

E-Voting System Using Aadhaar and Biometric Verification

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Abstract — Integration of Aadhaar verification along with the biometric fingerprint verification has been suggested to improve the security of the voting process. The fingerprint verification takes place when the captured fingerprint is matched against the Aadhaar details of the voter saved in the database; hence, eliminating any possibility of fraud or multiple voting. Every individual gets only one chance to vote.

The voting system has been designed using a webbased application, which automatically stores the result of the elections in a database. In case of mismatch during fingerprint verification, OTP verification can be done. The need for manual operation is avoided in this way.

Keywords — Secure voting system, Aadhaar verification, fingerprint verification, biometric security, electronic voting system, OTP verification, web-based application.

I. INTRODUCTION

Elections at large scale are one of the major components in the governance of India, the largest democracy in the world. Conventional forms of voter identification have been found vulnerable to fraud, duplicity, and manipulation which makes the whole voting procedure unreliable. The need for such a problem can be addressed in the most effective way possible by means of biometrics. Biometric authentication involves a process whereby the person in question has his identity validated using physiological traits like fingerprints. The method used here involves the fusion of fingerprint authentication along with Aadhaar based verification whereby the identity of the voter is authenticated against information stored in a database.

This paper proposes the use of a web-based system that streamlines the process of voting in order to minimize time and eliminate any possibility of errors

while maximizing voter turnout and minimizing manipulation of results.

II. MOTIVATION

In order to circumvent the flaws in existing election systems, a modern electronic voting mechanism incorporating Aadhaar and biometric techniques has been proposed. Traditional methods of voting through paper ballots or even the contemporary process of voting through electronic devices is prone to the risk of being rigged. The mechanism ensures the accuracy of the principle of one person one vote through fingerprint recognition linked with Aadhaar records. It saves both time and cost than traditional voting. Through the application of technology and modern identification techniques, this project aims at improving democracy through a reliable framework that assures precision, impartiality, and credibility in future elections.

III. LITERATURE REVIEW

Kashif Hussain Memon [1], In this research paper, a secured e-voting scheme for Pakistan has been proposed, where the fingerprint biometric method will be used for the implementation of a public voting system in Pakistan, aiming to increase transparency and efficiency in the election process while making voters happy. This client/server structure scheme can be executed by using a virtual private network, similar to automated teller machines and local area networks. This system will help in reducing cost and time, addressing many issues that arise in the existing voting system, such as low voter turnout rate, empty ballots, and cheating. The process of our proposed system consists of three phases: registration phase, administration phase, and vote casting phase.

Omkaresh Kulkarni [2], Election is a significant means of any democracy, through which each citizen is allowed to exercise their right to vote. While in-person voting is the most commonly adopted technique to cast votes, factors such as a pandemic situation, natural calamities, or any location-based problem might discourage a person from voting.

Amitesh Yadu [3], All that a person at the polling station needs to do is insert his or her finger into the finger print scanner and get their face captured through the web camera set at the counter of the polling station, thus obtaining the fingerprint and facial recognition of the voter who works. This information is then sent back to the control unit for authentication process. The controller receives the data sent from the reader and verifies the information against the already available information of the same voter obtained at the time of registration.

Tarun Kancherla [4], Electoral integrity is an important factor in ensuring a successful democracy, but conventional voting methods have been known to be prone to election rigging and voter fraud. This research paper discusses a biometric voting solution which uses fingerprint recognition as a method to ensure integrity in elections through implementation of this solution using C# and SQL Server Studio. As the name suggests, a biometric system makes use of biological recognition to identify a unique individual and eliminates any instances of impersonation or duplicate votes. System analysis results show 98% biometric matching accuracy.

Adhya Shetty P [5], The proposed system uses fingerprints and facial feature detection systems to ensure a tamper proof and secure election process. In the registration stage, fingerprints and faces of the voters are collected and saved in a database, which prevents voters from registering more than once. On the election day, fingerprints and faces of the voters are scanned to match the database.

S. Abimanyu [6], The biometric system allows users to scan their irises so that his or her credentials can be authenticated against already available iris images stored in the system's database. The current database of Aadhar will be used to authenticate the voters.

