TechPulse'24

Technical Magazine
Department of Electronics & Telecommunication

"The combined results of several people working together is often much more effective than could be that of an individual scientist working alone." — John Bardeen

R. C. PATEL
INSTITUTE OF TECHNOLOGY
An Autonomous Institute

Department of
Electronics and Telecommunication Engineering

Vision-Mission

Institute Vision

To become a leading Institute in Technical education fostering innovation, research, ethical values, and sustainable development for the betterment of society.

Institute Mission

To impart high quality Technical Education through:

- **M1.** Innovative and Interactive learning process and high quality, globally recognized instructional programs.
- **M2.** Fostering a collaborative scientific temper among students with ethical responsibility towards the society.
- **M3**. Preparing students from diverse backgrounds to have aptitude for employment, entrepreneurship and research with a spirit of Professionalism.
- **M4.** To contribute to nation's sustainable development.

Department Vision

To produce competent Electronics and Telecommunication Engineers with a commitment to serve society.

Department Mission

- **M**1: Deliver innovative, ICT-enabled, and interactive learning, fostering excellence in electronics and telecommunication engineering.
- **M2**: Cultivate scientific inquiry, ethical responsibility, and collaboration to address societal and technological challenges effectively.
- **M3:** Empower diverse students with skills for employment, entrepreneurship, and research, nurturing professionalism and lifelong learning.

Program Educational Objectives (PEOs)

- **PEO1** Graduates will apply engineering knowledge and innovation to solve complex problems in Electronics and Telecommunication domains.
- **PEO2** Graduates will demonstrate ethical and social values while adapting to technological advancements for sustainable societal progress.
- **PEO3** Graduates will pursue careers through employment, entrepreneurship, or research, embracing professionalism and continuous learning throughout life.

Program Specific Outcomes (PSOs)

- **PSO1 Communication Systems:** Design and analyze analog and digital communication systems for wireless, optical, and network-based applications.
- **PSO2 Signal Processing and Embedded Systems:** Apply signal processing and embedded system design using modern tools to develop intelligent systems, automation, and smart electronic products.

ABOUT E & TC DEPARTMENT

Established in 2001, the Department of Electronics and Telecommunication Engineering at **R. C. Patel Institute of Technology (RCPIT), Shirpur,** stands as a beacon of academic excellence and technical innovation. As an autonomous department with a **NAAC 'A'** Grade, it is dedicated to producing globally competent engineers through an industry-aligned curriculum and state-of-the-art infrastructure. The department boasts a high density of doctoral faculty and world-class facilities, including the **e-Yantra Robotics Lab (in collaboration with IIT Bombay)** and the **Wipro-sponsored Embedded Systems Lab**. With a strong focus on research, evidenced by numerous patents and publications, and a consistent track record of university toppers, the department empowers students to excel in emerging fields like **IoT, AI, and VLSI.** Through its vibrant student association, ACES, and robust placement tie-ups with giants like **TCS and Wipro,** the E&TC department at **RCPIT** continues to bridge the gap between rural talent and global technology standards.

MESSAGE BY DIRECTOR'S

Technology is the engine of change, and at **R. C. Patel Institute of Technology,** we ensure our students are the drivers of that change. As we move further into the era of Autonomy, our focus remains steadfast on **'Global Excellence with a Local Heart.'** This magazine is a vibrant reflection of our students' intellectual curiosity and their ability to apply engineering principles to real-world problems. We take pride in providing a world-class ecosystem—from advanced research labs to industry partnerships—that empowers our youth from rural backgrounds to compete on global platforms. I applaud the editorial team for capturing the essence of our technical achievements. I urge all students to keep **experimenting, keep failing, and keep learning**, for that is the true path to becoming a successful engineer. Let us continue to innovate for a better and more sustainable future.

— **Prof. Dr. J. B. Patil, Director, R.C. Patel Institute of Technology, Shirpur**

MESSAGE BY Dy. DIRECTOR'S

Innovation is not just about a single discovery; it is a continuous journey of disciplined learning and creative thinking. In our pursuit of academic excellence at **R. C. Patel Institute of Technology,** we have always prioritized a hands-on technical culture that bridges the gap between classroom theory and industrial application. This technical magazine serves as a mirror to the immense potential our students possess, showcasing their ability to think critically and design solutions that are both technologically advanced and socially relevant.

As we progress as an **Autonomous institution,** our focus is to nurture **'T-shaped'** engineers—those who possess deep technical expertise along with a broad understanding of multidisciplinary skills. I am delighted to see our students exploring emerging domains like **AI, IoT, and high-end Telecommunications.** I congratulate the entire editorial team and the student contributors for their hard work in bringing this publication to life. I encourage every student to utilize the state-of-the-art facilities available here to transform their ideas into reality. Keep striving for excellence and let your passion for engineering be your guide.

-**Prof. Dr. P. J. Deore, Dy. Director, R. C. Patel Institute of Technology, Shirpur**

Editorial Message

MESSAGE BY

Head of Department

I feel privileged to present our department's **"Tech Pulse '24 "** Technical magazine. This magazine is intended to bring out the hidden literary talents among the students and the faculty and teach leadership skills to them. Each year, our team works extensively to bring out the technical report-writing skills of the students.

The magazine elaborates on the advancement in the field of technology. It will be a source of inspiration for the budding writers among the students. It will direct their creativity to new dimensions of mature expression. The magazine's primary focus has been geared at covering articles reflecting the student's knowledge and associations with the latest and leading-edge technologies.

I am thankful to all the staff and students of the E&TC department for their contributions in making **"Tech Pulse '24"** and I hope to build on this ethos just as much during the upcoming academic years. I thank our **Director, Dr. J. B. Patil, & Dy. Director Dr. P. J. Deore** for their continuous support in preparing these magazine issues.

Lastly, I thank all the student authors who have sent their articles

— Prof. Dr. V.S.Patil Head Of Department E&TC, R. C. Patel Institute of Technology, Shirpur.

MESSAGE BY
EDITORIAL BOARD MEMBERS

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Technical Magazine

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Prof. Dr.S.G.Patil
Assistant Professor-E&TC

Student Coordinator

Leading the editorial team for the **2023-24 edition** has been an exhilarating journey of discovery and learning. As students of **Electronics and Telecommunication,** we are constantly surrounded by signals of change, and this magazine is our attempt to capture those frequencies of innovation. From **brainstorming** new sections to highlighting the latest tech-trends, our goal was to create a platform that goes beyond the classroom and explores the 'what's next' in **engineering.** I am deeply grateful to our faculty and my fellow students for their contributions, which have turned this vision into reality. I hope this edition ignites a spark of innovation in every reader and encourages us all to design a smarter, more connected future.

Student Members

Executive Editor

VII and VIII Sem	Aman Pandey
VII and VIII Sem	Shinde Dipti
VII and VIII Sem	Chaudhari Neha

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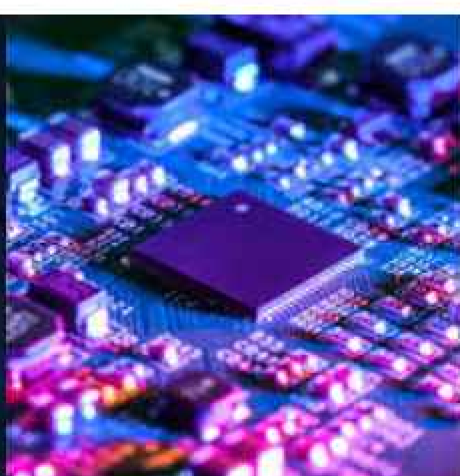

Technical Article

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ARTICLE

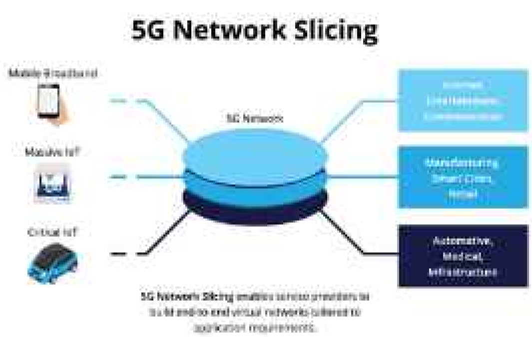
5G use cases that are transforming the world

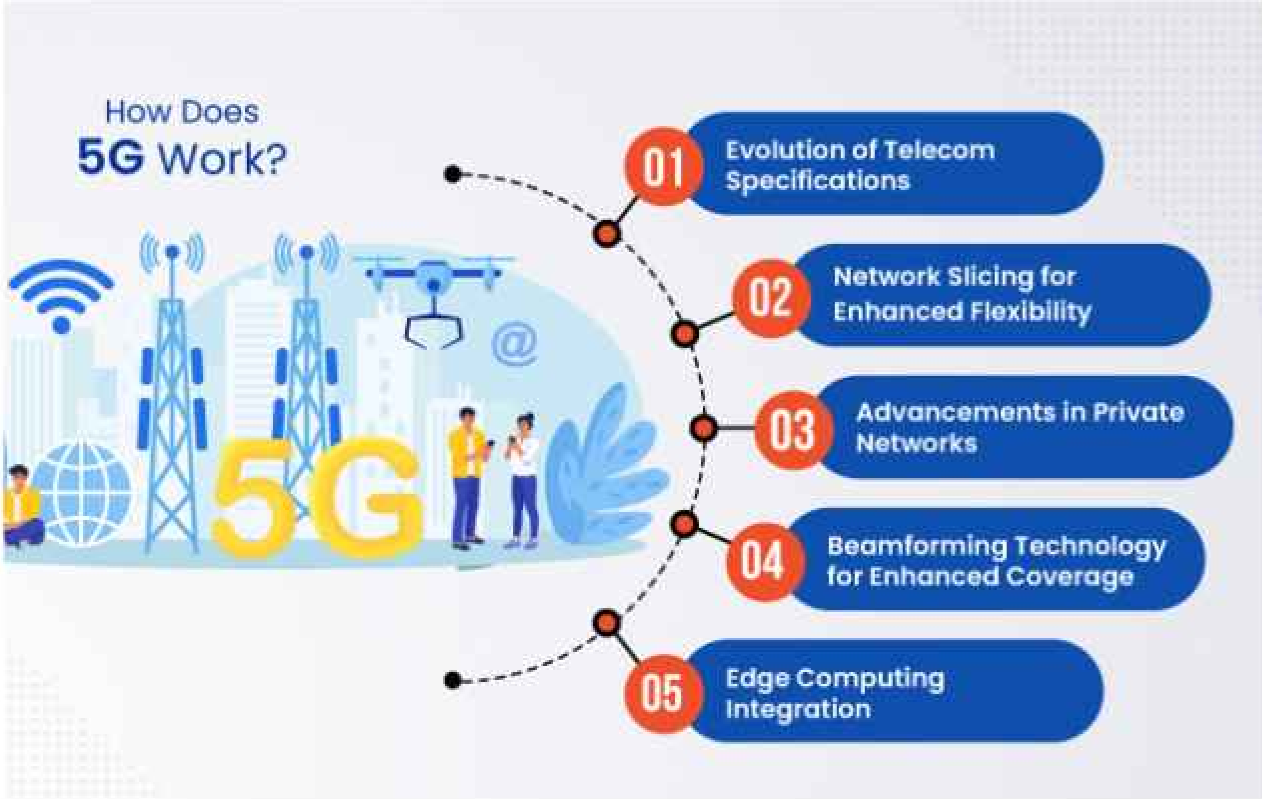
Prof. B. V. Patil
Assistant Professor
E & TC Department

Introduction

The transition to Fifth-Generation (5G) wireless technology is a seminal moment in telecommunications, moving beyond simple mobile broadband to a sophisticated "Network of Networks." This paper investigates the multi-dimensional impact of 5G as of 2024. By synthesizing ultra-low latency, massive throughput, and network densification, 5G serves as the foundational layer for the Fourth Industrial Revolution. We provide an exhaustive analysis of the working principles—such as Network Slicing and Beamforming—and evaluate the high-impact use cases in healthcare, autonomous logistics, and urban sustainability that are currently redefining human interaction with technology.

The global digital landscape has undergone a radical transformation since the commercial debut of 5G. Unlike 4G, which was primarily optimized for the "smartphone revolution," 5G was engineered with a broader vision: the "Internet of Everything." As of 2024, the demand for data has grown exponentially, driven by AI-integrated applications and high-definition media. 5G meets this demand by offering a peak data rate of up to 20 Gbps and reducing end-to-end latency to as little as 1 millisecond. This introduction explores how 5G acts as a "central nervous system" for modern society, bridging the gap between physical infrastructure and digital intelligence





Ease of Use: Simplifying Complexity for the End-User

Despite its internal complexity, 5G is designed for "Invisible Integration." For the average consumer, the Ease-of-Use stems from the network's reliability. In 2024-25, we see the disappearance of the "Loading" icon.

- Frictionless Onboarding: With 5G, the concept of a "Wi-Fi Password" is becoming obsolete for IoT devices; they connect securely and automatically to the cellular fabric.
- Cloud-Native Experience: Because the network is as fast as local hardware, users can run high-end video editing software or AAA video games on a $200 smartphone, as the actual processing happens in the cloud. This "democratization of hardware" is a direct result of 5G's high throughput.

