Published by :
http://www.ijert.org

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 12 Issue 05, May-2023

"E-Voting System Using Blockchain Technology"

Abhishek Tekade
BE-CS
Savitribai Phule Pune University, Pune

Vaibhav Padghan
BE-CS
Savitribai Phule Pune University, Pune

Rushikesh Kantule
BE-CS
Savitribai Phule Pune University, Pune

Pranav Pachpute
BE-CS
Savitribai Phule Pune University, Pune

Prof. Dr. B.D. Phulpagar
Guide :
Savitribai Phule Pune University, Pune

***Abstract* — The advent of blockchain technology has revolutionized various industries, and one such area that can greatly benefit from its implementation is the electoral process. This project proposes the development of an e-voting system utilizing blockchain technology to enhance transparency, security, and efficiency in elections.The proposed e-voting system aims to address several critical challenges faced by traditional voting systems, such as voter fraud, tampering, and lack of transparency. By leveraging the decentralized nature of blockchain, the system provides a secure and immutable platform for conducting elections.**

1. INTRODUCTION

1.1 MOTIVATION

The motivation behind developing an e-voting system using blockchain technology stems from the need to address the shortcomings of traditional voting systems and bring about a more transparent, secure, and efficient electoral process. The current voting methods, which often rely on manual paper-based processes or electronic systems without robust security measures, are susceptible to various issues such as voter fraud, tampering, and lack of transparency. These issues undermine the integrity of elections and erode public trust in democratic processes. Blockchain technology offers a unique set of characteristics that make it an ideal solution for the challenges faced by traditional voting systems. Firstly, blockchain is inherently transparent, as all transactions recorded on the blockchain are visible to all participants while maintaining the anonymity of the voters. This transparency ensures that the voting process can be audited and verified by anyone, thus enhancing trust and accountability.

Secondly, blockchain's decentralized nature eliminates the need for a central authority or intermediary to oversee the voting process. The distributed ledger ensures that all votes are securely recorded and cannot be altered or tampered with, providing immutability to the system. This decentralized approach mitigates the risk of manipulation or corruption by removing single points of failure.Another crucial aspect of blockchain technology is its strong cryptographic security measures. By utilizing advanced cryptographic techniques, such as encryption, digital signatures, and zero-knowledge proofs, the e-voting system can guarantee the privacy and integrity of each vote. These cryptographic mechanisms protect against unauthorized access, coercion, and vote buying, ensuring that voters can exercise their democratic rights without fear of reprisal.

1.2: PROBLEM STATEMENT

Traditional voting systems face various challenges that compromise the integrity of the electoral process and erode public trust in democratic systems. These challenges include Lack of transparency, Voter fraud and tampering, Inefficiency and delays, Accessibility. The use of blockchain technology in an e-voting system can address these challenges and provide a more transparent, secure, and efficient electoral process.

1.3: OBJECTIVE

The objective of the e-voting system using blockchain technology project is to develop a secure, transparent, and efficient platform that leverages blockchain's inherent properties to enhance the integrity and accessibility of the electoral process. The specific objectives of the project include Implementing a decentralized e-voting system, Ensuring transparency and auditability, Enhancing security and privacy, Improving accessibility and convenience etc. By achieving these objectives, the e-voting system using blockchain technology aims to revolutionize the electoral process, overcoming the limitations of traditional voting systems and instilling confidence in the integrity, transparency, and accessibility of democratic elections.

1.4: SCOPE

The scope of the e-voting system using blockchain technology project encompasses the development and implementation of a robust and secure platform for conducting electronic voting using blockchain technology. The project will cover the following key aspects.

- System Architecture: Designing and implementing a permissioned blockchain network that ensures decentralization, fault tolerance, and scalability. The architecture will include the necessary components

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 12 Issue 05, May-2023

such as nodes, consensus mechanism, smart contracts, and a distributed ledger for recording and validating voting transactions.

