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The Vocal Cortex of the Smart Home: A Review of ESP32-Based Control and Automation Architectures

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Abstract: *The convergence of the Internet of Things (IoT), advanced voice recognition, and accessible microcontroller technology is fundamentally reshaping human interaction with the domestic environment. Voice-controlled home automation has emerged as a pivotal domain, transitioning from a niche luxury to an attainable reality for a broad audience. At the heart of this democratization lies the ESP32, a low-cost, feature-rich microcontroller boasting integrated Wi-Fi and Bluetooth capabilities. This review paper synthesizes and analyzes the current state-of-the-art in voice-controlled home automation systems architected around the ESP32. We systematically explore the two predominant processing paradigms:* ***cloud-based architectures****, which leverage powerful external services like Amazon Alexa and Google Assistant for high-accuracy, natural language understanding, and* ***edge-based architectures****, which perform voice recognition directly on the ESP32, prioritizing ultra-low latency, operational independence, and enhanced data privacy. A critical comparison of these modalities is presented, highlighting their respective trade-offs in latency, accuracy, privacy, and computational load. Furthermore, the paper delves into system integration, examining communication protocols such as MQTT and HTTP for seamless device interoperability. Through a review of implementation case studies, we demonstrate the ESP32's versatility in enabling a wide spectrum of applications, from simple cloud-dependent switches to sophisticated, offline-capable voice controllers. Finally, we address persistent challenges—including power consumption, noise robustness, and security—and outline promising future research directions, such as the integration of TinyML for efficient on-device intelligence and the evolving Matter standard for improved ecosystem interoperability. This review concludes that the ESP32 serves as a powerful and flexible "vocal cortex," forming the foundational platform upon which the next generation of customizable, scalable, and intelligent smart homes will be built.*

Keywords*:* Smart Home, Home Automation, Internet of Things (IoT), Human-Computer Interaction (HCI), Voice Control

I. INTRODUCTION

1.1. The Evolution of the Smart Home

The concept of the "smart home," once a fixture of science fiction, has rapidly evolved into a tangible reality, driven by advancements in embedded systems and wireless communication. This evolution has transitioned from simple, standalone programmable devices, such as thermostats and timers, to a deeply interconnected ecosystem of intelligent appliances known as the Internet of Things (IoT). In this paradigm, everyday objects are endowed with processing power, sensors, and network connectivity, enabling them to communicate with each other and be monitored and controlled remotely. This interconnectedness aims to enhance convenience, security, and energy efficiency within the domestic environment, fundamentally changing how inhabitants interact with their living spaces.

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1.2. The Role of Human-Machine Interaction (HMI)

As smart home systems have grown in complexity, the mode of Human-Machine Interaction (HMI) has become a critical factor in their adoption and usability. Early systems relied heavily on physical switches and, later, smartphone applications, which often created a layer of digital complexity rather than simplifying tasks. The next logical step in this evolution is a shift towards more natural and intuitive interfaces. Voice control stands at the forefront of this shift, offering a hands-free, fast, and accessible method of interaction that closely mimics human-to-human communication. It holds particular promise for enhancing accessibility for the elderly and individuals with physical disabilities, making technology more inclusive.

Figure 1 illustrates this fundamental shift in interaction paradigms, moving from direct physical contact to abstracted digital and finally to natural language.

Figure 1: The Evolution of Home Interaction Paradigms.

1.3. The ESP32 as an Enabling Technology

The proliferation of low-cost, high-performance microcontrollers has been a primary catalyst for the democratization of smart home technology. Among these, the ESP32, developed by Espressif Systems, has emerged as a cornerstone for both Do-It-Yourself (DIY) enthusiasts and commercial product developers. Its compelling combination of a powerful dual-core processor, integrated Wi-Fi and Bluetooth capabilities, rich peripheral set, and remarkably low cost makes it an ideal single-chip solution for IoT nodes. The ESP32 effectively serves as the "bridge," connecting physical devices like lights and fans to the digital world of networks and voice commands, enabling the creation of sophisticated automation systems that were previously prohibitively expensive or complex.

Figure 2 provides a detailed look at the core components of the ESP32 that make it so suitable for this application.

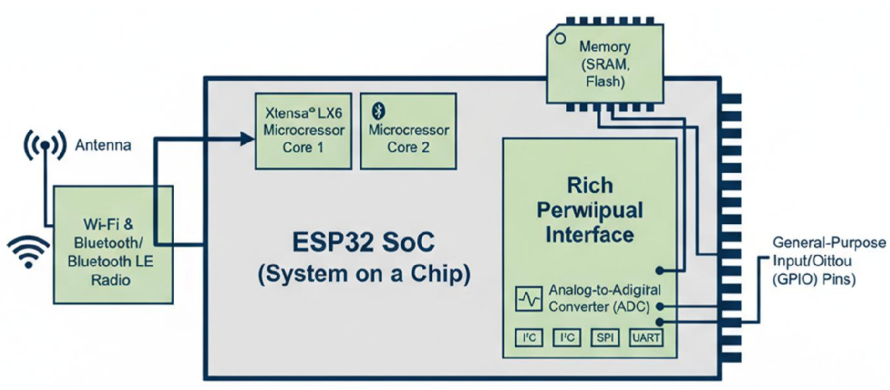

Figure 2: Functional Block Diagram of the ESP32 Microcontroller

1.4. Objective and Scope

While numerous studies and projects have demonstrated individual implementations of voice control with the ESP32, a synthesized and analytical review of the overarching architectures, their comparative trade-offs, and implementation challenges is lacking. This paper aims to fill that gap. The primary objective is to provide a comprehensive review of the current state-of-the-art in voice-controlled home automation systems centered on the ESP32. The scope of this review encompasses:

A detailed analysis of the core hardware (ESP32) and its justification.

A systematic comparison of cloud-based versus edge-based voice processing architectures.

An examination of system integration protocols and communication frameworks.

A discussion of persistent challenges and future research directions emerging from this rapidly evolving field.

II. THE CORE HARDWARE: ESP32 MICROCONTROLLER

The implementation of any robust IoT system is fundamentally constrained by the capabilities of its underlying hardware. In the domain of voice-controlled home automation, the ESP32 microcontroller has emerged not merely as a viable option, but as a predominant platform due to a confluence of performance, connectivity, and economic factors. This section delineates the technical specifications that make the ESP32 uniquely suited for this role and provides a comparative analysis against other prevalent microcontrollers in the ecosystem.

2.1. Technical Specifications

The ESP32 is a feature-rich System-on-a-Chip (SoC) that serves as a complete, integrated solution for connected devices. Its relevance to voice-controlled automation stems from several key specifications:

Processing Power: Equipped with a dual-core Xtensa® LX6 microprocessor, configurable to run at 240 MHz, the ESP32 provides the necessary computational headroom for managing multiple concurrent tasks. This is critical for handling network protocols, processing sensor data (including audio from a microphone), and controlling actuators simultaneously, a common requirement in responsive automation systems.

Wireless Connectivity: The integration of both Wi-Fi (802.11 b/g/n) and Bluetooth 4.2 + BLE (Bluetooth Low Energy) on a single chip is arguably its most significant advantage. Wi-Fi enables direct connection to the local network and the internet for cloud-based services, while BLE offers an alternative, low-power channel for direct device configuration and control via smartphones.

Memory Resources: With up to 520 KB of internal SRAM and support for external SPI Flash memory, the ESP32 possesses the memory capacity to buffer audio data, store network credentials, and run sufficiently complex software stacks—a clear differentiator from simpler 8-bit microcontrollers.

Low-Power Operation: Despite its performance, the ESP32 incorporates sophisticated power management features, including multiple sleep modes (e.g., Deep-sleep, Modem-sleep). This allows for the design of always-listening voice assistants that consume minimal power when not actively processing commands.

Peripheral Interface: A rich set of peripherals, including GPIO, PWM (Pulse-Width Modulation), ADCs (Analog-to-Digital Converters), and standard communication protocols like I²C, SPI, and I²S, provides the flexibility to interface with a wide array of components, from high-fidelity I²S microphones to relay modules and environmental sensors.

Figure 3 provides a visual breakdown of these core components and their interconnections within the ESP32 architecture.

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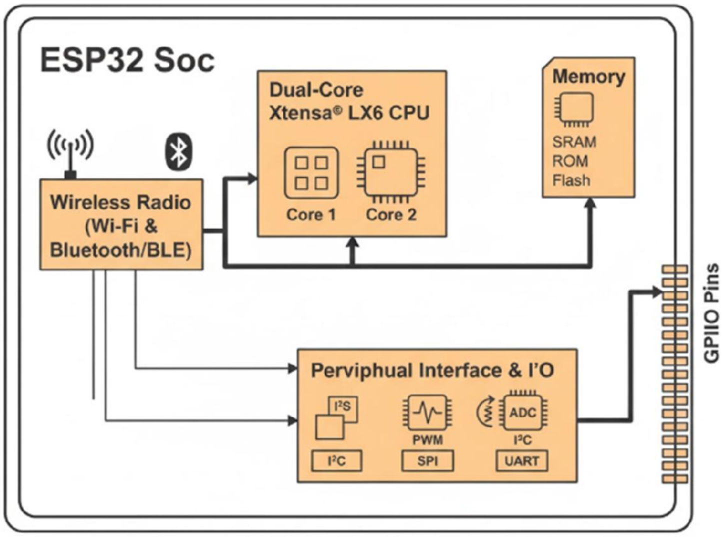

Figure 3: Internal Architecture of the ESP32 SoC.

2.2. Why the ESP32 for Home Automation?

The technical specifications translate directly into practical benefits for home automation projects. The combination of robust processing and built-in Wi-Fi eliminates the need for additional shield components, reducing both system complexity and cost. This "single-chip solution" philosophy, coupled with an extensive software development framework (ESP-IDF) and a massive, active community, significantly lowers the barrier to entry for developers and hobbyists alike. It enables the rapid prototyping and deployment of sophisticated systems that are both powerful and affordable.

2.3. Comparison with Other Microcontrollers

To contextualize the ESP32's position in the market, it is essential to compare it with other common microcontrollers used in prototyping. While alternatives like the Arduino Uno and Raspberry Pi Pico have their merits, the ESP32 occupies a unique niche, particularly for wireless, voice-enabled applications.

Table 1 provides a systematic comparison across several critical parameters for home automation.

Table 1: Comparative Analysis of Microcontrollers for Voice-Controlled Home Automation.

