IJITCE

ISSN 2347- 3657

International Journal of Information Technology & Computer Engineering

Email : ijitce.editor@gmail.com or editor@ijitce.com

International Journal of Information Technology & Computer Engineering

ISSN 2347–3657

Volume 13, Issue 2, 2025

BLOCKCHAIN-BASED SECURE VOTING SYSTEM FOR TRANSPARENT ELECTIONS

Lakki Reddy Vyshnavi Reddy[1], Putta Rahul [2], Ramadola Anvika [3], Mr. K. Ganapathi Babu [4]
[1,2,3]UG Scholar, Department of Computer Science and Engineering, St. Martin's Engineering College, Secunderabad, Telangana, India, 500100
[4]Assistant Professor, Department of Computer Science and Engineering, St. Martin's Engineering College, Secunderabad, Telangana, India, 500100
[4] kganapathibabucse@smec.ac.in

Abstract:

The rapid advancements in technology have paved the way for an efficient and secure online voting system, addressing challenges faced in traditional voting mechanisms. Online voting systems aim to provide a convenient, accessible, and efficient alternative to manual voting processes. However, the history of online voting systems reveals persistent challenges related to security, transparency, and voter privacy. Traditional systems, such as paper ballots and early electronic voting systems, were prone to issues like ballot tampering, vote manipulation, and lack of trust due to opaque processes. Despite attempts to introduce digital voting platforms, concerns about hacking, data breaches, and lack of transparency hindered widespread adoption. The motivation behind developing a smart online voting system using blockchain technology stems from the pressing need for a secure, transparent, and tamper-proof voting mechanism. Events such as vote manipulation in elections, technical failures, and voter fraud highlight the inadequacies of traditional systems. Blockchain technology, with its decentralized, immutable, and transparent nature, offers a promising solution to these challenges. The proposed system leverages blockchain to ensure the integrity of votes, maintain voter privacy, and enable real-time verification. Smart contracts within the blockchain automate processes like voter authentication and result tallying, minimizing human intervention and errors. By integrating blockchain into the voting system, this research aims to eliminate issues like vote duplication, unauthorized access, and result tampering, ensuring trust among voters and authorities. The smart online voting system enhances accessibility, allowing eligible voters to cast their votes remotely using secure digital authentication methods. This approach addresses the limitations of traditional systems and sets a new standard for secure and reliable democratic processes, fostering trust and participation in elections globally.

Keywords: Blockchain, Authentication, tamper-proof.

1. INTRODUCTION

India, being the world's largest democracy, conducts massive elections regularly, involving millions of voters and thousands of polling booths. The traditional voting methods, including paper ballots and Electronic Voting Machines (EVMs), have evolved over the decades. Despite significant improvements, issues such as voter fraud, ballot tampering, and logistical challenges persist. According to reports, voter turnout in India has been inconsistent, often dipping below 60% in some regions, highlighting accessibility challenges. Digital advancements introduced online voting systems,

but security breaches and lack of transparency hindered their adoption. Blockchain, with its decentralized and secure framework, is now emerging as a revolutionary technology for addressing these limitations. A Smart Online Voting System using Blockchain Technology ensures secure, transparent, and tamper-proof elections, overcoming the flaws of traditional systems. Applications include government elections, organizational decision-making, corporate voting, and secure online surveys, enabling trust and efficiency across domains.

At Traditional voting systems in India, including paper ballots and EVMs, face numerous issues such as vote tampering, voter impersonation, and limited accessibility. These systems are vulnerable to fraud, lack transparency, and involve significant logistical costs. Online voting systems introduced to address these challenges often fail due to security vulnerabilities, data breaches, and insufficient voter authentication mechanisms.

The motivation for this research stems from the need for a secure and efficient voting system that ensures voter confidence and participation. Blockchain technology, with its immutable and decentralized structure, promises to address trust issues. High-profile election controversies, voter fraud cases, and the digital transformation in governance inspired the development of a reliable, transparent, and inclusive system.

2. LITERATURE SURVEY

Liu Y., Wang Q. [1] This study introduces an e-voting protocol based on blockchain technology, leveraging its decentralized and tamper-proof characteristics to ensure secure voting. The authors emphasize the importance of voter anonymity, data integrity, and resistance to manipulation, presenting a framework that addresses common vulnerabilities in traditional electronic voting systems.

Shahzad B., Crowcroft J. [2] This work discusses an adjusted blockchain technology to create trustworthy electronic voting systems. By incorporating improved consensus mechanisms, it ensures transparency, efficiency, and scalability while addressing issues like network latency and energy consumption associated with traditional blockchain systems.

