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**MODERN EDUCATION SOCIETY'S
WADIA COLLEGE OF ENGINEERING,
PUNE -01**

SYNERGY 2025

10th National Conference on
**"Advancements in Communication,
Computing and Electronics Technology"**

4th April 2025

& 2nd International Symposium on
**"The Impact of AI on Education and
Engineering Jobs"**

5th April 2025

IN ASSOCIATION WITH



ICT ACADEMY



IETE PUNE

ORGANISED BY,

Department of Electronics and Telecommunication Engineering
Modern Education Society's Wadia College of Engineering
Wadia College Campus, 19, Late Prin. V. K. Joag Path, Pune-411001

<https://mescoe.mespune.org/synergy-2025/>

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Souvenir



Modern Education Society's Wadia College of Engineering, Pune

Department of Electronics & Telecommunication

in association with IETE Pune and ICT Academy

10th National Conference on

Advancements in Communication, Computing and

Electronics Technology

Synergy – 2025

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Organized By

Department of Electronics and Telecommunication

Modern Education Society's

WADIA COLLEGE OF ENGINEERING

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19, Late Prin, V.K. Joag Path, Wadia College Campus, Pune-411001, India.

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MES Wadia College of Engineering, Pune-01

Vision

To Groom - Motivated, Environment friendly,
Self-esteemed, Creative and Oriented Engineers.

Mission

To develop industry-oriented manpower to accept the challenges of Globalization, by promoting Value Education through motivated trained faculty, by maintaining a conducive environment for education at affordable cost, by promoting Industry Institute interaction, by involving alumni.

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Department of Electronics and Telecommunication

Mission

To develop industry-oriented manpower to accept the challenges of globalization,

- by imparting Electronics and Telecommunication knowledge through trained faculty in a conducive environment,
- by creating awareness about the needs of Electronics & Telecommunication industries through alumni and Industry-Institute interaction,
- by encouraging them to think innovatively and introduce them to various research activities, by grooming them in communication and interpersonal skills

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Hon. Principal's Message



It is indeed a matter of immense pleasure to know that the Department of Electronics and Telecommunication, MES College of Engineering (MESCoE), is going to organize the 10th National Conference on "Advancements in Communication, Computing and Electronics Technology" (ACCET-25) on 4th April, 2025.

Nowadays we come across various applications of the Electronics and Telecommunication field. The frequent changes in the technology of the Electronics and Telecommunication field greatly impact our day to day activities. The main objective of this conference is to provide a forum for discussing the development, implementation, use and application of emerging technologies in the Electronics and Telecommunication field.

I am confident that the conference discussions and the publication of the conference proceedings will bring opportunities among the academicians, corporate delegates, research scholars and students to present their innovative ideas, most up-to-date findings, and technical proficiency in the various fields of research trends in Electronics and Telecommunication.

On behalf of MESWCoE, I heartily welcome Keynote Speakers, eminent academicians, corporate delegates and all the paper presenters to ACCET-25.

I would like to congratulate the Department of Electronics and Telecommunication faculty and staff for organizing such events.

I take this opportunity to wish grand success to the conference and a memorable time for all the participants at ACCET-25.

Dr. M. P. Dale
I/c Principal
MES Wadia College of Engineering, Pune

HOD's Message



It is a profound moment, to be convening the 10th National conference 'Advancements in Communication, Computing and Electronics Technology' [ACCET-25], being organized by the Department of Electronics and Telecommunication Engineering, MES's Wadia College of Engineering, Pune.

The present century is referred to as the age of Information and Technology. Continued advancement in the previous decade has led to the explosion of Internet and Wireless Communication. The processing performances once exclusive to Supercomputers are now available in handheld personal digital devices. Improvements in Integrated Circuits have enabled space explorations, made automobiles more efficient, revolutionized the nature of warfare, brought vast libraries of information into our Web Browsers and made the world a more interdependent place.

ACCET-2025 attracts established academicians and research students from around the nation. The research papers published in this proceeding bear testimony to the fact that exciting work has been undertaken in numerous topics related to electronics and telecommunication engineering.

The success of this conference is a result of efforts of contributors and presenters who have shared with us the latest developments in their respective fields. Such an event is not possible without the hard work of the reviewers to whom I am deeply indebted for taking out time to provide professional opinions on the submissions.

I am highly obliged to our devoted and ever-enthusiastic Principal Dr. M. P. Dale for his constant support and encouragement.

I highly appreciate the efforts of the coordinators Dr. M. M. Dhanvijay ,Prof Y. M. Ajgar and the conference organizing team, who have coordinated and liaised with the contributors, reviewers and many other people concerned. The non-teaching support staff cannot be forgotten, their dedicated support ensures that the conference is of high quality and makes the conference a thoroughly enjoyable gathering.

Dr. P. P. Mane
Head of Department
Electronics and Telecommunication

Foreword



With the zest to support digital India and to boost Research and Development at international platforms, Department of Electronics and Telecommunication Engineering, M. E. S. College of Engineering, Pune has organized the 10th National Conference on “Advancements in Communication, Computing and Electronics Technology” [ACCET 2025] on 4th April, 2025. It has been a real honor and privilege to serve as the Coordinator of the conference.

The Souvenir of ACCET 2025 includes abstracts for oral presentations provided by enthusiastic students, practicing researchers, industry personalities and academicians. I extend my warmest thanks to the authors for their interest, enthusiasm and timely submission of research papers. We are also grateful to all the authors for their valuable contributions. The conference would not have been possible without the enthusiasm and hard work of my colleagues

We are thankful to Hon. Principal, Dr. M. P. Dale and the management of M. E. Society for their constant support and encouragement in making this National conference a big success. We are thankful to ACCET-2025 paper reviewers for giving their precious time for reviewing papers. The team work behind this conference, by the enthusiastic, hardworking and sincere faculty of the department, is highly commendable.

