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AUTOMATED ATTENDANCE AND STUDENT MONITORING USING FACIAL RECOGNITION

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ABSTRACT

Automated Attendance and Student Monitoring Using Facial Recognition is an advanced IoT-based attendance automation system designed to improve security, reliability, and transparency in educational institutions. The proposed framework integrates geofencing mechanisms with GPS tracking, AI-powered facial recognition, RF wireless communication, and real-time SMS notifications to verify student presence efficiently. The system utilizes a smart camera-based monitoring unit that captures student facial images and transmits authentication results to the receiver unit. The receiver validates whether the student is located within the predefined institutional geofence and performs facial verification using a stored database. Upon successful verification, attendance is automatically uploaded to a cloud platform through ESP8266-enabled internet connectivity. Faculty members can access attendance records remotely through a live dashboard, while GSM modules provide instant SMS notifications to parents. The proposed system eliminates the dependency on outdated RFID tags and enhances attendance reliability through contactless biometric authentication.

KEYWORDS: Automated Attendance and Student Monitoring Using Facial Recognition, IoT-based attendance system, Geofencing, GPS tracking, AI-based facial recognition authentication, RF communication, ESP8266, GSM SMS alerts, Student monitoring.

INTRODUCTION

Recent progress in embedded technologies, wireless communication, and location-aware systems enables the development of advanced tracking and monitoring solutions. Technologies such as the Global Positioning System (GPS), Radio Frequency Identification (facial recognition), and geofencing play an essential role in applications related to

transportation, logistics, and automated monitoring frameworks. Early GPS-based vehicle tracking and control systems enhance monitoring efficiency, however they lack features such as real-time data analytics and automated decision-making capabilities [1].

Similarly, GPS-based object tracking approaches primarily focus on improving positional accuracy while offering limited system intelligence and automation [2]. The introduction of geofencing technology enables automatic actions based on predefined virtual geographic boundaries, reducing manual intervention and improving operational efficiency in fleet and freight management systems [3].

Further advancements extend the use of geofencing to urban-scale monitoring, where sensor-based activity recognition techniques demonstrate effectiveness in managing large-area crowd environments [4]. Additionally, the integration of geographic information systems supports service-oriented applications by leveraging spatial data to enhance analysis accuracy and decision-making processes [5].

METHOD AND MATERIALS

The system captures real-time student presence using an AI-enabled camera module and processes facial data for identity verification. The receiver validates the student location using geofencing and performs facial recognition authentication before recording attendance. Attendance data is uploaded to a cloud platform through Wi-Fi, while SMS alerts are sent to parents using GSM communication.

Materials used:

- **Microcontroller:** ESP8266 development board.
- **GPS Module:** GPS positioning module.
- **Facial Recognition System**: facial recognition tags and facial recognition reader.
- **RFID System:** RFID tags and RFID reader.
- **RF Communication:** RF transmitter and receiver.
- **Wi-Fi Module:** ESP8266 Wi-Fi module.
- **GSM Module:** GSM communication module.
- **Power Supply:** Regulated DC power supply unit.
- **Accessories:** Antennas and connecting cables.
- **Software Tools:** Arduino IDE, embedded C/C++.

METHODOLOGY

The proposed system consists of two primary sections: the Camera Monitoring Unit and the Receiver Unit. The camera monitoring unit employs an ESP8266 microcontroller interfaced with a smart camera module to capture and process student facial images in real time. Location information obtained using the GPS module is transmitted wirelessly to the receiver unit through RF communication. A regulated power supply ensures stable operation of all components. The monitoring unit continuously detects student presence within the predefined geofenced area while maintaining reliable facial recognition performance.

The receiver unit functions as the central control module of the system. It receives location data through an RF receiver and processes facial authentication results using an ESP8266 microcontroller interfaced with the camera module, GPS module, and LCD display. When a recognized student face is detected within the authorized geofenced region, attendance is automatically recorded and uploaded to the cloud database. The GSM module sends instant SMS notifications to parents, while the Wi-Fi module synchronizes attendance records with the web-based dashboard. This IoT-enabled architecture ensures real-time, secure, and transparent attendance monitoring with minimal human intervention.

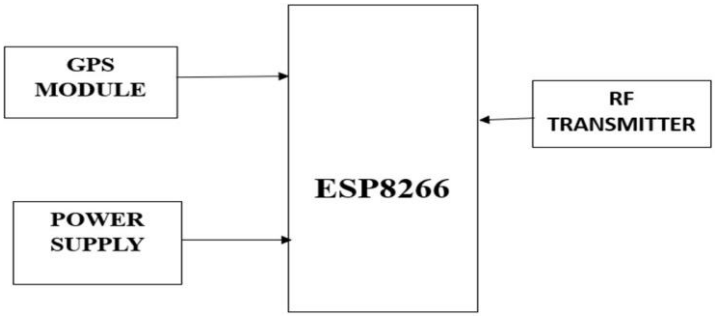

Figure 1 Block diagram of transmitter.

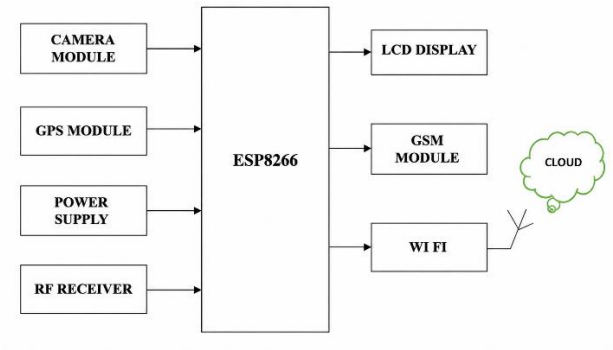

Figure 2 Block Diagram of Receiver.