- Security and Privacy: Implementing advanced cryptographic techniques to protect the privacy and integrity of voter data. This includes encryption, digital signatures, zero-knowledge proofs, and other security measures to safeguard against unauthorized access, tampering, or coercion.
- User Interface: Developing a user-friendly interface accessible through various devices, such as smartphones, tablets, or computers. The interface will enable voters to securely cast their votes, verify the integrity of the recorded transactions, and view their voting history.
- Voting Process: Defining the end-to-end voting process, including voter registration, authentication, ballot creation, vote casting, and result tabulation. The system will ensure that each eligible voter can participate in the election and that their vote is accurately recorded and counted.
- Transparency and Auditability: Enabling transparent and auditable voting transactions by leveraging the inherent transparency of blockchain. The system will allow stakeholders, including election officials, candidates, and the public, to verify the integrity and fairness of the voting process.

It is important to note that the scope of the project may vary depending on the specific requirements, regulations, and resources available in the target jurisdiction. The project team will need to conduct a thorough analysis and adapt the scope accordingly to ensure the successful development and deployment of the e-voting system using blockchain technology.

2. MATHEMATICAL MODEL

A mathematical model for an E-voting system using blockchain technology can be represented as follows:

Let there be N voters participating in an election with M candidates. Each voter V_i has a unique ID, and each candidate C_j has a unique ID.

The E-voting system using blockchain technology can be modeled as a distributed database consisting of blocks, each containing a set of transactions. Each transaction represents a vote cast by a voter for a particular candidate.

Let B_k denote the k-th block in the blockchain. Each block B_k contains a set of transactions T_k = {t_1, t_2, ..., t_n}, where each transaction t_i represents a vote cast by a voter V_i for a candidate C_j. Each transaction t_i can be represented as a tuple:

t_i = (V_i, C_j, s_i)

where s_i is the digital signature of the voter V_i, which ensures the authenticity and integrity of the vote.

Let H_k denote the hash of the block B_k, which is calculated using a cryptographic hash function such as SHA-256. The hash H_k serves as a unique identifier for the block B_k and is used to link it to the previous block in the blockchain. Thus, the entire blockchain can be represented as a sequence of blocks {B_0, B_1, ..., B_k} where B_0 is the genesis block.

The E-voting system can be designed to ensure the following properties:

1.Eligibility: Only eligible voters can participate in the election, and each voter can cast only one vote.

2.Anonymity: The identity of the voter is kept confidential, and the vote is anonymous.

3.Transparency: The voting process is transparent, and the results are publicly verifiable.

4.Integrity: The votes are recorded accurately, and the system is resistant to tampering.

The E-voting system can be implemented using smart contracts on a blockchain platform such as Ethereum. The smart contract can be designed to enforce the above properties and ensure the integrity of the voting process.

In summary, the E-voting system using blockchain technology can be modeled as a distributed database consisting of blocks, each containing a set of transactions representing votes cast by eligible voters for candidates. The system can be designed to ensure eligibility, anonymity, transparency, and integrity, and can be implemented using smart contracts on a blockchain platform.