Rustam et al. [3] performed a comparative analysis of supervised machine learning models for sentiment analysis on COVID-19 tweets. Their research evaluates models like Random Forest, Logistic Regression, and LSTM networks, focusing on their accuracy and efficiency in processing large datasets. They emphasize the need for balanced datasets to improve classification performance. Their approach to data balancing and model evaluation is relevant to VR user experience classification, where diverse interactions need to be analyzed in real-time.

Yaga D., Mell P., Roby N., Scarfone K. [4] This comprehensive overview of blockchain technology focuses on its foundational principles, applications, and challenges. The authors provide insights

International Journal of Information Technology & Computer Engineering

ISSN 2347–3657

Volume 13, Issue 2, 2025

into the potential use cases of blockchain, including voting systems, while emphasizing scalability and security concerns.

The Economist EIU Democracy Index [5] This index offers a global perspective on democracy, ranking countries based on electoral processes, political participation, and civil liberties. It serves as a benchmark to understand the readiness of different nations for adopting innovative solutions like blockchain-based e-voting.

Cullen R., Houghton C. [6] The study evaluates the effectiveness of online platforms for promoting democracy, specifically examining New Zealand government websites. It discusses how online systems can foster citizen engagement and transparency, providing a foundation for blockchain integration.

Schinckus C. [7] This paper investigates the sustainability of blockchain technology, discussing its environmental impact, energy efficiency, and the trade-offs between decentralization and scalability. It also evaluates the long-term feasibility of blockchain in critical applications like e-voting.

Gao S., Zheng D., Guo R., Jing C., Hu C. [8] The authors propose an anti-quantum e-voting protocol integrated with blockchain, ensuring quantum-resilient encryption and audit functionality. The system is designed to future-proof e-voting against emerging quantum computing threats.

Kim T., Ochoa J., Faika T., et al. [9] This study explores cyber-physical security concerns and the role of blockchain in safeguarding systems like battery management. It emphasizes the importance of blockchain in creating tamper-proof records, relevant to secure e-voting environments.

Hang L., Kim D.-H. [10] The paper outlines an IoT-integrated blockchain platform for ensuring data integrity, which has implications for secure data transmission in e-voting. It highlights the importance of real-time monitoring and tamper-proof mechanisms.

Chang V., Baudier P., Zhang H., et al. [11] This research explores blockchain's impact on financial services and provides recommendations for addressing challenges like scalability and governance. The findings offer insights into the technology's application in secure and transparent voting systems.

3. PROPOSED METHODOLOGY

The Smart Online Voting System using Blockchain Technology aims to overcome the limitations of traditional voting methods by providing a secure, transparent, and efficient solution for elections. Blockchain technology's decentralized and immutable nature makes it ideal for creating a voting platform that guarantees the integrity of votes, enhances voter privacy, and ensures transparency throughout the election process. The implementation of this system involves several key steps, from voter registration to vote tallying, ensuring that the entire voting process is secure, tamper-proof, and auditable in real-time.

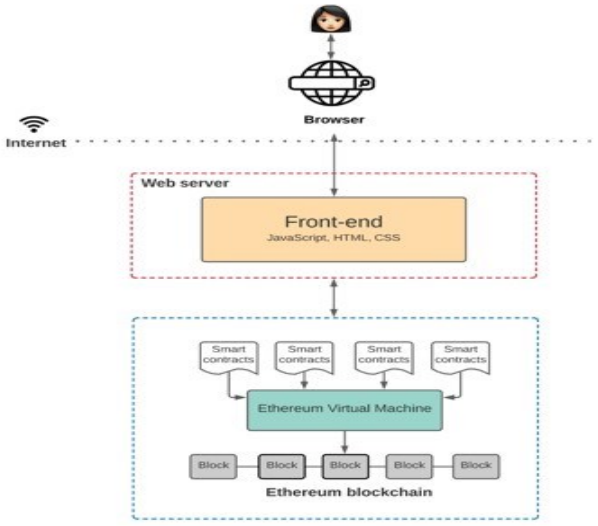

Figure 1: Block Diagram

Applications:

- **Government Elections:** Secure and transparent general and local body elections ensuring trust and participation.
- **Corporate Decision-Making:** Efficient shareholder voting systems for corporate resolutions.
- **Educational Institutions:** Conducting student body elections with minimal supervision.
- **Referendums and Surveys:** Reliable platforms for public consultations and feedback collection.
- **Non-Profit Organizations:** Transparent voting for board decisions and memberships.
- **Smart Cities:** Decentralized decision-making for community-based initiatives.
- **Policy Making:** Efficient and secure mechanisms for crowdsourced policymaking.
- **International Voting:** Enabling expatriates to participate securely in elections from abroad

