International Organization of Research & Development (IORD)
ISSN: 2348-0831
Vol 13 Special Issue 02 | 2026

IoT Based Automated attendance management system using Node MCU with mobile app and E-mail Notification

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DOI: 10.5281/zenodo.19558508

ABSTRACT

The rapid development of the Internet of Things (IoT) has enabled the creation of smart systems that automate traditional manual processes in educational institutions and organizations. This research presents an IoT-based automated attendance management system using the NodeMCU ESP8266 microcontroller integrated with a mobile application and e-mail notification service. The proposed system aims to eliminate manual attendance recording, reduce human errors, and improve efficiency in monitoring student or employee presence.

In this system, identification technologies such as Radio Frequency Identification (RFID) are used to capture attendance data when users scan their identification cards. The NodeMCU module processes the scanned data and transmits it to a cloud database via Wi-Fi connectivity. A dedicated mobile application allows administrators, teachers, or managers to access real-time attendance records, monitor attendance statistics, and generate reports remotely. Additionally, automated e-mail notifications are sent to registered users or guardians to confirm attendance events, ensuring transparency and improved communication.

The system architecture integrates embedded hardware, cloud computing, and mobile technologies to create a reliable and scalable attendance solution. Experimental implementation demonstrates that the system reduces administrative workload, improves accuracy, and enables real-time data access from anywhere. The proposed IoT-based attendance management system offers a cost-effective and efficient alternative to conventional attendance methods and can be widely adopted in educational institutions, corporate offices, and other organizations requiring automated attendance tracking.

Keywords:- IoT, NodeMCU, RFID, Automated Attendance System, Mobile Application, Email Notification, Cloud Database

1. INTRODUCTION

Attendance management plays an important role in educational institutions and organizations for monitoring the presence of students or employees. Traditionally, attendance is recorded manually using registers or spreadsheets, which can lead to several problems such as human errors, proxy attendance, and time consumption. With the rapid development of Internet of Things (IoT) technologies, it has become possible to automate various processes and improve operational efficiency. IoT refers to a network of interconnected devices that communicate and exchange data through the internet. By integrating IoT with attendance systems, it becomes possible to automatically capture attendance data and store it in a centralized database. The use of microcontrollers such as NodeMCU with built-in Wi-Fi connectivity allows easy communication with cloud platforms.

This research focuses on the development of an automated attendance management system using NodeMCU, RFID technology, mobile application, and email notification services. The system automatically records attendance when a user scans their RFID card and stores the data in a cloud database. The information can be accessed through a mobile application, and an email notification is sent to confirm attendance.

The main objective of this research is to design a reliable, efficient, and cost-effective attendance monitoring system that reduces manual effort and provides real-time information access

1.1 Need for Automated Attendance System

Manual attendance systems are widely used in schools, colleges, and offices. However, these systems have several limitations such as time consumption, data manipulation, and lack of real-time monitoring. Automated

attendance systems using IoT technologies overcome these limitations by providing accurate and efficient attendance recording.

The automated system ensures that attendance is recorded instantly and stored securely in a cloud database. It also eliminates the possibility of proxy attendance by verifying the unique identification of each user. Additionally, administrators can access attendance records from anywhere through a mobile application.

1.2 Objectives of the Proposed System

The main objectives of the proposed system are:

- To develop an automated attendance system using NodeMCU and RFID technology
- To store attendance records in a cloud database
- To provide real-time monitoring through a mobile application
- To send automatic email notifications after attendance is recorded
- To reduce manual errors and improve attendance accuracy

2. SYSTEM ARCHITECTURE

The proposed IoT-based attendance system consists of both hardware and software components that work together to record attendance automatically and store it in a cloud platform.

The hardware part includes NodeMCU microcontroller, RFID reader module, RFID cards, and power supply. The NodeMCU acts as the main controller that processes data from the RFID reader and sends it to the cloud server through Wi-Fi.

The software part includes cloud database services, mobile application interface, and email notification system. When a user scans an RFID card, the data is transmitted to the cloud server where attendance information is stored and displayed on the mobile application.

