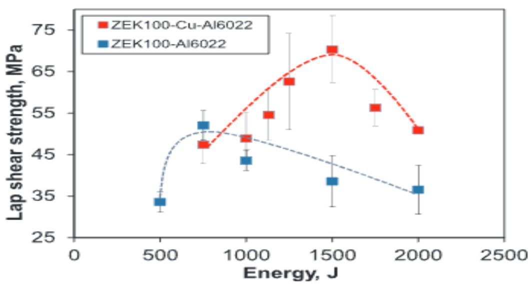


Figure 13. ZEK100-Al6022 vs ZEK100-Cu-Al6022

The joining of the Mg/Al dissimilar metals was accomplished with ultrasound spot welding (USW) supplemented with a Zn interlayer (From Fig. 14). Here, we studied the layer formation, microstructure, mechanical properties, and fracture behaviour of the structures obtained when mating Mg/Zn/Al by USW. Results indicated that four distinct morphologies, due to the variable temperature and stress distribution, form the interface. The integration of a Zn interlayer checked the molecular diffusing of Mg and Al atoms, thus inhibiting the genesis of Mg-Al IMC. The formed Mg-Zn and Zn-Al structure gave satisfactory results and exhibited minor brittleness. The greatest shear force attained with Mg/Al joints USW with Zn interlayer was approximately 89.6% greater than those of ones without the interlayer (**Xiaoyan et al,** 2019).

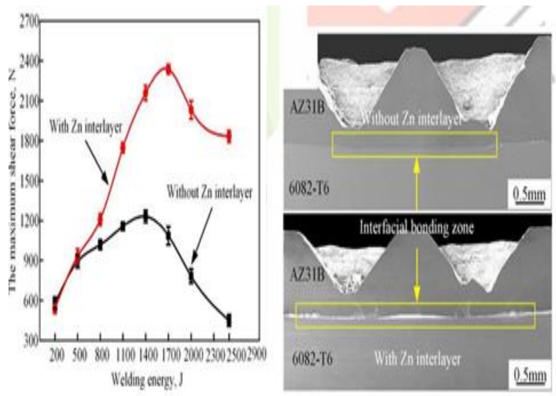


Figure 14. Image of joining of Al and Mg with Zn interlayer.

The incorporation of a Cu coating metallic interlayer in high-power ultrasonic spot welding (HP- USW) was studied for its weldability, joint strength, and its effect on the microstructure of AZ31B Mg alloy. Joints with the interlayer showed good weldability while requiring less energy, and their strength was comparable to joints without it (From Fig. 15) Temperature measurements, hardness data, and electron probe micro-analyzer (EPMA) results indicated the formation of Mg_2Cu in the interfacial regions. The changes in thermal and vibrational properties, grain structure, and the ternary alloy of MgCuxAly at the interface centerline suggest that this composited structure accounts for the joint strengthening (Chihiro et al, 2019).

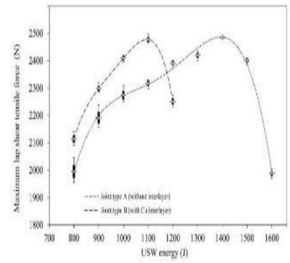


Figure 15. Image of comparative lap shear tensile force data vs energy, in high-power ultrasonic spot welding (HP-USW) of AZ31B, with and without interlayer (A: without interlayer; B: using Cu coating as interlayer)

The influence of gold coating and bare nickel interlayers on the microstructure and mechanical properties of aluminum-magnesium dissimilar resistance spot welds. Spot welds were performed with welding currents from 16 to 24 kA, with a fixed welding time of five cycles. Welds with bare nickel interlayers resulted in no joints; however, with the gold coating added to the nickel surface, resistances spot welds conforming to AWS D17.2 standards were created. The average lap shear strength of the welding compositions was almost 90% of the same of AZ-31B spot weld strengths. The fusion nugget size was evaluated, and the interfacial microstructure and fracture surface morphology were observed and recorded (Penner et al, 2013**)**.

Ultrasonic welding with a copper interlayer between aluminum and magnesium metal sheets is a process used to join two or more metals together as shown in Fig. 16. It is an economical and efficient way to join two metals, particularly when the two metals have different melting points. Ultrasonic welding works by using high frequency vibrations to generate heat at the surface and quickly melt the copper interlayer, which in turn melts and bonds the two metals together (Singh P. et al, 2017).

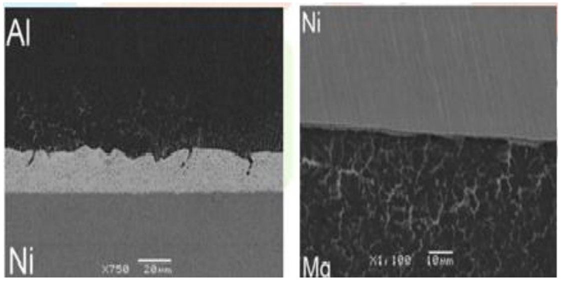


Figure 16. Image of Aluminium/nickel interface of weld (with Au coated Ni interlayer, 24 kA) and Magnesium/nickel interfaces in weld (with Au coated Ni interlayer, 24 kA)

The copper interlayer acts as a heat conductor and provides a strong bond between the aluminum and magnesium metal sheets. It also helps to prevent galvanic corrosion, which can occur when two dissimilar metals are joined together. The copper interlayer also helps to absorb shock and vibration, making the welded joint more durable and less prone to fatigue and cracking.An important consideration when using a copper interlayer during ultrasonic welding is the sheet thickness of each substrate. The sheet thickness of the substrate should be kept as close to that of the copper interlayer as possible, or thinner, if possible, to ensure an effective weld. If the sheet thickness of the two work pieces is significantly different, it can lead to an incomplete weld and a joint that is not as strong which expected to be **(**Chihiro et al, 2019).

Pure copper is an ideal interlayer material for ultrasonic welding due to its excellent mechanical properties. It has good electrical and thermal conductivity, making it ideal for use in applications where heat and electricity must be transferred quickly and efficiently. Copper also has high levels of ductility and malleability, meaning it can be easily bent and stretched into different shapes without fracturing. Pure copper also has excellent corrosion resistance and is resistant to abrasion, making it ideal for use in environments where exposure to corrosive chemicals or abrasive surfaces is likely. Additionally, copper is highly resistant to fatigue, meaning it can handle repeated stress without cracking or breaking· Another important point to consider when using copper as an interlayer is its ability to form an alloy with other materials. When the copper is subjected to vibrations from the transducer, it will form a liquid, allowing it to fuse with the two metals being welded together. This process helps to promote an even and complete weld, improving weld strength and joint integrity (Farzami F. et al, 2019).

