SECURE AADHAAR & VOTING CARD-ENABLED GOVERNMENT VOTING SYSTEM WITH BIOMETRIC VERIFICATION

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ABSTRACT

The "Secure Aadhaar & Voting Card-Enabled Government Voting System With Biometric Verification" represents a forward-looking approach to enhancing the security, accessibility, and inclusivity of government elections through the integration of biometric verification technologies and trusted identity systems. In an era where the integrity of electoral processes is of paramount importance, this innovative voting system leverages India’s Aadhaar and Voting Card databases to establish a robust, tamper-resistant platform for citizen participation. This proposed system introduces a seamless and secure mechanism for citizens to cast their votes remotely, ensuring greater convenience and increased voter turnout. By utilizing Aadhaar’s biometric data and the Voting Card’s unique identifier, the system minimizes the risk of fraudulent voting, identity theft, and impersonation. Biometric authentication, such as fingerprint scan, adds an additional layer of security, making it nearly impossible for malicious actors to manipulate the electoral process. Key components of this system include a user-friendly mobile application and a web portal that citizens can access to verify their identities, and cast their votes securely. The backend infrastructure integrates Aadhaar and Voting Card databases, guaranteeing real-time verification and authentication. Comprehensive encryption and data protection measures safeguard the privacy of voters, ensuring that their biometric data remains confidential. The benefits of this system are manifold. It reduces the need for physical polling stations, minimizing logistical challenges, and enabling remote voting, particularly advantageous in times of crises such as pandemics. Moreover, it ensures that every eligible citizen has an equal opportunity to participate in the democratic process, promoting inclusivity and reducing barriers to voting.

Keywords: Aadhaar And Voting Card Databases, Biometric Verification, Remote Voting, Mobile Application, Web Portal, Real-Time Verification, Encryption And Data Protection.

I. INTRODUCTION

The development of an online voting system incorporating Aadhaar card and biometric authentication is a significant step in modernizing the electoral process. In a democracy, elections are fundamental, ensuring citizens’ rights to choose their representatives. The integration of Aadhaar cards adds a layer of privacy and identity verification to the system. Biometric authentication further enhances security by using unique physiological traits for voter identification. Online voting not only streamlines the process but also aligns with the digital age, catering to citizens who expect convenient and efficient services, much like those provided by the private sector and the internet. This electronic approach promotes transparency, trust, and accessibility, potentially increasing voter participation. The Aadhaar card, as a unique identifier, prevents fraudulent activities and ensures the authenticity of voters. Biometric authentication, through fingerprint or facial recognition, adds an extra layer of security, making it nearly impossible for impersonation or multiple voting. Integrating these technologies into an online voting system is crucial for maintaining the credibility of the electoral process and instilling confidence in voters. The system allows citizens to vote at their convenience, eliminating the need for physical queues and reducing errors in the vote counting process. Each vote is securely stored in a database, providing a reliable means of determining the election results. This approach caters to the evolving expectations of a society accustomed to web-driven applications and digital services. The development of such a system should not only address the technical aspects but also consider the legal and ethical implications, ensuring that it complies with privacy laws and maintains the highest standards of data security.
By adopting an online voting system with Aadhaar card and biometric authentication, the aim is to create a more efficient, trustworthy, and accessible electoral process that encourages greater citizen participation and bolsters the foundations of democracy.

II. LITERATURE SURVEY

1. Existing System:

In India, the existing voting system is a cornerstone of its democratic process. It encompasses various elements, beginning with the registration of eligible citizens as voters. These voters are allocated to specific constituencies, each represented by elected officials in parliament or state assemblies. The Election Commission of India oversees the entire process, ensuring the fairness and integrity of elections. On the day of election, voters visit their assigned polling stations, where they cast their votes either on traditional paper ballots or through electronic voting machines (EVMs). The votes are then counted, and the candidate with the most votes in each constituency is declared the winner. While the current system combines paper-based and electronic voting, there is ongoing exploration into modernizing the process to enhance security, accessibility, and efficiency. This includes the potential adoption of biometric authentication and online voting systems.