ACCET is a great platform for all the technocrats. The idea behind this conference was to help and motivate researchers to carry forward their work to the next level. As coordinator of ACCET-2025, I anticipate that these proceedings would be of immense value and will be definitely useful to researchers in their practice or thinking process. This collection will also offer a window for new perspectives and directions in the respective horizons.

Dr. M. M. Dhanvijay
Coordinator
Synergy-2025



Foreword

With passion to advance Digital India and advance Investigate and Development on global platforms, Department of Electronics and Telecommunication Engineering, M. E. S. College of Engineering, Pune has organized the 10th National Conference on Advancements in Communication, Computing and Electronics Technology [ACCET 2025] on 4th April, 2025. It has been a real honor and privilege to serve as the Coordinator of the conference.

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We are grateful to Hon. Principal, Dr. M. P. Dale and the management of M. E. Society for their unwavering support and encouragement have been instrumental in making this National Conference a grand success. We are thankful to ACCET-2025 paper reviewers for giving their precious time for reviewing papers. The team work behind this conference, by the enthusiastic, hardworking and sincere faculty of the department, is highly commendable.

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Prof. Y. M. Ajgar
Coordinator
Synergy-2025

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1 : SMART VEHICLE SYSTEM WITH ENHANCED SAFETY

Radhika Angadi, Janhavi Mane, Shital Sonkamble, Srushti Patil, R.P. Khadse

JSPMNarhe Technical Campus Pune,

Abstract— The process of systems will ensure us safety and protect us by commanding on the speed of the vehicle. In order to protect the vehicle, we use blinking sensors, alcohol sensors (MQ3), ultrasonic sensors and other sensors. If any vehicle suddenly hits the road high vibrations detected by sensor the system will control prevent accidents and alert using GSM with proper location by using GPS and the vehicle applies the brakes, It likewise alerts the driver, and it demonstrates the driver when they are going to sleep mode during driving. These all sensors take the data from surrounding and send to the microcontroller and this microcontroller takes the action automatically. With the help of an IR sensor we will monitor the driver's eyes. If any alcohol sensor will detect it randomly and alert mode will be on for the driver and stop the vehicle. The presence of an Ultrasonic sensor detects the speed of the vehicle and simultaneously decreases the speed to zero.

2: Conceptual Design of an Autonomous 6-DoF Robotic System for Artillery Ammunition Loading

Siddharth Andhale, Ashlesha Parab, Sreeja Ronanki, Dr. P. M. Bagul
Dept. of E & TC MES's Wadia College of Engineering Pune, India

Abstract—Modern artillery operations require rapid, precise fire support while ensuring personnel safety. Conventional manual ammunition loading, however, is physically demanding, hazardous, and inconsistent under combat stress, creating a significant operational bottleneck. This paper presents a conceptual design for an autonomous 6-Degree-of-Freedom (6DoF) robotic arm system aimed at automating the artillery loading process. The proposed architecture integrates robotics, multi-modal sensor fusion (including vision), and intelligent control strategies, likely managed using ROS2. The primary goal is the full automation of ammunition detection, grasping, transport, and precise insertion into the breach. This seeks to enhance loading speed, guarantee operational consistency, significantly improve crew safety by removing personnel from immediate danger, and enable potential for continuous fire missions. This paper reviews the context of artillery operations, analyzes the shortcomings of current manual and semi-automated methods, surveys relevant related work, presents the motivation for full automation, details the proposed system design, and discusses key challenges and future research pathways.

3: ROBOAT-THE WATER CLEANING MACHINE

Akshada Phadtare 1 Shruti Kokate 2 Kedarnath Tawde 3 Prof.PriyankaTondewad4
E & TC, MES's Wadia College of Engineering,Pune , India.

Abstract: The increasing pollution in water bodies caused by industrial discharges, plastic waste, and other contaminants poses substantial environmental challenges that endanger aquatic ecosystems and public health. Traditional approaches to cleaning water surfaces are typically conventional, time-consuming, and have limited efficacy. Additionally, this project introduces an advanced water-cleaning robot that can independently detect and eliminate waste from different water sources, thereby enhancing water quality and supporting environmental sustainability. The robot is furnished with cutting-edge technologies, including high-resolution sensors that can identify various types of waste, including plastics, oils, and organic waste. The modular collection system enables the efficient collection of debris without causing any harm to aquatic life. The robot utilizes GPS navigation in conjunction with advanced machine learning algorithms to create detailed maps of its environment, optimize cleaning routes, and adjust its cleaning methods based on factors such as water currents and waste density. This self-governing operation reduces the need for human involvement, enabling constant surveillance and upkeep of water. This technology has far-reaching implications beyond its immediate capacity for cleanup. By water cleaning processes, the robot not only improves efficiency but also raises awareness about pollution concerns and promotes responsible measures for water conservation and environmental preservation. The successful completion of this project could serve as a catalyst for the widespread adoption of robotic solutions in environmental maintenance, leading to improved ecosystems and cleaner waterways.