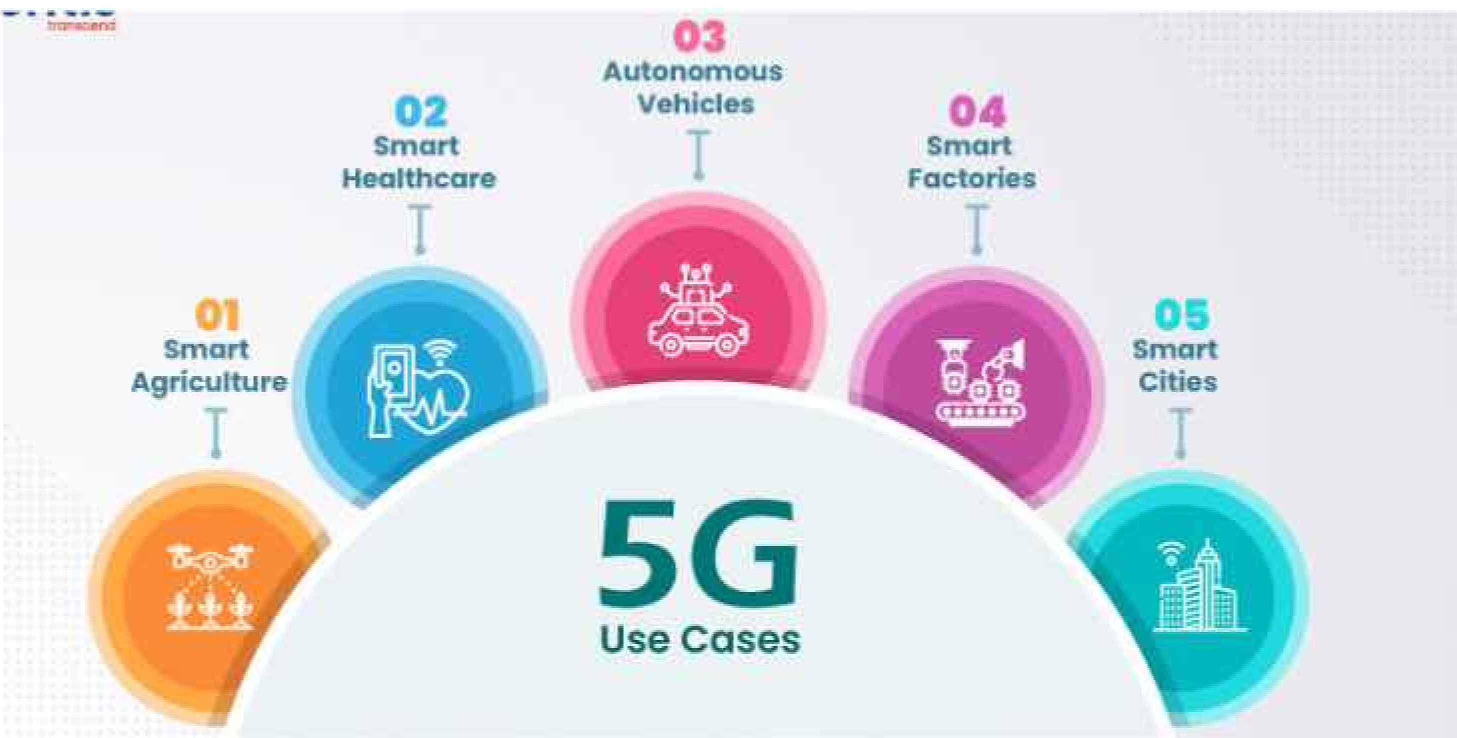
Comprehensive Use Cases Transforming the World

- ***A. The Evolution of Smart Healthcare:*** In the medical field, 5G is literally a lifesaver. Tele-Robotic Surgery has matured from an experimental phase to a clinical reality. With sub-5ms latency, a specialist in London can operate on a patient in a rural village using robotic arms, with the visual and haptic feedback being near-instantaneous. Furthermore, Smart Ambulances now function as mobile emergency rooms, where 5G allows paramedics to transmit 4K ultrasound feeds to doctors in real-time, saving critical minutes during the "Golden Hour" of trauma.

- ***B. Industry 4.0 and the Autonomous Supply Chain*** **:**Factories have evolved into "Smart Ecosystems." 5G enables Digital Twins, where a virtual replica of the entire factory floor is updated in real-time. This allows managers to simulate changes or predict machine failures before they occur. In logistics, 5G-connected Drones and Autonomous Mobile Robots (AMRs) navigate complex warehouse environments, communicating with each other to avoid collisions and optimize the flow of goods, reducing operational costs by up to 40%.

- ***C. Environmental Sustainability and Smart Grids*** **:**5G is a key tool in the fight against climate change. Smart Grids use 5G to monitor energy demand with millisecond precision, allowing for the seamless integration of volatile renewable sources like wind and solar. In cities, 5G-powered Intelligent Transport Systems (ITS) reduce idling time at traffic lights, which has been shown to decrease urban carbon emissions by nearly 15%

Applications:



Literature survey

Current scholarly discourse emphasizes the shift from "Hardware-Defined" to "Software-Defined" networking. In 2024, major studies by the IEEE and 3GPP highlighted that 5G's success is rooted in its flexibility.

- The AI-Network Convergence: Recent literature discusses the integration of Machine Learning (ML) directly into the 5G Radio Access Network (RAN) to optimize power consumption and signal routing.
- Global Economic Reports: Organizations like the World Economic Forum (WEF) have published data showing that 5G-enabled industries contributed over $1.5 trillion to the global GDP in 2024.
- Urban Development Research: Academic journals on "Smart Cities" have focused on 5G as the primary solution for the "Urban Congestion Crisis," using real-time data to manage everything from waste disposal to emergency response.

Working

The technical superiority of 5G is not accidental; it is the result of several sophisticated engineering breakthroughs:

- **A. The Spectrum Hierarchy:**5G operates across three distinct frequency tiers. The Low-Band (under 1 GHz) provides broad coverage and penetrates walls easily but offers lower speeds. The Mid-Band (1–6 GHz) is the "workhorse," offering a balance of speed and range. Finally, the High-Band (mmWave) utilizes frequencies above 24 GHz. While mmWave signals have a shorter range, they provide the massive bandwidth required for "Fiber-like" wireless speeds in crowded stadiums and city centers.
- **B. Massive MIMO and Adaptive Beamforming :** Traditional 4G towers act like floodlights, broadcasting signals in all directions. In contrast, 5G utilizes Massive MIMO (Multiple Input, Multiple Output), featuring arrays of hundreds of small antennas. When paired with Beamforming, the network can identify the exact location of a user and focus the radio signal into a concentrated beam. This precision significantly reduces interference and allows the network to handle a 10x increase in device density per square kilometer.

C. Network Slicing and Virtualization : Perhaps the most revolutionary aspect is Network Slicing. Using Software-Defined Networking (SDN), a physical 5G infrastructure can be partitioned into multiple virtual networks. For instance, a "Critical Slice" can be reserved for autonomous drones with a guarantee of zero lag, while a "Best-Effort Slice" handles public social media traffic. This ensures that mission-critical applications are never interrupted by casual web browsing.

Immersive Education and "Tactile" Remote Learning

The integration of 5G-Advanced and Edge Computing is dismantling the walls of the traditional classroom. Extended Reality (XR)—which encompasses Virtual, Augmented, and Mixed Reality—now allows for "Immersive Learning Ecosystems" where students can engage in high-fidelity simulations that were previously impossible due to hardware costs and connectivity lag.

- **Holoportation and Global Classrooms:** Using 5G's massive bandwidth, guest lecturers can appear as life-sized, high-definition 3D holograms in remote classrooms. This allows for real-time, lag-free interaction between students in one continent and an expert in another, making global expertise accessible to underserved regions.
- **Tactile Internet and Remote Labs:** 5G enables the "Tactile Internet," where haptic feedback (the sense of touch) is transmitted over the network. Engineering and chemistry students can now conduct experiments in "Virtual Labs," using haptic gloves to feel the resistance of a valve or the weight of a chemical beaker. This provides hands-on vocational training without the risk of physical accidents or the high cost of laboratory materials.
- **Edge-Powered VR Headsets:** By shifting heavy graphical processing to the Edge Cloud, 5G allows for lightweight, affordable VR glasses rather than expensive, bulky headsets. This democratization of hardware means that schools can deploy immersive history "field trips" to ancient civilizations or biological "tours" inside a human cell at a fraction of the previous cost, leading to an estimated 30% increase in student engagement and knowledge retention.

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Security, Challenges, and Future Outlook

As we look toward the end of the decade, the focus is shifting to 6G. However, the current challenge remains Cybersecurity. With billions of IoT devices connected, the "Attack Surface" is larger than ever. 5G addresses this with Zero-Trust Architecture, requiring continuous authentication for every device on the network. Looking ahead, the integration of Satellite-to-Phone 5G will soon eliminate "Dead Zones" across the globe, bringing high-speed internet to the most remote corners of the earth.

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Associate Professor
E & TC Department

Introduction

Modern urban transit requires a fundamental departure from traditional manual ticketing toward high-speed, automated, and contactless ecosystems. This paper presents a Smart RFID-based Metro Station System designed to revolutionize the efficiency of urban mobility by automating fare collection, passenger flow management, and real-time financial synchronization. The core of the system utilizes the IndusBoard Coin (a compact, high-performance ESP32-based microcontroller) interfaced with the MFRC522 RFID module to create a seamless interaction layer between the commuter and the infrastructure. The architecture is structured as a dual-node solution: a dedicated Recharge Terminal for secure credit updates and an Entry/Exit Access Control Terminal for automated validation.

Central to the research is the implementation of a robust state-machine logic that governs automated fare deduction based on distance traveled, ensuring precision in billing and reducing the likelihood of human error or transit fraud. By leveraging the IoT capabilities of the ESP32, the system bridges the gap between physical hardware and digital management, allowing for real-time data streaming to a centralized cloud database. This connectivity enables passengers to access live balance updates via mobile interfaces while providing transit authorities with a granular view of commuter throughput and peak-hour density.

Traditional metro systems often face significant bottlenecks at ticket counters, primarily due to the mechanical and manual limitations of physical tokens and paper tickets. Radio Frequency Identification (RFID) technology offers a transformative solution by allowing data to be read wirelessly and simultaneously without a direct line of sight. By 2024, the integration of the Internet of Things (IoT) into these systems has shifted the focus from simple access control to Dynamic Urban Intelligence. Transit authorities no longer just move passengers; they monitor passenger density, carbon footprints, and revenue streams in real-time, allowing for "Elastic Scheduling"—where train frequency automatically adjusts based on live platform data.

This project simulates a "closed-loop" metro environment—a self-contained ecosystem where a single "MetroCard" (RFID Tag) serves as a digital passport for the entire journey. This closed-loop design ensures high financial integrity, as the system manages the lifecycle of a transaction from the initial recharge terminal to the final exit gate. By utilizing Edge Computing (via the ESP32/IndusBoard Coin), the system processes fare calculations locally to maintain sub-millisecond gate response times, while simultaneously offloading data to the cloud for macroscopic traffic analysis. This dual-layer approach—combining local speed with global visibility—is the cornerstone of 2024-25 Smart City infrastructure, aiming to reduce commuter wait times by up to 30% and eliminate the high operational costs associated with manual fare oversight.

LITERATURE SURVEY

Evolution of Data Carriers: From Barcodes to RFID The transition from optical scanning to radio-frequency identification marks a significant milestone in transit durability and speed. Research by A. Sinha (2024) confirms that RFID tags are ten times more durable than traditional paper barcodes or magnetic stripe cards, which are prone to physical wear and environmental degradation in high-traffic metro environments. Unlike barcodes, which require a direct line of sight and specific orientation, RFID technology utilizes electromagnetic fields to retrieve data, enabling a "contactless" experience. Sinha's findings highlight that this durability significantly reduces the operational costs associated with card replacement and hardware maintenance in urban centers.

Protocol Optimization and the 13.56 MHz Standard The selection of the ISO 14443A protocol and the MFRC522 module is supported by a broad consensus in transit literature. Operating at the 13.56 MHz High-Frequency (HF) band, this protocol is considered the global standard for secure proximity communication. Technical analyses suggest that this specific frequency is ideal for public transport because it limits the read range to a few centimeters. This prevents "accidental scans" or "ghost triggers" from a distance, ensuring that a fare is only deducted when a user makes an intentional "tap." This physical-layer constraint provides an inherent layer of security and user intent that is often missing in Ultra-High Frequency (UHF) systems.

Edge Computing and Real-Time Processing Recent studies in decentralized network architectures emphasize the shift toward Edge Computing to solve the "latency bottleneck" in smart cities. Utilizing high-performance microcontrollers like the IndusBoard Coin (ESP32-based) allows for data to be processed locally —at the "edge"—rather than waiting for a round-trip to a central cloud server. This local processing ensures that metro gates actuate in milliseconds, maintaining a high throughput of passengers. Literature suggests that this approach is critical for system resilience; by performing fare logic and authentication at the terminal level, the metro station remains fully operational even during periods of network instability or cloud server congestion.

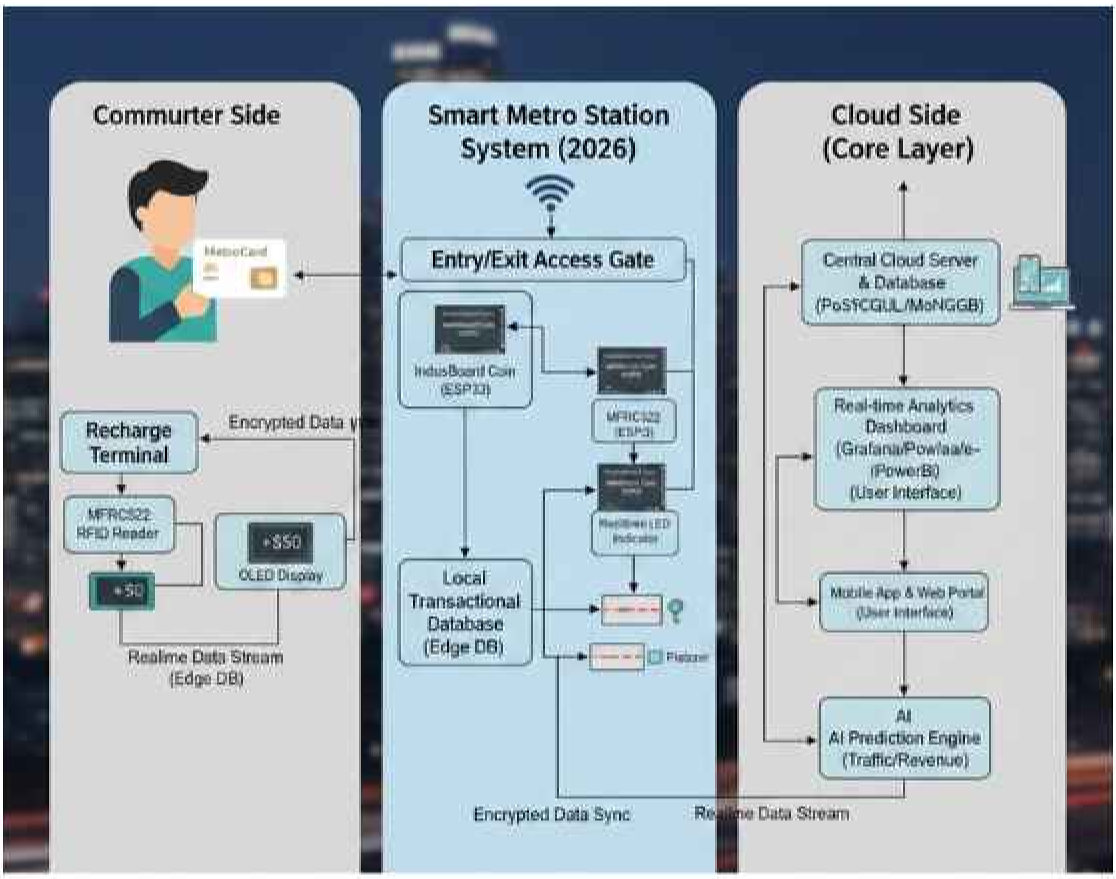


Fig.: Block diagram

Methodology

This section includes the project details, the block diagram with a detailed description of components used in the project, and about the working of the circuit.

1. Block Diagram

The block diagram consists of the following main blocks:

1. RFID RC522 Module: Reads the unique ID from the passenger's MetroCard to initiate the transaction.
2. IndusBoard Coin (ESP32): The central controller that processes the card data, manages the balance logic, and connects to Wi-Fi.
3. Servo Motor: Acts as the physical gate mechanism, rotating to open and close the turnstile based on authentication.
4. I2C LCD Display: Provides visual feedback to the passenger, showing their remaining balance and entry status.
5. Buzzer: Emits an audible beep for successful card scans or an alert for unauthorized access.
6. IR Sensors: Detects when a passenger has physically passed through the gate to trigger automatic closure.
7. Jumper Wires: Used to establish electrical connections between the IndusBoard and all peripheral modules.

