MAHATMA EDUCATION SOCIETY'S
PILLAI COLLEGE OF ENGINEERING,NEW PANVEL

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

MAJOR PROJECT - B

ChainVote : Blockchain Based Voting System

PROJECT GUIDE - ISHMEET SIR

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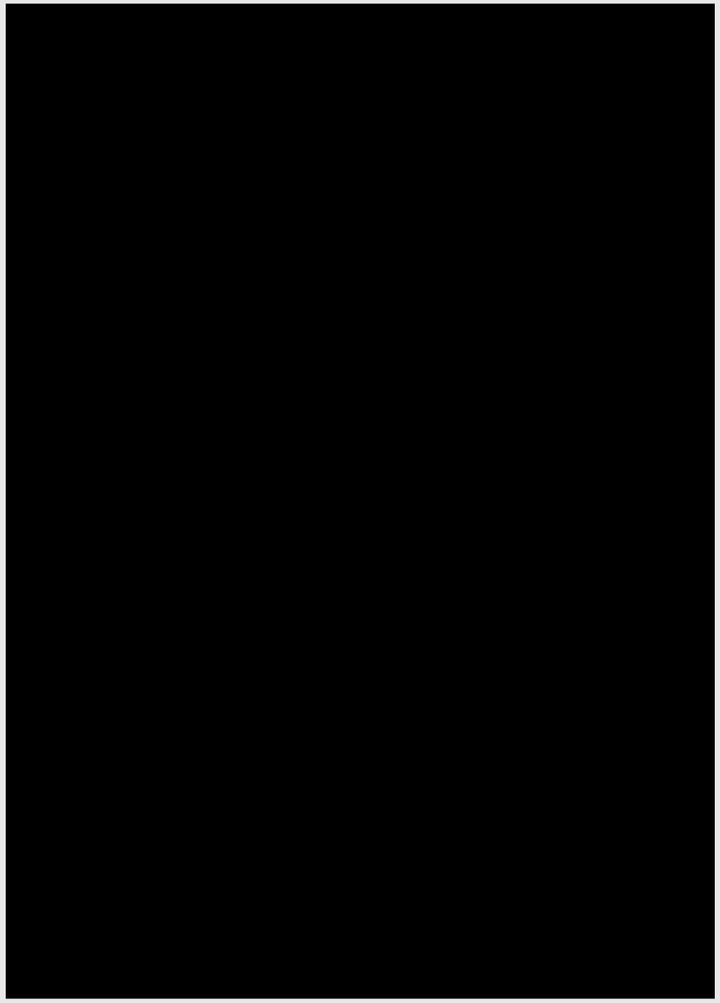
B.Tech EXTC 25-26



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Introduction

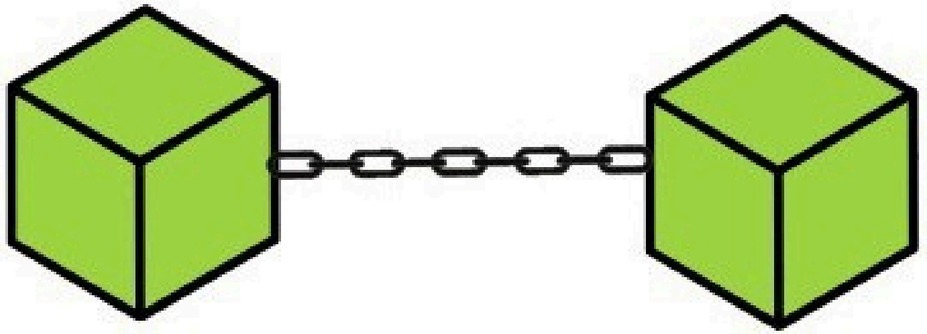
Blockchain is a decentralized digital ledger that records transactions securely and transparently. Unlike traditional databases controlled by a single authority, blockchain operates on a network of computers (nodes).