Disadvantages in existing system

- Fraud and Manipulation: Susceptibility to booth capturing, bogus voting, and ballot box stuffing.
- Inclusivity Issues: Difficulty for citizens with disabilities or mobility challenges to reach polling stations.
- Vote Counting Delays: Manual counting of votes leads to time-consuming processes and result delays.
- Geographical Barriers: Logistical challenges in remote or geographically difficult areas for setting up polling stations.
- Environmental Impact: Extensive paper usage in paper ballots contributes to environmental consequences.
- Limited Accessibility: Difficulty in accessing polling stations in densely populated urban areas.
- Voter Disenfranchisement: Challenges in voter registration and identity verification may disenfranchise eligible voters.
- Lack of Transparency: Traditional system may lack transparency and accountability, hindering citizen tracking of the election process.

2. Proposed System

- **Admin**: The system comprises three levels of administration: the Central Admin, State Admin, and District Admin, each with distinct roles and responsibilities.

  - **Central Admin**:  
    **Role**: The Central Admin is responsible for overseeing the entire voting system at a national level.  
    **Responsibilities**: The Central Admin can access all data related to voters across states and districts, making it the highest authority in the system. They can set national-level policies, manage the deployment of the system, and ensure overall security and integrity.  
    **Key Functions**: Setting the national election date and guidelines, monitoring the performance of state and district admins, and ensuring compliance with election laws and standards.

- **State Admin**:  
  **Role**: State Admins are responsible for managing the voting process within their respective states.  
  **Responsibilities**: They have access to all data related to voters in their state, enabling them to manage state-level elections efficiently. State Admins can set voting dates for different cities and regions within their state.  
  **Key Functions**: Configuring election dates for districts and villages, managing state-specific voter databases, ensuring the integrity of the voting process, and coordinating with city admins.

- **District Admin**:  
  **Role**: District Admins are responsible for overseeing the voting process at the city or municipal level.  
  **Responsibilities**: They can access data related to voters in their city, set specific voting dates for different areas within the district, and ensure that the voting process is secure and accessible.  
  **Key Functions**: Configuring voting dates for different areas within the district, managing the district’s voter database, and coordinating with local authorities to facilitate the voting process.
Functional Requirements:

- User Authentication and Authorization.
- System setup and software updates.
- Biometric data management and setting of voting Date and City.
- Election planning and result verification.

Main Flow:

- The admin first logs in to the system using their credentials.
- The admin can register new users into the system, providing necessary details.
- The admin oversees the secure storage and encryption of biometric data, ensuring that it is accessed only for voter authentication during elections.

Figure 1 represents the activity diagram of Admin for our proposed system.

![Figure 1: Activity diagram for Admin User Interface](image)

Voter – In the online voting system, voters play a pivotal role by following a secure process. Initially, they provide their unique Aadhaar number or voter ID for identification. After identity verification through biometric fingerprinting, the voting panel appears on the screen for the voter to make their choice. A second biometric fingerprint is required to confirm the vote, ensuring the rightful individual is casting it. This dual authentication system, involving both initial identification and confirmation, guarantees the integrity and security of the voting process while maintaining simplicity for the voter.

Functional Requirements:

- Voter Registration involves Aadhar and Voting Card Verification.
- Biometric Verification and Address Verification.
- Voting Process involves access to voting system, user-friendly interface, vote casting and verification.
- Security involves Vote Secrecy and Data Encryption.

Main Flow:

- Voter logs into the Voting System by entering Voting Card/Aadhar Card number.
Voter gives a Fingerprint & if match then the voter can cast their vote.
Voter again gives Fingerprints for confirmation of their selections.
After biometric authentication is done successfully then voting is submitted.

Figure 2 represents the activity diagram of Voter for our proposed system.

