Decentralized Voting System Using Ethereum Blockchain For Transparent Elections

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

PRESENTED BY : Mr. Mangesh Sunil Ingale.

GUIDED BY : Asst. Prof. Ms. Reeta V. Patil.

HEAD OF DEP. : Dr. Prof. Dinesh D. Puri.

DEPARTMENT OF COMPUTER APPICATIONS

SSBT's COLLEGE OF ENGINEERING AND TECHNOLOGY

BAMBHORI, JALGAON - 425 001 (MS)

2025–2026

OUTLINE

- INTRODUCTION
- IMPORTANCE
- PROBLEM STATEMENT
- SOLUTION
- MARKET OPPORTUNUTY
- OBJECTIVE
- SCOPE OF THE SYSTEM
- LITERATURE SURVEY
- SYSTEM ARCHITECTURE
- DIAGRAMS (SYSTEM/ UML/ FLOW)
- COMPONENTS OF ETHEREUM
- SOFTWARE & HARDWARE REQUIREMENT
- CONCLUSION

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**

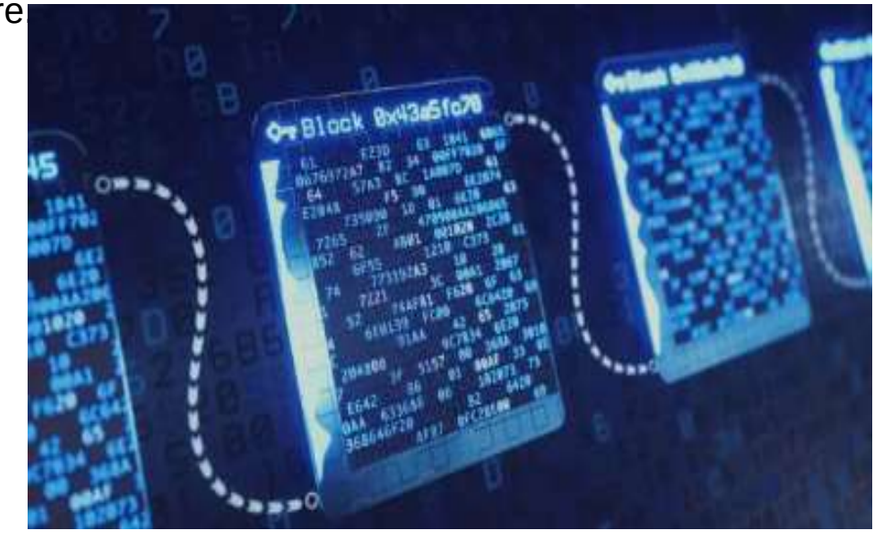
   Transparent and verifiable election data.

7. **Increased Accessibility**

   Enables secure remote voting.

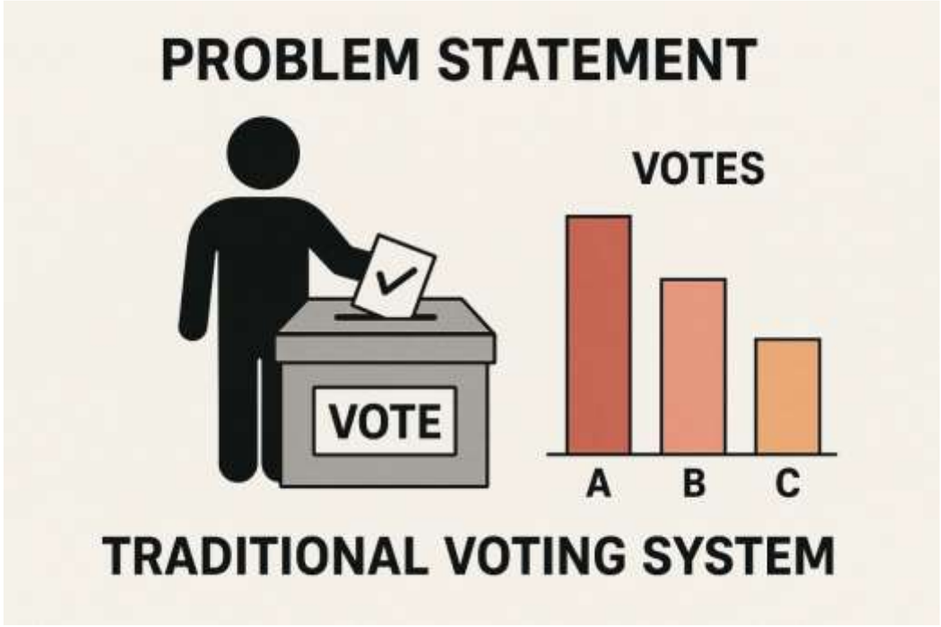
8 **Cost Reduction**

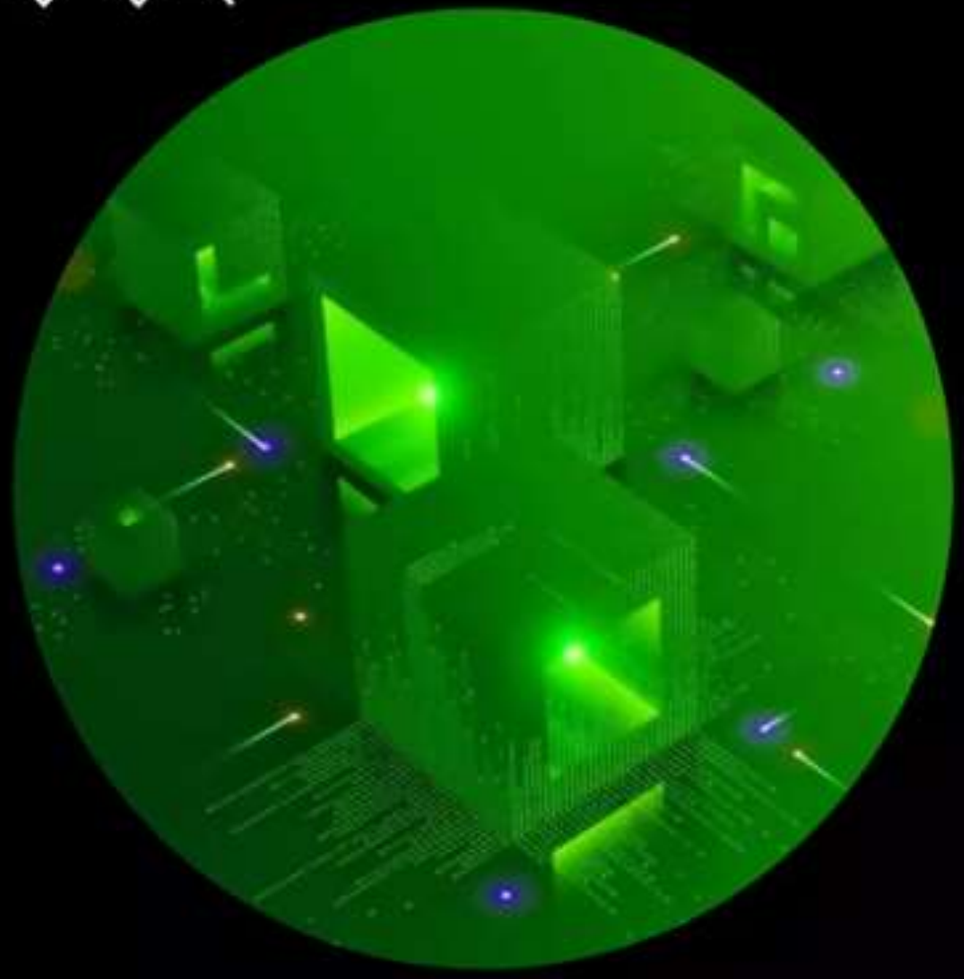
   Reduces expenses related to manpower, ballot printing, physical polling booths, and transportation.



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:**

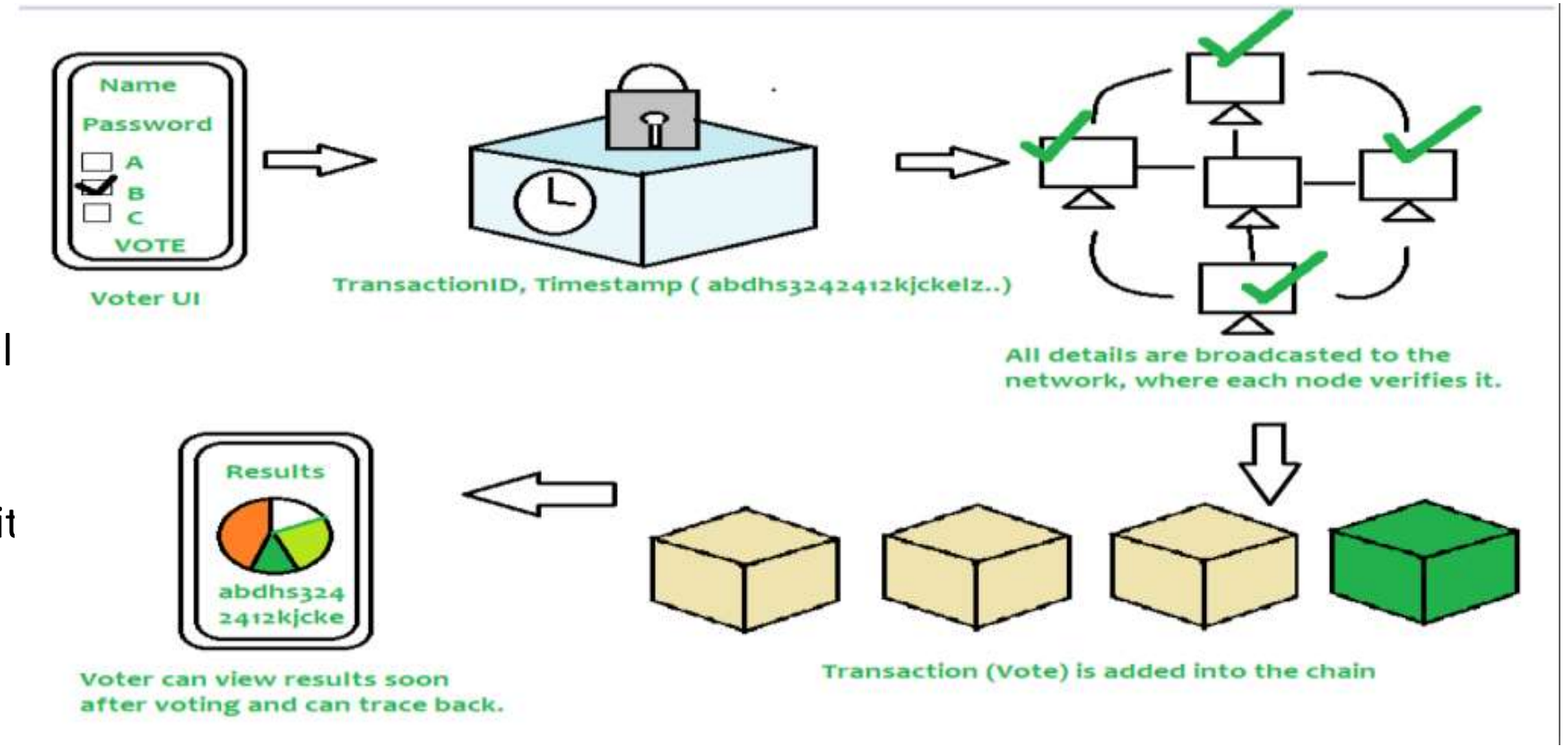
  Research includes digital ID integration, PKI-based authentication, and prevention of double-voting.

- **Challenges Identified:**

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

SYSTEM ARCHITECTURE

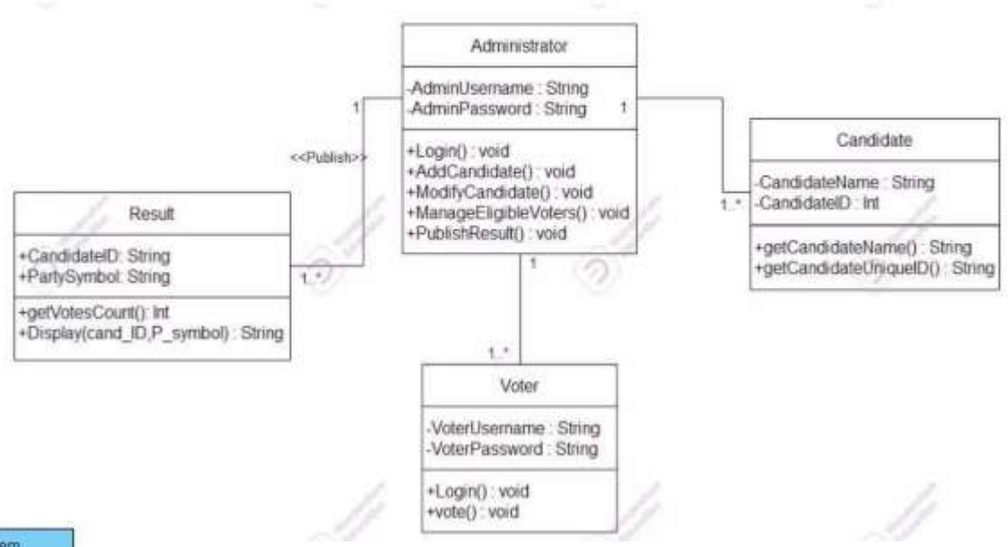
- **Voter**
  Registers and authenticates
  Casts vote securely
- **User Interface (Web / Mobile DApp)**
  Provides voting dashboard
  Connects voter wallet (MetaMask)
- **Authentication Module**
  Verifies voter identity
  Prevents duplicate voting
- **Ethereum Smart Contract**
  Stores candidates and votes
  Ensures one-person-one-vote
  Executes voting rules automatical
- **Ethereum Blockchain Network**
  Records votes immutably
  Provides transparency and securit
- **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



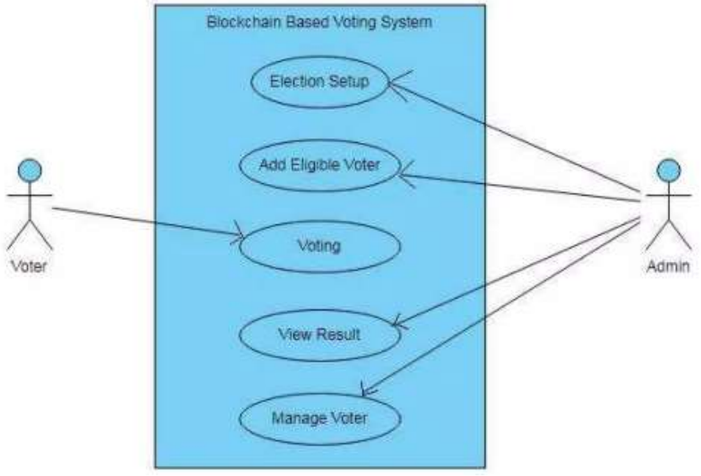
DIAGRAMS

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

Class Diagram



Use Case Diagram



SOFTWARE & HARDWARE REQUIREMENT

Software Requirements

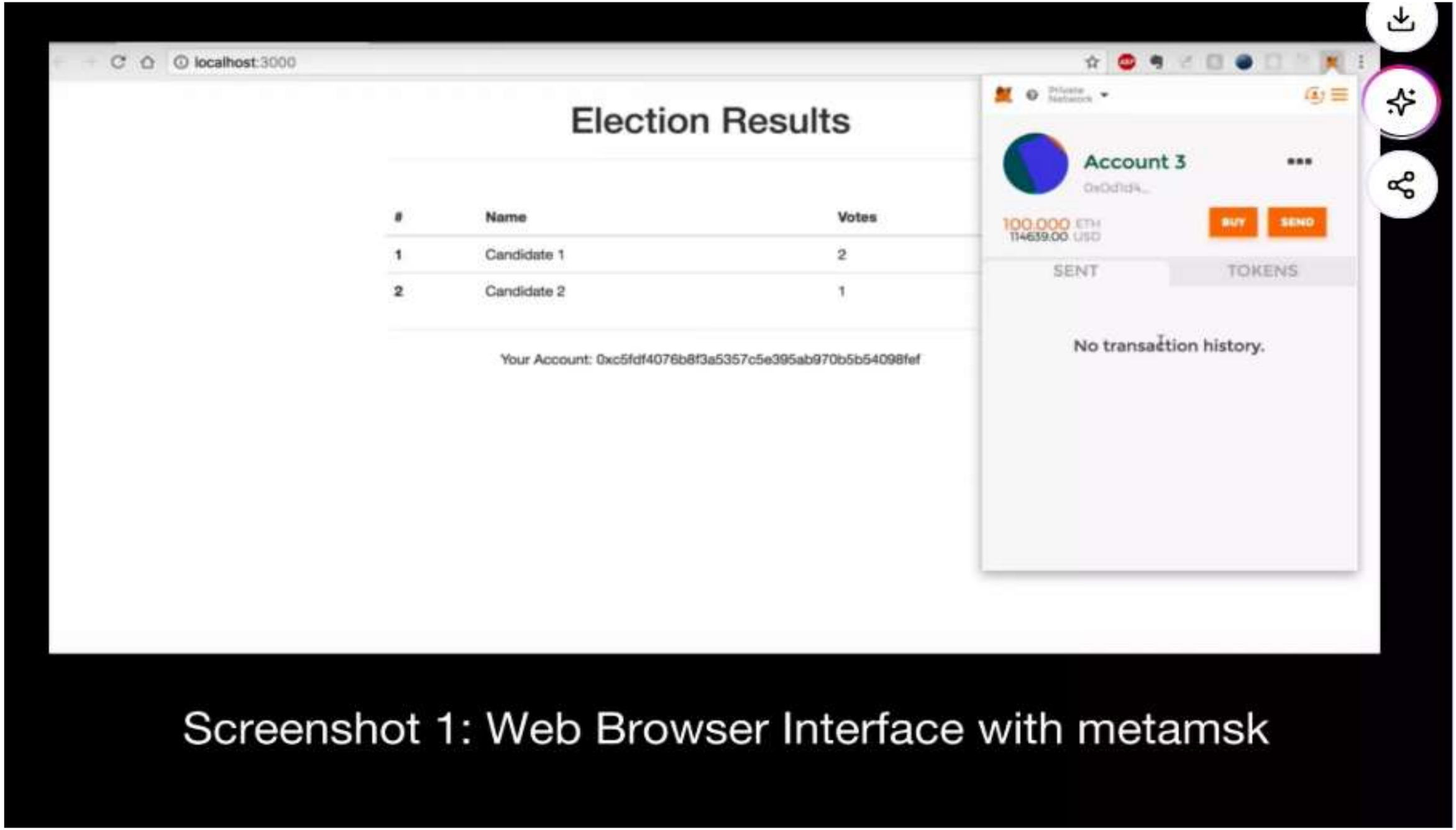
- **Operating System** – Windows / Linux / macOS
- **Programming Language** – Solidity, JavaScript
- **Blockchain Platform** – Ethereum
- **Smart Contract Tools** – Remix IDE / Truffle
- **Web Framework** – React.js / HTML, CSS
- **Wallet** – MetaMask
- **Web3 Library** – Web3.js / Ethers.js
- **Database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

Hardware Requirements

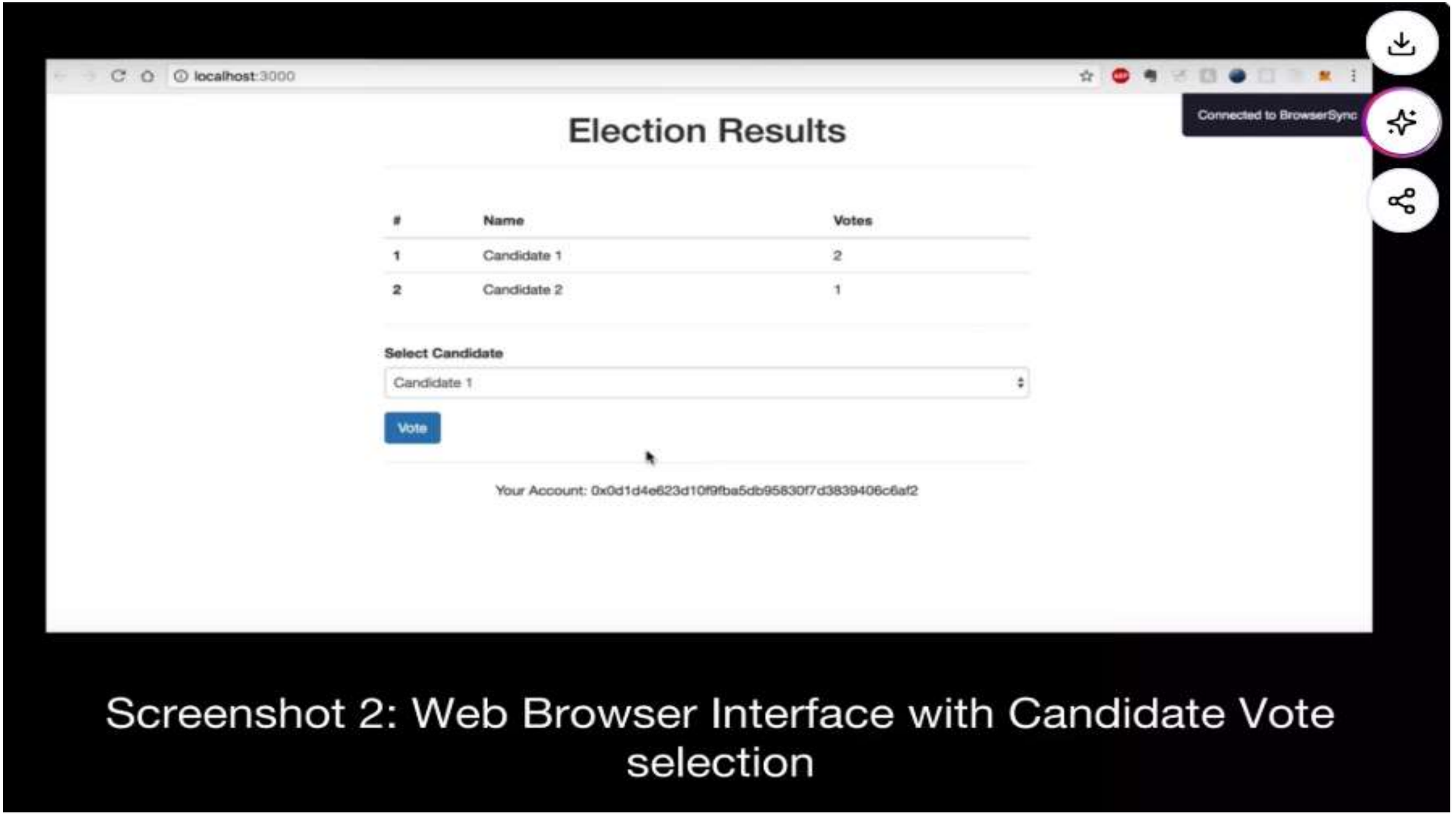
- **Processor** – Intel i3 or above
- **RAM** – Minimum 4 GB (8 GB recommended)
- **Hard Disk** – 20 GB free space
- **Internet Connection** – Required
- **Client Device** – PC / Laptop / Mobile

Components of Ethereum

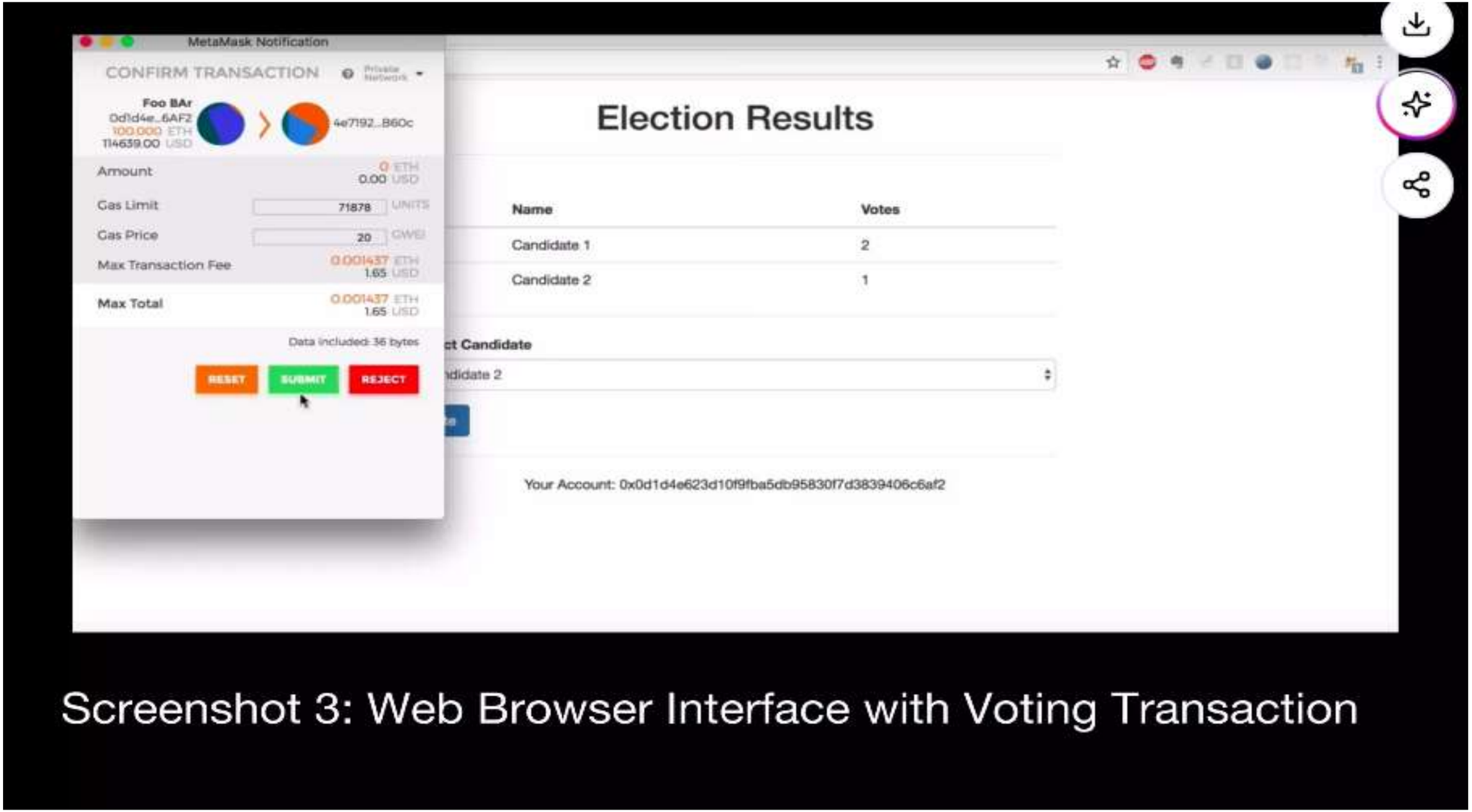
- **Smart Contracts** act as the back-end logic and storage. A contract is written in Solidity, a smart contract language, and is a collection of code and data that resides at a specific address on the Ethereum blockchain.1. Code on blockchain, Like a micro service, Written in solidity
- **The Ethereum 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

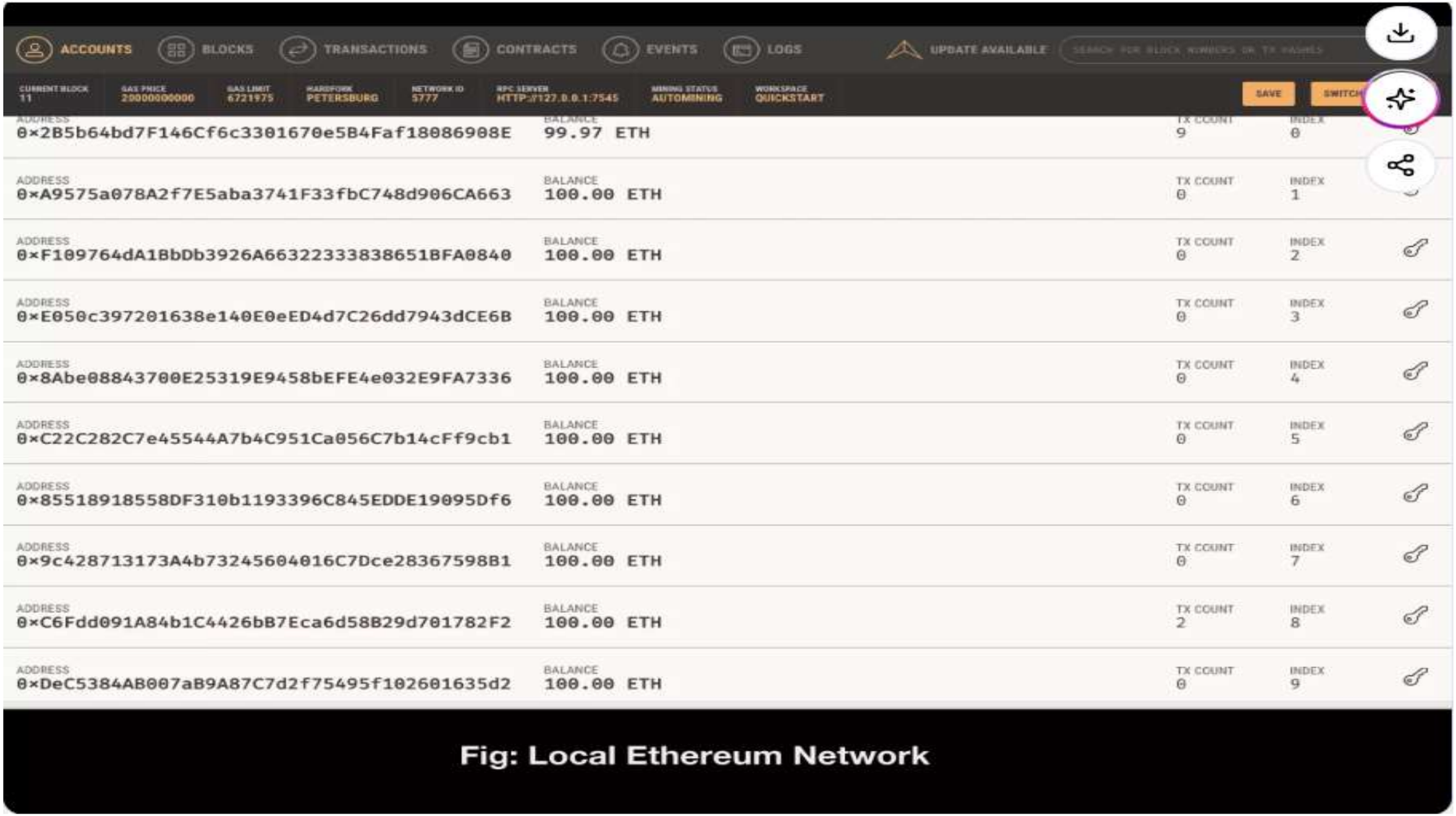


Fig: Local Ethereum Network

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