



# Enhancing Security in E-Voting through Blockchain Integration and Aadhaar Card Authentication

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## Abstract:

Positive developments have resulted from the incorporation of technology into many elements of social life. Blockchain technology is a significant game shift in this area. Blockchain has transformed many organizations by creating a fair playing field for both customers and large entities such as corporations and governments, thanks to its decentralized architecture and immutability. The blockchain's decentralized structure allows for transparency and independent verification of election results, while immutability ensures the integrity of the voting process by eliminating the possibility of interference. While blockchain-based voting systems have benefits such as decentralization, immutability, and transparency, several difficulties must be addressed. Scalability is one of these difficulties that requires careful consideration. Furthermore, it is critical to ensure the security of the voting process, which includes voter fraud, cyberattacks, and vote manipulation. However, by implementing robust safeguards like voter identification via Aadhaar card authentication and advanced security protocols like multifactor authentication and encryption.

**Keywords:** Blockchain, E-voting, Aadhar Authentication, Indian Elections, EVM

## I. Introduction

Any democratic society must have elections; thus, it is crucial to guarantee their integrity and fairness. Technology has significantly improved many facets of social life, and e-voting technologies have emerged as a viable way to improve election security, efficiency, and transparency. Voter impersonation, vote tampering, and hacking are just a few of the security and privacy risks that traditional e-voting systems are vulnerable to. In light of this, blockchain technology has drawn interest as a possible remedy to these problems and offer safe and transparent voting procedures.

Blockchain is a distributed ledger technology that eliminates the need for middlemen by allowing several parties to administer the same database. This technology's decentralization, immutability, and transparency are just a few of the features that make it suitable for voting systems. Furthermore, blockchain technology can be integrated with the Aadhaar card authentication system used in India to create a secure and efficient online voting system. The Aadhaar unique identification system assigns each Indian resident a 12-digit number based on biometric and demographic information. The Aadhaar system has been utilized for a variety of purposes, including financial transactions and identity verification for government services.

The proposed blockchain-based e-voting system addresses the security difficulties with traditional e-voting systems by improving the efficiency, transparency, and security of Indian elections through the use of Aadhaar card authentication for voter identification. Blockchain technology makes the voting process safer, more transparent, and impregnable, while Aadhaar card authentication makes voter identification reliable and effective. This paper provides a theoretical



framework for an electronic voting system based on blockchain technology in India, with voter identity using Aadhaar card authentication.

The proposed methodology might serve as a model for other countries looking to use blockchain-based electronic voting systems, and it is expected to increase the efficacy, security, and transparency of elections in India. More research and development are required to improve the proposed protocol's effectiveness and scalability, security against potential threats, and resilience against vulnerabilities. Furthermore, more research is needed to understand voter attitudes and perspectives

## II. LITERATURE SURVEY

The use of blockchain technology in e-voting systems has been widely discussed in the literature. Several researchers have proposed blockchain-based e-voting systems as a solution to the security and privacy issues inherent in traditional e-voting systems [6],[2],[3],[9],[5]. These systems typically use a distributed ledger to record votes and provide tamper-proof and transparent results. In the context of developing countries, Shahzad et al. [3] proposed a blockchain-based e-voting system that utilizes smart contracts to ensure the integrity of votes and reduce the risk of fraud. Similarly, Gupta et al. [10] proposed a decentralized e-voting system that uses blockchain technology and cryptographic techniques for secure and private voting.

In the context of India, the use of e-voting has been discussed in several studies. Bose et al. [5] explored the challenges of implementing e-voting in India, including issues related to security, privacy, and infrastructure. They recommended the use of blockchain technology as a potential solution to these challenges. Additionally, Jain and Jain [6] proposed a blockchain-based e-voting system for India that used a combination of smart contracts and distributed consensus algorithms to ensure the integrity of votes.

Furthermore, several studies have explored the security aspects of blockchain-based e-voting systems. For instance, Alotaibi et al. [11] proposed a secure and transparent e-voting system that uses a hybrid blockchain model to address the challenges of scalability, security, and privacy. Similarly, Bhatia et al. [11] proposed a secure e-voting system that uses a consensus-based approach to prevent vote manipulation and ensure the accuracy of results. In addition to the above, the literature has also explored the use of blockchain technology in other aspects of elections, such as voter registration and verification. For example, Bhatia et al. [9] proposed a blockchain-based voter registration system that ensures the accuracy and privacy of voter data. Similarly, Aggarwal and Singh [13] proposed a blockchain-based solution for voter verification that provides a secure and transparent mechanism for voters to authenticate their identity.

