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 6, Issue 4, April 2026
Impact Factor: 8.2

RFID Enabled Attendance Monitoring with Real Time Data Logging and Reporting

Pawan Balappa Bhure, Prajval Bapu Lokhande, Abhishek Vikram bhujbal
Onkar Ashok Parkhe, Poof. P. M. Shinde
Jayawantrao Sawant College of Engineering, Hadapsar, Pune, India
pawanbhure8228@gmail.com, bhaiyya.lokhande2006@gmail.com
bhujbalabhi3@gmail.com, omkarparkhe827@gmail.com, pmshinde_entc@jspmjspoly.edu.in

Abstract: *Traditional attendance tracking system are less efficient and time consuming, with high chances of human error. While alternative biometric methods are concerned over hygiene issues and performance limitations. This paper introduces a novel RFID-based attendance monitoring system that addresses these challenges through a combination of passive RFID technology and centralized data management. The solution proposed in this research uses individual RFID tags to users, enabling contactless, instantaneous attendance verification through strategically placed RFID readers within the environment and each connected to microcontrollers. The attendance data automatically logs to a centralized database, providing real-time monitoring and reporting through a Firebase portal dashboard. The dashboard can provide real- time insights about daily, weekly, and monthly attendance reports for easy administrative use. The proposed method shows significant improvements in both accuracy and efficiency as compared to traditional conventional manual attendance system, which is time consuming and prone to human errors. The proposed RFID based method is low-cost, scalable architecture suitable for diverse environments including both small-scale and large-scale.*

Keywords: Smart Attendance, RFID, Internet of Things (IoT), Educational Technology, Smart Attendance System

I. INTRODUCTION

In a large organization and academic institutions, two things prevail as a critical component, one is tracking of attendance and second is keeping track of attendance. Attendance monitoring is an important factor, directly impacting productivity, accountability, and performance tracking of an individual. Traditional old age attendance monitoring systems often rely on manual large book registers. With growing digital technologies, these methods are time-consuming and prone to human error. In the rapid era of digital transformation, there is an increasing demand for automated solutions that can enhance accuracy, reliability, and ease of use. One such innovation with respect to attendance monitoring is the use of Radio Frequency Identification (RFID) technology [1].

RFID based attendance systems provide a modern, contactless approach for capturing attendance. In which, the RFID reader is placed in several different strategic location with an organization premises, such that when a RFID ID is brought near the proximity of the reader, the attendance data gets captured automatically and instantaneously, suggesting a robust and efficient way to capture attendance data. This contactless approach eliminates manual data entry while significantly reducing opportunities for attendance fraud such as proxy marking [2].

The proposed system integrates standard RFID implementations by incorporating real time data logging and reporting, providing administrators ease of access to monitor attendance status through a web-based dashboard. The system utilizes microcontroller-based architecture to interface with RFID hardware and communicates with a centralized database to store timestamped attendance records. Additionally, features like automated report generation provide analytical insights for HR, academic, or event management purposes, further streamlining operational workflows.

DOI: 10.48175/568

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 6, Issue 4, April 2026
Impact Factor: 8.2

This paper put forward a complete design and implementation for an RFID enabled attendance monitoring system with real-time data logging capabilities in Firebase portal, with superior advantage in terms of speed, accuracy, security. Further, the system is structured to be adaptable and scalable, making it easy for use in schools, universities, offices, and large-scale events. The system has an optional function to integrate payroll or academic management systems and support for encrypted RFID tags to ensure data security. The solution addresses both efficiency and privacy concerns.

II. LITERATURE REVIEW

In recent days, several authors have worked on RFID-based attendance monitoring system, as it is an effective solution when compared to traditional manual methods, addressing key issues like proxy attendance and time constraint [3]. These systems combine IoT hardware, RFID technology and web- based interfaces to produce secure, real-time attendance management across diverse settings. In paper [4] authors have proposed combination of RFID and facial biometric recognition for attendance monitoring to mitigate proxy attendance and unauthorized access. The drawback of these methods highlights the need for real-time automated monitoring solutions to improve efficiency in capturing attendance and reduce human errors. RFID based solutions, combined with GSM module and database management, have proven effective in offering real-time monitoring, enhanced safety, and administrative efficiency [5][6]. Traditional paper- based attendance systems in organization are inefficient, time consuming, costly, and prone to data loss. RFID-based systems like the Activity Attendance Monitoring System (AAMS) offer a paperless, reliable alternative solution using student ID cards for real-time attendance tracking and management [7].

