International Journal of Technology and Applied Science (IJTAS)

E-ISSN: 2230-9004 ● Website: www.ijtas.com ● Email: editor@ijtas.com

Smart Attendance System Using RFID

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Abstract:
Smart Attendance System Using RFID is developed to automate and improve the traditional method of attendance tracking by implementing Radio Frequency Identification (RFID) technology. The RFID-based Smart Attendance System uses a unique RFID card for every user with a pre-defined ID code. The RFID reader will read the data and verify it by scanning the RFID card. The attendance will be recorded along with the date and time.The Smart Attendance System is developed by using an Arduino Uno microcontroller, RFID reader module, Real-Time Clock (RTC), and LCD display. The Smart Attendance System is developed and simulated by using Arduino IDE and Proteus software. The components are integrated to improve the accuracy and speed of the attendance tracking system. The Smart Attendance System is user-friendly and efficient for use in schools and offices. The Smart Attendance System is developed to improve the accuracy and speed of the attendance tracking system.

Keywords: RFID Technology, Smart Attendance System, Arduino Uno, RFID Reader, Automation, Real-Time Clock (RTC), Embedded Systems, Attendance Monitoring, IoT, LCD Display.

I. INTRODUCTION:

Attendance management plays a vital role in educational institutions, offices, and organizations, as it is closely associated with discipline, performance evaluation, and administrative decision-making. Accurate attendance records are essential for monitoring participation, ensuring accountability, and maintaining transparency in academic and professional environments. Traditionally, attendance has been recorded manually using paper registers or sign-in sheets. Although simple, these methods are inefficient, time-consuming, and prone to human errors such as incorrect entries, manipulation, and proxy attendance. Maintaining and storing paper-based records also increases administrative workload and makes data retrieval difficult. With the rapid advancement of digital technologies, automation has become an integral part of modern management systems. Researchers and developers have proposed various automated attendance systems using biometric technologies, computer vision, Internet of Things (IoT), and indoor localization methods. Face recognition-based attendance systems have gained significant attention due to their non-intrusive nature and ability to automate attendance without physical contact. Techniques such as Histogram of Oriented Gradients (HOG), Eigenfaces, Convolutional Neural Networks (CNN), and deep learning-based facial encodings have improved recognition accuracy and reliability. However, these systems are highly dependent on camera quality, lighting conditions, network availability, and computational resources. They are also vulnerable to spoofing attacks using photographs or videos and raise concerns related to privacy and data protection. Fingerprint-based and multimodal biometric attendance systems offer higher identification accuracy but require physical contact with sensors, leading to hygiene issues and increased maintenance costs. Post-pandemic learning environments have further highlighted the limitations of contact-based systems. Smartphone-based sensing and indoor localization technologies using WiFi, Bluetooth, or GPS have also been explored for attendance tracking, but these approaches require complex infrastructure, continuous device usage, and raise privacy and user-consent challenges. Therefore, despite technological advancements, many existing systems remain complex, expensive, or unsuitable for small- to medium-scale institutions. In contrast, Radio Frequency Identification (RFID) technology provides a simple, fast, and costeffective solution for automated

attendance management. RFID systems use uniquely assigned tags or cards to identify users wirelessly through an RFID reader. When an RFID card is brought within the reader's range, the identification data is captured instantly without physical contact. Compared to biometric and vision-based systems, RFID-based systems require minimal computational power, are easy to deploy, and offer high reliability in controlled environments such as classrooms and offices. The reduced system complexity makes RFID an attractive choice for institutions seeking affordable automation. Although some RFID authentication protocols have reported security challenges such as unauthorized tracking or communication vulnerabilities, basic RFID attendance systems remain effective when implemented in secure and supervised environments. By integrating additional modules such as Real Time Clock (RTC) and display units, RFID-based systems can accurately log attendance along with date and time, ensuring data integrity and real-time monitoring. The elimination of manual data entry significantly reduces human error and administrative burden. The proposed RFID-Based Attendance System is designed to automate the attendance process using an Arduino Uno microcontroller, RFID reader, RTC module, and LCD display. Each authorized user is provided with a unique RFID card that serves as an identification token. When the card is scanned, the system verifies the user's identity, records attendance automatically, and displays the relevant information on the LCD. The system is programmed using the Arduino IDE and simulated using the Proteus Design Suite to validate functionality and performance. This approach ensures a reliable, efficient, and user-friendly attendance solution without the need for complex infrastructure.

