



Decentralized Voting System Using Ethereum Blockchain For Transparent Elections

MCA –II (sem-III) Year Research Project Presentation

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INTRODUCTION

- Traditional voting systems often face challenges such as fraud, tampering, slow counting, and lack of transparency.
- To ensure trustworthy and fair elections, a secure and transparent voting mechanism is needed.
- Blockchain technology offers key features such as decentralization, immutability, and transparency, which make it suitable for secure voting.
- Ethereum blockchain enables the use of smart contracts to automate, record, and verify votes without human intervention.
- In a decentralized voting system, each vote is stored as a tamper-proof transaction, ensuring that election data cannot be altered.
- The system enhances security, privacy, auditability, and voter confidence, while also enabling fast and accurate result processing.
- Overall, Ethereum-based decentralized voting provides a modern, transparent, and reliable solution for conducting fair digital elections.



IMPORTANCE

1. Enhanced Transparency

All votes are recorded on a public, tamper-proof ledger.

2. Prevention of Fraud and Tampering

Blockchain's immutability prevents unauthorized changes.

3. Improved Security

Cryptographic techniques protect both voter identities and voting data from cyberattacks.

4. Decentralization Removes Single Point of Failure

No central authority controls the data, reducing risks of hacking, corruption, or system failure.

5. Faster Counting and Real-Time Results

Smart contracts automatically count and verify votes.

6. Greater Voter Trust

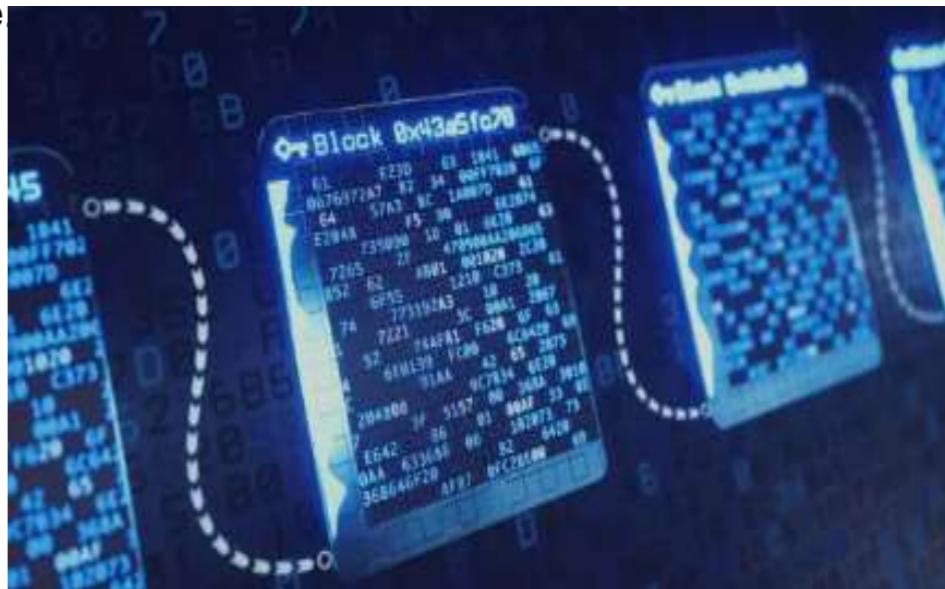
Transparent and verifiable election data.

7. Increased Accessibility

Enables secure remote voting.

