SMART ATTENDANCE SYSTEM USING FINGERPRINT(2024)

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***ABSTRACT*—** This project introduces an advanced fingerprint-based attendance system combined with a user-friendly web application, designed specifically for educational institutions. By utilizing a sophisticated pattern matching algorithm, the system ensures accurate and efficient fingerprint recognition, making attendance marking seamless and automated. Faculty members can easily take attendance, manage student information, and monitor each student's attendance through the web application. Meanwhile, administrators have access to a separate portal where they can manage both faculty and student data, view overall attendance statistics, and generate detailed reports.The system features a fingerprint scanner that captures and processes fingerprint images for both enrollment and verification purposes. Built on a modern tech stack, the web application ensures secure authentication, a responsive user interface, and reliable data storage in a relational database. The faculty dashboard streamlines attendance management, while the admin dashboard provides comprehensive tools for overseeing faculty and student information. Key features include real-time attendance tracking, detailed analytics, and visual reports that help identify trends and irregularities in attendance. By automating the attendance process and centralizing data management, this system aims to reduce manual errors, ease administrative tasks, and enhance overall attendance monitoring in educational environments.

***1.INTRODUCTION***

Managing attendance effectively is vital for educational institutions, as it impacts both administrative efficiency and student performance. Traditional methods, like manual or card-based systems, are often error-prone, susceptible to fraud, and time-consuming. To solve these issues, we’ve developed an advanced fingerprint-based attendance system, paired with a user-friendly web application. This system is designed to improve accuracy, security, and ease of use. At the heart of our system is a fingerprint recognition module that uses a pattern matching algorithm to verify each student's identity based on their unique biometric data. This ensures that attendance is recorded accurately and cannot be tampered with. The web application complements this by providing an intuitive interface for faculty and administrators to manage attendance records and student details seamlessly.

Faculty members can easily take attendance, add and manage student information, and view individual attendance records through the web portal. Administrators have broader capabilities, including managing faculty details, overseeing student data, and generating detailed attendance reports. This centralized system not only makes the attendance process more efficient but also offers valuable insights through detailed analytics and visual reports. By combining biometric technology with a robust web platform, our project aims to transform attendance management in educational settings, enhancing reliability, efficiency, and data security.

***II.******LITERATURE SURVEY***

# **Automated Wireless Biometric Fingerprint Based Student Attendance System**

This paper proposes an automated wireless biometric fingerprint-based attendance system designed to modernize and secure attendance recording in educational institutions. With 75% attendance being mandatory across India since 2002, traditional methods are prone to errors, document misplacement, and proxy attendance. The new system automates and enhances the accuracy and convenience of attendance management, eliminating manual errors and proxy issues. It is also cost-effective compared to existing market solutions, providing a practical upgrade to conventional practices.

# **Attendance Monitoring System Using Fingerprint Authentication**

The proposed system is intended to address the issues with the current attendance system. Biometric systems have been widely employed for identification purposes. These methods of recognition recognise persons based on certain physiological or behavioral characteristics. This method's main goal is to create a transparent attendance system and keep real-time data and display it online for parents and other academic purposes. Fingerprint Identification Attendance System is a dependable and simple to use system that produces accurate results.

# **Internet of Things based Biometric Smart Attendance System**

The proposed fingerprint-based attendance system enhances user security by using unique biometric data, making it a simple and practical solution for students to access the Internet of Things. Attendance is recorded via a biometric fingerprint scanner, with details securely stored in the cloud. This system seamlessly integrates with existing management systems and provides added safety and ecological benefits. Additionally, the collected fingerprint database can be used for identity management and access control applications.

**IoT-Based Portable Fingerprint Attendance System Using the Minutiae Based**

The portable IoT fingerprint attendance system (PoFAS-Class) modernizes traditional manual attendance by using electronic devices and the Internet of Things (IoT). Utilizing the Minutiae Based algorithm to detect unique fingerprint patterns, the system includes components like the Nodemcu ESP8266 microcontroller, fingerprint sensor, TFT OLED screen, and battery charger module. It offers a portable solution for recording attendance and features web-based registration and user information access, facilitating online attendance through networks like Wi-Fi.