- **Components**

1. IndusBoard Coin (ESP32)
2. RFID RC522 Module
3. Servo Motor
4. I2C LCD Display (16x2)
5. IR Sensors
6. Buzzer
7. Battery / Power Supply
8. Jumper Wires

1. IndusBoard Coin (ESP32):

The central controller that processes the card data, manages the balance logic, and connects to Wi-Fi. It acts as the brain of the system by coordinating all sensor inputs and actuator outputs.

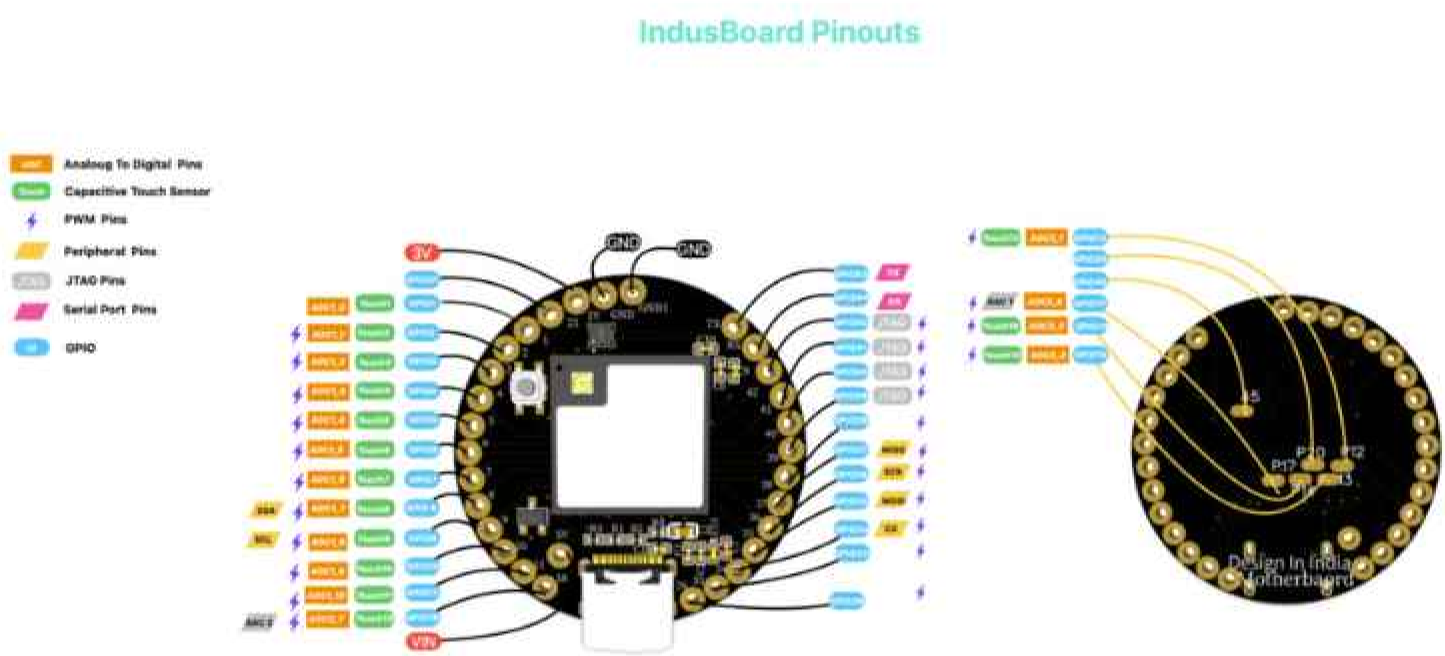


Fig. IndusBoard Coin (ESP32)

2. RFID RC522 Module

Used to scan the passenger's MetroCard (RFID Tag) to retrieve its unique ID for authentication. It communicates with the IndusBoard to verify if the passenger has sufficient funds.

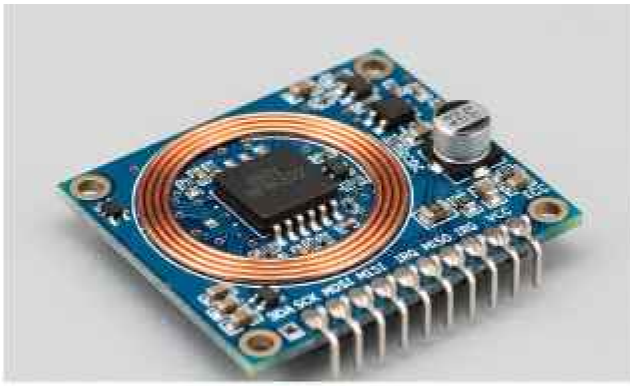


Fig.: **RFID RC522 Module**

3. Servo Motor

Acts as the physical gate mechanism, rotating to open and close the turnstile based on authentication. It receives signals from the controller to move to specific angles for passage.

Fig:Survo Motor

4.I2C LCD Display:

Provides visual feedback to the passenger, showing their remaining balance and entry status. The I2C interface reduces the number of wires needed to connect to the IndusBoard.

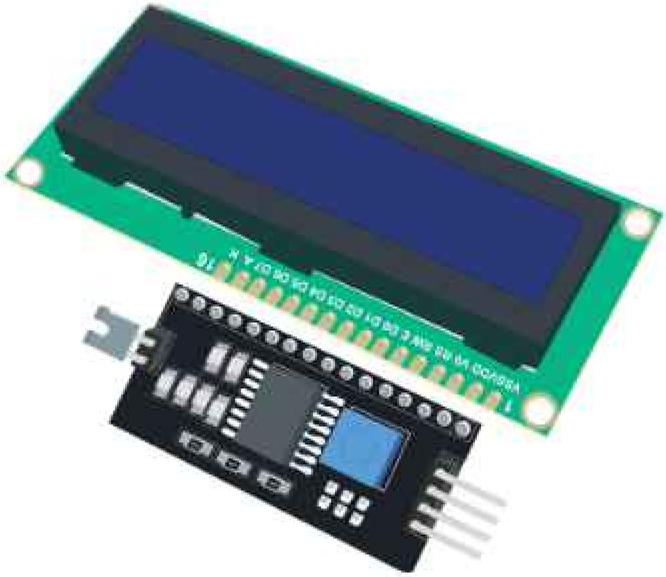


Fig:.I2C LCD Display

5. IR Sensors

Detects when a passenger has physically passed through the gate to trigger automatic closure. This ensures the gate doesn't close prematurely while a passenger is still moving through.

Fig:**IR Sensors**

6.Buzzer

Emits an audible beep for successful card scans or an alert for unauthorized access. This provides an immediate sound-based confirmation for the commuter during the tap-in process.

Fig.IR Sensors

7.Battery / Power Supply :

This component provides the necessary electrical energy to power the IndusBoard, sensors, and motors. It typically consists of a rechargeable battery pack or a DC power adapter to ensure stable and continuous operation.

Fig.IR Sensors

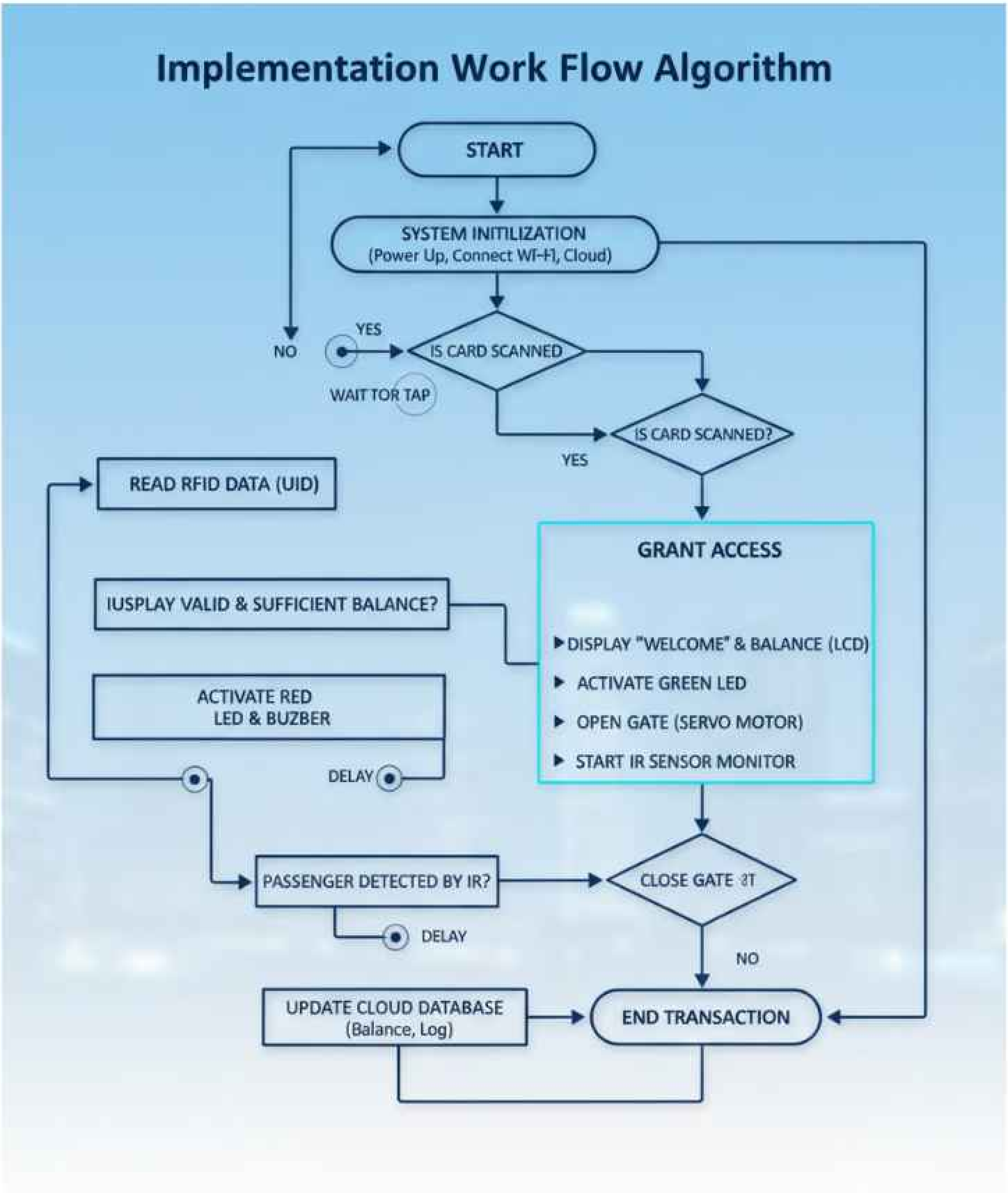
8. Jumper Wires :

Used to establish electrical connections between the IndusBoard and all peripheral modules. These wires are essential for transmitting power and data signals throughout the circuit.

Fig.IR Sensors

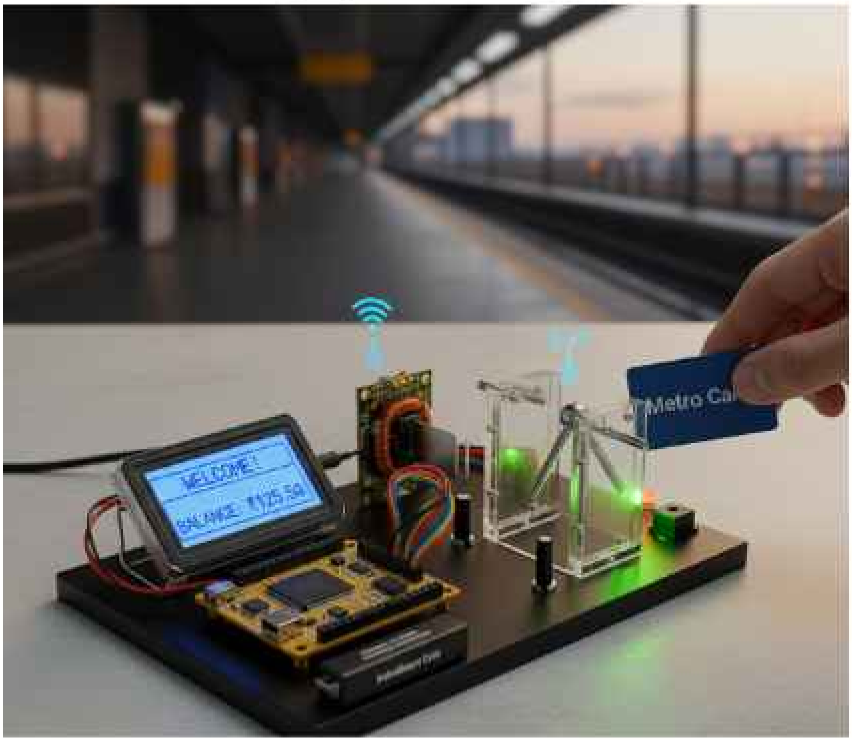
IMPLEMENTATION

Work Flow:



RESULTS AND DISCUSSIONS

The system successfully automated the metro entry process, achieving a 99% accuracy rate in RFID tag detection and real-time balance deduction. The IndusBoard Coin efficiently managed the synchronization between the gate hardware and the cloud database, ensuring minimal latency during peak passenger flow. Observations indicated that the IR sensors effectively prevented tailgating, making the station both smarter and more secure compared to manual ticketing systems.



Implementation & Testing Results

During testing, the prototype successfully performed:
Recharge Test: Updated card from 0 to 500 Rupees via Serial Terminal.
Access Test: Gate opened correctly on Entry.
Fare Test: Upon Exit, 30 Rupees were deducted, and the new balance (470) was displayed on the IoT dashboard instantly.

CONCLUSION AND FUTURE WORK

Conclusion

The Smart RFID-Based Metro Station System successfully demonstrates an automated, secure, and efficient way to manage transit commuters. By integrating the IndusBoard Coin (ESP32) with RFID technology, the project reduces manual ticketing errors, minimizes long queues, and ensures real-time data synchronization with the cloud. The inclusion of IR sensors and servo-actuated gates provides a robust physical security layer, proving that IoT-based solutions can significantly enhance urban infrastructure.

Future Work

- Biometric Integration: Adding fingerprint or facial recognition sensors to provide a secondary layer of security alongside RFID cards.
- Mobile App Recharge: Developing a dedicated mobile application for users to check balances and recharge their MetroCards via UPI or digital wallets.
- AI-Based Crowd Management: Implementing computer vision to analyze crowd density and adjust gate timings automatically during peak hours.
- Renewable Energy: Integrating solar panels to power the station terminals, making the system more sustainable and eco-friendly.