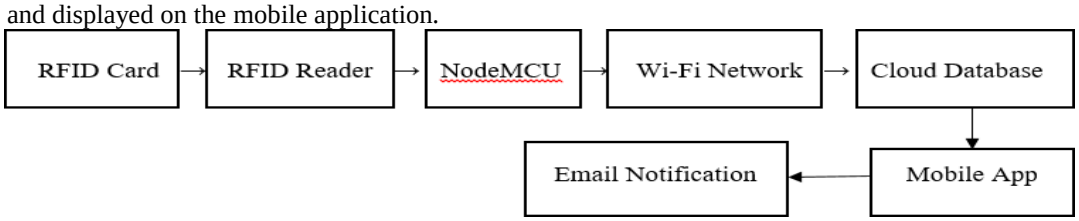

Fig-1: Block Diagram of IoT Based Attendance Syste

2.1 Hardware Components NodeMCU (ESP8266)

NodeMCU is an open-source IoT platform based on the ESP8266 Wi-Fi module. It acts as the central controller of the system and enables communication between hardware devices and the cloud server.

RFID Reader (RC522)

The RFID reader is used to read the unique identification number from RFID cards or tags. When a card is placed near the reader, the card ID is transmitted to the NodeMCU.

RFID Card

Each user is provided with a unique RFID card that contains a unique identification code used for attendance verification.

Power Supply

A stable power supply is required to operate the NodeMCU and RFID module.

Table-1: Hardware Components

Component	Function
NodeMCU	Main controller with Wi- Fi connectivity
RFID Card	Reads RFID card information
RFID Reader	Unique user identification
Power Supply	Provides electrical power

2.2 Software Components

- Arduino IDE for programming NodeMCU
- Cloud database (Firebase / Google Sheets)
- Mobile application for monitoring attendance
- Email notification service Features of software:
- Real-time data storage
- User authentication
- Attendance report generation
- Email notification alerts

3. WORKING OF THE PROPOSED SYSTEM

The working process of the proposed attendance system is simple and efficient. When a user places an RFID card near the RFID reader, the reader scans the card and sends the unique identification number to the NodeMCU microcontroller. The NodeMCU processes this data and connects to the internet using the built-in Wi-Fi module. The attendance data along with date and time is transmitted to a cloud server where it is stored in a database.

Once the attendance record is stored, the system automatically updates the mobile application interface so that administrators can view the attendance in real time. Additionally, an automatic email notification is sent to confirm that attendance has been recorded successfully.

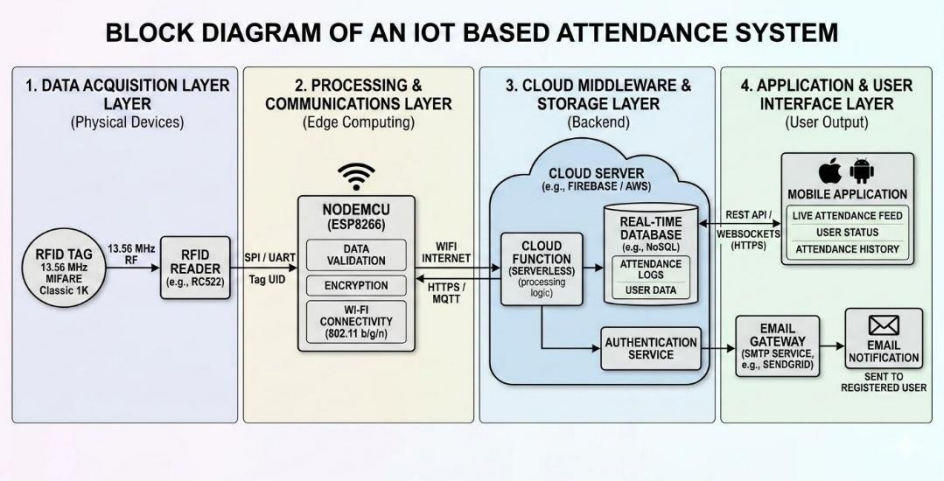

Chart-2: Attendance Data Flow

Advantages of the Proposed System

- Reduces manual work
- Prevents proxy attendance
- Provides real-time monitoring
- Secure cloud data storage
- Automatic email notifications
- Easy to implement and cost-effective

4. CONCLUSIONS

The IoT-based automated attendance management system using NodeMCU provides an efficient and reliable solution for attendance tracking. The integration of RFID technology with IoT enables automatic identification and recording of attendance without manual intervention. The use of cloud storage ensures secure and centralized data management, while the mobile application provides easy access to attendance records in real time.

The system also includes email notification functionality that informs users and administrators about attendance updates instantly. Compared to traditional manual attendance systems, the proposed system reduces time consumption, minimizes errors, and improves overall efficiency.

Future enhancements may include biometric authentication, facial recognition, and integration with advanced analytics tools for better attendance monitoring and management.

5. ACKNOWLEDGEMENT

The authors would like to express sincere gratitude to the faculty members and the Department of Electronics and Telecommunication Engineering for their continuous support and guidance during the development of this research work.

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