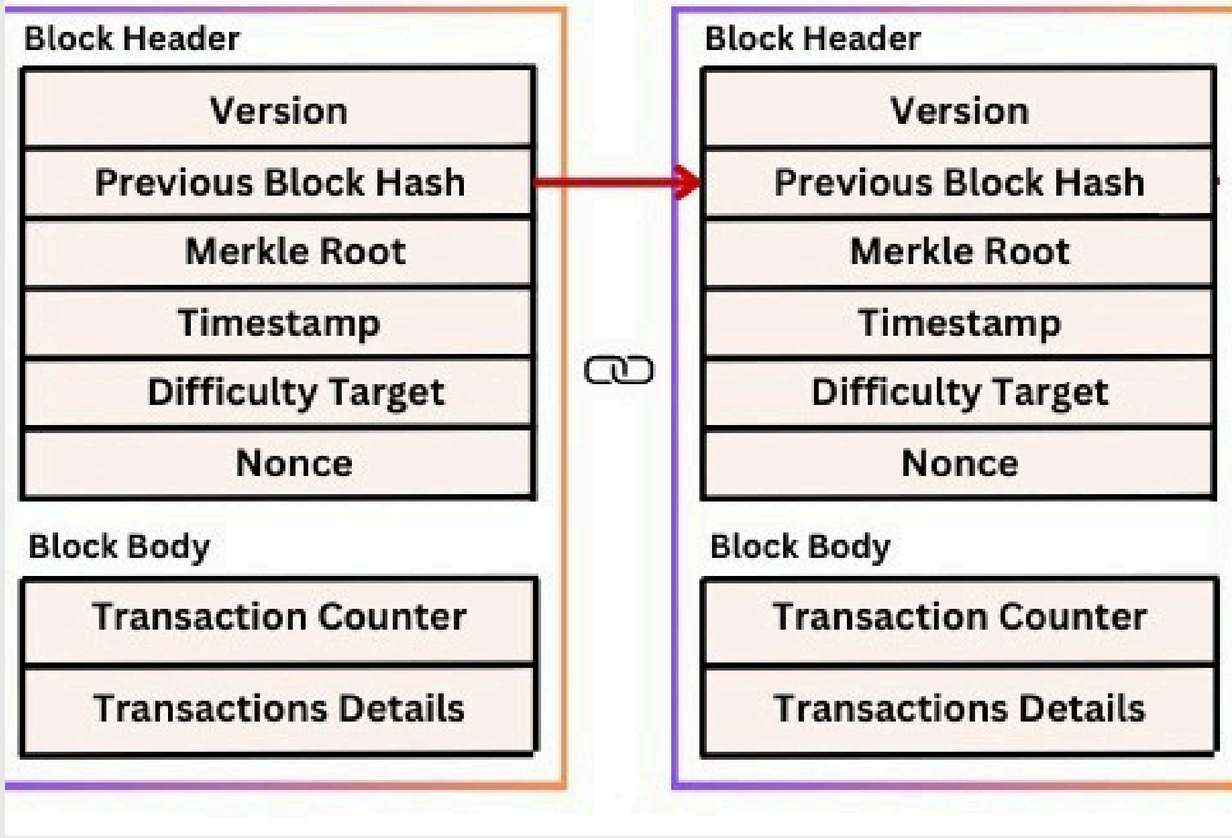
Key Features of Blockchain:

- **Decentralization**: No single entity controls the data; it is distributed across multiple nodes.
- **Immutability**: Once a transaction (or vote) is recorded, it cannot be changed or deleted, preventing fraud.
- **Transparency**: Transactions are publicly verifiable, increasing trust in the system.
- **Security**: Uses cryptographic techniques like hashing and encryption to protect data.
- **Smart Contracts**: Self-executing contracts that automate processes like vote counting in elections.

