

# A Review Paper on Smart Student Attendance System

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**Abstract:** The Smart Student Attendance System is an IoT-based solution designed to automate and enhance attendance tracking in educational institutions. Utilizing RFID-based authentication, each student is assigned a unique RFID tag linked to their name and roll number. The system integrates NodeMCU (ESP8266/ESP32) for seamless real-time data transmission to a cloud-based database, ensuring secure and efficient attendance storage, including Name, Roll Number, Date, and Time. An LCD display provides instant feedback by showing student details upon scanning, while the automated attendance marking eliminates manual processes, reducing errors and improving accuracy. This system enhances convenience, security, and data accessibility, making attendance management more efficient and reliable.

**Keywords:** RFID, Smart Attendance, Cloud Storage.

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## I. INTRODUCTION

In educational institutions, attendance tracking is a crucial task for monitoring student participation and ensuring academic discipline. However, traditional methods such as manual roll calls or paper-based registers are inefficient, time-consuming, and prone to errors. To overcome these challenges, an IoT-based Smart Student Attendance System is developed, integrating RFID technology, NodeMCU (ESP8266/ESP32), and cloud-based storage. This system automates attendance marking by allowing students to scan their unique RFID tags, which are linked to their name and roll number. The data is then transmitted to a cloud server in real time, enabling remote access for teachers and administrators. Additionally, an LCD display provides instant feedback by showing student details upon successful authentication. This automated approach enhances accuracy, security, and efficiency, reducing the administrative burden on faculty.

### ➤ RFID Technology

Radio Frequency Identification (RFID) is a wireless technology that uses radio waves to identify and track objects equipped with RFID tags. These tags contain an embedded microchip that stores data, which can be read by an RFID reader without direct contact. In the Smart Student Attendance System, each student is assigned a unique RFID tag, which, when scanned, transmits the student's details to

the NodeMCU-based system. The collected data is then processed and stored in the cloud for real-time access. RFID technology ensures fast, contactless authentication, eliminating the risk of proxy attendance and improving the overall reliability of attendance management. Its integration with IoT further enhances data accessibility, security, and automation, making it an ideal solution for modern educational institutions.

### ➤ Objective

- To Eliminate manual attendance-taking by using RFID technology for fast and accurate student identification.
- To Store attendance records (Name, Roll Number, Date, Time) securely on a cloud-based platform, reducing errors and discrepancies.
- To Utilize NodeMCU (ESP8266/ESP32) to send attendance data instantly to the cloud for remote access by teachers and administrators.
- To Display student details, including name, roll number, and attendance status, on an LCD screen upon RFID scanning.

### ➤ Problem Statement

Traditional attendance systems in educational institutions rely on manual roll calls or paper-based registers, leading to inefficiencies such as time consumption, human

errors, proxy attendance, and data loss. These conventional methods lack real-time monitoring, making it difficult for administrators to track student attendance remotely. Additionally, maintaining and retrieving attendance records over time becomes cumbersome. The Smart Student Attendance System addresses these issues by integrating RFID-based authentication, IoT-enabled real-time data transfer using NodeMCU, and cloud-based attendance storage. This system not only automates the attendance process but also enhances accuracy, security, and accessibility, allowing teachers and administrators to manage student attendance efficiently and generate insightful reports for academic analysis.

## II. LITERATURE REVIEW

According to the research P. Gopal Krishna et al. (2023) has expressed that the developed an IoT-based attendance detection system using RFID and IR sensor technology to address the inefficiencies of traditional attendance tracking methods. Their findings indicate that integrating RFID technology allows for automated, contactless student identification, significantly reducing manual errors and the possibility of proxy attendance. The system updates a real-time cloud database when a student scans their RFID card, ensuring instant data accessibility for administrators and parents. Additionally, the inclusion of IR sensors provides an extra layer of validation by counting the number of students physically present in the classroom and detecting discrepancies between RFID scans and actual attendance. The research highlights the system's ability to improve accuracy, efficiency, and security, while also allowing for future enhancements such as biometric authentication and facial recognition to further optimize attendance monitoring. [1]

The investigation reveals Srushti Gaikwad et al. (2024) has asserted that developed a Smart Attendance System using RFID, aimed at addressing inefficiencies in traditional attendance management methods. Their research highlights the automation of attendance tracking using RFID technology integrated with a relational database management system (RDBMS) for real-time data storage. The system enables seamless and secure identification of students through RFID tags, significantly reducing human errors, security breaches, and time consumption associated with manual attendance. By leveraging NodeMCU (ESP8266) for data transmission and cloud storage, the system enhances accuracy, security, and accessibility of attendance records. The implementation of this prototype demonstrated high efficiency, affordability, and portability, making it a viable solution for both academic and commercial environments. The study concludes that the proposed RFID-based system is a scalable and effective alternative to conventional attendance methods, with potential future enhancements such as biometric authentication and advanced data analytics. [2].

As indicated by the survey Dr. A. Meenakshi, Ms. K. Leelarani, Ms. S. Shopika, and Mr. M. Rajasekaran, has claimed that The research presents an Intelligent Sensor-Based Automatic Attendance Management System

Using IoT, which effectively integrates face recognition and temperature monitoring for contactless attendance tracking. The system uses an ESP32 Camera to capture facial images for recognition, and an MLX90614 IR Temperature Sensor to measure body temperature, ensuring safety compliance during health crises like COVID-19. The study concludes that the proposed IoT-based smart thermometer with attendance monitoring provides a reliable, efficient, and scalable solution for organizations looking to implement intelligent, automated attendance tracking with real-time health monitoring capabilities. [3]

The result of the review Ms. G.T. Bharathy, Ms. S. Bhavanisankari, and T. Tamilselvi has confirmed that Smart Attendance Monitoring System using IoT and RFID, designed to automate attendance tracking with higher accuracy, security, and efficiency. The system replaces traditional paper-based and biometric methods by integrating RFID technology with IoT, ensuring real-time monitoring, cloud-based data storage, and instant SMS notifications to parents via a GSM module. A GPS module further enhances security by tracking students' live locations, preventing attendance fraud. Compared to manual registers and biometric scanners, this system is faster, more reliable, and less prone to environmental errors. The Google Cloud database allows easy access and retrieval of attendance records, making it scalable for schools, colleges, and workplaces. Unlike biometric-based systems, RFID offers seamless automation without requiring physical contact, thus improving efficiency and hygiene. The study concludes that IoT-driven RFID attendance systems provide a secure, cost-effective, and tamper-proof solution for institutions. Future enhancements could integrate facial recognition with RFID to further eliminate proxy attendance and enhance security. [4]

From the collected information Prof. Ch. Ganapathy Reddy, Sunkari Bala Harini, Abbinenei Pranathi, Perumalla Serene, and Vancha Vidhisha has mentioned that IoT-Based RFID Attendance System, designed to automate attendance tracking in educational institutions and workplaces while minimizing errors and administrative workload. The system utilizes RFID technology and IoT sensors to automatically record attendance, eliminating the need for manual tracking. Data collected from RFID tags is processed using machine learning algorithms, allowing for insights into attendance patterns and improving management efficiency. The ESP32 microcontroller integrates with an EM-18 RFID reader module to process student or employee identification, displaying real-time attendance status on an LCD screen while transmitting data to the cloud. The system significantly reduces manual effort, enhances real-time monitoring, and offers scalability for both small and large organizations. Contactless RFID-based tracking also improves hygiene and security compared to traditional biometric or manual systems. Although occasional misreads due to RFID interference remain a limitation, future improvements could incorporate error detection mechanisms to enhance accuracy. Ultimately, this study demonstrates that IoT-powered RFID attendance systems provide a cost-effective, efficient, and reliable solution for attendance management across various domains. [5]

Based on the study Hicham El Mrabet and Abdelaziz Ait Moussa has noted that IoT-based School Attendance System Using RFID Technology, designed to streamline attendance tracking in educational institutions while minimizing disruption to learning. The system integrates RFID and IoT to automate attendance recording, ensuring real-time data transmission to school administrators and parents via email or SMS notifications. Additionally, absent students automatically receive missed lessons, reducing the negative impact of absenteeism. The study demonstrates that implementing IoT-driven attendance systems can enhance school performance, improve student discipline, and strengthen communication between schools and families. The findings highlight that RFID-based attendance is a cost-effective, scalable, and efficient alternative to manual attendance methods, making it a promising solution for modernizing school administration. [6]

From the information Kashif Ishaq and Samra Bibi has reported that systematic literature review on IoT-Based Smart Attendance Systems Using RFID, analyzing 21 major research studies on the integration of RFID and IoT for automated attendance tracking. The study highlights the advantages of real-time attendance monitoring, automation, and enhanced accuracy, addressing the inefficiencies of manual attendance systems, such as time consumption, proxy attendance, and data loss. The review emphasizes that IoT-based RFID attendance systems streamline administrative processes, improve student engagement, and enhance security by automatically registering attendance through RFID card scanning. Additionally, integrating Google Sheets and cloud storage ensures easy access and management of attendance records, while machine learning techniques further refine attendance pattern analysis. The findings suggest that smart attendance systems significantly reduce absenteeism and administrative workload, making them a cost-effective, scalable, and secure alternative to traditional methods. The study concludes that adopting RFID-based IoT attendance solutions enhances institutional efficiency and student performance, with future research focusing on error detection mechanisms and advanced analytics for further optimization. [7]