Figure 1: Activity diagram for Voter User Interface

III. SOFTWARE AND HARDWARE REQUIREMENTS

Model and Material which are used is presented in this section. Table and model should be in prescribed format.

SOFTWARE

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Software</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Flutter IDE</td>
<td>A development environment such as Android Studio or Visual Studio Code with Flutter plugins.</td>
</tr>
<tr>
<td>2</td>
<td>Flutter, Dart, Mobile Device</td>
<td>A cross-platform framework, programming language and</td>
</tr>
</tbody>
</table>
device for testing and deployment used for building Front-End development part.

| 3 | JDK, Spring Boot, Spring Boot IDE | Java development kit and Java-based framework used for Backend-End development part. |
| 4 | RESTful Web Services, Spring Boot Security, OAuth2.0, JSON Web Tokens, Database System | API’s, Authentication and Verification, and database for storage. |

### HARDWARE

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Software</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Server Hardware</td>
<td></td>
</tr>
<tr>
<td>1.1</td>
<td>CPU</td>
<td>A multi-core processor (e.g., quad-core or higher) to handle concurrent requests efficiently.</td>
</tr>
<tr>
<td>1.2</td>
<td>RAM</td>
<td>At least 8GB of RAM.</td>
</tr>
<tr>
<td>1.3</td>
<td>Storage</td>
<td>A SSD with ample storage space for the Spring Boot application, databases, and any data storage.</td>
</tr>
<tr>
<td>2</td>
<td>Client Hardware</td>
<td></td>
</tr>
<tr>
<td>2.1</td>
<td>CPU</td>
<td>Modern smartphones or tablets with dual-core processors or better should be able to run the Flutter-based voting app effectively.</td>
</tr>
<tr>
<td>2.2</td>
<td>RAM</td>
<td>A minimum of 2GB of RAM for smooth operation</td>
</tr>
<tr>
<td>2.3</td>
<td>Storage</td>
<td>At least 16GB is recommended for a voting app, considering media and user data.</td>
</tr>
<tr>
<td>2.4</td>
<td>Capacitive Sensor</td>
<td>Inbuilt fingerprint sensor on client device for proper verification and authentication.</td>
</tr>
</tbody>
</table>

### IV. CONCLUSION

The "Secure Aadhaar & Voting Card-Enabled Government Voting System With Biometric Verification" represents a visionary solution to enhance the integrity and accessibility of government elections in India. By combining the power of biometric technology with trusted identity systems, this system holds the potential to transform the way citizens engage with their democracy, making it more secure, efficient, and inclusive than ever before. This modernized approach offers features such as voter registration, secure login, single voting, and real-time vote counting. With a centralized voter information database ensuring accuracy and security, the benefits of increased voter turnout, cost and time savings, and user-friendliness become evident. Ultimately, this system not only streamlines the democratic process but also fosters transparency, ensuring a brighter future for the democratic landscape in India.

### V. FUTURE SCOPE

- **Machine Learning for Fraud Detection**: Implement machine learning algorithms to detect and prevent fraudulent activities during the voting process. This could include anomaly detection based on voting patterns or behavior analysis to identify potential threats.
- **Usability and User Experience Enhancements**: Focus on improving the usability and user experience of the voting system. Conduct user studies to identify potential pain points and implement design changes to make the system more user-friendly and accessible to a diverse population.
- **Open Source Collaboration**: Consider making the voting system an open-source project, allowing collaboration with the wider community. This can lead to continuous improvements, peer reviews, and a more transparent development process.
- **Cybersecurity Audits and Continuous Monitoring**: Implement regular cybersecurity audits and continuous monitoring to identify and address potential vulnerabilities promptly. This proactive approach will help in maintaining the system’s resilience against evolving cyber threats.
International Standards Compliance: Ensure that the voting system complies with international standards for secure electronic voting. This may involve collaboration with international organizations and adherence to established guidelines to promote trust and reliability on a global scale.

VI. REFERENCES