4: Test Automation:HMI & PLC

Rohan Satish Deokate, Devansh Paresh Naik, Sampada Sanjay Kulkarni

E & TC, MES's Wadia College of Engineering,Pune , India

Abstract- With the increasing intricacy of industrial automation systems, the dependability and efficiency of Human Machine Interfaces (HMI) is becoming increasingly important. Reliance on standard manual testing is tiresome, prone to mistakes, and not repeatable. In this paper, we describe the implementation of automated testing for validating the functionality of HMI using Robot Framework and Selenium. The framework incorporates keyword-driven testing, thus allowing for the creation of modular, scalable, and reusable test cases, which improves automation flexibility. Furthermore, the test execution is accompanied with extensive logging and reporting capabilities for thorough analysis and feedbacks. The framework is designed to minimize the need for any human effort in the execution of tests, thus enhancing the accuracy of tests and facilitating quick assessment of the performance of HMI. Results of the tests show that the framework is effective in identifying discrepancies in the response of HMI, which proves to be useful in guaranteeing reliability and accuracy in industrial settings.

5: Adaptive PID Controller Tuning

Aishwarya Manoj Kamble, Hrishikesh Bipin Bhavsar, Prof. U.V.Bomble,

E & TC, MES's Wadia College of Engineering,Pune , India

Abstract- With the increasing demand for precise and efficient temperature regulation in industrial applications, traditional PID controllers often struggle to adapt to dynamic environmental changes and disturbances. In this paper, we present a comparative study between a Traditional PID controller and an Adaptive PID controller for temperature control systems. The Adaptive PID tuning approach dynamically adjusts the controller gains based on system error, thereby improving response time, minimizing overshoot, and enhancing stability under varying conditions. Both implementations were tested under identical conditions with predefined disturbances, and their performance was analyzed in terms of temperature stability, settling time, and response to perturbations. The results indicate that the Adaptive PID controller outperforms the Traditional PID by offering improved adaptability and robustness, making it a more efficient solution for dynamic control environments.

6 : Iris Detection using Faster RCNN for Biometric Applications

Pooja Dilip Pokal, Prof. Shrinivas Dharwadkar, Nisha Nitin Ratnaparkhi

E & TC, MES's Wadia College of Engineering, Pune , India

Abstract - Iris recognition is a widely used biometric authentication method due to its high accuracy and uniqueness. In this study, we implement an iris detection system using Faster R-CNN, a deep learning-based object detection algorithm. The CASIA-IrisV4 dataset is used to train and evaluate the model, ensuring

robustness across various iris images. Faster R-CNN enhances detection efficiency by integrating a Region Proposal Network (RPN) with a Convolutional Neural Network (CNN), enabling accurate localization of the iris with improved speed. The proposed approach extracts feature maps using a pre-trained CNN, applies Region of Interest (RoI) pooling, and performs classification and bounding box regression to precisely detect the iris. The system is optimized to handle challenges such as occlusions, illumination variations, and small object detection. Experimental results demonstrate that Faster R-CNN provides high detection accuracy while maintaining efficient computation. This research contributes to the advancement of automated iris recognition systems, with potential applications in security, identity verification, and biometric authentication.

7 : Enhancing Linux Compatibility in Industrial HMI Systems

Prasad Nikam, Tejas Baru, Samarth Bacchewar, Prof. Aparna Kulkarni

MES Wadia College of Engineering Pune, India

Abstract—This paper explores the compatibility of Linux with Human-Machine Interfaces (HMI) in industrial and commercial applications. While Linux provides advantages like open-source flexibility, customization, and cost efficiency, challenges persist in achieving seamless integration with proprietary hardware and ensuring real-time performance. The impact of Linux’s modularity and adaptability on HMI development is evaluated, focusing on driver support, real-time kernel patches, and system stability. Proposed solutions include compatibility layers, open-source drivers, and enhancements to real-time Linux to address these challenges. The findings offer practical insights for industries considering the implementation of Linux-based HMI solutions

8 : Innovative Architecture of a Smart Bidirectional Input / output interface for Automotive Electronics

Pranav Veerkar, Anuj Sabade, Sarthak Terkhedkar, Prof. Y. M. Ajar, Mr. Vishwas Vaidya

MES’s Wadia College of Engineering Pune, India

Abstract— Abstract—The rapid advancement of automotive technologies, including connected, autonomous, and electrified vehicles, has led to increased integration of electronic systems into various vehicle subsystems. These electronic control units (ECUs) must interface efficiently with external input/output devices while adhering to robust and reusable architectural standards compliant with automotive regulations. When ECUs are intended for diverse vehicle families and segments, it is advantageous for each ECU pin interacting with external components to support multiple functionalities. This is particularly relevant for digital outputs (such as solenoids, lamps, and motors) and digital inputs (such as command switches, pushbuttons, and thermal switches). Currently available smart switch peripheral ICs function exclusively as outputs, lacking the flexibility to be reconfigured as inputs based on application needs. Additionally, these smart switch architectures often provide generic, overly complex solutions that may not be ideal for simpler digital output applications such as LED or solenoid control. This paper presents an innovative smart switch architecture that integrates both output and input interfaces while optimizing performance based on specific output load requirements such as current handling, thermal constraints, and

protection mechanisms. The proposed design follows a system engineering approach, identifying key performance requirements and evaluating alternative architectures to determine the optimal solution. The selection process involves assessing different designs based on critical performance metrics. A detailed design example is provided, covering both hardware implementation and a state-machine-based low-level command and diagnostic driver. The paper concludes with discussions on potential future improvements and opportunities for enhancing the proposed solution.

