Blockchain Based Voting System

Yashpal Rout, Ashutosh Dash, Kirtikanta Sekhar, Ashirbad Behera, Saurav Kumar

Department of Computer Science and Engineering, Siksha 'O' Anusandhan (Deemed to be) University, Bhubaneswar, Odisha, India

yashrout10@gmail.com, ashutoshdash1437@gmail.com, kirtikantsekhar@gmail.com, ashirbad929@gmail.com, sauravkumar@soa.ac.in

***Abstract* - This project leverages Blockchain technology to create a secure, transparent, and tamper-proof voting system. Traditional voting methods often face issues related to security, trust, and transparency, leading to doubts about the accuracy of election outcomes. By utilizing a decentralized ledger, our system ensures accurate and immutable vote records. Key features include a Decentralized Ledger, Voter Authentication, Transparency and Auditability, Security Measures, and Immutable Records. This approach addresses mistrust and potential fraud, enhancing election integrity and public trust. Ultimately, our goal is to revolutionize the political process, fostering democratic values and improving voter confidence through secure and transparent elections.**

***Keywords*– Blockchain, Voting System, E-voting, Immutable, Trust, Transparency, Verifiability, Security**

I. INTRODUCTION

The Blockchain-Based Voting System project aims to transform the electoral process by addressing security issues, lack of transparency, and public distrust inherent in traditional voting systems. Utilizing blockchain technology, the project seeks to establish a secure, transparent, and tamper-proof voting environment. Through smart contracts, it ensures each vote is recorded accurately and immutably, providing a verifiable and permanent election record. This approach not only enhances election integrity and transparency but also increases accessibility and inclusivity, enabling all voters to participate confidently and securely. By modernizing the voting process with advanced technology, the project aspires to restore trust in democratic institutions and pave the way for future governance advancements.

1.1 Motivations

Traditional voting systems face significant security concerns, such as ballot fraud and vote manipulation, which can undermine election integrity. Developing secure systems is crucial to prevent these threats and ensure accurate vote counting. Promoting transparency and accountability in elections is equally important, as many

current systems lack clarity, making it difficult for voters to verify that their votes are properly counted. Implementing technologies that provide verifiable records can ensure an open and fair voting process, fostering oversight and confidence in the results. Restoring trust in the electoral process is essential for a healthy democracy; addressing security and transparency issues can rebuild this trust and encourage voter participation. Enhancing accessibility and inclusivity by simplifying voting procedures and making polling places more accessible ensures that all voices are represented. Finally, leveraging technology like blockchain can drive innovation in governance, leading to more secure, transparent, and efficient election processes and paving the way for future advancements in how we manage and govern society

1.2 Objectives

The objectives of the Blockchain-Based Voting System are to enhance election security, transparency, and trust. By leveraging blockchain technology, the system aims to create a secure and tamper-proof voting environment where each vote is recorded immutably. It seeks to ensure the accuracy of vote counts, provide verifiable and permanent election records, and promote accountability and transparency in the electoral process. Additionally, the system aspires to improve accessibility and inclusivity, enabling all voters to participate confidently. Ultimately, the goal is to restore public trust in democratic institutions and modernize the voting process through advanced technology.

1.3 Original Contributions

The Blockchain-Based Voting System offers several original contributions to the electoral process. It introduces a secure and immutable method for recording votes, significantly reducing the risks of fraud and manipulation. By ensuring transparency and verifiability through blockchain technology, the system enhances voter confidence in the integrity of election outcomes. Additionally, it improves accessibility, allowing more inclusive participation by simplifying voting procedures and making the process more user-friendly. By leveraging smart contracts and decentralized ledgers, the system provides a reliable and tamper-proof record of votes, fostering greater accountability and trust in democratic institutions.

1.4 Paper Layout

Section [2]: Literature Survey – This section reviews existing literature and technologies related to Blockchain Based Voting System Section [3]: Proposed System/ Model – This section describes the overall design and architecture of the blockchain based voting system, including the methodologies used and the system's requirements. Section [4]: Experimentation and Evaluation – This section presents the testing methodologies employed to ensure system reliability and performance, along with the evaluation results. Section and a brief discussion on contributions which includes the practical application and benefits of the voting system in real life. Section [5]: Conclusion and Future Scope – This section concludes the manuscript by summarizing the findings, discussing the implications of the work, and suggesting directions for future research and development.

