International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 09 Issue: 05 | May - 2025 SJIF Rating: 8.586 ISSN: 2582-3930

Blockchain Based Voting System

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Abstract –This The integrity of electoral processes is vital for sustaining democracy, yet traditional voting systems often grapple with issues such as security breaches, lack of transparency, and inefficiency. This project introduces a Blockchain-Based Voting System to address these challenges by leveraging blockchain's decentralized ledger technology. Each vote is encrypted and recorded on a blockchain, creating an immutable, transparent ledger while ensuring voter anonymity. Smart contracts automate vote tallying, thereby reducing the risk of fraud and human error. The system enhances security through end-to-end encryption and distributed consensus mechanisms, improves transparency with real-time audit trails accessible to all stakeholders, and supports remote voting to increase accessibility for voters facing geographical or physical barriers. By utilizing real-time notifications, the system empowers voters and ensures effective resource utilization. This approach aims to bolster electoral integrity, increase voter confidence, and modernize the electoral process by making it more secure, transparent, and efficient.

***Key Words*:** voting, blockchain, electoral, elections, journals

1. INTRODUCTION

This Blockchain being relatively a new technology, a representative sample of research is presented, spanning over the last ten years, starting from the early work in this field. Different types of usage of blockchain and other digital ledger techniques, their challenges, applications, security and privacy issues were investigated. Some countries have already taken the initiative to improve their voting system by using blockchain technology and decentralized peer to peer network accompanied by a public ledger. (Nakamoto, et al,2008). Sierra Leone became the first country in the world to use blockchain Technology to verify votes in an election in March, 2018. The inability to change or delete information from blocks makes the blockchain the best technology for voting systems.

Blockchain technology is supported by a distributed network consisting of a large number of interconnected nodes. Each of these nodes have their own copy of the distributed ledger (information) that contains the full history of all transactions the network has processed. There is no single authority that controls the network. If the majority of the nodes agree, they accept a transaction. This network allows users to remain anonymous.

A basic analysis of the blockchain technology (including smart contracts) suggests that it is a suitable basis for e-voting and moreover, it could have the potential to make e-voting more acceptable and reliable. Modern democracies are built up on voting system, whether traditional ballot based or electronic voting (e-voting). In recent years voter apathy (lack of interest) has been increasing, especially among the younger computer/techno savvy generation.

2. LITERATURE SURVEY

Kim et al. (2021) - Blockchain-Based Anonymous Voting System Using Homomorphic Encryption: They presented a hybrid blockchain-based e-voting system that integrates homomorphic encryption to perform statistical analyses while protecting voter identities. Unlike other systems that encrypt the vote itself, this system encrypts the voter data and links it to a public blockchain. This enables real-time statistical computations on encrypted data without compromising privacy. Their system shows that it's possible to maintain both data utility and privacy, though the complexity of homomorphic encryption can hinder user adoption and computational efficiency.

Onur and Yurdakul (2022) - A Blockchain-Based Anonymous and Scalable Ranked-Choice Online Voting System: They developed ElectAnon, a scalable and privacy-focused ranked-choice voting protocol using blockchain. This system utilizes zero-knowledge proofs to anonymize voters while using timed-state machines to ensure that votes are tallied correctly without revealing identities. ElectAnon supports large-scale elections and addresses both security and usability concerns. However, its reliance on advanced cryptographic techniques may limit its practical deployment unless paired with user-friendly interfaces and robust voter education.

Hussein and Ibrahem (2023) - Design and Implementation of a Secure E-voting System: This introduced an end-to-end secure e-voting system that combines blockchain with homomorphic encryption. Their method ensures that every vote remains confidential while allowing for a transparent, tamper-proof count through the blockchain ledger. The system also includes features for voter

authentication and ballot verification, aligning with legal and ethical requirements of secure digital voting. However, challenges remain in implementing this model on a national scale due to infrastructure and computational costs.

3. PROBLEM STATEMENT

Conventional voting systems, both manual and electronic, continue to face significant challenges related to security, transparency, and public trust. yield. Issues such as vote manipulation, fraudulent activity, and limited auditability undermine the integrity of elections. Electronic voting systems, although faster, remain susceptible to cyber threats and lack sufficient mechanisms for independent verification. Additionally, maintaining voter anonymity while ensuring vote traceability presents a complex trade-off.