Key Terms Used in Blockchain

- **Block**: A collection of transactions linked to form a chain.
- **Ledger**: A decentralized record of transactions.
- **Decentralization**: No single authority controls the network.
- **Consensus Mechanism**: Ensures valid transactions (e.g., PoW, PoA).
- **Smart Contracts**: Self-executing contracts for automation.
- **Public & Private Keys**: Used for secure transactions.
- **Hashing**: Converts data into a fixed-length secure code.
- **Nodes**: Network participants that verify transactions.
- **Gas Fees**: Transaction fees on blockchain networks.





Problem Statement

Traditionalvotingsystems lacksecurity,transparency, and efficiency, making them vulnerable to fraud and manipulation. Chain-Vote uses blockchain to ensure tamper-proof, decentralized, and verifiable elections, eliminating third-party interference and improving voter trust.

Need for the Project

- Traditional voting systems are vulnerable to fraud, manipulation, and security breaches.
- Manual vote counting is slow and error-prone, delaying election results.
- Centralized e-voting systems still require trusted third parties, reducing transparency.
- A decentralized, secure, and tamper-proof voting system is needed to restore voter trust.

Objective of this project

- Develop a blockchain-based voting system for secure and transparent elections.
- Use smart contracts to automate vote registration, election management, and result declaration.
- Ensure tamper-proof, verifiable voting while maintaining voter privacy.
- Eliminate third-party interference and increase voter confidence in the electoral process.

Project Overview

Project Purpose:

- Traditional votingsystems are vulnerable to fraud, tampering, and lack of transparency.
- This project leverages blockchain technology to create a secure, tamper-proof, and user-friendly e-voting system.
- Chain-Vote ensures transparency, accessibility, and trust in elections.

Scope of the Project:

- Userscan register asvotersor candidate.
- An admin verifies registrations before allowing participation.
- Once verified, voters can cast votes when elections are active.
- Smart contracts handle election events (starting, ending, vote registration, and result declaration).
- Registration data is stored in a database, while all voting-related actions are on blockchain.

Target Audience:

- Government agencies,universities, and private organizations looking for secure election solutions.
- Tech and non-tech users, as the system is designed to be user-friendly.

Literature Review:

DVTChain: A blockchain-based decentralized mechanism to ensure the security of digital voting system - Syada Tasmia Alvi, Mohammed Nasir Uddin

Published by Elsevier in 2022

key Features:

- Blockchain & Ethereum 2.0: Ensures tamper-proof and verifiable voting records.
- Smart Contracts: Automate voter authentication, vote storage, and result computation.
- Cryptographic Security: Uses encryption and hashing to protect voter identities and votes.

Limitations :

- No OTP verification currently in voter registration.
- High storage costs for encrypted votes.

Literature Review

Hjálmarsson,Hreiðarsson **“ Blockchain-Based E-Voting System ”**

[IEEE ©2020-IEEE CLOUD Conference]

Key Features:

- The system adopts a permissioned blockchain with Proof-of-Authority (PoA), ensuring faster processing and secure validation by trusted authorities.
- It provides immutability and verifiability, meaning once votes are recorded, they cannot be altered, and the tally can be independently checked.

Limitations:

- Scalability is not fully addressed, making large-scale elections with millions of users potentially slow and resource-heavy.
- The system pays less attention to voter privacy, creating a trade-off between transparency and maintaining complete anonymity.

Literature Review

MohammadNabiluzzamanNeloy,Md.AbdulWahab: **A remote and cost-optimized voting system usingblockchainandsmartcontract.**IETBlockchain 3, WILEY 1–17 (2023).

Key Features

- **Multi-LayerVoter Authentication:**

Uses AI-based facial recognition and government database verification to authenticate voters.

- **Incentivization for Voter Turnout**

Introduces a reward mechanism to encourage voter participation.

Limitations

- **No Support for Other Biometric Verifications**

Only facial recognition is used; additional authentication methods like fingerprint or voice recognition could improve security.

- **Potential Single Point of Failure**

Since the backend relies on Django APIs, system failures or security breaches could affect operations.

Literature Review

SaidElKafhali,"**Blockchain-BasedElectronic Voting System: Significance and Requirements**," Mathematical Problems in Engineering [Hindawi - Wiley Online Library], vol. 2024, Article ID 5591147, 2024.

