



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

# IJRSET

International Journal of Innovative Research in  
**SCIENCE | ENGINEERING | TECHNOLOGY**



# INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 13, Issue 5, May 2024

**ISSN** INTERNATIONAL  
STANDARD  
SERIAL  
NUMBER  
INDIA

Impact Factor: 8.423

9940 572 462

6381 907 438

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# BlockVote: Blockchain-Based Voting System

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**ABSTRACT:** The increasing shift towards digitalization and the growing demand for trustworthy and transparent voting practices have propelled blockchain technology into the spotlight as a promising solution to address the complexities inherent in contemporary voting systems. This research paper comprehensively examines the conceptualization, execution, and evaluation of a blockchain-based voting system. By capitalizing on the immutability and decentralized blockchain framework, the proposed system enhances the dependability, transparency, and ease of the voting process while mitigating common vulnerabilities like manipulation and fraud. It offers an overview of blockchain architecture, encompassing consensus mechanisms and smart contract functionalities, to safeguard vote integrity and confidentiality. Furthermore, the paper evaluates the proposed system's performance, security, and scalability across various election scenarios through simulation and analysis. Our discoveries highlight how blockchain technology has the potential to revolutionize democratic procedures by providing a robust and trustworthy platform for holding elections. However, we acknowledge the practical obstacles and legal issues that need attention for the broad acceptance of blockchain-based voting systems. Overall, this study adds to the ongoing conversation regarding the incorporation of blockchain technology into election administration, offering significant insights and suggestions for creating and executing a secure and effective voting process in the digital era.

**KEYWORDS:** Digitalization, Blockchain technology, Decentralized framework, Smart contract functionalities, Election administration

## I. INTRODUCTION

Blockchain-powered voting systems harness blockchain technology to enhance the integrity, transparency, and security of electoral processes. Unlike traditional voting mechanisms that rely on centralized entities for vote oversight and authentication, it operates on a decentralized and immutable ledger system. This foundational innovation establishes a carefully designed ledger to document all votes or transactions, ensuring transparency and permanence. Through the use of cryptographic techniques, blockchain technology safeguards voter information and prevents unauthorized access or tampering, with each transaction encrypted and connected to preceding transactions, thereby making manipulation of votes nearly undetectable. Additionally, smart contracts, which are self-executing digital agreements stored on the blockchain, automate various aspects of the voting process, such as voter registration, authentication, and result tabulation. This simplifies the voting process while adhering to predetermined rules and regulations.

However, adhering to current electoral laws and regulations poses legal and regulatory hurdles for blockchain-based voting systems. Addressing this intricate regulatory landscape across different jurisdictions requires thorough consideration and collaboration with policymakers. Moreover, establishing trust and confidence in blockchain-powered voting systems among stakeholders is essential for broad acceptance.

## II. LITERATURE SURVEY

[1] Multiple studies have underscored the security benefits offered by blockchain technology in voting systems. By employing cryptographic techniques and decentralized ledger systems, blockchain-based voting systems can effectively prevent tampering, manipulation, and unauthorized access to voting data. The seminal work by

Nakamoto et al. (2008) introduced the concept of blockchain as a secure and transparent ledger for recording transactions, laying the foundation for its incorporation into voting systems.

- [2] Kshetri (2018) highlights that blockchain-based voting systems provide exceptional transparency and accountability, enabling voters to authenticate their votes and examine the electoral process. The study emphasizes the importance of transparency in electoral systems and investigates how blockchain technology can enhance trust and confidence in the electoral process by ensuring the integrity of votes.
- [3] Blockchain-based voting systems offer a notable advantage in improving accessibility and inclusivity. By introducing remote and online voting options, blockchain technology can overcome geographical barriers and encourage higher voter engagement. Research by Tapscott and Tapscott (2016) and Peters et al. (2020) explores the role of blockchain in expanding access to voting, particularly benefiting marginalized communities.
- [4] Despite the promising benefits they offer, blockchain-based voting systems face numerous challenges and constraints. Scholarly literature extensively discusses technical obstacles like scalability, interoperability, and privacy concerns. Additionally, legal and regulatory impediments, such as compliance with electoral laws and data privacy regulations, pose significant barriers to the widespread adoption of blockchain-based voting systems.
- [5] Many academic studies and real-world applications of blockchain-based voting systems have been documented in scholarly sources. For example, Culkin et al. (2019) examine the incorporation of blockchain technology into electoral processes in Estonia, demonstrating the country's pioneering endeavors in employing blockchain for electronic voting.