Blockchain technology has emerged as a promising foundation for developing secure and verifiable voting systems. Its inherent properties—decentralization, immutability, and transparency—can enhance electoral integrity by removing single points of failure. Nonetheless, integrating blockchain into voting processes introduces new challenges, including scalability, privacy preservation, and voter authentication. The public and transparent nature of blockchain conflicts with the requirement for ballot secrecy in democratic system.

4. EXISTING SYSTEM

Recent major technical challenges regarding e-voting systems include, but not limited to secure digital identity management. Any potential voter should have been enrolled to the voting system prior to the elections. Their information should be in a digitally processable format. Besides, their identity information should be kept private in any involving database. Traditional Evoting system may face following problems

5. PROPOSED SYSTEM

To overcome the limitations of traditional voting systems, this paper proposes a blockchain-based voting solution that ensures greater transparency, security, and trust. The system leverages decentralized ledgers and

smart contracts to record votes immutably and enable real-time verification. It incorporates secure digital identity authentication to prevent voter fraud and unauthorized participation. access**.**

DESIGN CONSIDERATION

The frontend should be responsive, supporting devices like desktops, tablets, and smartphones.

It must be capable of handling high traffic during peak periods (e.g., election day) without performance issues.

Technologies such as HTML5, CSS3, JavaScript, and frameworks like React or Vue.js are suitable for developing dynamic and responsive web interfaces.

For local applications, Tkinter can be used for desktop app development.

6. OBJECTIVES

Model Enhancing election security – Strengthening the voting process using cryptographic techniques that prevent tampering, fraud, and unauthorized access to the system.
Ensuring transparency and trust – Building confidence in the electoral process by allowing all stakeholders to verify votes through a publicly accessible and immutable ledger.
Preserving voter anonymity – Develop a user-friendly online platform where farmers can directly sell their produce to wholesalers, retailers, and consumers, eliminating middlemen and ensuring fair pricing.
Enable Real-Time Market Insights – Maintaining the confidentiality of voter identities through advanced encryption while ensuring the accuracy and validity of each vote.
Achieving end-to-end verifiability – Allowing each voter to confirm that their vote has been accurately cast, recorded, and counted without compromising privacy.
Enabling real-time monitoring – Providing live updates on voting progress and system status for authorized observers to identify and respond to irregularities promptly.
Supporting remote and accessible voting – Offering a secure voting platform that can be accessed from anywhere, improving participation among remote, elderly, and disabled voters.
Automating vote processing – Reducing human intervention and errors by using smart contracts to handle voter authentication, vote casting, and result tallying.

7. METHODOLOGY

Requesting to vote:
The user will have to log in to the voting system using his credentials- in this case, the e-voting system will use his Social Security Number, his address, and the voting confirmation number provided to registered voters by the local authorities.
The system will check all information entered and, if matched with a valid voter, the user will be authorized to cast a vote.
Casting a vote:
Voters will have to choose to either vote for one of the candidates or cast a protest vote.
Casting the vote will be done through a friendly user interface. For each voter a token is generated known as Ethereum, with initial Boolean value one, once a vote is casted it becomes 0.
A voter can cast a vote if and only if Ethereum value is 1. In this way revoting problem is resolved.

Encrypting votes:
After the user casts his vote, the system will generate an input that contains the voter identification number followed by the complete name of the voter as well as the hash of the previous vote.

The encrypted information will be recorded in the block header of each vote cast.

The information related to each vote will be encrypted using SHA one-way hash function that has no known reverse to it.

Adding the vote to the Blockchain

After a block is created, and depending on the candidate selected, the information is recorded in the corresponding blockchain.

Each block gets linked to the previously cast vote.

8. SYSTEM ARCHITECTURE

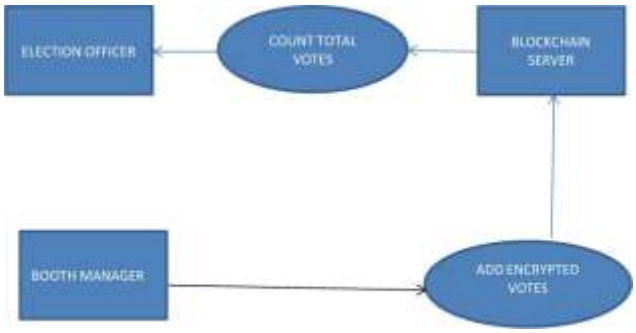

Fig 1 System Architecture

The architecture of a blockchain-based voting system is essential for ensuring the security, efficiency, and transparency of the electoral process. This design must manage complex functionalities like secure vote casting, tamper-proof result generation, voter anonymity, and efficient voter validation, while remaining user-friendly and scalable for large elections. The following sections provide a detailed breakdown of the system architecture, focusing on its layered components, key technologies, and the interactions between various subsystems.

