iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 13 **Issue:** VII **Month of publication:** July 2025

DOI: https://doi.org/10.22214/ijraset.2025.73359

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 13 Issue VII July 2025- Available at www.ijraset.com

Blockchain-Based Secure Voting System for Transparent Digital Elections in India

Yogita Shivaji Palave
Department of Artificial Intelligence and Data Science, Fabtech Technical Campus College of Engineering and Research, Sangola, India

Abstract: ***A widespread mistrust toward traditional voting systems in India has made digital transformation in elections increasingly crucial. Existing digital systems often lack transparency, scalability, and security, leading to voter disengagement. This paper proposes a blockchain-based voting system tailored to Indian elections.***
The framework ensures voter privacy, decentralization, and verifiable results using cryptographic techniques, smart contracts, and a decentralized app (dApp). The proposed system eliminates the need for physical polling stations, simplifies vote validation, and prevents tampering or fraud. It supports flexible consensus algorithms to improve performance and avoid 51% attacks. This paper discusses system architecture, layered design, implementation methodology, and the potential of blockchain to transform Indian elections.
Keywords: Blockchain, Voting System, E-voting, Smart Contracts, Indian Elections, Cryptographic Hash, Consensus Algorithm.

I. INTRODUCTION

India's large-scale elections involve complex logistics, high costs, and numerous challenges including human error and vote tampering. Traditional systems rely heavily on centralized control and are vulnerable to fraud. Even with EVMs, concerns around data integrity, physical security, and transparency persist. To modernize this process and improve public trust, the implementation of a blockchain-based voting platform is proposed.

II. LITERATURE REVIEW

Farooq et al. proposed a secure framework using blockchain to address transparency in elections. Their model supports smart contracts, cryptographic hashing, and immutability of records. Other models discussed in the literature include consensus algorithms (PoW, PoS), privacy-preserving techniques, and dApps. However, these models do not fully adapt to India's diverse population, languages, and regional constraints.

III. PROPOSED FRAMEWORK

The Indian blockchain voting system is composed of the following key components:

1) Voter Verification using Aadhaar or mobile OTP
2) Unique Vote Coin (VC) assigned to each verified voter
3) Decentralized Application (dApp) for voters to interact securely
4) Smart Contracts to validate votes and transactions
5) Blockchain Ledger to store immutable vote records
6) Miner Nodes to validate transactions and maintain consensus

IV. SYSTEM ARCHITECTURE

The architecture consists of five layers:

1) Interface Layer (dApps for mobile/web voting)
2) Application Layer (authentication, smart contracts)
3) Trust Layer (consensus and block validation)
4) Blockchain Layer (stores encrypted transactions)
5) Security Layer (protects against 51% attack, uses public/private key cryptography)

V. WORKFLOW OF THE PROPOSED MODEL

1) Voter registers via mobile/web using Aadhaar OTP.
2) On successful verification, system assigns one Vote Coin (VC).
3) Voter casts vote by selecting a candidate from their constituency.
4) Vote is hashed and verified by smart contract.
5) Miner adds vote to blockchain as a new block.
6) Voter gets a transaction hash for verification.
7) Vote Coin balance becomes zero, preventing multiple votes.

VI. SECURITY CONSIDERATIONS

The system uses cryptographic hashing to ensure vote data is unreadable without authorization. A digital signature is created using the voter's private key and attached to each transaction. Blockchain immutability prevents deletion or tampering. Smart contracts validate all conditions before a vote is accepted. A custom Chain Security Algorithm checks each block before replication.

VII. FLEXIBLE CONSENSUS ALGORITHMS

To maintain security and performance, the framework supports multiple consensus algorithms such as Proof of Work (PoW), Proof of Stake (PoS), and Proof of Authority. These can be switched dynamically based on node load and election size. The miner’s hash rate is monitored to prevent 51% control.

VIII. IMPLEMENTATION STRATEGY

Initial implementation can begin with local body or college elections as pilot projects. The system will use Ethereum-based smart contracts, with multilingual support in the dApp. Voters receive SMS/email confirmation with transaction hash. Admin dashboards show results in real-time.