II.LITERATURE REVIEW :

The author Ashwin Raj, Aparna Raj, and Imteyaz Ahmad (2021) proposed a smart attendance monitoring system using computer vision and IoT, where face recognition is used to automatically mark student attendance. Dalal and Triggs (2005) introduced the Histogram of Oriented Gradients (HOG) algorithm, which plays a key role in accurate face detection and feature extraction. Adam Geitgey (2016) presented a modern deep learning–based face recognition technique that improves recognition accuracy through facial encoding. Nuruzzaman Faruqui et al. (2019) developed an automatic examinee validation system using Eigenfaces, demonstrating the effectiveness of biometric approaches in attendance and identification systems[1]. The author Anzar et al. (2021) – RIAMS S. M. Anzar, N. P. Subhash , Alavikunhu Panthakkan, Shanid Malayil, Hussain Al Ahmad proposed the Random Interval Attendance Management System (RIAMS) to address attendance issues in postCOVID virtual learning. The system uses face recognition, CAPTCHA verification, and Unique Identification Number (UIN) queries at random time intervals to prevent proxy attendance and student disengagement. The use of a CNN-based Dlib face recognition model improves accuracy while reducing bandwidth usage. The study proves RIAMS to be reliable, secure, and suitable for largescale virtual classrooms[2]. The author Núñez et al. (2020) developed a facial recognition attendance system using artificial neural networks and Raspberry Pi, demonstrating reliable performance in employee identification. Similarly, Espinosa et al. (2019) implemented a facial recognition-based timekeeping system for a fruit exporting company, reporting improvements in payroll accuracy and productivity. These studies confirm that facial recognition can effectively automate attendance tracking while reducing administrative workload. The author Aljaafreh et al. (2021) evaluated multiple classifiers, including Support Vector Machines (SVM) and Convolutional Neural Networks (CNN), achieving accuracy levels above 99%.[3]. The author K. Cao and A. K. Jain (2018) proposed an automated latent fingerprint recognition system to improve identification accuracy. While fingerprint systems offer high precision, they suffer from hygiene issues and vulnerability to spoofing using artificial fingerprints. These limitations reduce their reliability in real-world attendance applications.S. Thakre, A. K. Gupta, and S. Sharma (2017) developed a multimodal biometric system combining fingerprint and face recognition. Although face recognition reduces physical contact, it can be deceived using photographs or videos, making it less secure for attendance systems[4]. The author Zhang et al. (2013) proposed a lightweight two-way RFID authentication protocol aimed at reducing computational overhead on RFID tags. While the protocol was efficient in terms of cost, it assumed a

secure communication channel between the reader and backend server, making it unsuitable for mobile RFID environments where communication is wireless and vulnerable to attacks.Liu, Zhang, and Ou (2013) designed a hashbased mobile RFID authentication protocol that removed the assumption of a secure channel between the reader and backend database. Although the protocol improved mobility support, it was vulnerable to location tracking attacks, as repeated queries produced identical[5]. The author Álvarez-Merino et al. (2025) present a comprehensive survey on integrating indoor localization technologies into Smart Education (SE). Their work analyzes WiFi, 5G, Bluetooth, IoT, UWB, RFID, and computer vision, highlighting how localization improves attendance control, indoor navigation, and occupancy monitoring. They also propose a Proof of Concept (PoC) using WiFi and 5G fusion for automatic attendance control with machine learning, while addressing GDPR privacy concerns.Zhu et al. (2016) describe Smart Education as a data-driven, adaptive learning paradigm where context awareness (including location) plays a central role in personalizing learning experience[6].The author Erdélyi et al. (2025) propose an unobtrusive smartphone-based sensing system to detect subtle signs of school attendance issues among university students. Using passive smartphone sensors (Wi-Fi, motion, light, noise, screen state) and daily questionnaires, they estimate sleep problems and study engagement over long periods. Their work highlights early screening without additional devices and minimal user burden Borazio et al. (2014) investigate sleep rhythm and quality using smartwatch heart-rate data, achieving high accuracy but noting concerns about invasiveness and adoption[7]. The author Sun et al. (2017) emphasized that excessive waiting times reduce patient satisfaction and overall service quality, highlighting the importance of optimized outpatient scheduling systems . Similarly, Sepúlveda and Berroeta (2012) proposed decision rules for selecting appointment systems based on patient and institutional characteristics, stressing patientcentered scheduling strategies[8]. The author Solanki and Pittalia (2016) presented a comprehensive review of various face recognition techniques, including geometric, holistic, and hybrid approaches. Their study highlighted the strengths and limitations of traditional biometric systems and emphasized the growing importance of face recognition due to its non-intrusive nature[9]. The author Zadeh (1965) introduced Fuzzy Set (FS) theory, enabling modeling of uncertainty using membership degrees. This laid the foundation for decision-making under vagueness.Atanassov (1986) proposed Intuitionistic Fuzzy Sets (IFS) by incorporating non-membership degrees to better capture human hesitation.Yager (2013, 2014) developed Pythagorean Fuzzy Sets (PFS), allowing greater flexibility by constraining the sum of squared membership and non-membership values[10].