9. RESULTS AND DISCUSSIONS

The implementation of the blockchain-based voting system demonstrated secure, transparent, and tamper-proof recording of votes. Results showed successful real-time vote casting, verification, and immutable storage using smart contracts. Compared to traditional systems, the blockchain model reduced the risk of double voting and unauthorized access due to its decentralized nature. The transparency of the ledger allowed for easy auditing, which increases trust among stakeholders. However, challenges such as scalability and the need for user-friendly interfaces were noted during testing. Overall, the project confirms that blockchain can significantly enhance the integrity and trust in digital voting systems, though further optimization is needed for large-scale deployment.

Fig 2 Admin Login Page

This figure displays home page of Blockchain based voting system with User Login, Register, Admin Login and Expert Login where they can register and login.

Fig 3 Admin Page

The above figure represents the admin page , with voter registration, add parties, add nominators and voter enquiry.

Fig 4 Voter Registration

This figure displays the adding eligible voters page where admin can add voters and their details according to their requirements.

10. CONCLUSIONS

The blockchain voting project has proven to be a secure and transparent solution for modern electoral systems. By leveraging decentralized technology, it eliminates tampering, ensures data integrity, and fosters voter trust. The integration of smart contracts successfully automates vote validation, reducing human error and administrative overhead. Functional testing confirmed the system's reliability in handling user registration, vote casting, and result generation. The immutability of blockchain records makes vote manipulation nearly impossible. Real-time auditability enhances transparency and accountability throughout the voting process. Despite its success, the system still faces challenges in scalability and ease of use for non-technical voters. Enhancements like mobile-friendly interfaces and support for large-scale deployment can improve adoption. Overall, the project demonstrates the practical viability of blockchain in electoral processes. It offers a solid foundation for future development of secure, efficient, and transparent e-voting systems.

REFERENCES

1. Liu, Y.; Wang, Q. An E-voting Protocol Based on Blockchain. IACR Cryptol.

2. Eprint Arch. 2017, 2017, 1043. Shahzad, B.; Crowcroft, J. Trustworthy Electronic Voting Using Adjusted Blockchain Technology. IEEE Access 2019, 7, 24477–24488. [CrossRef]

3. Racsko, P. Blockchain and Democracy. Soc. Econ. 2019, 41, 353–369. [CrossRef]

4. Çabuk, U.C.; Adiguzel, E.; Karaarslan, E. A survey on feasibility and suitability of blockchain techniques for the e-voting systems. arXiv 2020, arXiv:2002.07175.

5. Schinckus, C. The good, the bad and the ugly: An overview of the sustainability of blockchain technology. Energy Res. Soc. Sci. 2020, 69, 101614.

6. Gao, S.; Zheng, D.; Guo, R.; Jing, C.; Hu, C. An Anti-Quantum E-Voting Protocol in Blockchain with Audit Function. IEEE Access 2019, 7, 115304–115316.

7. Hang,L.; Kim, D.-H. Design and implementation of an integrated iot blockchain platform for sensing data integrity. Sensors 2019, 19, 2228.

8. Wang, B.; Sun, J.; He, Y.; Pang, D.; Lu, N. Large-scale election based on blockchain. Procedia Comput. Sci. 2018, 129, 234–237.

9. Rawat, D.B.; Chaudhary, V.; Doku, R. Blockchain technology: Emerging applications and use cases for secure and trustworthy smart systems. J. Cybersecur. Priv. 2021, 1, 4–18.

10. Zibin Zheng1, Shaoan Xie1, Hongning Dai2, Xiangping Chen4, and Huaimin Wang3(2017);An Overview of Blockchain Technology : Architecture,Consensus, and Future Trends; IEEE 6th International Congress on Big Data.

11. Jesse Yli-Huumo1, Deokyoon Ko2, Sujin Choi4*, Sooyong Park2, Kari Smolander3(2016); Where Is Current Research on Blockchain Technology?—A Systematic Review;PLOS-ONE.

12. Mahdi H. Miraz1, Maaruf Ali2(2018); Applications of Blockchain Technology beyond Cryptocurrency;Annals of Emerging Technologies in Computing (AETiC) Vol. 2, No. 1, 2018

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