III. METHODOLOGY

The implementation methodology for RFID based attendance monitoring system is discussed in this section.

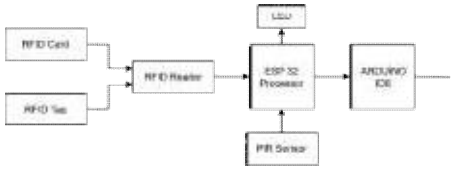

Figure 1. System Block Diagram

The proposed RFID base attendance monitoring is illustrated in Figure 1 as block diagram. The integrated RFID Card + Tag will be read using the RFID Reader, which will further be processed using the ESP32 Processor using the Arduino IDE and the data logging is stored in cloud database using Firebase platform. Figure 2 represents the Schematic Hardware Diagram of the prototype.

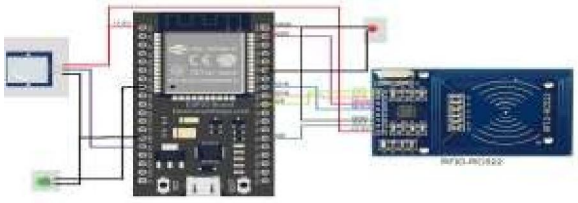

Figure 2. Schematic Hardware Diagram

IV. SYSTEM ARCHITECTURE

This section outlines the components and architecture of the proposed system, briefing about the specifications and functions of each module.

ESP32 Dev Module

The ESP32 WiFi module is a robust and versatile microcontroller unit designed and used for a variety of applications, from low-power sensor networks to complex performing tasks including voice encoding, MP3 decoding and music streaming. Figure 3 shows the ESP32 module. The features of ESP32 module includes:

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 6, Issue 4, April 2026
Impact Factor: 8.2

• CPU Specifications: With two independent CPU cores with adjustable clock frequencies ranging from 80 MHz to 240 MHz.
• Connectivity: Integrated Wi-Fi, Bluetooth, and BLE capabilities.
• Peripheral Integration: Supports high-speed SPI, UART, I2S, I2C interfaces, capacitive touch sensors Ethernet, and SD card interfacing.

Figure 3. ESP32 Module

This module considered as the central processing unit for the system development, enabling seamless communication between various sensors and peripherals. The ESP32 allows users to connect multiple components while maintaining sufficient processing capacity for real-time data management.

RFID Tags

RFID Tags are an advanced tracking technology that is capable of object identification. Each RFID tag consists of a antenna and a microchip (IC) that stores user defined information. The function of RFID tag is to send and receive information when scanned by an RFID Reader. These tags are uniquely used to identify individuals based on the stored information. Figure 4 shows an RFID Tag, and Figure 5 illustrates the core of RFID Tag.

Figure 4. RFID Tag

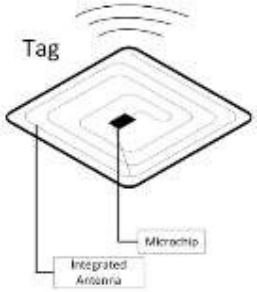

Figure 5. Functional Illustration of RFID Tag,

RFID Reader (RC522)

The use of RC522 RFID [8] reader is to scan RFID tags or cards to access their information, eventually reading the data and transferring it to ESP32. Figure 6 shows a RFID Reader. Key features include:
• Frequency Range: Operates in long-distance (860– 900 MHz) or long-range (13.56 MHz) frequency bands.
• Components: Includes an antenna for enhanced signal reception.

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 6, Issue 4, April 2026
Impact Factor: 8.2

• Functionality: Reads data from passive RFID tags and transmits it to the ESP32 module for processing.

The RFID reader facilitates [9] interaction between the system and RFID Cards. Figure 7 illustrates the principle of RFID mechanism.

Figure 6. RFID Reader

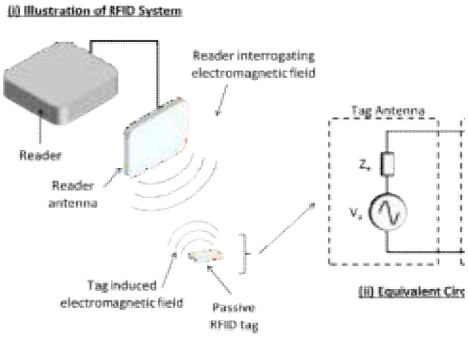

Figure 7. Principle of RFID Mechanism

PIR Sensor

A Passive Infrared (PIR) sensor is integrated into the system to detect motion by sensing infrared radiation emitted by objects within its range. Figure 8 shows a PIR Sensor. Key characteristics include:

• Detection Capability: Identifies the presence of humans or animals by differentiating between object movements and living beings.