***III.PROPOSED SYSTEM***

Traditional attendance recording systems, such as manual roll calls, sign-in sheets, and swipe cards, are prevalent in many educational and professional settings. These methods, while simple and straightforward, are inherently flawed and inefficient. Manual roll calls are time-consuming and disrupt workflow, while sign-in sheets can be easily manipulated, leading to inaccuracies and potential fraud. Swipe cards, though more automated, still suffer from issues such as card loss, theft, and the possibility of proxy attendance. Additionally, these systems require substantial administrative effort to compile, verify, and manage attendance data, often resulting in errors and delays.

***IV ALGORITHM***

**Fingerprint Acquisition:**

Image Capture: The process begins with capturing a high-resolution image of a fingerprint using a fingerprint scanner. This image includes various ridge and valley patterns unique to each individual.

Preprocessing: The captured image is then preprocessed to enhance quality. This may involve noise reduction, contrast adjustment, and binarization to improve the clarity of ridge patterns.

**Feature Extraction:**

Minutiae Detection: The core of fingerprint pattern matching involves detecting minutiae points, which are specific features of the fingerprint such as ridge endings and bifurcations (where a ridge splits into two).

Feature Mapping: These minutiae points are mapped and represented in a data format that includes their locations and orientations. This data forms the basis for comparison.

**Pattern Matching Algorithm:**

Template Creation: During the enrollment phase, the minutiae data from a fingerprint is used to create a biometric template. This template is stored in the database for future comparisons.

Matching Process: When a fingerprint is scanned for attendance, the system extracts minutiae points from this new scan and compares them against the stored templates. This comparison is based on the spatial relationship and pattern of minutiae points.

Algorithm Application: A pattern matching algorithm, such as the Minutiae-Based Matching Algorithm, is applied to calculate a similarity score between the newly scanned fingerprint and stored templates. This algorithm evaluates the degree of match based on factors like the distance between minutiae points, their orientation, and their relative positions.

**Decision Making:**

Threshold Setting: The system uses a predefined threshold to determine if the similarity score is high enough to confirm a match. If the score exceeds this threshold, the system verifies the identity and records attendance; otherwise, the attempt is rejected.

Error Handling: If a match is not found or if there is a low confidence level, the system may prompt for additional authentication or flag the attempt for review.

***V. CONCLUSION & FUTURE WORK***

The fingerprint-based attendance system presents a modern solution to the challenges of traditional attendance methods. By leveraging biometric technology and advanced pattern matching algorithms, the system offers a secure, efficient, and accurate approach to tracking attendance in educational institutions. The integration of a fingerprint scanner with a web application portal simplifies the attendance process for faculty and administrators, minimizing manual errors and reducing the potential for fraudulent activities. The system’s design emphasizes ease of use and real-time data synchronization, ensuring that attendance records are promptly updated and accessible. The web application provides a comprehensive interface for managing student and faculty information, generating detailed reports, and monitoring attendance trends. This enhances administrative efficiency and supports better decision-making.

Moreover, the use of fingerprint technology ensures that each individual's attendance is recorded accurately and securely, with a high level of tamper-proof verification. The system's scalability and adaptability make it suitable for various institutional sizes and evolving needs, while its focus on data security and compliance with privacy regulations safeguards sensitive information. Overall, the proposed system not only streamlines attendance management but also contributes to a more organized and accountable educational environment. Its combination of biometric accuracy, user-friendly design, and robust data management capabilities represents a significant advancement over traditional attendance methods.

**Integration with Other Biometric Systems:** Future developments could include integrating additional biometric methods, such as facial recognition or iris scanning, to further strengthen security and provide multi-factor authentication options.

**AI and Machine Learning Enhancements:** Incorporating AI and machine learning algorithms could improve the accuracy of fingerprint recognition and pattern matching. These technologies could also help in identifying and mitigating potential fraud or anomalies in attendance data.

**Mobile and Cloud Integration:** Expanding the system to include mobile applications and cloud-based services could provide greater flexibility and accessibility. Users could manage attendance and view reports from any device, and data could be stored securely in the cloud for better scalability and disaster recovery.

**Enhanced Analytics and Reporting:** Developing advanced analytics features to provide deeper insights into attendance patterns, trends, and student performance could help institutions make data-driven decisions and improve educational outcomes.

**Automated Notifications and Alerts:** Integrating automated notification systems for attendance-related events, such as absences or tardiness, could enhance communication between faculty, students, and parents, fostering a more responsive and engaged learning environment.

***VI. REFERENCES***

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