III.METHODS:

1. RFID + QR Code Attendance Method (2021): This method combines RFID cards and QR code technology to record attendance. Users scan their ID or QR code, and the system stores attendance data digitally while ensuring accuracy, security, and reduced manual effort.
2. Smart Card RFID Attendance Method (2023):
   This approach uses RFID-enabled smart cards for automatic attendance marking. When a user scans the card, the system records the entry, prevents proxy attendance, and simplifies attendance management in institutions.
3. RFID + Machine Learning Attendance Method (2024):
   This method integrates RFID technology with machine learning to create an intelligent attendance system. It analyzes attendance patterns in real time, improves accuracy, and makes tracking more adaptive and efficient.
4. Digital ID Card Method (2024): This approach develops a digital ID card system to verify user identity and record attendance securely.
   It enhances authentication, reduces forgery, and supports efficient digital record management.
5. Self-Supervised Learning Attendance Method (2024):

This system uses a self-supervised learning approach for smart attendance management. It automates attendance tracking, improves accuracy over time, reduces manual effort, and enhances overall data reliability.

6. Cloud-Based Biometric Attendance Method (2024):
This method uses fingerprint recognition with Convolutional Neural Networks (CNNs) and cloud storage. It provides secure, fast, and accurate attendance tracking with centralized data access for educational institutions.

IV.PROPOSED WORK:

The proposed system, Smart Attendance Monitoring System using RFID, is designed to automate and simplify the attendance process using RFID technology and Arduino. In this system, each student is provided with a unique RFID tag, which stores a specific identification number. When the student places the RFID tag near the RFID reader, the reader scans the tag and sends the data to the Arduino microcontroller. The Arduino processes this data to verify the student's identity and records their attendance automatically. The system then displays the student's details along with a confirmation message on the LCD screen and activates a buzzer to indicate successful attendance marking. All attendance records are stored in the system's memory or transmitted to a computer for future reference. This setup eliminates manual attendance errors, saves time, and ensures accuracy and transparency in managing attendance records. The software part of the system is implemented using Arduino IDE and Embedded C, while the hardware consists of components such as the RFID reader, RFID tags, Arduino board, LCD display, and buzzer. Overall, the proposed system provides a reliable, efficient, and low-cost.

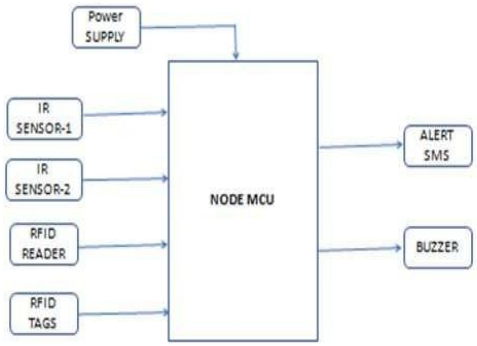


Fig: Block diagram of smart attendance system using RFID

Hardware Requirements:
- RFID Reader
- RFID Tags
- Arduino uno
- Liquid Crystal Display
- Buzzer