## III. SYSTEM ANALYSIS

### A. EXISTING SYSTEM

The proposed biometric electoral voting system allows the user's credentials to be compared to existing fingerprint and iris scans kept in the system's database. Voting is now faster, safer, and more efficient because counting occurs immediately. This approach requires the voter's thumb impression, iris image, and confirmation of their Aadhaar cards. Each voter's complete information, including iris and fingerprint images, is collected and stored in a database. Voters verify their identity by entering their Aadhaar card information, inserting their finger within a fingerprint scanner, and placing their eye in front of an iris camera. The system verifies the voter's identification by matching the iris image to the existing seal in the database. If the data matches, the voter is instructed to vote electronically. The voter is barred



from voting, and vote rigging is suspected if the fingerprints do not match, the voting officer looks for the voter's registration, or the iris image does not match after the fingerprints do.

## DISADVANTAGES OF THE EXISTING SYSTEM

**Security and Tampering:** Discuss how the current system is vulnerable to electoral fraud and tampering.

Highlight past incidents of suspected electoral fraud or involvement.

Discuss cases in which electronic voting machines (EVMs) have been accessed without authorization and the risk of vote manipulation.

**Accountability and transparency:** Explain how the current voting procedure is opaque in terms of reporting and counting votes. Discuss the problems in auditing and certifying election results. Draw attention to instances of doubt and disagreement over the election's transparency. Voter Identification and Impersonation

## B. PROPOSED SYSTEM

The security and integrity of Indian elections are key concerns, and the proposed e-voting protocol addresses these. The Aadhaar Card, provided by the Unique Identification Authority of India (UIDAI), is used to ensure each voter's unique identification under the protocol. The election process is divided into three phases: pre-voting, voting, and post-voting, each with its own set of regulations and principles that work together to ensure impartiality and openness. Several protocols must be followed before the actual voting process begins. At this point, the processes require that a central authority (CA) participate in voter registration. The CA's job is limited to voter registration and has no impact on the election's decentralized blockchain framework. Using a system, each voter will be assigned a unique identity that is linked to their Aadhaar Card. During the voting process, this identification is used to verify the voter's eligibility to vote. To register voters, a central authority (CA) must be involved at the pre-voting stage. The CA will assign each voter a unique identity number that is linked to the information on their Aadhaar card. This ensures that every voter is eligible to participate in the actual voting process.

## IV.SYSTEM DESIGN

### SYSTEM ARCHITECTURE

Below diagram depicts the whole system architecture.

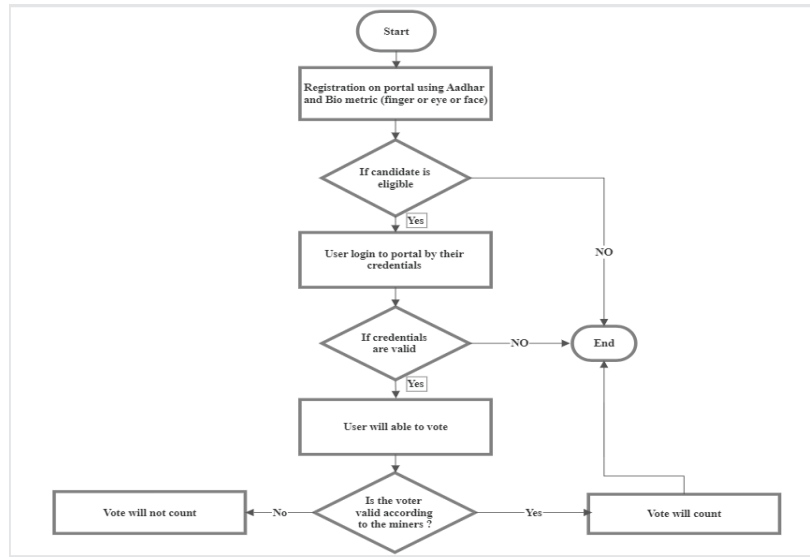


Fig 1. Methodology followed for proposed mode

## V. SYSTEM IMPLEMENTATION

### MODULES

**1. Blockchain Infrastructure:** This section explains how the electronic voting mechanism was constructed. It includes of the blockchain network configuration, the consensus mechanism, and smart contracts for voting records and vote verification.

Functions: Maintains transparency, decentralization, and data immutability during the voting process.

**2. Aadhaar Card Authentication Module:** Purpose: In charge of validating voters' identities using their Aadhaar cards.

Functions: Increases voting process security and prevents voter impersonation.

**3. Voter registration and identification:** Verification: Overview: Oversees the registration and identification of eligible voters.

Functions: Maintains data integrity and confirms the voter list's accuracy.

**4. Vote Casting and Encryption:** Overview: Uses blockchain technology to safeguard the voting process.

Functions: To protect voter privacy, ballot choices are encrypted.

**5. Vote Counting and Verification:** Purpose: Responsible for the transparent counting and verification of votes.

Functions include independent verification of results and ensuring the correctness of the vote-counting system.

**6. Security measures:** Described as follows: Implements security protocols in each module to protect against manipulation and hacking.

Functions: Encrypts data, uses multi-factor authentication, and other security measures to protect the system from assaults.

**7. Scalability and Performance Optimization:** Overview: Addresses scalability difficulties in support of large-scale election operations.

Features: Improves system performance to handle a huge number of votes.