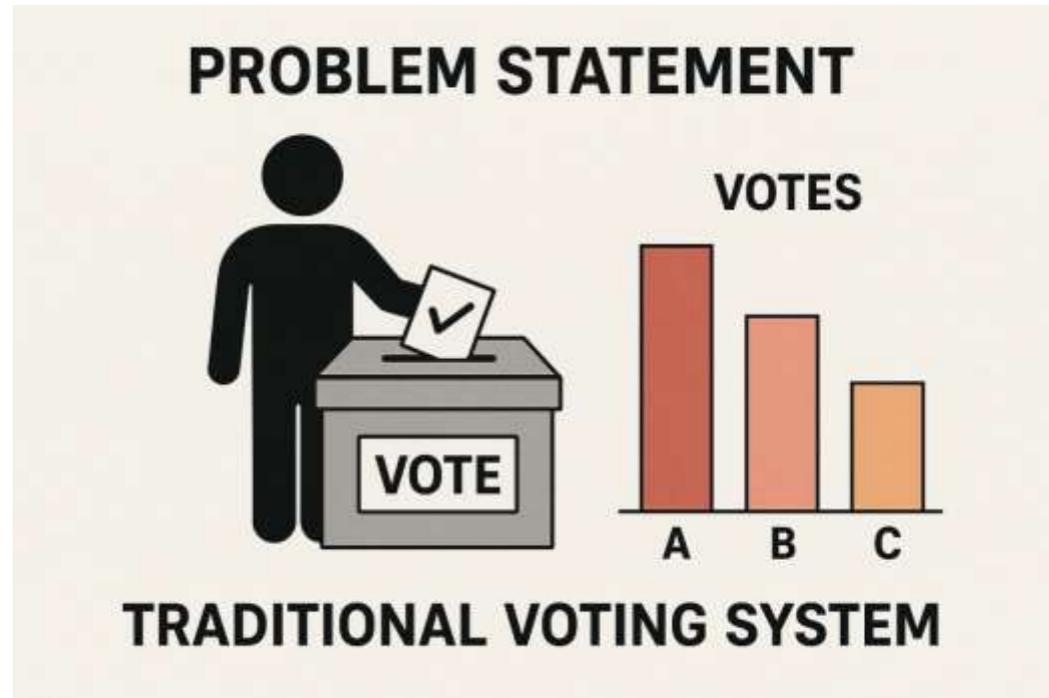
8. Cost Reduction

Reduces expenses related to manpower, ballot printing, physical polling booths, and transportation.



PROBLEM STATEMENT

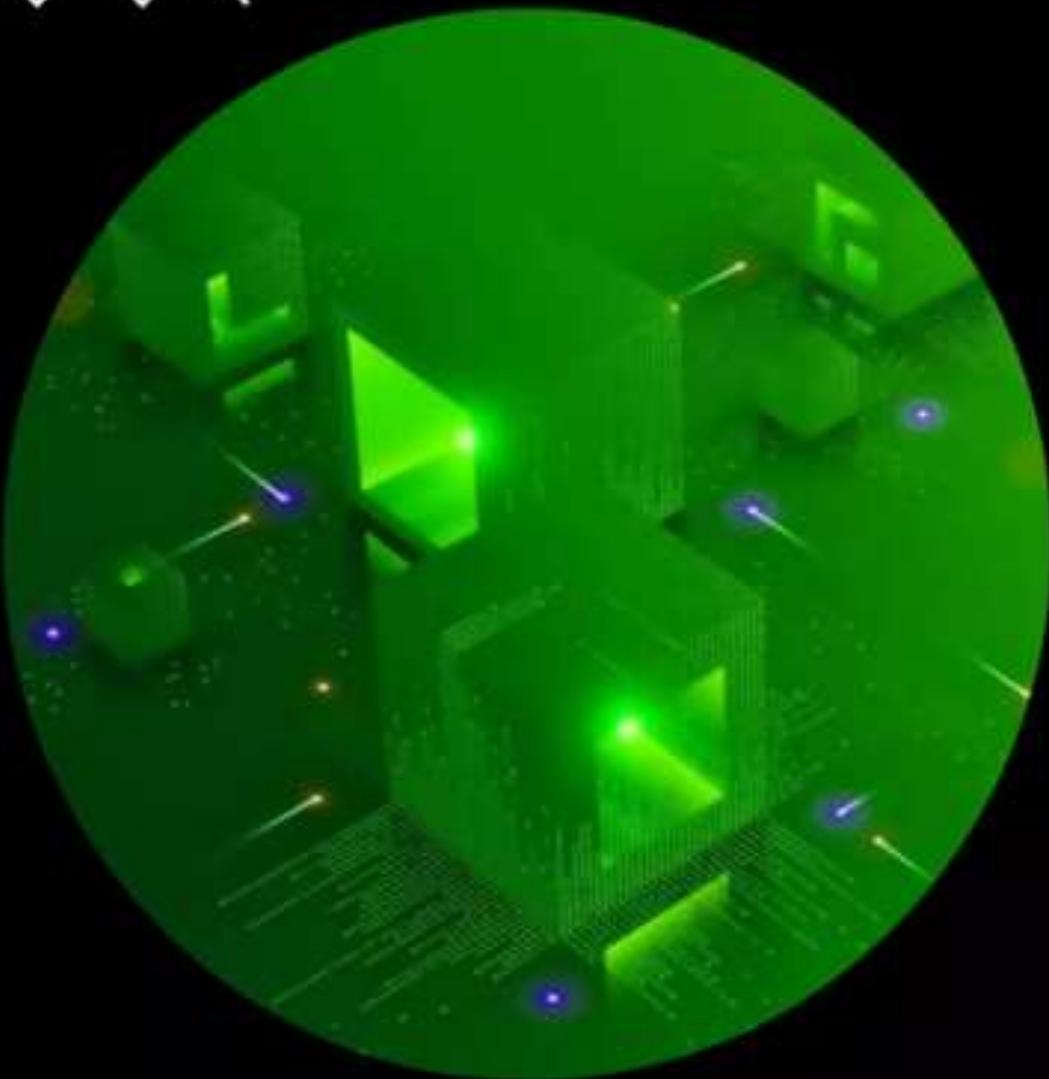
- Traditional voting systems lack transparency and citizens cannot verify vote accuracy.
- Centralized databases are vulnerable to hacking and manipulation.
- Manual counting causes delays and increases human error.
- Weak voter verification can lead to duplicate or unauthorized voting.
- Limited accessibility affects remote, elderly, and overseas voters.
- High operational costs make elections expensive.
- No end-to-end auditability, making independent verification difficult.
- Public trust decreases due to poor security and transparency.