9: Unmanned Aerial Vehicle for Surveillance and Reconnaissance using NRF module and STM32 Flight Controller

Jaspal Singh Wasal, Darshal Gopal Barapatre, Manuel Mojes Ullagaddi, Prof. A. S. Kulkarni,

Dr. Mrs. P. P. Mane

MES's Wadia College of Engineering Pune, India

Abstract: The demand for Unmanned Aerial Vehicles (UAVs) in surveillance and reconnaissance applications has seen significant growth, with the UAV industry emerging as a pivotal player in various sectors such as defense, agriculture, environmental monitoring, and infrastructure inspection. In India, the hobbyist drone market is valued at approximately 24.5 million dollars and is expanding rapidly, driven by advancements in technology and the growing interest in UAV-based solutions. This paper presents the design and development of an Unmanned Aerial Vehicle (UAV) for surveillance and reconnaissance, utilizing the nRF24 wireless communication module and an STM32 flight controller. The system integrates a telemetry communication system for real-time data transmission, and a custom-designed antenna to ensure long-range communication, making the UAV capable of operating effectively over extended distances. The UAV design is focused on cost-effectiveness, leveraging affordable components without compromising performance. The project addresses the growing need for UAVs in India and globally, where their application in security, surveillance, and monitoring is crucial due to increasing urbanization, security concerns, and the need for efficient monitoring of large areas. The UAV's ability to perform autonomous missions, coupled with its efficient communication system, positions it as an essential tool in modern surveillance operations. This study explores the integration of communication and flight control technologies, highlighting the importance of UAVs in supporting critical security and surveillance needs in both urban and rural settings.

10. RPI-Powered Smart Glasses for Object Detection and Feedback

Divyanshi Rathore, Jyotika Kumari, Pratiksha Ghandge, Prof. A.S.Kulkarni

MES's Wadia College of Engineering Pune, India

Abstract—In 2024, India has approximately 8 million blind people and 62 million people with visual impairments. This accounts for nearly a quarter of the global burden of blindness and vision impairment. This paper presents a smart assistive device designed to aid visually impaired individuals by detecting and recognizing furniture objects within a

200cm range. The system utilizes a Raspberry Pi Model B 4, a Raspberry Pi camera, ultrasonic sensors, and earphones to provide real-time audio feedback. When the ultrasonic sensor detects an object, the Raspberry Pi camera captures an image, and a Convolutional Neural Network (CNN) algorithm classifies the object. The system then provides an audio output stating the object's name and its distance. The experimental results indicate high accuracy in object recognition, providing an effective assistive solution for visually impaired individuals. The study demonstrates that a cost-effective device with minimal computational requirements can be built to enhance mobility and independence for visually impaired users.

11. AI-Driven Early Warning System for GLOFs Using IoT & Remote Sensing

Chinmay Kumbhar, Dr. R. R. Itkarkar, Dr. V. N. Patil
AISSMS College of Engineering, Pune.

Glacier Lake Outburst Floods (GLOFs) are increasingly severe due to climate-induced glacier retreat, threatening communities and infrastructure, particularly in the Himalayas. This study presents an AI-powered Early Warning System (EWS) integrating IoT-based real-time monitoring, UAV-assisted surveillance, satellite-derived geospatial analytics, and deep learning-based risk classification for precise flood prediction. The system utilizes multi-sensor data fusion, low-power LoRaWAN communication, and Google Earth Engine (GEE) analytics for improved monitoring efficiency. Leveraging UAV-based photogrammetry, synthetic aperture radar (SAR), and hydrologic modeling (HEC-RAS, ArcHydro), the EWS enhances lake volume tracking, flood forecasting, and early warning reliability. Validation results highlight increased detection accuracy, reduced false alarms, and improved hazard response, offering a scalable solution for GLOF-prone regions. Keywords: Glacial Lake Outburst Flood (GLOF), Early Warning System (EWS), Himalayan Glaciers, Artificial Intelligence (AI), Internet of Things (IoT), Remote Sensing, UAV Surveillance, Hydrologic Modeling, Google Earth Engine (GEE), Deep Learning, Sentinel-2, Landsat 8.

12. Developing Wireshark Plugins for Detecting TCP, UDP, and SYN Flood Attacks

Prince Pasi, Joel Sunny, Abhishek Jadhav, Prof. Nabegha Yusufzai
Electronics and Telecommunication, M.E.S Wadia College Of Engineering, Pune, India

Abstract—With the increasing reliance on technology, network security has become paramount in establishing robust systems that defend against cyberattacks. The term "network vulnerabilities" refers to weaknesses within a network that attackers exploit to breach security and access sensitive data. To identify these vulnerabilities, attackers often employ open port scanning techniques to probe systems and data. Consequently, network administrators must configure their networks correctly and close any unnecessary open ports to mitigate these risks. Monitoring network traffic is essential for maintaining security, prompting developers to design analytical tools that inspect transmitted packets and trace anomalous activities. One of the most renowned packet analysis tools is Wireshark, widely used for monitoring packets and examining network protocols. Wireshark can generate statistical reports that help identify the types of attacks occurring on the network. For example, if an attacker sends SYN packets to a target device, Wireshark will provide detailed information about these packets. When TCP SYN requests are flooded to a device, the impact on the device's resources can be significant, consuming bandwidth and ultimately affecting system performance. This paper presents a penetration test to launch a SYN flood attack by sending a substantial number of SYN packets from a Kali Linux machine to three targeted systems: Windows 8.1, Windows 10, and Metasploitable. The test encompasses three scenarios: the first focuses on flooding SYN packets using the real source IP address of the attacker machine; the second involves sending SYN packets with a spoofed source IP address; and the final scenario utilizes a random source IP address to flood SYN packets. Wireshark will be employed on the Kali machine to capture the packets and generate detailed reports. The results of the captured data will be recorded for analysis, highlighting the capabilities of this powerful tool. Keywords: Wireshark, SYN flood attack, VMware, Hping3.