Key Features:

- Security and Integrity – Ensures that only verified and eligible voters can participate, votes cannot be altered after submission, and the system is resistant to cyber-attacks.
- Privacy and Transparency – Voters remain anonymous while casting their votes, and the system allows public auditability without exposing individual voter choices.

Limitations:

- Accessibility Challenges – Not all voters, especially those unfamiliar with digital technology, may be able to use the system effectively. Additionally, people in remote areas or with disabilities may face difficulties accessing blockchain-based voting.
- Scalability and Cost Issues – While blockchain enhances security and transparency, handling large-scale elections can be expensive and may result in longer transaction confirmation times. Implementing solutions like sharding or off-chain components is necessary but adds complexity

Detailed Project Plan

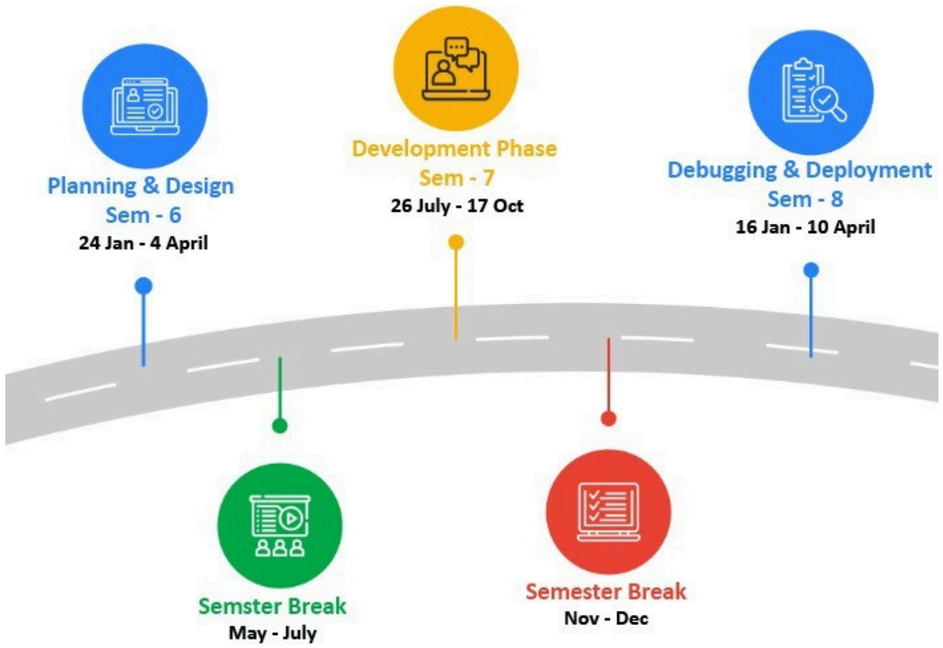
Technology Stack:

- Frontend: React.js / Next.js for an interactive and responsive UI.
- Backend: Node.js with Express.js to handle user requests and admin verification.
- Database: MongoDB for storing voter and candidate registration data.
- Blockchain: Ethereum/Polygon for secure, immutable vote storage.
- Smart Contracts: Solidity-based contracts to automate election events like vote registration, electionstart/stop, andresult declaration.

Key Functional Modules:

- User Authentication: Simple registration/login system for voters and candidates.
- Admin Panel: Admin verifies users and manages the election lifecycle.
- Voting System: Voters securely cast votes, stored on the blockchain.
- Result Processing: Smart contracts tally votes and display election outcomes.