IX. CONCLUSION

Ultrasonic Welding can lead to the development of new techniques and equipment, which can enhance the performance, reliability, and cost-effectiveness of the process. Additionally, understanding the science behind ultrasonic welding can help researchers optimize the process for specific materials and applications, leading to improved quality and performance. There is a need to study Ultrasonic Welding due to its numerous advantages, such as the ability to join different materials, high production rates, and low energy consumption. It is widely used in the automotive, electronics, medical device, and packaging industries, among others. Ultrasonic metal welding is a solid-state welding process that utilizes high-frequency vibrations to join two metal pieces together. Unlike traditional welding methods, ultrasonic metal welding does not require the use of heat or any external filler material. Instead, the process relies on mechanical energy to create a strong bond between the two metals. some of the advantages of ultrasonic metal welding are: High Precision, Strong Welds, Cost-Effective, No Heat Distortion, Environmentally Friendly, Versatility.

REFERENCES

[1] Akbari A., Gholami S., and Rezaei M., (2021), ‘Microstructure and mechanical properties of ultrasonic spot welded AA6061 aluminum alloy sheets’, Journal of Materials Research and Technology, Vol. 10, pp. 1085-1094.

[2] Basak S., and Kumar S., (2021), ‘Experimental Investigation on Ultrasonic Welding of Similar and Dissimilar Thermoplastics: A Review’, Polymers and Polymer Composites ,Vol.29, pp.289- 307.

[3] Chen D., Gao L., Liu H., Wu Y., and Xu L., (2016), ‘Investigation of the joint properties of ultrasonic spot welded AZ31B magnesium alloy to AA6061 aluminum alloy’, Journal of Materials Processing Technology, Vol. 229, pp. 65-72.

[4] Chihiro I., Amir B., Shigeo S., and Suguru T., (2019) ‘Interface Characterization of Ultrasonic Spot-Welded Mg Alloy Interlayered with Cu Coating’, Metals, Vol.9, pp.1-18.

[5] Davis J.R., (2003), ‘Handbook of Aluminum’, Physical Metallurgy and Processes, 1st edition, Vol. 1, pp.26-38.

[6] Deekshant Varshney K., (2021), ‘Application and use of different aluminium alloys with respect to workability, strength and welding parameter optimization’, Ain Shams Engineering Journal, Vol. 12, pp. 1143-1152.

[7] Emamian S. R., and Mirzaei M., (2021), 'Effect of ultrasonic welding parameters on the microstructure and mechanical properties of AZ31B magnesium alloy sheets', Materials Science and Engineering: A, Vol. 809, pp. 111953.

[8] Faes K., (2023), 'Influence of the Process Parameters on the Properties of Cu-Cu Ultrasonic Welds', Journal of Manufacturing and Materials Processing, Vol.7, pp.19.

[9] Farzami F., Naseri M., and Sadeghian Z., (2019), 'Microstructure and mechanical properties of ultrasonic welded joints of AZ31B magnesium alloy to AA6061 aluminum alloy with copper interlayer', Journal of Manufacturing Processes, Vol.40, pp.123-132.

[10] Felice R., Hetal P., Vitantonio E., and Pierpaolo C., (2020) ,'Ultrasonic welding of magnesium alloys: a review', Materials and Manufacturing Processes, Vol.35, pp.1051-1068

[11] Ghobadi R., Yavari M., (2021), 'Effect of welding parameters on the microstructure and mechanical properties of ultrasonically welded AZ31B magnesium alloy sheets', Journal of Materials Research and Technology, Vol. 10, pp. 2181-2191.

[12] Hajian S., Hosseini S.M., Mahmoodi M., and Moslemi Naeini H. (2021), 'Effect of welding parameters on mechanical and microstructural properties of ultrasonic spot welded AA6061 aluminum alloy sheets', Journal of Materials Research and Technology, Vol. 10, pp. 1208-1218.

[13] Heinzle E., Wilhelm A., and Schmachtenberg H., (2006), 'Ultrasonic welding," in Plastics technology handbook', C. L. Beatty, Ed. New York: CRC Press, pp. 389–396.

[14] Jayasathyakawin S., (2020),'Mechanical properties and applications of Magnesium alloy – Review', Materials Today: Proceedings, Vol. 27 Part-2, pp. 909-913.

[15] Jilin Xie W., (2021), 'Microstructure and mechanical properties of ultrasonic spot welding TiNi/Ti6Al4V dissimilar materials using pure Al coating', Journal of Manufacturing Processesji, Vol. 64, pp. 473-480.

[16] Jingwei Y., Biao C., (2021) 'Investigation of resistance heat assisted ultrasonic welding of 6061 aluminum alloys to pure copper', Materials Research, Vol.74, pp.19-24.

[17] Liu J., Huang Y., and Sun S., (2019), 'Research progress on joining of aluminum alloys for automotive body', Journal of Materials Engineering and Performance, Vol.28, pp.5417-5426.

[18] Macwan A., Jiang X.Q., And Chen D.L. (2015), 'Microstructure and mechanical properties of ultrasonic spot welded copper-to-magnesium alloy joints', Materials & Design, Vol.84, pp. 261- 269.

[19] Michael DL, Seop SH. (2016) 'Weldability assessment of Mg alloy (AZ31B) sheets by an ultrasonic spot-welding method', Journal of Materials Processing Technology, Vol.243, pp. 1–8

[20] Peng H., (2019), 'Ultrasonic spot welding of magnesium-to-aluminum alloys with a copper', Journal of Manufacturing Processes, Vol. 37, pp. 91-100.

[21] Penner P., Liu L., Gerlich A., and Zhou

Y. (2013) ‘Feasibility study of resistance spot welding of dissimilar Al/Mg combinations with Ni based interlayers’, Science and Technology of Welding and Joining, Vol.18, pp.541-550.

[22] Prangnell P., Haddadi F., and Chen Y. C. (2011) ‘Ultrasonic spot welding of aluminium to steel for automotive applications—microstructure and optimisation’, Materials Science and Technology, Vol.27, pp.617-624.