• Cost Efficiency: A low-cost sensor suitable for motion detection applications.

The PIR sensor enhances system functionality by enabling motion-based triggers or alerts.

Figure 8. PIR Sensor

The final system architecture integrates all components into a unified and functional setup. The ESP32 Dev Module serves as the central controlling unit [10], handling data from connected sensors and peripherals. The RFID reader captures ID information from nearby tags, while the PIR sensor detects motion, helping the system activate only when someone is present [11]. Once the data is processed, it can be sent wirelessly through Wi-Fi or Bluetooth for storage,

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 6, Issue 4, April 2026 Impact Factor: 8.2

monitoring, or further actions. This design ensures smooth communication between all hardware parts and offers the flexibility to adapt the system for various real-world applications.

V. ALGORITHM

5.1. Initialization Phase

A. System boots and initializes all hardware components.
B. PIR sensor is activated in continuous monitoring mode.
C. RFID reader remains in low-power standby mode.
D. LED indicators are set to off state.
E. Network connection is established with the cloud database.

5.2 Operational Sequence

A. Motion Detection

• PIR sensor continuously monitors the surrounding area for human presence.
• When motion is detected, the system proceeds to the active scanning phase.
• If no motion is detected, the system remains in low-power standby mode.

B. RFID Activation

• Upon motion detection, the ESP32 activates the RC522 RFID reader module.
• The reader generates the electromagnetic field necessary for passive tag reading.
• A brief initialization period (approximately 100ms) allows the reader to stabilize.

C. User Authentication

• User presents their assigned RFID tag within the reader's detection field.
• RC522 module captures the unique identifier from the RFID tag.
• System retrieves tag data and forwards it to the verification module.
• Authentication algorithm compares the tag ID against the authorized database.

D. Feedback Mechanism [12]

• For verified users:
 Green LED blinks for 3 seconds indicating successful entry.
 Attendance record is created with user ID, timestamp, and location data.
• For unverified tags:
 Red LED blinks for 3 seconds indicating authentication failure.
 Security log entry is created documenting the unauthorized access attempt.

E. Data Logging

• All authentication events (both successful and failed) are formatted for transmission to the cloud database.
• System establishes secure connection to cloud database.
• Data is transmitted in real-time via the ESP32's Wi-Fi connection.
• Acknowledgment is received from cloud server confirms successful data logging.
• If network connectivity is unavailable, data is cached locally for later synchronization.

F. Return to Standby

• After completing the authentication and logging processes.
• RFID reader returns to low-power standby mode.
• System resumes PIR-based motion detection.
• Process repeats when new motion is detected.

This algorithm ensures efficient power management [13] by activating the energy-intensive RFID reading function only when potential users are detected in proximity to the system. The dual-LED feedback mechanism [12] provides immediate visual confirmation of authentication status, enhancing user experience while the parallel cloud logging

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 6, Issue 4, April 2026
Impact Factor: 8.2

ensures that attendance records are securely maintained and instantly available for administrative review. Figure 9 illustrates the flowchart of the algorithm.

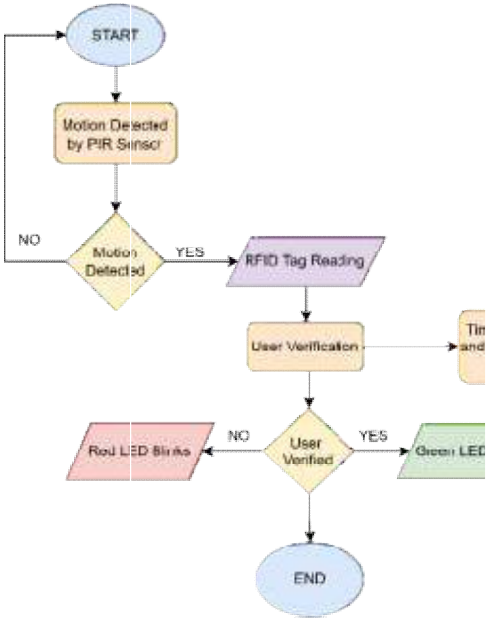

Figure 9. Algorithm of the RFID Attendance Monitoring System.

VI. RESULTS AND DISCUSSIONS

The RFID-enabled attendance monitoring system was successfully implemented using the ESP32 WiFi Module, RC522 RFID reader, and Firebase Realtime Database for data storage and access logging. The performance metrics and integration of every component were evaluated based on system responsiveness, accuracy, and real-time data handling.

