A Mini Project Report on

BUILDING SECURE VOTING SYSTEM USING BLOCKCHAIN

Submitted in Partial fulfilment for the
degree of Bachelor of Technology in
Computer Science and Technology

Submitted by

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CERTIFICATE

This is to certify that **Pooja Rathod, Neha Tembhe, Pradnya Sharma** has successfully completed mini project work on **Building Secure Voting System Using Blockchain** in the partial fulfillment for the bachelor's degree in **Computer Science and Technology** during the year 2023-24 as prescribed by SNDT Women's University.

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Examiner 2

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Pooja Rathod

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Date:

Place:

ABSTRACT

Building voting using Ethereum blockchain is a secure, transparent and tamper-proof way of conducting online voting. It is a building application built on the Ethereum blockchain network, which allows participants to cast their votes and view the voting results without the need for intermediaries. In this system, votes are recorded on the blockchain, making it impossible for anyone to manipulate or alter the results. The use of smart contracts ensures that the voting process is automated, transparent, and secure. The use of the blockchain technology and the implementation of a building system provide a reliable and cost-effective solution for conducting trustworthy and fair elections.

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Chapter 1

Introduction

1.1 Introduction to Blockchain

Blockchain is a distributed digital ledger technology that allows participants in a network to share and validate transactions in a secure and transparent manner without the need for intermediaries. The technology is designed to be building, meaning that the data is stored on a network of computers instead of a central database. This makes it difficult to hack or manipulate the data, ensuring the integrity and security of the system. The blockchain technology gained popularity with the emergence of Bitcoin, which was the first building cryptocurrency. However, the technology has since been applied to various industries, including finance, supply chain management, healthcare, and voting, among others. Blockchain works by creating blocks of data that are linked together in a chain, hence the name blockchain. Each block contains a unique code, known as a hash, that is generated based on the contents of the block. This hash is then used to link the block to the previous one, forming a chain of blocks.

Blockchain is one of the emerging technologies with strong cryptographic foundations enabling applications to leverage these abilities to achieve resilient security solutions. A Blockchain resembles a data structure which maintains and shares all the transactions being executed through its genesis. It is primarily a distributed building database that maintains a complete list of constantly germinating and growing data records secured from unauthorized manipulating, tampering and revision.

Once a block is added to the blockchain, it cannot be altered or deleted without the consensus of the network participants. This makes the technology immutable, ensuring that the data stored on the blockchain is tamper-proof and transparent. Overall, blockchain technology has the potential to revolutionize the way we store and share data, making it more secure,transparent, and accessible.

1.2 Building Voting Using Blockchain

A building voting system built on the Ethereum blockchain has the potential to revolutionize the way we conduct elections. By leveraging the security, transparency, and immutability of blockchain technology, building voting systems can eliminate many of the challenges and risks associated with traditional voting systems.

In a building voting system, each voter has a unique digital identity, and their vote is recorded on the blockchain, ensuring that the vote is tamper-proof and cannot be altered. Building voting systems also eliminate the need for intermediaries, such as government agencies, to oversee the election process, making it more efficient and less susceptible to corruption or manipulation.

Furthermore, building voting systems can increase voter participation by allowing voters to cast their ballots from anywhere in the world, as long as they have an internet connection. This can lead to a more democratic and inclusive electoral process, with greater voter engagement and higher turnout. Overall, a building voting system using the Ethereum blockchain has the potential to bring significant benefits to the electoral process, making it more secure, transparent, and accessible to everyone.

1.3 Problem Statement

The current voting systems suffer from security vulnerabilities, lack of transparency, and trust issues. Election fraud, manipulation, and hacking are major concerns under mining the integrity of the democratic process. The innovation gap lies in improving the security,transparency, and trustworthiness of voting systems.

Aim:- building an voting system that satisfies the legal requirements of legislators has been a challenge for a long time. Distributed ledger technologies is an exciting technology world. Also aims to evaluate the application of blockchain as service to implement distributed electronic voting systems.

Ethereum provides solutions to these challenges, it's important to consider potential issues such as scalability and user education during the implementation of a blockchain-based voting system. Ongoing developments in the Ethereum ecosystem, including Ethereum 2.0, aim to address scalability concerns and enhance the overall performance of the platform.

Chapter 2

Literature Survey

Sr.no.	Paper Title	Authors	Observation	Limitation
1	A Survey of Blockchain Based on E-voting Systems Year:- Dec 2019	Yousif Osman Abuidris, Rajesh kumar and Wang Wenyoug	The paper compares security and privacy requirements of current blockchain-based e-voting systems.	The paper may oversimplify the advantages and challenges of blockchain e-voting, overlooking specific contexts, and might not account for recent developments, potentially lacking the latest information.
2	Survey on Voting System Using Blockchain Technology Year:- 04 April 2022	Mayur Shirsath, Mohit Zade, RiteshKumar Talke, Praful Wake and Maya P.Shelke	The project aims for a user-friendly blockchain e-voting system, prioritizing simplicity and accessibility for all users, irrespective of technical expertise.	Blockchain's potential for enhancing electronic voting faces resistance from stakeholders, including government agencies and the public, posing challenges to its widespread adoption.
3	A Survey on Smart Electronic Voting System Using Block-Chain Technology Year:- Jan 2021	Naina Nagesh Dhepe and DR.Pathan Mohd Shafi	The research aims to enhance electoral security by developing a transparent, secure voting machine through blockchain technology.	The paper outlines a system for India's electoral process, cautioning that its applicability may vary across countries due to differing implementation details and considerations in electoral systems.
4	A Systematic Literature Review and Meta-Analysis on Scalable Blockchain-Based Electronic Voting Systems Year:- Oct 2022	Uzma Jafar , Mohd Juzaiddin Ab Aziz, Zarina Shukur and Hafiz Adnan Hussain	The research guides future studies to consider voting needs, merits, and drawbacks, providing scalable voting solutions' guidelines.	Blockchain security, while robust, faces risks from smart contract bugs and network attacks, necessitating stringent measures and audits, offering no absolute protection against malicious actors.
5	Blockchain based E-voting System Year:- 2022	Albin Benny, Aparna Ashok Kumar, Abdul Basit, Betina Cherian and Amol Kharat	The paper explores a transparent, secure e-voting system with cost-efficiency, employing blockchain and smart contracts via Ethereum's private blockchain.	Blockchain voting's implementation may face accessibility hurdles for specific demographics, and scalability issues, despite solutions like sharding, may affect efficiency in the electoral process.

Table 2.1: Literature Survey

Chapter 3

Existing System

- **Brief Explanation of existing system**

The existing voting system typically involves voters physically visiting a designated polling place to cast their vote on paper ballots. These ballots are then manually counted and recorded. Some countries also have electronic voting systems in place, which allow voters to cast their votes electronically through machines or the internet. However, electronic voting systems have faced criticism due to security concerns and potential vulnerabilities.

3.1 Disadvantages of existing system

1. **Lack of transparency:** In most voting systems, it's difficult for voters to know whether their vote was counted correctly, and for observers to ensure that the vote counting process is fair.

2. **Vulnerability to fraud:** Both paper ballots and electronic voting machines can be vulnerable to tampering, hacking and other types of fraud. This can be especially problematic when there is no paper trail or other way to audit the results.

3. **Slow results:** Counting paper ballots can be a time-consuming and labor-intensive process, which can delay the announcement of election results.

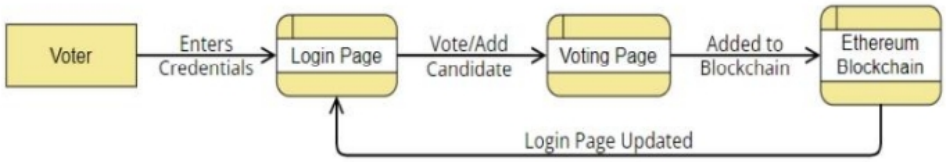
4. **Cost:** Running a traditional voting system can be expensive, requiring the hiring of poll workers, the purchase of voting machines or paper ballots, and the rental of polling places.

5. **Centralization:** Many traditional voting systems are centralized, meaning that they are controlled by a small number of authorities. This can create the potential for abuse of power or manipulation of the voting process.

6. **Limited Accessibility:** Some voting systems require voters to travel to specific polling places, which can be difficult or impossible for people with disabilities, limited mobility, or other challenges. This can result in voter disenfranchisement.

3.2 Proposed System

- Level 1 data flow diagram



- Level 2 data flow diagram

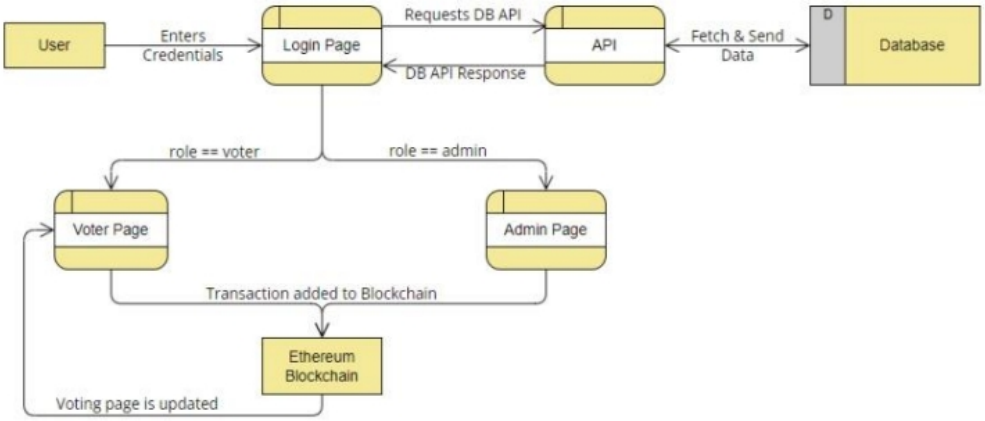


Figure 3.1: Data Flow Diagram

The proposed voting system using Ethereum blockchain aims to provide a transparent and tamper-proof solution for conducting elections. By leveraging smart contracts on the Ethereum network, the system enables secure and anonymous voting, while ensuring the integrity and immutability of the voting data. This would increase voter trust in the election process and reduce the risk of fraud or manipulation.

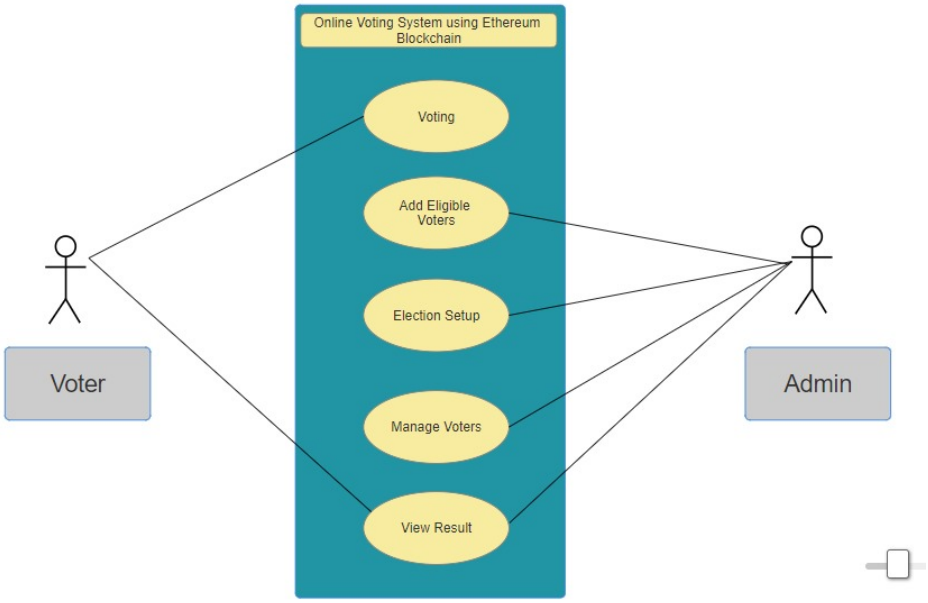


Figure 3.2: Use Case Diagram

3.3 Advantages of Proposed System

1. Building ensures that no party controls the voting process.
2. Transparency throughout the voting process.
3. It is tamper proof.
4. Voters can vote from any part of the world.
5. This method of voting is cost effective.
6. The results are provided in real time.

• Objectives of the Proposed Research

1. **Security:** The proposed system aims to provide a secure platform for conducting elections, eliminating the possibility of tampering with votes, and ensuring that the election results are transparent and verifiable.
2. **Transparency:** The proposed system aims to provide complete transparency to the voters, allowing them to view the entire voting process, including the vote counting and results.

3. **Accessibility**: The proposed system aims to make the voting process more accessible to all eligible voters by eliminating the need for physical presence at a polling station, thus increasing voter turnout.

4. **Efficiency:** The system aims to increase the efficiency of the voting process by reducing the time and resources required to conduct elections. Since the system is automated and eliminates the need for intermediaries, it can significantly reduce the cost and time associated with traditional voting methods.

5. **Trust:** The proposed system aims to increase trust in the voting process by providing a transparent and tamper-proof mechanism for recording and tallying votes.

3.4 System Architecture

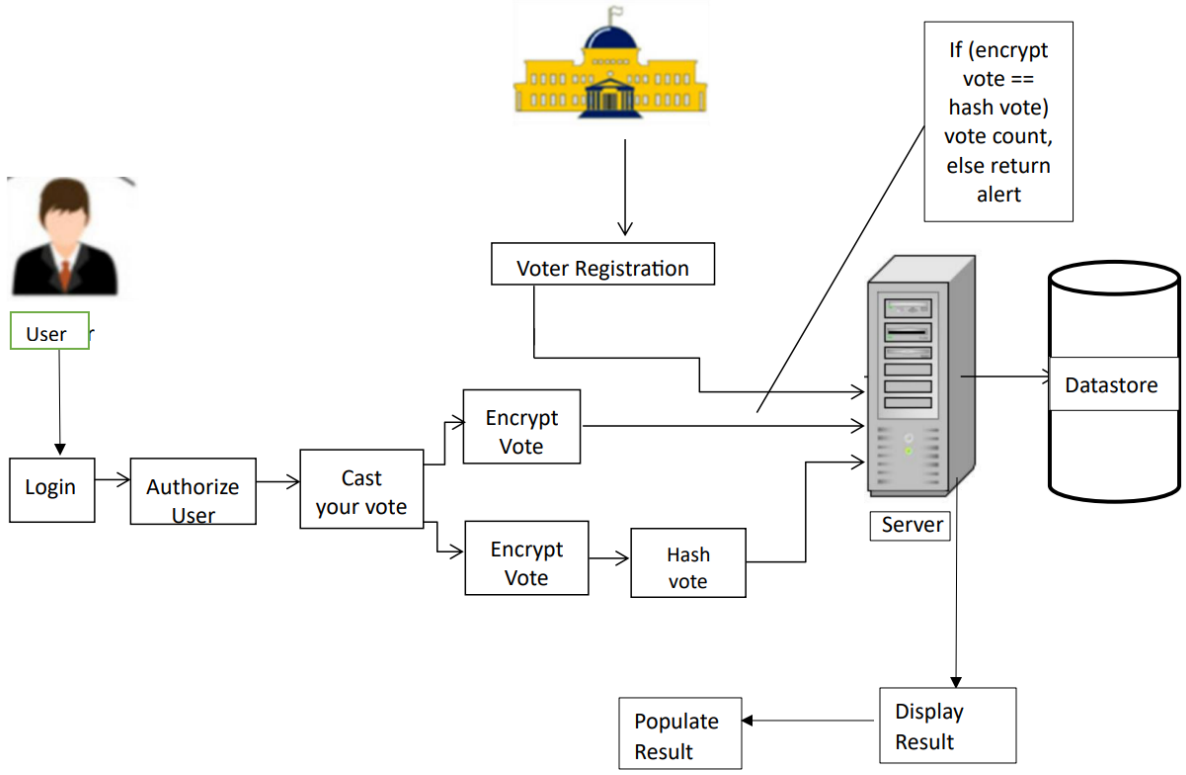


Figure 3.3: System Architecture of Voting System

Electronic voting is a method of voting that uses electronic devices to record or count votes. It traditionally involves electronic hardware and software to support the voting process and can handle tasks ranging from the initiation of the election to the storage of votes. At a minimum, the electronic voting system should include registration, authentication, voting, and tallying.

The first step is registering voters, where the government records each voter's profile. During registration, certain fields such as phone number and email address must be filled in to input data into the system. Qualified voters are given access, after which the system automatically generates a unique ID and password for each voter. All registration details are stored in the database.

Once registered, the user enters their credentials (voter ID and password), which are then matched with the database. If the user is validated, they are redirected to the voting page. The voter can vote once the voting process begins. After the voter casts their vote, the transaction is recorded to the blockchain.

The system verifies each voter's vote to ensure it has not been altered during transit. This process involves comparing each unique identity's result by matching the encrypted vote with

the hashed vote. If verified, the system automatically updates the user's vote count. If the vote has been tampered with during transmission, it will not be counted for the voter. The voting page is updated with real-time votes.

Votes must be encrypted and verifiable, and the confidentiality, anonymity, and accuracy of the votes must be ensured, with the votes being immutable.

