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RFID-Based Smart Attendance System with Real-Time Monitoring

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Abstract:

This paper presents the design and implementation of an RFID-based smart attendance system aimed at improving efficiency and accuracy in attendance management. Traditional attendance systems are time-consuming and prone to errors, whereas the proposed system automates the process using Radio Frequency Identification (RFID) technology. Each student is assigned an RFID card, which is scanned through an RFID reader connected to a microcontroller. The collected data is transmitted to a real-time database using IoT technology and displayed on a web-based dashboard. The system ensures faster processing, reduced manual effort, and real-time tracking of attendance. Experimental results show that the system is reliable, efficient, and suitable for educational institutions. The system minimizes manual effort, reduces errors, and ensures fast and reliable attendance tracking. Experimental results indicate that the proposed solution is efficient, scalable, and suitable for modern educational environments.

Keywords — **RFID, Smart Attendance System, IoT, Web Dashboard, Firebase, Automation**

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I. INTRODUCTION

Attendance management plays an important role in educational institutions, as it helps in tracking student participation and maintaining records. Traditional methods of taking attendance, such as manual marking, are time-consuming and prone to errors. In some cases, proxy attendance and data mismanagement can also occur, which reduces the reliability of the system.

With the advancement of technology, automated systems have been introduced to overcome these issues. Among them, RFID (Radio Frequency Identification) technology provides a fast, contactless, and efficient way to identify individuals. By integrating RFID with IoT, it becomes possible to record and store attendance data in real time.

This project presents an RFID-based smart attendance system that uses an RFID reader and ESP32 microcontroller to capture and process student data. The system also includes an LCD display for instant feedback and uses Wi-Fi connectivity to send data to a cloud database. A web-

based dashboard is used to monitor and manage attendance records.

The main objective of this system is to reduce manual effort, improve accuracy, and provide a reliable and efficient solution for attendance management in educational institutions.

II. LITERATURE REVIEW

Various attendance management systems have been developed using different technologies to improve accuracy and efficiency. Traditional manual methods are simple but suffer from issues such as time consumption, human errors, and proxy attendance. To overcome these limitations, biometric systems such as fingerprint and face recognition have been introduced, which provide higher accuracy but require costly hardware and regular maintenance.

RFID (Radio Frequency Identification) technology has emerged as an effective alternative due to its contactless operation and faster response time. RFID-based systems use tags and readers to identify individuals uniquely, making the attendance process more efficient and less time-consuming. Several studies have implemented RFID systems using microcontrollers like Arduino for basic attendance tracking.

With the advancement of IoT, modern attendance systems are integrated with cloud platforms to enable real-time data storage and remote monitoring. Microcontrollers such as ESP32 provide built-in Wi-Fi capabilities, allowing seamless communication with cloud databases like Firebase. These systems support real-time updates and centralized data management through web-based dashboards.

However, some existing systems lack user-friendly interfaces or real-time updates. The proposed system improves these aspects by combining RFID technology with IoT and a web-based dashboard to provide a simple, efficient, and reliable attendance management solution.

III. SYSTEM ARCHITECTURE AND METHODOLOGY

The proposed RFID-based smart attendance system follows an IoT-based architecture that integrates hardware and software components for efficient attendance management. The system mainly consists of an RFID reader, ESP32 microcontroller, LCD display, and a cloud database.

The RFID reader is used to scan the RFID card and capture the unique identification number. This data is then sent to the ESP32 microcontroller, which acts as the central processing unit of the system. The ESP32 processes the data and, using its built-in Wi-Fi capability, transmits it to the cloud database (Firebase).

The cloud database stores the attendance records, which can be accessed through a web-based dashboard. The LCD display provides instant feedback to the user by showing messages such as attendance status. This architecture ensures real-time data processing and easy accessibility of attendance information.

The methodology of the proposed system is based on automatic identification and real-time data processing. Initially, each student is assigned a unique RFID card. When the card is brought near the RFID reader, the system reads the card ID and sends it to the ESP32 microcontroller.

The ESP32 verifies the received ID and checks whether it matches the stored data. If the ID is valid, the attendance is marked and displayed on the LCD screen. At the same time, the data is transmitted to the cloud database using Wi-Fi.

The attendance data is stored in real time and can be viewed later through a web dashboard. This approach reduces manual effort, improves accuracy, and ensures efficient attendance management.

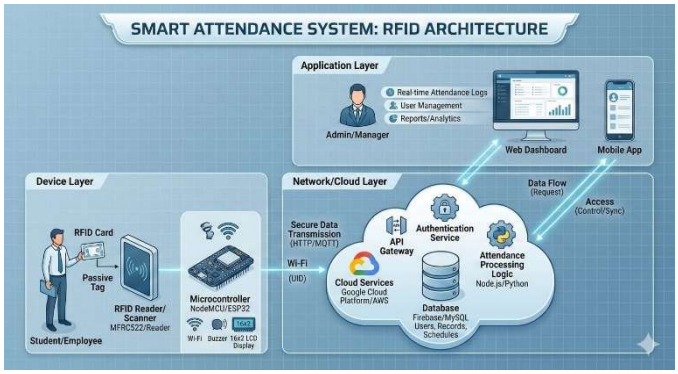

Fig 1. RFID Architecture

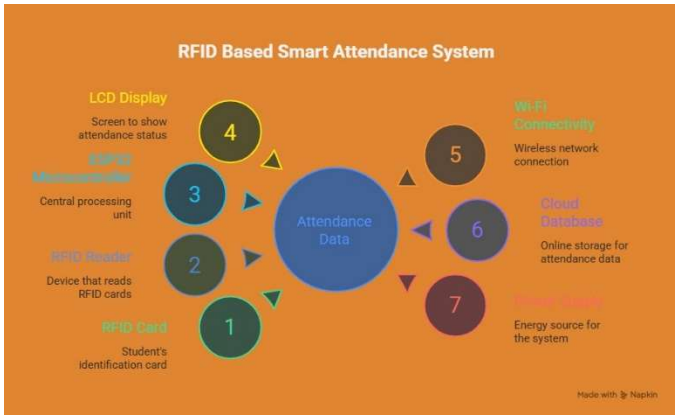

Fig 2. System Components.

IV.CONCLUSION

In this paper, an RFID-based smart attendance system has been designed and implemented to improve the efficiency and reliability of attendance management. The system uses RFID technology along with an ESP32 microcontroller to automatically record attendance, thereby reducing manual effort and minimizing errors. The inclusion of an LCD display provides instant feedback, while Wi-Fi connectivity enables real-time data transmission to a cloud database.

The integration of a web-based dashboard allows easy monitoring and management of attendance records from any location. The system demonstrates fast response time, accuracy, and ease of use, making it suitable for practical deployment in educational institutions.

Overall, the proposed system offers a cost-effective and scalable solution for attendance management. It can handle large amounts of data efficiently and provides a user-friendly interface for both students and administrators.

In the future, the system can be further enhanced by integrating mobile application support, biometric authentication, and data analytics features to improve security and provide deeper insights into attendance patterns.

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