Solution

- To develop a decentralized node for online voting using blockchain technology.
- Security and transparency can be ensured by leveraging the immutable and transparent nature of blockchain.
- The use of blockchain technology will address concerns related to the accuracy and transparency of voting systems.





Market Opportunity

- The global electoral market is expanding, with a growing demand for secure and transparent voting systems.
- Governments, organizations, and institutions are actively seeking innovative solutions to address the flaws in existing voting systems.
- We aim to capture a significant market share by offering a cutting-edge blockchain-based voting platform.



OBJECTIVE



- Ensure Transparency
- Increase Security
- Prevent Voter Fraud
- Guarantee Data Integrity
- Enhance Trust in Elections
- Enable Real-Time Vote Counting
- Improve Accessibility
- Reduce Operational Costs
- Provide Auditability
- Decentralize Control

SCOPE OF THE SYSTEM

- ❖ Enables **secure digital voting** using Ethereum blockchain technology.
- ❖ Provides a **tamper-proof, immutable ledger** for recording all votes.
- ❖ Ensures **transparency** by allowing public verification of votes without exposing voter identity.
- ❖ Supports **voter authentication** using cryptographic techniques or digital identities.
- ❖ Allows **real-time vote counting** with automatic tallying via smart contracts.
- ❖ Facilitates **remote voting** through decentralized applications (DApps).
- ❖ Reduces dependence on centralized authorities, minimizing risks of fraud or manipulation.
- ❖ Provides **auditable election results** accessible to all stakeholders.
- ❖ Maintains **anonymity and privacy** using secure encryption methods.
- ❖ Supports **scalability and integration** with government e-ID systems or biometric verification (optional).

LITERATURE SURVEY

❑ Blockchain Voting Overview:

Studies show blockchain improves transparency, immutability, and auditability in e-voting.

❑ Ethereum-based Voting Models:

Research highlights use of smart contracts for secure vote casting, automated tallying, and tamper-proof storage.

❑ Security & Privacy Techniques:

Literature emphasizes cryptographic tools like zero-knowledge proofs, encryption, and anonymity schemes to protect voter identity.

❑ End-to-End Verifiability:

Papers propose systems where voters can verify their votes without revealing personal data.

❑ Scalability & Performance Issues:

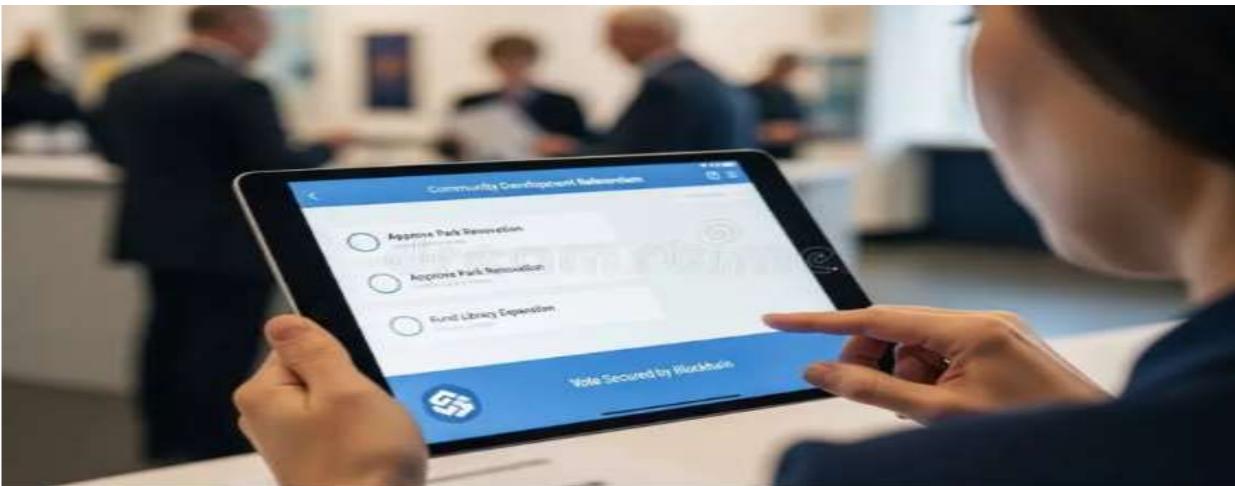
Many studies point out Ethereum gas cost, transaction speed, and scalability limitations.