For the proper working of the system we can list our assumptions and dependencies as follow:

1.Metamask Browser Extension

Metamask is a crypto currency wallet that allows users to interact with Ethereum Blockchain. Using metamask users can store and manage their account keys and exchange Ethereum based cryptocurrencies and tokens. Users can connect to decentralized networks through the web browser or through the browsers provided in mobiles as apps. Developers can use javascript plugin Web3js to initiate connections between a decentralized network and Metamask. Ethers are used as gas to perform transactions between metamask and smart contracts.Metamask allows blockchain users to manage their wallet. Using the browser extension, users can use the wallet and perform transactions through the browser. When a transaction is performed, a metamask pops up and asks the user to confirm the transaction.

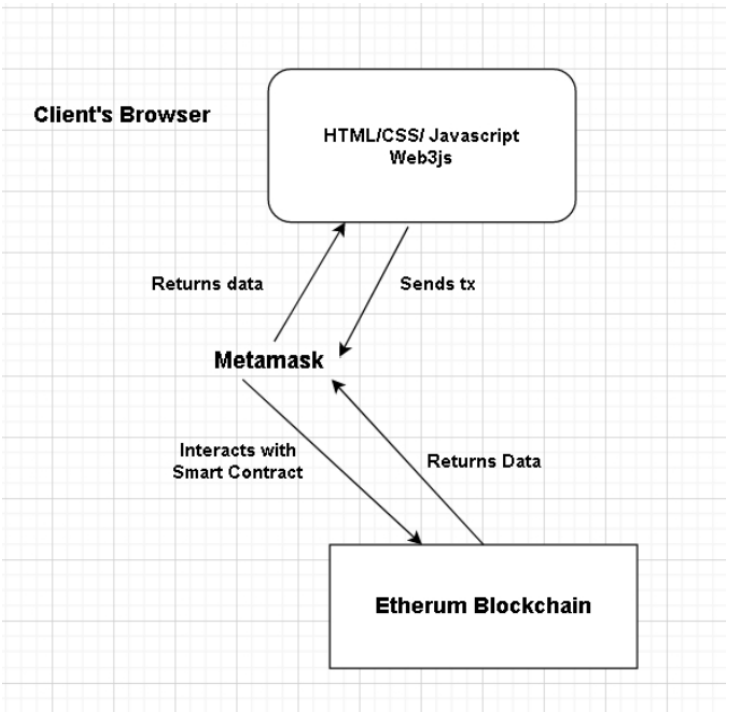


Figure 3.4: Metamask Working

2.Ganache

It is a private blockchain for instant Ethereum and Corda allotted software development.Used to set up a personal Ethereum blockchain which mimics the real international blockchain and which helps you to execute commands , run tests, and test out united states of america on the identical time as controlling how the blockchain works.It comes with flavors: a UI(User Interface) and CLI(Command Line Interface). The UI flavor is a computing tool software helping every Ethereum and Corda technology. The ganache-cli flavor is a command line tool that is available for Ethereum development.

3.Truffle

Truffle offers an improved environment primarily based totally on ethereum blockchain. Truffle is capable of compiling the ethereum contracts and migrating them. After migration contracts are deployed on ganache, any ethereum takes a look at the net (e.g. Ropsten, Rinkeby) or on an actual ethereum network.It is a global elegance improvement tool, trying out a framework and useful pipeline for blockchains using the Ethereum Virtual Machine (EVM). With Truffle, you get:

- Built-in clever settlement compilation, linking, deployment and binary control.
- Automated settlement for speedy improvement.
- Scriptable, extensible deployment migrations framework.
- Network control for deploying to any range of public non-public networks.
- Interactive console for direct settlement communication.
- Configurable construct pipeline with aid for tight integration.
- External script runner inside a Truffle environment.