A. Firebase Integration and Data Logging

The implementation of Firebase Realtime Database [14] proved to be highly effective in capturing and storing attendance logs. As depicted in Figure 10, the database accurately reflects attendance status immediately following successful RFID authentication events. For instance, the user "Aishwarya 115" is marked as "Present," after scanning the authorized tag, confirming successful data transmission and storage in the cloud.

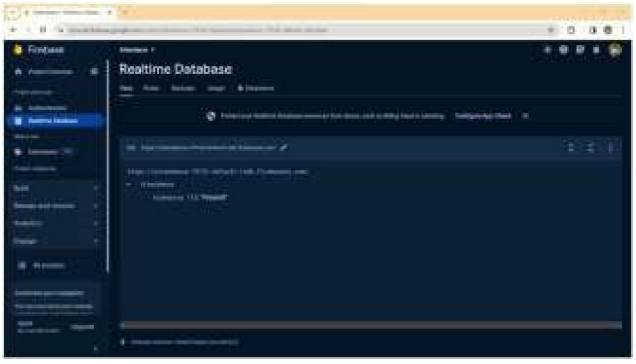

Figure 10. Attendance being logged in Firebase Database

Firebase provides a robust backend infrastructure. The platform's real-time synchronization capabilities ensure that attendance records remain consistently available to admins regardless of their physical location. Additionally, the

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 6, Issue 4, April 2026
Impact Factor: 8.2

scalable nature of Firebase makes it suitable and versatile for usage and deployment from small scale institutions to bigger organizations.

B. ESP32 Configuration and Serial Monitoring

The configuration of the ESP32 module with the Arduino IDE is illustrated in Figure 11, showing the integration of Wi- Fi credentials [15], Firebase authentication, and RFID setup. The serial monitor confirms the system's execution flow: Wi- Fi connection, RFID card detection, access control, and data upload to Firebase. The system correctly differentiates between authorized and unauthorized users, generating appropriate messages ("Card detected! Access granted!") for valid users while maintaining security by denying access to unregistered tags ("Access denied!"), ensuring system integrity.

Figure 11. Configuration of ESP32 with Arduino IDE

C. Real-Time Detection and User Feedback

To address energy concerns and promote sustainability while maintaining continuous availability, a PIR sensor is integrated to handle this task. A PIR sensor activates the RFID reader only when motion is detected. The dual LED feedback mechanism enhances user experience by providing immediate visual confirmation of authentication status, green light blinking confirms successful verification while red indicates access denial. This feature eliminates uncertainty for users and improve user interaction and system transparency.

D. System Performance and Accuracy

The system achieved 100% accuracy during multiple test iterations in controlled conditions. The performance has been proven to be exceptional in all the cases, where all the valid RFID tags were successfully logged into Firebase, and invalid tags were appropriately denied without exception. The integration of ESP32's processing capabilities and Firebase's real-time database functionality resulted in minimal latency between tag scanning and database updating, typically under 1 second even under moderate network conditions. This fast responsiveness makes the system suitable for high-traffic environments.

VII. CONCLUSION

The existing limitations in the traditional attendance monitoring methods are over-ruled by RFID enabled attendance capturing system with real-time data logging and storing, offering a fast, reliable and secure alternative. Leveraging the ESP32 Wi-Fi Module, RC522 RFID reader, PIR sensor, and Firebase Realtime Database, the proposed system provides seamless automation and efficient data management.

The integration of motion detection PIR sensor ensures the RFID reader activates, when necessary, thereby conserving power and enhancing system responsiveness. Real-time feedback via blinking of LEDs and instant cloud-based updates make the system user-friendly and transparent. Furthermore, data is securely logged into Firebase, enabling remote access and eliminating manual record keeping.

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 6, Issue 4, April 2026 Impact Factor: 8.2

This system not only minimizes errors and prevents fraudulent practices like proxy attendance. This system lays the groundwork for scalable deployment in educational institutions, workplaces, and event management. The system has flexibility to integrate with payroll or academic systems further increases its utility.

REFERENCES

[1] A. Shrivastava, S. J. Suji Prasad, A. R. Yeruva, P. Mani, P. Nagpal, and A. Chaturvedi, "IoT Based RFID Attendance Monitoring System of Students using Arduino ESP8266 & Adafruit.io on Defined Area," Cybern Syst, 2023, doi: 10.1080/01969722.2023.2166243.

[2] A. K. Tammisetti, K. S. Nalamalapu, S. Nagella, K. Shaik, and K. A. Shaik, "Deep Residual Learning based Attendance Monitoring System," in 8th International Conference on Advanced Computing and Communication Systems, ICACCS 2022, Institute of Electrical and Electronics Engineers Inc., 2022, pp. 1089–1093. doi: 10.1109/ICACCS54159.2022.9785042.

[3] ICAIT - 2019 : First IEEE International Conference on Advances in Information Technology : proceedings : 24th - 27th July 2019. IEEE, 2019.

[4] K. Sangeetha, M. Shobana, V. S. Nagul Pranav, S. Darunya, K. P. Madhumitha, and M. Nidharshini, "IoT Based Identification and Attendance Monitoring System Using Design Thinking Framework," in 2023 International Conference on Computer Communication and Informatics, ICCCI 2023, Institute of Electrical and Electronics Engineers Inc., 2023. doi: 10.1109/ICCCI56745.2023.10128367.

[5] S. Chatrati, S. Naidu, and C. H. Raghava Prasad, "RFID based Student Monitoring and Attendance Tracking System."

[6] Q. Miao, F. Xiao, H. Huang, L. Sun, and R. Wang, "Smart Attendance System Based on Frequency Distribution Algorithm with Passive RFID Tags." [Online]. Available: http://creativecommons.org/licenses/by/4.0/

[7] R. A. J. M. Gining, S. S. M. Fauzi, I. M. Ayub, M. N. F. Jamaluddin, I. Puspitasari, and Okfalisa, "Design and development of activity attendance monitoring system based on RFID," Indonesian Journal of Electrical Engineering and Computer Science, vol. 17, no. 1, pp. 500–507, 2019, doi:10.11591/ijeecs.v17.i1.pp500-507.

[8] A. Choudhury, A. Choudhury, U. Subramanium, and S. Balamurugan, "HealthSaver: a neural network based hospital recommendation system framework on flask webapplication with realtime database and RFID based attendance system," J Ambient Intell Humaniz Comput, vol. 13, no. 10, pp. 4953–4966, Oct. 2022, doi: 10.1007/s12652-021-03232-7.

[9] J. Yin, X. Xie, H. Mao, and S. Guo, "Efficient Missing Key Tag Identification in Large-scale RFID Systems: An Iterative Verification and Selection Method," IEEE Trans Mob Comput, 2024, doi: 10.1109/TMC.2024.3493597.

[10] V. Aravindhaa, K. V. K. Manikanta, H. Mandula, D. Allamaneni, and N. Sangeetha, "Applying IoT and Machine Learning for Enhanced Efficiency and Disease Management, Advancing Sustainability in Freshwater Prawn Farming," in 2024 3rd International Conference on Artificial Intelligence for Internet of Things, AIIoT 2024, Institute of Electrical and Electronics Engineers Inc., 2024. doi: 10.1109/AIIoT58432.2024.10574631.

[11] "An NFC Based Student Attendance Tracking". doi: 10.1109/CSCI51800.2020.00201

[12] M. I. M. Rozlan, S. B. Kutty, N. A. Sulaiman, N. S.
M. Pakhrudin, S. Saaidin, and M. Kassim, "RFID Based Attendance Monitoring System with LED Authentication," in 2023 IEEE International Conference on Automatic Control and Intelligent Systems, I2CACIS 2023 - Proceedings, Institute of Electrical and Electronics Engineers Inc., 2023, pp. 85–90. doi: 10.1109/I2CACIS57635.2023.10193394.

[13] V. Kolla, H. Mandula, A. V, and K. E, "Machine Learning-Driven Analysis and Prediction of Solar Power Generation for Enhanced Energy Management," in 2025 International Conference on Electronics and Renewable Systems (ICEARS), IEEE, Feb. 2025, pp. 1640–1645. doi: 10.1109/ICEARS64219.2025.10940748.

[14] Computer Communication and Informatics (ICCCI), 2015 International Conference on. 2015. "A Web Enabled Secured System for Attendance Monitoring and Real Time Location Tracking Using Biometric and Radio Frequency Identification (RFID) Technology"

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 6, Issue 4, April 2026
Impact Factor: 8.2

[15] V. Aravindhaa, R. J. Sanjanaa, A. T. Mithul Raaj, C. Rani, and M. Rajesh Kumar, "Advancing Sustainability in Mushroom Cultivation by leveraging IoT and ML Techniques," in 2024 3rd International Conference on Artificial Intelligence for Internet of Things, AIIoT 2024, Institute of Electrical and Electronics Engineers Inc., 2024. doi: 10.1109/AIIoT58432.2024.10574773.