Software Requirements:
- Arduino IDE
- Embedded C Compiler

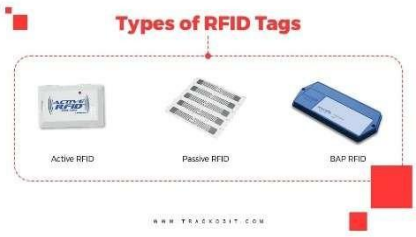
RFID READER:

An RFID reader is an electronic device used to identify and read data stored in RFID tags using radio frequency signals without any physical contact. It works by emitting radio waves through an antenna, which energizes nearby RFID tags and receives the unique identification data transmitted by them. The

reader then sends this data to a microcontroller or computer for further processing. RFID readers operate at different frequencies such as low frequency (125 kHz), high frequency (13.56 MHz), and ultra-high frequency, depending on the application.

RFID TAGS:

RFID tags are small electronic devices used to store and transmit data wirelessly using radio frequency signals. Each RFID tag consists of a microchip and an antenna, where the microchip stores a unique identification number and the antenna enables communication with an RFID reader. When the tag comes within the range of an RFID reader, it receives radio waves and transmits its stored information back to the reader without requiring physical contact. RFID tags are available in different types such as passive, active, and semi-passive, and they operate at various frequency ranges depending on the application.



Arduino UNO

Arduino UNO is an open-source microcontroller development board based on the ATmega328P microcontroller. It is widely used for learning, prototyping, and developing embedded systems and IoT projects.The Arduino UNO has 14 digital input/output pins, out of which 6 pins can be used as PWM outputs, and 6 analog input pins. It operates at 5V and can be powered using a USB cable or an external power supply.

LCD:

An LCD 162 is a type of electronic gadget that displays data and messages. It has 16 columns and2 rows, allowing for a total of 32 characters (16 2 = 32) to be displayed, with each character consisting of 5 8 (40) pixel dots. As a result, the total pixels in this LCD are 32 x 40, otherwise1280 pixels.

Buzzer:
A buzzer is an electronic device that converts electrical signals into audible sound, typically used for alerts or notifications. It works by rapidly vibrating an internal component, such as a piezoelectric disc or a metal diaphragm, to create sound waves. There are two main types based on their driving requirements: active buzzers, which have a built-in oscillator and sound immediately when connected to DC power, and passive buzzers, which require an external oscillating signal to produce different tones. Physically, they are small, polarized components with positive and negative pins.

Regulated power supply:
In an embedded circuit, a regulated power supply turns unregulated AC (Alternating Current) into a steady DC. It transforms AC power into DC with the help of a rectifier. Its purpose is to provide a constant voltage (or, less frequently, current) to a circuit or device that must operate within particular power supply parameters. The regulated power supply's output can be alternating or unidirectional, but it's almost usually DC (Direct Current).

Software Requirements:
Arduino IDE:
Arduino IDE (Integrated Development Environment) is a software platform used to write, compile, and upload programs to Arduino boards such as Arduino Uno, Nano, and Mega. It provides a simple and user-friendly interface where programs, called sketches, are written using C/C++ based language. The Arduino IDE includes features like a code editor, compiler, serial monitor for debugging, and a library manager to easily add hardware-specific libraries for sensors, motors, RFID, and IoT modules. It supports Windows, macOS, and Linux operating systems and is widely used in embedded systems, electronics projects, IoT applications

Embedded C:
Embedded C is a microcontroller-based programming language that is an extension of the C language. I/O Hardware Addressing, fixed-point arithmetic operations, accessing address spaces, and other features

distinguish the Embedded C language from traditional C programming. Embedded C is a programming language that is used in the development of Embedded Systems. Embedded Systems are specialized systems designed to perform very specific functions or tasks. Embedded System is the combination of hardware and software and the software is generally known as firmware which is embedded into the system hardware. Embedded C is used to program a wide range of microcontrollers and microprocessors. Embedded C requires less number of resources to execute in comparison with high -level languages such as assembly programming language.. The devices like air conditioners, printers, and mobile phones that we use in our daily lives are programmed by embedded C.