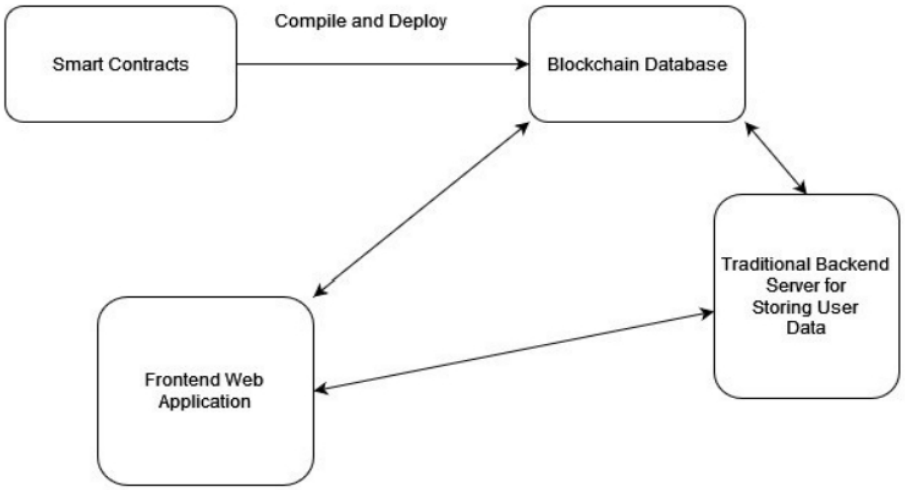


Figure 3.5: Truffle Working

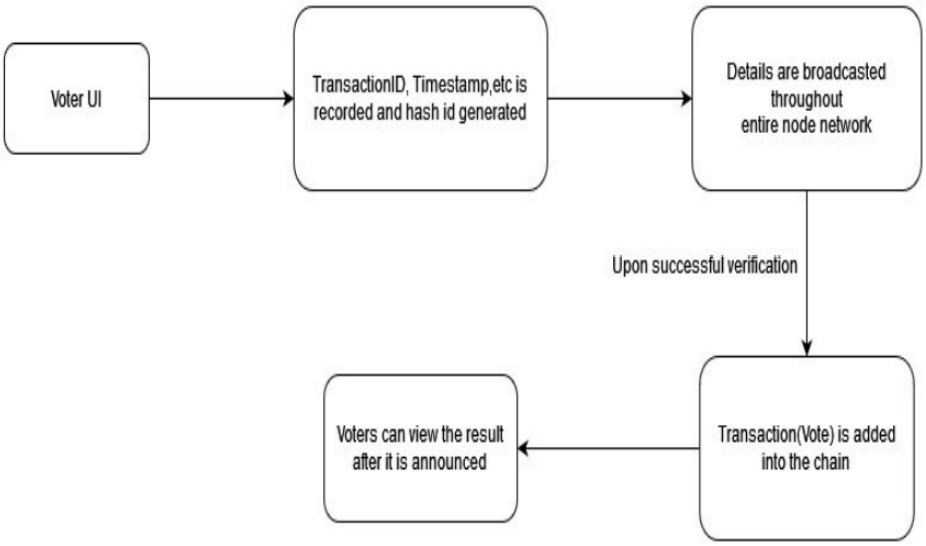


Figure 3.6: Internal flow of system

Chapter 4

Hardware And Software Requirement

Requirement Analysis

In order to effectively design and develop a system, it is important to understand and document the requirements of the system. The process of gathering and documenting the requirements of a system is known as requirement analysis. It helps to identify the goals of the system, the stakeholders and the constraints within which the system will be developed. The requirements serve as a blueprint for the development of the system and provide a reference point for testing and validation.

4.1 Hardware Requirements

1. **Processor :–** 2 GHz or more
2. **RAM :–** 4 GB or more
3. **Disk Space :–** 100 GB or more

4.2 Software Requirements

1. **Node.j**s (version – 18.14.0)
2. **Web3.js** (version – 1.8.2)
3. **Truffle** (version – 5.7.6)
4. **Solidity** (version – 0.5.16)
5. **Ganache** (version – 7.7.3)
6. **Metamask**
7. **Python** (version – 3.9)
8. **FastAPI**
9. **MySQL Database** (port – 3306)
10. **OS Windows 10 and above**
11. **HTML, CSS ,JAVASCRIPT**

Chapter 5

Implementation

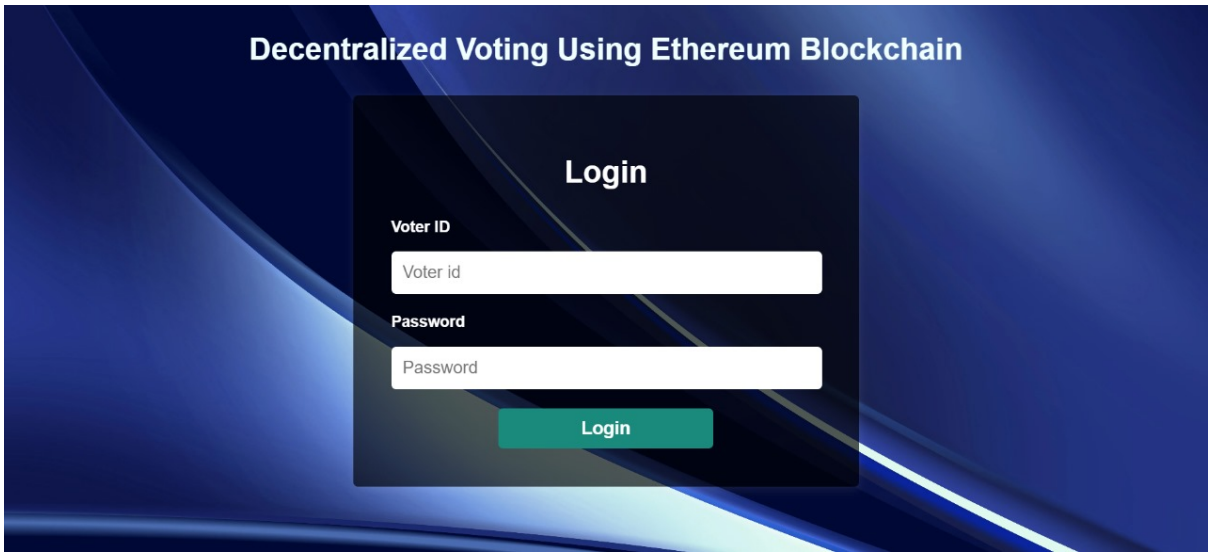


Figure 5.1: Login Page

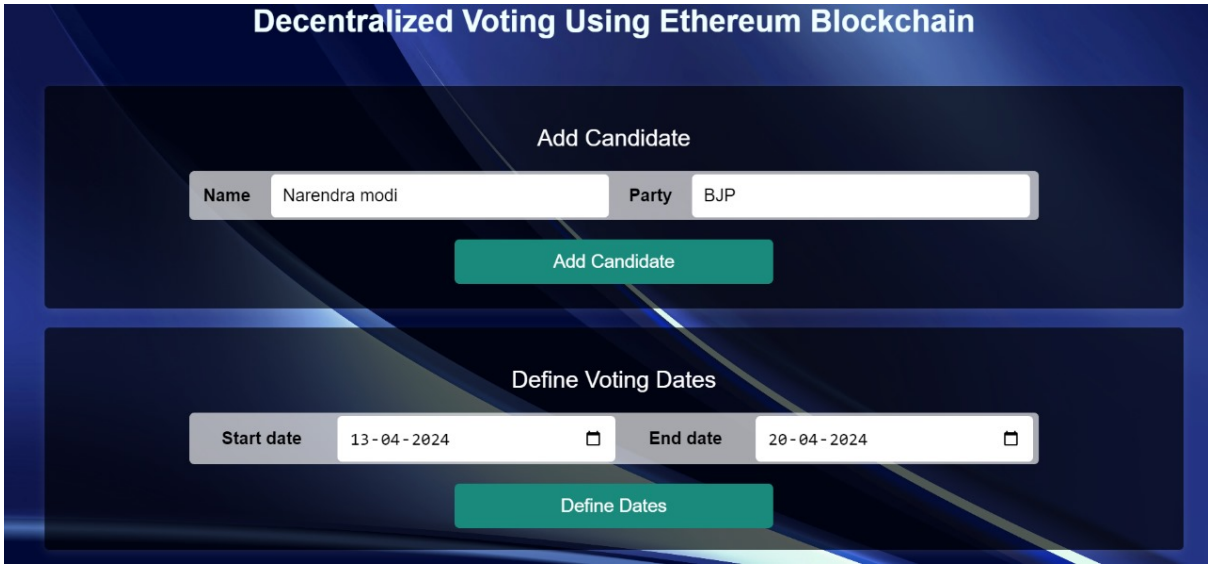


Figure 5.2: Add Candidate and Define Voting Dates

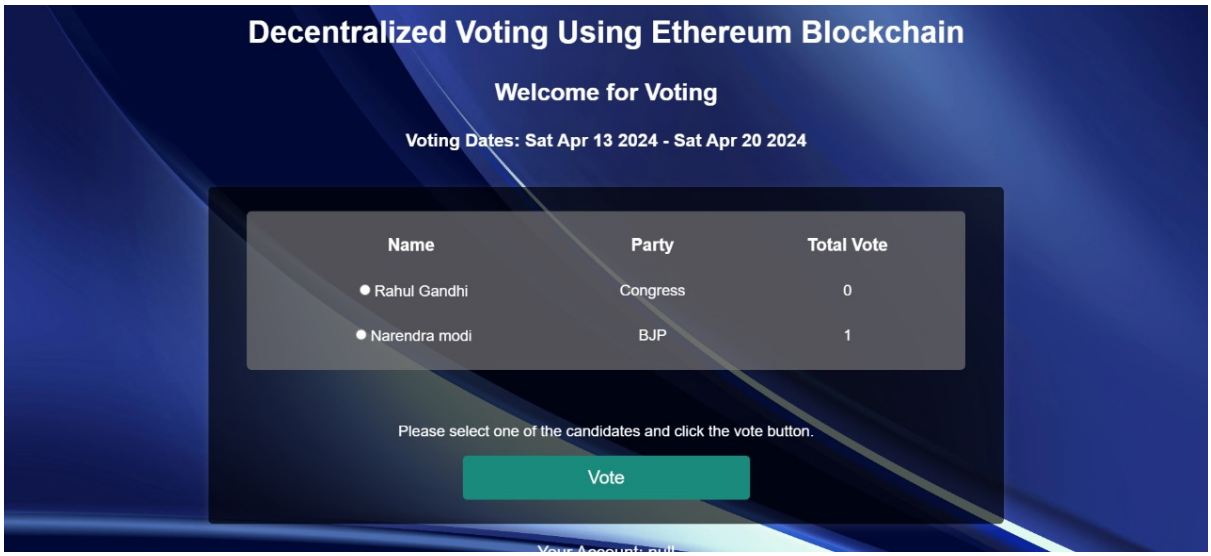


Figure 5.3: Welcome for Voting

Chapter 6

Applications

The application of building a secure voting system using blockchain technology has several benefits and can be applied in various contexts:-

1. **Political Elections:** Implementing a blockchain-based voting system for political elections can increase transparency, reduce fraud, and improve the integrity of the electoral process. It can provide voters with a verifiable record of their votes and ensure that votes are accurately counted.

2. **Corporate Governance:** Companies can use blockchain-based voting systems for shareholder meetings and corporate governance processes. Shareholders can cast votes on important issues such as board elections, executive compensation, and corporate policies securely and transparently.

3. **Nonprofit Organizations:** Nonprofit organizations can use blockchain-based voting systems for decision-making processes such as board elections, project funding proposals, and policy decisions. This can increase participation among members and donors and improve the accountability of organizational leadership.

4. **Election Transparency:** Blockchain ensures transparency by providing a tamper-resistant and immutable ledger of all transactions. This transparency fosters trust among voters and stakeholders in the electoral process.

5. **Enhanced Security**: Blockchain's cryptographic features make it extremely difficult for unauthorized parties to tamper with or manipulate voting data. This enhances the security and integrity of the voting system, reducing the risk of fraud or hacking.

6. **Privacy Protection:** Blockchain enables the encryption of voting data, ensuring the privacy of individual voters while still maintaining the integrity of the overall voting process. This protects against voter coercion or intimidation.

7. **Accessibility:** A blockchain-based voting system can potentially increase accessibility by allowing voters to cast their ballots remotely via digital devices, thereby reducing barriers such as physical distance or mobility issues.

8. **Cost Efficiency:** Implementing a blockchain-based voting system can reduce costs associated with traditional paper-based voting methods, such as printing, transportation, and manual counting of ballots.

Chapter 7

Conclusion and Future Scope

7.1 Conclusion

Decentralized Voting with Ethereum Blockchain offers a robust and transparent solution for secure elections. By leveraging blockchain technology, it ensures the integrity of votes and provides a tamper-proof platform.

With continued enhancements, including improved user experience, scalability, and integration with other cutting-edge technologies, it has the potential to revolutionize the democratic process and empower citizens to participate in a trusted and efficient voting system. It represents a significant step towards building a more democratic and accountable society.

7.2 Future Scope

- In future iterations, the decentralized voting system can be enhanced by implementing additional features such as real-time vote counting, secure voter identification mechanisms, advanced data analytics for voter insights, and integration with emerging technologies like artificial intelligence and biometrics.

- In continuation of this work, we are focused at improving the resistance of blockchain technology to 'double spending' problem which will translate as 'double voting' for e-voting systems.

- Although blockchain technology achieves significant success in detection of malleable change in a transaction however successful demonstration of such events have been achieve which motivates us to investigate it further.

- These enhancements will further enhance the efficiency, security, and accessibility of the voting process, making it more inclusive and trustworthy.

- In addition, the study's external validity should be improved, which should be discussed in future research activities. Accordingly, we would also like to encourage researchers to make their effect on blockchain research taking into account a wide variety of factors, including underlying cryptography and its ecosystem limitations.

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