Project Timeline &Milestone



1. Planning & Design (Phase 1)

- Duration: Mid Jan 2025 – 4 April 2025 (5 working Fridays)
- Activities: Research, system design, technology stack selection

2. Semester Break (Phase 2)

- Duration: Mid-May 2025 – Mid-July 2025
- No work scheduled

3. Development Phase (Phase 3)

- Duration: 19 July 2025 – 19 September 2025 (05 working
- Fridays) Activities:
  - Frontend & backend development (user registration, admin verification, voting interface)
  - Smart contracts for vote registration, election control, and result declaration

4. Semester Break (Phase 4)

- Duration: 7 November 2025 – 1 January 2026
- No work scheduled

5. Testing, Debugging & Deployment (Phase 5)

- Duration: 3 January 2026 – 28 March 2026 (8 working Fridays)
- Activities:
  - System testing, bug fixing, and deployment
  - Final project report

Tools &Technologies

- **Blockchain Platform**:Ethereum (Solidity)/ Hyperledger Fabric(Go) / Solana (Rust).
  Smart Contract Frameworks: Truffle, Hardhat
- (Ethereum) / Remix IDE. **Front-End**: HTML, CSS, Js, React js.
  Backend & APIs: Node.js, Express.js
- **Database / Storage:** MongoDB, IPFS (distributed storage)
- **Security & Auditing:** MythX, JWT token.

Risks and Mitigation

1

Scalability Issues: High traffic could slow the system.

Mitigation: Optimize blockchain gas fees and explore layer-2 scaling solutions.

2

User Accessibility: Non-tech users may struggle with blockchain interactions.

Mitigation: Simple UI, clear instructions, and assisted registration.

3

Smart Contract Vulnerabilities: Bugs in the contract could lead to manipulation.

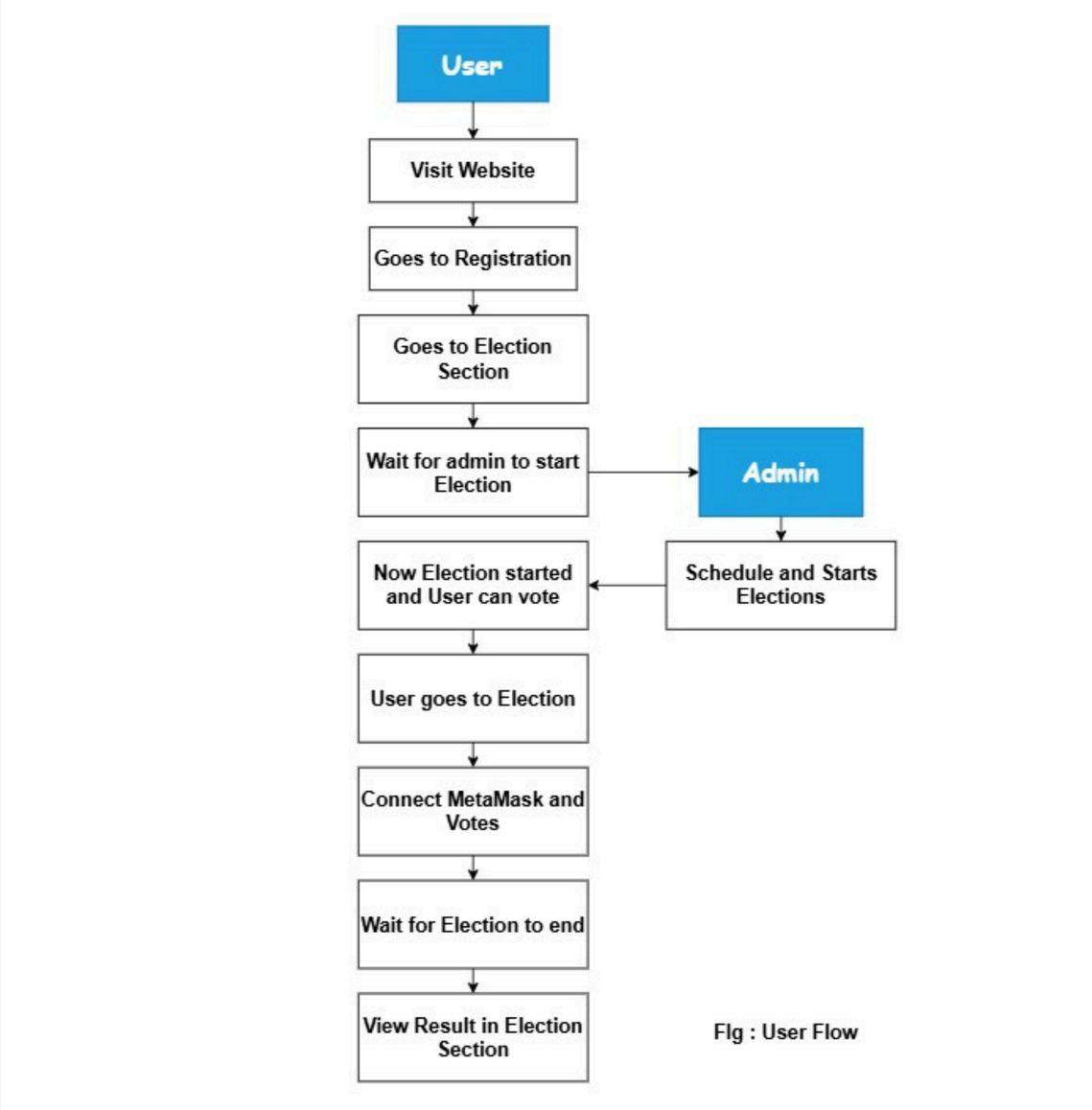
Mitigation: Thorough smart contract auditing and security testing before deployment.