❑ Identity & Authentication:

Research includes digital ID integration, PKI-based authentication, and prevention of double-voting.

❑ Challenges Identified:

Privacy leakage on public chains, coercion resistance, usability issues, and regulatory barriers.



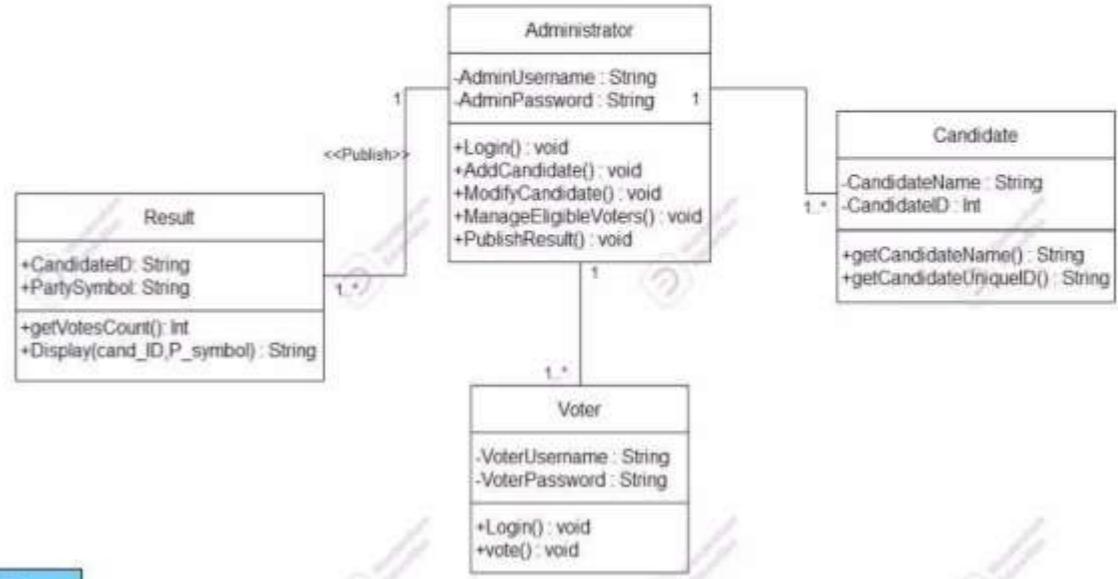
SYSTEM ARCHITECTURE

- Voter**
 - Registers and authenticates
 - Casts vote securely
 - User Interface (Web / Mobile DApp)**
 - Provides voting dashboard
 - Connects voter wallet (MetaMask)
 - Authentication Module**
 - Verifies voter identity
 - Prevents duplicate voting
 - Ethereum Smart Contract**
 - Stores candidates and votes
 - Ensures one-person-one-vote
 - Executes voting rules automatically
 - Ethereum Blockchain Network**
 - Records votes immutably
 - Provides transparency and security
 - Consensus Mechanism**
 - Validates transactions
 - Prevents tampering and fraud
 - Admin / Election Authority**
 - Deploys smart contract
 - Manages election setup (candidates, duration)
 - Result Module**
 - Fetches real-time results
 - Publicly verifiable and transparent
-
- The diagram illustrates the flow of a vote from a voter's perspective through a blockchain network to a result module.
- Voter UI:** A mobile device screen shows a login form with fields for Name and Password, and a list of candidates A, B, and C with a checked box next to candidate A. Below the list is a "VOTE" button.
 - Transaction Processing:** An arrow points from the Voter UI to a central box labeled "TransactionID, Timestamp (abdhs3242412kjckelz..)". This box contains a padlock icon and a clock icon, symbolizing security and time-stamping.
 - Blockchain Network:** An arrow points from the Transaction Processing box to a network of four nodes. Each node is represented by a rectangular box with a checkmark above it, indicating successful verification. The nodes are interconnected by arrows forming a chain.
 - Result Module:** An arrow points from the Blockchain Network to a mobile device screen labeled "Results". The screen displays a pie chart and the same TransactionID and Timestamp as the previous step.
 - Blockchain Chain:** At the bottom, a series of colored cubes (yellow, yellow, green, green) represents the blockchain chain. A downward-pointing arrow indicates the addition of a new transaction (Vote) into the chain.
- Annotations:**
- "All details are broadcasted to the network, where each node verifies it."
 - "Voter can view results soon after voting and can trace back."
 - "Transaction (Vote) is added into the chain"