Table 1. Hardware Requirements.

Sr. No.	Component	Specification
1	Microcontroller	ESP8266 Microcontroller Unit
2	GPS Module	GPS Positioning Module
3	AI Vision System	Smart Camera Module and Facial Database
4	RF Communication	RF Transmitter and Receiver
5	Power Supply	Regulated DC Source
6	Wi-Fi Module	ESP8266 Wi-Fi Module
7	GSM Module	GSM Communication Module
8	Accessories	Antennas and Connecting Cables

RESULT AND DISCUSSION

The proposed system is successfully implemented and evaluated using AI-based facial recognition integrated with a cloud-enabled attendance management platform. The monitoring and receiver modules operate reliably, ensuring accurate acquisition of student facial data and GPS coordinates using wireless communication. The receiver unit effectively validates geofence conditions and authenticates students through facial recognition before recording attendance.

The web-based dashboard results confirm real-time synchronization between the hardware unit and cloud server. The login interface ensures secure access for administrators, while the student management module displays facial recognition-linked student records with date-wise attendance logs. The system supports dynamic timetable configuration allowing administrators to modify attendance periods without hardware intervention.

Day-wise and monthly attendance summaries clearly differentiate present and absent students with automated percentage calculations. The monthly reports visually present attendance statistics, enabling quick analysis of student participation. SMS notifications are triggered instantly for attendance events, ensuring transparency and parental awareness.

Overall, the experimental results demonstrate that the proposed system provides accurate, automated, and tamper-resistant attendance monitoring. The integration of IoT, geofencing, and cloud technologies significantly reduces manual effort, prevents unauthorized attendance marking, and enhances operational efficiency, making the system suitable for real-world academic deployment.

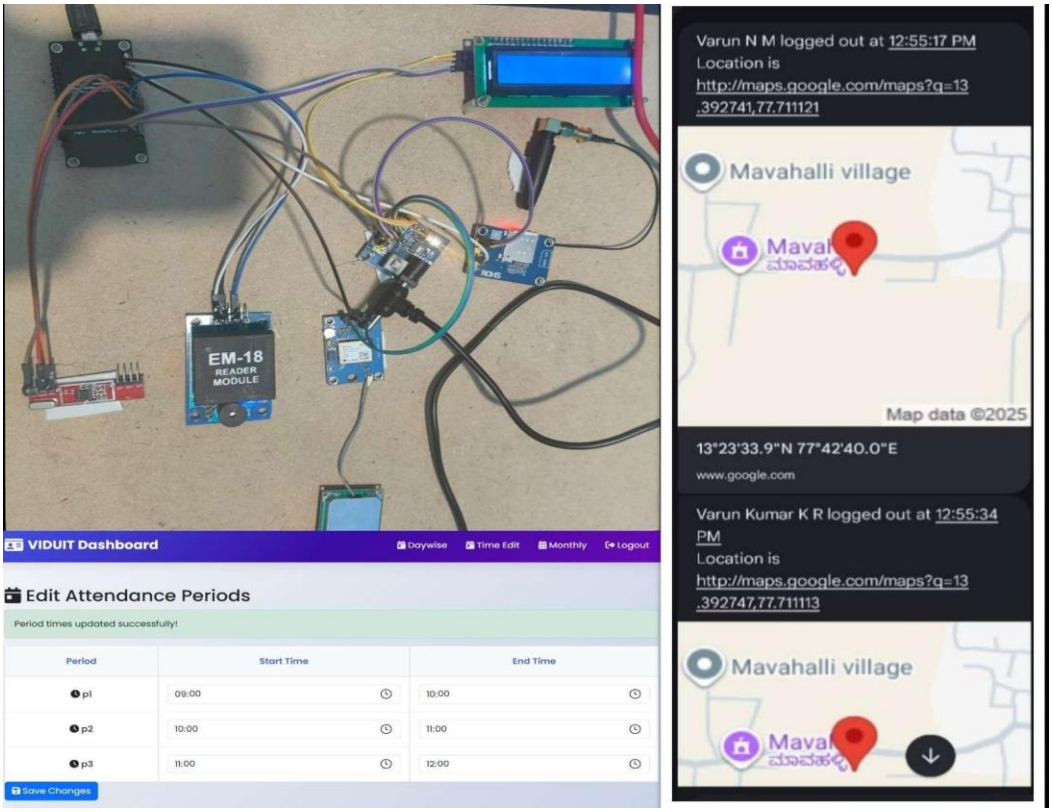

Figure 3. Result of proposed methodology.

CONCLUSION

The cloud-enabled geofencing attendance system provides a reliable IoT-based solution for automating attendance processes in educational institutions. The framework integrates ESP8266 microcontrollers with GPS tracking, AI-powered facial recognition, GSM communication, and cloud synchronization to achieve secure and location-authenticated attendance logging. Attendance is recorded only when a student's face is successfully recognized within the predefined geofenced region, thereby improving accuracy and reducing fake attendance attempts.

The proposed system significantly reduces manual workload and minimizes human errors associated with traditional attendance methods while ensuring secure data storage and transmission. Experimental evaluation demonstrates dependable facial recognition accuracy, real-time cloud updates, and reliable notification services. Overall, VIDFACE represents a scalable, intelligent, and secure attendance management framework that effectively combines geofencing, computer vision, and IoT technologies to support modern digital education environments.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest regarding the publication of this paper.

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