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Fingerprint Based Voting System

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ABSTRACT

In democracies like India, the essence of governance lies in the voting process, allowing citizens to elect representatives for effective governance. Despite the introduction of electronic voting machines, the voting percentage has only marginally increased over the years. Rural and urban areas face issues like misuse of polling centers and low voter turnout due to various reasons. To address these challenges, an innovative solution, the Fingerprint Based Voting Project, is proposed. This system authenticates users through fingerprint recognition, ensuring unique voter identification and preventing multiple voting. Admin privileges are granted for candidate registration, ensuring transparency and security in the electoral process. The system aims to achieve a target voting percentage of over 80% by 2029, offering affordability and minimal hardware requirements. This solution seeks to enhance democratic participation and uphold the integrity of the electoral process.

Keyword – Democracies, Electronic voting machines, Fingerprint, authenticates.

INTRODUCTION

Biometrics, encompassing the statistical analysis of biological data, involves the utilization of technologies to assess various human body characteristics for authentication and verification purposes. These characteristics may include DNA, fingerprints, retinas, irises, voice patterns, facial features, and hand gestures. In our research, we focus specifically on fingerprint biometrics for voter identification and authentication due to the uniqueness of fingerprint patterns, which ensures maximum accuracy.

To facilitate this, we have developed a database that stores the fingerprints of every individual within a constituency. This database serves to prevent illegal voting and the repetition of votes, thereby ensuring fair and rigging-free elections. Our system, termed the "Fingerprint Election System," is designed to enable users to vote smoothly and effectively.

Key features of our system include server services linked to a remote database for persistent data storage, with administration responsibilities lying in the hands of designated administrators tasked with ensuring the fair conduct of elections.

The primary purpose of this project is to facilitate the easy and effective conduct of elections, thus ensuring fairness and the prevention of malpractice. Additionally, our research aims to make elections more dynamic by allowing any number of candidates to apply for candidacy.

This study on the "Fingerprint Election System" is being undertaken as part of an academic course, with the objective of providing detailed specifications of the system's requirements for developers. Through this research, we aim to contribute to the enhancement of electoral processes and the promotion of democratic principles.

LITERATURE RIVIEW

• First Generation Voting System

Initially, Vishal Vilas Natu proposed a voting mechanism reliant on paperwork and electronic machines. This involved extensive paperwork for voter registration and authentication, followed by voting using electronic machines containing

candidate lists. However, this system was time-consuming due to paperwork, especially with India's vast number of polling centers.

• Second Generation Voting System

In the paper-based election system, voters deposited their votes in sealed ballot boxes distributed across electoral circuits. Votes were manually counted by election officials, leading to errors and the potential for manipulation. Thus, this system lacked efficiency and needed urgent replacement.

• Third Generation Voting System

An electronic voting system, integrated with UIDAI for authentication, validation, and counting, was proposed by Virendra Kumar Yadav. While innovative, this system faced security concerns and high manufacturing costs. David Chaum introduced secure electronic voting using untraceable mail and digital pseudonyms, ensuring anonymity but demanding heightened security measures.

• Fourth Generation Voting System

D. Ashok Kumar analyzed fingerprint matching algorithms for Electronic Voting Machines (EVMs), highlighting fingerprint technology's enhanced security. Other advancements included adaptive pore models for secure fingerprint recognition and the integration of skin detection techniques for image extraction and verification. These innovations aimed to improve fingerprint-based voting systems, ensuring accuracy and efficiency.

EXISTING SYSTEM

The Elections serve as the cornerstone of democracy, yet often the intricacies of the electoral process are overlooked. In 1977, the Chief Election Commissioner initiated the deployment of Electronic Voting Machines (EVMs), a technological advancement in collaboration with Bharat Electronics Limited (BEL) and Electronics Corporation of India Limited (ECIL).

Comprising two primary units, the EVM system consists of the Control Unit and the Balloting Unit, connected via a five-meter cable. The Control Unit is entrusted to the designated officer, while the Balloting Unit remains within the voting compartment.

However, despite its implementation, the current EVM system faces notable challenges:

1. Security Vulnerabilities: The potential for unauthorized manipulation of the installed program within the EVM, enabling tampering with election results in favor of specific candidates.
2. Electoral Fraud (Rigging): Rigging, a prevalent issue encountered by the Election Commission of India, involves individuals casting multiple votes across different constituencies.
3. Manual Candidate Registration: In a democratic nation like India, where every citizen possesses the right to stand for election, a surge in the number of candidates can pose logistical challenges for the election commission. Our dynamic project addresses this by accommodating an unlimited number of candidates.