[23] Singh. P, Gupta R. K., Shandilya A., and Singh K., (2017), ‘Ultrasonic welding of aluminum to magnesium: Influence of copper interlayer’, Materials Science and Engineering: A, Vol. 680, pp.1- 8.

[24] Sun S., Huang Y., and Liu J., (2019), ‘Research progress on joining of aluminum alloys for automotive body’, Journal of Materials Engineering and Performance, Vol.28, pp.5417-5426.

[25] Tariq H., (2014), ‘Effect of ultrasonic welding parameters on microstructure and mechanical properties of dissimilar joints’, Materials & Design, Vol. 55, pp. 263-273.

[26] Troughton M. J.,(2009), ‘Handbook of Plastics Joining(Second Edition)’, Elsevier Inc., pp. 15-35.

[27] Xiaoyan G., Chenglong S., Jing L., Donglai L., Zhengyu M., and Kaixuan Z. (2019) ‘Microstructure and mechanical properties of Mg/Al joints welded by ultrasonic spot welding with Zn interlayer’, Materials & Design, Vol.181, pp. 108103.

[28] Zhang L., (2021), ‘Recent advances in welding aluminum alloys for aerospace applications: A review’, Journal of Materials Science & Technology Vol.52, pp.23-44.

[29] Zhanzhan S., Zhengqiang Z., Yifu Z., Hua Z. (2021) ‘Analysis of Microstructure and Mechanical Properties of AZ31B Magnesium Alloy/AA6061 Aluminum Alloy Welded Joint by Ultrasonic Welding’, Materials Research, Vol.24, pp.2.

[30] Zhenlei L., Shude J.& Xiangchen M. (2018) ‘Joining of magnesium and aluminum alloys via ultrasonic assisted friction stir welding at low temperature,’ International Journal Advanced Manufacturing Technology, Vol.97, pp.4127–4136.

Visualization tools in data science for analysis the data

B.Gayathri M.E
Assistant professor,department of CSE
Mount zion college of engineering and technology
Pudukottai
n.gayathrinair@gmail.com

Mrs.P. Thenmozhi M.Tech
Assistant professor,department of CSE
Mount zion college of engineering and technology
pudukottai
thenmozhi1861@mountzion.ac.in

Mrs.Saru Nivedha
Assistant professor,department of CSE
Mount zion college of engineering and technology
pudukottai

Abstract

In today's world, data science plays a pivotal role in numerous fields. Within the realm of data science, data scientists are tasked with analyzing data.[3] By conducting these analyses, predictions about the future can be made. The data analysis process encompasses both structured and unstructured data. Data science relies on data visualization tools to streamline the analysis of data, making the process more manageable.[2] Data analysts utilize a variety of visualization tools, which initially examine the dataset and present the results in visual formats such as pie charts, bar charts, and histograms. These visualization tools play a significant role in the decision-making process[5]. Tableau and PowerBI are the primary tools used in data analysis.

Key terms: data scientist- structured data-unstructured data-data visualization tools-histograms-decision making-tableau-power bi.

1. Power BI &Tableau Introduction:

Power BI is a set of cloud-based tools that **allow companies to access, analyze and understand data** and, therefore, to make data-driven decisions. In fact, Power BI was created as an application **designed for business analysis and enables access to data from practically any device[8]**. Furthermore, the data is accessible and can be shared by any worker in the company and it is updated in real time

Tableau is data visualization tool.

Tableau provide a three platform for users.They are tableau desktop,tableau public and tableau server[9]. Tableau pulic is fully free version for users.Tableau analysis a various dataset and produce the result in visualization type.users easily understand the dataset in the form of visualization.

Power BI includes three programs:

- **Power BI Desktop:** A free desktop app that allows the transformation and visualization of data, as well as the creation of reports.
- **Power BI Service:** This online service (SaaS) has similar capabilities to the desktop application, but it also allows the updating of data in real time so that users can check the updated information at any time, as well as publish and share it.
- **Power BI Mobile:** Power BI also has an application through which reports can be viewed from iOS, Android and Windows mobile devices.

Tableau in three program :

In the age of data-driven decision-making, the importance of tools that enable efficient data visualization and analysis cannot be overstated. Tableau, a prominent platform for business intelligence and data visualization, provides a range of products tailored to various requirements[6]. This article delves into the capabilities and differences of Tableau Desktop, Tableau Public, and Tableau Server, highlighting their distinct features and practical applications[7].

Tableau Desktop

Tableau Desktop is an essential tool that enables the creation of engaging and visually captivating data visualizations. It caters to the needs of individual analysts and data professionals, providing them with the ability to connect to diverse data sources such as spreadsheets, databases, and cloud-based repositories. With its user-friendly drag-and-drop interface, Tableau Desktop empowers users to effortlessly design dashboards, reports, and visualizations without the requirement of intricate coding[5].

Tableau public

Tableau Public is a cloud-based platform that offers a complimentary version of Tableau. It provides users with the opportunity to share their Tableau creations globally. This platform is designed for enthusiasts, students, and individuals who wish to publicly display their data stories. With Tableau Public, users can create interactive dashboards that can be easily embedded on websites or shared on various social media platforms[2].

Tableau Server elevates the functionalities of Tableau to a corporate scale, offering a centralized framework for secure teamwork, data management, and expandability. It caters to organizations requiring efficient administration and widespread dissemination of interactive dashboards and reports to a substantial user community[3].

2.Power BI for data visualization:

Power BI's main benefit is that it is one of the data visualization platforms that allows the development of better information presentations and designs —whether they are charts, reports or others—, as well as it includes integration capabilities and **guarantees the security of the data**. In other words, this set of applications enables the development of interactive graphic representations that promote the understanding of the information, that are visually impressive and interesting and can be easily shared. In addition, Power BI allows the **personalization of all panels and reports and includes a data security and data governance system that protects the information** and facilitates data management and data governance[6].

Another competitive advantage of Power BI is that it **encourages data integration**, since it has the capacity to **collect data from many sources and in any format** -either from a local software or digital platforms-. For example, it has access to both relational and non-relational databases, Excel, CRM, Azure and SQL files, or even web applications such as Google Analytics or Google Ads.

Power BI is also the only visualization tool that integrates with Zebra BI, a data visualization and reporting software that provides advanced and innovative visuals for Power BI and Excel.