4

Network Attacks: Risk of DDoS attacks on the system.

Mitigation: Implement rate limiting, firewall protection, and decentralized hosting

Block Diagram



Flg : User Flow

Results

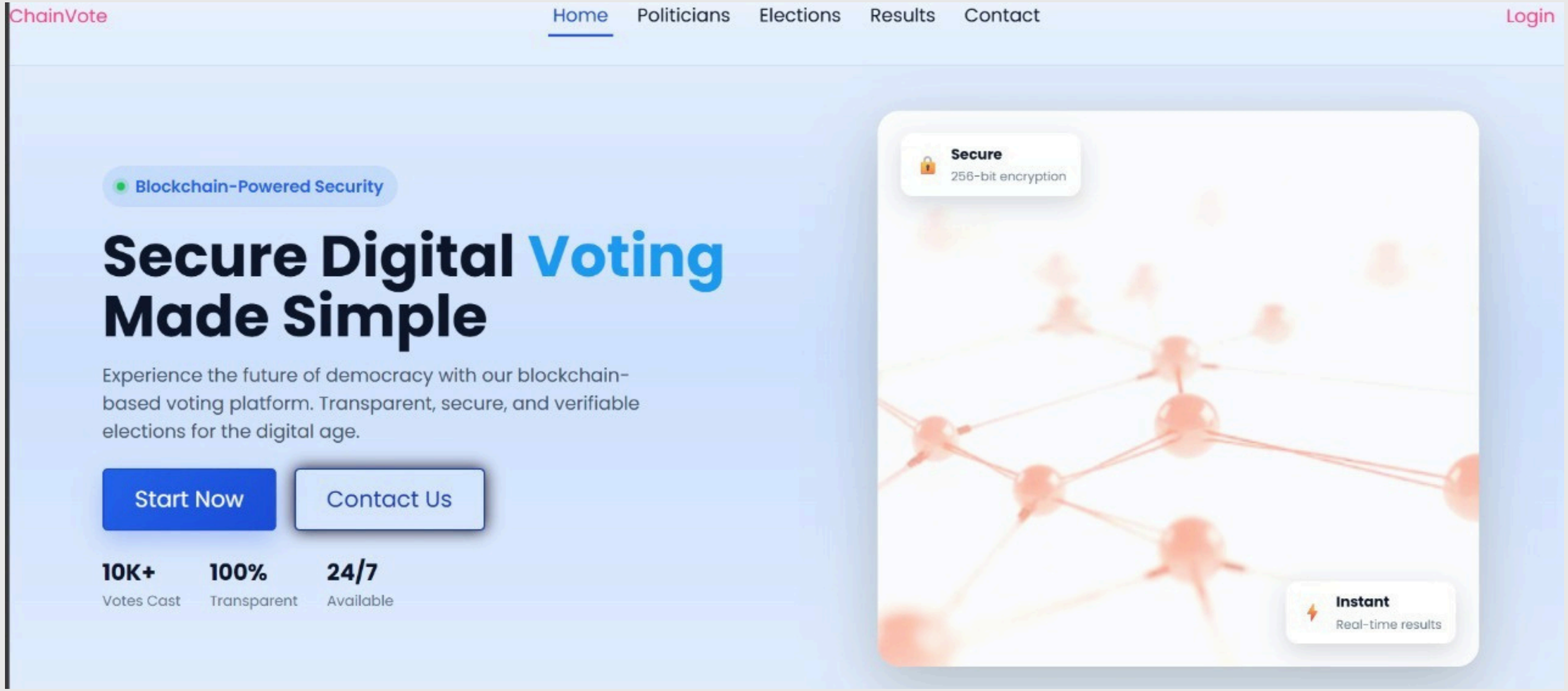


Fig 1 - Home Page of ChainVote.

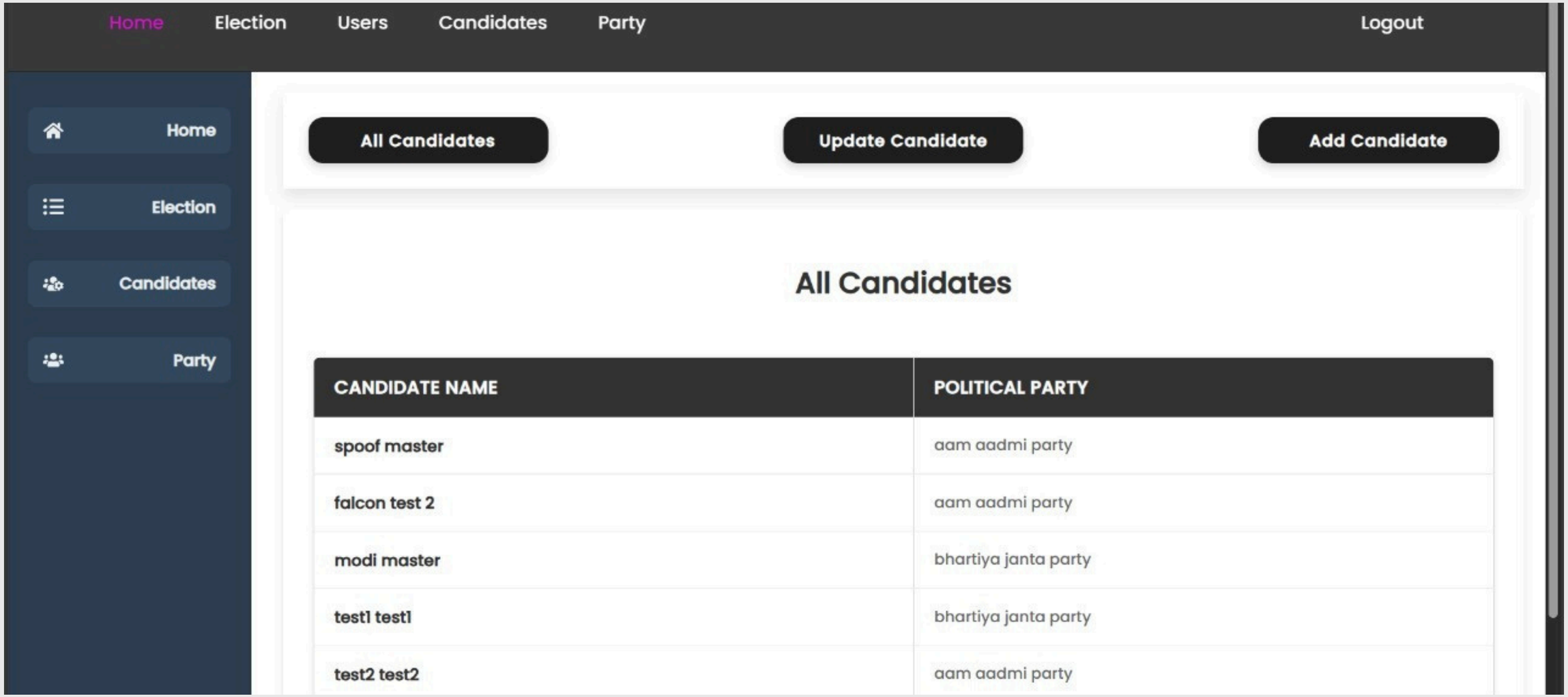


Fig 2- List of all Candidate & thier