13. Reversible Logic-Based Kogge-Stone Adder

Aishwarya Bhadke, Dimpal Satish Gosavi, Dr. K. S Tiwari
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Modern Education Society's Wadia College of Engineering Pune, India

Abstract: Parallel Prefix Adders (PPAs) are integral in VLSI due to their high speed, low delay, scalability, and efficiency in high-performance arithmetic operations. Among these, the Kogge-Stone Adder (KSA) stands out for its minimal delay by generating carries in $O(\log n)$ time, making it ideal for modern microprocessors and AI accelerators. However, conventional KSA suffers from high power dissipation due to irreversible logic. To address this, this paper implements a Kogge-Stone Adder using reversible logic to reduce power dissipation by preventing information loss, thereby enhancing energy efficiency. Additionally, a time comparison between reversible and irreversible KSA is performed to evaluate performance improvements. All structures are designed using Verilog HDL in a structural description and simulated using Xilinx ISE 14.7.

As the demand for high-performance and energy-efficient computing grows, reversible logic has emerged as a promising solution, particularly in low-power and quantum computing applications. Traditional computing systems suffer from energy dissipation due to information loss, which is addressed by reversible computing principles. The proposed Reversible Kogge-Stone Adder (RKSA) integrates fundamental reversible logic gates such as the Feynman, Toffoli, Fredkin, and Peres gates. The design ensures reduced quantum cost, minimal garbage outputs, and improved power efficiency while maintaining the speed advantages of the conventional KSA. The research focuses on constructing the RKSA in three key stages: pre-computation, carry generation, and summation, utilizing reversible logic to enhance efficiency. The implementation minimizes the number of gates required and ensures bijective input-output mapping to preserve information integrity. Performance analysis demonstrates that the RKSA achieves significant reductions in power dissipation and resource consumption compared to conventional designs. Simulation results validate that the proposed design maintains computational speed while optimizing energy efficiency, making it highly suitable for emerging applications in quantum computing and ultra-low-power VLSI circuits. Future research may further refine the RKSA architecture for larger-bit operations and explore integration into more complex arithmetic systems.

14. IOT Based Battery Free, Wireless Thermal Tag

Siddhesh Sable, Tejasvi Jadhav, Saloni Mehtre, Dr. P. B. Chopde
Electronics and Tele-Communication
Modern Education Society's Wadia College of Engineering Pune, India

Abstract: This paper presents a battery-free wireless thermal tag that utilizes energy harvesting from electromagnetic waves generated by power line cables. The harvested energy powers the system, eliminating the need for batteries and enabling long-term, maintenance-free operation. A negative temperature coefficient (NTC) sensor is integrated into the tag for accurate temperature measurement. The sensed data is transmitted wirelessly using backscatter communication, ensuring low power consumption and reliable data transfer. This approach enhances sustainability, reduces operational costs, and supports various applications such as industrial monitoring, smart grids, and supply chain management. Experimental results validate the efficiency of the proposed system, demonstrating its potential for autonomous and energy-efficient temperature sensing.

15. Implementation For Matter Protocol in Industrial Automation

Tanishka Bhowmick, Abhijeet Kamble, Neeraj Thombre, Dr. P. M. Bagul
Electronics and Tele-Communication Modern Education Society's Wadia College of Engineering Pune, India

Abstract: The rapid development of the Internet of Things (IoT) has revolutionized industrial automation by enabling seamless connectivity and real-time data exchange between devices. However, interoperability, security, and reliability

remain key challenges in industrial environments where diverse IoT ecosystems coexist. This project, “Implementation of Matter Protocol for Industrial Automation,” aims to explore and demonstrate the integration of the Matter protocol in industrial applications to ensure standardized, secure, and interoperable communication between connected devices. Matter, developed by the Connectivity Standards Alliance (CSA), is a unified application-layer protocol designed to provide cross-platform compatibility, robust security, and simplified device onboarding. This project leverages the ESP-Matter SDK provided by Espressif and implements the Matter protocol using the ESP32-WROOM-32E microcontroller. The objective is to establish a local Wi-Fi-based industrial network, enabling multiple devices to communicate securely and efficiently. The development environment is set up using Ubuntu, which offers a stable and flexible platform for implementing Matter, along with Visual Studio Code, essential extensions, and FreeRTOS for handling real-time tasks.

16. MediVoice: AI-Based Voice Assistant

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Abstract: Healthcare facilities often face challenges in managing patient interactions efficiently, leading to long wait times, miscommunication, and administrative burdens. To address these issues, we propose MediVoice, a medical voice assistant designed to assist clinic reception areas in handling appointment bookings, doctor availability inquiries, patient registration, and check-ins through voice-based interactions. The system aims to provide a seamless and intuitive interface, reducing the dependency on manual administrative tasks and improving patient experience.

MediVoice is implemented on a Raspberry Pi 5 and currently operates with a headset for voice input and output. The software stack consists of Python, SpeechRecognition, PyAudio, and NLTK for natural language processing (NLP), along with ALSA for audio handling. The system converts voice input into text using speech recognition, processes it through NLP models to determine intent, and generates appropriate responses in either text or synthesized speech. It also integrates with hospital management systems (HMS) via API calls to fetch real-time doctor availability and appointment slots.

The project has successfully implemented basic voice input and output using a headset, as well as API integration for retrieving information. Additionally, a structured questionnaire has been developed to streamline patient interactions. Future work includes expanding language support (Marathi and other regional languages), AI-driven symptom logging, and IoT integration for enhanced patient monitoring.

Preliminary results indicate that MediVoice improves efficiency in patient reception tasks, reducing wait times and enhancing accessibility, particularly for elderly and visually impaired patients. With further advancements in machine learning and voice adaptation, the system has the potential to revolutionize clinic automation, making healthcare interactions more efficient and user-friendly.

