

## DESIGN AND DEVELOPMENT OF RFID-BASED ATTENDANCE SYSTEM

Shrushti Mashal <sup>1</sup>

Snehal Rathod <sup>2</sup>

Mahejabin Shaikh <sup>3</sup>

Ishwari Deshak <sup>4</sup>

Students, Department of Electronics and Telecommunication Engineering  
A.G. Patil Polytechnic Institute, Solapur, Maharashtra, India

Prof. Margur L. S.

Lecturer, Department of Electronics and Telecommunication Engineering  
A.G. Patil Polytechnic Institute, Solapur, Maharashtra, India

### Abstract

The RFID-Based Attendance System is designed to automate and simplify the process of recording attendance in educational institutions and workplaces. Traditional manual attendance systems are often time-consuming and prone to human errors or proxy marking. This project utilizes Radio Frequency Identification (RFID) technology to ensure accurate and efficient attendance management. Each individual is provided with a unique RFID tag that contains a distinct identification number. When the tag is brought near the RFID reader, the microcontroller verifies the data and marks the attendance automatically. The user's details and confirmation are displayed on a 16x2 LCD screen, while a buzzer provides feedback for successful or invalid scans. This automated approach minimizes human intervention, reduces administrative workload, and ensures reliable record-keeping for long-term data management.

### 1. Introduction

Attendance management plays an essential role in educational institutions, as it directly influences discipline, performance tracking, and overall classroom monitoring. Traditional methods such as manual roll calls or attendance registers are often time-consuming, prone to human error, and difficult to maintain over long periods.

With the increasing use of automation and digital technologies, modern systems now focus on improving accuracy, efficiency, and data accessibility. The RFID-based IoT attendance system offers a reliable and automated alternative to paper-based methods. Using RFID cards and a reader module, each student can record their presence with a simple scan, minimizing delays during class sessions.

The NodeMCU ESP8266 microcontroller facilitates wireless communication, enabling real-time synchronization of attendance data to a cloud dashboard where teachers can review, store, and analyze records conveniently.

The system integrates a 16x2 I2C LCD module that guides users during the scanning process by displaying instructions and confirming identities after each scan. Each RFID tag is assigned to a specific student, ensuring unique identification and secure logging of attendance.

Through Wi-Fi connectivity, the recorded data is transmitted to a web-based interface that visualizes weekly attendance patterns and provides options to manage student records. This project demonstrates how embedded systems, RFID technology, and IoT platforms can be combined to create

an accurate and user-friendly attendance solution. It enhances transparency, reduces manual workload, and makes attendance information accessible anytime for teachers and administrators.

## 2. Literature Review

The evolution of automated attendance systems has attracted significant research attention over the last two decades, primarily due to the increasing demand for accurate, efficient, and scalable student monitoring methods in educational institutions.

Early digital attendance systems relied heavily on barcode scanning and manual computer entry, which offered a slight improvement over traditional registers but still required physical contact and human involvement. The limitations of barcode-based systems, such as line-of-sight requirements, susceptibility to damage, and slow operational speed, encouraged researchers to explore alternative technologies.

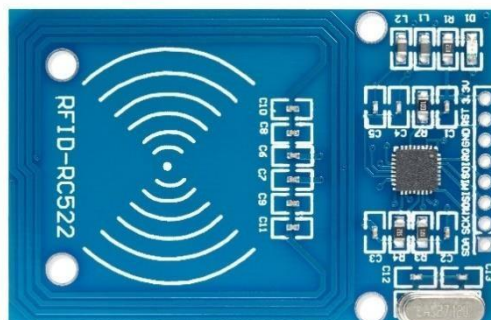
Radio Frequency Identification (RFID) became a promising approach because it supports contactless identification and can operate effectively without the need for direct alignment between the tag and the reader. Researchers demonstrated that RFID tags could store unique identification numbers and be read within milliseconds, making them suitable for real-time attendance monitoring.

Several studies highlighted the advantages of RFID in minimizing human error, reducing proxy attendance, and improving classroom efficiency. Academic projects and commercial implementations have shown that passive RFID tags are cost-effective, require no internal power source, and can be assigned easily to students for long-term use.