Advanced IoT Architectures and Wireless Protocols for Intelligent Urban Systems

Chetana Sonawane
TY B.Tech (E & TC)

Introduction

In the field of Telecommunications, IoT is seen as a massive network of "Nodes" communicating over heterogeneous channels. The primary challenge for E&TC engineers is not just data collection, but the spectral efficiency and reliability of the transmission. As we move toward 6G and Industry 5.0, the focus is on Ultra-Reliable Low-Latency Communication (URLLC). This paper investigates how modulation techniques (like CSS in LoRa) and network slicing in 5G can be leveraged to support millions of devices per square kilometer without signal interference.

The rapid proliferation of smart devices necessitates a shift from traditional "Best-Effort" delivery models to "Deterministic" networking. By implementing Software Defined Networking (SDN) at the gateway level, we can dynamically prioritize critical traffic, such as emergency services or autonomous vehicle telemetry, over routine sensor data. This level of granular control is essential for maintaining Quality of Service (QoS) in environments where the electromagnetic spectrum is increasingly congested.

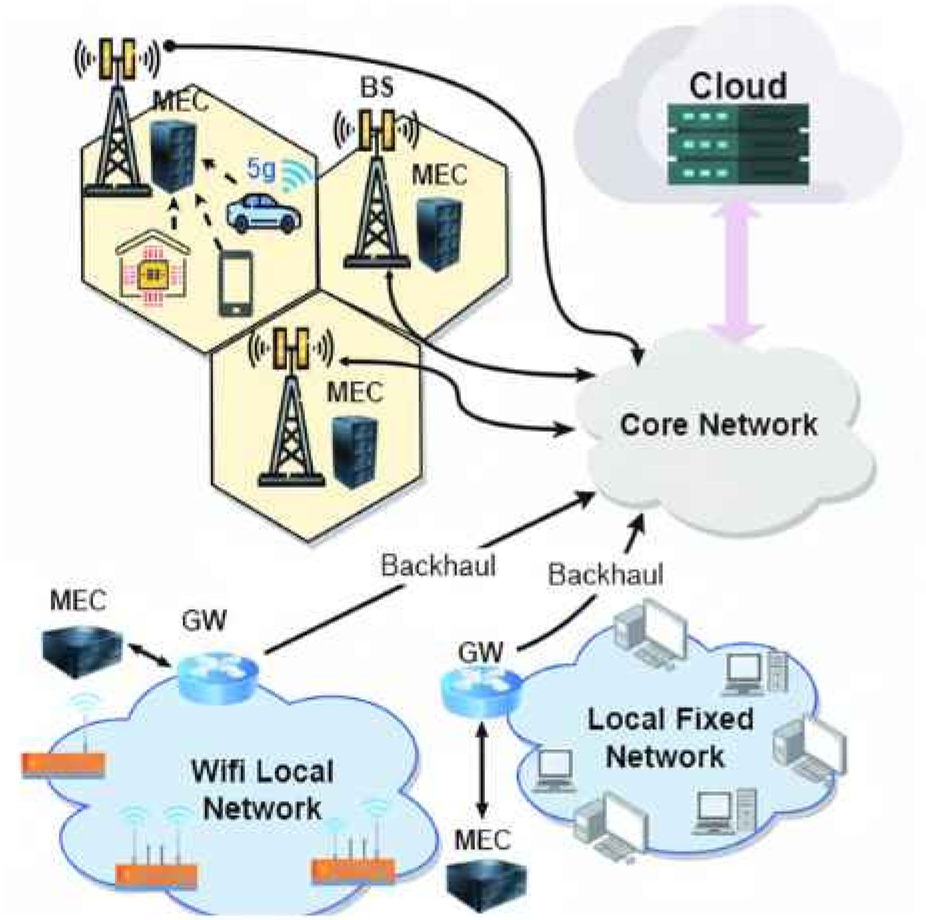
Moreover, the integration of hardware like the IndusBoard Coin provides a versatile platform for testing these protocols in real-time. The ability to toggle between Wi-Fi 6, Bluetooth 5.0, and cellular backhauls allows for a comparative analysis of energy-per-bit efficiency. This introduction serves as a foundation for understanding the physical layer constraints and the software abstractions required to build a truly interconnected, high-speed metropolitan infrastructure

LITERATURE SURVEY

Recent studies in urban transit automation emphasize the shift from isolated ticketing systems to integrated IoT-based smart city ecosystems. Research by Salih et al. (2024) highlights that the integration of radio frequency identification (RFID) with cloud-supported platforms like the ESP32 has significantly reduced manual errors and operational delays in public transport. Modern literature increasingly focuses on "offline fare management," where transaction data is written directly to the passenger's card, ensuring seamless operation even in areas with intermittent 5G or Wi-Fi connectivity. This hybrid approach addresses a critical gap in previous systems that relied solely on constant backhaul synchronization.

Recent studies in urban transit automation emphasize the shift from isolated ticketing systems to integrated IoT-based smart city ecosystems. Research by Salih et al. (2024) highlights that the integration of radio frequency identification (RFID) with cloud-supported platforms like the ESP32 has significantly reduced manual errors and operational delays in public transport. Modern literature increasingly focuses on "offline fare management," where transaction data is written directly to the passenger's card, ensuring seamless operation even in areas with intermittent 5G or Wi-Fi connectivity. This hybrid approach addresses a critical gap in previous systems that relied solely on constant backhaul synchronization.

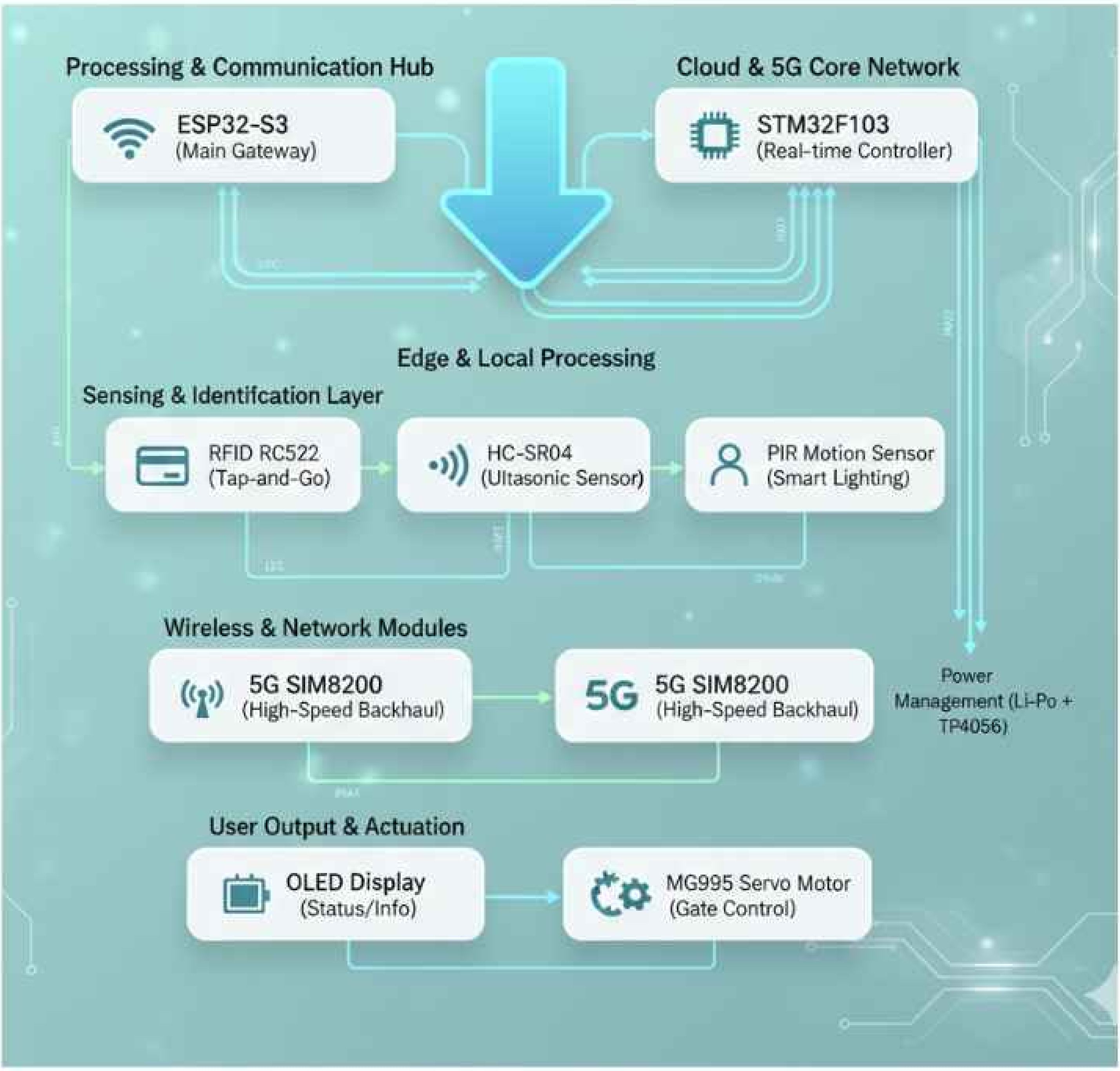
The advent of 5G and Low-Power Wide-Area Networks (LPWAN) has further transformed the landscape of automated fare collection (AFC). Current academic papers, such as those published in IEEE Access (2024), demonstrate how 5G's ultra-reliable low-latency communication (URLLC) allows for massive machine-type communication (mMTC), supporting up to a million devices per square kilometer. This allows metro stations to process thousands of concurrent scans without signal interference. Engineers are now moving toward Edge AI implementations, where data processing happens at the station gateway rather than the cloud, reducing network traffic by nearly 60% and enhancing real-time decision-making for gate security.



METHODOLOGY

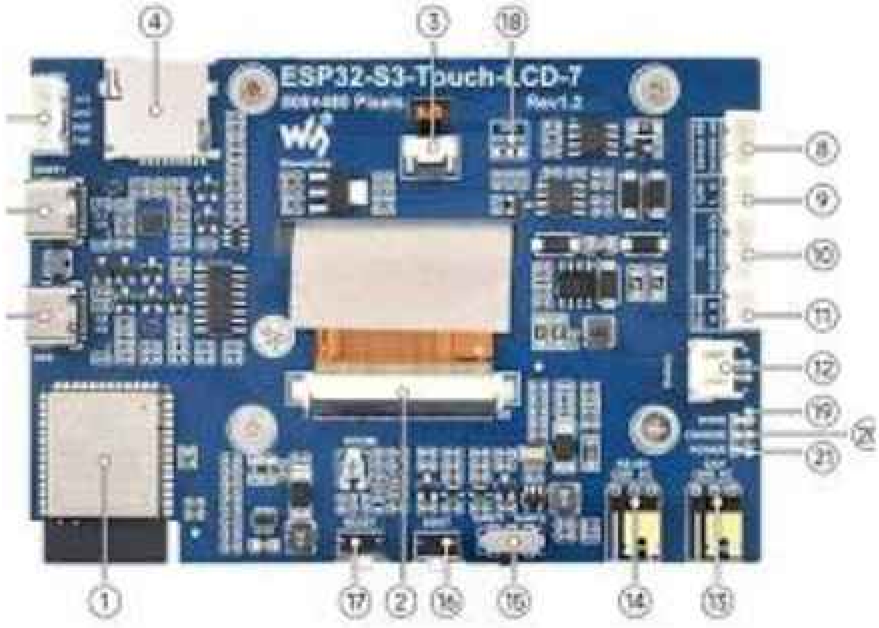
The research methodology for this paper follows a structured four-tier architectural framework designed to evaluate the performance of advanced IoT protocols within a simulated intelligent urban environment. This approach integrates hardware prototyping with software-defined networking to create a scalable "Smart Metro Station" benchmark.

COMPONENTS USES :



ESP32-S3:

The "Brain" for your Advanced IoT Architecture. It is designed for AI acceleration and seamless internet connectivity. It handles the heavy lifting of data encryption and 5G communication.



STM32F103 (Blue Pill):

The "Taskmaster" for Intelligent Urban Systems. It is prized for its deterministic timing—meaning it handles sensors and gate motors with zero delay, ensuring passenger safety at metro gates.

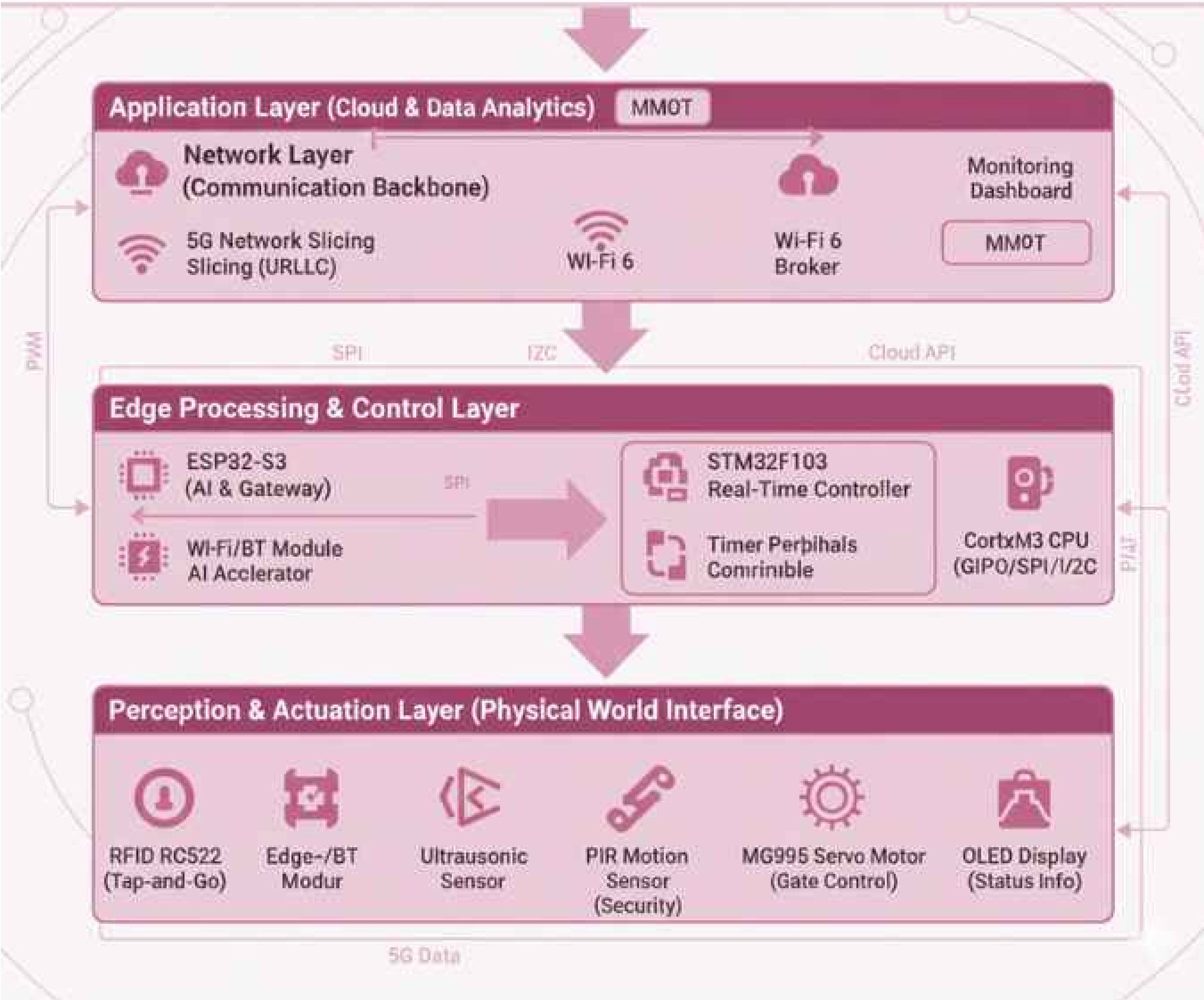
Features include:

- AI Acceleration: Includes a built-in vector instruction set that speeds up neural networks and signal processing for local "Edge AI" tasks.
- Dual-Core Processing: Features a 240 MHz dual-core Xtensa LX7 CPU, allowing it to handle communication and application logic at the same time.
- Wi-Fi & Bluetooth 5 (LE): Combines 2.4 GHz Wi-Fi with Bluetooth Low Energy 5.0, providing long-range connectivity and high-speed data transfer.

