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Secure Biometric and RFID Based Student Attendance System using Andriod Application

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ABSRACT:

Attendance management is an essential task in educational institutions, but traditional methods such as manual registers and basic mobile attendance systems are time-consuming and prone to proxy attendance. To overcome these issues, this project proposes a Smart Student Attendance System integrated with Fingerprint and RFID authentication and uploading to cloud. In this system, each student is provided with a unique RFID card and their fingerprint data is enrolled into the system. During attendance, the student first scans the RFID card, and then verified identity through fingerprint recognition. Attendance is marked only when both RFID verification and fingerprint authentication are successfully validated, ensuring high security and eliminating proxy attendance. Hence, Attendance System fingerprint Authentication integrated with RFID Technology platform was developed. The Attendance System connected to a database that stored student information and attendance records. In addition, the user interface displayed the attendance records in an attractive approach and easy to manage by lecturers or system administrators. The web application (i.e. cloud) processes the fingerprint data and confirms the student's identity in real time.

Keywords: Attendance, IOT, RFID, Fingerprint Sensor.

I. INTRODUCTION

Attendance management is an important task in educational institutions to monitor student participation and academic discipline. Traditional attendance methods such as manual registers require significant time and effort from teachers and are prone to human errors. In addition, manual attendance systems allow proxy attendance, where one student marks attendance on behalf of another, reducing the reliability of attendance records.

With the rapid advancement of embedded systems, biometric technology, and mobile applications, automated attendance systems have become more efficient and secure. Technologies such as RFID (Radio Frequency Identification) and biometric fingerprint authentication provide accurate and reliable methods for identifying individuals.

This project proposes a Secure Biometric and RFID Based Student Attendance System using ESP32, EM-18 RFID module, R307 fingerprint sensor, and an Android application integrated with the GNR Techno server. The system verifies student identity through both RFID card scanning and fingerprint authentication, ensuring secure and accurate attendance recording.

II. PROBLEM STATEMENT

The project titled "Secure Biometric and RFID Based Student Attendance System using Android Application" was chosen to overcome the problems associated with traditional attendance systems used in educational institutions. In many colleges and schools, attendance is still recorded manually using paper registers. This process is time-consuming, requires significant effort from teachers, and may lead to errors in maintaining attendance records.

With the advancement of embedded systems and communication technologies, automated attendance systems have become more efficient and reliable. Technologies such as RFID and biometric authentication provide secure identification methods that help in preventing unauthorized attendance marking. RFID cards allow quick identification of students, while fingerprint recognition ensures that the person marking attendance is the authorized student.
Therefore, this project was selected to design a secure, automated, and reliable attendance management system that reduces manual work, improves accuracy, prevents proxy attendance, and provides efficient monitoring through an Android-based application.

III. LITERATURE SURVEY

S. No	Author / Year	System Used	Methodology	Limitations
1	A. Kumar et al., 2020	RFID-Based Attendance System	Students scan RFID cards to mark attendance	Allows proxy attendance if card is shared
2	S. Patel et al., 2021	Biometric Attendance System	Fingerprint authentication for attendance	No remote monitoring, slower processing
3	R. Sharma et al., 2022	IoT-Based Attendance System	Attendance uploaded to cloud using Wi-Fi	Security issues, depends on internet
4	M. Rao et al., 2023	Mobile App Attendance System	Android app used for manual attendance	Human errors, lacks authentication
5	Proposed System	RFID + Biometric + Arduino + Android	Dual authentication with real-time Android monitoring	Higher initial setup cost

IV. EXISTING METHOD

In the modern digital era, the use of Internet of Things (IoT) and mobile technologies has significantly improved many systems used in educational institutions. One such system is the student attendance management system. Traditionally, attendance in classrooms is recorded manually using paper sheets where students sign their names to indicate their presence. The Android-based attendance system is developed to replace the traditional paper-based method with a digital platform. In this system, attendance records are stored in a database connected to a server, and the information can be easily accessed and managed through the mobile application. This approach helps lecturers and administrators monitor attendance records efficiently.

V. PROPOSED METHOD

The proposed system aims to develop a secure and automated student attendance management system using biometric fingerprint authentication, RFID technology, ESP32 microcontroller, and an Android application. The system is designed to overcome the limitations of traditional attendance methods by providing a reliable and efficient way to record student attendance. The system uses both RFID and biometric fingerprint authentication, which provides double verification and prevents unauthorized access. The system records attendance quickly, saving valuable classroom time compared to manual methods. The interface provided through the LCD display and Android application makes the system easy to operate.

VI. SYSTEM ARCHITECTURE

The system architecture consists of of both hardware and software components working together to perform authentication and record attendance.