PROPOSED SYSTEM

Our system is meticulously crafted to overcome the limitations inherent in the current electoral framework, while simultaneously bolstering the authentication and verification protocols integral to the election process. Operating on a pattern recognition model, our system utilizes acquired data to compare feature sets against securely stored information within a remote database. This functionality effectively mitigates illegal voting practices and prevents the duplication of votes, thereby ensuring the integrity and fairness of elections. Moreover, our system streamlines the voting process through full automation, simplifying the act of casting votes and empowering individuals to elect their preferred candidates. In doing so, our system strengthens the foundation of democracy, fostering a more robust and inclusive electoral landscape.

METHODOLOGY USED

The system consists of one main module and its submodules:

Admin Login

a. Add Candidate: Admin dynamically adds candidates for election.
b. Add Election: Admin adds elections.
c. View Election: Admin views election details except voter-candidate associations.
d. Add Voter: Admin registers voters by scanning thumb impressions and storing details in the remote database.
e. View Result: Admin views election results to determine the winner.

SOFTWARE REQUIREMENT

• Windows Platform.
• Microsoft Visual Studio.
• Microsoft SQL Server 2008.
• Visual studio.

HARDWARE REQUIREMENT

• A system with a basic configuration.
• Fingerprint Sensor.

USE OF FINGERPRINT BIOMETRICS

• Fingerprint Recognition:

In contemporary times, biometrics stands as a crucial tool for personal identification, given the inherent uniqueness and immutability of biometric identifiers. Biometric authentication encompasses various human characteristics such as eye patterns, fingerprints, facial features, and speech patterns. Among these, fingerprint recognition holds particular importance, despite its complexities arising from subtle variations even within the same fingerprint.

Fingerprint recognition refers to the electronic process of identifying or verifying fingerprint images belonging to individuals. Fingerprints are widely recognized as one of the most vital forms of biometrics for identity verification. There are two primary modes in fingerprint recognition systems: verification mode and identification mode. In essence, fingerprints can be tailored to function in either identification or verification mode. In verification mode, the system compares the input fingerprint against the individual's stored template in the database. Conversely, in identification mode, the system conducts a search within the database for matching fingerprint templates to establish the individual's identity. To expedite this process, various techniques such as fingerprint classification and indexing are employed. Notably, the algorithms utilized in both verification and identification modes are often similar, enabling a unified approach to fingerprint authentication.

• Fingerprint Classification:

Fingerprints are categorized into three distinct visual patterns: loops, arches, and whorls. Each type further branches into smaller classifications. Arch, the first type, is found in approximately 5% of individuals and is divided into two subtypes: plain arch and tented arch. The second type, loop fingerprints, are present in about 60% of people and can be further categorized as radial loop or ulnar loop. The third type, whorls, account for around 35% of individuals and are subdivided into plain whorl, central pocket whorl, double loop whorl, and accidental patterns.

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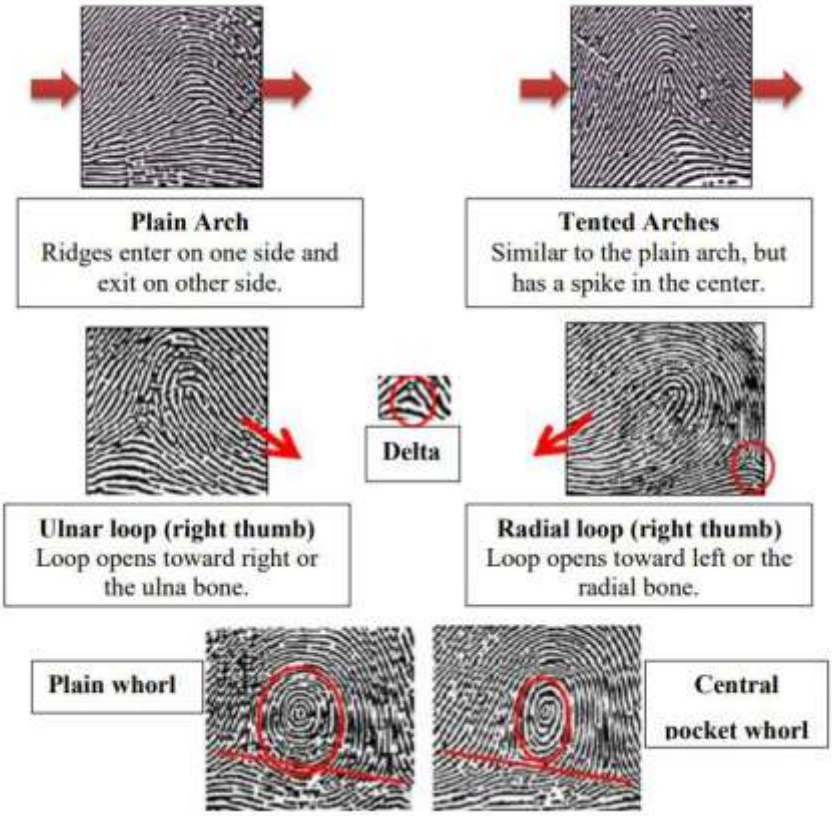