Tableau for data visualization:

Tableau's interface has been meticulously crafted to prioritize simplicity and user-friendliness. By incorporating drag-and-drop functionality, users can effortlessly generate visually captivating charts, graphs, and dashboards, all without the need for extensive programming expertise.

3.Benefits of Power BI :

- **Connectivity:** Power BI has the ability to import data in any format and stored in any data source. In addition, it facilitates the transformation and crossing of data from different sources in a single view.
- **Sharing:** As an application stored in the cloud, Power BI makes it easy for reports to be shared with employees and with customers. This makes it easier for all departments to be connected and to consult each other's reports, promoting cooperation between different business areas and joint strategies.
- **Transversal utility:** Another key aspect of this tool is that it is functional and useful for all the departments of a company. The creation of dashboards is adapted to the requirements and needs of each department, and it improves the overall business activity.
- **Real-time updating:** Data is updated automatically. This way, companies are able to make real-time decisions.
- **Price:** Power BI Desktop and Power BI Mobile are totally free. Power BI Pro, on the other hand, os a monthly payment tool which also allows to create collaborative spaces, has superior security measures and more storage capacity.

Benefits of Tableau

Tableau facilitates the art of data storytelling, empowering users to construct narratives around their visualizations. This functionality greatly assists in delivering data insights in a captivating and comprehensible manner.

4.Step-by-step guide to use Power BI for data visualization:

1. **Install Power BI Desktop**: Start by downloading and installing the Power BI Desktop application from the official Microsoft website. This is a free tool that allows you to create reports and dashboards on your local machine.

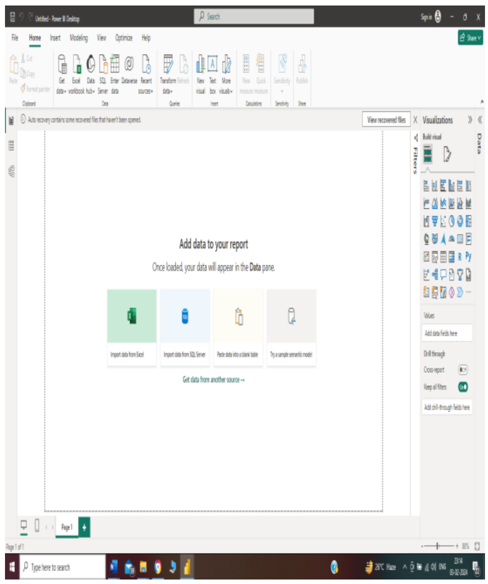


Fig.no:1 .Power BI for Desktop

2. **Connect to Data Sources**: Launch Power BI Desktop and click on "Get Data" in the Home tab. You can connect to a wide range of data sources such as Excel files, databases, online services like SharePoint, SQL Server, Azure, etc. Choose the appropriate data

source and provide the necessary credentials or file path.

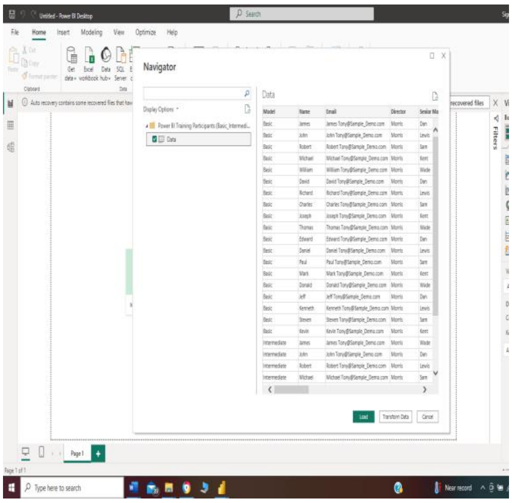


Fig.no:2 .Power BI connect to data sources

3. **Transform Data (optional)**: If your data requires any cleaning, transformation, or merging, you can use Power BI's Power Query Editor to do so. Power Query is a powerful tool for data preparation and shaping.

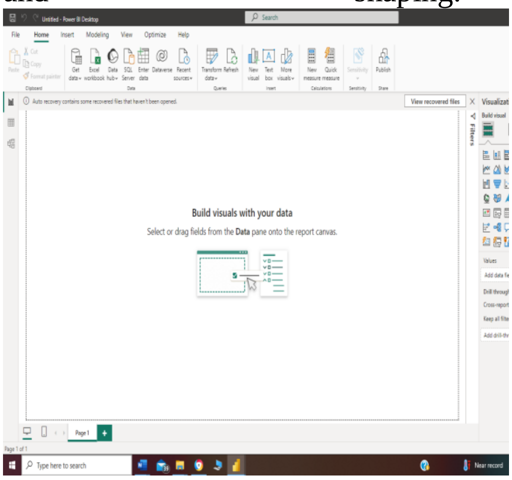


Fig.no:1 .Power BI transform data

4. **Create Visualizations**: Once your data is loaded, you can start creating visuals. Power BI provides a vast array of visualization options, including bar charts, line charts, pie charts, maps, tables, matrices, etc. You can select a visualization type from the "Visualizations" pane and drag and drop the fields from the data model to the appropriate areas (e.g., Values, Axis, Legend) to build the visualization.

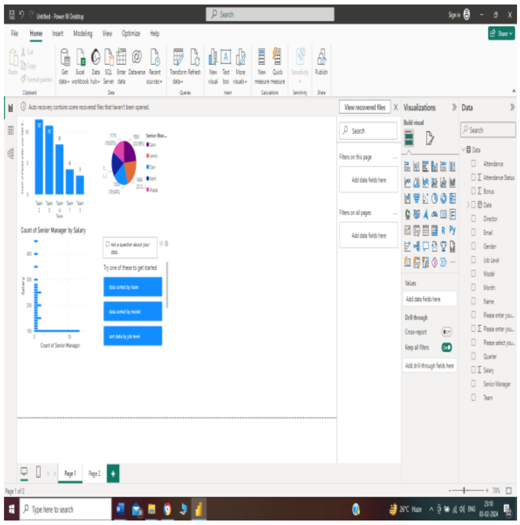


Fig.no:4 .Power BI for data visualization

5. **Add Filters and Slicers**: Power BI allows you to add filters and slicers to your reports. Filters allow users to control what data is displayed in the visuals, while slicers provide a way to interactively filter data across multiple visuals.
6. **Create Relationships (if needed)**: If your data comes from multiple tables or data sources, you may need to create relationships between the tables to enable proper data aggregation and visualization. You can do this by defining relationships in the "Model" view.
7. **Format and Customize**: Customize your visuals, adjust colors, fonts, and styles to make your report visually appealing and easy to interpret.
8. **Add Calculated Measures (if needed)**: Power BI allows you to create new calculated measures

using DAX (Data Analysis Expressions) to perform calculations not available in the original data.
9. **Create Dashboards**: After creating individual visuals, you can group them together in a dashboard. Dashboards provide a unified view of your data and allow you to organize and present your insights effectively.
10. **Share and Publish**: Once you have built your report and dashboard, you can save the file and share it with others using Power BI Service. You can publish the report to the cloud, and others can access it through the web or mobile app.