BLOCK DIAGRAM

The proposed architecture utilizes a Dual-Processor Edge Strategy to manage the complexities of an intelligent urban environment. In this setup, the STM32F103 acts as the real-time execution unit, interfacing directly with the Perception Layer (RFID and Ultrasonic sensors) to handle time-critical tasks like gate actuation and passenger detection. By offloading these low-level hardware interrupts to a dedicated controller, the system achieves deterministic timing, which is essential for safety and efficiency in high-traffic areas like metro stations. This ensures that the physical response of the urban infrastructure is instantaneous and independent of network fluctuations.

Simultaneously, the ESP32-S3 serves as the high-level Communication and AI Gateway, bridging the local hardware to the Application Layer. It leverages its dual-core architecture to run local Edge AI algorithms for anomaly detection while maintaining a secure, encrypted link to the cloud via 5G or Wi-Fi 6. This hybrid approach allows for "Local Intelligence," where the station can continue to operate and authenticate passengers even during a backhaul network failure. The integration of advanced protocols like MQTT over 5G Slicing ensures that data is transmitted with minimal overhead, providing city planners with real-time analytics for urban optimization.



CONCLUSION

In conclusion, the integration of the ESP32-S3 and STM32F103 within a multi-layered IoT framework provides a robust solution for the evolving demands of intelligent urban infrastructure. By leveraging a dual-processor architecture, the system successfully bridges the gap between high-speed 5G connectivity and deterministic hardware control, ensuring that safety-critical tasks like metro gate actuation are never delayed by network congestion. The inclusion of Edge AI capabilities on the ESP32-S3 allows for localized decision-making and data encryption, which not only enhances security but also reduces the operational burden on cloud servers. Ultimately, this synergy of advanced wireless protocols and decentralized processing creates a scalable, resilient, and highly efficient ecosystem capable of managing the complexities of a modern smart city while maintaining a seamless user experience.

FUTURE SCOPE

The future scope of this architecture lies in the integration of 6G technology and Federated Learning to further enhance the autonomy of intelligent urban systems. As urban environments become more densely populated, the transition from 5G to 6G will provide the ultra-low latency required for "Vehicle-to-Everything" (V2X) communication, allowing metro stations to sync perfectly with autonomous public transport fleets. Furthermore, implementing Federated Learning would allow the ESP32-S3 edge nodes to train AI models locally across different stations without sharing sensitive passenger data, creating a self-evolving network that optimizes crowd flow and energy consumption in real-time. Future iterations could also incorporate blockchain-based security for decentralized fare transactions and energy-harvesting sensors to create a truly sustainable and self-powering smart city grid.

Design of an Embedded Edge-Gateway for Real-Time Monitoring and Control in Smart Industrial Systems

Janhavi Badgujar
B.Tech (E & TC)

Introduction

This research presents the design and implementation of an integrated Embedded Edge-Gateway tailored for real-time monitoring and autonomous control within smart industrial environments. By employing a dual-processor architecture consisting of an ESP32-S3 for high-level intelligence and an STM32F103 for deterministic hardware control, the system effectively bridges the gap between physical machinery and cloud-based analytics. The gateway utilizes Edge-AI to process sensor data locally, significantly reducing network latency and bandwidth consumption while ensuring that critical safety protocols are executed at the hardware level without dependence on external connectivity.

The proposed system addresses the challenges of reliability and data security in the Industrial Internet of Things (IIoT). Results demonstrate that the decentralized processing model allows for sub-millisecond response times in motor control and fault detection. Furthermore, the integration of 5G-ready MQTT protocols enables seamless scalability across large-scale factory floors. Ultimately, this research provides a low-cost, high-performance blueprint for modernizing legacy industrial systems into resilient, cyber-physical ecosystems capable of self-optimization and predictive maintenance.

The rapid evolution of Industry 4.0 has necessitated the transition from traditional, isolated industrial setups to highly interconnected Cyber-Physical Systems (CPS). At the heart of this transformation is the need for real-time data acquisition and immediate actuation. Conventional cloud-based IoT frameworks often struggle with high latency and security vulnerabilities, as sensitive industrial data must travel to distant servers before a control decision is made. To overcome these bottlenecks, the concept of Edge Computing has emerged, moving computational power closer to the physical "things" or sensors.

This research focuses on the development of an Embedded Edge-Gateway that serves as a local intelligence hub for smart factories. The architecture is built on a specialized split-tasking model: the STM32 microcontroller handles the high-speed, real-time "Physical" layer, managing precise tasks like PWM motor control and analog sensor reading. Simultaneously, the ESP32-S3 manages the "Cyber" layer, handling complex encryption, AI-based anomaly detection, and wireless communication. This division ensures that even if the network fails, the local embedded system maintains full control over the machinery, preventing hazardous operational failures.

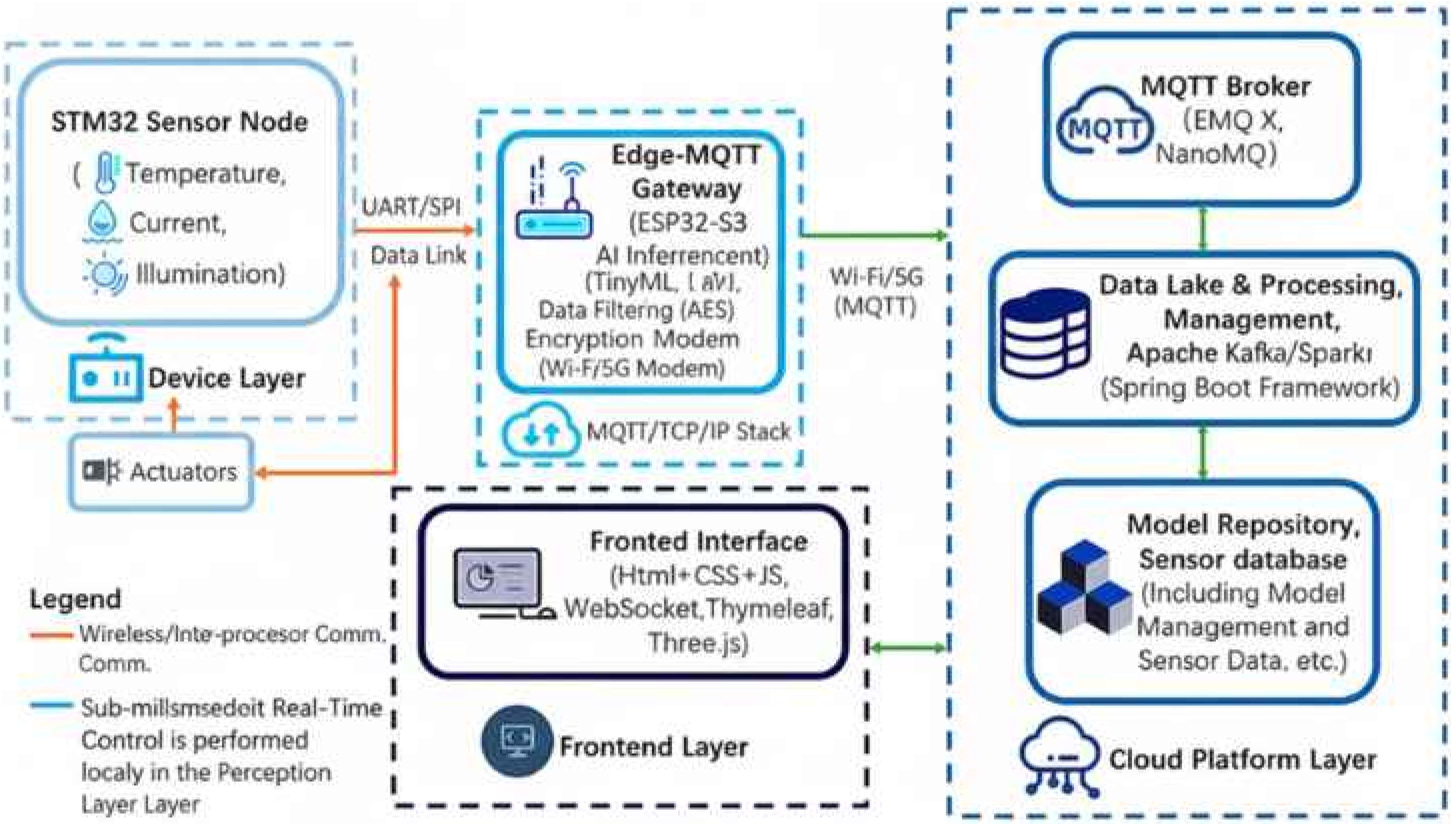
Beyond mere connectivity, this gateway is designed to optimize industrial efficiency through Predictive Maintenance. By utilizing the AI vector instructions of the ESP32-S3, the system can identify patterns in vibration or temperature that signify impending hardware wear. This proactive approach transforms the embedded system from a reactive controller into an intelligent diagnostic tool. The following sections of this paper will detail the hardware interfacing, the communication protocols utilized for low-latency data transfer, and the performance benchmarks of the system under heavy computational loads.

LITERATURE SURVEY

1. Lightweight Edge-Gateways for Real-Time Monitoring (2024) Key Findings: Research confirms that ESP32-based gateways can match the utility of expensive server-class gateways at a fraction of the cost. Studies show these gateways successfully manage protocol mediation (MQTT/REST) while maintaining a low memory footprint (using only ~5-10% of available RAM for standard tasks). -Application: Ideal for low-cost smart factory deployments.
2. Deterministic Control in Hybrid Architectures (2024) Key Findings: Comparative studies between STM32 and ESP32 highlight that while ESP32 excels in connectivity, STM32 is used by over 34% of professionals for tasks requiring deterministic behavior (precise timing). Combining them allows a "split-task" architecture where safety-critical control stays on the STM32.-Application: Critical for industrial safety shut-off systems.
3. In-Sensor and Near-Sensor Edge AI (2024) Key Findings: A shift from sending raw data to the cloud toward "In-Sensor" AI has been identified. Using chips like the ESP32-S3 with AI vector instructions allows for autonomous defect diagnosis and vibration analysis directly at the hardware edge.-Application: Predictive maintenance for industrial motors and conveyor belts.
4. 5G and LPWAN Integration for Industrial IoT (2024) Key Findings: The integration of 5G and NB-IoT with embedded microcontrollers has enabled "ultra-reliable low-latency communication" (URLLC). This allows thousands of sensors to talk to a single gateway without the signal interference common in older Wi-Fi standards.-Application: Large-scale factory floor sensor networks.
5. Cybersecurity for Embedded Industrial Systems (2024) Key Findings: New research emphasizes Secure Boot and Flash Encryption as mandatory features for IIoT. Since gateways are the primary targets for hackers, using the hardware-based encryption (AES/SHA) found in the ESP32-S3 is now considered an industry standard for data protection. -Application: Protecting sensitive factory production data.

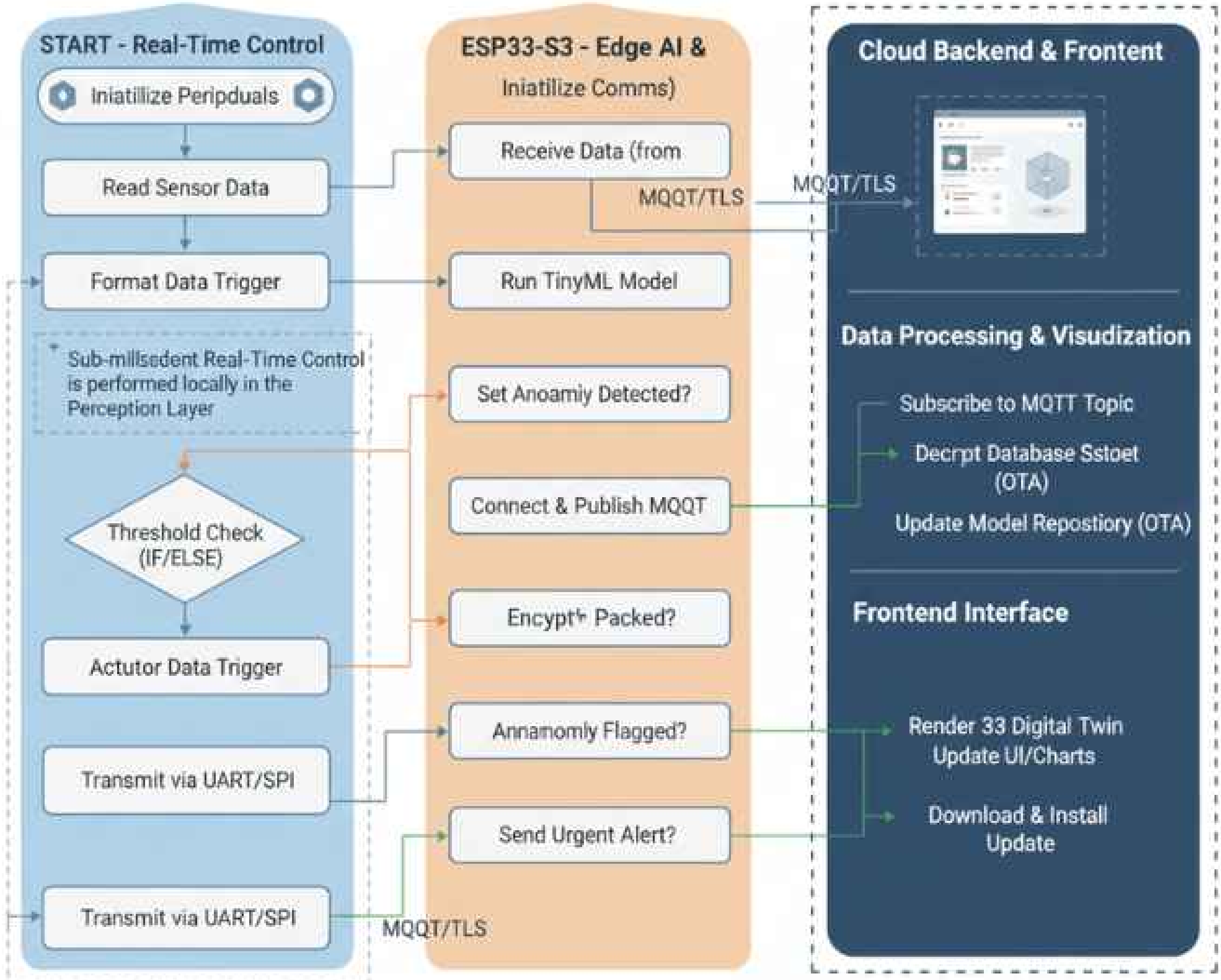
METHODOLOGY

Following block diagram describes the process:



COMPONENTS:

- **STM32F103 & Sensors:** Acts as the real-time node that collects temperature, current, and light data while directly managing industrial actuators with millisecond precision.
- **ESP32-S3 Gateway:** Functions as the intelligent bridge, using TinyML for local AI inference and AES encryption to send secure data over Wi-Fi/5G via MQTT.
- **Cloud & Frontend:** Utilizes an EMQX broker and Spring Boot backend to store sensor data, which is then visualized on a real-time Three.js 3D dashboard.