17. Plant Leaf Disease Detection using CNN

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Abstract: Abstract—Agriculture plays a vital role in the global economy, and early detection of plant diseases is crucial for ensuring healthy crop yields. Traditional disease detection methods are time-consuming and require expert knowledge. This project aims to develop an automated plant leaf disease detection system using Convolutional Neural Networks (CNNs) to classify and diagnose plant leaf diseases. The system utilizes image processing techniques to capture and pre-process plant leaf images. CNN architecture effectively extracts key features from leaf images, making it a robust tool for disease diagnosis. The proposed system captures leaf images using a camera module of raspberry

pi and processes them through a CNN model trained on a dataset of diseased and healthy plant leaves. The CNN extracts key features from the images and classifies them into different disease categories with high accuracy. The model is implemented on a Raspberry Pi 4 B, enabling real-time disease detection in agricultural fields. This approach provides a cost-effective, efficient, and scalable solution for farmers to monitor plant health and take preventive measures. By leveraging deep learning and image processing, the system enhances disease diagnosis, reduces crop losses, and promotes sustainable farming practices.

18. LiDAR-IMU Fusion for 3D Mapping

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Abstract: Accurate 3D mapping is essential for autonomous navigation in complex environments. This research presents a LiDAR-IMU fusion algorithm that addresses limitations of traditional 2D mapping techniques by effectively incorporating elevation data and handling multi-level structures. Our approach integrates point cloud data from LiDAR sensors with motion information from Inertial Measurement Units to generate detailed 3D environmental maps. By employing quaternion-based transformations, our system effectively represents orientation changes and corrects motion-induced distortions in LiDAR scans. This mathematical framework provides superior numerical stability compared to Euler angles, eliminating gimbal lock issues common in complex rotational scenarios. An Extended Kalman Filter serves as the core of our fusion algorithm, combining the strengths of both sensors while minimizing their individual weaknesses.

The software pipeline includes data synchronization mechanisms, point cloud preprocessing, and real-time visualization capabilities. Our system uses a probabilistic occupancy grid mapping approach that effectively represents free, occupied, and unknown spaces in 3D. The resulting maps provide rich spatial information that enhances potential localization and path planning capabilities. The algorithm has been validated through simulated environments, demonstrating promising results for future real-world implementation. Our approach shows potential for improved mapping precision and consistency in dynamic and uneven terrains. The cost-effective nature of our solution makes it accessible for applications including search-and-rescue operations, disaster response, and industrial inspections. This research contributes to the field of autonomous navigation by providing a practical, scalable approach to 3D mapping that maintains high accuracy while using affordable sensor configurations.

19. Design and Performance Analysis of Power-Efficient and High-Speed Multipliers Using Vedic Mathematics

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Abstract— Digital circuits rely on efficient arithmetic operations, with multiplication and squaring being fundamental to various applications. The speed and power consumption of these operations significantly impact overall system performance, necessitating the development of high-speed, low-power architectures. In modern digital design, optimizing computational efficiency while minimizing on-chip area and memory usage is crucial. This paper presents the design and implementation of multiplier and square circuits based on Vedic mathematics. Vedic mathematics, an ancient Indian system based on sixteen sutras, offers efficient computational techniques that enhance speed and reduce delay. The Urdhva Tiryakbhyam (Vertical and Crosswise) and Nikhilam Navatashcaramam Dashatah (All from Nine and Last from Ten) Sutras are utilized for designing optimized arithmetic circuits. The proposed circuits are designed using DSCH software, with power, area, and delay parameters analyzed in Microwind. The analysis is conducted using 90nm, 65nm, and 45nm technology to evaluate performance variations across different fabrication scales. Simulation results demonstrate significant improvements in computational speed, power efficiency, and resource optimization compared to conventional methods. By integrating Vedic mathematics with modern digital circuit design, this research

contributes to the development of high-speed, low- power computing systems with applications in signal processing, cryptography, and real-time embedded systems. Index Terms—Multiplication, squaring , speed , performance, high-speed ,optimization, Microwind

20. OCR Based Number Plate Recognition Using YOLOv8

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Abstract: Automatic Vehicle License Plate Recognition (AVLPR) is a computer vision-based technology that detects, extracts, and recognizes license plate numbers from digital images or real-time video feeds. The system integrates image acquisition, plate localization, alphanumeric character extraction, and Optical Character Recognition (OCR) for efficient identification. This project develops a high-accuracy license plate recognition system using YOLOv8 for detection and EasyOCR for text extraction, implemented in Python and OpenCV. The detection model, trained on Roboflow-annotated images, ensures robustness against variations in lighting, angles, and motion blur. This technology is widely applied in traffic monitoring, law enforcement, toll collection, and parking management. Deploying the system on a Raspberry Pi with a camera module makes it cost-effective and lightweight. To enhance OCR accuracy, preprocessing techniques like grayscale conversion, noise reduction, and edge detection are applied. Despite challenges like poor lighting and high-speed vehicles, deep learning techniques improve system robustness. Index Terms—YOLOv8, Optical Character Recognition, ANPR, Machine Learning, Embedded Systems.

