

NodeMCU Encrypted Biometric Attendance System

¹Aadhithiya Narayan. S, ²Raagul. S, ³Rakesh. S, ⁴Dr S Mohandoss, ⁵Durga Nandini E

^{1,2,3}IV Year B. Tech Computer Science and Engineering
(Cyber Forensics and Information Security) Students,
Department of Computer science and Engineering,
Dr MGR Educational And Research Institute, Maduravoyal,

Abstract- This project focuses on creating a Biometric Attendance System using NodeMCU ESP8266 12E, LED Display, and R305 Fingerprint Sensor. The system collects fingerprint data from multiple users and sends it securely over the internet to a server. Enrolment of fingerprints occurs on the server using a compatible fingerprint sensor. The project emphasizes security, utilizing NodeMCU for data encryption and ensuring the protection of sensitive biometric data. The system enables identity verification and access control through the transmission of fingerprint templates over the network.

Keywords: Node MCU, Fingerprint Scanner, Attendance System, Biometrics.

1. INTRODUCTION

This challenge utilizes NodeMCU, LED Display, and R305 Fingerprint Sensor to create a steady and value-powerful Biometric Attendance System. The ESP8266 Wi-Fi Module collects fingerprint information from users, sending it to a server for enrollment. NodeMCU ensures facts encryption, garage, and verbal exchange. Emphasis on security safeguards biometric facts from unauthorized get entry to. Verification is patron-aspect, with fingerprint templates transmitted over the network for authentication.

This mission specializes in creating a Fingerprint Sensor Based Biometric Attendance System the usage of Arduino and Node MCU. The gadget, designed for schools, faculties, and agencies, makes use of a fingerprint module and Arduino for correct attendance statistics recording. Integration with Node MCU enhances protection, making it applicable in numerous settings wherein precise attendance tracking with time is essential. A Fingerprint scanner serves as an digital security system using biometrics to free up gadgets, doorways, and exclusive files. Each individual's unique fingerprint, unalterable in nature, makes it a widely used identification technique. Law enforcement continues fingerprint databases, and numerous professions, consisting of monetary advisors and teachers, require fingerprinting for licensing. It's additionally ideal for home and workplace safety, controlling get admission to and storing essential facts. Fingerprint scanners offer advantages which includes security, reliability, and fee-effectiveness over traditional strategies, making them convenient for companies and groups searching for steady identification and authentication. .

2. OBJECTIVES

a. Secure Biometric Authentication:

Implement a secure biometric authentication system using a fingerprint scanner and NodeMCU for reliable user identification.

b. Encryption of Fingerprint Data:

Utilize NodeMCU's capabilities to encrypt the captured fingerprint data, ensuring that sensitive information remains protected during transmission and storage.

c. Remote Enrollment and Storage:

Facilitate the enrollment of fingerprints on a remote server using the NodeMCU, enhancing scalability and centralization of user data.

d. User-Friendly Interface:

Design a user-friendly interface, possibly leveraging LED displays, to provide feedback and status indications during the authentication process.

e. Access Control and Attendance Tracking:

Integrate the system for applications such as access control and attendance tracking in organizations, schools, or businesses.