The literature contains numerous relevant studies and practical deployments of blockchain-based voting systems. Culkin et al. (2019) examine how blockchain technology is used in Estonia's electoral process, providing insight into the key factors motivating the country's adoption of blockchain for electronic voting. In general, research on blockchain-based voting systems underscores the technology's ability to improve the accessibility, security, and integrity of democratic processes. Nonetheless, it is crucial to address technical, legal, and social obstacles to fully realize this potential and ensure the effective deployment of blockchain-based voting systems in actual elections

### III. PROPOSED WORK

Our proposed work aims to develop and implement a blockchain-based voting system that leverages the capabilities of blockchain technology to enhance the integrity, transparency, and accessibility of electoral processes. Our proposed plan of action involves two modules to be completed across three phases. These modules include:

1. User interface for the application.
2. Server-side implementation using Solidity for Blockchain integration.

Each of these modules will be treated as a separate phase, with the remaining phase dedicated to connecting and testing these modules.

1: This phase will focus on the front-end module, encompassing the creation of an interactive user interface for both administrators and users. Concurrently, research activities related to the implementation of Blockchain in decentralized applications will be conducted.

2: Here, attention will shift to the back-end module, where Blockchain will be implemented using the Ethereum framework to transform the system into a decentralized application.

3: The final phase will involve connecting the two modules and conducting comprehensive testing of the platform to ensure its functionality and reliability.

- **Phase One Breakdown:**

Admin Module:

- a) Dashboard: This section will display various charts presenting information such as the number of parties and voters.
- b) Add Candidate: Admins can utilize this feature to add candidates participating in the election. Once added, candidate information will be visible to users.
- c) Create Election: Admins can create an election through this feature, enabling users to cast their votes within the specified start and end dates.
- d) Election Details: In this segment, admins can update election details such as the start and end dates.
- e) Candidate Details: This section displays all candidates added by the admin. Admins can modify candidate details if any inaccuracies are found.

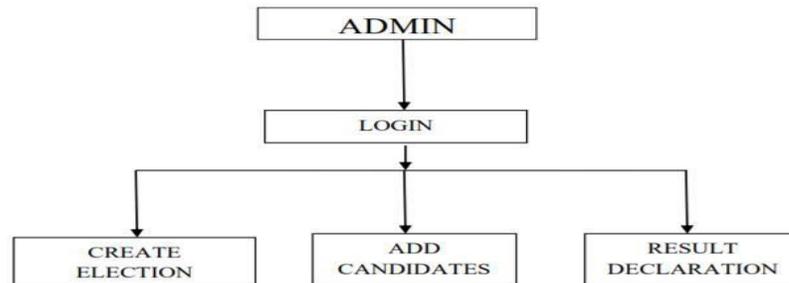


Figure 1: Admin flow diagram

User Module:

- a) Dashboard: Users can access party and candidate information through this dashboard, providing comprehensive insights into each candidate.
- b) Voter Registration: Users must complete registration before being allowed to cast their votes.
- c) Voting Area: Once registered, users will be directed to this page to cast their votes.
- d) Results: Users can view election results in this section once the voting period concludes.

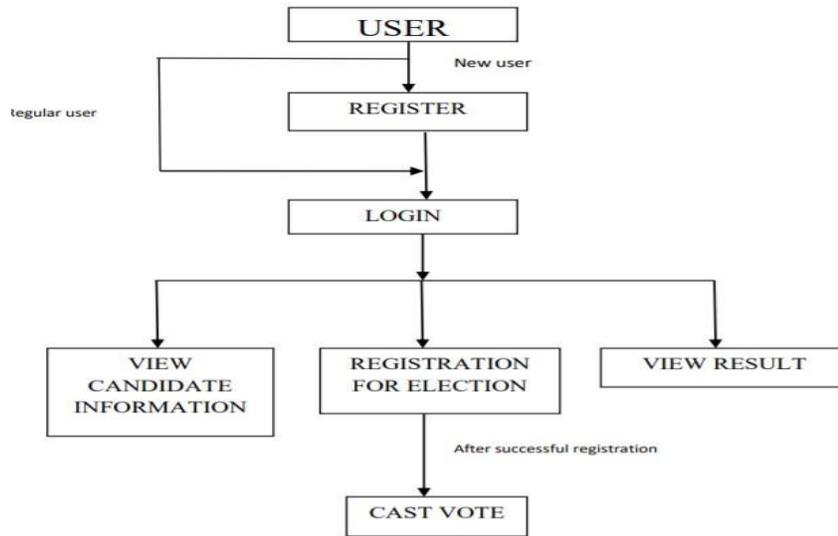


Figure 2: User flow diagram

• Phase Two Breakdown:

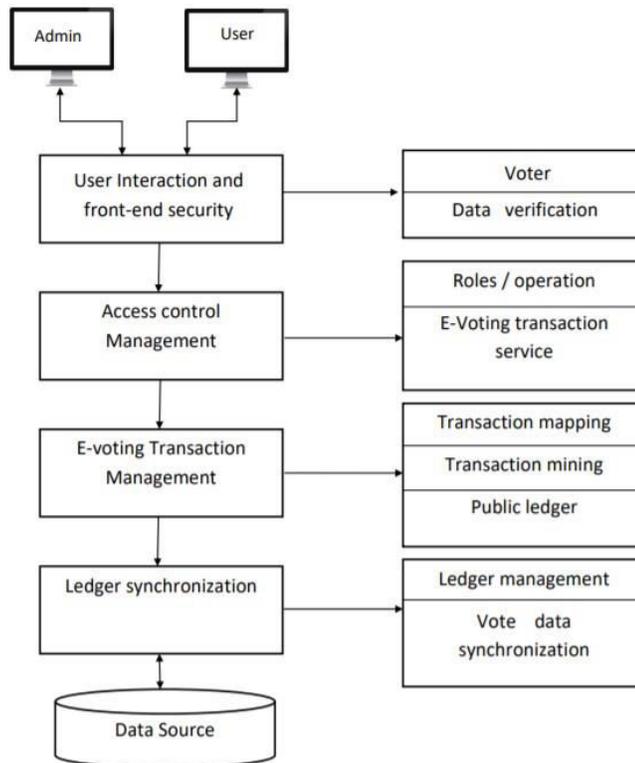


Figure 3: Research Methodology



#### IV. IMPLEMENTATION

Our deployment of the blockchain-based voting system was a meticulous undertaking, involving several pivotal stages. Initially, we concentrated on crafting the framework of the blockchain network, meticulously considering elements like node count and their designated roles. This phase necessitated detailed planning to uphold network decentralization and integrity.

Following this, we delved into creating smart contracts, serving as the backbone of our voting infrastructure. These contracts were intricately designed to automate various voting processes, including registration, ballot generation, and tallying. Substantial effort was dedicated to refining these contracts to ensure their robustness and security. An essential facet of our implementation was the voter registration process. We integrated authentication mechanisms utilizing cryptographic techniques to securely verify voters' identities. Upon verification, voters received unique digital credentials, enabling their participation in elections.

During the voting phase, users accessed a user-friendly interface via a web or mobile application connected to the blockchain network. Each vote was recorded as a transaction on the blockchain, ensuring its immutable and transparent nature.

To safeguard voter anonymity and confidentiality, we employed advanced cryptographic methods such as zero-knowledge proofs or homomorphic encryption to securely encrypt and store votes on the blockchain. Access to view and verify encrypted votes was restricted to authorized parties like election administrators and auditors. Following the conclusion of the voting period, our smart contracts autonomously computed results based on the encrypted votes stored on the blockchain. We conducted meticulous auditing and verification processes to validate the integrity of election results, collaborating with independent third-party entities to verify the accuracy of vote tallies.

- **Coding Part:**

The below smart contract code is used by the system to evaluate user requests and make the voting records decentralized and transparent.

```
pragma solidity 0.5.16;

contract Contest{

    struct Contestant{
        uint id;
        string name;
        uint voteCount;
        string party;
        uint age;
        string qualification;
    }

    struct Voter{
        bool hasVoted;
        uint vote;
        bool isRegistered;
    }

    address admin;
    mapping(uint => Contestant) public contestants;
    // mapping(address => bool) public voters;
    mapping(address => Voter) public voters;
    uint public contestantsCount;
    // uint public counter;
    enum PHASE{reg, voting , done}
    PHASE public state;

    modifier onlyAdmin(){
        require(msg.sender==admin);
        _;
    }
}
```

Figure 4: Smart Contract code

## V. CONCLUSION

In conclusion, We have developed a blockchain-based electronic voting system that harnesses smart contracts to facilitate secure and cost-effective elections while safeguarding voters' privacy. This innovative approach leverages blockchain technology to surmount the limitations and adoption challenges faced by traditional electronic voting systems, thereby ensuring election security, integrity, and transparency. By utilizing an Ethereum private blockchain, we can efficiently process hundreds of transactions per second, optimizing the utilization of smart contracts to alleviate the strain on the blockchain.

Our project is structured into three distinct modules: the front-end module, the back-end module, and the integration and testing phase. Currently, we have completed the first module, which involved creating an intuitive user interface for both administrators and voters. Additionally, we have conducted preliminary research on integrating blockchain technology into decentralized applications.

## VI. FUTURE SCOPE

Future advancements geared towards bolstering voting security show considerable potential with the incorporation of machine learning (ML) and artificial intelligence (AI) principles. Through the utilization of these technologies,

we can authenticate voters' identities during the voting process by comparing them to the information provided during registration.

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