Feature / Parameter	ESP32	Arduino Uno + Shield	Raspberry Pi Pico W	STM32 (e.g., Blue Pill)
Built-in Wi-Fi	**Yes (802.11 b/g/n)**	No (Requires external shield)	**Yes**	No (typically)
Built-in Bluetooth	**Yes (Classic & BLE)**	No	No	Yes (on specific series)
Processing Cores	**Dual-core**	Single-core	Single-core	Single-core

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Feature / Parameter	ESP32	Arduino Uno + Shield	Raspberry Pi Pico W	STM32 (e.g., Blue Pill)
Typical Clock Speed	**Up to 240 MHz**	16 MHz	133 MHz	72 MHz
Cost Index	Low	Medium	**Very Low**	Low
Power Efficiency	**High (with sleep modes)**	Low	High	High
Ideal Use Case	**All-in-one Wi-Fi/BT IoT projects,** Voice control	Basic logic control, simple sensors	Simple, cost-sensitive Wi-Fi projects	Complex, high-performance embedded tasks
Community & Library Support	**Extensive**	Extensive	Growing Rapidly	Good

III. VOICE CONTROL MODALITIES AND PROCESSING ARCHITECTURES

The implementation of voice control in home automation systems is defined by where and how the crucial step of speech-to-intent conversion occurs. The choice of processing architecture represents a fundamental trade-off between computational capability, latency, privacy, and operational independence. This section reviews the two primary paradigms—cloud-based and edge-based processing—along with hybrid models that attempt to synthesize their advantages, with a specific focus on their implementation using the ESP32.

3.1. Cloud-Based Voice Processing

In cloud-based architectures, the ESP32 acts primarily as an intelligent gateway. Its role is to capture audio input, stream it over a Wi-Fi connection to a powerful remote server (the cloud), and subsequently execute the command returned by that server.The typical workflow, as illustrated in **Figure 4**, involves: 1) The user speaks a command, which is captured by a microphone connected to the ESP32. 2) The ESP32 pre-processes the audio (e.g., buffering, encoding) and transmits it via Wi-Fi to a cloud service API (e.g., Amazon Alexa Voice Service, Google Assistant SDK). 3) The cloud service performs computationally intensive Automatic Speech Recognition (ASR) and Natural Language Understanding (NLU) to derive the user's intent. 4) A structured command is sent back to the ESP32, often via a WebSocket or MQTT connection. 5) The ESP32 parses this command and controls the appropriate actuator (e.g., relay, LED).

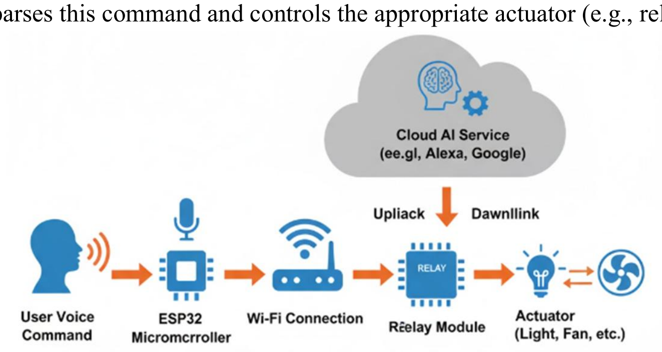

Figure 4: System Architecture for Cloud-Based Voice Processing.

3.2. Hybrid Approaches

To balance responsiveness and intelligence, hybrid architectures have emerged. These systems split the voice processing pipeline between the edge and the cloud. A common implementation uses a low-power, **always-listening wake-word engine** (like "Alexa" or "Okay Google") running locally on the ESP32. Once the wake word is detected, the subsequent voice command is streamed to the cloud for full NLU processing. This approach provides a seamless user experience by combining the instant responsiveness of local wake-word detection with the powerful understanding capabilities of the cloud, while mitigating always-on privacy concerns.

Table 2 provides a direct, quantitative comparison of the two primary architectures, highlighting the critical engineering trade-offs.

Table 2: Comparative Analysis of Voice Processing Architectures for ESP32-based Systems.

Parameter	Cloud-Based Architecture	Edge-Based Architecture
Latency	High (500ms - 2000ms)	**Very Low (<100ms)**
Internet Dependency	**Required**	**Not Required**
Vocabulary & NLP Capability	**Virtually Unlimited, Complex NLU**	Limited (10-200 pre-defined commands)
Data Privacy	Lower (Data sent to 3rd party)	**Higher (Data remains local)**
Computational Load on ESP32	Low (Network client)	**High (On-device AI inference)**
Power Consumption	Moderate (Wi-Fi always active)	Can be optimized with deep sleep
Development Complexity	Lower (Leverages existing cloud APIs)	**Higher (Custom model training/tuning)**
Operational Cost	Potential API fees	**Free after development**

The choice between these architectures is not merely technical but also philosophical, hinging on the specific application's requirements for privacy, reliability, and linguistic flexibility. The following section will explore how these architectures are integrated into a complete system through various communication protocols.

IV. SYSTEM INTEGRATION AND COMMUNICATION PROTOCOLS

The efficacy of a voice-controlled home automation system depends not only on accurate voice recognition but also on the seamless and reliable integration of all components into a cohesive network. This section reviews the critical hardware interfaces for connecting sensors and actuators to the ESP32, as well as the software communication protocols that enable robust data exchange between devices, both locally and with cloud services.

4.1. Sensor and Actuator Interfacing

The ESP32 interacts with the physical world through a suite of input and output peripherals. The choice of components and their interfacing method is crucial for system performance.

Audio Input (Microphones): The quality of the voice input directly impacts recognition accuracy. Common interfaces include:

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I²S (Inter-IC Sound): This digital serial bus is the preferred method for connecting higher-fidelity microphones (e.g., INMP441). It provides clean, digital audio data, which is essential for reliable cloud streaming and accurate on-device speech recognition, minimizing analog noise.

Analog Microphones: Simple analog microphones (e.g., MAX9814 with AGC) connect directly to the ESP32's Analog-to-Digital Converter (ADC) pins. While simpler and lower cost, they are more susceptible to electrical noise and require careful signal conditioning.

Outputs and Actuators: To control home appliances, the ESP32's GPIO pins are used to drive various components:

Relay Modules: Electromechanical or solid-state relays are the standard for safely switching high-voltage AC loads like lamps and fans. The ESP32's 3.3V digital output can easily control the low-voltage side of an opto-isolated relay module.

PWM (Pulse-Width Modulation): The ESP32's hardware PWM controllers are used for dimming LEDs, controlling fan speed, or positioning servo motors by generating a variable-duty-cycle square wave.

Figure 5 provides a detailed wiring diagram showing how these key components are physically and logically connected to the ESP32.

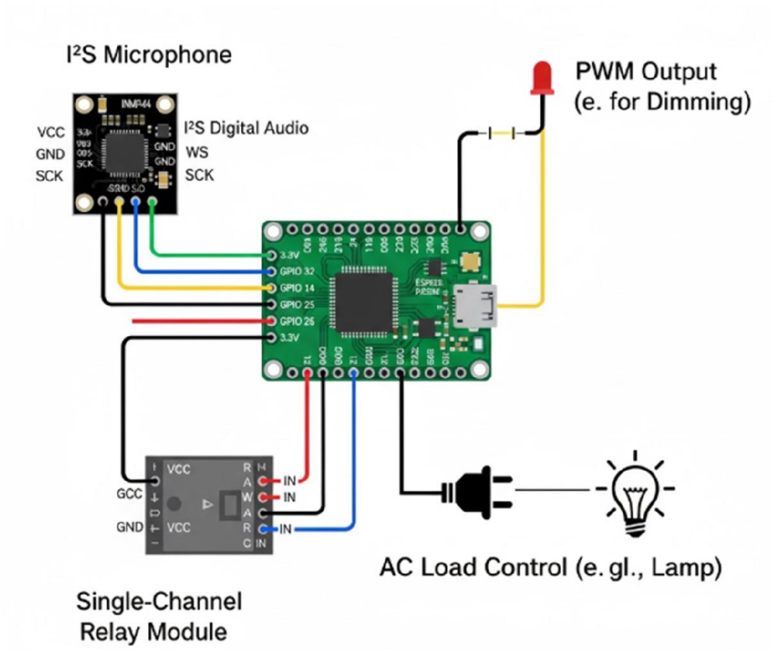

Figure 5: ESP32 Peripheral Interfacing Diagram.

4.2. In-Home Wireless Communication Protocols

The ESP32's integrated wireless capabilities are the backbone of its connectivity, enabling communication with the network infrastructure and user devices.

Wi-Fi (IEEE 802.11 b/g/n): This is the primary protocol for voice-controlled systems. It provides the high-bandwidth, low-latency connection necessary for streaming audio to the cloud and enables the ESP32 to join the local area network (LAN), making it accessible for control via local servers and cloud integrations alike.

Bluetooth Low Energy (BLE): While not the main channel for voice, BLE serves as a highly valuable secondary control channel. It allows users to directly pair with the ESP32 using a smartphone app for initial configuration (e.g., inputting Wi-Fi credentials), debugging, or local control without using voice or the internet, enhancing user convenience and system robustness.

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4.3. Home Automation Ecosystem Protocols

For the ESP32 to act as a node within a larger smart home system, it must communicate using standardized application-layer protocols.

MQTT (Message Queuing Telemetry Transport): This lightweight, publish-subscribe messaging protocol is exceptionally well-suited for IoT applications. In a typical setup, the ESP32 acts as an MQTT client, publishing sensor data or receiving command messages from a central broker (which could be hosted on a local server like a Raspberry Pi or a cloud service). Its minimal overhead and event-driven nature make it ideal for low-power devices and responsive control, forming the nervous system of a decentralized smart home.

HTTP/REST API: The Hypertext Transfer Protocol is widely used for communication with web services. The ESP32 can function as an HTTP client to send data to or receive commands from cloud platforms like IFTTT, ThingSpeak, or custom backend servers. Conversely, it can also run a lightweight HTTP server to host a simple web dashboard for local control and monitoring, providing a multi-modal interface to the user.

Figure 6 synthesizes all these elements into a complete system architecture, demonstrating how the ESP32 integrates sensors, local networks, and cloud services to create a functional voice-controlled automation system.

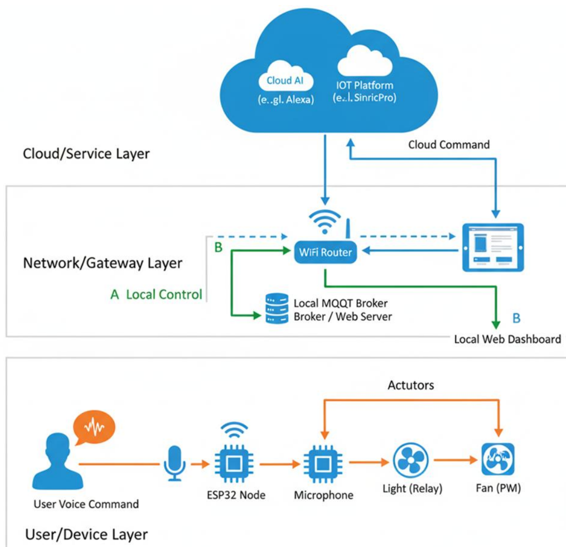

Figure 6: Comprehensive System Architecture of a Voice-Controlled Home Automation Node

Table 3 summarizes the key communication protocols and their specific roles within the ESP32-based ecosystem.

Table 3: Communication Protocols in ESP32-based Home Automation.

Protocol	Layer	Primary Function	Key Characteristic
Wi-Fi (802.11n)	Network/Transport	Primary internet & LAN connectivity for voice streaming and cloud communication.	High bandwidth, ubiquitous infrastructure.
Bluetooth LE (BLE)	Network/Application	Secondary channel for device configuration, debugging, and local control.	Low power, short-range, direct device pairing.

Protocol	Layer	Primary Function	Key Characteristic
MQTT	Application	Machine-to-machine (M2M) messaging for decentralized control and sensor data aggregation.	Lightweight, publish-subscribe, event-driven.
HTTP/REST	Application	Communication with web services and for hosting local control dashboards.	Request-response, stateless, universally supported.
I²C / SPI	Hardware Bus	Connecting low-level peripheral sensors (e.g., temperature, humidity).	

V. REVIEW OF IMPLEMENTATION APPROACHES AND CASE STUDIES

The theoretical architectures and protocols discussed previously are best understood through their practical implementation. This section reviews three distinct case studies that exemplify the primary approaches to building voice-controlled home automation systems with the ESP32. Each case study highlights a different design philosophy, showcasing the trade-offs between complexity, capability, and user experience.

5.1. Case Study 1: Cloud-Dependent Smart Switch using Alexa

Objective: To create a robust and user-friendly system for controlling a mains-powered lamp using natural language commands via the Amazon Alexa ecosystem.

Method: This implementation leverages the **Sinric Pro** cloud service as an intermediary. The ESP32 is configured as a virtual "Smart Switch" device within the Sinric Pro platform. It maintains a persistent WebSocket connection to the Sinric Pro servers. When a user says, "Alexa, turn on the lamp," the Alexa cloud service routes the command to Sinric Pro, which then sends a standardized JSON message via WebSocket to the ESP32. Upon receipt, the ESP32 toggles a GPIO pin connected to a relay module, which physically switches the lamp.

Findings & Analysis: This approach proved highly reliable and offered an excellent user experience due to seamless integration with the Alexa app and ecosystem. The use of a service like Sinric Pro abstracted away the complexity of directly interfacing with the Alexa Voice Service (AVS), significantly accelerating development. The primary limitation, as theorized, was the noticeable latency (approximately 1-2 seconds) between the command and the action. Furthermore, a complete system failure occurred during an internet outage, confirming the critical dependency on cloud connectivity.

Table 4: Case Study 1 - Implementation Summary.

Aspect	Details
Architecture	Cloud-Based
Key Technology	Sinric Pro Cloud Service, Amazon Alexa
ESP32 Role	Networked Actuator
Voice Processing	Amazon Alexa Cloud NLU
Pros	Easy setup, high accuracy, natural language, good user experience

Aspect	Details
Cons	High latency, internet dependency, no offline functionality

5.2. Case Study 2: Offline, Low-Latency Fan Controller with Local Wake Word

Objective: To develop a responsive and privacy-focused fan controller that operates entirely offline, independent of internet connectivity.

Method: This system utilizes the **Espressif Speech Recognition (ESP-SR)** framework for on-device processing. A wake word ("Fan Control") is trained using the ESP-SR model training tool. The system runs a continuous audio acquisition loop on the ESP32. Upon detecting the wake word, it listens for a pre-defined command such as "low," "medium," "high," or "off." The recognized command ID is mapped directly to a specific PWM duty cycle, which controls the fan's speed through a MOSFET, or toggles the fan via a relay.

Findings & Analysis: The system achieved its goal of providing instantaneous control (latency <100ms) and total operational independence from the internet. Privacy was ensured as no audio data left the device. However, the system's vocabulary was severely limited, and accuracy was susceptible to environmental noise and user accent. Retraining the model for new commands was a non-trivial process, making the system inflexible compared to its cloud-based counter part.

Table 5: Case Study 2 - Implementation Summary.

Aspect	**Details**
Architecture	Edge-Based
Key Technology	ESP-SR Framework
ESP32 Role	Standalone Voice-Controlled Actuator
Voice Processing	On-device Wake Word & Command Recognition
Pros	Ultra-low latency, works offline, high privacy
Cons	Limited vocabulary, sensitive to noise, difficult to update

VI. CHALLENGES AND FUTURE RESEARCH DIRECTIONS

Despite the significant advancements enabled by the ESP32, the development of robust, user-friendly, and secure voice-controlled home automation systems is not without its challenges. This section synthesizes the key technical and user-centric hurdles identified across current implementations and outlines promising avenues for future research that could overcome these limitations and shape the next generation of smart home technology.

6.1. Technical Challenges

Power Consumption: For always-listening voice applications, power management remains a critical issue. While the ESP32 features efficient sleep modes, continuously powering the microphone and running a wake-word detection loop prevents the deepest sleep states, limiting battery-operated applications. Optimizing the duty cycle and exploring ultra-low-power wake-word co-processors are necessary for truly wireless devices.

Computational and Memory Constraints: The ESP32's resources are finite. High-quality audio sampling and on-device speech recognition models compete for RAM and processing power with Wi-Fi/BT stacks and application logic. This often forces a choice between model complexity (and thus accuracy) and system responsiveness, especially in edge-based architectures. Efficient model quantization and pruning are essential.

Noise Robustness and Accuracy: Real-home environments are acoustically challenging, with background noise (e.g., TV, conversations, traffic) that can severely degrade the performance of both cloud and edge-based voice recognition. Current systems often lack sophisticated noise cancellation and beamforming capabilities, leading to false triggers and failed commands.

Network Security and Device Hardening: As an IoT device, the ESP32 is a potential entry point for cyber-attacks. Ensuring secure boot, encrypted communication (TLS for MQTT/HTTP), and protection against common vulnerabilities is paramount. Many DIY projects overlook these aspects, creating risks for the local network.

6.2. User-Centric Challenges

The Privacy-Convenience Paradox: Users are often forced to choose between the high convenience and intelligence of cloud-based processing and the privacy and immediacy of edge-based processing. Building user trust requires transparent data handling policies and technically robust local processing options.

Accessibility and Inclusivity: Voice recognition systems can struggle with diverse accents, dialects, and speech patterns, as well as the speech of individuals with disabilities. Most models are trained on limited datasets, potentially excluding user demographics and reducing the technology's universal accessibility.

6.3. Future Research Directions

TinyML for On-Device Intelligence: The integration of **Tiny Machine Learning (TinyML)** is the most promising path for enhancing edge-based systems. Future work should focus on developing and deploying more complex, yet efficient, speech models on the ESP32. This includes few-shot learning for personalized command training and smaller, more accurate wake-word models that consume less power.

Hardware-Software Co-Design: The development of dedicated, low-power wake-word chips that work in tandem with the ESP32 could revolutionize power efficiency. The main ESP32 core could remain in deep sleep until awakened by this co-processor, dramatically extending battery life for voice-activated devices.

Advanced Audio Pre-Processing: Research into implementing real-time digital signal processing (DSP) algorithms on the ESP32, such as acoustic echo cancellation (AEC) and blind source separation, could significantly improve noise robustness and accuracy in real-world conditions without relying on cloud computing.

Standardization and Interoperability: The emerging **Matter standard** presents a significant future direction. Research into implementing Matter endpoints on the ESP32 would ensure interoperability between DIY projects and commercial products from different vendors, creating a more unified and user-friendly smart home ecosystem.

Federated Learning for Personalized Models: Exploring federated learning techniques could allow voice models to be improved based on user data without the data ever leaving the local device. This would enhance accuracy and personalization while rigorously maintaining user privacy.

VII. CONCLUSION

The ESP32 functions as a versatile and powerful "vocal cortex" for the modern smart home. It provides the foundational substrate upon which the future of intelligent, responsive, and accessible living spaces will be built. By continuing to bridge the gap between high-level intelligence and practical, decentralized control, ESP32-based systems are not merely replicating existing paradigms but are actively paving the way for a more democratic, privacy-conscious, and integrated future for home automation. The ongoing evolution of this technology promises to further blur the line between human command and environmental action, making our interaction with the places we live more natural and effortless than ever before.

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REFERENCES

1. Bantilan, N., Malgaroli, M., Ray, B., & Hull, T. D. (2024). Deep learning for depression detection from text and audio: A multi-modal approach. Journal of Affective Disorders, 340, 123-130. https://doi.org/10.1016/j.jad.2024.05.087
2. Chen, Z., Zhang, Y., & Liu, P. (2025). Multimodal AI for remote patient monitoring: Reducing hospitalization rates through early detection. Health Informatics Journal, 31(1), 78-89. https://doi.org/10.1177/14604582241234567
3. De Choudhury, M., Sharma, S., & Kiciman, E. (2024). Social media and multimodal AI for mental health crisis prediction. Proceedings of the ACM on Human-Computer Interaction, 8(CSCW1), 1-22. https://doi.org/10.1145/3637372
4. Godase, V., Pawar, P., Nagane, S., & Kumbhar, S. (2024). Automatic railway horn system using node MCU. Journal of Control & Instrumentation, 15(1).
5. Jamadade, V. K., Ghodke, M. G., Katakdhond, S. S., & Godase, V. A Comprehensive Review on Scalable Arduino Radar Platform for Real-time Object Detection and Mapping.
6. Godase, V. (2025, April). Advanced Neural Network Models for Optimal Energy Management in Microgrids with Integrated Electric Vehicles. In Proceedings of the International Conference on Trends in Material Science and Inventive Materials (ICTMIM-2025) DVD Part Number: CFP250J1-DVD.
7. Dange, R., Attar, E., Ghodake, P., & Godase, V. (2023). Smart agriculture automation using ESP8266 NodeMCU. J. Electron. Comput. Netw. Appl. Math, (35), 1-9.
8. Mane, V. G. A. L. K., & Gangonda, K. D. S. Pipeline Survey Robot.
9. Godase, V., & Jagadale, A. (2019). Three element control using PLC, PID & SCADA interface. International Journal for Scientific Research & Development, 7(2), 1105-1109.
10. Godase, V., Modi, S., Misal, V., & Kulkarni, S. (2025). LoRaEdge-ESP32 synergy: Revolutionizing farm weather data collection with low-power, long-range IoT. Advance Research in Analog and Digital Communications, 2(2), 1-11.
11. Godase, V., Modi, S., Misal, V., & Kulkarni, S. Real-time object detection for autonomous drone navigation using YOLOv8,‖. Advance Research in Communication Engineering and its Innovations, 2(2), 17-27.
12. Bhaganagare, S., Chavan, S., Gavali, S., & Godase, V. V. (2025). Voice-Controlled Home Automation with ESP32: A Systematic Review of IoT-Based Solutions. Journal of Microprocessor and Microcontroller Research, 2(3), 1-13.
13. Jamadade, V. K., Ghodke, M. G., Katakdhond, S. S., & Godase, V. A Comprehensive Review on Scalable Arduino Radar Platform for Real-time Object Detection and Mapping.
14. V. Godase, R. Ghodake, S. Takale, and A. Mulani, ―Design and Optimization of Reconfigurable Microwave Filters Using AI Techniques,‖ Journal of RF and Microwave Communication Technologies, vol. 2, no. 2, pp.26–41, Aug. 2025.
15. Godase, V. (2025). Cross-Domain Comparative Analysis of Microwave Imaging Systems for Medical Diagnostics and Industrial Testing. Journal of Microwave Engineering & Technologies, 12(2), 39-48p.
16. V. K. Jamadade, M. G. Ghodke, S. S. Katakdhond, and V. Godase, ―A Review on Real-time Substation Feeder Power Line Monitoring and Auditing Systems," International Journal of Emerging IoT Technologies in Smart Electronics and Communication, vol. 1, no. 2, pp. 1-16, Sep. 2025.
17. V. Godase, A. Mulani, R. Ghodake, S. Takale, "Automated Water Distribution Management and Leakage Mitigation Using PLC Systems," Journal of Control and Instrumentation Engineering, vol.11, no. 3, pp. 1-8, Aug. 2025.
18. V. Godase, A. Mulani, R. Ghodake, S. Takale, "PLC-Assisted Smart Water Distribution with Rapid Leakage Detection and Isolation," Journal of Control Systems and Converters, vol. 1, no. 3, pp. 1-13, Aug. 2025.
19. A. Salunkhe et al., "A Review on Real-Time RFID-Based Smart Attendance Systems for Efficient Record Management," Advance Research in Analog and Digital Communications, vol. 2, no. 2, pp.32-46, Aug. 2025.

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International Journal of Advanced Research in Science, Communication and Technology
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ISSN: 2581-9429 Volume 5, Issue 4, October 2025 Impact Factor: 7.67

20. V. V. Godase, S. R. Takale, R. G. Ghodake, and A. Mulani, "Attention Mechanisms in Semantic Segmentation of Remote Sensing Images," Journal of Advancement in Electronics Signal Processing, vol. 2, no. 2, pp. 45–58, Aug. 2025.
21. Godase, V., Mulani, A., Takale, S., & Ghodake, R. (2025). Comprehensive Review on Automated Field Irrigation using Soil Image Analysis and IoT. Journal of Advance Electrical Engineering and Devices, 3(1), 46-55.
22. D. Waghmare, A. Mulani, S. R. Takale, V. Godase, and A. Mulani, "A Comprehensive Review on Automatic Fruit Sorting and Grading Techniques with Emphasis on Weight-based Classification," Research & Review: Electronics and Communication Engineering, vol. 2, no. 3, pp. 1-10, Oct. 2025.
23. Godase, M. V., Mulani, A., Ghodak, R., Birajadar, G., Takale, S., & Kolte, M. (2024). A MapReduce and Kalman filter based secure IIoT environment in Hadoop.
24. Nagane, M.S., Pawar, M.P., & Godase, P.V. (2022). Cinematica Sentiment Analysis. *Journal of Image Processing and Intelligent Remote Sensing*.
25. Dhope, V. (2024). SMART PLANT MONITORING SYSTEM. In International Journal of Creative Research Thoughts (IJCRT). https://www.ijcrt.org
26. Godase, V., Mulani, A., Takale, S., & Ghodake, R. (2025). A Holistic Review of Automatic Drip Irrigation Systems: Foundations and Emerging Trends. Available at SSRN 5247778.
27. Godase, V., Mulani, A., Pawar, A., & Sahani, K. (2025). A Comprehensive Review on PIR Sensor-Based Light Automation Systems. International Journal of Image Processing and Smart Sensors, 1(1), 22-29.
28. Karve, S., Gangonda, S., Birajadar, G., Godase, V., Ghodake, R., & Mulani, A. O. (2023, October). Optimized Neural Network for Prediction of Neurological Disorders. In International Conference on Emerging Trends in Artificial Intelligence, Data Science and Signal Processing (pp. 183-191). Cham: Springer Nature Switzerland.
29. Godase, M. V., Mulani, A., Ghodak, M. R., Birajadar, M. G., Takale, M. S., & Kolte, M. A MapReduce and Kalman Filter based Secure IIoT Environment in Hadoop. Sanshodhak, Volume 19, June 2024.
30. Mulani, A. O., & Mane, P. B. (2017). Watermarking and cryptography based image authentication on reconfigurable platform. Bulletin of Electrical Engineering and Informatics, 6(2), 181-187.
31. Gadade, B., Mulani, A. O., & Harale, A. D. IoT Based Smart School Bus and Student Tracking System. Sanshodhak, Volume 19, June 2024.
32. Dhanawadel, A., Mulani, A. O., & Pise, A. C. IOT based Smart farming using Agri BOT. Sanshodhak, Volume 20, June 2024.
33. Mulani, A., & Mane, P. B. (2016). DWT based robust invisible watermarking. Scholars' Press.
34. R. G. Ghodke, G. B. Birajdar, A.O. Mulani, G.N. Shinde, R.B. Pawar, Design and Development of an Efficient and Cost-Effective surveillance Quadcopter using Arduino, Sanshodhak, Volume 20, June 2024.
35. R. G. Ghodke, G. B. Birajdar, A.O. Mulani, G.N. Shinde, R.B. Pawar, Design and Development of Wireless Controlled ROBOT using Bluetooth Technology, Sanshodhak, Volume 20, June 2024.
36. Swami, S. S., & Mulani, A. O. (2017, August). An efficient FPGA implementation of discrete wavelet transform for image compression. In 2017 International Conference on Energy, Communication, Data Analytics and Soft Computing (ICECDS) (pp. 3385-3389). IEEE.
37. Mane, P. B., & Mulani, A. O. (2018). High speed area efficient FPGA implementation of AES algorithm. International Journal of Reconfigurable and Embedded Systems, 7(3), 157-165.
38. Mulani, A. O., & Mane, P. B. (2016). Area efficient high speed FPGA based invisible watermarking for image authentication. Indian journal of Science and Technology, 9(39), 1-6.
39. Kashid, M. M., Karande, K. J., & Mulani, A. O. (2022, November). IoT-based environmental parameter monitoring using machine learning approach. In Proceedings of the International Conference on Cognitive and Intelligent Computing: ICCIC 2021, Volume 1 (pp. 43-51). Singapore: Springer Nature Singapore.
40. Nagane, U. P., & Mulani, A. O. (2021). Moving object detection and tracking using Matlab. Journal of Science and Technology, 6(1), 2456-5660.

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 4, October 2025
Impact Factor: 7.67

41. Kulkarni, P. R., Mulani, A. O., & Mane, P. B. (2016). Robust invisible watermarking for image authentication. In Emerging Trends in Electrical, Communications and Information Technologies: Proceedings of ICECIT-2015 (pp. 193-200). Singapore: Springer Singapore.
42. Ghodake, M. R. G., & Mulani, M. A. (2016). Sensor based automatic drip irrigation system. Journal for Research, 2(02).
43. Mandwale, A. J., & Mulani, A. O. (2015, January). Different Approaches For Implementation of Viterbi decoder on reconfigurable platform. In 2015 International Conference on Pervasive Computing (ICPC) (pp. 1-4). IEEE.
44. Jadhav, M. M., Chavan, G. H., & Mulani, A. O. (2021). Machine learning based autonomous fire combat turret. Turkish Journal of Computer and Mathematics Education, 12(2), 2372-2381.
45. Shinde, G., & Mulani, A. (2019). A robust digital image watermarking using DWT-PCA. International Journal of Innovations in Engineering Research and Technology, 6(4), 1-7.
46. Mane, D. P., & Mulani, A. O. (2019). High throughput and area efficient FPGA implementation of AES algorithm. International Journal of Engineering and Advanced Technology, 8(4).
47. Mulani, A. O., & Mane, D. P. (2017). An Efficient implementation of DWT for image compression on reconfigurable platform. International Journal of Control Theory and Applications, 10(15), 1-7.
48. Deshpande, H. S., Karande, K. J., & Mulani, A. O. (2015, April). Area optimized implementation of AES algorithm on FPGA. In 2015 International Conference on Communications and Signal Processing (ICCSP) (pp. 0010-0014). IEEE.
49. Deshpande, H. S., Karande, K. J., & Mulani, A. O. (2014, April). Efficient implementation of AES algorithm on FPGA. In 2014 International Conference on Communication and Signal Processing (pp. 1895-1899). IEEE.
50. Kulkarni, P., & Mulani, A. O. (2015). Robust invisible digital image mamarking using discrete wavelet transform. International Journal of Engineering Research & Technology (IJERT), 4(01), 139-141.
51. Mulani, A. O., Jadhav, M. M., & Seth, M. (2022). Painless Non□invasive blood glucose concentration level estimation using PCA and machine learning. The CRC Book entitled Artificial Intelligence, Internet of Things (IoT) and Smart Materials for Energy Applications.
52. Mulani, A. O., & Shinde, G. N. (2021). An approach for robust digital image watermarking using DWT□PCA. Journal of Science and Technology, 6(1).
53. Mulani, A. O., & Mane, P. B. (2014, October). Area optimization of cryptographic algorithm on less dense reconfigurable platform. In 2014 International Conference on Smart Structures and Systems (ICSSS) (pp. 86-89). IEEE.
54. Jadhav, H. M., Mulani, A., & Jadhav, M. M. (2022). Design and development of chatbot based on reinforcement learning. Machine Learning Algorithms for Signal and Image Processing, 219-229.
55. Mulani, A. O., & Mane, P. (2018). Secure and area efficient implementation of digital image watermarking on reconfigurable platform. International Journal of Innovative Technology and Exploring Engineering, 8(2), 56-61.
56. Kalyankar, P. A., Mulani, A. O., Thigale, S. P., Chavhan, P. G., & Jadhav, M. M. (2022). Scalable face image retrieval using AESC technique. Journal Of Algebraic Statistics, 13(3), 173-176.
57. Takale, S., & Mulani, A. (2022). DWT-PCA based video watermarking. Journal of Electronics, Computer Networking and Applied Mathematics (JECNAM) ISSN, 2799-1156.
58. Kamble, A., & Mulani, A. O. (2022). Google assistant based device control. Int. J. of Aquatic Science, 13(1), 550-555.
59. Kondekar, R. P., & Mulani, A. O. (2017). Raspberry Pi based voice operated Robot. International Journal of Recent Engineering Research and Development, 2(12), 69-76.
60. Ghodake, R. G., & Mulani, A. O. (2018). Microcontroller based automatic drip irrigation system. In Techno-Societal 2016: Proceedings of the International Conference on Advanced Technologies for Societal Applications (pp. 109-115). Springer International Publishing.

61. Mulani, A. O., Birajadar, G., Ivković, N., Salah, B., & Darlis, A. R. (2023). Deep learning based detection of dermatological diseases using convolutional neural networks and decision trees. Traitement du Signal, 40(6), 2819.
62. Boxey, A., Jadhav, A., Gade, P., Ghanti, P., & Mulani, A. O. (2022). Face Recognition using Raspberry Pi. Journal of Image Processing and Intelligent Remote Sensing (JIPIRS) ISSN, 2815-0953.
63. Patale, J. P., Jagadale, A. B., Mulani, A. O., & Pise, A. (2023). A Systematic survey on Estimation of Electrical Vehicle. Journal of Electronics, Computer Networking and Applied Mathematics (JECNAM) ISSN, 2799-1156.
64. Gadade, B., & Mulani, A. (2022). Automatic System for Car Health Monitoring. International Journal of Innovations in Engineering Research and Technology, 57-62.
65. Shinde, M. R. S., & Mulani, A. O. (2015). Analysisof Biomedical Image Using Wavelet Transform. International Journal of Innovations in Engineering Research and Technology, 2(7), 1-7.
66. Mandwale, A., & Mulani, A. O. (2014, December). Implementation of convolutional encoder & different approaches for viterbi decoder. In IEEE International Conference on Communications, Signal Processing Computing and Information technologies.
67. Mulani, A. O., Jadhav, M. M., & Seth, M. (2022). Painless machine learning approach to estimate blood glucose level with non-invasive devices. In Artificial intelligence, internet of things (IoT) and smart materials for energy applications (pp. 83-100). CRC Press.
68. Maske, Y., Jagadale, A. B., Mulani, A. O., & Pise, A. C. (2023). Development of BIOBOT system to assist COVID patient and caretakers. European Journal of Molecular & Clinical Medicine, 10(01), 2023.
69. Utpat, V. B., Karande, D. K., & Mulani, D. A. Grading of Pomegranate Using Quality Analysis‖. International Journal for Research in Applied Science & Engineering Technology (IJRASET), 10.
70. Takale, S., & Mulani, D. A. (2022). Video Watermarking System. International Journal for Research in Applied Science & Engineering Technology (IJRASET), 10.
71. Mandwale, A., & Mulani, A. O. (2015, January). Different approaches for implementation of Viterbi decoder. In IEEE international conference on pervasive computing (ICPC).
72. Maske, Y., Jagadale, M. A., Mulani, A. O., & Pise, A. (2021). Implementation of BIOBOT System for COVID Patient and Caretakers Assistant Using IOT. International Journal of Information Technology and, 30-43.
73. Mulani, A. O., & Mane, D. P. (2016). Fast and Efficient VLSI Implementation of DWT for Image Compression. International Journal for Research in Applied Science & Engineering Technology, 5, 1397-1402.
74. Kambale, A. (2023). Home automation using google assistant. UGC care approved journal, 32(1), 1071-1077.
75. Pathan, A. N., Shejal, S. A., Salgar, S. A., Harale, A. D., & Mulani, A. O. (2022). Hand gesture controlled robotic system. Int. J. of Aquatic Science, 13(1), 487-493.
76. Korake, D. M., & Mulani, A. O. (2016). Design of Computer/Laptop Independent Data transfer system from one USB flash drive to another using ARM11 processor. International Journal of Science, Engineering and Technology Research.
77. Mandwale, A., & Mulani, A. O. (2016). Implementation of High Speed Viterbi Decoder using FPGA. International Journal of Engineering Research & Technology, IJERT.
78. Kolekar, S. D., Walekar, V. B., Patil, P. S., Mulani, A. O., & Harale, A. D. (2022). Password Based Door Lock System. Int. J. of Aquatic Science, 13(1), 494-501.
79. Shinde, R., & Mulani, A. O. (2015). Analysis of Biomedical Image‖. International Journal on Recent & Innovative trend in technology (IJRITT).
80. Sawant, R. A., & Mulani, A. O. (2022). Automatic PCB Track Design Machine. International Journal of Innovative Science and Research Technology, 7(9).
81. ABHANGRAO, M. R., JADHAV, M. S., GHODKE, M. P., & MULANI, A. (2017). Design And Implementation Of 8-bit Vedic Multiplier. International Journal of Research Publications in Engineering and Technology (ISSN No: 2454-7875).

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 4, October 2025
Impact Factor: 7.67

82. Gadade, B., Mulani, A. O., & Harale, A. D. (2024). Iot based smart school bus and student monitoring system. Naturalista Campano, 28(1), 730-737.
83. Mulani, D. A. O. (2024). A Comprehensive Survey on Semi-Automatic Solar-Powered Pesticide Sprayers for Farming. Journal of Energy Engineering and Thermodynamics (JEET) ISSN, 2815-0945.
84. Salunkhe, D. S. S., & Mulani, D. A. O. (2024). Solar Mount Design Using High-Density Polyethylene. NATURALISTA CAMPANO, 28(1).
85. Seth, M. (2022). Painless Machine learning approach to estimate blood glucose level of Non-Invasive device. Artificial Intelligence, Internet of Things (IoT) and Smart Materials for Energy Applications.
86. Kolhe, V. A., Pawar, S. Y., Gohery, S., Mulani, A. O., Sundari, M. S., Kiradoo, G., ... & Sunil, J. (2024). Computational and experimental analyses of pressure drop in curved tube structural sections of Coriolis mass flow metre for laminar flow region. Ships and Offshore Structures, 19(11), 1974-1983.
87. Basawaraj Birajadar, G., Osman Mulani, A., Ibrahim Khalaf, O., Farhah, N., G Gawande, P., Kinage, K., & Abdullah Hamad, A. (2024). Epilepsy identification using hybrid CoPrO-DCNN classifier. International Journal of Computing and Digital Systems, 16(1), 783-796.
88. Kedar, M. S., & Mulani, A. (2021). IoT Based Soil, Water and Air Quality Monitoring System for Pomegranate Farming. Journal of Electronics, Computer Networking and Applied Mathematics (JECNAM) ISSN, 2799-1156.
89. Godse, A. P. A.O. Mulani (2009). Embedded Systems (First Edition).
90. Pol, R. S., Bhalerao, M. V., & Mulani, A. O. A real time IoT based System Prediction and Monitoring of Landslides. International Journal of Food and Nutritional Sciences, Volume 11, Issue 7, 2022.
91. Mulani, A. O., Sardey, M. P., Kinage, K., Salunkhe, S. S., Fegade, T., & Fegade, P. G. (2025). ML-powered Internet of Medical Things (MLIOMT) structure for heart disease prediction. Journal of Pharmacology and Pharmacotherapeutics, 16(1), 38-45.
92. Aiwale, S., Kolte, M. T., Harpale, V., Bendre, V., Khurge, D., Bhandari, S., ... & Mulani, A. O. (2024). Non-invasive Anemia Detection and Prediagnosis. Journal of Pharmacology and Pharmacotherapeutics, 15(4), 408-416.
93. Mulani, A. O., Bang, A. V., Birajadar, G. B., Deshmukh, A. B., Jadhav, H. M., & Liyakat, K. K. S. (2024). IoT Based Air, Water, and Soil Monitoring System for Pomegranate Farming. Annals of Agri-Bio Research, 29(2), 71-86.
94. Kulkarni, T. M., & Mulani, A. O. (2024). Face Mask Detection on Real Time Images and Videos using Deep Learning. International Journal of Electrical Machine Analysis and Design (IJEMAD), 2(1).
95. Thigale, S. P., Jadhav, H. M., Mulani, A. O., Birajadar, G. B., Nagrale, M., & Sardey, M. P. (2024). Internet of things and robotics in transforming healthcare services. Afr J Biol Sci (S Afr), 6(6), 1567-1575.
96. Pol, D. R. S. (2021). Cloud Based Memory Efficient Biometric Attendance System Using Face Recognition. Stochastic Modeling & Applications, 25(2).
97. Nagtilak, M. A. G., Ulegaddi, M. S. N., Adat, M. A. S., & Mulani, A. O. (2021). Breast Cancer Prediction using Machine Learning.
98. Rahul, G. G., & Mulani, A. O. (2016). Microcontroller Based Drip Irrigation System.
99. Kulkarni, T. M., & Mulani, A. O. Deep Learning Based Face-Mask Detection: An Approach to Reduce Pandemic Spreads in Human Healthcare. African Journal of Biological Sciences, 6(6), 2024.
100. Mulani, A., & Mane, P. B. (2016). DWT based robust invisible watermarking. Scholars' Press.
101. Dr. Vaishali Satish Jadhav, Dr. Shweta Sadanand Salunkhe, Dr. Geeta Salunkhe, Pranali Rajesh Yawle, Dr. Rahul S. Pol, Dr. Altaf Osman Mulani, Dr. Manish Rana, Iot Based Health Monitoring System for Human, Afr. J. Biomed. Res. Vol. 27 (September 2024).
102. Dr. Vaishali Satish Jadhav, Geeta D. Salunke, Kalyani Ramesh Chaudhari, Dr. Altaf Osman Mulani, Dr. Sampada Padmakar Thigale, Dr. Rahul S. Pol, Dr. Manish Rana, Deep Learning-Based Face Mask Recognition in Real-Time Photos and Videos, Afr. J. Biomed. Res. Vol. 27 (September 2024).

103. Altaf Osman Mulani, Electric Vehicle Parameters Estimation Using Web Portal, Recent Trends in Electronics & Communication Systems, Volume 10, Issue 3, 2023.
104. Aryan Ganesh Nagtilak, Sneha Nitin Ulegaddi, Mahesh Mane, Altaf O. Mulani, Automatic Solar Powered Pesticide Sprayer for Farming, International Journal of Microwave Engineering and Technology, Volume 9 No. 2, 2023.
105. Annasaheb S. Dandage, Vitthal R. Rupnar, Tejas A Pise, and A. O. Mulani, Real-Time Language Translation Application Using Tkinter. International Journal of Digital Communication and Analog Signals. 2025; 11(01): -p.
106. AnnaSaheb S Dandage, Vitthal R. Rupnar, Tejas A Pise, and A. O. Mulani, IoT-Powered Weather Monitoring and Irrigation Automation: Transforming Modern Farming Practices. . 2025; 11(01): -p.
107. Mulani, A.O., Kulkarni, T.M. (2025). Face Mask Detection System Using Deep Learning: A Comprehensive Survey. In: Singh, S., Arya, K.V., Rodriguez, C.R., Mulani, A.O. (eds) Emerging Trends in Artificial Intelligence, Data Science and Signal Processing. AIDSP 2023. Communications in Computer and Information Science, vol 2439. Springer, Cham. https://doi.org/10.1007/978-3-031-88759-8_3.
108. Karve, S., Gangonda, S., Birajadar, G., Godase, V., Ghodake, R., Mulani, A.O. (2025). Optimized Neural Network for Prediction of Neurological Disorders. In: Singh, S., Arya, K.V., Rodriguez, C.R., Mulani, A.O. (eds) Emerging Trends in Artificial Intelligence, Data Science and Signal Processing. AIDSP 2023. Communications in Computer and Information Science, vol 2440. Springer, Cham. https://doi.org/10.1007/978-3-031-88762-8_18.
109. Saurabh Singh, Karm Veer Arya, Ciro Rodriguez Rodriguez, and Altaf Osman Mulani, Emerging Trends in Artificial Intelligence, Data Science and Signal Processing, Communications in Computer and Information Science (CCIS), volume 2440.
110. Saurabh Singh, Karm Veer Arya, Ciro Rodriguez Rodriguez, and Altaf Osman Mulani, Emerging Trends in Artificial Intelligence, Data Science and Signal Processing, Communications in Computer and Information Science (CCIS), volume 2439.
111. Godase, V., Mulani, A., Pawar, A., & Sahani, K. (2025). A Comprehensive Review on PIR Sensor-Based Light Automation Systems. International Journal of Image Processing and Smart Sensors, 1(1), 22-29.
112. Godase, V., Mulani, A., Takale, S., & Ghodake, R. (2025). Comprehensive Review on Automated Field Irrigation using Soil Image Analysis and IoT. Journal of Advance Electrical Engineering and Devices, 3(1), 46-55.
113. Altaf Osman Mulani, Deshmukh M., Jadhav V., Chaudhari K., Mathew A.A., Shweta Salunkhe. Transforming Drug Therapy with Deep Learning: The Future of Personalized Medicine. Drug Research. 2025 Aug 29.
114. Altaf O. Mulani, Vaibhav V. Godase, Swapnil R. Takale, Rahul G. Ghodake (2025), Image Authentication Using Cryptography and Watermarking, International Journal of Image Processing and Smart Sensors, Vol. 1, Issue 2, pp 27-34.
115. Altaf O. Mulani, Vaibhav V. Godase, Swapnil R. Takale, Rahul G. Ghodake (2025), Advancements in Artificial Intelligence: Transforming Industries and Society, International Journal of Artificial Intelligence of Things (AIoT) in Communication Industry, Vol. 1, Issue 2, pp 1-5.
116. Altaf O. Mulani, Vaibhav V. Godase, Swapnil R. Takale, Rahul G. Ghodake (2025), AI-Powered Predictive Analytics in Healthcare: Revolutionizing Disease Diagnosis and Treatment, Journal of Advance Electrical Engineering and Devices, Vol. 3, Issue 2, pp 27-34.
117. Godase, V., Mulani, A., Takale, S., & Ghodake, R. (2025). A Holistic Review of Automatic Drip Irrigation Systems: Foundations and Emerging Trends. Available at SSRN 5247778.
118. V. Godase, R. Ghodake, S. Takale, and A. Mulani, ―Design and Optimization of Reconfigurable Microwave Filters Using AI Techniques, International Journal of RF and Microwave Communication Technologies, vol. 2, no. 2, pp.26–41, Aug. 2025.

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
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Impact Factor: 7.67

119. V. Godase, A. Mulani, R. Ghodake, S. Takale, "Automated Water Distribution Management and Leakage Mitigation Using PLC Systems," Journal of Control and Instrumentation Engineering, vol.11, no. 3, pp. 1-8, Aug. 2025.
120. V. Godase, A. Mulani, R. Ghodake, S. Takale, "PLC-Assisted Smart Water Distribution with Rapid Leakage Detection and Isolation," Journal of Control Systems and Converters, vol. 1, no. 3, pp. 1-13, Aug. 2025.
121. V. V. Godase, S. R. Takale, R. G. Ghodake, and A. Mulani, "Attention Mechanisms in Semantic Segmentation of Remote Sensing Images," Journal of Advancement in Electronics Signal Processing, vol. 2, no. 2, pp. 45–58, Aug. 2025.
122. D. Waghmare, A. Mulani, S. R. Takale, V. Godase, and A. Mulani, "A Comprehensive Review on Automatic Fruit Sorting and Grading Techniques with Emphasis on Weight-based Classification," Research & Review: Electronics and Communication Engineering, vol. 2, no. 3, pp. 1-10, Oct. 2025.
123. Karande, K. J., & Talbar, S. N. (2014). Independent component analysis of edge information for face recognition. Springer India.
124. Karande, K. J., & Talbar, S. N. (2008). Face recognition under variation of pose and illumination using independent component analysis. ICGST-GVIP, ISSN.
125. Kawathekar, P. P., & Karande, K. J. (2014, July). Severity analysis of Osteoarthritis of knee joint from X-ray images: A Literature review. In 2014 International Conference on Signal propagation and computer technology (ICSPCT 2014) (pp. 648-652). IEEE.
126. Daithankar, M. V., Karande, K. J., & Harale, A. D. (2014, April). Analysis of skin color models for face detection. In 2014 International Conference on Communication and Signal Processing (pp. 533-537). IEEE.
127. Karande, J. K., Talbar, N. S., & Inamdar, S. S. (2012, May). Face recognition using oriented Laplacian of Gaussian (OLOG) and independent component analysis (ICA). In 2012 Second International Conference on Digital Information and Communication Technology and it's Applications (DICTAP) (pp. 99-103). IEEE.
128. Asabe, H., Asabe, R., Lengare, O., & Godase, S. (2025). IOT- BASED STORAGE SYSTEM FOR MANAGING VOLATILE MEDICAL RESOURCES IN HEALTHCARE FACILITIES. INTERNATIONAL JOURNAL OF PROGRESSIVE RESEARCH IN ENGINEERING MANAGEMENT AND SCIENCE (IJPREMS), 05(03), 2427–2433. https://www.ijprems.com
129. Karche, S. N., Mulani, A. O., Department of Electronics, SKN Sinhgad College of Engineering, Korti, & University of Solapur, Maharashtra, India. (2018). AESC Technique for Scalable Face Image Retrieval. International Journal of Innovative Research in Computer and Communication Engineering, 6(4), 3404–3405.
130. https://doi.org/10.15680/IJIRCCE.2018.0604036
131. Bankar, A. S., Harale, A. D., & Karande, K. J. (2021). Gestures Controlled Home Automation using Deep Learning: A Review. International Journal of Current Engineering and Technology, 11(06), 617–621. https://doi.org/10.14741/ijcet/v.11.6.4
132. Mali, A. S., Ghadge, S. K., Adat, A. S., & Karande, S. V. (2024). Intelligent Medication Management System. IJSRD - International Journal for Scientific Research & Development, Vol. 12(Issue 3).
133. Water Level Control, Monitoring and Altering System by using GSM in Irrigation Based on Season. (2019). In International Research Journal of Engineering and Technology (IRJET) (Vol. 06, Issue 04, p. 1035) [Journal-article]. https://www.irjet.net
134. Modi, S., Misal, V., Kulkarni, S., & Mali A.S. (2025). Hydroponic Farming Monitoring System - Automated system to monitor and control nutrient and pH levels. In Journal of Microcontroller Engineering and Applications (Vol. 12, Issue 3, pp. 11–16). https://doi.org/10.37591/JoMEA
135. Siddheshwar S. Gangonda, Prashant P. Patavardhan, Kailash J. Karande, "VGHN: variations aware geometric moments and histogram features normalization for robust uncontrolled face recognition", International Journal of Information Technology, https://doi.org/10.1007/s41870-021-00703-0.
136. Siddheshwar Gangonda and Prachi Mukherji, "Speech Processing for Marathi Numeral Recognition using MFCC & DTW Features", International Journal of Engineering Research And Applications (IJERA) pp. 118-122, ISSN: 2248-9622.

137. Siddheshwar S. Gangonda, Prashant P. Patavardhan, Kailash J. Karande, "Recognition of Marathi Numerals Using MFCC and DTW Features", Book Title: Recent Trends on Image Processing and Pattern Recognition, RTIP2R 2018, CCIS 1037, pp. 1–11, © Springer Nature Singapore Pte Ltd. 2019 https://doi.org/10.1007/978-981-13-9187-3_17.
138. Siddheshwar S. Gangonda, Prashant P. Patavardhan, Kailash J. Karande, "Analysis of Face Recognition Algorithms for Uncontrolled Environments", Book Title: Computing, Communication and Signal Processing, pp. 919–926, © Springer Nature Singapore Pte Ltd. 2018.
139. Siddheshwar S. Gangonda, Prashant P. Patavardhan, Kailash J. Karande, "Recognition of Marathi Numerals using MFCC and DTW Features", 2nd International Conference on Recent Trends in Image Processing and Pattern Recognition (RTIP2R 2018), 21th -22th Dec., 2018, organized by Solapur University, Solapur in collaboration with University of South Dakota (USA) and Universidade de Evora (Portugal), India.
140. Siddheshwar S. Gangonda, Prashant P. Patavardhan, Kailash J. Karande, "A Comprehensive Survey of Face Databases for Constrained and Unconstrained Environments", 2nd IEEE Global Conference on Wireless Computing & Networking (GCWCN-2018), 23th-24th Nov., 2018, organized by STES's Sinhgad Institute of Technology, Lonavala, India.
141. Siddheshwar S. Gangonda, Prashant P. Patavardhan, Kailash J. Karande, "An Extensive Survey of Prominent Researches in Face Recognition under different Conditions", 4th International Conference on Computing, Communication, Control And Automation (ICCUBEA-2018), 16th to 18th Aug. 2018 organized by Pimpri Chinchwad College of Engineering (PCCOE), Pune, India.
142. Siddheshwar S. Gangonda, Prashant P. Patavardhan, Kailash J. Karande, "Analysis of Face Recognition Algorithms for Uncontrolled Environments", 3rd International Conference on Computing, Communication and Signal Processing (ICCASP 2018), 26th-27th Jan.2018, organized by Dr. BATU, Lonere, India.
143. Siddheshwar Gangonda and Prachi Mukherji, "Speech Processing for Marathi Numeral Recognition", International Conference on Recent Trends, Feb 2012, IOK COE, Pune.
144. S. S. Gangonda, "Bidirectional Visitor Counter with automatic Door Lock System", National Conference on Computer, Communication and Information Technology (NCCCIT-2018), 30th and 31st March 2018 organized by Department of Electronics and Telecommunication Engineering, SKN SCOE, Korti, Pandharpur.
145. Siddheshwar Gangonda and Prachi Mukherji, "Speech Processing for Marathi Numeral Recognition using MFCC & DTW Features", ePGCON 2012, 23rd and 24th April 2012 organized by Commins COE for Woman, Pune.
146. Siddheshwar Gangonda and Prachi Mukherji, "Speech Processing for Marathi Numeral Recognition", National Conference on Emerging Trends in Engineering and Technology (VNCET'12), 30th March 2012 organized by Vidyavardhini's College of Engineering and Technology, Vasai Road, Thane.
147. Siddheshwar Gangonda and Prachi Mukherji, "Speech Processing for Marathi Numeral Recognition", ePGCON 2011, 26th April 2011 organized by MAEER's MIT, Kothrud, Pune-38.
148. Siddheshwar Gangonda, "Medical Image Processing", Aavishkar-2K7, 17th and 18th March 2007 organized by Department of Electronics and Telecommunication Engineering, SVERI's COE, Pandharpur.
149. Siddheshwar Gangonda, "Image enhancement & Denoising", VISION 2k7, 28th Feb-2nd March 2007 organized by M.T.E. Society's Walchand College of Engineering, Sangli.
150. Siddheshwar Gangonda, "Electromagnetic interference & compatibility" KSHITIJ 2k6, 23rd and 24th Sept. 2006 organized by Department of Mechanical Engineering, SVERI's COE, Pandharpur.
151. A. Pise and K. Karande, "A genetic Algorithm-Driven Energy-Efficient routing strategy for optimizing performance in VANETs," Engineering Technology and Applied Science Research, vol. 15, no. 5, 2025, [Online]. Available: https://etasr.com/index.php/ETASR/article/view/12744
152. A. C. Pise, K. J. Karande, "Investigating Energy-Efficient Optimal Routing Protocols for VANETs: A Comprehensive Study", ICT for Intelligent Systems, Lecture Notes in Networks and Systems 1109, Proceedings of ICTIS 2024 Volume 3, Lecture Notes in Networks and Systems, Springer, Singapore, ISSN 2367-3370, PP 407-417, 29 October 2024 https://doi.org/10.1007/978-981-97-6675-8_33.