## 3. Technical Specifications

### RFID Module

An RFID (Radio Frequency Identification) module is a wireless communication device that utilizes electromagnetic fields to automatically identify and track electronic tags attached to objects. The reader emits a radio frequency signal that creates a magnetic field, which powers passive tags and enables them to transmit stored data back to the reader.



**Fig. 1: RFID Module**

### ESP8266 (NodeMCU)

The ESP8266 NodeMCU is an open-source, low-cost development board designed for IoT applications. It features an integrated ESP-12E Wi-Fi module and operates at 80–160 MHz. It includes built-in flash memory and supports communication protocols such as PWM, I2C, SPI, and UART.



**Fig. 2: ESP8266 (NodeMCU)**

### **Buzzer**

A buzzer is an audio signaling device that converts electrical energy into sound. It can be active or passive and is commonly used for alerts and user feedback in electronic systems.



**Fig. 3: Buzzer**

### **LCD 16x2 Display**

The 16x2 LCD module is widely used in embedded systems to display alphanumeric data. It is based on the HD44780 controller and can display 32 characters across two rows.



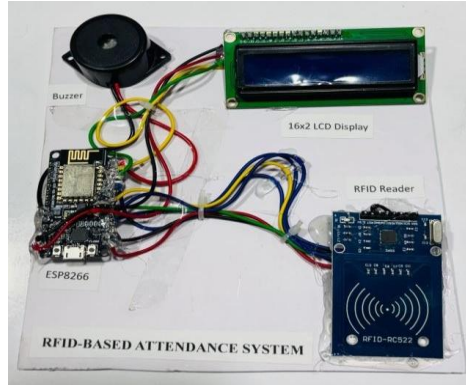
**Fig. 4: LCD 16x2 Display**

## **4. Electronics System and Wiring**

A detailed system analysis is essential to understand how the RFID-based IoT attendance system functions in a real environment. Traditional systems rely heavily on manual effort and lack real-time data access.

RFID technology is chosen due to its contactless operation, speed, and reliability. The MFRC522 RFID reader is selected for its low power consumption and compatibility.

The NodeMCU ESP8266 acts as the processing unit and communication interface, enabling Wi-Fi-based data transfer. It simplifies the design by eliminating the need for external memory modules and supports efficient power operation.



**Fig. 6: Electronics System and Wiring**



**Fig. 7: Arduino IDE Software**

**RFID Classroom Attendance**

Device: 192.168.137.177  
 Time: 21:37:02  
 Week: 2025-W48

-- Prev **This Week** Next -- | CSV Clear Week

Attendance (Mon-Sat)

Student	UID	Mon	Tue	Wed	Thu	Fri	Sat	Sun
Student 4	4C:5D:17:4A	A	A	A	A	23:59:45	00:03:14	Holiday
Unknown	66:FC:13:85	A	A	A	A	23:59:56	00:03:38	Holiday
Student 3	A2:34:F4:24	A	A	A	A	A	00:00:41	Holiday
Student 5	7E:99:F5:88	A	A	A	A	A	00:03:23	Holiday
Student 2	65:5A:F2:21	A	A	A	A	A	00:03:53	Holiday

Add / Update RFID Tag

UID e.g. 43.F5.D6.03    Student Name    **Save Tag**

**Fig. 8: Web Dashboard of RFID-Based Attendance System**

## 5. Software Tools

### Arduino IDE

The Arduino IDE is a simple software used to write and upload code to microcontroller boards. It uses a simplified C/C++ language and provides built-in libraries and examples, making it easy for beginners and developers to build electronic projects.

## **6. Conclusions**

The development of the RFID-based IoT attendance system demonstrates how embedded electronics and web technologies can automate attendance processes. The system provides fast and accurate attendance recording while reducing manual effort.

It enhances transparency by providing time-stamped records and enables efficient management through real-time dashboards. The system is reliable, scalable, and suitable for educational environments.

## **7. Future Scope**

- Integration of biometric verification (fingerprint or face recognition)
- Development of a mobile application for monitoring
- Cloud-based storage and analytics
- Automated attendance reports with visualization
- SMS or WhatsApp notifications for parents