
Smart Attendance System Using RFID Technology to Monitor and Record Attendance in Real-Time

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Abstract

The advancement of automation technology has demanded a more efficient and dependable solution. This research presents the design and implementation of a Smart Attendance System using Radio Frequency Identification (RFID) technology. This system records attendance and enhances operational efficiency by enabling automated access control, restricting unauthorized entry, and triggering customized alerts for absenteeism or late arrivals. Each individual has an RFID tag and uses it to mark attendance in the system. The moment the reader detects the tag, the time and date get recorded automatically with present or absent, leaving scope for proxy attendance. The conventional Attendance System involves much manual work and paperwork, which is very time-consuming and error-prone due to human factors. Real-time monitoring and tracking of attendance in this system make it more convenient for the administrator to maintain and analyze attendance. The attendance records are maintained on the database and ready to present reports and individual performances. This paper presents the RFID-based technique, and its interface using microcontrollers such as NodeMCU, and discusses various advantages of this intelligent solution. The Smart Attendance System acts as a modern solution to an age-old problem of organizational management. It saves manual effort, improves accuracy, and provides ease to the end users.

Keywords: *RFID, Smart Attendance System, Automation, Arduino, Microcontroller, Real-time Monitoring, Database*

I. INTRODUCTION

The Smart Attendance System employs the use of RFID tags, a microcontroller such as the NodeMCU, and an appropriate database system to automate attendance. Each person is tagged with an RFID encoding device which captures attendance data as they enter or exit a region defined by borders. An RFID reader interprets the encoded tags and sends the information to automatically adjust attendance data in the system. The system increases efficiency by improving accuracy in attendance tracking, easing the burden on administrators, and fully automating the entire process of attendance management.

In addition, the system can be upgraded to include real-time notifications for when students are absent and automatic report generation, which lessens the need to have people control the system and guarantees that relevant attendance information is captured on time and

accurately. This paper designs, applies, and gains the advantages of the Smart Attendance System demonstrating the capability for better results than the previous methods of attendance.

II. LITERATURE REVIEW

Information Technology (IT) has played a significant role in developing several aspects in academic sectors and domains such as student monitoring and management systems [1]. Therefore, it is a critical subject to tracking and manages student's attendance in school, college, and university environment. Since it can be helped to urge students to attend on time, amend the efficiency of the learning, increase learning grade, and finally boosting and improving the education level [2].

In the digital era, technologies have been developed and emerged recently, and that could change the future of sciences to affect people everyday life such as Wireless Sensor Networks (WSNs) [3]. Biometrics techniques are used to verify identification through their characteristics like face recognition, signatures, fingerprint, voice recognition, irises, barcode, Bluetooth, Near-Field Communication (NFC), RFID and so on [4].

Identification, tracking, and counting are different applications for these technologies based attendance systems. RFID is an automation technology used to identifying and positioning an object [5].

Diverse studies have been conducted to propose students attendance system to manage, record, and track the presenting of the students in an academic sector. These systems used several technologies that are ranging from Quick Response (QR) code, Ethernet and Wi-Fi interfaces to RFID with Liquid Crystal Display (LCD), or General Packet Radio Service (GPRS). Related works proposed and developed student system attendance such as, in 2012, Patel et al. proposed student attendance system based on RFID technology to compact lightweight and inexpensive used to record students' attendance and displayed on the screen and integrated good system [6].

In addition to, student's attendance system with RFID designed by Kurniali et al., 2014 that collected web-based with RFID readings and the main findings of the proposed system was to reduce or eliminate the manual labor requirements. As well as, the system provided faster processes, less inventory, fewer efforts, and better quality via providing direct cost savings while it caused some technical issues and slow system deployment [7].

III. METHODOLOGY

Smart Attendance using RFID is designed to automate the attendance management of an educational institute or working professionals in the corporate world. The main components of the system are a Node MCU microcontroller, an RFID reader, and RFID tags. This solution allows precise attendance logging in real time with reduced human interaction.

3.1 Proposed Model

The Smart Attendance System works by scanning RFID tags associated with each individual

(e.g. students or employees) as they pass an RFID reader. Once the tags are within range, the RFID reader detects the unique ID that is linked to the tag and passes this information to the NodeMCU microcontroller. The information is then processed by the microcontroller to save the attendance record in the database.