153. A. C. Pise, et. al., "Smart Vehicle: A Systematic Review", International Journal - The Ciência & Engenharia - Science & Engineering Journal ISSN: 0103-944XVolume 11 Issue 1, 2023pp: 992–998, 2023.
154. A. C. Pise, et. al., "Smart Vehicle: A Systematic Review", International Journal of Research Publication and Reviews, ISSN 2582-7421, Vol 4, no 10, pp 2728-2731 October 2023.
155. A. C. Pise, et. al., "Development of BIOBOT System to Assist COVID Patient and Caretakers", European Journal of Molecular and Clinical Medicine ; 10(1):3472-3480, 2023.
156. A. C. Pise, et. al., "IoT Based Landmine Detection Robot", International Journal of Research in Science & EngineeringISSN: 2394-8299Vol: 03, No. 04, June-July 2023.
157. A. C. Pise, et. al., "A Systematic survey on Estimation of Electrical Vehicle", Journal of Electronics, Computer Networking and Applied Mathematics (JECNAM) ISSN: 2799-1156, Volume 3, Issue 01, Pages 1-6, December 2023.
158. A. C. Pise, et. al., "Python Algorithm to Estimate Range of Electrical Vehicle", Web of Science, Vol 21, No 1 (2022) December 2022
159. A. C. Pise, et. al., "Implementation of BIOBOT System for COVID Patient and Caretakers Assistant using IOT", International Journal of Information technology and Computer Engineering. 30-43. 10.55529/ijitc.21.30.43, (2022).
160. A. C. Pise, et. al., "An IoT Based Real Time Monitoring of Agricultural and Micro irrigation system", International journal of scientific research in Engineering and management (IJSREM), VOLUME: 06 ISSUE: 04 | APRIL – 2022, ISSN:2582-3930.
161. A. C. Pise, Dr. K. J. Karande, "An Exploratory study of Cluster Based Routing Protocol in VANET: A Review", International Journal of Advanced Research in Engineering and Technology(IJARET), 12,10, 2021, 17-30, Manuscript ID :00000-94375 Source ID : 00000006, Journal_uploads/ IJARET/VOLUME_12_ISSUE_10/IJARET_12_10_002.pdf
162. A. C. Pise, et. al., "Android based Portable Health Support System," A Peer Referred & Indexed International Journal of Research,Vol.8,issue.4 , April 2019.
163. A. C. Pise, et. al., "Facial Expression Recognition Using Image Processing," International Journal of VLSI Design, Microelectronics and Embedded System,Vol.3,issue.2 , July 2018.
164. A. C. Pise, et. al., "Detection of Cast Iron Composition by Cooling Curve Analysis using Thermocouple Temperature Sensor," UGC Approved International Journal of Academic Science (IJRECE),Vol.6, Issue.3 , July-September 2018.
165. A. C. Pise, et. al., "Android Based Portable Health Support", System International Journal of Engineering Sciences & Research Technology (IJESRT 2017) Vol.6, Issue 8, pp 85-88 5th Aug 2017
166. A. C. Pise, et. al., "Adaptive Noise Cancellation in Speech Signal", International Journal of Innovative Engg and Technology, 2017
167. A. C. Pise, et. al., "Lung Cancer Detection System by using Baysian Classifier", ISSN 2454-7875, IJRPET, published online in conference special issue VESCOMM-2016, February 2016
168. A. C. Pise, et. al.,"Review on Agricultural Plant Diseases Detection by Image Processing", ISSN 2278-62IX, IJLTET, Vol 7, Issue 1 May 2016
169. A. C. Pise, et. al. "Segmentation of Retinal Images for Glaucoma Detection", International Journal of Engineering Research and Technology (06, June-2015).
170. A. C. Pise, et. al. "Color Local Texture Features Based Face Recognition", International Journal of Innovations in Engineering and Technology(IJIET) , Dec. 2014
171. A. C. Pise, et. al. "Single Chip Solution For Multimode Robotic Control", International Journal of Engineering Research and Technology (IJERT-2014), Vol. 3, Issue 12, Dec. 2014.
172. Anjali C. Pise et. al., "Remote monitoring of Greenhouse parameters using zigbee Wireless Sensor Network", International Journal of Engineering Research & Technology ISSN 2278-0181 (online) Vol. 3, Issue 2, and pp: (2412-2414), Feb. 2014.

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173. A. C. Pise, K. J. Karande, "Cluster Head Selection Based on ACO In Vehicular Ad-hoc Networks", Machine Learning for Environmental Monitoring in Wireless Sensor Networks
174. A. C. Pise, K. J. Karande, "Architecture, Characteristics, Applications and Challenges in Vehicular Ad Hoc Networks" Presented in 27th IEEE International Symposium on Wireless Personal Multimedia Communications (WPMC 2024) "Secure 6G – AI Nexus: Where Technology Meets Humanity" Accepted for book chapter to be published in international Scopus index book by River publisher.
175. A. C. Pise, Dr. K. J. Karande, "K-mean Energy Efficient Optimal Cluster Based Routing Protocol in Vehicular Ad Hoc Networks", International Conference on Innovations in Artificial Intelligence and Machine Learning (ICAIML-2022), August 20th and 21st 2022 Springer database Conference.
176. A. C. Pise, Mr. D. Nale, "Web-Based Application for Result Analysis", ", International Conference on Innovations in Artificial Intelligence and Machine Learning (ICAIML-2022), August 20th and 21st 2022 Springer database Conference.
177. A. C. Pise, et. al., "Detection of Cast Iron Composition by Cooling Curve Analysis using Thermocouple Temperature Sensor," 2nd International Conference on Engineering Technology, Science and Management Innovation (ICETSMI – 2018), 2nd September 2018.
178. A. C. Pise, et. al., "Facial Expression Recognition Using Facial Features," IEEE International Conference on Communication and Electronics Systems (ICCES 2018), October 2018.
179. A. C. Pise, et. al., "Estimating Parameters of Cast Iron Composition using Cooling Curve Analysis," IEEE International Conference on Communication and Electronics Systems (ICCES 2018), Coimbatore, October 2018.
180. A. C. Pise, et. al., "Android based portable Health Support System," International Conference on Innovations in Engineering and Technology (CIET 2016), SKN Sinhgad College of Engineering, 30-31 Dec 2016.
181. A. C. Pise, et. al., "Baysian Classifier & FCM Segmentation for Lung Cancer Detection in early stage," International Conference on Innovations in Engineering and Technology (CIET 2016), SKN Sinhgad College of Engineering, 30-31 Dec 2016.
182. A. C. Pise, et. al., "Cast Iron Composition Measurement by Coding Curve Analysis," International Conference on Innovations in Engineering and Technology (CIET 2016), SKN Sinhgad College of Engineering, 30-31 Dec 2016.
183. A. C. Pise, et. al., "War field Intelligence Defence Flaging Vehicle," International Conference on Innovations in Engineering and Technology (CIET 2016), SKN Sinhgad College of Engineering, 30-31 Dec 2016.
184. A. C. Pise, et. al. "Disease Detection of Pomegranate Plant", IEEE sponsored International Conference on Computation of Power, Energy, Information and Communication, 22- 23 Apr. 2015.
185. A. C. Pise, P. Bankar. "Face Recognition by using GABOR and LBP", IEEE International Conference on Communication and Signal Processing, ICCSP, 2-4 Apr. 2015
186. A. C. Pise, et. al. "Single Chip Solution For Multimode Robotic Control", Ist IEEE International Conferene on Computing Communication and Automation, 26-27 Feb2015.
187. Anjali C. Pise, Vaishali S. Katti, "Efficient Design for Monitoring of Greenhouse Parameters using Zigbee Wireless Sensor Network", fifth SARC international conference IRF,IEEE forum ISBN 978-93-84209-21-6,pp 24-26, 25th May 2014
188. A. C. Pise, P. Bankar, "Face Recognition using Color Local Texture Features", International Conference on Electronics and Telecommunication, Electrical and Computer Engineering, Apr.2014.
189. A. C. Pise, et.al. "Monitoring parameters of Greenhouse using Zigbee Wireless Sensor Network", 1st International Conference on Electronics and Telecommunication, Electrical and Computer Engineering, 5-6 Apr.2014.
190. A. C. Pise, et. al. "Compensation schemes and performance Analysis of IQ Imbalances in Direct Conversion Receivers", International Conference at GHPCOE, Gujarat, (Online Proceeding is Available), 2009.