Figure 1: Types of fingerprints

The features of fingerprints, specifically the ridges, are referred to as minutiae. These minutiae include dots, bifurcations, and ridge endings. Ridge endings mark the termination of a ridge, while bifurcations occur when a single ridge splits into two. Dots are very small ridges. These features play a crucial role in the identification process, as algorithms are designed to detect and compare them for accurate matching.

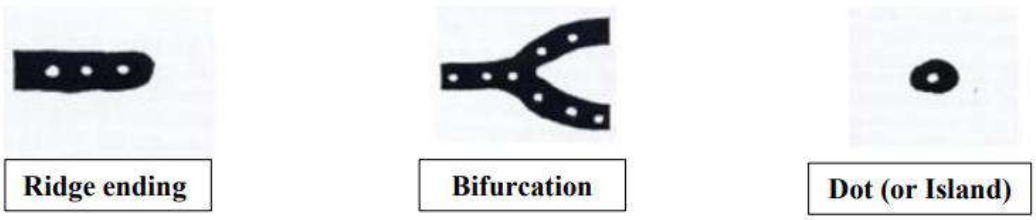

Figure 2: Identification character

Two key factors are utilized to assess the accuracy of fingerprint matching algorithms: false acceptance rate (FAR) and false rejection rate (FRR). FAR represents the proportion of impostor images incorrectly identified as authentic by the algorithm, while FRR signifies the ratio of authentic images wrongly rejected. When FAR and FRR are equal, it is known as the equal error rate (ERR), which serves as a measure of algorithm performance.

IMPLEMENTATION

• Installation Of the Drivers

For the hardware to function properly, drivers are essential. We utilize the SecuGen Hamster Pro 20 for fingerprint scanning and matching. Employing hybrid technology ensures greater accuracy and efficiency, particularly in recognizing fingerprints even when conditions like sweating occur. Only essential fingerprint data is stored in the database to maintain security. During validation, the scanned fingerprint data is compared with the stored information. If a match is found, the

user is identified as a registered voter. If the user has already cast their vote, a notification is displayed; otherwise, they can proceed to vote.

• Front End

The frontend, crucial for user interaction, prioritizes user-friendliness and accessibility. It is meticulously designed to facilitate smooth software navigation. The admin login page, for instance, ensures a seamless login experience for administrators. The provided code showcases the implementation details.

✓ Admin Login Page

This section includes the code snippet for the admin login page, enabling administrators to securely access the system.

✓ Admin Dashboard

The admin dashboard serves as a central hub for administrative tasks. Various functionalities such as adding candidates, elections, and voters are easily accessible from the dashboard. The provided code demonstrates the implementation of the admin dashboard.

• Back-End

The backend infrastructure, managed by MySQL, is vital for database management. Microsoft SQL Server 2008 R2 hosts the backend system, ensuring data security through encryption. Access control algorithms safeguard the system, restricting unauthorized access. Only essential administrative tasks are permitted, maintaining the integrity of the voting process. MySQL is utilized as the backend language for database management.

OUTPUT & RESULT ANALYSIS

• The Voting Menu:

Voters will access a menu to cast their votes for their preferred candidate. Additionally, they can view candidate profiles or images by selecting "View Profile". Each vote cast increases the candidate's vote count, with no individual voter information stored. Results can be exported as an Excel file (.xls) for additional analysis.