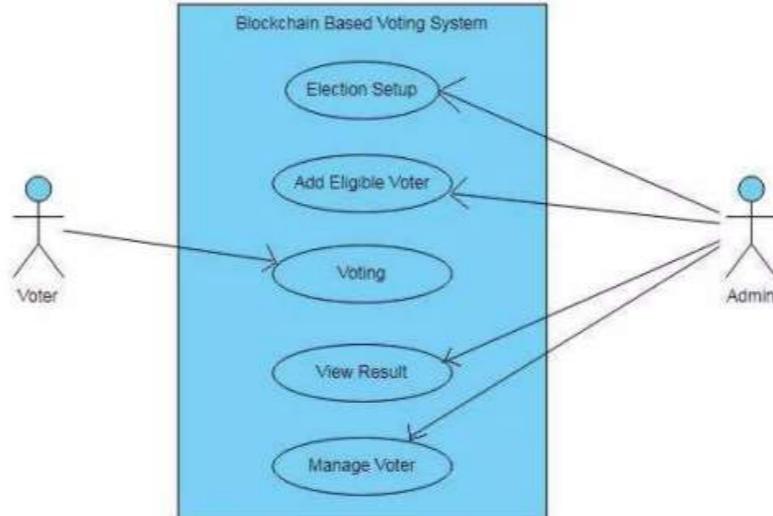
DIAGRAMS

Class Diagram

- System Architecture Diagram
- Block Diagram
- Flowchart Diagram
- Data Flow Diagram (DFD)
- Sequence Diagram
- Use Case Diagram
- Component Diagram
- Deployment Diagram



