National Institute Of Technology
Tiruchirappalli

Project Report
On
Blockchain Technology in Voting

Submitted By:

Abhinav Raj	(205222002)
Bhupendra Patel	(205222004)
Bikash Singh	(205222005)
Nikhil Pareek	(205222010)

Under Guidence Of:
Asst. Prof. Dr Saroja S
Department of Computer Applications
April, 2023

ABSTRACT

An electoral system or voting system is crucial in determining how elections and referendums are conducted and how their results are determined. However, current voting systems suffer from various security threats and require significant resources, leading to distrust among voters. Blockchain voting has emerged as a potential solution, as it offers greater accessibility, transparency, and security by leveraging distributed ledger technology. This report discusses the benefits of blockchain voting, including increased voter turnout and reduced costs, and how it can pave the way for direct democracy. Moreover, the report also acknowledges that blockchain voting is not yet fully mature and requires further development before it can be widely adopted. By implementing blockchain technology, we can prevent DDoS attacks and any other malware, ensuring greater reliability in the voting process. Using a peer-to-peer network, blockchain technology eliminates the need for centralized authorities, making the process more democratic. Despite the potential benefits of blockchain voting, we must continue to improve the technology to ensure the highest level of security and trustworthiness.

TABLE OF CONTENTS

1. INTRODUCTION

1.1. Background

E-voting is an electronic voting system that enables voters to cast their votes remotely through the internet, without the need for physical ballot papers or polling booths. However, security and transparency issues have always been major concerns in e-voting systems, as there have been instances of hacking, tampering, and manipulation of votes in the past.

To address these issues, blockchain technology has been proposed as a solution for secure and transparent e-voting. Blockchain is a distributed ledger technology that enables secure, transparent, and immutable record-keeping. In a blockchain-based e-voting system, each vote is recorded as a transaction on the blockchain, which is secured through cryptography and distributed across a network of nodes. This ensures that the voting data is tamper-proof, transparent, and verifiable.

The ”E-voting using Blockchain” project aims to develop a blockchain-based e-voting system that is secure, transparent, and easy to use. The system will allow voters to cast their votes remotely through a web interface, which will be integrated with a blockchain network. The votes will be recorded as transactions on the blockchain, which will be secured through cryptography and distributed across the network. The system will also provide real-time updates on the voting process, ensuring transparency and accountability.

1.2. Motivation

The motivation behind this project was to develop a secure and transparent system for conducting online voting using blockchain technology. With traditional voting systems, there are often concerns about fraud, security breaches, and lack of transparency. By leveraging the immutability and decentralization of blockchain, we aimed to create a system that ensures the integrity of the voting process and allows for verifiable results. Additionally, we wanted to create a system that is accessible and user-friendly for voters while also being scalable and customizable for different types of elections.

1.3. Objectives

The project aims to remove the need for voters to stand in long queues by enabling them to vote from anywhere, anytime, and using any device with an internet connection.

1. The main objective of the project is to develop a secure and transparent electronic voting system using blockchain technology. The system is designed to enable voters to cast their votes remotely from any location, with assurance that their votes are counted correctly and securely.
2. The project aims to remove the need for voters to stand in long queues by enabling them to vote from anywhere, anytime, and using any device with an internet connection.

1.4. Problem statement

The problem addressed by this project is the current inefficiency and insecurity of traditional voting systems. In many countries, voting is still conducted using paper ballots, which can be prone to human errors, lost votes, and even fraud. Additionally, traditional voting systems require people to stand in long queues, which can discourage voter turnout. With the COVID-19 pandemic, these inefficiencies were magnified, making it difficult for people to vote safely in person. Therefore, there is a need for a secure and efficient voting system that eliminates the need for paper ballots and long queues, and ensures the integrity of the voting process. The proposed solution is a blockchain-based e-voting system that can provide secure and transparent voting while ensuring the anonymity of voters.

1.5. Scope of Project

The scope of this project includes the development of a user-friendly web application that will enable voters to register, view candidate information, and cast their votes securely using blockchain technology. The application will also provide a real-time display of the vote count, which will enable the public to view the results as they are tabulated. The scope of the project will be limited to the development of the web application and the blockchain technology required for the voting process. The project will not include the hardware required to conduct the voting process, nor will it cover any changes to the electoral laws or regulations. The project will be developed using the Python programming language and the Django framework.

2. LITERATURE REVIEW

Paper titled 'Blockchain-Enabled E-Voting by Nir Kshetri and Jeffrey Voas'

- The authors begin by discussing the current state of e-voting and the various security and trust issues that are associated with it. They argue that traditional e-voting systems are vulnerable to attacks and manipulation, which can compromise the integrity of the voting process. To address these concerns, the authors propose the use of blockchain technology for e-voting
- The article provides a detailed explanation of blockchain technology and its key features, such as immutability, transparency, and decentralization. The authors argue that these features make blockchain well-suited for e-voting because they can help ensure the integrity of the voting process and increase trust in the system.
- The article also discusses several potential benefits of using blockchain for e-voting, including increased transparency, reduced costs, and improved security. The authors argue that blockchain can help reduce the risk of fraud and manipulation in the voting process, as well as provide a more efficient and cost-effective way of conducting elections.
- However, the authors also acknowledge several challenges and limitations associated with blockchain-enabled e-voting. These include issues related to scalability, privacy, and the need for a robust digital identity system. The authors suggest that these challenges need to be addressed before blockchain can become a mainstream technology for e-voting.

3. REQUIREMENT ANALYSIS

- Front Ends: HTML, CSS, Javascript
- Backend: Django web framework
- Programming language: Python ‘

4. SYSTEM ARCHITECTURE AND METHODOLOGY

4.1. Theoretical Background

Electronic voting is a type of voting that uses electronic systems to record, tabulate and report voting results. Electronic voting systems have been developed to improve the accuracy and efficiency of voting. However, there are concerns about the security and transparency of electronic voting systems, which can be vulnerable to hacking, tampering, or other forms of manipulation.

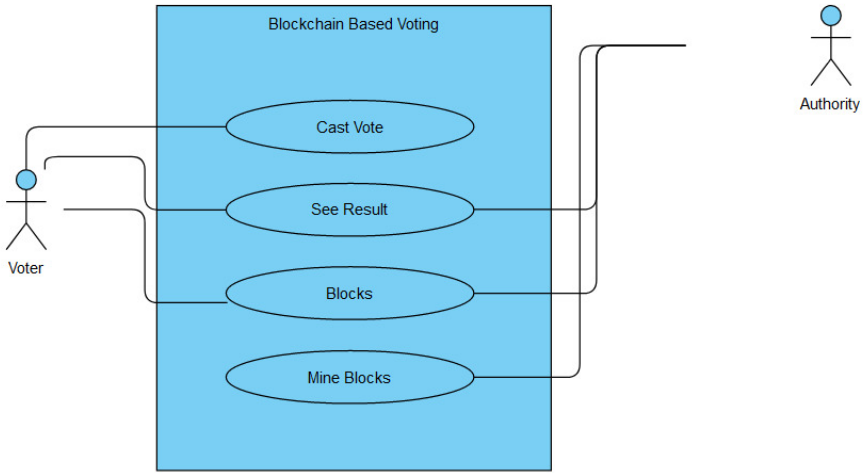
Blockchain technology, on the other hand, is a decentralized, distributed ledger system that records transactions in a secure and transparent manner. A blockchain consists of blocks of data that are linked together in a chronological order using cryptography. Each block contains a unique digital signature, or hash, that verifies its authenticity and ensures that it cannot be altered without invalidating the entire chain.

The combination of these two concepts, electronic voting and blockchain technology, provides a promising solution for improving the security and transparency of voting systems. By using blockchain technology, the voting process can be made more secure and transparent, as each vote is recorded on a tamper-proof and transparent ledger. This can help to eliminate concerns about election fraud and hacking, and ensure that the voting results are accurate and trustworthy.

4.2. Consensus Algorithm used

The consensus algorithm used in the project is Proof of Authority (PoA), which is a consensus mechanism that relies on a fixed set of validators, also known as ”authorities.” These authorities are pre-approved by the network to validate transactions and create new blocks. We hardcoded few id as id of authority and only they have permission to mine blocks. Unlike other consensus algorithms, such as Proof of Work (PoW) or Proof of Stake (PoS), PoA does not require significant computational power or stake from validators. Instead, it is based on the reputation and identity of the authorities. In the context of the project, the use of PoA ensures faster block validation and transaction processing, making the voting process more efficient and secure.

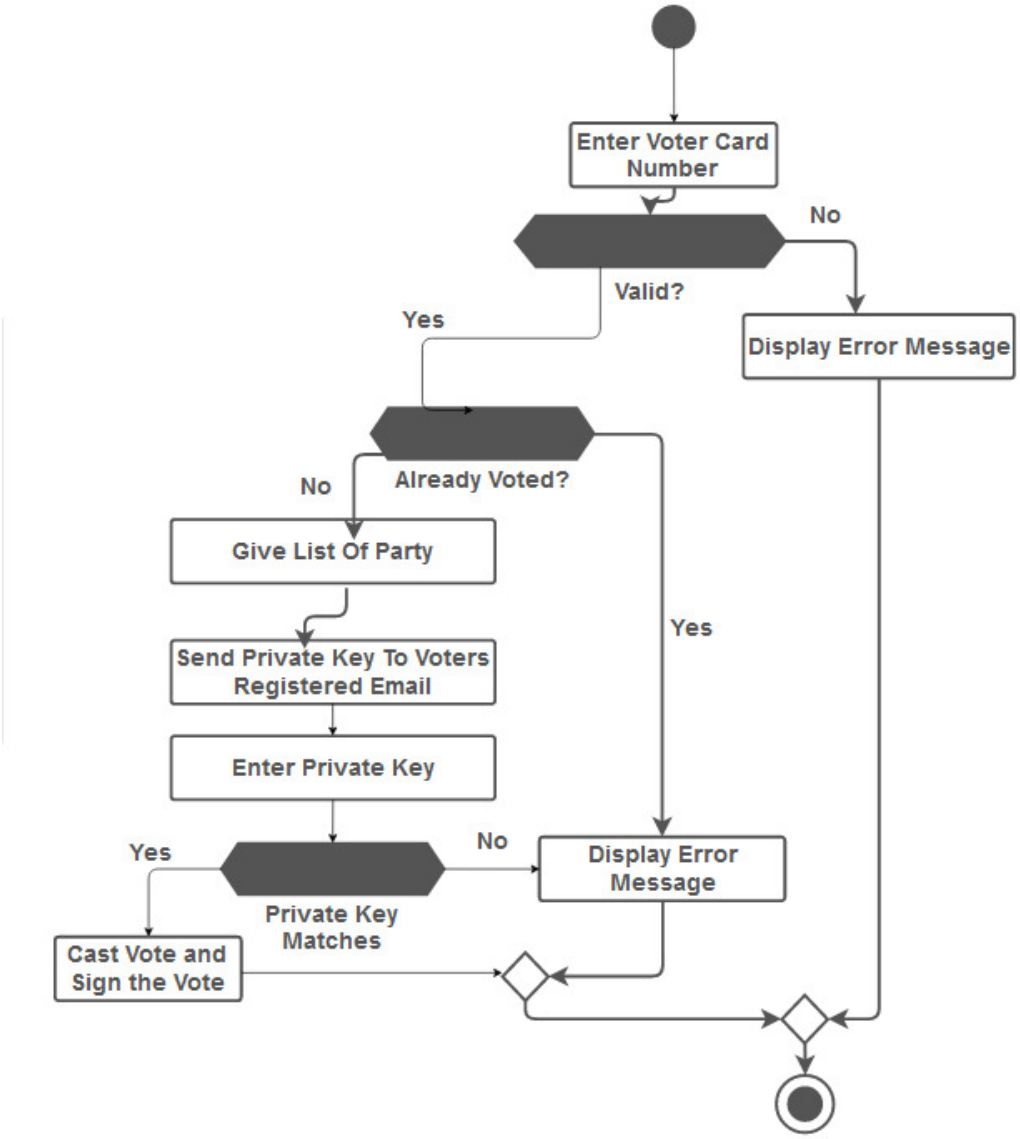
4.3. Use Case Diagram



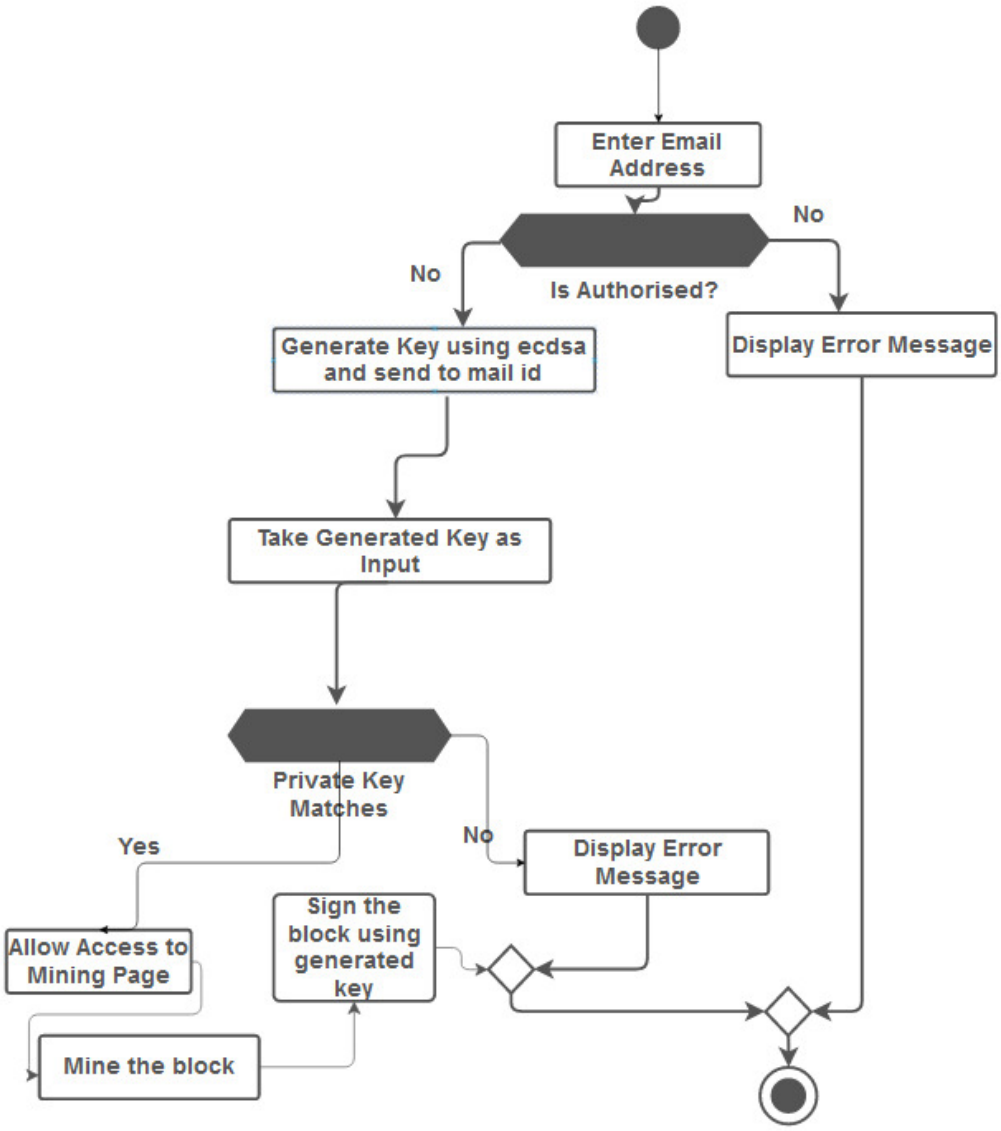
USE CASE DIAGRAM: The purpose of a use case diagram in UML is to demonstrate the different ways that a user might interact with a system.

- SYSTEM: A specific sequence of actions and interactions between actors and the system. A system may also be referred to as a scenario.
- USE CASES: Horizontally shaped ovals that represents an action which accomplishes some sort of task within the system.
- ACTORS: Stick figures that represent the people actually employing the use cases. It should be placed outside the system.
- ASSOCIATION: A line between actors and use cases. In complex diagrams, it is important to know which actors are associated with which use cases

4.4. Data Flow Diagram Voter

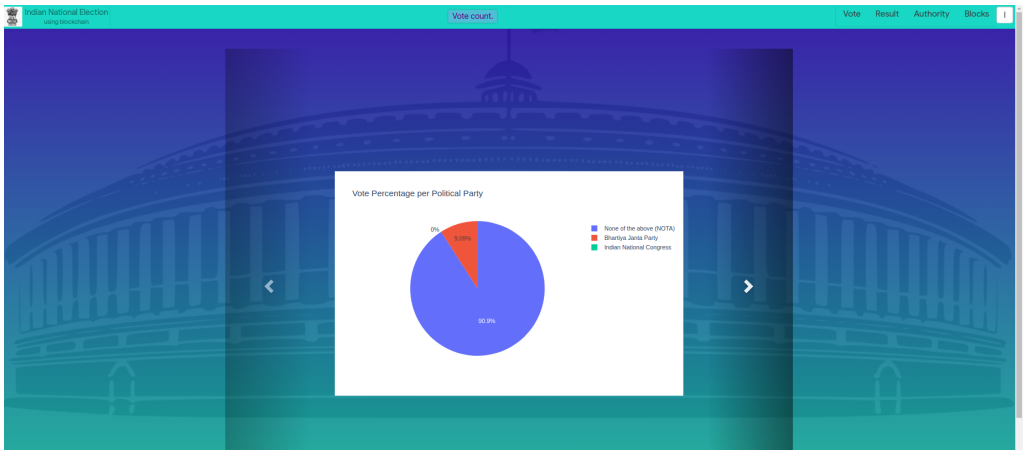


4.5. Data Flow Diagram Miner

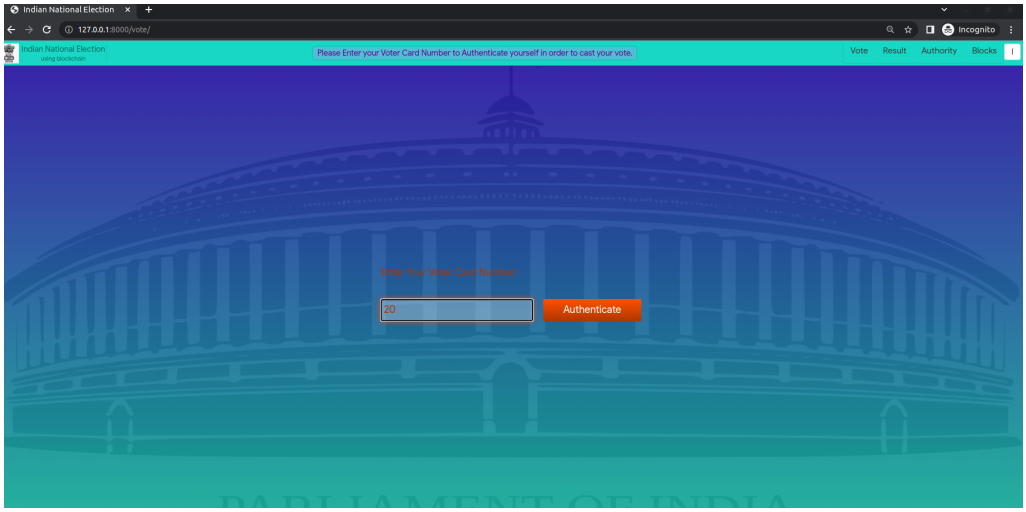


5. IMPLEMENTATION DETAILS

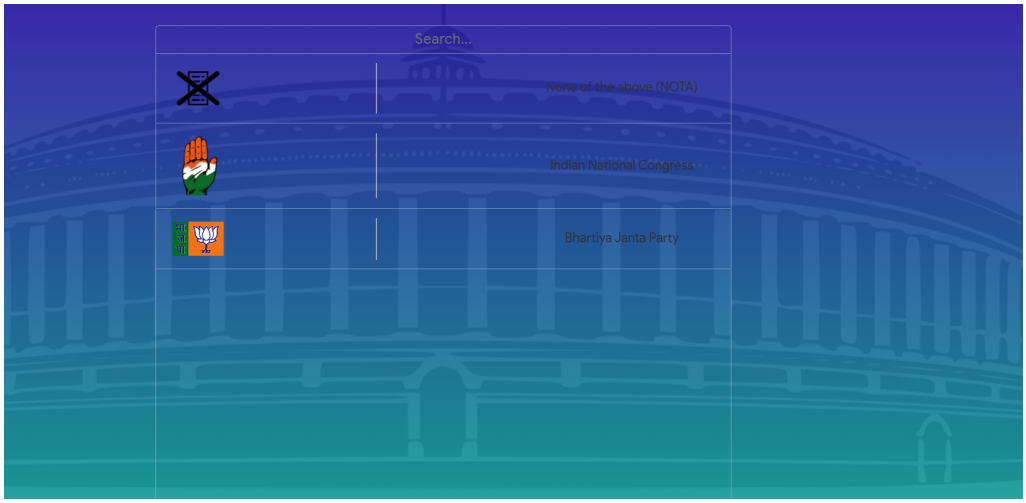
5.1. Home Page



5.2. Cast Vote



5.3. Select a Party

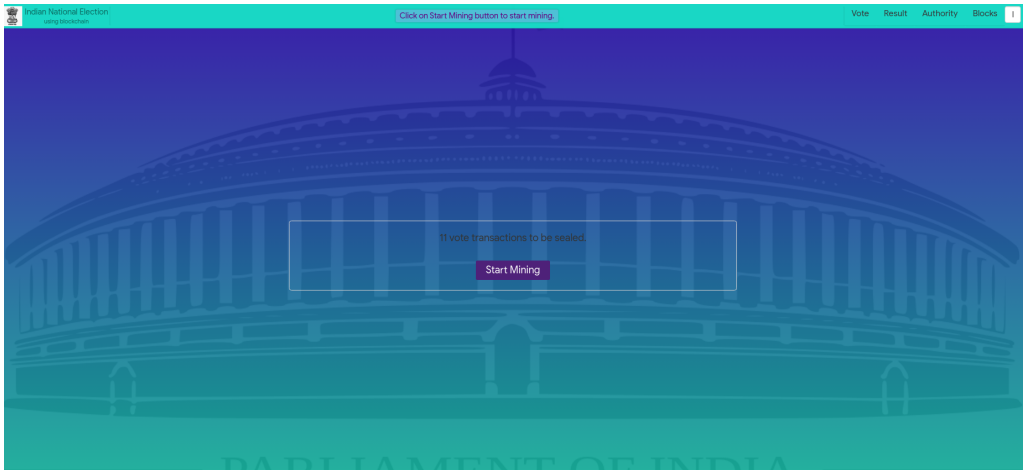


5.4. Vote Done

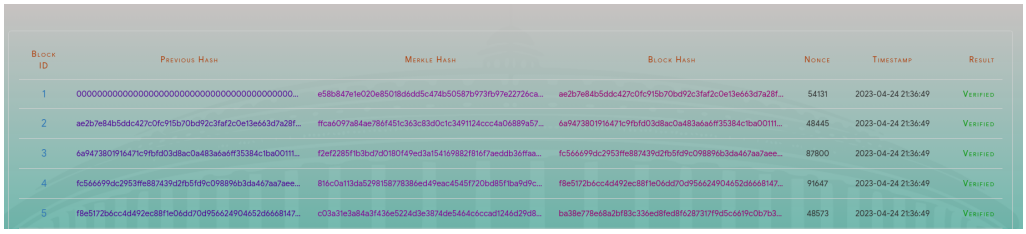
5.5. Miner

5.6. Miner Signature

5.7. Start Mining

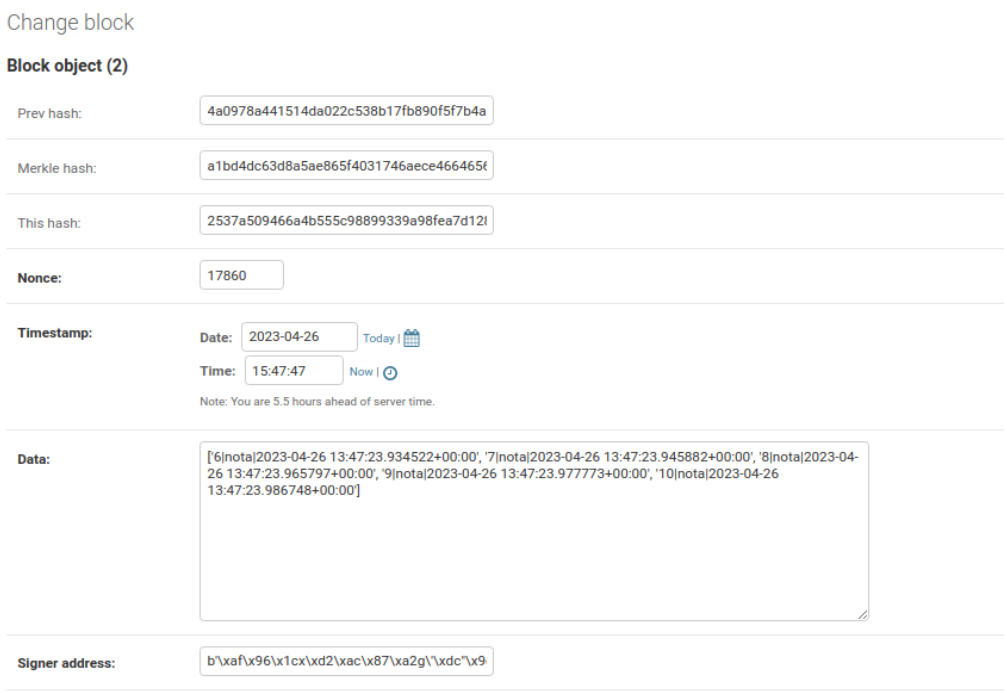


5.8. BlockChain



Block ID	Previous Hash	Merkle Hash	Block Hash	Nonce	Timestamp	Result
1	0000000000000000000000000000000000000000...	e58b847e1e020e85018d6dd5c474b50587b973fb97e22726ca...	ae2b7e84b5ddc427c0fc915b70bd92c3faf2c0e13e663d7a28f...	54131	2023-04-24 21:36:49	Verified
2	ae2b7e84b5ddc427c0fc915b70bd92c3faf2c0e13e663d7a28f...	ffca6097a84ae786f451c363c83d0c1c3491124cccc4a06889a57...	6a947380191647 1c9fbfd03d8ac0a483a6a6ff35384c1ba00111...	48445	2023-04-24 21:36:49	Verified
3	6a947380191647 1c9fbfd03d8ac0a483a6a6ff35384c1ba00111...	f2ef2285f1b3bd7d0180f49ed3a15416982f816f7aeddb36ffaa...	fc5666990dc2953ffe887439d2fb5fd9c098896b3da467aa7aee...	87800	2023-04-24 21:36:49	Verified
4	fc5666990dc2953ffe887439d2fb5fd9c098896b3da467aa7aee...	816c0a113da5298158778386ed49eac4545f720bd85f1ba9d9c...	f8e5172b6cc4d492ec88f1e06dd70d956624904652d6668147...	91647	2023-04-24 21:36:49	Verified
5	f8e5172b6cc4d492ec88f1e06dd70d956624904652d6668147...	c03a31e3a84a3f436e5224d3e3874de5464c6ccad1246d29d8...	ba38e778e68a2bf83c336ed8fed8f628731f9d5c6619c0b7b3...	48573	2023-04-24 21:36:49	Verified

