VISVESVARAYA TECHNOLOGICAL UNIVERSITY

"JnanaSangama", Belgaum -590014, Karnataka.

BLOCKCHAIN AAT REPORT on

DECENTRALIZED VOTING APPLICATION

Submitted by

IBRAHIM KHAN (1BM21CS076)

JEEVANTHI KASHYAP(1BM21CS080)

Under the Guidance of
Prof. Namratha M
Assistant Professor, BMSCE

in partial fulfillment for the award of the degree of
BACHELOR OF ENGINEERING
in
COMPUTER SCIENCE AND ENGINEERING

B.M.S. COLLEGE OF ENGINEERING
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B. M. S. College of Engineering,
Bull Temple Road, Bangalore 560019
(Affiliated To Visvesvaraya Technological University, Belgaum)

Department of Computer Science and Engineering

CERTIFICATE

This is to certify that the AAT work entitled "**DECENTRALIZED VOTING APPLICATION**" is carried out by **IBRAHIM KHAN (1BM21CS076), and JEEVANTHI KASHYAP (1BM21CS080)** who are bonafide students of **B.M.S. College of Engineering.** It is in partial fulfillment for the award of **Bachelor of Engineering in Computer Science and Engineering** of the Visveswaraya Technological University, Belgaum during the year 2023-2024. The AAT report has been approved as it satisfies the academic requirements in respect of **Blockchain (22CS6PCBLC)** work prescribed for the said degree.

Signature of the Guide
Prof. Namratha M
Assistant Professor
BMSCE, Bengaluru

Signature of the HOD
Dr. Jyothi S Nayak
Prof.& Head, Dept. of CSE
BMSCE, Bengaluru

B.M.S. COLLEGE OF ENGINEERING

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

DECLARATION

We, IBRAHIM KHAN (1BM21CS076) and JEEVANTHI KASHYAP (1BM21CS080), students of 6th Semester, B.E, Department of Computer Science and Engineering, B. M. S. College of Engineering, Bangalore, hereby declare that, this AAT entitled " DECENTRALIZED VOTING APPLICATION " has been carried out by us under the guidance of Prof. Namratha M, Assistant Professor, Department of CSE, B. M. S. College of Engineering, Bangalore during the academic semester March 2024 to June 2024.

We also declare that to the best of our knowledge and belief, the development reported here is not from part of any other report by any other students.

Signature

IBRAHIM KHAN(1BM21CS076)

JEEVANTHI KASHYAP(1BM21CS080)

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Chapter 1 Introduction

Problem Statement:

To develop Voting-Dapp, a decentralized voting application leveraging the Ethereum blockchain and Solidity, ensuring a secure, transparent, and tamper-proof voting process.

In modern democracies, ensuring the integrity, transparency, and security of the voting process is crucial. Traditional voting systems are often plagued by issues such as voter fraud, lack of transparency, and centralization of control, which can undermine public trust in the electoral process. To address these challenges, there is a growing interest in leveraging blockchain technology to develop decentralized voting applications that offer enhanced security, transparency, and trustworthiness.

Chosen Platform: ETHEREUM

Ethereum blockchain is chosen for its robustness and widespread adoption in the development of decentralized applications (dApps). Ethereum's ability to execute smart contracts makes it an ideal platform for ensuring the integrity and transparency of the voting process.

Reasons for Choosing Ethereum for the Voting-Dapp Project

- Smart Contract Capability:
  Ethereum supports the development and deployment of smart contracts, which are essential for creating secure, automated, and transparent voting processes.
- Decentralization:
  Ethereum's decentralized network ensures that there is no single point of failure, making it resistant to tampering and ensuring the integrity of the voting process.
- Security:
  Ethereum's robust consensus mechanisms (currently transitioning from Proof of Work to Proof of Stake) provide high levels of security, making it suitable for applications that require trust and reliability.
- Transparency and Immutability:
  Transactions on the Ethereum blockchain are transparent and immutable, meaning that once votes are recorded, they cannot be altered, ensuring a transparent and verifiable election process.
- Large Developer Community:
  Ethereum has a large and active developer community, providing extensive resources, tools, and support, which facilitates the development of complex applications like Voting-Dapp.
- Established Ecosystem:

Ethereum's mature ecosystem includes a variety of development tools (such as Truffle, Ganache, and Remix), libraries, and frameworks that simplify the development, testing, and deployment of dApps.