IX. RESULTS AND PERFORMANCE ANALYSIS

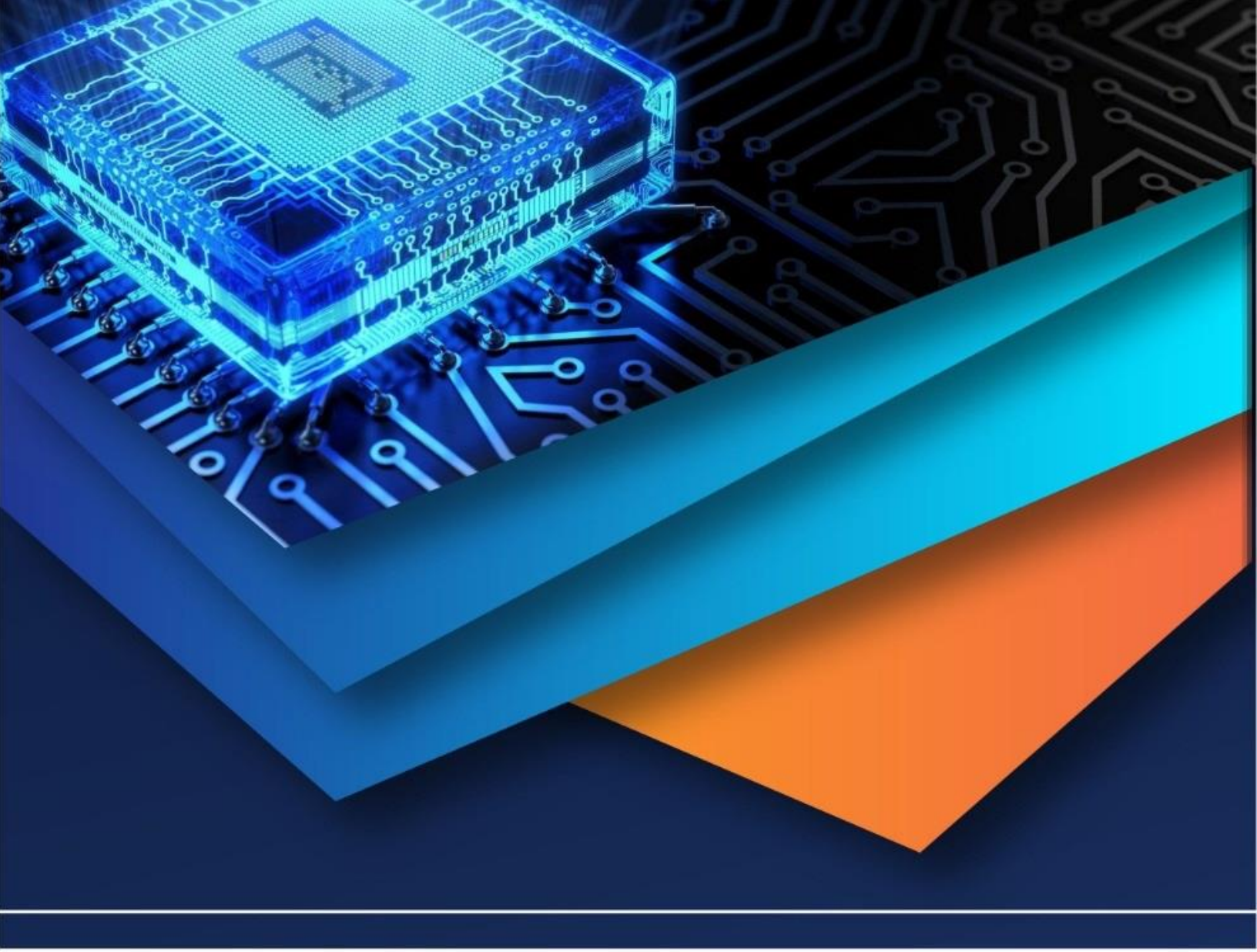
Performance is evaluated based on response time, transaction throughput, and latency. The proposed system reduces human involvement, maintains average response time under 2 seconds, and handles thousands of simultaneous transactions. Risk of vote duplication or tampering is near zero.

X. CONCLUSION

This paper presented a blockchain-based voting system tailored for India. It enhances transparency, scalability, and voter trust. With blockchain's immutability and smart contracts, the system removes the need for physical polling and middlemen. Pilot implementations and awareness campaigns can help adopt this technology for national elections.

REFERENCES

[1] M. S. Farooq et al., "A Framework to Make Voting System Transparent Using Blockchain Technology," IEEE Access, 2022.
[2] B. Shahzad and J. Crowcroft, "Trustworthy electronic voting using adjusted blockchain technology," IEEE Access, 2019.
[3] S. Hossain et al., "E-voting using blockchain," Proc. Int. Conf. Blockchain Tech., 2019.
[4] D. Chaum et al., "End-to-end verifiable optical-scan voting systems," IEEE Security & Privacy, 2008.



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY