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# Smart student attendance system

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**ABSTRACT :**

Manually tracking student attendance is challenging and prone to errors. This project aims to develop an automated, intelligent attendance system that accurately records and manages student presence in a school environment. This automated student attendance system utilizes microcontrollers and RFID readers to identify students via unique ID cards. Leveraging Wi-Fi for network-dependent communication with a student database and a GSM module for sending attendance updates to parents, the system aims to significantly reduce the manual workload for educators and administrators. This approach integrates popular IoT and RFID technologies for efficient attendance management. The provided text discusses a smart attendance monitoring system designed for smart classrooms. This system aims to lower dropout rates by using connected devices and RFID technology. Instead of traditional, potentially slow and inaccurate attendance methods, this system uses the (IoT) to automatically record student attendance when they are physically present. This attendance information is then sent to the administrative staff. The project specifically outlines an IoT-based RFID Attendance System that uses different types of sensors to gather data that identifies students or employees.

**Keywords**- RFID, Smart Attendance, Cloud storage Microcontroller , RFID card

## INTRODUCTION

Attendance is a very crucial aspect for any organization. In many organizations, as well as colleges and schools, attendance is still managed using paper. This paper-based method has a high possibility of errors. However, by using technology, this problem can be overcome, and the need for paper can be eliminated. Several technologies can be used to address this, but RFID is considered one of the best. As its name implies, RFID uses radio waves to identify and track objects or individuals. The communication in RFID is wireless, utilizing electromagnetic and electrostatic coupling

through radio frequencies. An RFID system consists of an RFID tag (or card) and an RFID reader. Each tag (or card) contains a unique identification number that is first stored in a database before being assigned to a user. To record their attendance, the user needs to bring their tag within a specific range of the RFID reader.This RFID-based attendance system is designed with ease of use in mind, particularly for commercial use, and it incorporates a storage system for each student's individual identification number. By utilizing RFID tags, educational institutions like schools and colleges can efficiently track student attendance. The system automatically records attendance data in a Google Sheet and can also inform parents about attendance events through SMS messages. If parents actively use these SMS notifications, it can discourage students from trying to exploit the SMS feature to skip classes. Current attendance systems often suffer from issues such as In

efficiency, the likelihood of human errors, and the need for continuous monitoring. This project aims to develop a more effective and automated attendance management system by integrating both hardware and software components. The primary hardware components involved are the ESP32 microcontroller, the EM-18 reader module for scanning RFID tags.

## RFID TECHNOLOGY

RFID, or Radio Frequency Identification, is a way to wirelessly identify and keep track of things that have special RFID tags attached. These tags have a tiny computer chip inside that holds information. RFID readers can get this information using radio waves without needing to touch the tag. In the Smart Student Attendance System, every student gets their own unique RFID tag. When this tag is scanned, it sends the student's information to the system that's controlled by the NodeMCU. This information is then handled and saved online (in the cloud) so it can be accessed at any time. RFID technology allows for quick and touch-free identification, which stops students from marking attendance for their friends and makes the whole attendance process more dependable. Combining RFID with the Internet of Things (IoT) makes the data even easier to get to, more secure, and more automatic, making it a great solution for today's schools and colleges.

*OBJECTIVE*

- To get rid of taking attendance by hand by using RFID tech, which quickly and correctly identifies students.
- To keep attendance information (like name, roll number, date, and time) safe on an online platform, which helps cut down on mistakes and differences in records.
- To use NodeMCU (either ESP8266 or ESP32) to immediately send attendance data to the internet so teachers and administrators can check it from anywhere.
- To show student information, such as their name, roll number, and whether they're present or absent, on a small screen right after their RFID tag is scanned.

## LITRATURE SURVEY:

The investigation reveals Srushti Gaikwad et al. (2024) This project developed and deployed an RFID-based attendance system featuring unique, rigorously tested RFID tags for individual identification, a robust software architecture with a user-friendly interface and secure database, and a streamlined attendance recording process. Real-time data capture and transmission were achieved through programmed microcontrollers and configured RFID readers. Comprehensive data management and analysis tools, including validation and pattern recognition algorithms, were integrated. Rigorous testing, including simulated scenarios and user feedback, ensured system reliability and usability. Following deployment in educational and organizational settings, thorough training was provided, and ongoing maintenance protocols were established to guarantee continuous performance and longevity.[1]

According to the research P. Gopal Krishna et al. This project introduces an IoT-based automated attendance monitoring system (AMS) designed to streamline attendance using RFID and other hardware components. The system's primary objectives are to autonomously record student attendance, eliminating manual processes, and to monitor instructor punctuality. Furthermore, it incorporates a notification feature to alert students regarding attendance discrepancies. The developed AMS demonstrates cost-effectiveness, time efficiency, and a notable feature of electricity-free operation.[2]

As indicated by the survey Dr. A. Meenakshi, Ms. K. Leelarani, Ms. S. Shopika, and Mr. M. Rajasekaran, has claimed that two distinct IoT-driven attendance systems were investigated. One case study detailed a system implemented at the University of Port Harcourt, employing fingerprint sensors for student authentication during both registration and class attendance, with data transmission via a Wi-Fi-enabled ESP32 microcontroller to a web-based storage platform and information display on a OLED . Separately, a proposed "Smart Attendance System" integrates RFID technology, embedding tags within student ID cards and installing receivers in classrooms for automatic attendance recording. [3]

In a report Jinto TJ, Sudip Chakraborty published in November 2023 , researchers gave the first comprehensive characterization of the performance and dynamic of Smart Student Attendance System this system employs RFID technology for automated student attendance. When a student presents their card to the reader, the microcontroller verifies the card's data against its stored records. An OLED display then confirms the student's presence if the data matches, or denies it if it doesn't. Additionally, a connected state button allows for on-demand access to a student's attendance status. The project aims to enhance existing attendance systems by integrating robust data management and rapid processing capabilities, all while utilizing cost-effective technologies. [4]

The result of the review Ms. G.T. Bharathy, Ms. S. Bhavanisankari, and T. Tamilselvi has confirmed that Student absenteeism, or truancy, negatively impacts academic success. Traditional attendance methods are slow and unreliable. To address this, an IoT-based RFID attendance system is proposed. This solution leverages two cutting-edge technologies, the Internet of Things (IoT) and Radio-Frequency Identification (RFID), to automate and streamline attendance tracking.Our schools and universities have access to lots of cool technology, but we're still doing things the old-fashioned way. For example, teachers still take attendance by hand and type it into computers. This takes up a lot of their time. We could make things much easier by using technology like RFID (those little tags that automatically identify things). If we combine RFID with the internet of things (IoT), we can automate the attendance process. This means teachers wouldn't have to do it manually anymore. And to make it even better, we can store all the attendance data in the cloud. This allows us to access it from anywhere, at any time, making the whole system more efficient and flexible. [5]

The article details the research efforts of Narayanamma Institute of Technology and colleagues to design and install a Smart Student Attendance system, including their presentation at an international conference in November 2023 While information technology has significantly improved workplace efficiency, many organizations still struggle with outdated, paper-based attendance systems. These systems are slow and prone to errors. To address this, we propose an RFID-based attendance system. This system uses RFID sensors to automatically record attendance from student or employee ID cards, ensuring accurate and immediate data entry into a database. This real-time system promotes punctuality and provides instant attendance information for both individuals and administrators. By replacing manual processes with RFID technology, attendance tracking becomes faster, simpler, and more secure. [6]

Based on the study Hicham El Mrabet and Abdelaziz Ait Moussa has noted the modern education is evolving towards smart learning environments that foster active knowledge acquisition, independent learning, and intrinsic motivation. These environments empower students to become active participants in the learning process, where both teachers and students collaborate to construct knowledge, thereby enhancing student confidence. Leveraging the Internet of Things (IoT), these smart environments integrate diverse physical devices like smartphones, smart cards, tablets, smart

boards, and digital textbooks, enabling seamless interaction between learners and educational resources, transcending the limitations of traditional classrooms. This approach provides students with access to a wealth of digital resources from any location. Essentially, smart learning integrates various technologies and methodologies into a cohesive system, built upon four fundamental pillars, to revolutionize educational practices. [7]

Insights from the data indicate Rajarshi Samaddar, Aikyam Ghosh, Sounak Dey Sarkar, Mainak Das, and Avijit Chakrabarty h a s c o n f i r m e d t h a t This project aims to develop a modern attendance tracking system. First, a thorough review of current attendance systems and their shortcomings will be performed, alongside an exploration of relevant IoT and cloud technologies to select the best tools. The system's will then be created, outlining both hardware and software. Hardware will consist of an RFID reader linked to an controller capturing attendance data. The software, built with Python will be deployed on cloud for data storage and processing. Finally, the system will be built and tested in a real-world setting, utilizing RFID tags or cards for attendance recording.[8]

Finding from the assessment Om D. Bhamare, Aditya D. Bhalerao, Dhaval S. Chorwadkar, Dr. Ravindra G. Dabhade, and Dr. Dnyaneshwar D. Ahire present Two attendance systems are described, both using student ID readings. The first system utilizes a reader connected to a microcontroller. When a student touches the reader, their ID is compared to stored IDs within the microcontroller. If a match is found, the student's name, ID, and attendance status are displayed on an OLED screen, and this data is subsequently transmitted to a PC via an Node MCU232/ Node MCU port. The second proposed system uses an RFID terminal to capture student IDs, along with the date and time, and stores this information directly into an online server database. However, both systems lack a method for verifying the student's identity, potentially leading to inaccurate attendance records due to proxy attendance. [9]

From the information Kashif Ishaq and Samra Bibi has reported that This attendance System, like manual sign-in, are time-consuming and prone to errors, risking the loss of crucial records. This creates significant challenges, especially for educators managing large classes, as collecting signatures distracts from teaching and maintaining student focus. Tracking attendance is vital for academic success, as absenteeism often leads to poor performance. To address these issues, this paper proposes utilizing RFID technology. RFID offers advantages over other identification methods, providing accurate data input for attendance software, reading information reliably within a defined range, and minimizing direct contact between tags and readers. This project aims to design and implement an efficient, well-structured attendance system using RFID, ultimately improving the monitoring of punctuality and effectively managing student and employee absences. [10]

Indicated by the survey Ganesh Prasad B R "IoT based Class Attendance Monitoring System using RFID and GSM "2021 Accurate attendance tracking during classes is crucial, but traditional manual methods are prone to errors like proxy attendance and make quick record retrieval difficult. To address this, technology-driven attendance monitoring systems are needed in classrooms to improve accuracy and facilitate efficient data analysis.[11]

The article details the research efforts Prof. (Dr) Ajay Talele,Rushikesh Joshi, Pratiksha Mandage that this paper proposes a new, IoT-based approach to tracking student attendance using RFID technology. Educational institutions are concerned about student absenteeism because it can negatively impact their academic performance. Traditional methods of taking attendance, such as calling names or using sign-in sheets, are time-consuming and inefficient. An RFID-based attendance system integrated with IoT offers a potential solution to this problem .The suggested research combines two popular technological trends: IoT and RFID. Despite the availability of various technologies, many educational systems still rely on conventional, manual attendance processes. In these systems, professors manually record attendance and then update the database with this information. To improve speed and accessibility, the proposed system intends to use cloud storage. This allows for access to attendance data anytime and from anywhere via IoT and the cloud, providing greater efficiency and flexibility.[12]