Use Case Diagram



SOFTWARE & HARDWARE REQUIREMENT

Software Requirements

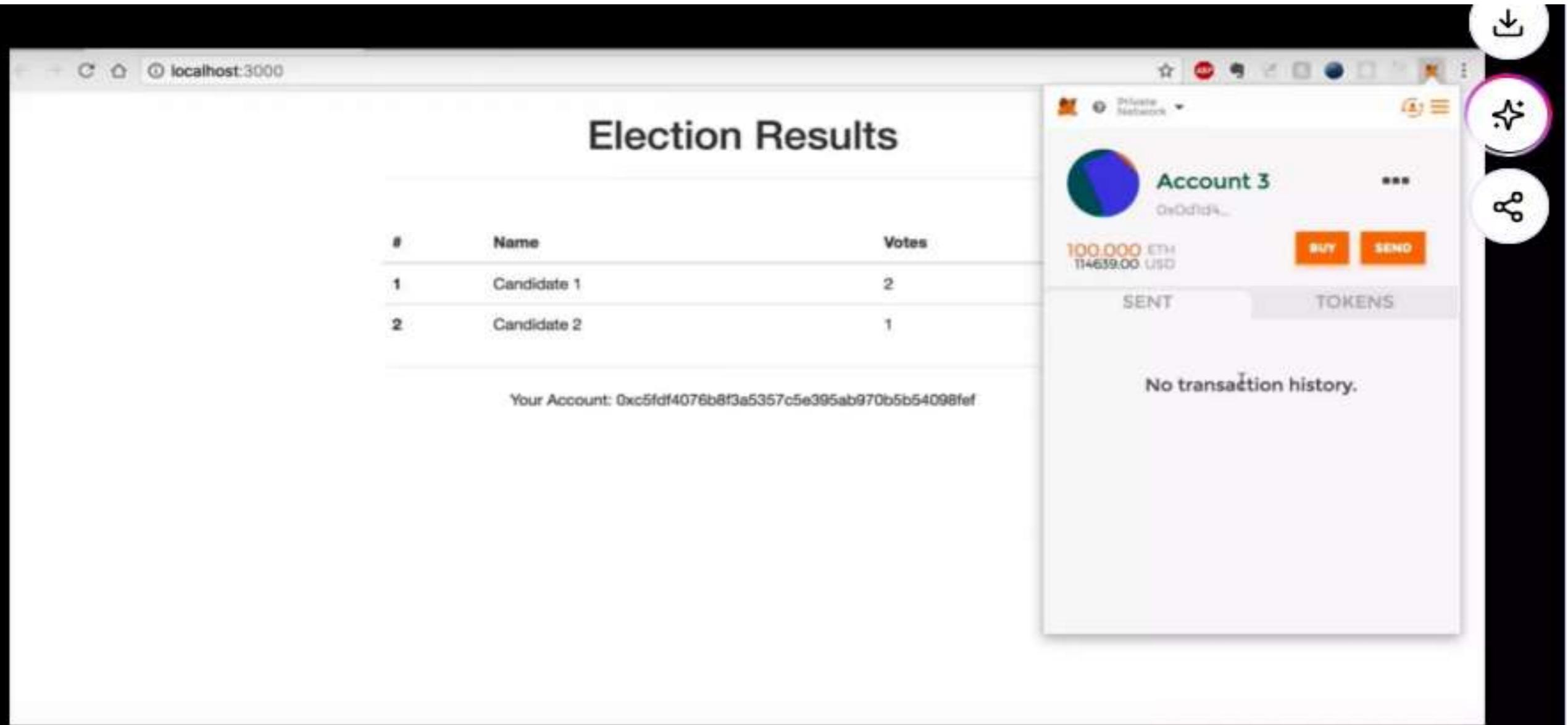
- **Operating System** – Windows / Linux / macOS
- **Programming Language** – Solidity, JavaScript
- **Blockchain Platform** – Ethereum
- **Smart Contract Tools** – Remix IDE / Truffle
- **Web Framework** – React.js / HTML, CSS
- **Wallet** – MetaMask
- **Web3 Library** – Web3.js / Ethers.js
- **Database (Optional)** – MongoDB / MySQL
- **Browser** – Google Chrome

Hardware Requirements

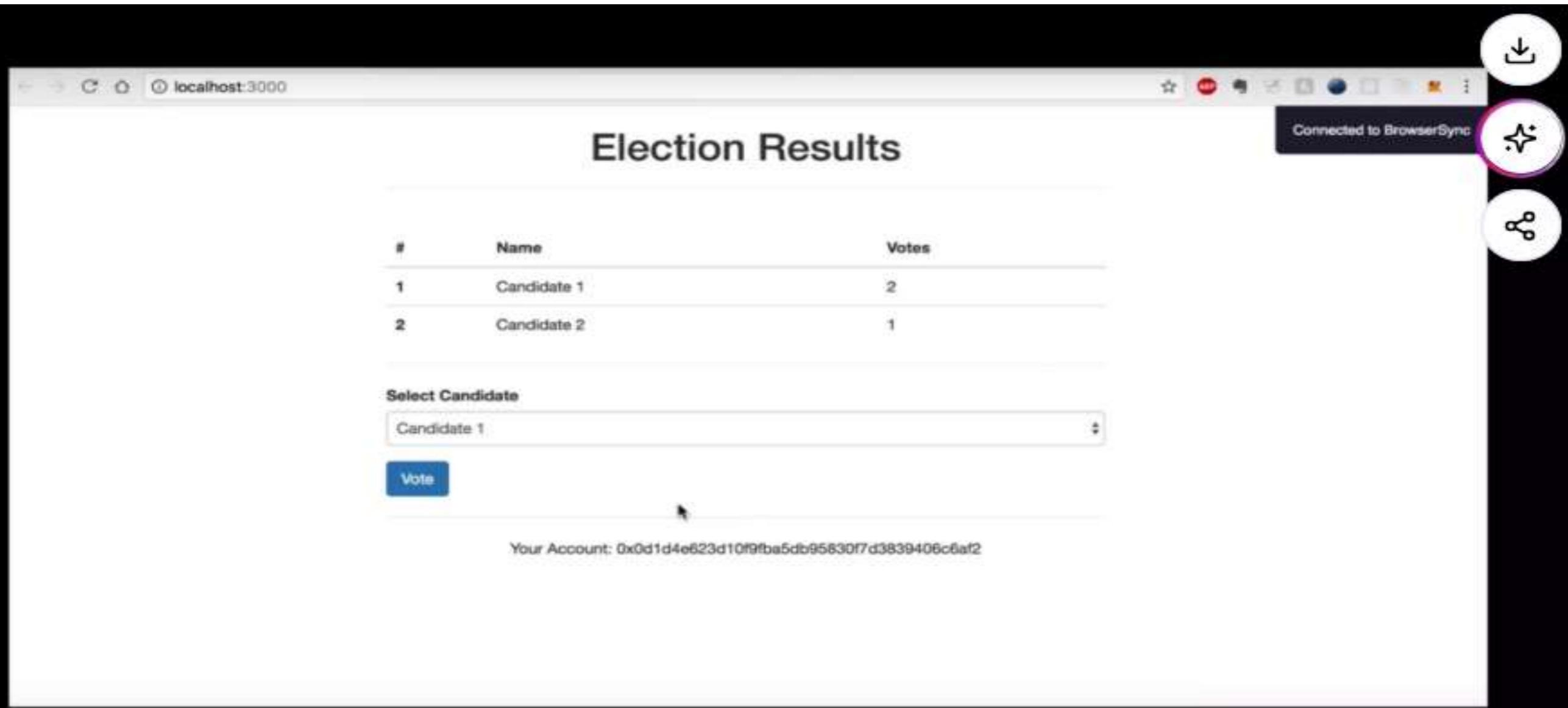
- **Processor** – Intel i3 or above
- **RAM** – Minimum 4 GB (8 GB recommended)
- **Hard Disk** – 20 GB free space
- **Internet Connection** – Required
- **Client Device** – PC / Laptop / Mobile