3.2 System Components

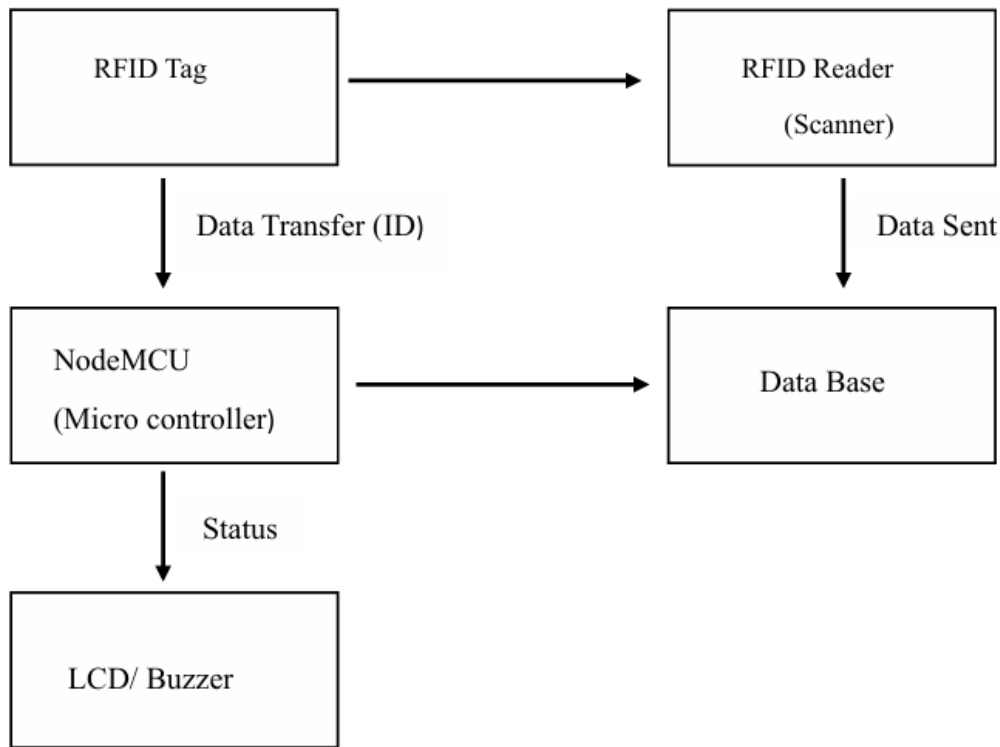


Figure1: Block diagram of the system

Hardware

According to the basic block diagram of the smart attendance system each and every device including a sensor and actuators connected to the Node MCU. RFID sensor is connected to the Node MCU. Additionally, we have to connect the power supply to the system. Finally, the output is shown in 16*2 LCD display.

- **Node MCU Microcontroller:** The main controller of the system, responsible for reading the RFID tag data and processing it.
- **RFID Reader:** Used to scan RFID tags. This module sends the unique ID from the tag to the Node MCU.
- **RFID Tags:** Unique identifiers assigned to each individual. These are passive tags that communicate with the RFID reader when in proximity.

- **LCD Display (16x2):** Provides real-time feedback to users by displaying the status of the attendance process (e.g., attendance recorded or error message).
- **Buzzer:** Provides audible confirmation when attendance is successfully logged or when an unauthorized tag is detected.
- **Jumper wires:** These are used to make connections between the components, ensuring that the system operates as intended without permanent soldering.
- **Power Supply:** Power supply is required to power the Node MCU, RFID reader, LCD, and other components.



Figure2: RFID Reader



Figure3: NodeMCU

Software

- **Arduino IDE:** Arduino IDE used to write, compile, and upload code to the NodeMCU microcontroller. Supports programming language C++ for microcontroller logic and RFID module integration.
- **Database:** For larger systems, attendance records are stored and managed in a centralized database, which can be accessed remotely.



Figure4: Database of the system

The Smart Attendance System utilizing RFID technology automates the attendance marking process, minimizing the need for manual input and enhancing accuracy.



SCANNING YOUR ID
CHECKING IN

SCANNING YOUR ID
CHECKING OUT

When an RFID tag is placed near the RFID reader, the system reads the unique tag ID and displays “CHECKING IN” as displayed in Figure 8 or “CHECKING OUT” as displayed in Figure 9 on the LCD. A short beep from the buzzer serves as feedback, indicating that the attendance has been successfully logged. If an invalid tag is scanned, the system displays an error message, and the buzzer emits a beep to alert the user of the incorrect scan.



According to Figure 10, it demonstrates the total number of students at the moment with the live status in the system database. The system was tested with various RFID tags, and the NodeMCU accurately captured the tag information, transmitted it over Wi-Fi, and displayed the results on the LCD screen.

SMART ATTENDANCE SYSTEM V1.1			
Attendance Summary			
		Search:	
User ID	Device Id	Time	Status
14331013213	device1	1/25/2025, 8:58:02 AM	Check In
139494503	device1	1/25/2025, 2:07:25 PM	Check In
139494503	device1	1/25/2025, 2:07:05 PM	Check Out
139494503	device1	1/25/2025, 3:08:00 PM	Check In
139494503	device1	1/25/2025, 2:08:01 PM	Check Out
139494503	device1	1/25/2025, 2:08:03 PM	Check In

Figure11: Interface of Website

Additionally, according to Figure 11, the data can be logged and transferred to an external cloud database for real-time tracking of attendance.

Overall, the Smart Attendance System employing RFID technology has proven to be an effective, reliable, and user-friendly solution for automating attendance tracking. It not only reduces the manual effort required but also ensures data accuracy, providing a seamless and efficient solution for various applications such as schools, colleges, and workplaces.

V. CONCLUSION

In conclusion, our systems' RFID reader scans the RFID tags assigned to individuals, and the data is displayed in real-time on an LCD screen, providing immediate feedback. The NodeMCU microcontroller processes the data and logs it efficiently, sending it to a centralized database for tracking and analysis. The buzzer serves as auditory feedback, and the system enhances the accuracy and integrity of attendance records by minimizing human errors. It is user-friendly, easy to deploy, and offers a seamless experience for users.

The technology utilized in this Smart Attendance System has significant potential for further development and application in various fields. For instance, by integrating GPS functionality with RFID, we can enable location-based attendance tracking, which would be particularly beneficial in large institutions or environments.

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