5.9. Block Structure



6. RESULTS AND DISCUSSIONS

One of the main benefits of an e-voting system using blockchain technology is the increased security and transparency it provides. By using a distributed ledger, votes can be securely recorded and verified, reducing the risk of fraud or tampering. Additionally, the use of a permissioned blockchain and proof of authority consensus algorithm can further enhance security by ensuring that only authorized parties can participate in the voting process.

Another potential benefit is increased accessibility and convenience for voters. With an e-voting system, voters can cast their ballots from anywhere with an internet connection, eliminating the need to travel to a physical polling location and potentially reducing wait times and long lines.

However, there are also some potential drawbacks and challenges to implementing such a system. One issue is the potential for technical problems or glitches, which could result in lost or invalid votes. Additionally, there may be concerns about the privacy and anonymity of voters, as blockchain records are permanent and cannot be easily modified or deleted.

Overall, an e-voting system using blockchain technology has the potential to greatly improve the efficiency and security of the voting process, but careful consideration and planning is necessary to ensure that the system is implemented in a way that is accessible, reliable, and secure.

7. CONCLUSION

In conclusion, we have successfully developed a blockchain-based e-voting system using the Proof of Authority (PoA) consensus algorithm. Our system addressed the issues related to traditional voting systems, such as fraud, manipulation, and long queues. By leveraging the security and immutability of blockchain technology, we were able to ensure the integrity and transparency of the voting process.

We have demonstrated that the PoA consensus algorithm is a reliable and efficient mechanism for ensuring the validity of transactions and maintaining the integrity of the blockchain. The use of PoA consensus eliminated the need for energy-intensive mining and made our system faster and more efficient. Additionally, our system enabled users to cast their votes remotely, increasing accessibility and convenience.

8. References

1. Ali, S.T.; Murray, J. An Overview of End-to-End Verifiable Voting Systems. arXiv 2016, arXiv:160508554.

2. Zhang, S.; Wang, L.; Xiong, H. Chaintegrity: Blockchain-enabled large-scale e-voting system with robustness and universal verifiability. Int. J. Inf. Secur. 2020, 19, 323–341.

3. Wang, Baocheng, Jiawei Sun, Yunhua He, Dandan Pang and Ningxiao Lu, "Large-scale election based on blockchain", Procedia Computer Science, vol. 129, pp. 234-237, 2018.

4. Liu Yi and Qi Wang, "An E-voting Protocol Based on Blockchain", IACR Cryptology ePrint Archive, pp. 1043, 2017.

5. De Angelis, Stefano, Aniello, Leonardo, Baldoni, Roberto, Lombardi, Federico, Margheri, Andrea and Sassone, Vladimiro (2018) PBFT vs proof-of-authority: applying the CAP theorem to permissioned blockchain. Italian Conference on Cyber Security, Milan, Italy. 11 pp .

6. B. Dickson, "Blockchain Tech Could Fight Voter Fraud—and These Countries Are Testing It," VentureBeat, 22 Oct. 2016; https://venturebeat .com/2016/10/2/blockchain -tech-could-ght-voter-fraud-and -these-countries-are-testing-it.