## METHODOLOGY

The way the Smart Student Attendance System was researched and built involved a well-organized process. It began by looking at the problems with old-fashioned attendance methods. The system itself uses RFID technology to identify students, giving each student a special RFID tag connected to their personal information. The physical parts of the system, like the RFID reader, NodeMCU (either ESP8266 or ESP32), and an LCD screen, were put together to make sure data is processed smoothly. When a student's tag is read, their attendance information (name, roll number, date, and time) is immediately sent to online storage, allowing access from anywhere. The system was created using IoT and embedded programming techniques, which ensure good communication between the physical components and the online services.
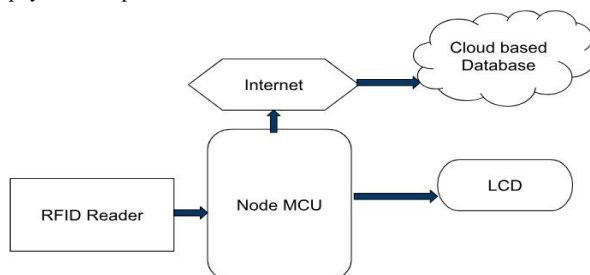


**Figure no : 1 Block diagram of attendance system**

## DESCRIPTION

The brain of the Smart Student Attendance System is the NodeMCU, which could be either an ESP8266 or an ESP32 chip. This microcontroller takes in information and controls how the different hardware parts of the system talk to each other and to the internet (the cloud).
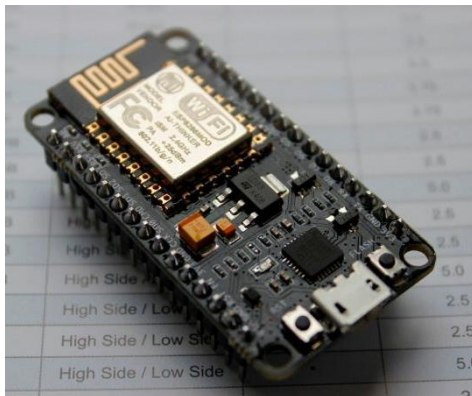


**Figure 2:- NodeMCU ESP8266**

*Input Device – RFID Reader:*

The RFID reader is the main way the system gets information. It scans the RFID tags that are given to each student. When a student swipes their tag the reader picks up the special ID number (UID) on the tag and sends it to the NodeMCU so it can be processed.
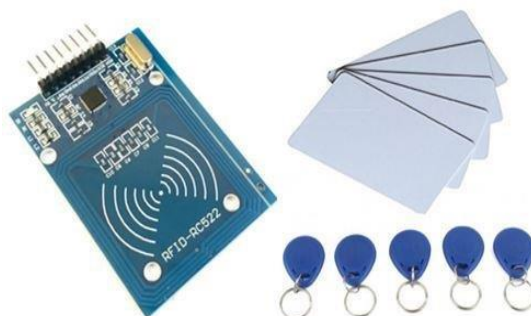


**Figure 3:- RFID Cards**

*Processin Unit - NodeMCU (ESP8266/ESP32):*

The NodeMCU chip takes the ID number it gets from the RFID reader and checks it against the student information it has stored (like their name and roll number) . After finding the match, it sends the attendance information – which includes the student's name, roll number, the date, and the time – to the online (cloud) database using the internet.



**Figure 4:- NodeMCU ESP32**

*Output Device – OLED Display:*

- OLED: Thin display, no backlight, bright colors, true black, low power. Used in phones, TVs, DIY projects.
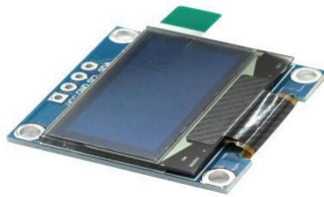


**Figure 5:- OLED Display**

**Jumper wires – conections :**

Jumper wires are short, insulated wires with connector pins, used for quick, solderless connections in electronics. They're vital for breadboarding and testing, offering flexibility and ease of use in prototyping