Advantages:

CNNs offer several advantages over traditional machine learning algorithms:

- **Automatic Feature Extraction**: CNNs autonomously learn relevant features from raw input data, eliminating the need for manual feature engineering.
- **Parameter Sharing**: Convolutional filters are applied across the entire input, reducing the number of parameters and computational load.
- **Translation Invariance**: CNNs can recognize objects regardless of their position in the image, enhancing robustness.
- **High Accuracy**: CNNs have achieved state-of-the-art performance in various image and video recognition tasks.

International Journal of Information Technology & Computer Engineering

ISSN 2347–3657

Volume 13, Issue 2, 2025

- **Robustness to Noise**: CNNs are robust to noise and distortion in the input data, which makes them highly effective in real-world applications.

4. EXPERIMENTAL ANALYSIS

The e-voting system is a secure and decentralized application designed to leverage blockchain technology and cryptographic techniques for tamper-proof and transparent elections. It ensures the integrity of sensitive voter and candidate data through Elliptic Curve Cryptography (ECC), which encrypts Aadhaar information, and SHA256 hashing, which adds an additional layer of data authentication. The platform interacts with a blockchain deployed on a local Ethereum network to store and retrieve election-related data, such as voter credentials, party details, and vote records, ensuring immutability and reliability. A robust admin panel allows election administrators to manage candidates, set election dates, and oversee results, while users can securely register, log in, and cast their votes. To prevent duplicate voting, the system checks against previously cast votes. After elections, it calculates and displays results, highlighting the winning candidate and their vote count. The system ensures secure data transmission and storage by combining blockchain's decentralized structure with ECC's lightweight encryption. It also provides an intuitive user interface for voters, candidates, and administrators, promoting ease of use while maintaining strict security and transparency. By combining cryptographic security, blockchain immutability, and comprehensive election management features, this e-voting solution addresses the challenges of fraud, data manipulation, and privacy breaches in traditional voting systems.