Ankit Mishra [7], The new system includes all the latest advancements in terms of security and privacy. Votes cast will be encrypted using strong encryption algorithms, the blockchain and authentication mechanisms will be applied.

C.M. Nalayini [8], This scheme is designed to enhance election security through a fingerprint identification algorithm for verifying voter identity.

Thus, all eligible voters can take part in the election process regardless of their geographical location. There may be situations such as the COVID-19 epidemic, wherein holding an actual election is impossible, but this model helps to overcome the problem.

IV. SCOPE INCLUDED

1. Aadhaar Based Identification – This system uses information from Aadhaar to identify and authenticate voters.
2. Biometric Fingerprint Authentication – Fingerprints authentication is employed by the system for secure and unique voter authentication.
3. OTP Based Authentication (Fallback) – In case of failure of fingerprints, OTP based authentication is implemented as a fallback mechanism.
4. One Person-One Voting System – This mechanism allows the user to cast only one vote at one go based on voter identification.
5. Voter Registration and Login System – Provides facility to register the user in the system and login into the system for voting.
6. Voting System – This subsystem enables the user to cast their vote using secure interface.
7. Centralized Database Storage – Data related to voter as well as the vote will be stored in centralized database in secure way.
8. Result Generating Module – Enables the system to generate accurate result.
9. Admin Panel – Enables admin to do various operations.

V. REQUIREMENT ENGINEERING

Basic electronic voting Requirement Engineering plays an important role in the development of the EVoting System using Aadhaar and Biometric Verification. This system includes features such as voter registration, login, Aadhaar-based identification, fingerprint authentication, vote casting, and result generation.

The requirements ensure that the system performs secure voter authentication and prevents duplicate or fake voting. A structured requirement engineering approach helps in defining system functionalities clearly, improving communication during development, and ensuring reliable and secure system performance.

Functional Requirements

- The system should allow voters to register and create their account.
- The system should enable users to login using valid credentials.
- The system should verify voter identity using Aadhaar details.
- The system should perform biometric fingerprint verification for authentication.
- The system should use OTP verification when

fingerprint authentication fails.

- The system should allow authenticated users to cast their vote.
- The system should ensure that each voter can vote only once.
- The system should store voter and voting data securely in the database.
- The system should allow the admin to manage voters, elections, and results.
- The system should generate and display election results accurately.

Non-Functional Requirements

- Usability: The system must be easy to use by both voters and administrators.
- Security: The system must have strong security features like Aadhaar, fingerprint, and OTP authentication.
- Reliability: The system must be reliable and work effectively without any data loss or error.
- Performance: The system must execute login, authentication, and voting processes fast and effectively.
- Scalability: The system must work well for many users simultaneously.

VI. EXISTING SYSTEM

Traditional voting is conducted using basic EVMs or paper ballots. Although these methods are common, there are many drawbacks, including late results generation, vote tampering, duplication, and fake voting. Voter ID cards, which serve as the primary means of identification, can be easily counterfeited and exploited, leading to illegal voting. Moreover, the tallying process in traditional voting systems is laborious and lengthy. Despite the use of EVMs, the absence of biometric authentication poses security threats in the system. Therefore, an enhanced system that utilizes biometric verification

through Aadhaar is required to address these limitations and implement an efficient and secure voting process.

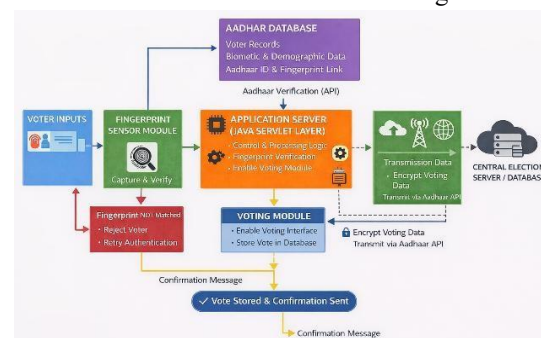
VII. PROPOSED SYSTEM

The suggested project system named "E-voting system with Aadhaar and biometric verification" aims to develop an efficient and effective system for e-voting through a transparent, secure, and reliable voting process. The current system for voting is not very effective as it has some flaws including fake voting, booth capturing, long queues, and late computation of results. The proposed system is aimed at overcoming all these challenges with the use of the Internet and web technologies for automation of the whole voting process. In the proposed system, the voters will be first required to provide their Aadhaar card, and then biometric verification will be performed to validate the identity of the voter. The key goal of the project is to provide voters with an efficient voting process. In particular, the key objective of the project is to automate the process by which the voters will be able to cast their votes online using their computers. Also, the key objective of the system will be to guarantee that no voter casts his/her vote twice.