3. SYSTEM DESIGNS

- UML DIAGRAMS

3.1 Architecture Diagram

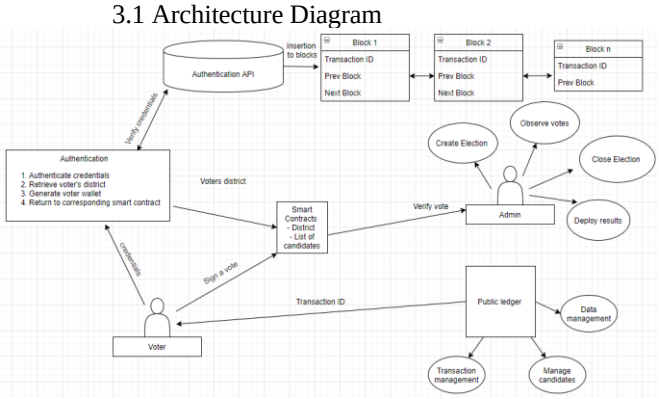

Fig 3.1 Architecture Diagram

3.2 Use-Case Diagrams

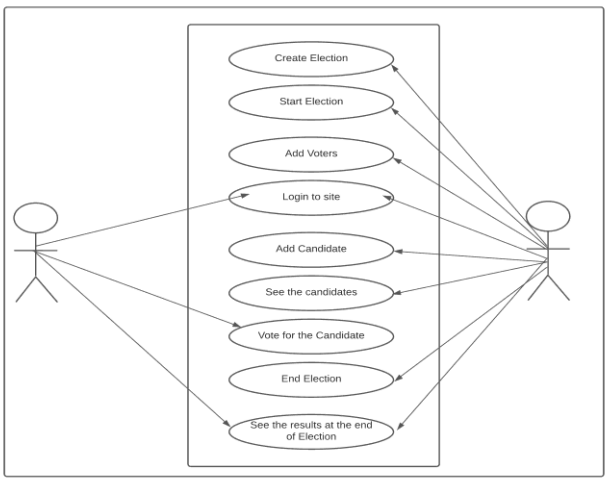

Fig 3.2.1 Use-Case Diagram

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 12 Issue 05, May-2023

3.3 Transaction Diagram

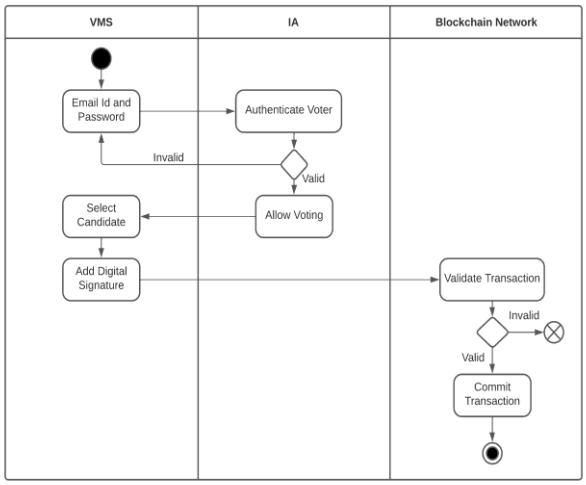

Fig 3.3 Transaction Diagram

3.4 Signature Algorithm Diagram

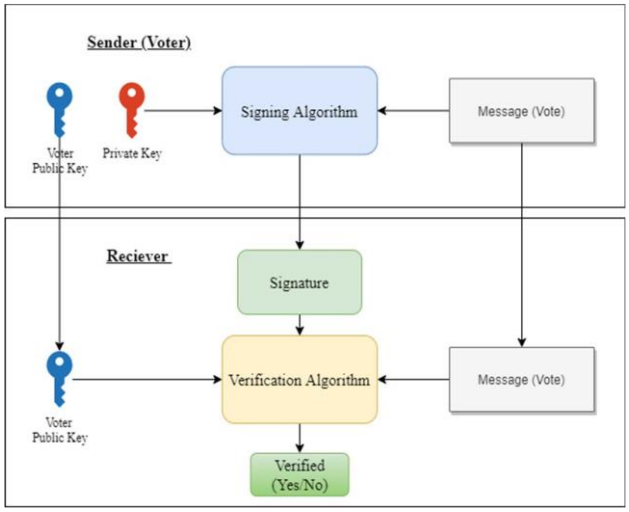

Fig Signature Algorithm Diagram

3.5 GUI

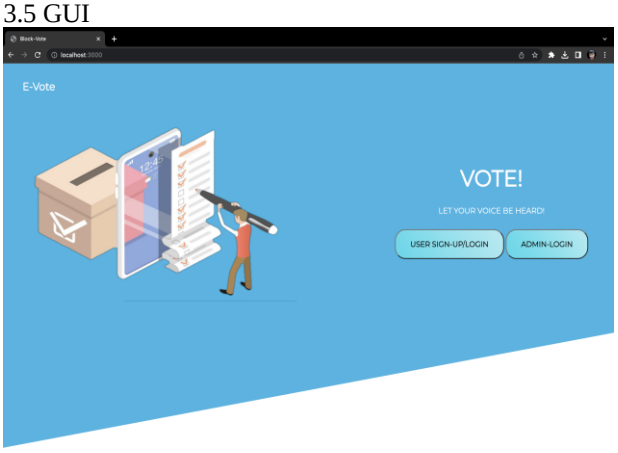

Fig 3.5.1 GUI

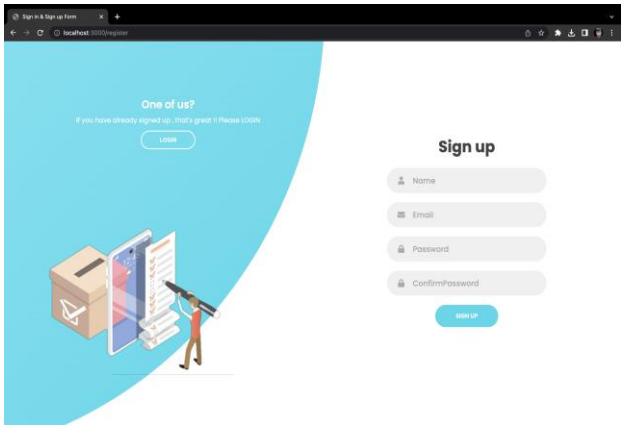

Fig 3.5.2: Registration Page

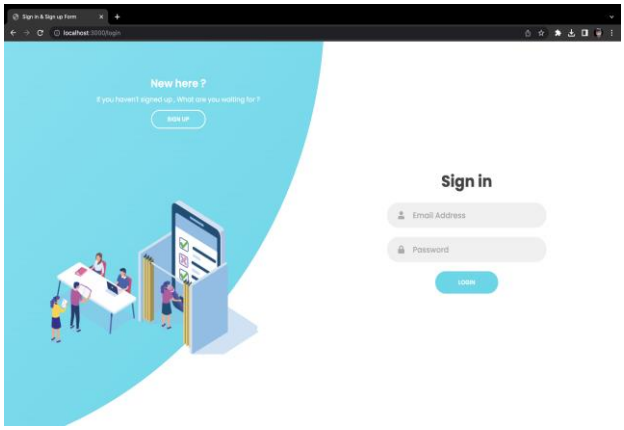

Fig 3.5.3: Login Page

4. METHODOLOGY

1.Define Project Scope:

Clearly identify the objectives, goals, and scope of the e-voting system project.

2. Gather Requirements:

Conduct stakeholder interviews and workshops to gather functional and non-functional requirements. Identify the needs of voters, election authorities, candidates, and any other involved parties. Consider legal and regulatory requirements related to voting and data privacy.

3.Design the System Architecture:

Define the overall architecture of the e-voting system, considering the components and their interactions.Determine the type of blockchain to be used (public, private, consortium) based on requirements.Design the user interfaces for voters, candidates, and election administrators.

4.Establish Trust and Identity:

Implement a robust identity management system to verify the eligibility of voters and candidates.Integrate with government databases or authentication systems for identity verification.Utilize cryptographic techniques to ensure secure and private authentication.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 12 Issue 05, May-2023

5.Develop Smart Contracts:

Design and implement smart contracts to enforce the voting rules and manage the election process.Define the data structures for storing voter information, candidate details, and voting records.Implement functions for voter registration, candidate registration, and vote casting.

6.Blockchain Network Setup:

Select a suitable blockchain platform (e.g., Ethereum, Hyperledger) based on the project requirements.Set up the blockchain network with the appropriate consensus mechanism and network configuration.Configure and deploy the necessary nodes, including validating and non-validating nodes.

7.Implement User Interfaces:

Develop user-friendly interfaces for voters to register, authenticate, and cast their votes securely.Create interfaces for candidates to register, manage their profiles, and monitor the election process.Design administrative interfaces for election authorities to oversee and manage the system.

8.Ensure Security and Privacy:

Implement encryption techniques to secure sensitive data, such as voter identities and voting records.Establish access controls and permissions to prevent unauthorized access to the system.Perform comprehensive security testing and vulnerability assessments.

9.Test and Validate:

Conduct thorough testing of the e-voting system to verify its functionality and performance.Perform simulation tests to ensure the system can handle the expected user load and concurrent votes.Engage with stakeholders and conduct pilot tests to gather feedback and validate the system.

10.Deployment and Maintenance:

Deploy the e-voting system on appropriate infrastructure, ensuring scalability and reliability.Establish monitoring mechanisms to track system performance, security incidents, and anomalies.Regularly update the system with bug fixes, security patches, and feature enhancements.

5. RESULTS AND OUTPUT

A functioning e-voting system that leverages blockchain technology to provide transparency, immutability, and security in the voting process.