Step by step guide to install tableau

Installing Tableau is a straightforward process, and here's a step-by-step guide to help you install Tableau Desktop:

Tableau Desktop Installation Guide:

Step 1: Download Tableau Desktop

1. Go to the official Tableau website: [Tableau Download Page](https://www.tableau.com/products/desktop/download).

2. Choose the appropriate operating system (Windows or macOS).

3. Click on the "Download" button to start the download.

Step 2: Run the Installer

For Windows:

4. Locate the downloaded installer file (usually in your Downloads folder) with a name like `TableauDesktop-<version>-<architecture>.exe`.

5. Double-click the installer file to run it.

For macOS:

4. Locate the downloaded DMG file (usually in your Downloads folder) with a name like `TableauDesktop-<version>.dmg`.

5. Double-click the DMG file to mount it, then double-click the Tableau Desktop icon to run the installer.

Step 3: Begin Installation

6. The Tableau Setup Wizard will launch. Click "Next" to begin the installation.

Step 4: Review and Accept License Agreement

7. Read and accept the license agreement. Click "I accept the terms in the License Agreement" and then click "Next."

Step 5: Choose Installation Location

8. Choose the installation location for Tableau Desktop. You can use the default location or specify a different one. Click "Next" when ready.

Step 6: Select Installation Type

9. Choose the installation type. For most users, the default "Typical" installation is sufficient. Click "Install."

Step 7: Complete Installation

10. The installer will now proceed with the installation process. Once completed, click "Finish" to exit the installer.

Step 8: Launch Tableau Desktop

11. After installation, Tableau Desktop may automatically launch. If not, find the Tableau Desktop shortcut on your desktop or in the Start menu (Windows) or Applications folder (macOS) and double-click to open it.

Step 9: Activate Tableau Desktop

12. When you first launch Tableau Desktop, you may need to activate it. Follow the on-screen instructions to enter your product key or sign in if you have a Tableau account.

Congratulations! You have successfully installed Tableau Desktop. You can now start creating visualizations and analyzing your data. Keep in mind that Tableau Desktop requires a valid license or a trial key for full functionality. If you don't have a license, you can start a trial or purchase one from the Tableau website.

Comparison of powerbi and tableau

Integration with Microsoft Ecosystem:

Power BI seamlessly integrates with other Microsoft products such as Excel, Azure, and SQL Server, providing a cohesive experience for users who are already invested in the Microsoft ecosystem.

Pricing Model:

Power BI is well-known for its cost-effectiveness, particularly for small to medium-sized enterprises. It offers a free version with limited features, making it accessible for users with budget constraints.

Ease of Use:

Power BI boasts a user-friendly interface, and those familiar with Microsoft products may find it more intuitive. The drag-and-drop functionality simplifies the creation of visualizations without the need for extensive training.

Data Preparation:

Power BI offers robust data preparation capabilities, allowing users to clean, shape, and transform data within the tool itself. The powerful Power Query feature enables efficient data transformation[9].

Natural Language Processing (NLP):

Power BI incorporates NLP features, enabling users to ask questions in plain language and receive relevant visualizations and insights.

Enterprise Integration:

Power BI is tightly integrated with Azure, making it a preferred choice for organizations utilizing Microsoft's cloud services for data storage and processing.

Tableau:

Data Visualization Flexibility:

Tableau is renowned for its extensive visualization capabilities, offering a wide range of visualization types. Users have greater control over the appearance and customization of visualizations.

Community and Resources:

Tableau has a large and active user community. The Tableau Public platform allows users to share and access a vast repository of public visualizations, fostering collaboration and facilitating learning.

Advanced Analytics Integration:

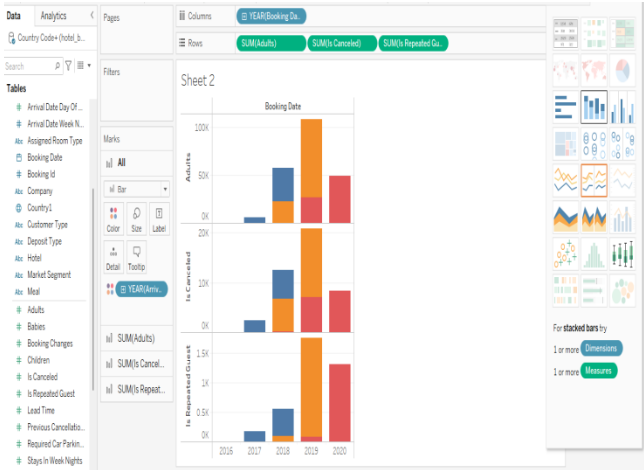
Tableau seamlessly integrates with advanced analytics tools and statistical languages like R and Python, providing users with more sophisticated analytical capabilities.

Dashboard Interactivity:

Tableau is highly regarded for its interactive dashboards, enabling users to create dynamic and immersive data experiences. The level of interactivity enhances data exploration and analysis.

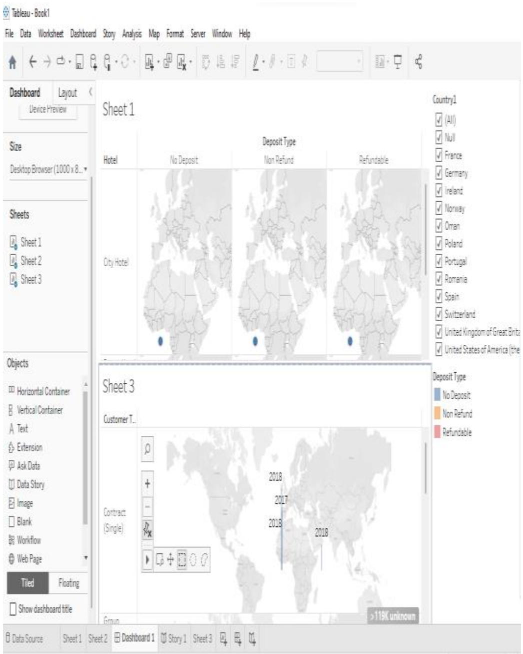
To evaluate the effectiveness of Tableau, we utilize various datasets to construct a comprehensive dashboard. One such dataset is the Park City Peaks Hotel dataset. This dataset encompasses information regarding hotel bookings and cancellations on a monthly basis, statistics on recurring guests, the preferred food options chosen by guests, and whether they opt for individual or family bookings. In this project, we analyze the dataset using both Tableau and PowerBI.

Tableau Desktop is utilized in the analysis and creation of visualizations within the Tableau platform. Tableau Public offers both measures and dimensions, with dimensions consisting solely of date and name information. On the other hand, measures encompass all numerical values that can be altered. The Tableau Public menu includes options such as file, data, worksheet, dashboard, and more. Dashboards and storytelling are crucial components of Tableau, with dashboards enabling the analysis of multiple visualization data on a single sheet. Additionally, Tableau Public offers features such as analyze, map, format, and windows.

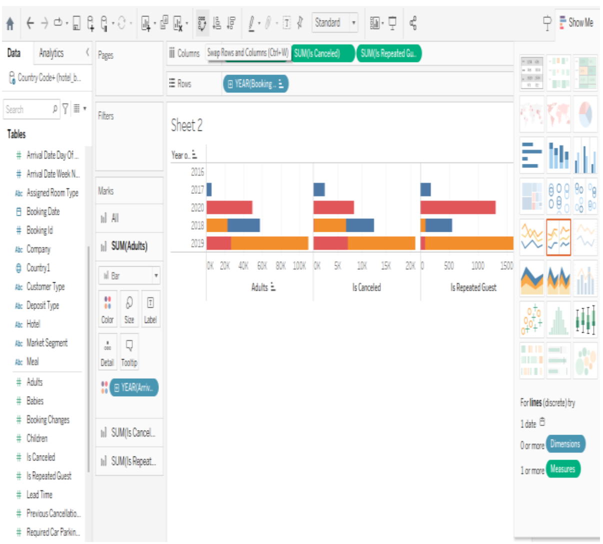


CREATE A CAPTION IN WORKSHEET-----→ SHOW CAPTION

Dashboard



In Tableau, it is necessary to generate multiple charts and analyze them using a dashboard. The dashboard is a key feature utilized in Tableau. Additionally, Tableau can be used to create a Gantt view.



The figure presented here illustrates the analyses conducted on the dataset of Park City Hotel. The data analyst employed visualization techniques to depict the results of the analyses performed on the dataset of Park City Hotel.

5. Conclusion

Our experience with Power BI has shown that it is a radical approach to simplifying the business intelligence and data analytics space, whereby individuals and organizations can easily provide data for visualization, and share it with minimal investment of time and effort. When this service is delivered by an organization of the repute of Microsoft, with independent verification by Gartner which has compared the competition, it is evident that Power BI is a unique opportunity for research institutions and professionals to fulfil their data analysis needs.

Tableau is recognized for its strong and adaptable capabilities in data visualization and business intelligence. It provides a wide array of features that cater to the varied requirements of individuals, analysts, and organizations.[1] Its user-friendly interface, extensive visualization choices, and effortless data connectivity all contribute to its widespread acclaim in the industry.

6. References :

1. Miguel Martinez, 2017, “Gartner positions Microsoft as a leader in BI and Analytics Platforms for ten consecutive years”, Accessed online at https://powerbi.microsoft.com/en-us/ blog/gartner-positions-microsoft-as-a-leader-inbi-and-analytics-platforms-for-ten-consecutiveyears/

2.https://support.office.com/en-us/article/Power-BI-Getting-StartedGuides-bd30711a-7ccf-49e8-aafa-2e8f481e675d?ui=en-US&rs=enUS&ad=US

3.https://powerbi.microsoft.com/en-us/documentation/powerbi-desktopgetting-started/

4.Microsoft Community : http://community.powerbi.com/

5. Maggie Sparkman, 2017, “Frequently asked questions about Power BIFrequently asked questions about Power BI”, Accessed online at h tt ps: // powerbi. m icr osoft .com/ en -us/ documentation/powerbi-frequently-askedquestions/

6. Microsoft, 2017, “Guided Learning”, Accessed online at https://powerbi.microsoft.com/en-us/ guided-learning/

7. Adam Saxton, 2017, “Signing up for Power BI with a new Office 365 Trial”, Accessed online at h tt ps: // powerbi. m icr osoft .com/ en -us/ documentation/powerbi-admin-signing-up-forpower-bi-with-a-new-office-365-trial/

8. Michele Hart, 2017, “Power BI - basic concepts for Power BI service”, Accessed online at https:/ /powerbi.microsoft.com/en-us/documentation/ powerbi-service-basic-concepts/

9. Bin Wu and Lei Qin. “Design and implementation of

business-driven BI platform based on cloud computing”.In: 2021 IEEE International Conference on CloudComputing and Intelligence Systems. IEEE. 2021, pp.118–122.

10. Lin Lin. “Research and Analysis on Key Technologies of Cloud Computing Platform Based on IPv6”. In: 2020 IEEE International Conference on Power, Intelligent Computing and Systems (ICPICS). IEEE. 2020, pp. 181–183.

11. Wei Hu et al. “Power BI for Impacts Analysis on Cost of Living Caused by Industry Prevalence in Smart Cities”.In: 2019 3rd International Conference on Smart Grid and Smart Cities (ICSGSC). 2019, pp. 134–139. DOI:10.1109/ICSGSC.2019.000-6.

Efficient Waste monitoring System using IoT

R.Yogeshwari[1] , Assosiate Professor,
K.A.Muthulakshmi[2], Assistant professor,
Department of Electronics and Communication,
Sri Bharathi Engineering College for Women, Pudukkottai
yogasai4@gmail.com[1],muthumeena@gmail.cocm[2]

***Abstract*— Technology always helps mankind in making life easier. Now presenting an innovative way which revolutionizes trash management system through this we are taking a step towards clean India. Waste management placed across cities set at open places are flooding because of increment in the waste each day and making unhygienic condition for the citizens, to maintain a strategic distance from such a circumstance we have proposed wireless solid waste management system for smart cities which allows municipal corporations to monitor status of dustbins remotely over web server and keep cities clean very efficiently by optimizing cost and time required for it. As soon as simulating creation maximum level, waste management department gets alert via cloud web server via GSm module placed at device so department can send waste collector vehicle to respective location to collect garbage**

***Keywords*—Waste management, ESP32 Microcontroller, IoT, GSM.**

I. INTRODUCTION

India comes under the category of developing nations. Separation of waste is crucial for apt disposal of a huge quantity of trash which is been produced in our daily routine from various sources. People became used to just throwing things away and never realize the consequences of their actions as Problems like health hazards, pollution, environmental disturbance can take place due to an appropriate system of management.

Urban areas with developing economies face poor waste collection services and fail in the management of dump collection which worsens the problem. The waste collection method that is been implemented in many countries is a challenge and the majority struggle due to weak guidelines and rapid urbanization . At present, the volume of municipal solid waste is increasing drastically with an increase in the rate of population, economic uprising, industrial development, change in consumption habits, and many other factors in the lifestyle of the urban population. It is alerted to the management company about the area that has to be visited to pick the overflowing or the bin that is nearing its saturation level so that the scavenger allotted may reach in prompt time and clear it.

Inefficient collection services exacerbate the issue, leading to further environmental and health concerns. Implementing robust waste management strategies and leveraging technology for timely interventions can mitigate these challenges. Collaboration between stakeholders is essential for sustainable waste management practices and to address the growing demands of urbanization.

. Fig 1.1 Public Dustbin

II. LI TERATURE SURVEY

1. **"An IOT Based Smart Garbage Monitoring and Disposal Support System":**by Dr.T.M.N.Vamsi, Mr.G.Kalyan Chakravarthi, Mrs.Pratibha Lanka, Mr.B.Divakar(2021): To maintain the level of cleanliness in the city and form an environment which is better for living.
2. **"Internet of Things based Waste Management System for Smart Cities":**by Ayaskanta Mishra, Nisha Ghosh,Pujarini Jena(2019): waste management problem whichwill effectively separate dry and wet wastes.
3. **" Environmental Monitoring and Smart Garbage Sorting System Based on LoRa Wireless Transmission Technology":**by Chun-Yen Chung, I-Ting Peng, Jong-Chao Yeh(2020): The system uses electrostatic capacitance-type proximity sensors to determine the types of garbage deposited in garbage cans.
4. **" IoT-Based Solid Waste Management**
5. **" Waste Management System Using IoT-Based Machine Learning in University"**: **by** Tran Anh Khoa,Cao Hoang Phuc,**Pham Duc Lam** (2020): We examine data transfer on the LoRa module and demonstrate the advantages of the proposed system, which is implemented through a simple circuit designed with low cost, ease of use, and replace ability.

III. EXISTING SYSTEM

Nowadays the waste collected from a streets, house and other establishment on circadian basis but which is not an effective management system. Because cleaning of garbage is not done immediately based on our needs. The existing system have no proper planning recording the collection garbage which makes the city or town unhygienic. Also this existing system cannot regularly update the level and odour of the garbage bin to the authority. It too have disadvantage of consumption of more amount of fuels and more time.

The labours who are cleaning the dustbins are also not taking any responsibility which makes the system worst in urgent cases. Normally, the purpose of the dustbin is only collecting a waste from different zonal. But here, the aim of our project is by utilizing a embedded system to maintain the management activities in addition with a waste collection in a dustbin and also in a mass waste collection places for detecting a unpleasant activities like over fire, moisture content etc., in a accurate manar

All paragraphs must be indented. All paragraphs must be

IV PROPSED SYSTEM.

Garbage is a waste generated due to the various activities generated by various activities such as industry waste, vegetable waste, commercial waste, house hold wastes etc. Improper utilization of the garbage may pose several environment issues namely generation of various hazardous gases which leads to the various health issues. Curb side collection, Incineration is the most common method of disposal in which waste is collected at regular intervals by

SYSTEM ARCHITECHTURE

4.1 BLOCK DIAGRAM

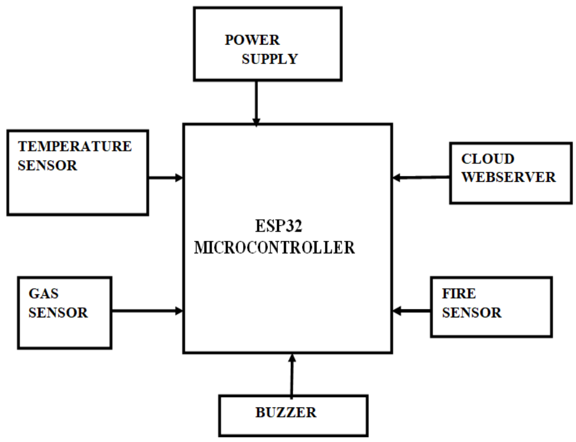
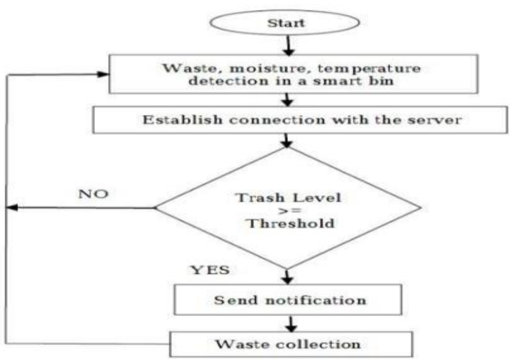


Fig 4 .1 Block Diagram

4.2 FLOW CHART



4.3 HAREDWARE USED :

ESP32 MICROCONTROLLER:

ESP32 is a single 2.4 GHz Wi-Fi-and-Bluetooth combo chip designed with the TSMC ultra-low-power 40 nm technology. It is designed to achieve the best power and RF performance, showing robustness, versatility and reliability in a wide variety of applications and power scenarios.

The ESP32 series of chips includes ESP32-D0WDQ6, ESP32-D0WD, ESP32-D2WD, and ESP32-S0WD.

ESP32 uses CMOS for single-chip fully-integrated radio and baseband, while also integrating advanced calibration circuitries that allow the solution to remove external circuit imperfections or adjust to changes in external conditions.