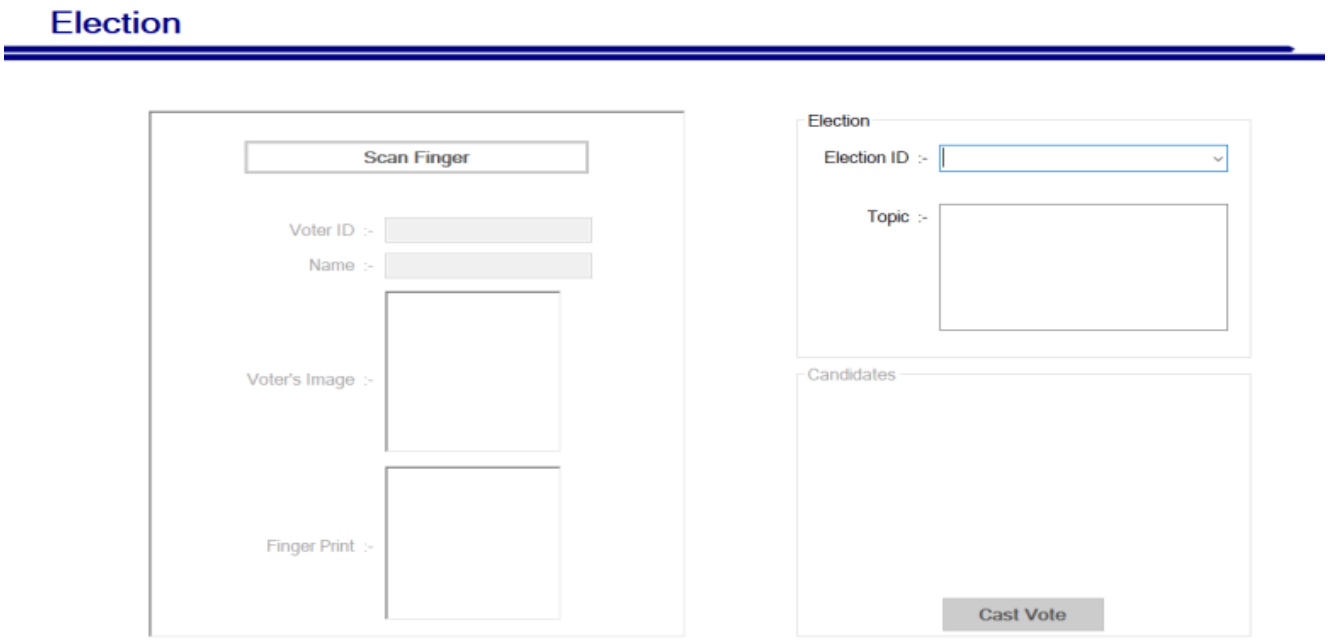

Figure 3: Voter's Page

• Admin Login Interface:

Only the administrator can access the system using their unique login ID and password. Once logged in, the administrator will have access to perform the following actions.

Figure 4: Admin login Page

• Admin Dashboard:

The admin dashboard serves as a centralized platform where the administrator can access various tools such as adding voters, candidates, and elections, as well as calculating and viewing results—all stored in a database.

Each function is designed to be user-friendly and easily understandable, catering to users with basic English proficiency. Additionally, we plan to implement a text-to-speech function for accessibility, particularly for visually impaired individuals. To streamline the voting process, we have separated the election and login functionalities, ensuring that voters can directly cast their votes without requiring admin access. This process will be available only on the designated voting date and cannot be accessed before or after. The admin can log out from the dashboard, allowing voters to proceed with casting their votes. The fingerprint sensor will be automatically detected, with the capture button labeled as "submit" for a seamless voting experience.

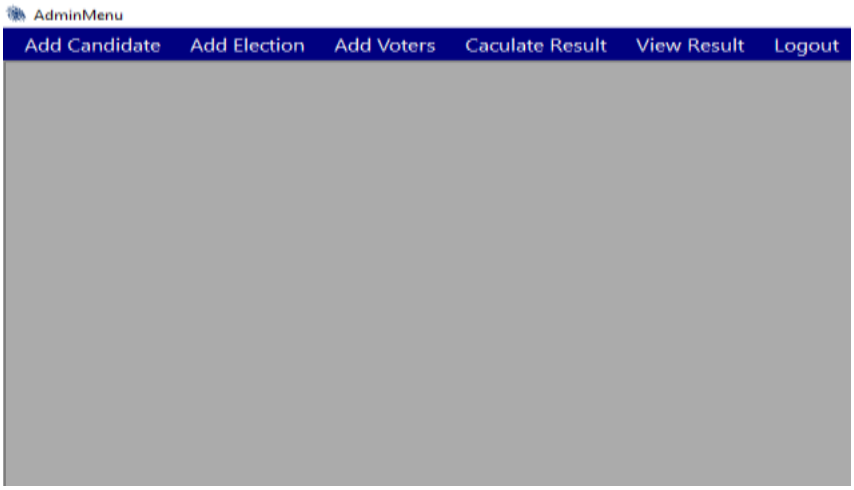

Figure 5: Admin dashboard

• Counting Votes and Result:

The vote counting and result section serves as the final output stage where the admin can tally the votes, accessible to both the admin and the user. The admin calculates the result only when the election date changes, not on the same day. For in-depth analysis, the result data can be exported from the software as an Excel sheet, providing a detailed breakdown of each candidate's votes.

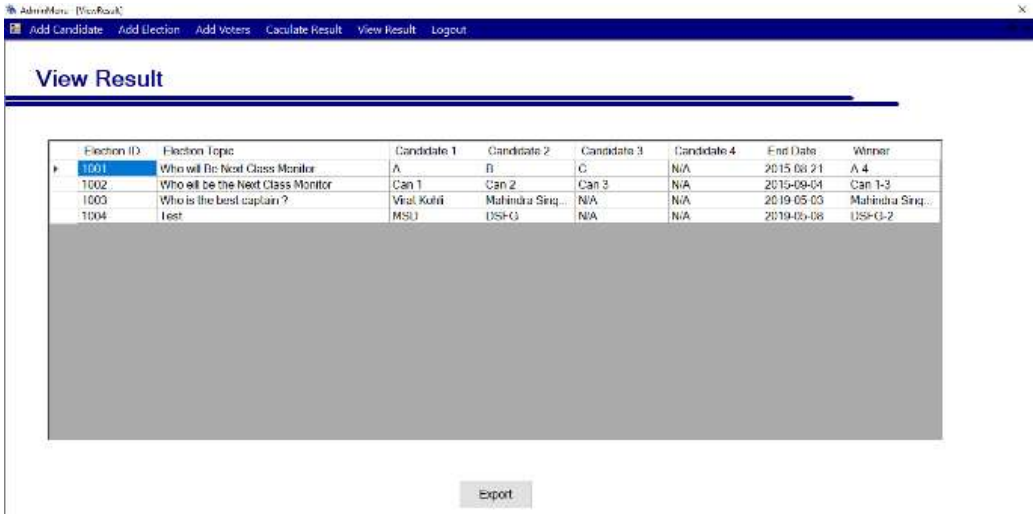

Figure 6: Count vote & result

FUTURE SCOPE

The current study focuses solely on one module, with plans to integrate additional modules in the future, incorporating various biometrics such as Iris Scanner to enhance user authentication and verification.

Advantages of Iris Recognition:

• Iris recognition boasts maximum accuracy rates.
• Studies have shown no false matches in over two million cross-comparisons.
• Iris recognition can efficiently manage large populations with rapid speed, conducting extensive searches within milliseconds.
• It is non-invasive and inherently safe.
• Iris patterns remain constant throughout an individual's lifetime.

To bolster system security, Blockchain technology will be implemented to ensure database consistency across all copies, with the network performing continuous checks. Blockchain's append-only data structure prevents data alteration or deletion by any individual, maintaining transaction records in sequential order. To improve system scalability, a NoSQL database like MongoDB will be utilized, enhancing efficiency and stability through its schema-less nature and compatibility with dynamic queries.

Furthermore, while the current system is compatible only with the Windows platform, future iterations aim for platform independence to maximize usability across various environments.

CONCLUSION

Overall, this system effectively addresses many challenges encountered in traditional voting methods. Its efficiency hinges on a user-friendly web interface, ensuring a secure voting process crucial for the progress of a developing nation.

The proposed fingerprint-based voting system surpasses its predecessors in speed and accuracy. By preventing unauthorized access, ensuring user-friendliness, and upholding transparency, it eliminates the risk of rigging. With each user's fingerprint recorded only once, multiple voting is prevented, enhancing the integrity of the electoral process.

This innovative system minimizes invalid votes, streamlines polling processes, and reduces staffing requirements at voting centers. It offers convenient access to candidate information and ensures registered voters can participate in elections.

With rapid and error-free result generation, the system mitigates the potential for vote tampering or bias. Its automation extends to preventing administrators from altering votes or accessing voter information, safeguarding the integrity of the process.

Moreover, the system saves time and resources previously spent on distributing and retrieving physical ballots. Its minimal hardware requirements make it accessible, and integration of a fingerprint sensor ensures robust security measures.

REFERENCES

[1]. Yinyeh, M. O., & Gbolagade, K. A. (2013). Overviewof Biometric Electronic Voting System in Ghana. International Journal of Advanced Research in Computer Science and Software Engineering. [2] Electrical system-A comprehensive introduction by David M Farrell
[2]. The Great March of Democracy: Seven Decades of India's Elections by S.Y.Quasi [4] A Handbook of Poll Surveys in Media: An Indian Perspective by Dr. N. Bhaskara Rao [5] The website of Election commission of India. https://eci.gov.in/
[3]. https://ieeexplore.ieee.org/abstract/document/79722
[4]. https://ieeexplore.ieee.org/document/8261341