- Interoperability:
  Ethereum's ERC standards (such as ERC-20 and ERC-721) ensure interoperability with other dApps and services on the Ethereum network, allowing for potential integration with other blockchain-based solutions.
- Mainnet Deployment:
  Deploying on the Ethereum mainnet provides a globally recognized and trusted platform, enhancing the credibility and acceptance of the voting application.
- Support for Layer 2 Solutions:
  Ethereum supports Layer 2 solutions like Rollups and Plasma, which can enhance scalability and reduce transaction costs, crucial for handling large-scale voting operations efficiently.
- Future-Proofing:
  Ethereum's continuous development and upcoming upgrades (such as Ethereum 2.0) aim to improve scalability, security, and sustainability, ensuring the platform remains a viable choice for future enhancements.

WORK HIGHLIGHTS:

MOTIVATION:

Choosing the problem statement of developing a secure and transparent decentralized voting application using Ethereum stems from a profound motivation to address critical issues plaguing traditional voting systems. Electoral integrity lies at the core of democratic processes, yet concerns surrounding voter fraud, manipulation, and lack of transparency persist. By harnessing blockchain technology, particularly Ethereum's capabilities, we seek to instill trust and confidence in the electoral process. Transparency is paramount in fostering public trust, and Ethereum's transparent ledger ensures that every vote cast is securely recorded and immutable. Additionally, decentralizing the voting process mitigates risks associated with centralized control, enhancing the system's resilience and credibility. Ultimately, our motivation is to combat voter apathy and bolster democratic participation by providing a robust, accessible, and verifiable voting platform.

APPLICATIONS:

The applications of a decentralized voting system are as follows:

1. Government Elections: Facilitating secure and transparent elections at local, national, and even international levels, ensuring the integrity of the democratic process.

2. Organizational Governance: Enabling corporations, non-profit organizations, and other institutions to conduct secure and auditable voting for board elections, policy decisions, and other governance matters.
3. Community Decision-Making: Empowering decentralized communities, such as homeowners' associations or neighborhood councils, to make collective decisions on issues like infrastructure projects, budget allocations, or community events.
4. Student Elections: Providing educational institutions with a secure and transparent platform for conducting student government elections, class representative selections, or referendum votes on campus-related matters.
5. Union Elections: Assisting labor unions in conducting fair and transparent elections for union leadership positions, negotiating committee members, or ratification of collective bargaining agreements.
6. Online Surveys and Polls: Offering a tamper-proof platform for conducting surveys, opinion polls, and feedback collection on various topics, ensuring the authenticity and integrity of responses.
7. Corporate Shareholder Voting: Allowing publicly-traded companies to facilitate shareholder voting on matters such as mergers and acquisitions, executive compensation plans, or corporate governance reforms in a transparent and secure manner.
8. Remote and Overseas Voting: Addressing the challenges of remote or overseas voting by providing a decentralized platform that allows eligible voters to securely cast their ballots from anywhere in the world without relying on traditional postal voting methods.
9. NGO and Community Organization Elections: Supporting non-governmental organizations (NGOs) and community-based organizations in conducting transparent and inclusive elections for leadership positions, project funding allocations, or strategic planning initiatives.

Chapter 2

Methodology

The methodology used for this project is as follows:

Smart Contract Development:

Candidate Contract:

- Define a smart contract to manage candidate information.
- Include functions to add, update, and remove candidates.
- Implement data structures to store candidate details (e.g., name, party affiliation).

Voting Contract:

- Create a smart contract to handle the voting process.
- Include functions for voters to cast their votes securely.
- Implement logic to prevent double voting and ensure the integrity of the voting process.

Admin Contract:

- Develop a smart contract to manage administrative tasks.
- Include functions to set voting dates, monitor results, and manage overall election logistics.

Frontend Development:

Admin Panel:

- Design and develop an admin panel interface using HTML, CSS, and JavaScript
- Implement forms and input fields for managing candidates, setting voting dates, and viewing election results.
- Integrate with Ethereum wallets like MetaMask for admin authentication and interaction with smart contracts.