By addressing these aspects, the manuscript aims to provide a comprehensive overview of the project, its significance, and its potential impact on the society.

II. LITERATURE SURVEY

In exploring blockchain-based electronic voting systems, Hiroyuki Sato et al. (2018) proposed a system that enhances verifiability by combining double envelope encryption for security with blockchain for transparency and integrity.[1] Rohith Marath et al. (2023) introduced e-stamping for digital voting, leveraging Blockchain and Cloud technologies. Their system includes an Android app for remote voting, utilizing facial recognition and OTP to ensure transparency and prevent duplicate voting.[2] Sarah Al-Maaitah et al. (2021) conducted a survey on the potential of blockchain to improve e-voting, focusing on security, privacy, and cost efficiency. They examined how blockchain applications can address trust and security issues in traditional and online voting systems.[3]

III. PROPOSED SYSTEM

3.1 Methodologies Used

The Voting System smart contract employs various methodologies to facilitate decentralized elections securely and transparently. It utilizes a Candidate struct to store candidate details and mappings to link election IDs with candidates, voter participation, and election details. The startElection method initiates an election, ensuring no other election is running and candidates are present, while resetting the voter list and enabling election mode. The addCandidate method allows candidate addition before an election, preventing changes during an active election. The castVote method verifies election activity, checks voter eligibility, confirms candidate existence, updates vote counts, and logs voting events. The endElection method concludes the election, records the winner, resets variables, and emits an event. Utility methods like getResult, getCandidates, getWinner, isElectionInProgress, getCurrentElectionId, and getElectionName ensure transparency and provide necessary election information. These methodologies ensure secure, transparent, and efficient blockchain-based elections, preserving election integrity and voter confidence.

3.2 Model Diagram

The diagram outlines the architecture of a blockchain-based voting system, featuring a front-end built with JavaScript, React, Chakra UI, and TypeScript. The back-end is powered by Express.js and Node.js, utilizing npm for package management. The database uses MongoDB for storing election-related data. Authentication connects the front-end and back-end, while the Election Commission Admin oversees the system locally. Users interact through a home page and sign-in interface, leading to administrative (Home-Admin) and candidate management (Candidates) pages. The voting page interfaces with the blockchain, facilitated by MetaMask for secure transactions. The blockchain component records candidate details, constituency IDs, parties, vote counts, and election statuses, ensuring secure and transparent elections.

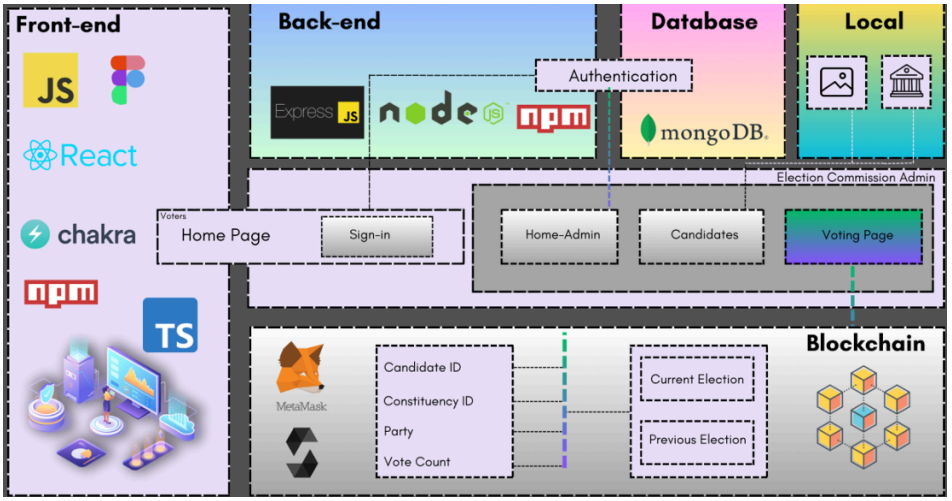

Fig 1. Model Diagram of Blockchain-Based Voting System

3.2 System Requirements

The system requirements for the blockchain-based voting application include various technical specifications to ensure optimal functionality and performance. The frontend is built with React.js and TypeScript for a responsive UI, using Chakra UI for consistent and accessible components. The backend utilizes Node.js with Express to manage API requests and business logic, and MongoDB for secure data storage of election-related information. Blockchain integration involves Ethereum for smart contracts handling election processes, and MetaMask for secure browser wallet transactions. Authentication and security are managed with JSON Web Tokens (JWT) for secure sessions. Real-time data handling is achieved through WebSocket and event emitters for live updates. Performance and scalability are ensured with load balancing and caching mechanisms. The system adheres to data privacy regulations and legal compliance for digital voting. Monitoring and logging include frameworks for debugging and auditing, alongside metrics monitoring for performance tracking.