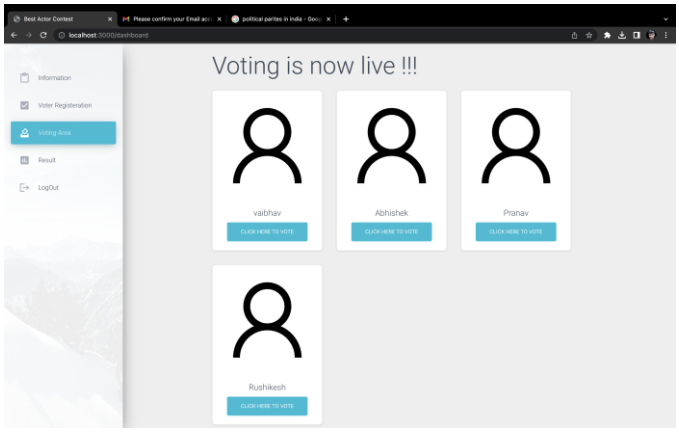

Fig 5.1: Registered Candidates.

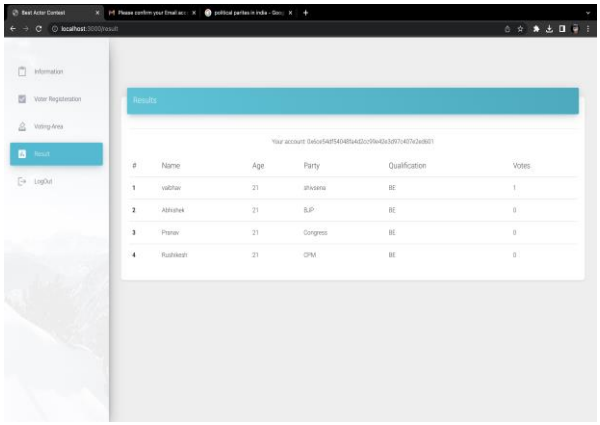

Fig 5.2: Election Results

6. FUTURE WORK

Here are some potential future work directions for an e-voting system using blockchain technology project:

1.Integration with other voting systems: The e-voting system could be integrated with other voting systems to increase its reach and accessibility.

2.Enhancement of the user interface: The user interface could be improved to make it more user-friendly and intuitive, especially for older voters who may not be familiar with digital systems.

3.Integration with other blockchain networks: The e-voting system could be integrated with other blockchain networks to provide greater decentralization and security.

4.Integration with other digital identity systems: The e-voting system could be integrated with other digital identity systems to make it easier for voters to prove their identity and cast their votes securely.

5.Ongoing maintenance and support: Ongoing maintenance and support will be needed to ensure that the e-voting system remains up-to-date and secure, and to address any issues that may arise.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 12 Issue 05, May-2023

7. CONCLUSION

In conclusion, an e-voting system using blockchain technology has the potential to revolutionize the way we conduct elections by providing transparency, immutability, and security. By leveraging the power of blockchain, we can create a tamper-proof voting system that ensures each vote is counted accurately and fairly.However, developing an e-voting system using blockchain technology is not a trivial task, and it requires careful planning, design, and implementation. The methodology outlined above provides a framework for developing such a system, but ongoing maintenance and support will be required to ensure its continued success.Despite the challenges, the benefits of an e-voting system using blockchain technology are significant. It can provide greater accessibility, especially for voters who may have difficulty physically attending polling stations, and it can increase trust in the electoral process by making it more transparent and secure.Overall, an e-voting system using blockchain technology represents a major step forward in the evolution of democratic systems, and it has the potential to transform the way we conduct elections for years to come.

8. REFERENCES

[1] Deni Pramulia and Bayu Anggorojati, "Implementation and evaluation of blockchain based e-voting system with Ethereum and Metamask".
[2] Amit Kumar Tyagi, Terrance Frederick Fernandez and Aswathy S U, "Blockchain and Aadhaar based Electronic Voting System".
[3] Friorik .p. Hjalmarsson, Gunnlaugur K. Hreioarsson and Mohammad Hamdaqa, "Blockchain-Based E-Voting System".
[4] Puneet Aman Chaudhary, Nitin Chauhan and Abhishek Kumar, "Decentralized Voting Platform based on Ethereum Blockchain".
[5] Divya Rathore and Virender Ranga, "Secure Remote E-Voting using Blockchain".
[6] Yamuna Rosasooria, Shingo Yamaguchi and Sharifah Saon, "E-Voting on Blockchain using Solidity Language".