21. Seat electronic control unit for automotive application.

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Abstract: The Seat Electronic Controller Unit (SECU) is an advanced automotive system designed to provide enhanced comfort and convenience for passengers through automated seat adjustments and integrated climate control features. This project leverages the capabilities of Renesas microcontrollers, motor drivers, and various system-on-chip (SoC) solutions to achieve precise control over seat positioning. Passengers can adjust the seat's position using electronic switches for optimal ergonomic support. A key feature of the SECU is its dual-mode heating and cooling system, designed to maintain a comfortable seating temperature in varying environmental conditions. The system uses thermoelectric elements and temperature sensors to regulate heat distribution effectively. Additionally, the use of intelligent algorithms ensures energy-efficient thermal management. The microcontroller-based design provides real-time monitoring and closed-loop feedback to ensure smooth motor operation and accurate seat positioning. Safety mechanisms such as over-load detection and thermal cut-off protection are implemented to prevent damage to the system components. The integration of a user-friendly interface allows seamless interaction, providing easy access to adjustment and climate control settings. Furthermore, the SECU is designed to be modular and scalable, allowing customization for different vehicle models, from luxury to economy class. Through the efficient use of embedded systems and motor control technologies, this project aims to contribute to the development of smart automotive interiors that enhance the overall passenger experience. The SECU's innovative design ensures reliable performance, reduced energy consumption, and improved passenger comfort, making it a valuable addition to modern vehicles.

22. WEAPON DETECTION SYSTEM USING YOLOv8

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The YOLOv8-based weapon detection system is a highly efficient deep-learning framework designed for real-time identification and localization of weapons in video footage and images. With the growing need for advanced security solutions, this system provides a powerful tool for detecting firearms, knives, and other hazardous objects with remarkable accuracy and speed. YOLOv8 improves upon its predecessors by offering an optimized model architecture, enhanced detection capabilities, and better precision, making it highly effective in threat prevention and law enforcement applications. To develop this system, a comprehensive dataset of weapon images was curated and preprocessed with advanced augmentation techniques. This ensures that the model generalizes well across various environments, lighting conditions, and crowded scenes. The YOLOv8 architecture enables one-pass object detection, ensuring near-instantaneous recognition of threats. This real-time processing capability is crucial for applications such as public safety monitoring and law enforcement, where immediate action can prevent potentially tragic outcomes. Additionally, YOLOv8's efficiency allows deployment on edge devices, making it a practical solution for real-time surveillance without requiring high-end computing resources. Extensive testing of the system has demonstrated its high recall and precision rates, significantly reducing false positives while maintaining accurate threat detection. The model performs effectively even in complex scenarios, such as densely populated areas, fluctuating lighting conditions, and varying backgrounds. These results indicate that the YOLOv8 weapon detection system enhances situational awareness for security personnel, allowing for timely interventions. By integrating this AI-powered technology into surveillance networks, security agencies can improve response times and reinforce safety protocols, creating more secure environments in both public and private spaces. With its high accuracy, rapid processing, and adaptability, the YOLOv8-based weapon detection system represents a significant advancement in AI-driven security solutions, ensuring proactive threat mitigation in critical scenarios.

23. VisionAssist- Facial Recognition system for Visually Impaired.

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Abstract—This project aims to develop an assistive technology solution that enhances the ability of visually impaired individuals to recognize people around them through facial recognition. The system utilizes a Raspberry Pi 4 as the computing device, a Pi Camera to capture real-time images, a microphone to receive voice commands, and a speaker to output the recognized face's name, offering a seamless, user-friendly experience. The primary goal is to empower visually impaired users by providing a portable system that can be integrated into various devices, offering flexibility beyond just specialized glasses. By capturing the image of a person in the user's environment, the system processes the data using facial recognition algorithms, compares it with a pre-stored database of known individuals, and vocally announces the recognized face through the speaker. The system is designed to be compact, cost-effective, and efficient, combining machine learning techniques for facial recognition with a user-friendly interface that responds to voice commands. This project holds the potential to improve the daily social interactions and overall quality of life for visually impaired individuals, promoting independence and inclusion in society.

24. Offline Voice Recognition for Home Automation.

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Abstract: The project "Voice Recognition for Home Automation without Internet Connectivity" deals with the designing and implementing of voice-controlled smart home systems that can work completely without an internet

connection. This project addresses the privacy, security, and reliability issues pertaining to cloud dependent voice recognition systems. The initiative avails localized processing to ensure that the voice data stored is local on the device, thus hugely enhancing the security of data and protecting the user's privacy. The project essentially will work on local processing wherein users will be able to control their lights, fans, or appliances directly by voice commands without being dependent upon an active internet connection. Because it will be engineered to recognize voice commands with significant accuracy and speed, thanks to the availability of embedded systems and microcontrollers, the aftermath will be an economically sound, secure, and effective solution improving on user privacy, with functionality that will not be interrupted by environments with unreliable or absent internet connectivity. This significantly reduces the possibility of data breaches. In addition, an offline system can provide uninterrupted functionality and reliability, even in areas where internet connectivity is either not accessible or rather poor. This project will develop an adaptive, secure, and reliable voice recognition system that enhances the capabilities and user experience in smart home settings while protecting user data and privacy.

25. AeroAgri Stabilization & Spraying.

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Abstract: The agricultural sector in India is a vital industry, but it adopts modern technologies more slowly than Western nations. To improve crop treatment, developed countries deploy agricultural drones equipped with cameras. Crop monitoring and pesticide spraying are two important drone uses in precision agriculture that are the subject of this research. This project focuses on developing a gimbal-based crop detection and pesticide spraying system integrated into an agricultural drone. The system utilizes a stabilized camera gimbal to capture real-time aerial imagery, detect unhealthy crops using Raspberry Pi, and send signals to a PIC microcontroller to enable targeted pesticide spraying. By ensuring precision spraying, this technology minimizes chemical wastage, reduces environmental impact, and enhances crop yields. The Arduino Uno-based gimbal control system stabilizes the camera for crop monitoring, target tracking, and surveillance. This project aligns with the "Make in India" initiative, promoting indigenous innovation in agricultural automation while reducing dependence on imports. The system aims to revolutionize farming through efficient resource management, cost-effective pesticide use, and sustainable agriculture.