3. DESIGN

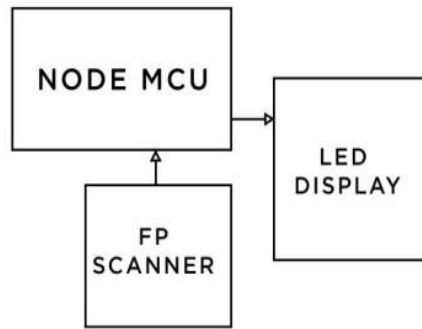


Figure 1: Block Diagram

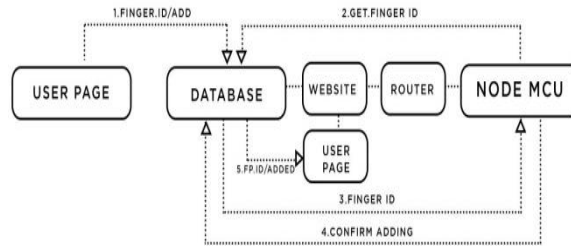


Figure 2: Adding a new fingerprint

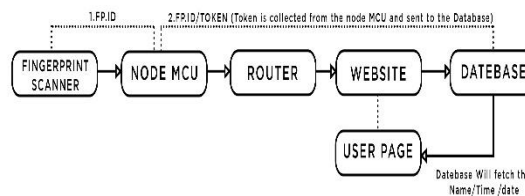


Figure 3: Working of Login/Logout

4. METHODOLOGY

4.1. Adding a New Fingerprint:

- a. A Fingerprint ID (1-127) will be picked from the user page and sent to the database.
- b. Node MCU sends a Get request to the database that should be added.
- c. The Database will the Fingerprint ID to the Node MCU to store.
- d. Now the Node MCU will send a confirming request to the website to display that the new ID has been successfully added.

4.2. Login/Logout:

- a. FP Scanner send a FP.ID packet to Transmitter (Node MCU).
- b. Node MCU adds the respective FP token for the pre registered Fingerprint and send to the database.
- c. Database fetch the name of the Fingerprint and adds the time/date and register it on the login page
- d. When the fingerprint is placed for the first time it is recorded as login time and when the same Fingerprint is recorded once again, it consider it as Timeout.

4.3. Communication Techniques:

The communicate between the NodeMCU device and the database is vital to the Biometric Attendance System. It entails the transmission of fingerprint statistics from the NodeMCU to the database for garage and retrieval. The fingerprint statistics are processed and saved as hash-encrypted values in the database to enhance security.

4.3.1. Hash Encryption Process:

- a. **Enrollment:** Fingerprint facts have hashed a steady enrollment algorithm (e.g., SHA-256), developing a unique virtual illustration.
- b. **Storage:** Hash-encrypted fingerprints are securely despatched to the database, in which the hash values are stored at the side of user statistics.

c. **Verification:** During attendance verification, captured fingerprints are hashed compared to saved hash values for authentication.

4.4. Benefits:

a. **Security:** Hash encryption provides a layer of security by making the fingerprint facts irreversible and particular.

b. **Privacy:** Only hash values, no longer the unique fingerprints, are stored, protecting user privacy.

c. **Integrity:** Hash encryption ensures the integrity of saved statistics, detecting tampering for the duration of verification.

5. CONCLUSION

The NodeMCU Encrypted Biometric Attendance System is a current solution for stable identification verification. This undertaking combines the NodeMCU IoT platform with a biometric fingerprint scanner to create an green, cost-powerful, and secure attendance monitoring gadget. Emphasizing statistics encryption and steady verbal exchange, the gadget addresses worries associated with managing sensitive biometric records. The integration of an LED display enhances consumer interplay, making it appropriate for numerous applications in schooling, commercial enterprise, and beyond. Overall, this innovative gadget showcases the abilities of NodeMCU at the same time as highlighting the importance of stable facts coping with in present day attendance systems.

The NodeMCU encrypted biometric fingerprint scanner mission represents a large development in each protection and IoT era. By integrating biometric authentication with encryption protocols, this undertaking ensures an immoderate degree of records protection and patron identification verification. It has the potential to be completed in numerous fields, consisting of having entry to govern structures, consistent virtual transactions, and additional, in which robust protection is paramount.

As era maintains to comply, responsibilities like this pave the way for progressive answers beautifying our virtual lives at the same time as preserving nice safety standards. Furthermore, this mission demonstrates the hardware and software application convergence, leveraging the NodeMCU's capabilities to interface seamlessly with the biometric fingerprint scanner. Encryption gives a similar layer of safety, making it tough for unauthorized individuals to access data breaches properly. One of the exceptional blessings of this project is its capacity for remote monitoring and control. With the NodeMCU's connectivity competencies, administrators can display admission to tries and device popularity from everywhere, improving elegant tool management and responsiveness.

Moreover, the undertaking showcases the potential to offer charge-powerful and reachable biometric safety answers. The NodeMCU, for its affordability and flexibility, democratizes get right of entry to to superior protection era, making it extra for a broader range of programs and users. In precis, the NodeMCU encrypted biometric fingerprint scanner assignment is no longer high-quality and exemplifies the fusion of modern-day technologies; but, it highlights the importance of privateness and protection inside the virtual age. Its versatility, affordability, and functionality for far-flung control role it as precious in improving protection and authentication systems at some stage in numerous industries.

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