



IOT-Cloud Integrated Attendance System

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Abstract: Attendance monitoring is an essential requirement in educational institutions to maintain discipline and performance records. Traditional manual systems are error-prone, while biometric systems often involve higher costs and longer processing times. This paper proposes an IoT cloud-integrated automated attendance system for enhanced security and accuracy. Each student carries an RFID tag that is scanned by the RFID reader to mark attendance. To prevent proxy usage of RFID cards, the system incorporates a camera module that captures the image of the individual during scanning, enabling cross-verification. The attendance data is stored in a real-time cloud database, allowing instant access for report generation and analysis. The system also sends notifications to the parents of individual students regarding their attendance status and features a web interface to track attendance changes on a date-by-date basis. This solution reduces manual effort, improves reliability, enables real-time monitoring, and provides efficient, secure, and transparent attendance management suitable for schools, colleges, and other organizations.

Index Terms - IoT, Cloud-Integrated Attendance System, RFID, Real-Time Database, Notification Service, Web Interface.

I. INTRODUCTION

[1] Keeping track of attendance is an important task in schools, colleges, and other institutions. Traditional methods, like manual roll calls or paper registers, are slow, prone to mistakes, and difficult to manage, especially in large classrooms.

[2] With modern IoT (Internet of Things) and cloud technologies, it is possible to create smart, automated, and low-cost attendance systems. This project proposes an IoT cloud-integrated attendance system using RFID and camera-based biometric verification. Every student has an RFID tag that is scanned to mark attendance, and the camera module captures their image for biometric verification to prevent proxy attendance.

[3] The system saves all data in a real-time cloud database, allowing teachers and administrators to access and analyse attendance instantly. It also provides a simple notification service to inform parents about their child's attendance and includes a web interface to track attendance day by day.

[4] This approach is efficient, reliable, and easy to use, helping institutions maintain accurate attendance records while reducing manual work. By combining RFID, camera-based biometric verification, IoT, and cloud technologies, attendance management becomes secure, transparent, and smart.

II. PROPOSED SYSTEM

The proposed IoT cloud-integrated attendance system is designed to overcome the limitations of existing systems by combining RFID-based identification, camera-based biometric verification, real-time cloud storage, notifications, and a web interface. The system is efficient, reliable, and secure for monitoring attendance in educational institutions.

2.1 Hardware Components:

2.1.1. RFID Reader and Tags

- Purpose: Reads unique ID from each student's RFID tag to identify them.
- Function: When a student scans their tag, the reader captures the unique code and sends it to the microcontroller.
- Example Hardware: MFRC522 RFID Reader, 13.56 MHz RFID Tags.



fig.1. RFID reader writer module

2.1.2. Camera Module

- Purpose: Captures the image of the student at the time of scanning for biometric verification.
- Function: The camera takes a snapshot, which is compared with stored images in the cloud database to prevent proxy attendance.
- Example Hardware: ESP32-CAM, OV2640 camera.
- Advantage: Acts as a biometric sensor without expensive hardware like fingerprint scanners.



fig.2.ESP 32 CAM module

2.1.3. NodeMCU (ESP8266)

- Purpose: Acts as the main processing unit to collect data from RFID and camera and send it to the cloud.
- Function: Reads RFID data, triggers camera capture, and communicates with the cloud server using Wi-Fi.
- Advantage: Low power, supports IoT protocols, easy integration with sensors.



fig.3.NodeMCU ESP8266

2.1.4. IoT Cloud Platform

- Purpose: Stores attendance data in real-time and enables web interface access.
- Function: Receives data from the microcontroller, maintains database, and allows retrieval for reports..
- Advantage: Remote access, real-time monitoring, scalable storage.

2.1.5. Notification Module

- Purpose: Sends simple notifications to parents regarding student attendance.
- Function: Uses cloud messaging or email APIs to notify parents when a student marks attendance.
- Advantage: Keeps parents informed and increases accountability.

2.1.6. Web Interface / Dashboard

- Purpose: Allows teachers and administrators to view date-wise attendance records.
- Function: Retrieves data from the cloud database and presents it in tables and charts.
- Advantage: Easy monitoring, report generation, and analysis.

III. SYSTEM ARCHITECTURE

The proposed attendance system uses RFID technology combined with a microcontroller and a camera to automate and secure attendance tracking. Each student or employee is assigned a unique RFID card or tag, which is read by an RC522 RFID reader. The reader sends the card information to an ESP32-CAM or NodeMCU microcontroller, which acts as the system's central controller. The microcontroller verifies the card against a database stored on Firebase. If the card is recognized, the ESP32-CAM captures a photo of the individual, records the attendance along with the timestamp in the cloud database, and turns on a green LED to indicate successful registration. If the card is invalid or unregistered, a red LED signals an error