As such, the mass production of ESP32 solutions does not require expensive and specialized Wi-Fi testing equipment

WI-FI

ESP32 implements a TCP/IP and full 802.11 b/g/n Wi-Fi MAC protocol. It supports the Basic Service Set (BSS) STA and SoftAP operations under the Distributed Control Function (DCF). Power management is handled with minimal host interaction to minimize the active-duty period.

GAS SENSOR

The time of processing in the cities is important. Because, in recent days the garbage collection is not collecting properly due to lack of workers, specialized vehicles and other means. So, the garbage which is on the road or land is degrading itself and emits a bad smell. And also in the garbage collectors, it’s not cleaned properly, it emits a bad smell and causes the different diseases like cholera, skin diseases etc. The proper utilization of garbage can help us to get some gases. Some may harm and some are useful. The useful gases which are emitting from the garbage can be utilized for commercialpurpose also

TEMPERATURE SENSOR

Fig Gas sensor

The sensors in the flame detector will detect the radiation that is sent by the flame, the photoelectric converts the radiant intensity signal of the flame to a relevant voltage signal and this signal would be processed in a single chip microcomputer and converted into a desired output

HUMIDITY SENSOR

In that system we are calculating the moisture and temperature inside the dustbin if the temperature is high then its gets the message to fire alarm. This system purpose that we are presenting the separation of wait and dry garbage. If garbage is wait then its go to wait dustbin then garbage is dry then its go to dry dustbin. Finally, we are showing the graphical representation on whole garbage monitoring system.

Fig Humidity sensor

TESTING RESULTS

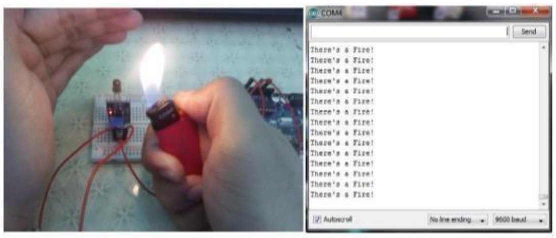
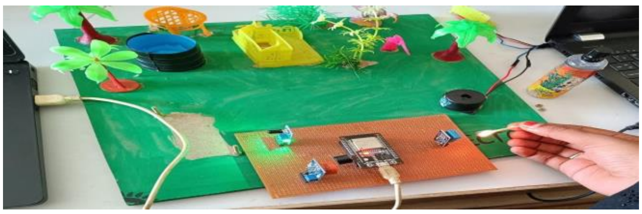


Fig Output

THINGSPEAK

The Internet of Things (IoT) links together various devices with embedded operating systems and internet connectivity. These devices rely on IoT services to communicate and work together effectively. While individual IoT devices can't do much on their own, they gain significant functionality when connected to a service. This service acts as a behind-the-scenes manager, enabling tasks like data collection, monitoring, and advanced analytics. In essence, IoT's true power emerges when devices

V RESULT



V CONCLUSIONS

The objective of the project is for the real time access of information about the dustbin. This waste Management System using IOT has implemented the

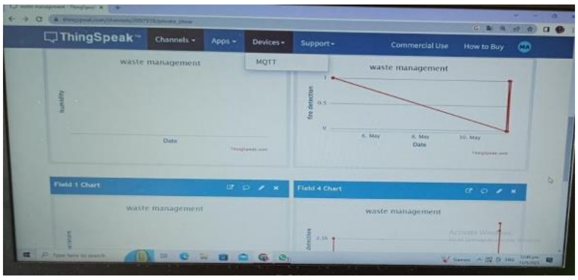


Fig 5.1 Output showing in rising the gas

management of waste in real time using smart dustbin to check the fill level of dustbin to check if it is full or not.This system also helps to monitor the fake reports and hence can reduce the corruption in the overall management system. This reduces the total number of trips of garbage collection vehicle and hence reduces the overall expenditure associated with the garbage collection. It ultimately helps to keep cleanliness in the society. Therefore, the smart garbage management system makes the garbage collection more efficient. Such systems are vulnerable to plundering of components in the system in different ways which needs to be worked on.

FUTURE SCOPE

Further in this we can add up the cost management portion and by the virtue of which we can place them in an individual's home. So that they can use them and can manage the day- to-day garbage by their own and as the bin hits on alarm of filling its further recycled and can be used in kitchen garden in homes. That would be a good practice in field of environment safety. Smart dustbin helps us to reduce the pollution. Many times garbage dustbin is overflow and many animals like dog or rat enters inside or near the dustbin. This creates a bad scene. Also some birds are also trying to take out garbage from dustbin. This project can avoid such situations. And the message can be sent directly to the cleaning vehicle instead of the contractor's office

REFERENCES

[1] S. M. Metev and V. P. Veiko, *Laser Assisted Microtechnology*, 2nd ed., R. M. Osgood, Jr., Ed. Berlin, Germany: Springer-Verlag, 1998.

[2] J. Breckling, Ed., *The Analysis of Directional Time Series: Applications to Wind Speed and Direction*, ser. Lecture Notes in Statistics. Berlin, Germany: Springer, 1989, vol. 61.S. Zhang, C. Zhu, J. K. O. Sin, and P. K. T. Mok, "A novel ultrathin elevated channel low

temperature poly-Si TFT," *IEEE Electron Device Lett.*, vol. 20, pp. 569–571, Nov. 1999.

[3] M. Wegmuller, J. P. von der Weid, P. Oberson, and N. Gisin, "High resolution fiber distributed measurements with coherent OFDR," in *Proc. ECOC'00*, 2000, paper 11.3.4, p. 109.

[4] R. E. Sorace, V. S. Reinhardt, and S. A. Vaughn, "High-speed digital-to-RF converter," U.S. Patent 5 668 842, Sept. 16, 1997.

[5] (2002) The IEEE website. [Online]. Available: http://www.ieee.org/

[6] M. Shell. (2002) IEEEtran homepage on CTAN. [Online]. Available: http://www.ctan.org/tex-archive/macros/latex/contrib/supported/IEEEtran/

[7] *FLEXChip Signal Processor (MC68175/D)*, Motorola, 1996.

[8] "PDCA12-70 data sheet," Opto Speed SA, Mezzovico, Switzerland.

[9] A. Karnik, "Performance of TCP congestion control with rate feedback: TCP/ABR and rate adaptive TCP/IP," M. Eng. thesis, Indian Institute of Science, Bangalore, India, Jan. 1999.