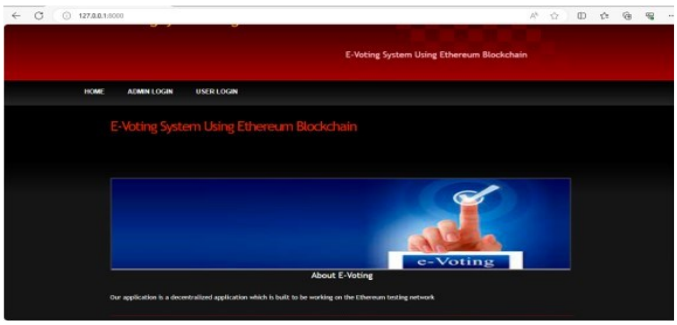

Figure 1: Home Page

Figure2: Login Screen

Figure 3: Candidate Register

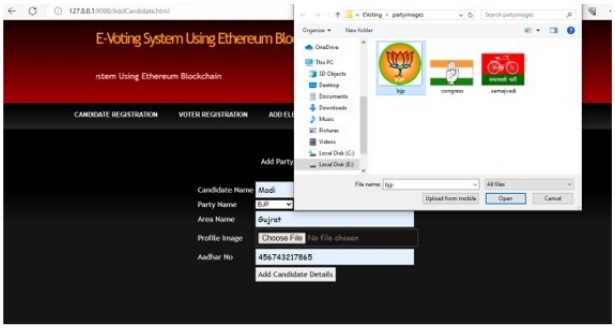

Figure 4: Add Party

Figure 5: Candidate added Successfully

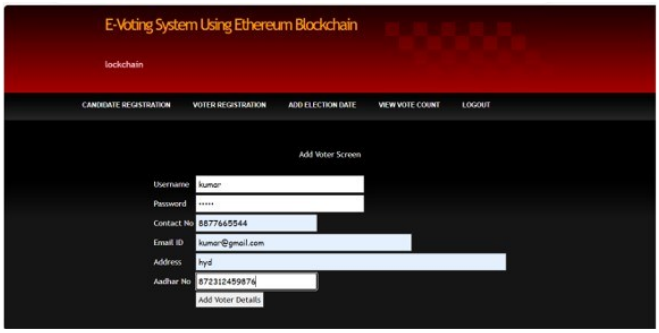

Figure 6 : Voter Screen

International Journal of Information Technology & Computer Engineering

ISSN 2347–3657

Volume 13, Issue 2, 2025

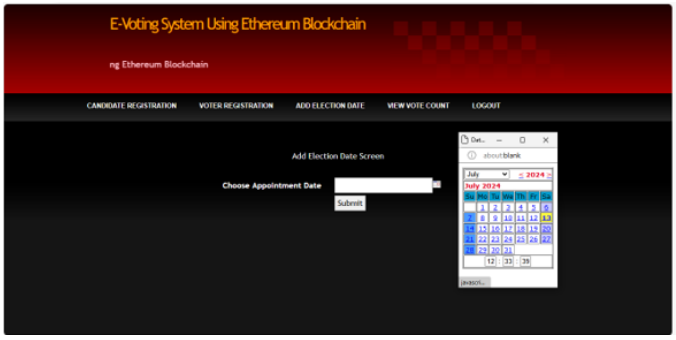

Figure 7: Election Date Choose

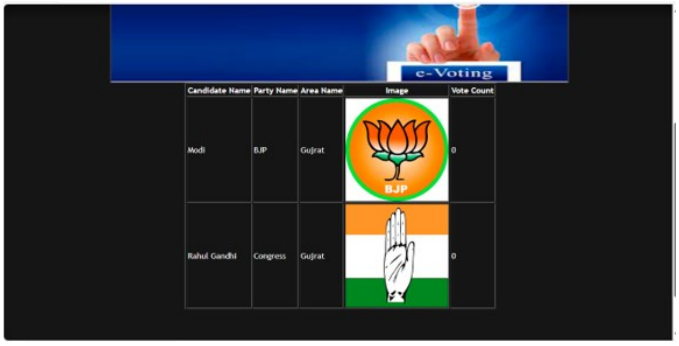

Figure 8: Party View Screen

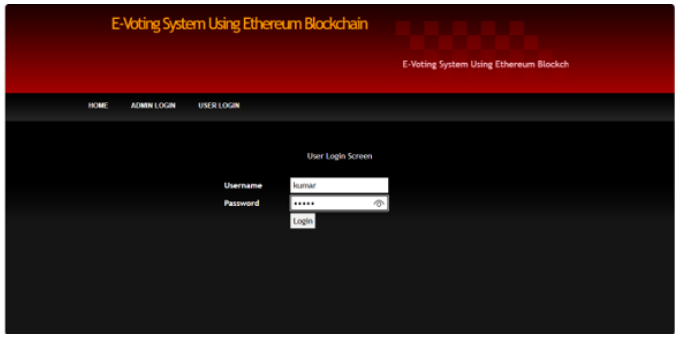

Figure 9: Voter Login Screen

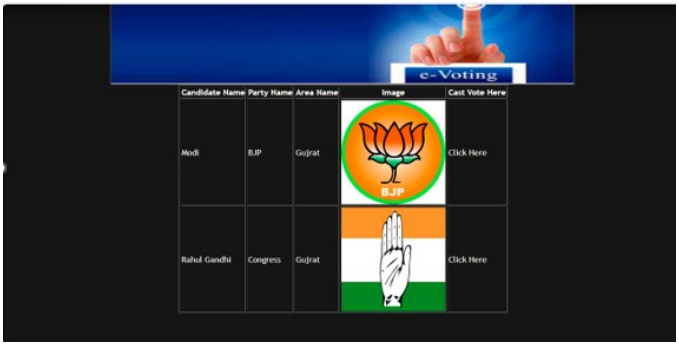

Figure 10: Cast Vote

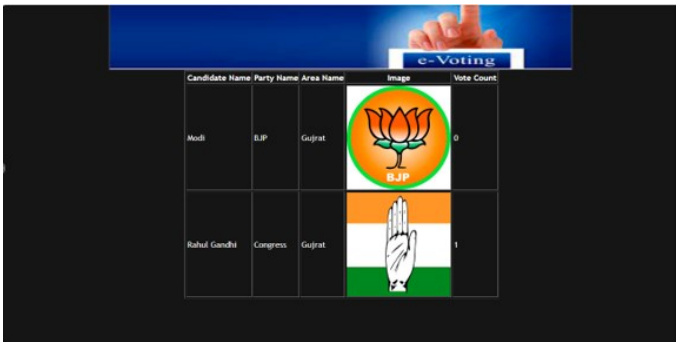

Figure 11: Vote Count

5. CONCLUSION

The e-voting system developed in this research represents a significant step toward secure, transparent, and efficient election management. By integrating blockchain technology and advanced cryptographic techniques, the system ensures data immutability, privacy, and security, addressing long-standing challenges such as tampering, fraud, and lack of transparency in traditional voting systems. Blockchain's decentralized nature guarantees that vote records are immutable and accessible only to authorized entities, fostering trust among stakeholders. The use of Elliptic Curve Cryptography (ECC) and SHA256 hashing enhances security by encrypting sensitive voter and candidate data and authenticating records, ensuring that unauthorized access or manipulation is practically impossible.