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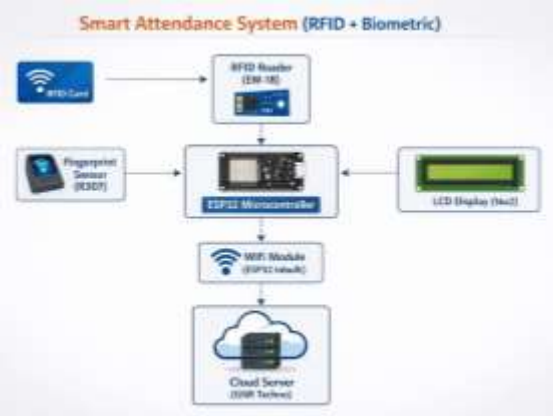

Fig 1: System Architecture

The ESP32 microcontroller acts as the main controller of the system. It receives input from the EM-18 RFID reader and R307 fingerprint sensor. When a student scans their RFID card, the system reads the unique RFID number and checks whether it matches the registered student data. After the RFID verification, the student is required to place their finger on the fingerprint sensor for biometric authentication.

If both RFID and fingerprint data match the stored records, the attendance is considered valid. The system then displays confirmation on the I2C LCD display and sends the attendance information to the web server through Wi-Fi. The data is stored in the database and can be viewed through the Android application (GNR Technology).

VII. SYSTEM ARCHITECTURE LAYER

☞ The system consists of three main units: Input Layer, Processing Unit, and Output/Application Layer.

☞ In the Input Layer, devices like RFID reader and fingerprint sensor capture student identity data.

☞ The Arduino microcontroller acts as the central processing unit, where all authentication logic is executed.

☞ The Arduino verifies both RFID and biometric inputs before approving attendance.

☞ The LCD display provides real-time feedback such as access granted or denied.

☞ A communication module (Bluetooth/Wi-Fi) transmits attendance data to the Android application.

☞ In the Application Layer, the Android app stores, manages, and displays attendance records.

☞ The system ensures secure, fast, and automated attendance tracking with real-time monitoring.

VII. WORKING METHOD

The methodology of the Secure Biometric and RFID Based Student Attendance System using Android Application describes the step-by-step process used to design, develop, and implement the system. The proposed system integrates RFID technology, biometric authentication, and wireless communication to ensure secure and accurate attendance management. Initially, the ESP32 microcontroller is used as the main controller of the system. It is responsible for controlling all hardware components such as the RFID reader, fingerprint sensor, LCD display, and push buttons.

The ESP32 also provides Wi-Fi connectivity to send attendance data to the web server. In the first step, each student is assigned a unique RFID card and their fingerprint is enrolled into the database using the enrollment function. The fingerprint IDs are stored in the sensor memory and linked with the student information. When the system is activated, the student first scans the RFID card using the EM-18 RFID reader. The system reads the unique RFID number and compares it with the registered RFID data stored in the program. After successful RFID verification, the student is asked to place their finger on the fingerprint sensor. The R307 fingerprint sensor captures the fingerprint image and compares it with the stored fingerprint templates in its memory. If both the RFID card and fingerprint match, the system confirms the student's identity.

The attendance is then recorded and displayed on the I2C LCD screen, indicating successful authentication. The ESP32 then uses its Wi-Fi capability to send the attendance data to the web server (GNR Technologies).

The data is stored in the server database and can be accessed through the Android application, allowing administrators to monitor attendance records in real time. If either the RFID card or fingerprint does not match, the

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system displays an invalid authentication message and the attendance is not recorded.

