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SMART BIOMETRIC ATTENDANCE MONITORING SYSTEM

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Abstract - *The development and implementation of a smart biometric attendance system utilizing fingerprint recognition technology can make the attendance tracking process simpler or more efficient, designed specifically for college environments. The system aims to address the existing systems and challenges associated with traditional attendance tracking methods by offering a portable efficient solution. The proposed system uses fingerprint biometrics for user identification, ensuring accuracy and reliability in attendance recording. A portable device, such as a handheld scanner, is employed to capture student's fingerprints during each attendance session. The captured data is then processed and compared against a database of enrolled students to authenticate their identity and record attendance. Important features of the system include real-time attendance tracking, automated data management, and integration with existing college management Systems. Additionally, the portability of the device enables faculties to conveniently record attendance in various settings, including classrooms, laboratories, and outdoor activities. By eliminating manual attendance processes and minimizing the risk of errors or buddy punching, the system enables colleges to optimize resource utilization and focus on academic excellence.*

Key Words*: *IOT Biometric, Fingerprints, Paperless, Database, Attendance Tracking, Matching algorithm, etc.

1. INTRODUCTION

Student participation in class is very important. Many colleges use attendance records to record class attendance. Teachers call at the end or beginning of class and mark "Present" or "Absent" on the attendance sheet. This process takes a long time, and students may also rely on someone else's name for virtual participation.We all know that every person has unique biometric characteristics such as fingerprints. Even as we get older, the fingerprint patterns on our fingers remain the same. Therefore, these characteristics are used as a unique identifier to distinguish a person from other people. In many applications for identification and verification, people's unique characteristics are used to identify people, which increases the accuracy and reliability of the application. Biometric authentication system is one of the most effective and secure technologies. Considering the need for smart attendance in classes, we planned and implemented an Internet of Things-based smart attendance system for universities using fingerprints in attendance. Indicators of student knowledge. We produce portable devices with fingerprint scanners and Wi-Fi connectivity. Devices will be distributed to each classroom to capture students' fingerprints. The captured fingerprints are compared with the fingerprints on file and the student's registration number is sent to a remote location. We created a website as a control panel for attendance where students and teachers can access and view attendance information as needed. Using this system greatly benefited the participants in the classroom; It reduced the time required to maintain the call book while also increasing the reliability and accuracy of the system.

2. METHODOLOGY

The device comprises an R307 fingerprint sensor for biometric authentication, an ESP8266 NodeMCU for connectivity and data processing, an OLED 0.96 display for user interaction, and a power bank for portability. This device is circulated in classrooms to take attendance during lectures. During each lecture, the portable attendance device is circulated among students, who use the R307 fingerprint sensor to register their attendance. The ESP8266 NodeMCU collects and processes this data, updating the Attendance table in the database in real-time. Meanwhile, the GUI provides teachers with access to attendance information from any location with internet connectivity.

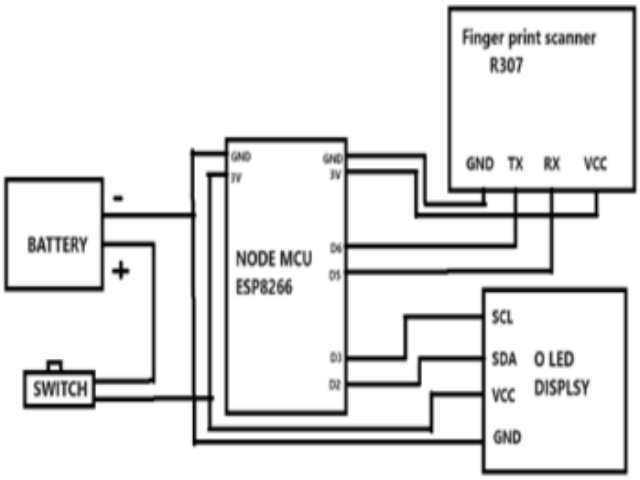

Fig -1: Circuit Diagram

2.1 NodeMCU ESP8266

The ESP8266 is a low-cost Wi-Fi microchip with full TCP/IP stack and microcontroller capability produced by Espressif Systems. It gained popularity due to its low cost, built-in Wi-Fi capabilities, and the ability to be programmed using Arduino IDE. NodeMCU development boards are designed to make it easy to prototype IOT projects with the ESP8266. These boards typically include a USB interface for programming and power, GPIO pins for connecting sensors and actuators, and built-in voltage regulators.