The platform provides seamless functionality for both administrators and voters, allowing election setup, voter registration, candidate management, and vote casting through an intuitive user interface. It emphasizes user privacy by encrypting sensitive data and preventing duplication of votes. The system's real-time vote count and automated winner declaration ensure quick and accurate election results. By blending security, efficiency, and user-centric design, this solution demonstrates the potential of blockchain-based e-voting systems to revolutionize electoral processes. It aligns with the global push for digital transformation in governance, offering a reliable alternative to traditional and electronic voting systems that often fall short in ensuring transparency and security.

REFERENCES

[1] Liu Y., Wang Q. An E-voting Protocol Based on Blockchain. IACR Cryptol. Eprint Arch. 2017;2017: 1043.

[2] 2.Shahzad B., Crowcroft J. Trustworthy Electronic Voting Using Adjusted Blockchain Technology. IEEE Access. 2019;7:24477–24488. doi: 10.1109/ACCESS.2019.2895670.

[3] 3.Racsko P. Blockchain and Democracy. Soc. Econ. 2019;41:353–369. doi: 10.1556/204.2019.007.

[4] 4.Yaga D., Mell P., Roby N., Scarfone K. Blockchain technology overview. arXiv. 20191906.11078

[5] 5.The Economist EIU Democracy Index. [(accessed on 18 January 2020)];2017 Available online:

[6] 6.Cullen R., Houghton C. Democracy online: An assessment of New Zealand government web sites. Gov. Inf. Q. 2000;17:243–267. doi: 10.1016/S0740-624X(00)00033-2.

[7] 7.Schinckus C. The good, the bad and the ugly: An overview of the sustainability of blockchain technology. Energy Res. Soc. Sci. 2020;69:101614. doi: 10.1016/j.erss.2020.101614.

[8] 8.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. doi: 10.1109/ACCESS.2019.2935895.

[9] 9.Kim T., Ochoa J., Faika T., Mantooth A., Di J., Li Q., Lee Y. An overview of cyber-physical security of battery management systems and adoption of blockchain technology. IEEE J. Emerg. Sel. Top. Power Electron. 2020 doi: 10.1109/JESTPE.2020.2968490.

[10] 10.Hang L., Kim D.-H. Design and implementation of an integrated iot blockchain platform for sensing data integrity. Sensors. 2019;19:2228. doi: 10.3390/s19102228.

[11] 11.Chang V., Baudier P., Zhang H., Xu Q., Zhang J., Arami M. How Blockchain can impact financial services–The overview, challenges and recommendations from expert interviewees. Technol. Forecast. Soc. Chang. 2020;158:120166. doi: 10.1016/j.techfore.2020.120166.

[12] 12.Wang B., Sun J., He Y., Pang D., Lu N. Large-scale election based on blockchain. Procedia Comput. Sci. 2018;129:234–237. doi: 10.1016/j.procs.2018.03.063.

[13] 13.Ometov A., Bardinova Y., Afanasyeva A., Masek P., Zhidanov K., Vanurin S., Sayfullin M., Shubina V., Komarov M., Bezzateev S. An Overview on Blockchain for Smartphones: State-of-the-Art, Consensus, Implementation, Challenges and Future Trends. IEEE Access. 2020;8:103994–104015. doi: 10.1109/ACCESS.2020.2998951.

[14] 14.Hakak S., Khan W.Z., Gilkar G.A., Imran M., Guizani N. Securing smart cities through blockchain technology: Architecture, requirements, and challenges. IEEE Netw. 2020;34:8–14. doi: 10.1109/MNET.001.1900178.

[15] 15.Çabuk U.C., Adiguzel E., Karaarslan E. A survey on feasibility and suitability of blockchain techniques for the e-voting systems. arXiv. 2020 doi: 10.17148/IJARCCE.2018.7324.2002.07175

[16] 16.Szabo N. Formalizing and securing relationships on public networks. First Monday. 1997;2:9. doi: 10.5210/fm.v2i9.548.

[17] 17.Wood G. Ethereum: A secure decentralised generalised transaction ledger. Ethereum Proj. Yellow Pap. 2014;151:1–32.