Insights from the data indicate Rajarshi Samaddar, Aikyam Ghosh, Sounak Dey Sarkar, Mainak Das, and Avijit Chakrabarty has confirmed that IoT & Cloud-based Smart Attendance Management System using RFID, designed to enhance accuracy, efficiency, and reliability in attendance tracking. The system integrates RFID technology with IoT, AWS cloud computing, and Python Django, eliminating the limitations of traditional attendance methods. The hardware component includes an RFID module and Arduino Uno R3, capturing attendance data, while the software component, hosted on AWS, processes and stores data, enabling real-time tracking and reporting accessible via web or mobile applications. The study demonstrates that this system is more accurate and efficient than conventional methods, providing a cost-effective, automated, and scalable solution suitable for educational institutions and workplaces. The findings suggest that cloud integration ensures seamless data management, while potential future enhancements, such

as facial recognition and machine learning for absenteeism prediction, could further optimize attendance monitoring. [8]

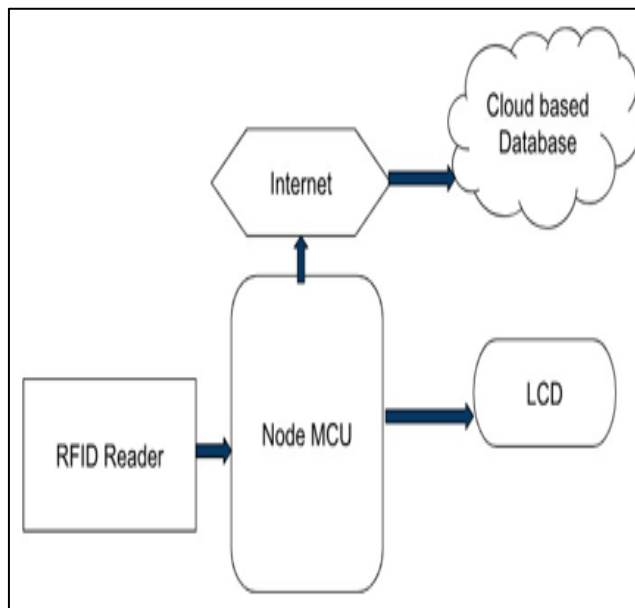
Finding from the assessment Om D. Bhamare, Aditya D. Bhalerao, Dhaval S. Chorwadkar, Dr. Ravindra G. Dabhade, and Dr. Dnyaneshwar D. Ahire present a Cloud-Based Smart Attendance System Using RFID and Facial Recognition, designed to enhance accuracy, security, and automation in attendance tracking. The system integrates RFID for quick identification and facial recognition for identity verification, ensuring a dual-layer authentication process that prevents fraudulent attendance marking. By leveraging Google Firebase for real-time cloud storage, the system allows instant access to attendance records, reducing manual effort and improving efficiency. Comparative analysis with traditional methods demonstrates higher accuracy (98%) and improved proxy prevention compared to manual and biometric-based systems. The study concludes that integrating RFID with facial recognition and cloud computing provides a reliable, scalable, and secure attendance management solution for educational institutions and workplaces, with potential applications in access control and time-tracking systems. [9]

Indicated by the survey Ganesh Prasad B R "IoT based Class Attendance Monitoring System using RFID and GSM "2021 has claimed that IEEE International Conference on Mobile Networks and Wireless Communications (ICMNWC) worked recording student attendance quicker and effortless compared to the conventional method using the IoT technologies. The authors developed a smart attendance system considering the RFID component hardware, which is integrated with the Arduino software for data transmission and storage. Students are registered to the smart attendance system through the unique RFID card attached with the student ID card. RFID reader records the student's attendance for login and logout time and time-lapse. Through the web-based Graphical User Interface (GUI), the administrator and access provided person can generate a report at anytime and anywhere within the network. The proposed system is tested for two different RFID tags and RFID cards and succeeded in recognizing the registered cards. [10]

### III. PROPOSED METHODOLOGY

The research methodology for the Smart Student Attendance System follows a structured approach, starting with requirement analysis to identify the limitations of traditional attendance systems. The system is designed using RFID-based authentication, where each student is assigned a unique RFID tag linked to their identity. The hardware components, including RFID reader, NodeMCU (ESP8266/ESP32), and LCD display, are integrated to ensure seamless data processing. The attendance data (Name, Roll Number, Date, and Time) is transmitted to a cloud-based storage system in real time, enabling remote access. The system is developed using IoT and embedded programming, ensuring efficient communication between hardware and cloud services.