2.2 R-307 Fingerprint Scanner

The R307 Fingerprint Scanner is a biometric sensor module with an optical sensor for capturing fingerprint images and onboard image processing capabilities. It stores fingerprint templates internally and utilizes a matching algorithm for authentication. The module communicates with microcontrollers or other devices through standard interfaces like UART or SPI, enabling seamless integration into various systems. Typically used in access control, time attendance, and identity verification systems, it offers reliable and convenient fingerprint recognition for secure applications.

2.3 OLED 0.96 Display

The OLED 0.96 Display is a small, lightweight display module that utilizes organic light-emitting diode (OLED) technology. With a size of 0.96 inches, it offers high contrast, brightness, and wide viewing angles compared to traditional LCD displays. These displays are typically driven by SSD1306 or similar controller chips and can display monochrome graphics and text.

3. WORKING

3.1 Capturing biometric data (such as fingerprints) with sensors

When a user places their finger on the sensor, the sensor detects the presence of a fingerprint.

3.2 Data processing to extract unique features

The fingerprint image is divided into regions of interest, such as ridges and valleys, to isolate the fingerprint pattern from the background.

3.3 Properly storing attributes in the database

Create a table to store user information, including unique identifiers names, roles, and any other relevant details. Each user should have a corresponding record in this table.

3.4 When a user wants to clock in, he/she provides his/her biometric data

The biometric data provided by the user is captured and processed by the system to extract unique features, such as fingerprint minutiae.

3.5 The system matches the given data with the stored attributes

The smart biometric attendance system ensures accurate and reliable matching of provided biometric data with the stored attributes, facilitating secure authentication for users.

3.6 Records attendees if they see a contact

The system can effectively record attendees when they come into contact with a designated area or device, providing an automated and efficient attendance tracking solution.

3.7 Transmits attendance data to a central server for processing

The smart biometric attendance system can effectively transmit attendance data to a central server for centralized processing, enabling real-time monitoring, analysis, and reporting of attendance information.

3.8 Alternatively, it can provide real-time analysis and reporting capabilities

The system is capable of instantly analyzing attendance data as it flows in. It's like having a live feed of attendance information that's constantly being processed and interpreted.

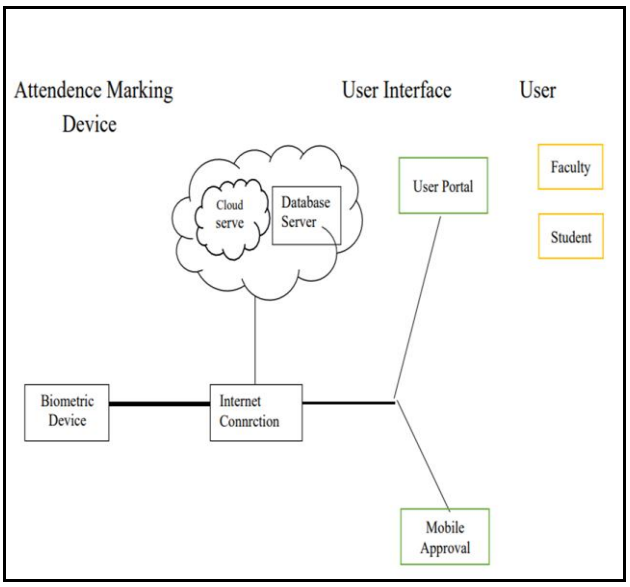

Fig -2: Block Diagram

Attendance Marking Device: This can be a fingerprint scanner, facial recognition, or other device that the students/faculty use to clock in and out of work.

- **Biometric Device**: This refers to a device that identifies a person using unique biological characteristics such as fingerprints or facial features.

User Interface: This is the part of the system that students/faculty interact with to mark their presence. An arrival recognition device can have a physical touch screen, or a software application on a computer or mobile device.

- **Database Server**: The database server is the place where the data of the available marking devices is stored. This local server can be on-premises or a cloud-based server.
- **Internet connectivity**: It is essential for communicating presence marking devices with a data center or server.
- **Mobile Approval**: The system can allow for mobile approval, such as a manager approving an employee's vacation request through a mobile app.