Components of Ethereum

- **Smart Contracts** act as the back-end logic and storage. A contract is written in Solidity, a smart contract language, and is a collection of code and data that resides at a specific address on the Ethereum blockchain.¹. Code on blockchain, Like a micro service, Written in solidity
- **The Ethereum Virtual Machine(Ganache)**: handles the internal state and computation of the entire Ethereum Network. Think of the EVM as this massive decentralized computer that contains “addresses” that are capable of executing code, changing data, and interacting with each other.
- **Web3.js** is a Javascript API that allows you to interact with the Blockchain, including making transactions and calls to smart contracts.
- **Metmask** brings Ethereum to your browser. It is a browser extension that provides a secure web3 instance linked to your Ethereum address, allowing you to use Decentralized Applications.



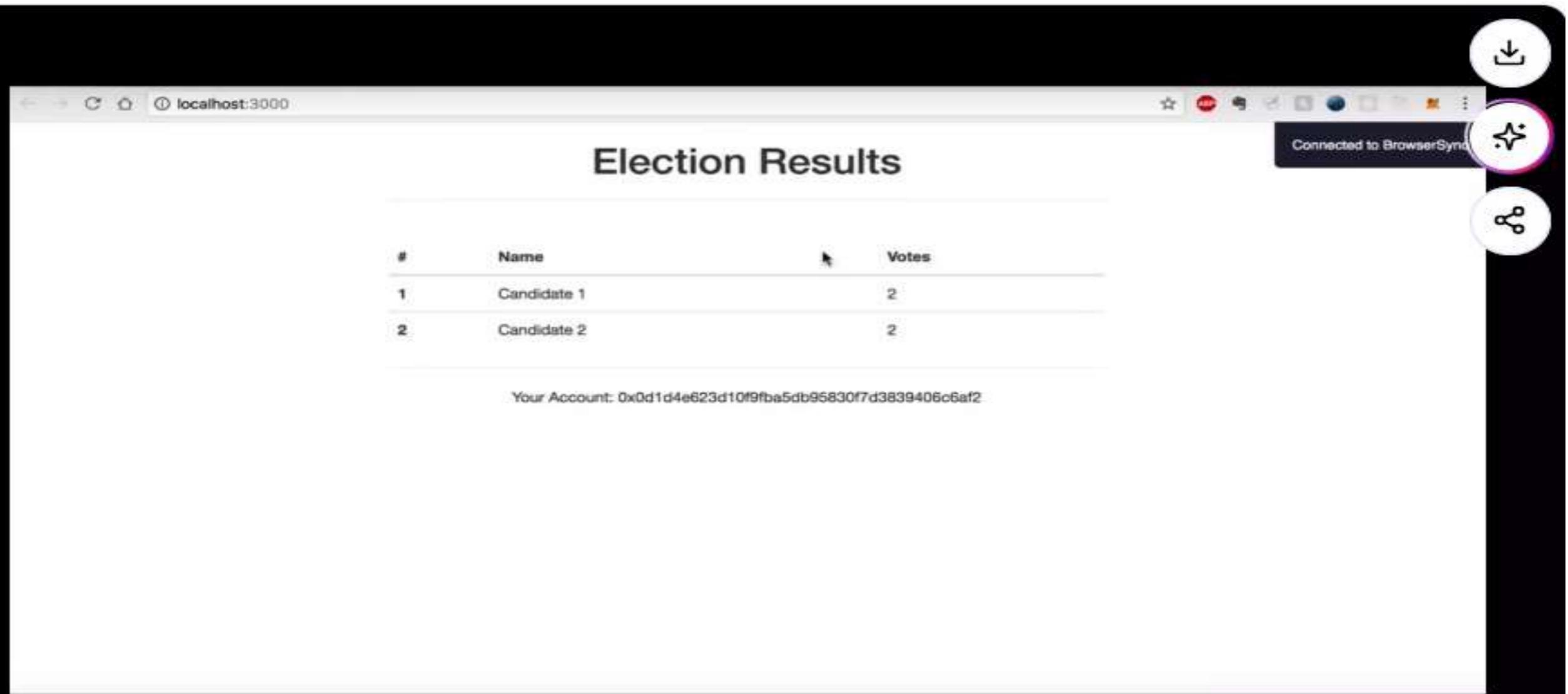
Screenshot 1: Web Browser Interface with metamsk