Some of the key characteristics of the system include:

- Voter authentication through Aadhaar number.
- Fingerprint biometrics for identifying the authenticity of the voter.
- Authorization based on role.
- Instant vote counting and automated generation of results.
- Storage of votes in encrypted format.

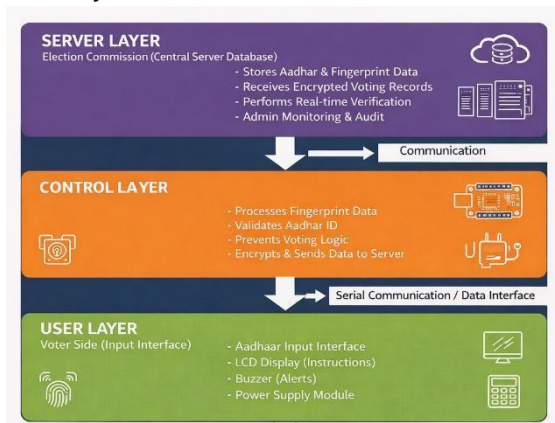
This system provides a number of benefits over the existing conventional systems. This is because it lowers the chances of vote fraud and duplicate voting and saves costs associated with elections and reduces human involvement. Additionally, results can be computed easily. The use of biometrics and Aadhaar numbers ensures that all the voters are legitimate.



VIII. SYSTEM DESIGN

This architecture involves hierarchical levels such as the User Layer, the Control Layer, and the Server Layer, where each level performs its respective tasks in order to facilitate secure and efficient voting.

1. **User Layer** – This layer forms part of the interface where voters make interactions within the system. This includes the Aadhaar input interface, an LCD display interface for commands, a buzzer for alert purposes, and the power supply unit. Voters' inputs include Aadhaar information as well as the biometric data.
2. **Control Layer** – This layer handles all the processing of the information received from voters. This includes fingerprint scanning, validation of the ID, prevention of duplication of votes as well as encryption of data sent to the server.
3. **Server Layer** – This layer acts as the database of the whole system, storing the Aadhaar data, biometric data, and voting information in real time. It acts as the communication point between control layer and the user.
4. **Inter-layer Communication** - The layers communicate securely, with data flowing from the user layer to the control layer and then to the server layer.



IX. METHODOLOGY

The suggested E-Voting system that makes use of Aadhaar along with biometric authentication has utilized a systematic approach for ensuring the security and efficiency of elections. The following is the approach taken by the methodology under consideration:

Voter Registration: Voters provide the required information, which will be stored in the database for future reference.

User Authentication: The elector logs into the system through valid credentials and restricts usage to only authenticated users.

Aadhaar Authentication: The system verifies the identity of the elector through a match of Aadhaar details with those available in the database.

Fingerprints Authentication: The fingerprints of the elector are verified by comparing them with those stored in the database.

OTP Authentication (Falling back): Where fingerprint-based authentication fails, the voter's identity can be confirmed using OTP verification.

Voting: After a successful authentication process, the user will be authorized to cast the vote. The system ensures that the voting process is secure and user-friendly.

Voting Data Storage: The cast vote is safely stored along with the status of the elector to avoid any duplicate votes. It also ensures data integrity and confidentiality throughout the storage process.

Result Generation: The system automatically calculates the results of the election. It ensures accurate and real-time display of voting outcomes.

X. ADVANTAGES

High Security: There is the use of Aadhaar number and fingerprint scanning system for securing and ensuring reliable identification of voters.

Prevention of Multiple Voting: One person, one vote approach is implemented in order to prevent any instances of multiple voting.

Decrease in Manual Labor: Voting and tallying are carried out automatically, reducing the necessity for manual operations that would lead to mistakes.

Quick Calculation of Results: Automatic counting of votes makes results available quickly.

Centralized System of Information Storage: All voters' and voting information are stored in a centralized database.

Easy-to-Use Interface: The user interface for voters and managers is convenient and user-friendly.

XI. LIMITATIONS

Dependence on Biometric Sensors — This system requires fingerprint readers, which might sometimes fail or show signs of unreliability during their usage.

Problems With Fingerprint Quality — The biometric authentication process can be affected due to poor fingerprint quality or faulty sensors.

Dependence on Internet Connection — The system cannot operate without an uninterrupted internet connection.

High Initial Cost — Costs will be incurred when installing and deploying the system for its functioning.

Deployment Limitations — The system was developed for indoor use and is not ready to be employed in nationwide elections.

Vulnerabilities to Attacks — Lack of proper maintenance might make the system vulnerable to cyberattacks.

XII. RESULT

The suggested E-Voting System based on Aadhaar and biometrics was tested after deployment. The software provides functions for user registration, login, and authentication based on Aadhaar details and biometric fingerprint verification. When fingerprint verification fails, users can authenticate using OTP.

Once the user passes the authentication stage, he/she can proceed with voting using the provided web interface. The program ensures one vote per person by changing the voter's status after the voting session. All votes are saved in a central database.

Vote counting is done automatically without manual interference from system administrators. As a result, accuracy and efficiency are significantly improved. The system operated flawlessly during the test run and executed all procedures correctly.

The following results demonstrate the successful implementation and performance of the system during testing.

Figure 1: Voter Registration Page

Figure 2: Biometric Verification

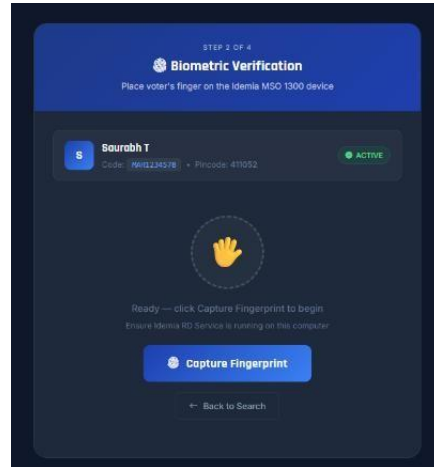


Figure 3: Admin Dashboard

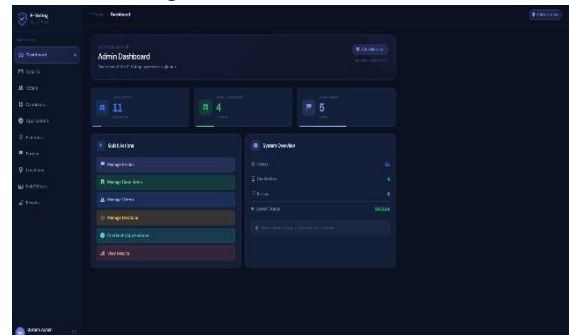
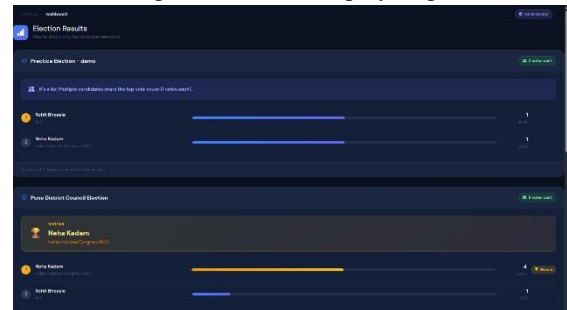


Figure 4: Result Display Page



XIII. CONCLUSION

The E-Voting System proposed, which combines Aadhaar verification with biometric authentication, is a robust system that can be used for current elections. Combining fingerprint verification with Aadhaar authentication will ensure that only eligible voters are able to cast votes, eliminating chances of duplicate and fake votes. This system cuts down on manpower and minimizes human errors in the process of voting and counting votes manually. Every individual can cast only one vote, and results can be delivered efficiently. Overall, the proposed system will improve the election process, making it reliable, transparent, and secure.

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