*A. Block Diagram*

Block Diagram 1: Attendance System

*B. Description*

The **Smart Student Attendance System** is designed using **NodeMCU (ESP8266/ESP32)** as the central microcontroller, which processes input data and manages communication between hardware components and the cloud. The system operates as follows:

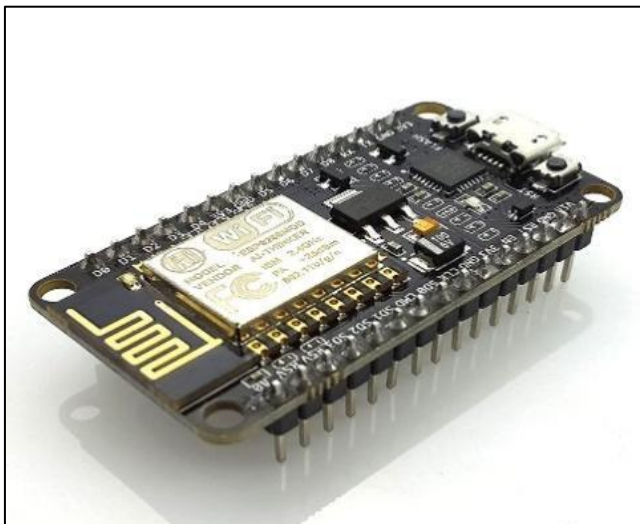


Fig 1: NodeMCU ESP8266

*C. Input Device – RFID Reader:*

- The RFID reader acts as the primary input device, scanning RFID tags assigned to students.
- When a student scans their tag, the reader extracts the unique identification number (UID) and sends it to the NodeMCU for processing.



Fig 2: RFID Cards

*D. Processing Unit – NodeMCU (ESP8266/ESP32):*

- The **NodeMCU microcontroller** processes the data received from the **RFID reader** and matches it with stored student information (Name & Roll Number).
- It then forwards the attendance details (**Name, Roll Number, Date, Time**) to the **cloud database** via an **internet connection**.

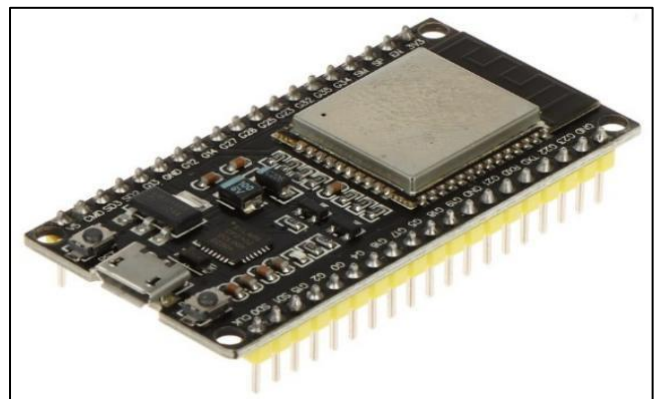


Fig 3: NodeMCU ESP32

*E. Output Device – LCD Display:*

- Upon successful authentication, the **LCD display** provides real-time feedback by showing the **student's name, roll number, and attendance status**.

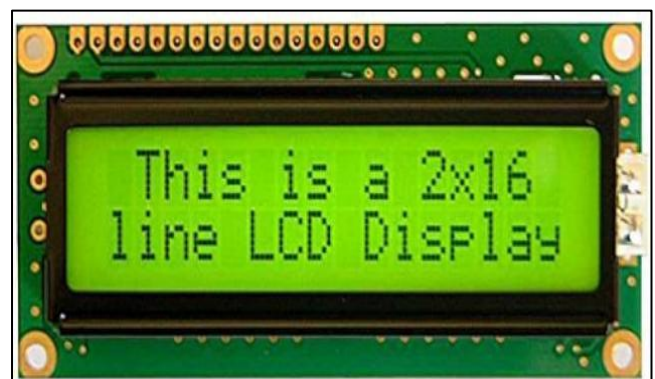


Fig 4: LCD Display

#### F. Cloud Storage – Internet Connectivity:

- The attendance data is transmitted to a cloud-based database.



Fig 5: Google Cloud

### IV. SYSTEM REQUIREMENT

#### A. Hardware Requirement

- Node MCU
- RFID Reader
- LCD

#### B. Software Requirement

- Arduino IDE
- Tinker cad

### V. CONCLUSIONS

The Smart Student Attendance System presents an efficient, automated, and real-time solution to overcome the limitations of traditional attendance tracking methods. By integrating RFID-based authentication with IoT and cloud computing, the system ensures accurate, secure, and seamless attendance management. The use of NodeMCU (ESP8266/ESP32), RFID readers, and LCD displays enables automated data collection and instant transmission to a cloud-based storage system, allowing remote access and real-time monitoring. Compared to conventional systems, this approach reduces manual effort, minimizes errors, and eliminates proxy attendance, making it a cost-effective and scalable solution for educational institutions. The system's efficiency, accuracy, and security highlight its potential for widespread adoption, with future enhancements such as facial recognition and AI-based analytics further improving attendance tracking and student monitoring.

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