Screenshot 2: Web Browser Interface with Candidate Vote selection



Screenshot 3: Web Browser Interface with Voting Transaction



Screenshot 4: Web Browser Interface with Final Voting Result

ACCOUNTS	BLOCKS	TRANSACTIONS	CONTRACTS	EVENTS	LOGS	UPDATE AVAILABLE	SEARCH FOR BLOCK NUMBERS OR TX HASHES	SAVE	SWITCH
CURRENT BLOCK 11	GAS PRICE 20000000000	GAS LIMIT 6721975	RANFORM PETERSBURG	NETWORK ID 5777	RPC SERVER HTTP://127.0.0.1:7545	MINING STATUS AUTOMINING	WORKSPACE QUICKSTART		
ADDRESS 0x2B5b64bd7F146Cf6c3301670e5B4Faf18086908E	BALANCE 99.97 ETH							TX COUNT 9	INDEX 0
ADDRESS 0xA9575a078A2f7E5aba3741F33fbC748d906CA663	BALANCE 100.00 ETH							TX COUNT 0	INDEX 1
ADDRESS 0xF109764dA1BbDb3926A66322333838651BFA0840	BALANCE 100.00 ETH							TX COUNT 0	INDEX 2
ADDRESS 0xE050c397201638e140E0eED4d7C26dd7943dCE6B	BALANCE 100.00 ETH							TX COUNT 0	INDEX 3
ADDRESS 0x8Abe08843700E25319E9458bEFE4e032E9FA7336	BALANCE 100.00 ETH							TX COUNT 0	INDEX 4
ADDRESS 0xC22C282C7e45544A7b4C951Ca056C7b14cFf9cb1	BALANCE 100.00 ETH							TX COUNT 0	INDEX 5
ADDRESS 0x85518918558DF310b1193396C845EDDE19095Df6	BALANCE 100.00 ETH							TX COUNT 0	INDEX 6
ADDRESS 0x9c428713173A4b73245604016C7Dce28367598B1	BALANCE 100.00 ETH							TX COUNT 0	INDEX 7
ADDRESS 0xC6Fdd091A84b1C4426bB7Eca6d58B29d701782F2	BALANCE 100.00 ETH							TX COUNT 2	INDEX 8
ADDRESS 0xDeC5384AB007aB9A87C7d2f75495f102601635d2	BALANCE 100.00 ETH							TX COUNT 0	INDEX 9

Fig: Local Ethereum Network

CONCLUSION

- The decentralized voting system ensures **transparency, security, and trust** using Ethereum blockchain.
- Smart contracts eliminate **tampering, duplication, and manual errors**.
- Blockchain provides **immutable and verifiable voting records**.
- The system reduces **fraud and third-party interference**.
- It enables **secure, fast, and cost-effective elections**.
- Overall, the project demonstrates the effectiveness of blockchain for **transparent digital elections**.

THANK YOU