User: This refers to the person who uses the attendance marking system, such as an employee, faculty member, or student.

- **User Gateway**: This can be a web-based interface that allows employees to view their attendance records, request leave, and perform other tasks. Cloud-based attendance marking systems offer many advantages over traditional paper-based systems.

Advantages-
Improved accuracy and reduced error.
Enhanced performance.
Easy data management.
Real-time reporting.
Security was tightened.

4. Flowchart of a System

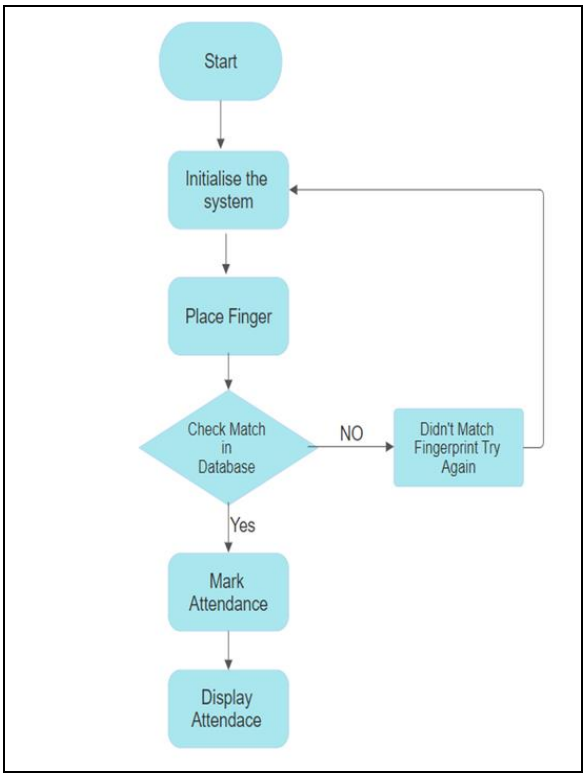

Fig -3: Flowchart

5. Database Creation

Database Design: - Design the database schema to save statistics which includes user information, attendance information, biometric facts, and many others.

XAMPP Setup: - Download and install the XAMPP server for the device, making sure Apache and MySQL servers are working. Access the database (phpMyAdmin) to manipulate the MySQL database.

HTML Interface: Create HTML paperwork/pages for consumer authentication, registration, and attendance marking. Design an intuitive consumer interface for easy interaction.

PHP Backend: Develop PHP scripts to deal with form submissions, database interactions, and business common sense. Use PHP to hook up with the MySQL database, insert new statistics, fetch records, and many others.

JavaScript for Client-aspect Interaction: Utilize JavaScript for consumer-facet validation of paperwork and to enhance personal reveal in dynamic updates. Advanced JavaScript design part may be used for asynchronous verbal exchange with the server to fetch facts without reloading the page.

User Authentication: Implement a secure login device for the usage of PHP classes to authenticate customers. Ensure passwords are securely hashed and stored inside the database.

Attendance Marking: Create the capability to mark attendance, both manually through a module integrated with biometric devices. PHP scripts are taught to deal with recording attendance in the database.

Reporting and Analysis: - Develop features to generate reports and examine attendance records. Use PHP and MySQL queries to extract relevant records from the database. Present facts in a user-friendly manner, the usage of HTML and JavaScript.

Testing and Deployment: Thoroughly test the system to ascertain that, it works successfully in unique eventualities Once examined, install the software on the XAMPP server for actual use.

Security Considerations: Implement security features to protect in opposition to unauthorized access which includes SQL injection, pass-web page scripting (XSS), and so on. Regularly update and patch the system to cope with any safety flaws.

Documentation and Maintenance: Document the machine structure, database schema, and codebase for destiny reference. Plan for ongoing preservation and updates to make sure that, the machine remains stable and purposeful.

6. CONCLUSION

A smart biometric attendance monitoring system offers enhanced accuracy, efficiency, and security in tracking attendance. It reduces administrative overhead, provides real-time monitoring, and integrates well with other systems. Despite initial costs, the long-term benefits, including time savings and improved data accuracy, make it a cost-effective solution. However, organizations must prioritize user privacy, comply with regulations, and ensure transparent communication for successful implementation and user acceptance.

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