191. A. C. Pise, K. J. Karande, "Energy-Efficient Optimal Routing Protocols in VANETs", 66th Annual IETE Convention, AIC -2023 September16-17, 2023, under the Theme: The Role of 5G In Enabling Digital Transformation for Rural Upliftment.
192. A. C. Pise, et. al. "Automatic Bottle Filling Machine using Raspberry Pi", National Conference on computer ;Communication & information Technology (NCCIT-2018) dated 30th & 31st March 2018.
193. A. C. Pise, et. al. "Design & Implementation of ALU using VHDL", National Conference on computer ;Communication & information Technology (NCCIT-2018) dated 30th & 31st March 2018.
194. A. C. Pise, et. al. "Mechanism and Control of Autonomus four rotor Quad copter", National Conference on Computer, Electrical and Electronics Engineering, 23- 24 Apr. 2016.
195. A. C. Pise, et. al. "Segmentation of Optic Disk and Optic Cup from retinal Images", ICEECMPE – Chennai, June 2015
196. A. C. Pise, et. al. "Diseases Detection of Pomegranate Plant", IEEE Sponsored International conference on Computation of Power, Energy , April 2015.
197. A. C. Pise, et. al. "Compensation Techniques for I/Q Imbalance in Direct-Conversion Receivers", Conference at SCOE, Pune 2010.
198. A. C. Pise, et. al. "I/Q Imbalance compensation Techniques in Direct Conversion Receiver ", Advancing Trends in Engineering and Management Technologies, ATEMT-2009, Conference at Shri Ramdeobaba Kamla Nehru Engineering College, Nagpur, 20-21 November 2009
199. A. C. Pise, et. al. "Compensation Techniques for I/Q Imbalance in Direct Conversion Receiver", Conference at PICT, Pune 2008.
200. A. C. Pise, et. al. "I/Q Imbalance compensation Techniques in Direct Conversion Receiver ", Conference at DYCOE, Pune 2008.
201. A. C. Pise, et. al. "DUCHA: A New Dual channel MAC protocol for Multihop Ad-Hoc Networks", Conference at SVCP, Pune 2007.
202. Godase, V., Pawar, P., Nagane, S., & Kumbhar, S. (2024). Automatic railway horn system using node MCU. Journal of Control & Instrumentation, 15(1).
203. Godase, V., & Godase, J. (2024). Diet prediction and feature importance of gut microbiome using machine learning. Evolution in Electrical and Electronic Engineering, 5(2), 214-219.
204. Jamadade, V. K., Ghodke, M. G., Katakdhond, S. S., & Godase, V. A Comprehensive Review on Scalable Arduino Radar Platform for Real-time Object Detection and Mapping.
205. Godase, V. (2025). A comprehensive study of revolutionizing EV charging with solar-powered wireless solutions. Advance Research in Power Electronics and Devices e-ISSN, 3048-7145.
206. Godase, V. (2025, April). Advanced Neural Network Models for Optimal Energy Management in Microgrids with Integrated Electric Vehicles. In Proceedings of the International Conference on Trends in Material Science and Inventive Materials (ICTMIM-2025) DVD Part Number: CFP250J1-DVD.
207. Dange, R., Attar, E., Ghodake, P., & Godase, V. (2023). Smart agriculture automation using ESP8266 NodeMCU. J. Electron. Comput. Netw. Appl. Math, (35), 1-9.
208. Godase, V. (2025). Optimized Algorithm for Face Recognition using Deepface and Multi-task Cascaded Convolutional Network (MTCNN). Optimum Science Journal.
209. Mane, V. G. A. L. K., & Gangonda, K. D. S. Pipeline Survey Robot.
210. Godase, V. (2025). Navigating the digital battlefield: An in-depth analysis of cyber-attacks and cybercrime. International Journal of Data Science, Bioinformatics and Cyber Security, 1(1), 16-27.
211. Godase, V., & Jagadale, A. (2019). Three element control using PLC, PID & SCADA interface. International Journal for Scientific Research & Development, 7(2), 1105-1109.
212. Godase, V. (2025). Edge AI for Smart Surveillance: Real-time Human Activity Recognition on Low-power Devices. International Journal of AI and Machine Learning Innovations in Electronics and Communication Technology, 1(1), 29-46.

213. Godase, V., Modi, S., Misal, V., & Kulkarni, S. (2025). LoRaEdge-ESP32 synergy: Revolutionizing farm weather data collection with low-power, long-range IoT. Advance Research in Analog and Digital Communications, 2(2), 1-11.
214. Godase, V. (2025). Comparative study of ladder logic and structured text programming for PLC. Available at SSRN 5383802.
215. Godase, V., Modi, S., Misal, V., & Kulkarni, S. Real-time object detection for autonomous drone navigation using YOLOv8,‖. Advance Research in Communication Engineering and its Innovations, 2(2), 17-27.
216. Godase, V. (2025). Smart energy management in manufacturing plants using PLC and SCADA. Advance Research in Power Electronics and Devices, 2(2), 14-24.
217. Godase, V. (2025). IoT-MCU Integrated Framework for Field Pond Surveillance and Water Resource Optimization. International Journal of Emerging IoT Technologies in Smart Electronics and Communication, 1(1), 9-19.
218. Godase, V. (2025). Graphene-Based Nano-Antennas for Terahertz Communication. International Journal of Digital Electronics and Microprocessor Technology, 1(2), 1-14.
219. Godase, V., Khiste, R., & Palimkar, V. (2025). AI-Optimized Reconfigurable Antennas for 6G Communication Systems. Journal of RF and Microwave Communication Technologies, 2(3), 1-12.
220. Bhaganagare, S., Chavan, S., Gavali, S., & Godase, V. V. (2025). Voice-Controlled Home Automation with ESP32: A Systematic Review of IoT-Based Solutions. Journal of Microprocessor and Microcontroller Research, 2(3), 1-13.
221. Jamadade, V. K., Ghodke, M. G., Katakdhond, S. S., & Godase, V. A Comprehensive Review on Scalable Arduino Radar Platform for Real-time Object Detection and Mapping.
222. Godase, V. (2025). Cross-Domain Comparative Analysis of Microwave Imaging Systems for Medical Diagnostics and Industrial Testing. Journal of Microwave Engineering & Technologies, 12(2), 39-48p.
223. V. K. Jamadade, M. G. Ghodke, S. S. Katakdhond, and V. Godase, ―A Review on Real-time Substation Feeder Power Line Monitoring and Auditing Systems," International Journal of Emerging IoT Technologies in Smart Electronics and Communication, vol. 1, no. 2, pp. 1-16, Sep. 2025.
224. V. V. Godase, "VLSI-Integrated Energy Harvesting Architectures for Battery-Free IoT Edge Systems,"Journal of Electronics Design and Technology, vol. 2, no. 3, pp. 1-12, Sep. 2025.
225. A. Salunkhe et al., "A Review on Real-Time RFID-Based Smart Attendance Systems for Efficient Record Management," Advance Research in Analog and Digital Communications, vol. 2, no. 2, pp.32-46, Aug. 2025.
226. Vaibhav, V. G. (2025). A Neuromorphic-Inspired, Low-Power VLSI Architecture for Edge AI in IoT Sensor Nodes. Journal of Microelectronics and Solid State Devices, 12(2), 41-47p.
227. Nagane, M.S., Pawar, M.P., & Godase, P.V. (2022). Cinematica Sentiment Analysis. Journal of Image Processing and Intelligent Remote Sensing.
228. Godase, V.V. (2025). Tools of Research. SSRN Electronic Journal.
229. Godase, V. (n.d.). EDUCATION AS EMPOWERMENT: THE KEY TO WOMEN'S SOCIO ECONOMIC DEVELOPMENT. Women Empowerment and Development, 174–179.
230. Godase, V. (n.d.). COMPREHENSIVE REVIEW ON EXPLAINABLE AI TO ADDRESSES THE BLACK BOX CHALLENGE AND ITS ROLE IN TRUSTWORTHY SYSTEMS. In Sinhgad College of Engineering, Artificial Intelligence Education and Innovation (pp. 127–132).
231. Godase, V. (n.d.-b). REVOLUTIONIZING HEALTHCARE DELIVERY WITH AI-POWERED DIAGNOSTICS: A COMPREHENSIVE REVIEW. In SKN Sinhgad College of Engineering, SKN Sinhgad College of Engineering (pp. 58–61).
232. Dhope, V. (2024). SMART PLANT MONITORING SYSTEM. In International Journal of Creative Research Thoughts (IJCRT). https://www.ijcrt.org
233. M. M. Zade,Sushant D.Kambale,Shweta A.Mane,Prathamesh M. Jadhav.(2025) "IOT Based early fire detection in Jungles". RIGJA&AR Volume 2 Issue 1,ISSN:2998-4459. DOI:https://doi.org/10.5281/zendo.15056435

234. M. M. Zade, Bramhadev B. Rupanar, Vrushal S. Shilawant , Akansha R. Pawar(2025) "IOT Flood Monitoring & Alerting System using Rasberry Pi-Pico "International Journal of Research Publication & Reviews , Volume 6 ,Issue 3,ISSN:2582-7421.DOI:https://ijrpr.com/uploads/V6ISSUE3/IJRPR40251.pdf
235. M.M.Zade(2022) "Touchless Fingerprint Recognition System"(Paper-ID 907)(2022) International Conference on "Advanced Technologies for Societal Applications: Techno-Societal 2022 https://link.springer.com/book/10.1007/978-3-031-34644-6?page=6
236. Mr.M.M.Zade published the paper on "Automation of Color Object Sorting Conveyor Belt", in International Journal of Scientific Research in Engineering & Management (IJSREM),ISSN:2582-3930 Volume 06 ,Issue 11th November 2022.
237. Mr.M.M.Zade published the paper on "Cloud Based Patient Health Record Tracking web Developement",in International Journal of Advanced Research in Science, Communication & Technology(IJARSCT),ISSN NO:2581-9429 Volume 02 ,Issue 03,DOI 1048175/IJARSCT-3705,IF 6.252, May 2022.
238. Mr. Mahesh M Zade, "Performance analysis of PSNR Vs. Impulse Noise for the enhancement of Image using SMF", Journal of Applied Science & Computations (JASC UGC Approved), Volume VI, Issue II, Feb.2019
239. Mr. Mahesh M Zade, "Classification of Power Quality Disturbances Using SVM & their Efficiency Comparison", Journal of Applied Science & Computations (JASC UGC Approved), Volume VI, Issue II, Feb.2019
240. Mr. Mahesh M Zade, "Dynamic Clustering of Wireless Sensor Network Using Modified AODV", Journal of Applied Science & Computations (JASC UGC Approved), Volume VI, Issue II, Feb.2019
241. Mr. Mahesh M Zade, "Performance analysis of PSNR Vs. Impulse Noise for the enhancement of Image using SMF", National Conference on Mathematical Modeling and Computational Intelligence 2K19 (MMCI-2k19), in association with JASC, at S. B. Patil College of Engineering, Indapur, Feb.2019
242. Mr. Mahesh M Zade, "Classification of Power Quality Disturbances Using SVM & their Efficiency Comparison", National Conference on Mathematical Modeling and Computational Intelligence 2K19 (MMCI-2k19), in association with JASC, at S. B. Patil College of Engineering, Indapur Feb.2019
243. Mr. Mahesh M Zade, "Dynamic Clustering of Wireless Sensor Network Using Modified AODV", National Conference on Mathematical Modeling and Computational Intelligence 2K19 (MMCI-2k19), in association with JASC, at S. B. Patil College of Engineering, Indapur Feb.2019
244. Mr. Mahesh M Zade & Mr.S.M.Karve,"Performance Analysis of Median Filter for Enhancement of Highly Corrupted Images", National Conference on Advanced Trends in Engineering, Association with IRJMS, Karmyogi Engineering College, Shelave, Pandharpur, March 2016.
245. Mr. Mahesh M Zade & Mr.S.M.Karve,"Implementation of Reed Solomen Encoder & Decoder Using FPGA",National Conference on Advanced Trends in Engineering, Association with IRJMS, Karmyogi Engineering College, Shelave, Pandharpur, March 2016.
246. Mr. Mahesh M Zade & Dr.S.M.Mukane,"Performance of Switching Median Filter for Enhancement of Image", National Conference on Mechatronics at Sinhgad Institute of Technology and Science, Narhe, Pune, Feb. 2016.
247. Mr. Mahesh M Zade & Dr.S.M.Mukane,"Enhancement of Image with the help of Switching Median Filter", National Conference on Emerging Trends in Electronics & Telecommunication Engineering, SVERI's College of Engineering Pandharpur, NCET 2013.
248. Mr.Mahesh M Zade & Dr.S.M.Mukane,"Enhancement of Image with the help of Switching Median Filter", International Journal of Computer Application (IJCA) SVERI's College of Engineering, Pandharpur, Dec.2013.