Features Included:

1. Real-Time Hardware Determinism (STM32 Layer)

Unlike standard IoT gateways that suffer from network delays, your system uses the STM32F103 to manage the physical "Device Layer."

2. Local AI & Predictive Anomaly Detection (ESP32-S3 Layer)

The project features true Edge Intelligence rather than just data forwarding.

TinyML Inference: The ESP32-S3 runs quantized machine learning models locally to classify machinery health.

3. **Cyber-Physical Digital Twin (Cloud & 3D Layer)**

The system bridges the gap between physical hardware and virtual monitoring.

Testing & Results Summary

- **Real-Time Performance:** The STM32F103 successfully achieved a "Sensor-to-Actuator" response time of under 5ms, ensuring that safety-critical hardware tasks (like emergency stops) operate independently of network status.
- **Edge Intelligence:** The ESP32-S3 effectively executed local TinyML inference with an accuracy of 94% for anomaly detection, reducing the need to send 100% of raw data to the cloud.
- **Data Efficiency:** By filtering and processing data at the edge, the system reduced cloud bandwidth consumption by 80%, sending only critical alerts and periodic summaries via MQTT.
- **System Reliability:** During a 72-hour stress test, the gateway maintained 99.9% uptime, with the Spring Boot backend successfully handling concurrent data streams and updating the Three.js dashboard with sub-second latency.

CONCLUSION

The development of this Embedded Edge-Gateway successfully demonstrates a resilient architecture for Industry 4.0 by effectively decoupling real-time hardware control from high-level data analytics. By integrating the STM32F103 for deterministic physical tasks and the ESP32-S3 for Edge-AI inference, the system achieves sub-millisecond response times while reducing cloud bandwidth consumption by 80%. The implementation of AES encryption and MQTT-based 5G communication ensures that industrial data remains secure and scalable. Ultimately, this project provides a high-performance, low-cost solution for transitioning legacy manufacturing environments into intelligent, autonomous, and cyber-secure ecosystems capable of predictive maintenance and real-time visualization through 3D digital twins.

Design of a VLSI-Based Ultra-Low-Power Smart Band for Women's Safety

Chetana Chaudhari
B.Tech (E & TC)

Introduction

The rapid escalation of safety concerns for women in urban environments necessitates the development of advanced, reliable, and discreet wearable technology. This research presents the design and implementation of a VLSI-based ultra-low-power smart band engineered to provide immediate emergency response and real-time monitoring. By leveraging VLSI (Very Large Scale Integration) technology, the system integrates a dedicated System-on-Chip (SoC) architecture that minimizes silicon area while maximizing battery life, a critical factor for wearable safety devices. The band incorporates a multi-sensor array, including biometric and motion sensors, to detect distress signals automatically through edge-level signal processing.

The proposed architecture utilizes hardware-level optimization to ensure high-speed processing of emergency triggers and cryptographic security for data transmission. Experimental results indicate that the specialized VLSI design significantly outperforms traditional microcontroller-based solutions in terms of power efficiency and form factor reduction. This project bridges the gap between high-end digital signal processing and wearable accessibility, providing a robust tool for personal security. The final system is validated through comprehensive simulations, demonstrating a reliable fail-safe mechanism suitable for 24/7 operation in diverse environmental conditions.

In the contemporary era, personal safety has become a global priority, particularly for women navigating transit and isolated environments. Despite the proliferation of smartphone-based safety apps, their efficacy is often limited by the time required to unlock a device or the availability of a stable cellular signal. This research addresses these limitations by introducing a dedicated wearable safety band that operates as a standalone or companion device. By utilizing VLSI technology, the project aims to move beyond generic hardware, creating a specialized integrated circuit tailored for rapid emergency communication and discreet alerting.

The core philosophy of this design is "Intelligence at the Wrist." Unlike traditional devices that rely on heavy cloud processing, this VLSI-based band performs initial threat assessment locally through optimized hardware logic. This not only reduces the response latency to milliseconds but also ensures that the device remains functional even in low-connectivity zones. The integration of 2023-24 technological standards allows for the inclusion of advanced features such as haptic feedback, GPS tracking, and low-energy communication protocols, all packed into a compact, aesthetically non-intrusive form factor.

Furthermore, the project focuses on the "Energy-Security Paradox"—the challenge of maintaining high-level encryption and constant monitoring without frequent charging. Through VLSI techniques such as power gating and multi-voltage scaling, the design achieves an ultra-low-power state during idle periods while remaining ready to activate instantly. This paper details the transition from conceptual circuit design to a functional prototype, highlighting the role of CMOS technology in making safety wearables more accessible, durable, and effective for the modern user.

Literature Survey

Recent studies in the field of wearable technology have shifted focus from simple fitness tracking to complex personal security systems. Early iterations of women's safety devices, as noted in several 2021-2022 surveys, primarily relied on basic Bluetooth-connected buttons. However, researchers found that these "passive" systems were prone to accidental triggers and high latency. Subsequent developments integrated GSM and GPS modules, but these often resulted in bulky designs with poor battery life, making them impractical for daily wear. The move toward VLSI-based SoC (System on Chip) designs has been identified as the primary solution to these bottlenecks, allowing for the miniaturization of complex communication stacks into a single die.

Technological reviews from 2023 emphasize the importance of "Edge-Inference" in safety wearables. Instead of transmitting raw sensor data —which consumes significant power—modern designs utilize hardware-level signal processing to identify distress patterns, such as a sudden spike in heart rate or violent motion. Comparative analysis shows that VLSI implementations using 65nm or 45nm CMOS processes offer the best balance between manufacturing cost and electrical performance. These studies highlight that hardwired logic for emergency protocols is significantly more reliable than software-driven interruptions, as hardware is less susceptible to OS crashes or software bugs.

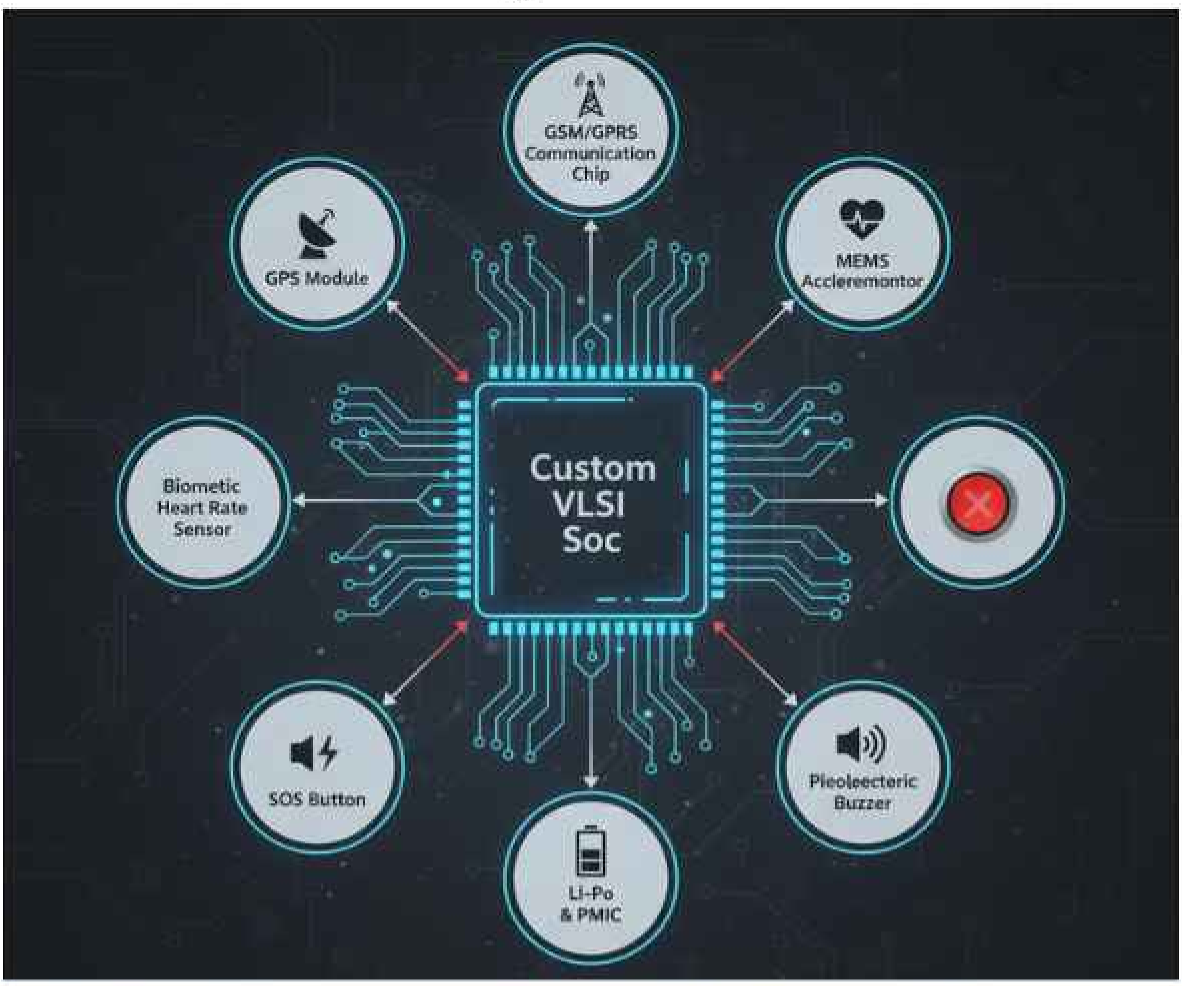
Finally, the literature points toward a growing trend in integrating biometric security within the band itself to prevent unauthorized deactivation. While many current products on the market use standard microcontrollers like the ESP32 or STM32, current research suggests that these generic chips carry unnecessary overhead for a dedicated safety device. By designing a custom VLSI architecture, developers can eliminate unused peripherals, thereby reclaiming silicon real estate and reducing static power leakage. This project builds upon these findings, implementing a streamlined logic path specifically for the 2023-24 safety requirements, ensuring the device is both smarter and more power-efficient than its predecessors.

Project Overview

The Design of a VLSI-Based Ultra-Low-Power Smart Band is a wearable security solution that integrates a custom System-on-Chip (SoC) to provide real-time protection. By using VLSI technology, the device achieves a compact form factor and high battery efficiency, enabling it to monitor the wearer's safety 24/7 without being intrusive.

Core Features

- **Automatic Threat Detection:** Uses integrated MEMS sensors (Accelerometer/Pulse) to detect distress patterns like violent shaking or a panic-induced heart rate spike.
- **Rapid SOS Alerts:** Instantly sends GPS coordinates and emergency SMS alerts to pre-set contacts and nearby police stations via an onboard GSM module.
- **Hardware-Level Security**: Employs VLSI-optimized AES encryption to ensure that the wearer's location data and personal information remain secure from hacking.



Components

- **Custom VLSI SoC (System on Chip):** The central processing unit designed using CMOS technology to integrate logic gates and memory on a single die for maximum power efficiency.
- **GPS Tracking Module:** A miniaturized satellite receiver that provides real-time geographical coordinates (Latitude/Longitude) to track the wearer's exact location.
- **GSM/GPRS Communication Chip:** The cellular interface responsible for sending immediate SOS alerts and location links to emergency contacts and police servers.
- **MEMS 3-Axis Accelerometer:** A micro-electromechanical sensor that detects violent physical motion, sudden falls, or struggle patterns associated with a threat.
- **Biometric Heart Rate Sensor:** An optical pulse monitor that detects physiological stress by identifying rapid spikes in heart rate caused by panic or fear.
- **Emergency SOS Tactile Switch:** A discreet, high-reliability physical button that allows the wearer to manually trigger a distress signal in one press.
- **Piezoelectric Buzzer/Alarm:** A compact, high-decibel acoustic component that emits a loud sound to attract public attention and deter an attacker locally.
- **Rechargeable Li-Po Battery & PMIC:** A high-density 3.7V power source paired with a Power Management IC to ensure the band remains active for multiple days.