VIII. FLOW CHART

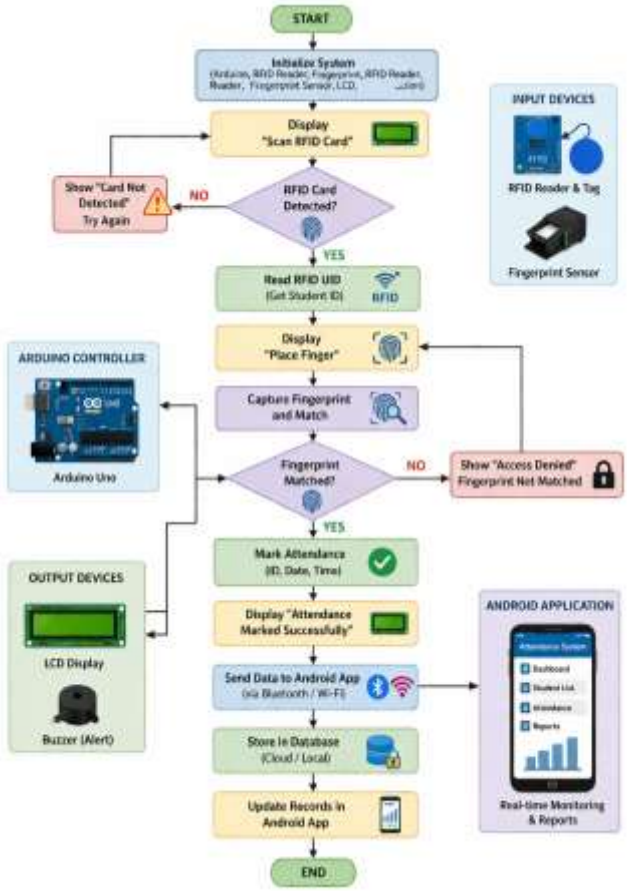

Fig 2. System Flowchart

IX. RESULT

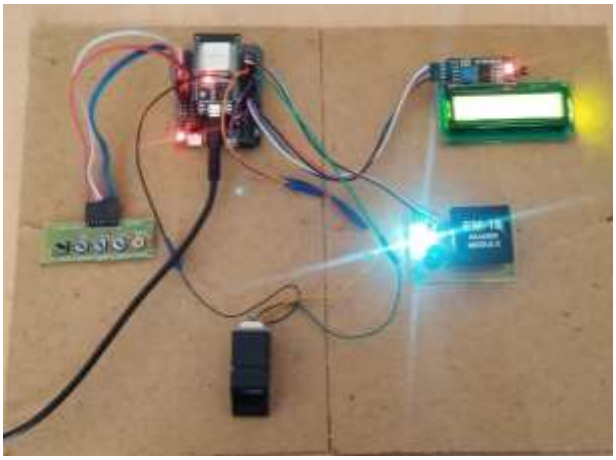

Fig 2: Project Hardware Kit Model.

Fig 3: Updated Attendance on Server.

X. APPLICATIONS

- **Educational Institutions**: Schools, colleges, and universities for student attendance tracking.
- **Corporate Offices**: Employee attendance and access control systems.
- **Training Institutes**: Monitoring student participation and session attendance.
- **Examination Halls**: Secure verification of candidates.
- **Hostels & Libraries**: Entry/exit monitoring and usage tracking.
- **Industrial Environments**: Workforce attendance and shift management.

XI. WORKING ALGORITHM

1. **System Initialization**: Power ON the system and initialize Arduino, RFID reader, fingerprint sensor, LCD, and communication module.
2. **RFID Card Scanning**: The student places the RFID card near the reader.
3. **RFID Verification**: The system checks if the RFID card ID matches the registered database.
4. **Fingerprint Authentication**: If RFID is valid, the system prompts the user to place their finger on the sensor.
5. **Biometric Matching**: The fingerprint is matched with stored templates for authentication.
6. **Attendance Marking**: If both RFID and fingerprint are verified, attendance is marked successfully.
7. **Display Status**: LCD displays messages such as “Access Granted” or “Access Denied”.
8. **Data Transmission**: Attendance data is sent to the Android application via Bluetooth/Wi-Fi.

9. **Database Update**: The Android app stores and updates attendance records in real time.
10. **Repeat Process**: The system continues to monitor and process the next student.

X. FUTURE SCOPE

1. AI-Based Face Recognition Integration:

The system can be enhanced by adding face recognition technology to allow contactless attendance. This improves speed and convenience while maintaining security.

2. Cloud-Based Data Analytics:

Advanced analytics can be applied to attendance data to generate reports, trends, and performance insights, helping faculty make better academic decisions.

3. Mobile Notifications & Alerts:

Future versions can send automatic notifications to students and parents regarding attendance status, absences, or low attendance, improving communication and awareness.

4. IoT-Based Smart Campus Integration:

The system can relate to other smart campus systems like smart classrooms and access control, enabling centralized monitoring and automation.

XI. CONCULISON

The proposed attendance system provides a secure, efficient, and automated solution by combining RFID and biometric technologies. Real-time data storage and access ensure better monitoring and management by faculty and administrators. The system enhances overall transparency, reliability, and digital transformation in attendance management.

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P. Shushmitha is a final-year undergraduate student in the Department of Electronics and Communication Engineering at Vignan's Institute of Management and Technology for Women. Her areas of interest include Embedded Systems, IoT, and Arduino-based system design. She is actively involved in developing innovative hardware-based projects with real-time applications.

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S. Swapna is pursuing her Bachelor's degree in Electronics and Communication Engineering at Vignan's Institute of Management and Technology for Women.

She has a strong interest in Microcontroller-based systems, IoT applications, and mobile-integrated solutions. She is passionate about designing secure and efficient embedded systems.

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