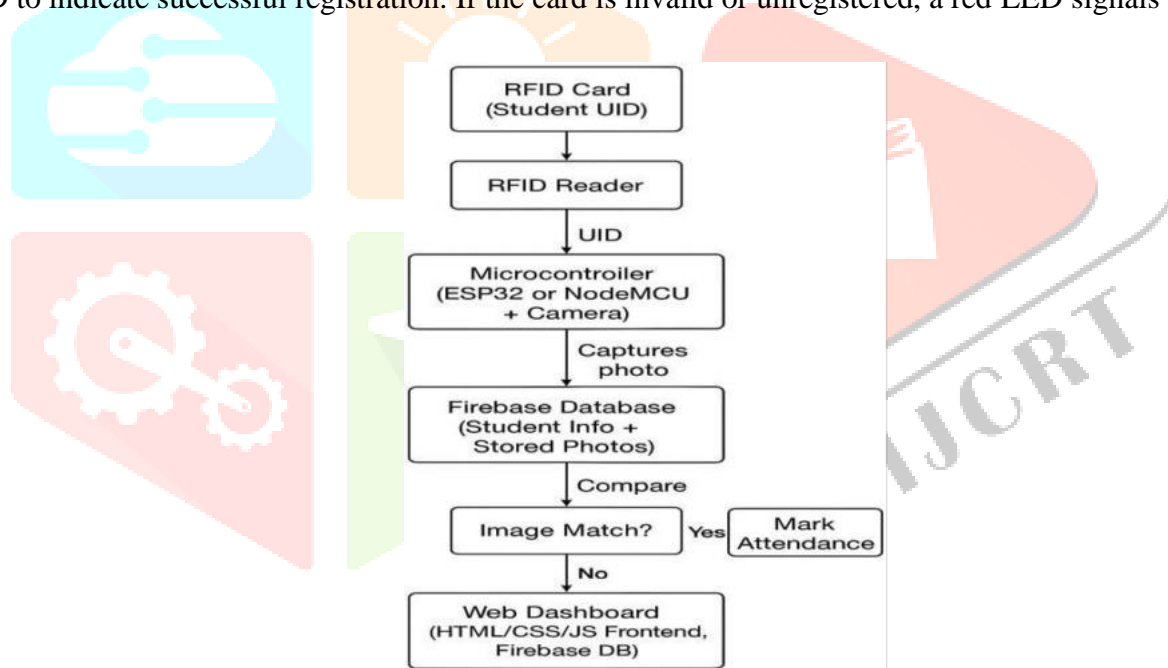


fig.4.flow chart of system

IV.EXPERIMENTAL RESULTS

The RFID-based attendance system was thoroughly tested in real-time conditions to assess its performance in terms of accuracy, speed, and reliability. Each student was provided with a unique RFID card, and the system was operated continuously for several days. The RC522 RFID reader consistently recognized card swipes in less than a second. When a valid card was scanned, the ESP32-CAM instantly captured the student's photo, updated the attendance record on the Firebase cloud, and activated a green LED to confirm successful entry. In contrast, unregistered or invalid cards triggered a red LED signal and were recorded as errors in the system. Additionally, email alerts were promptly sent to parents and staff within seconds of each attendance event. Throughout testing, the system achieved perfect accuracy in identifying registered users, and the camera module functioned smoothly without any noticeable delay.

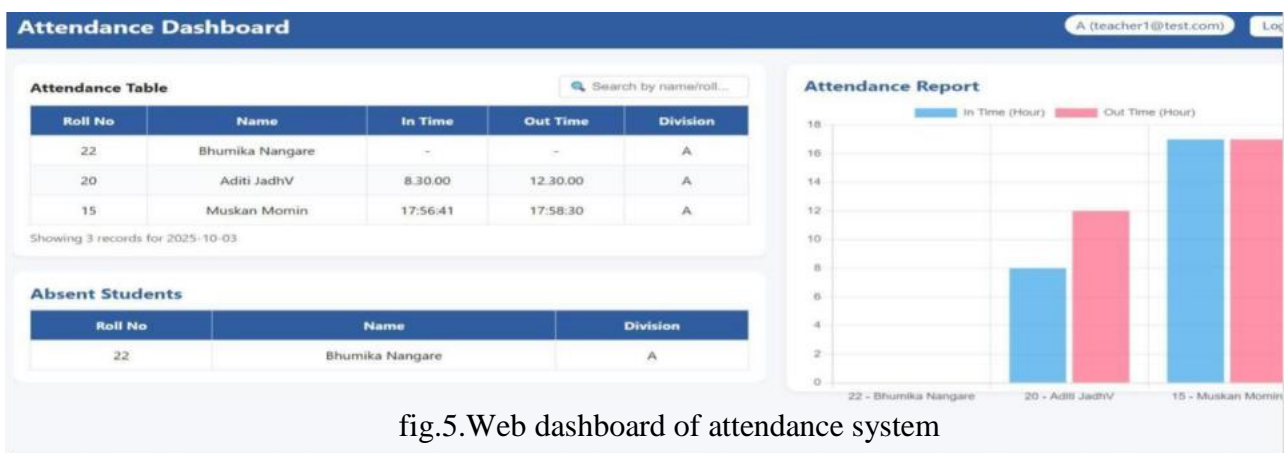


fig.5.Web dashboard of attendance system

V. CONCLUSION

The RFID-based attendance system integrated with a camera module and cloud notifications provides an efficient, reliable, and real-time method for tracking student attendance. The system eliminates manual errors, saves time, and ensures accuracy by automatically verifying entries through RFID cards and photographic evidence. The inclusion of email notifications to parents adds an extra layer of communication and transparency. Overall, this project demonstrates the practical application of IoT and cloud technologies in educational settings, offering a scalable solution that can be adapted for larger institutions and other attendance-critical environments.

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VII. REFERENCES

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