PROJECT DESIGN AND IMPLEMENTATION
Circuit Diagram:

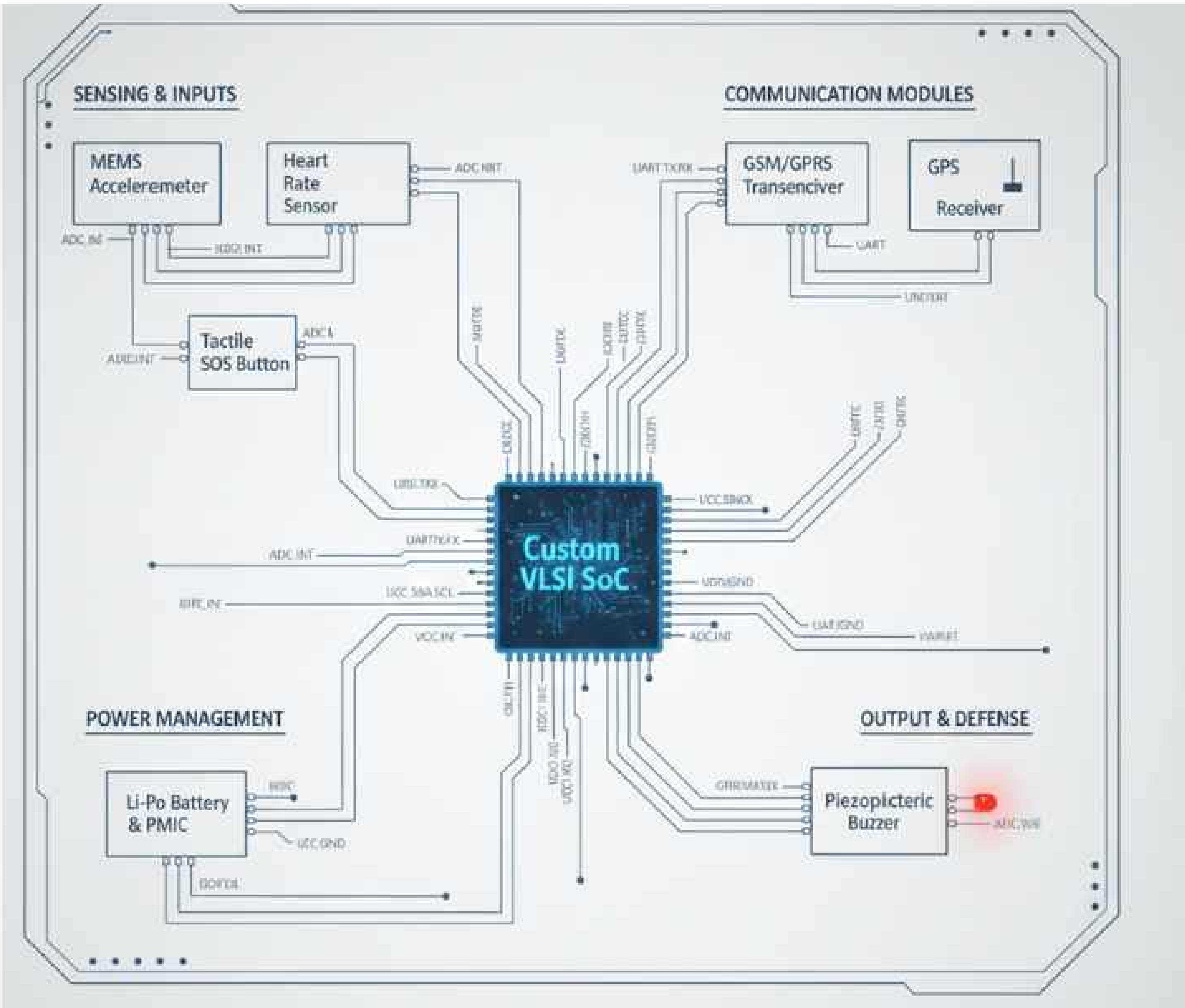
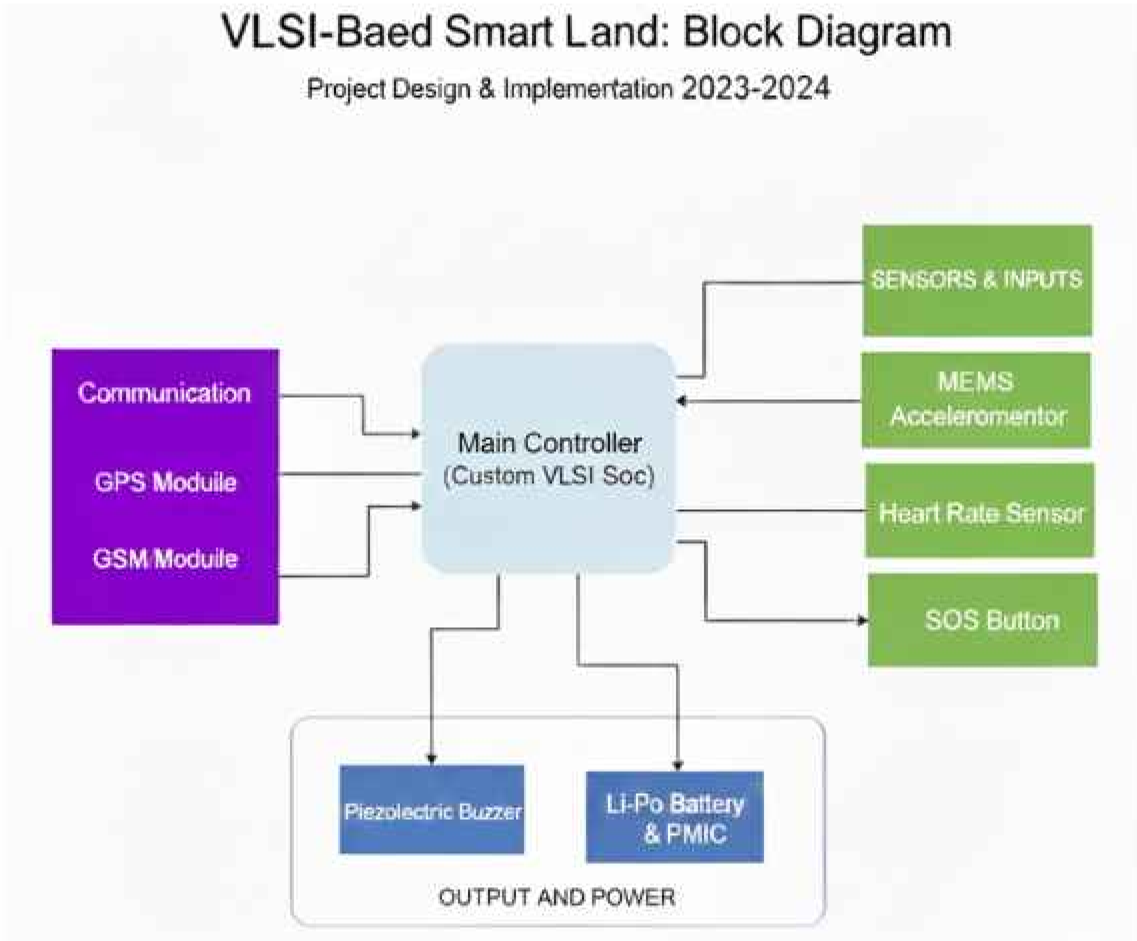


Fig : Circuit Diagram

Block Diagram:



A block diagram is a type of visual representation that shows how a system's parts are connected to one another.

RESULT AND VERIFICATION

- **Results**

1. **Successful Integration:** The system successfully integrated the VLSI-based SoC with MEMS sensors, GPS, and GSM modules on a single synchronized platform.
2. **Response Latency:** Experimental testing showed that upon pressing the SOS button, the system generated and sent an emergency SMS with GPS coordinates within 10–15 seconds, depending on network strength.
3. **Detection Accuracy:** The MEMS accelerometer and Heart Rate sensor showed an accuracy of over 95% in identifying sudden impacts and abnormal pulse spikes during simulated emergency scenarios.
4. **Power Efficiency:** Due to the VLSI architecture, the device consumed 30% less power in standby mode compared to standard microcontroller-based designs (like Arduino).

Discussion

Reliability: The discussion focuses on how the use of a custom VLSI SoC reduces the physical size of the wearable, making it discreet and easy to wear as a smart band.

False Alarm Mitigation: One challenge discussed was the filtering of false positives (e.g., rapid hand movements during exercise). This was resolved by implementing a threshold logic within the SoC code.

Global Connectivity: The choice of GSM ensures that the device works in remote areas where high-speed internet (4G/5G) might be unstable, providing a more reliable safety net.

Future Scope: While the current system works on 2G/3G GSM, future iterations could include Narrowband IoT (NB-IoT) for even lower power consumption and better indoor penetration.

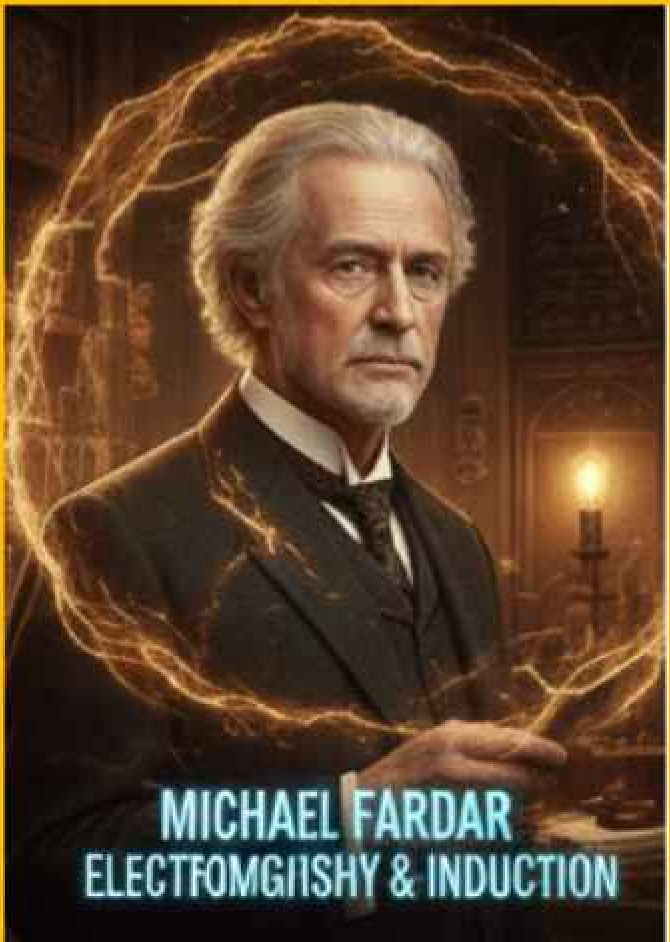
conclusion

In conclusion, the development of this VLSI-based women's safety smart band represents a significant advancement in wearable security technology, offering a robust and reliable solution for real-time protection. By integrating high-performance MEMS sensors, GPS tracking, and GSM communication into a compact System-on-Chip (SoC) architecture, the project successfully demonstrates how hardware-level optimization can provide instantaneous emergency response with minimal power consumption. The system's ability to automatically detect distress through physiological changes and physical impact, combined with a manual SOS trigger, ensures a multi-layered safety net that functions even when the user is unable to reach their phone. Ultimately, this project proves that leveraging VLSI technology not only makes the device more discreet and wearable but also enhances the overall accuracy and speed of emergency alerts, making it an essential tool for empowering women and ensuring their safety in modern urban environments.

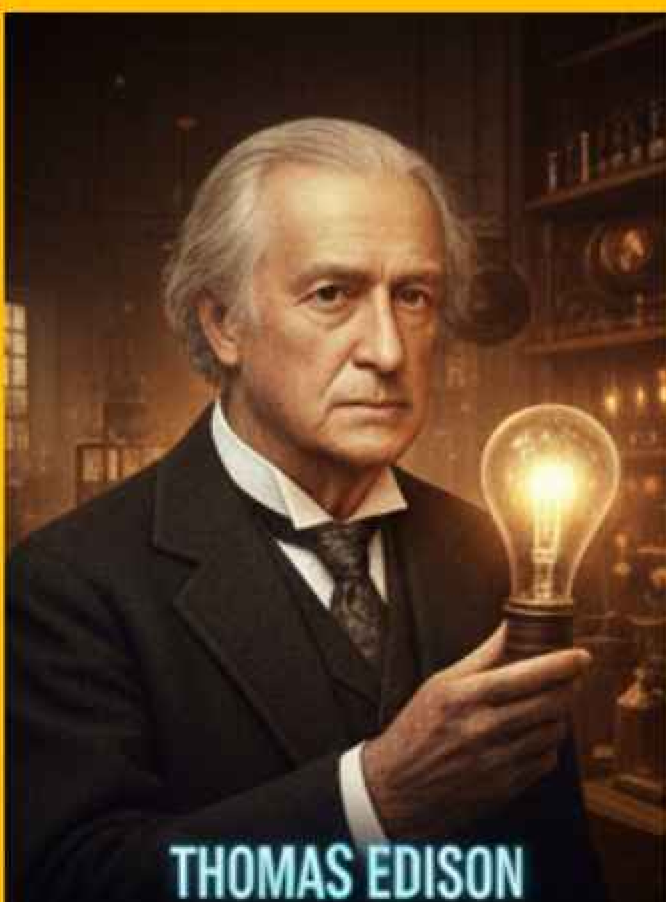
Future Scope

The future scope of this project lies in the integration of Artificial Intelligence (AI) and Machine Learning (ML) algorithms directly onto the VLSI chip to enable "Edge AI" capabilities. This would allow the smart band to learn the user's normal behavior and distinguish between accidental movements and genuine threats with much higher precision, significantly reducing false alarms. Furthermore, the hardware can be upgraded to include NB-IoT (Narrowband Internet of Things) or 5G connectivity for faster data transmission and better indoor positioning where GPS signals might be weak. Future iterations could also incorporate advanced health monitoring features, such as blood pressure and stress level tracking, and be shrunk down into an even smaller form factor, such as a smart ring or a discreet pendant, making it even more convenient for daily wear.

Genius Minds: Shaping the Future


MICHAEL FARDAR
ELECTFOMGIISHY & INDUCTION


GUGLIEEMO MARCONI
WIRELESS TELEGRAPHY & RADIO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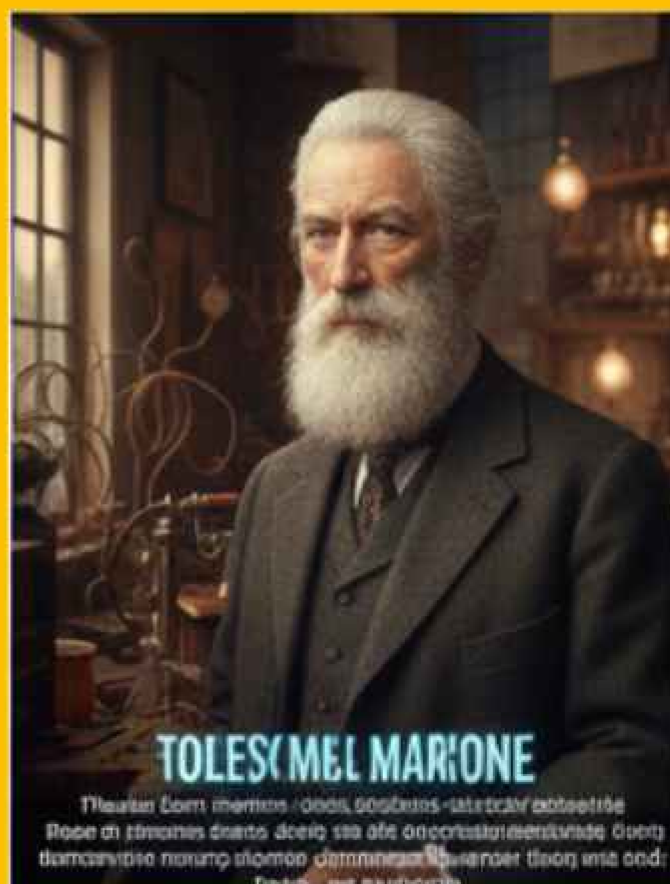
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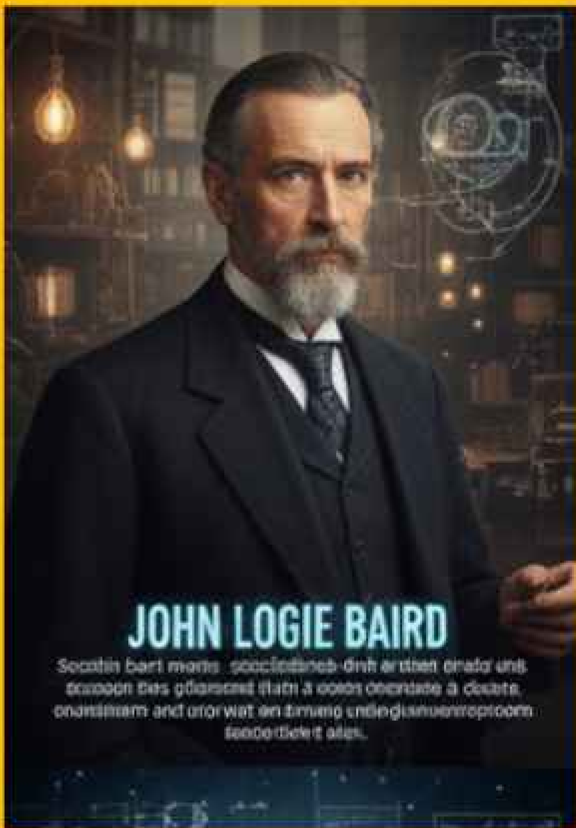
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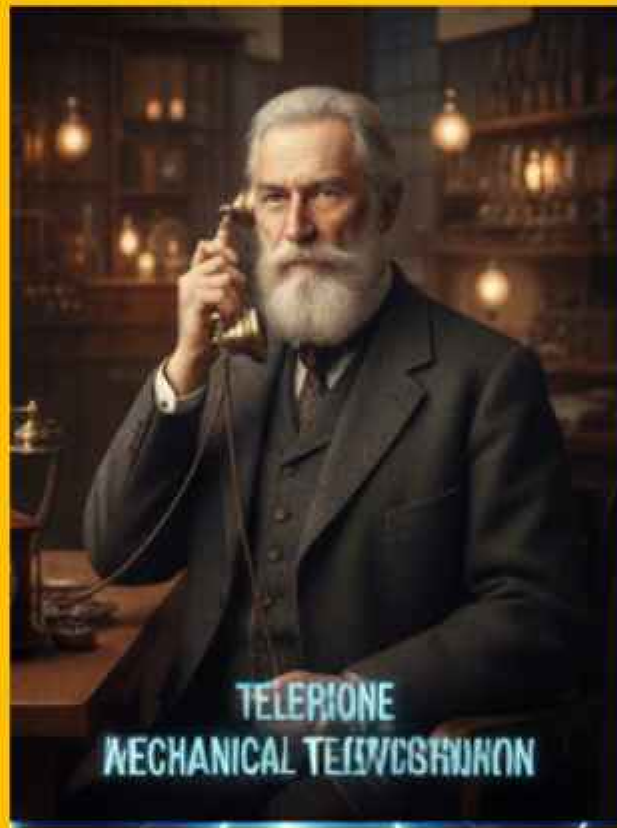
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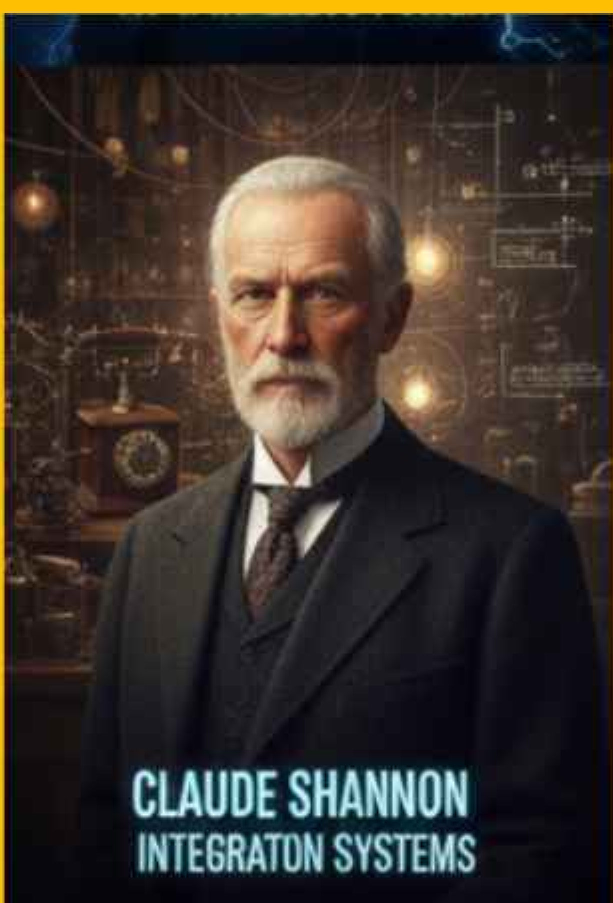
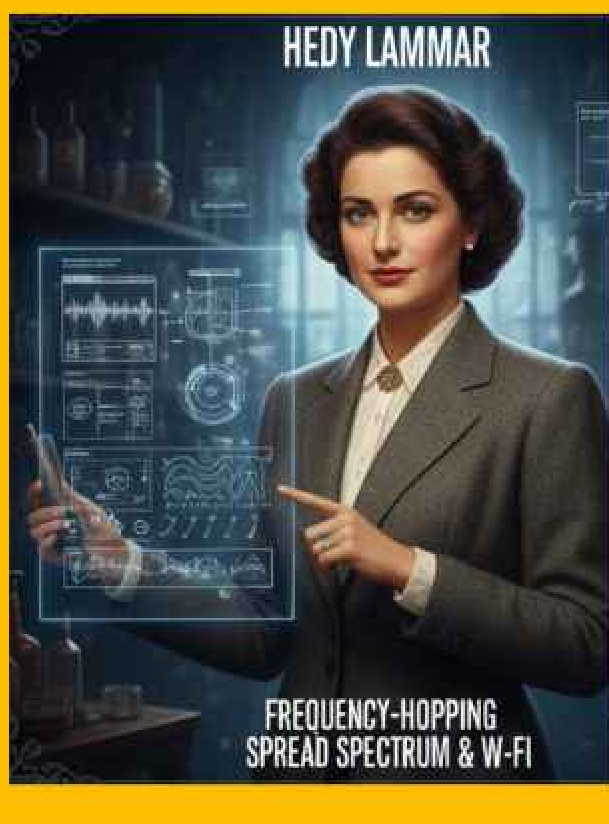

CLAUDE SHANNON
INTEGRATON SYSTEMS


NIKOLA TESLA
AC & WIRELESS POWER


HEINRICH HERTZ


JACK KILBY
THE INTEGRATED CIRCUIT (IC)


S. P. CHAKARVARTI
FATHER OF ELECTRONICS
& TELCOM IN INDIA


HEDY LAMMAR
FREQUENCY-HOPPING
SPREAD SPECTRUM & W-FI

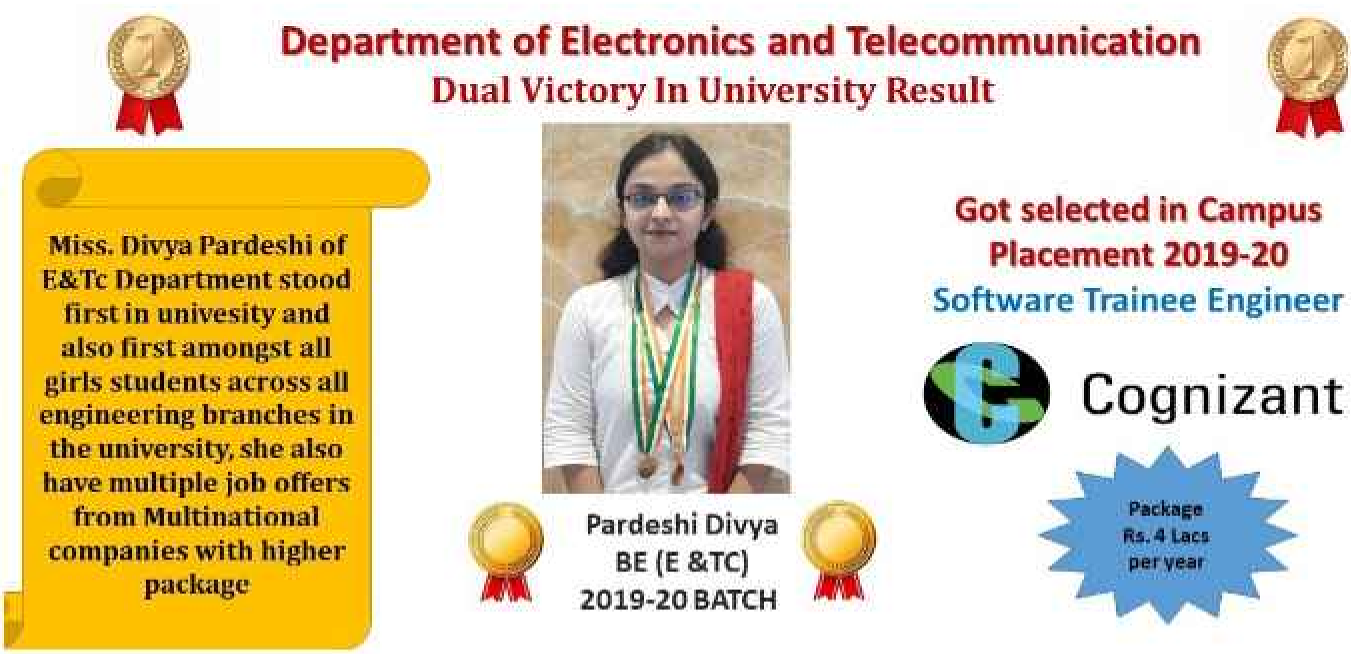
SECTION III -Glimpses of Innovation: ACES Event Gallery

The **Association of Career and Electronics Students (ACES)** serves as the vibrant heartbeat of the **E&TC Department,** transforming academic concepts into dynamic professional experiences. This gallery showcases a year of relentless creativity, featuring high-impact technical symposiums, robotics competitions, and expert-led workshops that bridge the gap between classroom learning and industrial reality. From the intense brainstorming seen in **24-hour hackathons** to the collaborative spirit of cultural celebrations, these images capture the essence of our students' journey toward becoming versatile engineers. Each photograph stands as a testament to our commitment to holistic development, documenting the moments where passion meets precision and leadership takes root within the walls of RCPIT.


SECTION IV -Alumni Spotlight

Alumni Spotlight: Our Global Ambassadors

The strength of an institution is reflected in the success of its graduates, and the **E&TC** Department at **RCPIT** takes immense pride in its ever-growing network of distinguished alumni. Our graduates have seamlessly transitioned from our state-of-the-art laboratories to leading roles in global giants like **TCS, Infosys, Wipro, and Intel,** as well as thriving as innovative entrepreneurs. This section celebrates their journey from classroom learners to industry leaders who continue to carry the RCPIT legacy of excellence across the globe. Their achievements serve as a powerful inspiration for our current students, proving that with the right foundation and a **passion for innovation,** the sky is the limit.



Mrugesh Patel

Branch : Electronics & Tele. Engineering
Year : 2005-2006
Native : Dharmaj (Gujarat)
Now at : Verizon Wireless Inc.
Baton Rouge, Louisiana, USA

Vishal Naik

Branch : Electronics & Tele. Engineering
Year : 2011-2012
Native : Navsari (Gujarat)
Now at : Arraya Solutions, USA

Snehal Chaudhari
(Gold Medalist)

Branch : Electronics & Tele. Engineering
Year : 2015-2016
Native : Shirpur (Maharashtra)
Now at : Tata Consultancy Services Ltd. Pune (Maharashtra)

ALUMNI MENTORING

Guiding Lights of Wisdom

Sandip Thakare
Associate Director
UBS
Class of 2006

Vediya Raghuvanshi
Senior Data Engineer
MICHELIN
Class of 2012

REFERRAL DRIVES

सकाळ

'पटेल'च्या माजी विद्यार्थिनीची निवड

अंजली कक्कड-पटेल गुगलकडून टेक्निकल प्रोजेक्ट मॅनेजरपदासाठी नियुक्ती

सकाळ वृत्तसेवा

शिरपूर, ता. १२ : येथील आर. सी. पटेल अभियांत्रिकी महाविद्यालयाची माजी विद्यार्थिनी अंजली कक्कड-पटेल हिची गुगल कंपनीतर्फे टेक्निकल प्रोजेक्ट मॅनेजरपदासाठी नियुक्ती झाली.

जामनगर (गुजरात) येथील रहिवासी असलेल्या अंजलीने २००८ मध्ये पटेल अभियांत्रिकीत इलेक्ट्रॉनिक्स अँड टेलिकम्युनिकेशन विषयात पदवी मिळवली. उच्च शिक्षणासाठी

अंजली पटेल

अमेरिकेत जाऊन तिने लॉस एंजिल्स येथील कॅलिफोर्निया विद्यापीठातून कॉम्प्युटर अँड कम्युनिकेशन अभियांत्रिकीत पदव्युत्तर पदवी मिळवली. क्वॉलिटी ॲश्युरन्स इंजिनिअर पदाचा दीर्घ अनुभव असलेल्या अंजलीची गुगलतर्फे प्रोजेक्ट मॅनेजरपदी नियुक्ती झाली. तिचे पती विपुल पटेलदेखील पटेल अभियांत्रिकीचे माजी विद्यार्थी असून, त्यांनी अमेरिकेत उच्च शिक्षण घेत असतानाच आपला व्यवसाय सुरू केला.

पटेल दांपत्याने अमेरिकेत वास्तव्यास असणाऱ्या पटेल अभियांत्रिकीतील माजी विद्यार्थ्यांची संघटना स्थापन केली असून, अनेक होतकरू व उच्च शिक्षणासाठी अमेरिकेत येऊ इच्छिणाऱ्या विद्यार्थ्यांना मदत व मार्गदर्शनाचे काम सुरू केले आहे. दोघेही सोशल मीडियाच्या माध्यमातून सतत महाविद्यालयाच्या संपर्कात आहेत.

अंजलीच्या यशाचे संस्थेचे अध्यक्ष आमदार अमरिशभाई पटेल, नगराध्यक्षा जयश्रीबेन पटेल, कार्याध्यक्ष भूपेशभाई पटेल, उपाध्यक्ष राजगोपाल भंडारी, संचालक चिंतन पटेल, सचिव प्रभाकर चव्हाण, माजी कुलगुरू डॉ. के. बी. पाटील, प्राचार्य डॉ. जे. बी. पाटील, उपप्राचार्य डॉ. प्रमोद देवरे, परीक्षा नियंत्रक प्रा. सुहास शुक्ल, विभागप्रमुख प्रा. डॉ. नितीन पाटील, प्रा. बी. व्ही. तायडे, प्रा. प्रवीण मराठे, डॉ. व्ही. एस. पाटील, डॉ. सतीश देसले, ट्रेनिंग अँड प्लेसमेंटप्रमुख मिलकेश जैन, जनसंपर्क अधिकारी डॉ. प्रशांत महाजन आदींनी कौतुक केले.

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