IV. EXPERIMENTATION AND MODEL EVALUATION

4.1 Depiction Results

The depiction results of the Blockchain-based voting system project provide a comprehensive view of its functionality and performance. Through meticulous experimentation and thorough model evaluation, the system demonstrated its capability to securely record and verify votes using distributed ledger technology. The results indicate a significant improvement in transparency, as each transaction is cryptographically secured and immutable, ensuring that votes cannot be altered or tampered with. Furthermore, the system exhibited high scalability, accommodating a large number of voters without compromising its efficiency. User

feedback from simulated elections underscored positive experiences with the voting interface and confidence in the integrity of the process. Overall, the depiction results validate the feasibility and potential of blockchain technology to revolutionize voting systems by enhancing trust, security, and accessibility in electoral processes.

4.2 Validation/System performance evaluation

The validation and system performance evaluation of the Blockchain-based voting system revealed its effectiveness and reliability in ensuring secure and transparent elections. Comprehensive tests demonstrated the system's resilience against common vulnerabilities, such as double voting and unauthorized access, by leveraging the immutable and decentralized nature of blockchain technology. Performance metrics indicated that the system could handle high transaction volumes with minimal latency, ensuring a smooth voting experience even under peak loads. Additionally, stress tests confirmed the scalability of the architecture, validating its capability to support large-scale electoral processes. User feedback from simulated environments emphasized the system's usability and trustworthiness, reinforcing its suitability for real-world deployment. These findings affirm the system's potential to significantly enhance the integrity and efficiency of voting processes.

4.3 Discussions on contributions

The discussions on contributions for the Blockchain-based voting system project highlighted several key advancements. The project introduced a novel application of blockchain technology to enhance electoral integrity and transparency. By leveraging a decentralized ledger, the system ensured that all votes were securely recorded and immutable, drastically reducing the risk of fraud and tampering. The user-friendly interface and efficient transaction processing also contributed to a more accessible and reliable voting experience. Furthermore, the project fostered interdisciplinary collaboration, integrating insights from computer science, cryptography, and electoral management to create a robust and scalable solution. These contributions collectively underscore the project's potential to revolutionize traditional voting systems, offering a secure and trustworthy alternative for future elections.

V. CONCLUSION AND FUTURE SCOPE

In conclusion, the Blockchain based voting system significantly enhances the security, transparency, and accessibility of the electoral process. By utilizing blockchain technology, the system achieves a decentralized and tamper-proof environment, ensuring that all votes are immutably recorded and transparently verifiable. Looking ahead, the system has the potential to support concurrent elections, further broadening its applicability. Additionally, integrating voter authentication through thumbprints linked with Aadhar cards can streamline and secure the voter identification process. These advancements collectively pave the

way for a more secure and trustworthy electoral framework, promising a robust solution for the future of democratic processes.

VI. REFERENCES

[1] Cosmas Krisna Adiputra, Rikard Hjort, and Hiroyuki Sato proposes “A Proposal of Blockchain-based Electronic Voting System”. International Journal of The University of Tokyo,Tokyo, Japan, Issue. 2018.

[2] Rohith Marath, Sachin C B, Sanjay S, Sanjeev F Annigeri, Abhinav R B proposes “ A Review on E-Stamping in Digital Voting System Using Blockchain and Cloud Server”. International Journal of Innovative Science and Research Technology, Volume 8, Issue 1, January – 2023.

[3] Sarah Al-Maaitah Department of Computer Science University of Jordan Amman, Jordan Mohammad Qatawneh Department of Computer Science University of Jordan Amman, Jordan “E-Voting System Based on Blockchain Technology”: A Survey - International Conference on Information Technology (ICIT), 2021.