**8. User interface and accessibility:** Describes: Provides voters with an easy-to-use interface while ensuring accessibility for a diverse range of users, including distant voters and those with special needs.

Features: Encourages diversity and enhances the overall voting experience.

**9. Integration with Current Election Infrastructure:** This section explains how to work with electoral commissions and administrative processes to guarantee a smooth and quick transition to India's existing election infrastructure.

Features: Makes it easier to transition from the existing system to blockchain-based electronic voting.

**10. Logging and Audit Trail:** This feature retains detailed records of every vote and transaction conducted on the blockchain.

## VI. RESULTS AND DISCUSSION

The proposed e-voting protocol divides the entire election process into three distinct phases, namely pre-voting, voting, and post-voting

Pape	Verification Method		
	Voter Identifier	Fingerprint	Face Recognition
[10]	Aadhaar Card	YES	NO
[2]	ID Number, Personal Details	NO	NO
[6]	ID Number, Personal Details	NO	NO
Proposed Model	Aadhaar Card	YES	YES

Table 1. Blockchain Based E-Voting Registration Process Comparison

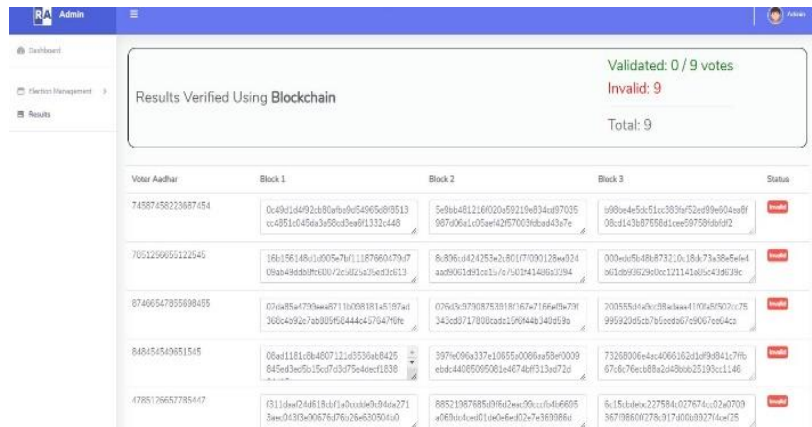


Fig 2. Blockchain based Voting

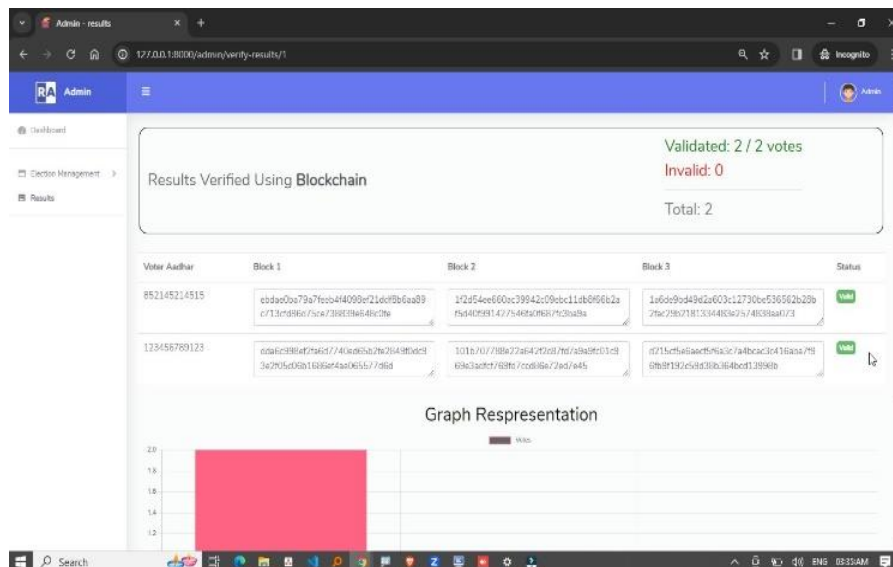


Fig 3.Verifying Blockchain based voting

## VII.CONCLUSION AD FUTURE WORK

Traditional Indian e-voting systems' security problems are imaginatively addressed by the proposed blockchain-based e-voting system with Aadhaar card identification. The use of blockchain technology ensures that the voting process is transparent and irreversible, and the eligibility of voters is validated by Aadhaar card validation, which provides a unique identifying mechanism.

The suggested e-voting protocol divides the entire election process into three distinct phases: pre-voting, voting, and post-voting. At each level, a series of norms and procedures are followed to ensure that the electoral process is secure, fair, and transparent. The protocol does not change the decentralized nature of the blockchain-based election; rather, it leverages the central authority just for voter registration. Overall, the proposed blockchain-based e-voting system with Aadhaar card identification can address the security challenges associated with traditional e-voting systems, hence boosting the effectiveness, openness, and security of Indian elections. It is hoped that this study would contribute to the ongoing discussions in India and other countries about the development of transparent and secure voting systems.

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