**Figure 6:- Jumper wires.**

**Cloud Storage – Internet Connectivity:**

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



**Figure 7:- Google Cloud**
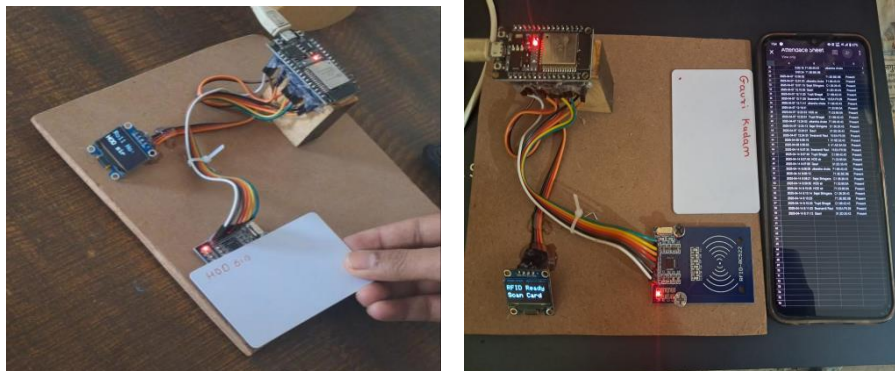


**Figure 8 :- Ckt of smart student attendence system**

**SYSTEM REQUIREMENT**

*HARDWARE REQUIREMENT*

1. Node MCU
2. RFID Reader
3. OLED

*SOFTWARE REQUIREMENT*

1. Arduino IDE
2. Tinker cad.

**RESULT**

The preceding explanation details the functionality and impact of smart student attendance systems. These systems move beyond traditional manual attendance-taking by leveraging technology for automation, data management. Key technologies like RFID, QR codes, GPS, and IoT are employed to streamline the process.

Essentially, these systems aim to:

- *Automate attendance:* reducing human error and saving time.
- *Digitize data:* enabling easy access and analysis.
- *Provide real-time information:* enhancing safety and communication.
- *Improve efficiency:* by integrating with mobile apps and web portals.



| 2025-04-07 12:23:33 | HOD sir | 71:33:95:0A | Present | 1 |
| 2025-04-07 12:23:51 | Trupti Bhagat | C1:68:42:43 | Present | 2 |
| 2025-04-07 12:24:02 | utkarsha chuke | F1:66:45:43 | Present | 3 |
| 2025-04-07 12:24:13 | Sejal Shingane | C1:36:26:43 | Present | 4 |
| 2025-04-07 12:24:21 | Gauri | 31:2D:35:43 | Present | 5 |
| 2025-04-07 12:24:30 | Swanandi Raut | 15:EA:F9:29 | Present | 6 |

**Figure 8:- Value stored in the cloud (attendance report)**

This results in benefits such as increased accuracy, enhanced efficiency, improved security, better data analysis, and enhanced communication with parents. However, there are also considerations like privacy concerns, implementation costs, and system reliability. In summary, smart student attendance systems offer a technologically advanced approach to managing student presence, with the potential to significantly improve school operations.

**VII .CONCLUSION**

The Smart Student Attendance Monitoring System marks a considerable improvement in how educational institutions handle attendance. By leveraging up-to-date technologies like RFID, this system guarantees precise, quick, and immediate tracking of student presence, cutting down on manual mistakes and the workload for administrators. The system strengthens the security and reliability of attendance information, offers better clarity, and reduces the chances of dishonest practices like students marking attendance for others. Furthermore, it gives both students and teachers easy access to attendance records, which can be helpful for monitoring academic development and spotting trends in how students are participating. Looking ahead, this kind of system could be linked with other school management functions, providing a more comprehensive understanding of student performance. The Smart Attendance System also paves the way for future advancements, such as live data analysis and automated reports, ultimately enhancing overall school or college administration. Nevertheless, it's crucial to tackle possible worries about privacy, data protection, and the expenses involved in setting up the system. As technology continues to advance and become more affordable, we can anticipate these systems becoming a common feature in educational settings, making attendance management more effective and convenient for students.

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