Voting Page:

- Create a user-friendly voting page for voters to cast their votes.
- Display candidate information and voting instructions clearly.
- Implement a voting interface that interacts with smart contracts securely through MetaMask or other Ethereum wallets.

Ethereum Integration:

Ganache Setup:

- Install and configure Ganache for local blockchain development and testing.
- Create test accounts and fund them with test Ether for testing purposes.

Truffle Configuration:

- Set up Truffle for compiling, deploying, and testing smart contracts.
- Configure Truffle to connect to the local Ganache blockchain for development.

Smart Contract Deployment:

- Compile smart contracts using Truffle.
- Deploy smart contracts to the Ganache blockchain for testing and development purposes.

Testing and Deployment:

Testing:

- Conducting unit tests and integration tests for smart contracts, frontend, and backend components.
- Test the application under various scenarios to ensure functionality and security.

Deployment:

- Deploy the frontend and backend components to a web server or hosting platform.
- Deploy the smart contracts to the Ethereum mainnet or testnet using Truffle.

FLOW DIAGRAM:

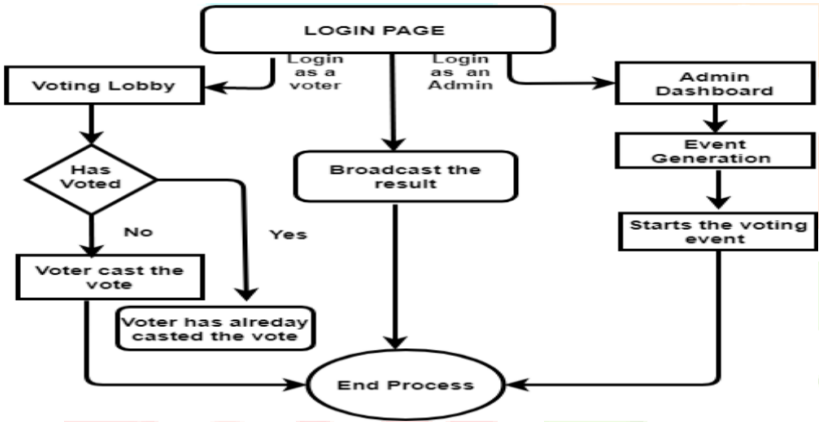

Fig2.1: Flow for voting system Dapp

HOW BLOCKCHAIN IS RELEVANT FOR VOTING SYSTEM:

Blockchain is highly relevant for the chosen application, a decentralized voting system, for several reasons:

1. **Security**: Blockchain technology provides a high level of security by design. The decentralized nature of blockchain networks ensures that no single entity has control over the entire system, making it resistant to tampering and unauthorized access. Each vote cast in the decentralized voting application is recorded on the blockchain in an immutable and transparent manner, ensuring the integrity of the voting process.
2. **Transparency and Integrity**: Transparency is a fundamental aspect of democratic elections. With blockchain, all transactions, including votes, are recorded on a public ledger that is accessible to all participants. This transparency enhances trust in the electoral process as voters and other stakeholders can independently verify the integrity of the election results.
3. **Tamper-Resistance**: Once recorded on the blockchain, votes cannot be altered or deleted. This tamper-resistant nature of blockchain technology ensures that election results remain immutable and verifiable, preventing any attempts to manipulate the outcome of the vote.
4. **Decentralization**: Traditional voting systems are often centralized, leading to vulnerabilities such as single points of failure and susceptibility to manipulation. By leveraging blockchain, the decentralized voting application distributes control across a network of nodes, eliminating the risk of central authority interference and enhancing the resilience of the voting system.
5. **Trustworthiness**: Blockchain technology instills trust in the voting process by providing a transparent and auditable record of all transactions. Through cryptographic techniques and consensus mechanisms, blockchain ensures that votes are securely recorded and counted without the need for intermediaries, thereby reducing the risk of fraud and increasing voter confidence in the electoral process.