26. Adaptive Traffic Lights for ITS.

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Abstract: With the rapid increase in the number of vehicles, urban areas are experiencing severe traffic congestion, accidents, and other transportation challenges, particularly as cities transition into smart cities. In recent years, managing traffic efficiently has become a major concern for engineers and urban planners. To address this issue, we propose an IoT-based intelligent traffic control system that dynamically adjusts traffic signals to improve road efficiency. Our system integrates Raspberry Pi, GSM-based GPS tracking, and cloud communication via MQTT to monitor real-time traffic conditions and optimize signal timing. Additionally, the system provides live traffic updates through a mobile application, enabling drivers to make informed route decisions and avoid congestion. The proposed solution enhances urban mobility by reducing unnecessary waiting times at intersections, minimizing traffic bottlenecks, and improving overall traffic flow in smart cities.

27. Smart Library Management System using RFID Tags and Data Analytics.

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Abstract: The Smart Library Management System (SLMS) utilizes RFID technology and data analysis to boost the efficiency of library processes, automate inventory, and provide in-depth information on user behavior. Through the use of RFID tags in books and sensors at entry and exit points, the system allows for real-time tracking of library resources, hence, minimizing book theft and optimizing the use of resources. The SLMS leverages data-driven methodologies to analyze borrowing patterns, identify the most borrowed books and book genres, and detect trends in reading behavior. It also enhances the user experience through personalized recommendations and customized library services that match individual reading interests. This research examines the implementation, advantages, and limitations of the SLMS, illustrating its potential to revolutionize traditional library management into an intelligent and data-driven system. Keywords—Radio frequency identification (RFID), RFID reader, RFID technology, RFID tracking, Library Management System, Library Security, Data Mining, Data Analytics, Database Management.

28. Hand Gesture-Based Speech System for the Hearing and Speech Impaired.

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Abstract: Vocal communication is essential for expressing emotions, messages, and information. However, individuals with speech and hearing impairments face challenges in interacting with others. While sign language is their primary mode of communication, it becomes ineffective when the recipient does not understand it. This project proposes a hand glove-based sign-to-text translation system to bridge this gap. The glove enables individuals with speech and hearing impairments to communicate with those unfamiliar with sign language. Hand gestures made using the glove are detected, processed, and converted into speech output via a speaker. The system consists of flex sensors that capture finger movements and a microcontroller that interprets and transmits the data. This technology offers an efficient and practical solution to communication barriers, ensuring that messages are accurately conveyed and understood.

Keywords— Flex, Accelerometer, Arduino, Bluetooth, Android Mobile, Vocal communication, Speech impairment, Hearing impairment, Sign language, Hand gesture recognition, Assistive technology, Sign-to-text translation, Glove-based communication system, Flex sensors, Microcontroller-based system, Gesture-to-speech conversion, Accessibility solutions,

29. Smart IoT Based Personal Safety and Health Monitoring Device

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Abstract— In today's world, ensuring the safety of women and monitoring their health has become critically important. Women are often at risk in workplaces, colleges, schools, and public spaces, with harassment rates increasing day by day. Many women do not feel safe and confident while traveling alone. This project proposes a smart IoT-based Women Safety and Health Monitoring System to address these concerns. The system not only enhances women's safety but also extends its benefits to children and elderly individuals who may be vulnerable to kidnapping, medical emergencies, or accidental falls. Children often face risks of abduction or getting lost, while elderly individuals are prone to falls and health-related issues. This device serves as a multi-purpose safety solution for all vulnerable groups. The proposed system is built using the NodeMCU ESP32, which is integrated with a GSM module, GPS module, vibration sensor, heartbeat sensor, panic button, and buzzer. When the panic button is pressed, the system is activated, triggering the buzzer to alert nearby people and grab public attention. Simultaneously, a real-time location message with an emergency alert is sent to pre-registered contacts via the GSM module. Additionally, the device detects sudden vibrations like an attack or fall and abnormal heart rate fluctuations, sending real-time health alerts to the registered mobile numbers. By integrating IoT technology with real-time monitoring, this device ensures enhanced personal security and health tracking, making it a valuable solution for women also for children and elderly individuals in distress. **Keywords**— IoT, Women Safety, Health Monitoring, ESP32, GPS, GSM, Panic Button, Vibration Sensor, Real-Time Location

30. LLC RESONANT CONVERTER FOR 480W SMPS

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Abstract— In today's world, power converters are expected to be highly efficient, compact, and reliable, especially in industries like telecommunications, servers, electric vehicles, and renewable energy systems. The LLC Resonant Converter is a popular solution that meets these demands by using soft-switching techniques such as Zero Voltage Switching (ZVS) and Zero Current Switching (ZCS). This converter reduces switching losses, lowers heat generation, and minimizes electromagnetic interference (EMI), making it ideal for high-frequency, high-power applications. This paper presents a detailed study of the LLC Resonant Converter, focusing on its basic operation, resonant tank design, and soft-switching behavior. It explains how the converter uses frequency modulation instead of traditional PWM control to regulate output voltage efficiently. The paper also provides key waveforms, circuit diagrams, and an analysis of how ZVS and ZCS are achieved, contributing to the converter's high performance. The insights shared aim to help engineers and researchers design more efficient and compact power supplies using the LLC Resonant Converter. **Keywords**— LLC Resonant Converter, Soft-Switching, Zero Voltage Switching (ZVS), Zero Current Switching (ZCS), Frequency Modulation, Resonant Tank, High-Efficiency Power Converter, Magnetizing Inductance, EMI Reduction, High-Frequency Transformer, Power Electronics, DC-DC Converter.