V.RESULT AND DISCUSSION:

The RFID Based Attendance System was successfully designed, simulated, and tested using Arduino Uno, RFID reader, RTC module, and LCD display in the Arduino IDE and Proteus Design Suite. The system accurately detected RFID cards, verified unique identification codes, and recorded attendance along with the correct date and time provided by the RTC module. The LCD display effectively showed user information and attendance status in real time.

The system demonstrated fast response time, reliable data logging, and minimal errors during operation. Attendance records were automatically generated without the need for manual input, significantly reducing human errors and paperwork. The simulation results confirmed that the system operates efficiently and consistently, making it suitable for real-world attendance management applications.

VI.CONCLUSION:

The RFID Based Attendance System provides an efficient, accurate, and automated solution to traditional attendance management methods. By integrating RFID technology with Arduino and realtime clock functionality, the system ensures secure identification and precise time-stamped attendance recording. The project successfully minimizes manual effort, reduces data manipulation errors, and enables real-time monitoring of attendance.

Due to its simplicity, low cost, and scalability, the system can be effectively implemented in educational institutions, offices, and organizations. Future enhancements may include database integration, wireless data transmission, biometric authentication, or web-based monitoring to further improve functionality and security. Overall, the project demonstrates a practical and reliable approach to modern attendance management systems.

REFERENCES:

1. A. Raj, A. Raj and I. Ahmad, "Smart Attendance Monitoring System with Computer Vision Using IOT," in Journal of Mobile Multimedia, vol. 17, no. 1-3, pp. 115-126, January 2021, doi: 10.13052/jmm1550-4646.17135.
2. S. M. Anzar, N. P. Subheesh, A. Panthakkan, S. Malayil and H. A. Ahmad, "Random Interval Attendance Management System (RIAMS): A Novel Multimodal Approach for Post-COVID Virtual Learning," in IEEE Access, vol. 9, pp. 91001-91016, 2021, doi: 10.1109/ACCESS.2021.3092260.
3. H. -D. Thai, Y. -S. Seo and J. -H. Huh, "Enhanced Efficiency in SMEs Attendance Monitoring: Low Cost Artificial Intelligence Facial Recognition Mobile Application," in IEEE Access, vol. 12, pp. 184257-184274, 2024, doi: 10.1109/ACCESS.2024.3504858.
4. Q. Miao, F. Xiao, H. Huang, L. Sun and R. Wang, "Smart attendance system based on frequency distribution algorithm with passive RFID tags," in Tsinghua Science and Technology, vol. 25, no. 2, pp. 217-226, April 2020, doi: 10.26599/TST.2018.9010141.
5. L. Zheng et al., "A New Mutual Authentication Protocol in Mobile RFID for Smart Campus," in IEEE Access, vol. 6, pp. 60996-61005, 2018, doi: 10.1109/ACCESS.2018.2875973.

6. C. S. Álvarez-Merino, E. J. Khatib, A. T. Muñoz and R. B. Moreno, "Integrating Indoor Localization Technologies for Enhanced Smart Education: Challenges, Innovations, and Applications," in IEEE Access, vol. 13, pp. 105317-105333, 2025, doi: 10.1109/ACCESS.2025.3578718.
7. V. Erdélyi et al., "Detecting Subtle Signs of School Attendance Issues Using Smartphone-Based Sensing," in IEEE Access, vol. 13, pp. 4652-4669, 2025, doi: 10.1109/ACCESS.2024.3523108.
8. F. Troncoso-Espinosa, G. Latorre-Núñez, C. Valenzuela-Núñez and J. San MartínDurán, "Preventing Health Risks Through Intelligent Medical Appointment Management Using Disease and Attendance Propensity," in IEEE Access, vol. 12, pp. 180747-180766, 2024, doi: 10.1109/ACCESS.2024.3508454.
9. H. Yang and X. Han, "Retracted: Face Recognition Attendance System Based on Real-Time Video Processing," in IEEE Access, vol. 8, pp. 159143-159150, 2020, doi: 10.1109/ACCESS.2020.3007205.
10. D. Alghazzawi et al., "Dynamic Aggregation Operators for Optimal Biometric-Based Attendance Device Selection Under Complex Fermatean Fuzzy Environment," in IEEE Access, vol. 12, pp. 75396-75411, 2024, doi: 10.1109/ACCESS.2024.3396351