Chapter 3

Results and Discussion

SCREENSHOTS OF IMPLEMENTATION:

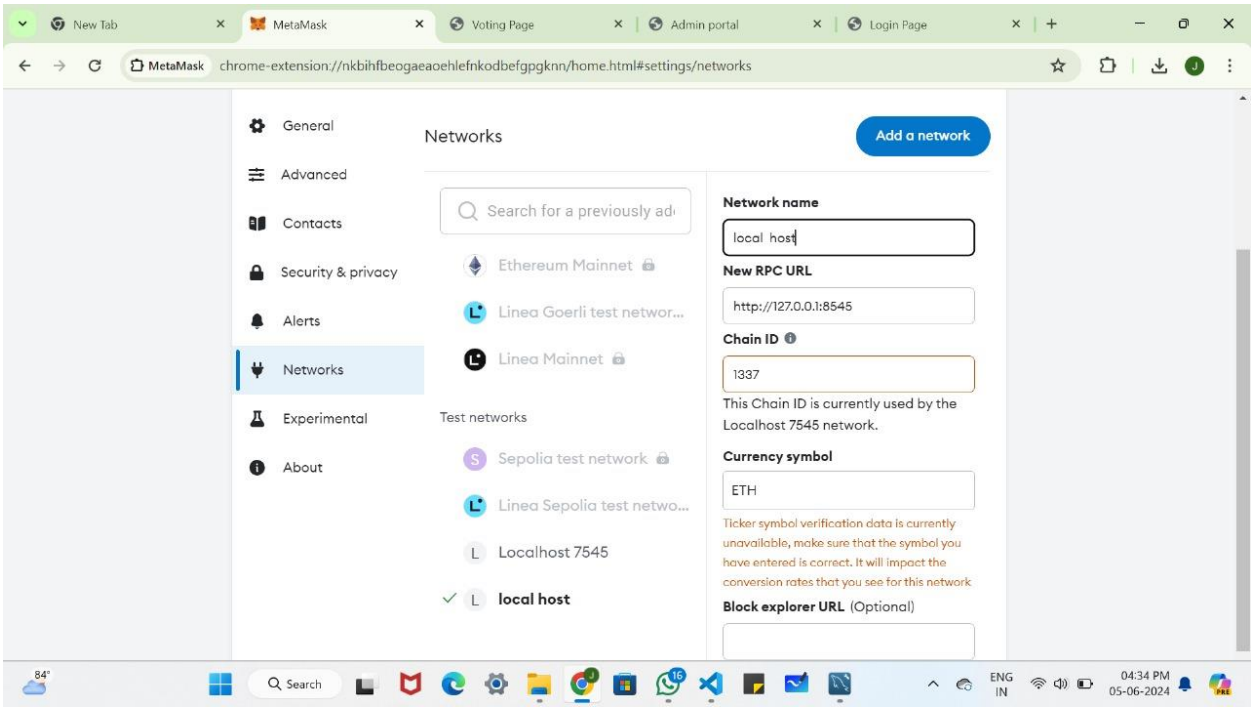

Fig3.1: Setting up a local network for METAMASK after installing it

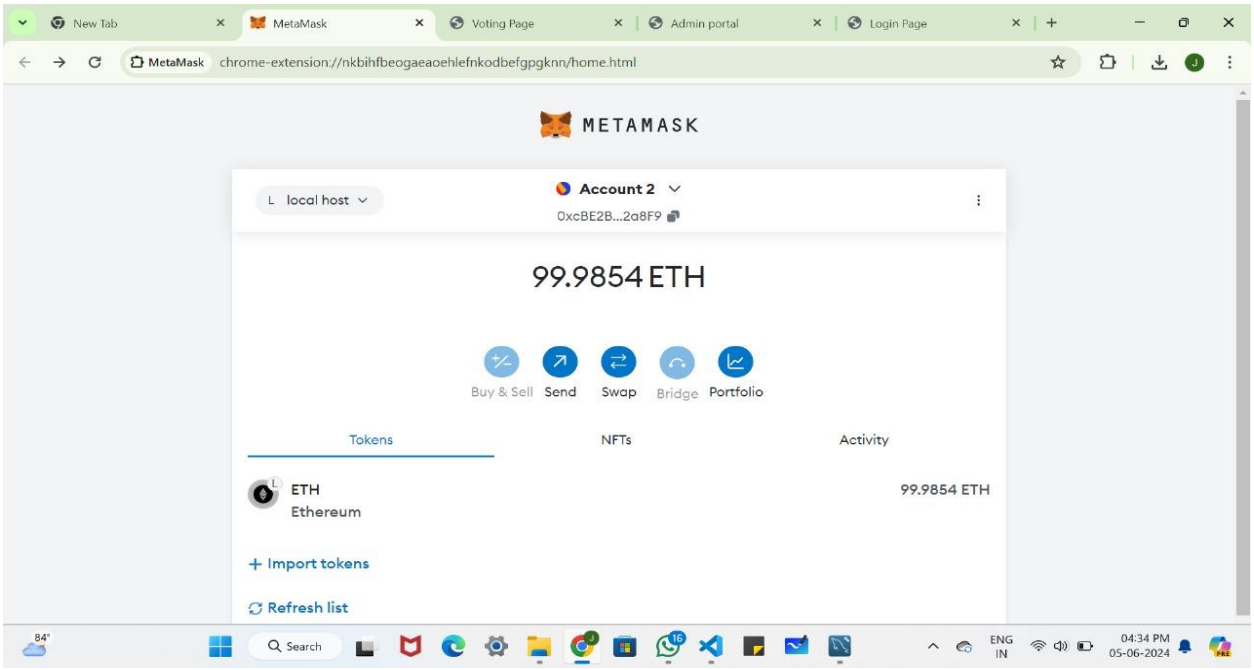

Fig3.2: Importing accounts from Ganache

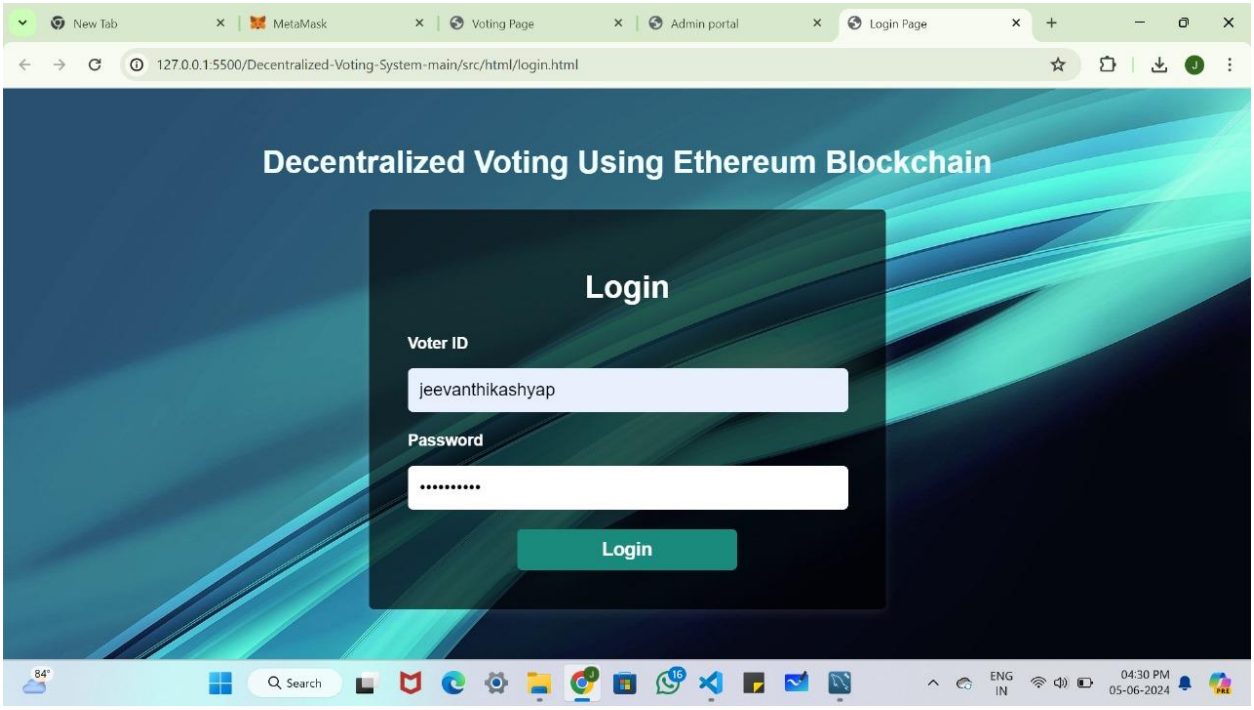

Fig3.3: Login page for admin and users

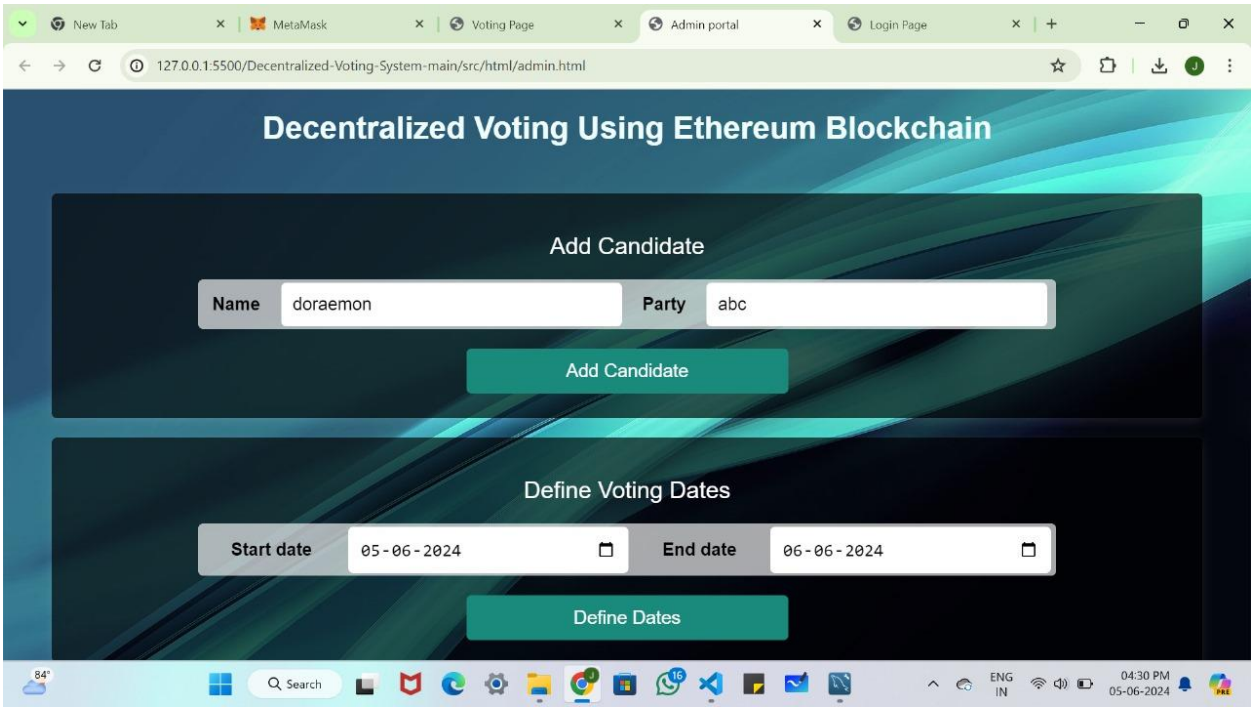

Fig3.4: Admin portal for adding candidate information and voting timelines

Fig3.5: Users page to cast votes

Chapter 4

Conclusion

The decentralized voting application leveraging Ethereum's blockchain demonstrated significant enhancements in security and transparency. Each vote was recorded immutably on the blockchain, ensuring resistance to tampering and fraud, which in turn strengthened the integrity of the voting process. This transparent and auditable nature of blockchain technology instilled greater trust among voters and stakeholders, allowing for independent verification of election results. The decentralized architecture of the system effectively eliminated single points of failure and reduced the risk of manipulation by central authorities, thereby enhancing the resilience and reliability of the voting system. Additionally, the application was found to be efficient and user-friendly, providing a seamless experience for both voters and administrators. Overall, the implementation showcased how blockchain technology can be effectively used to create a secure, trustworthy, and transparent voting system.

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