Political Party.

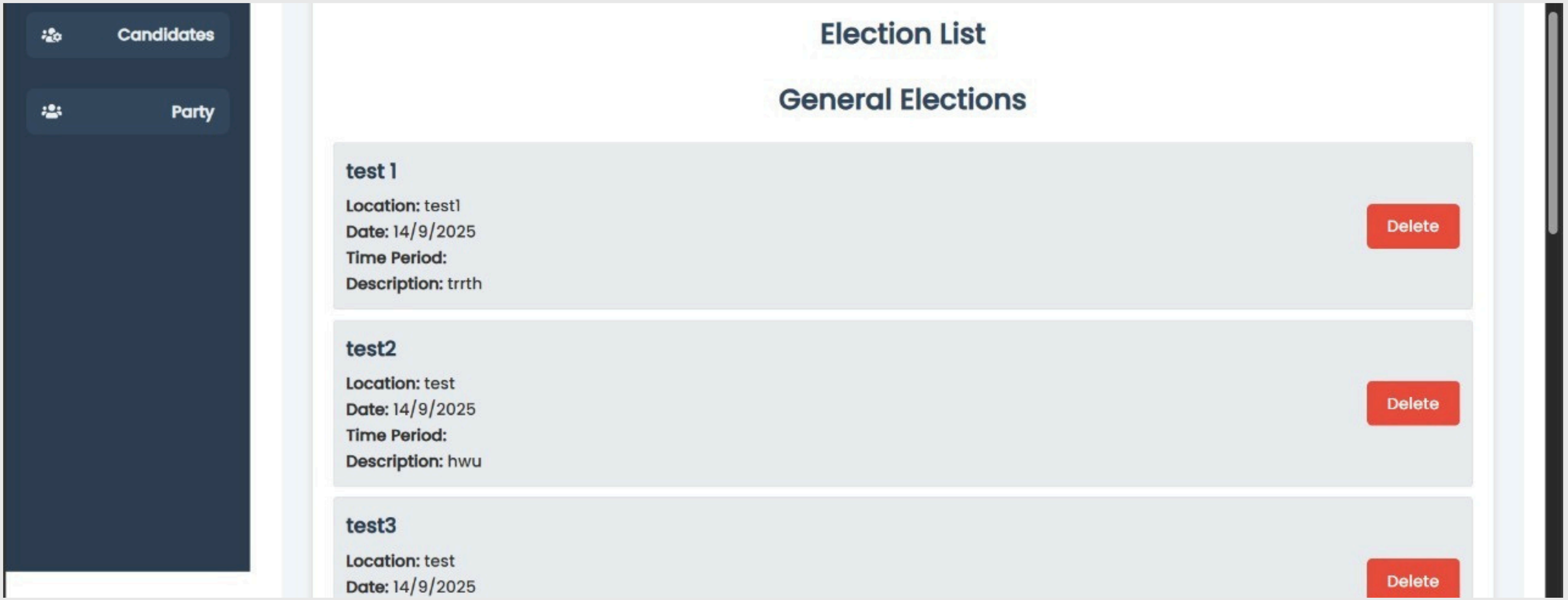


Fig 3- Election List.

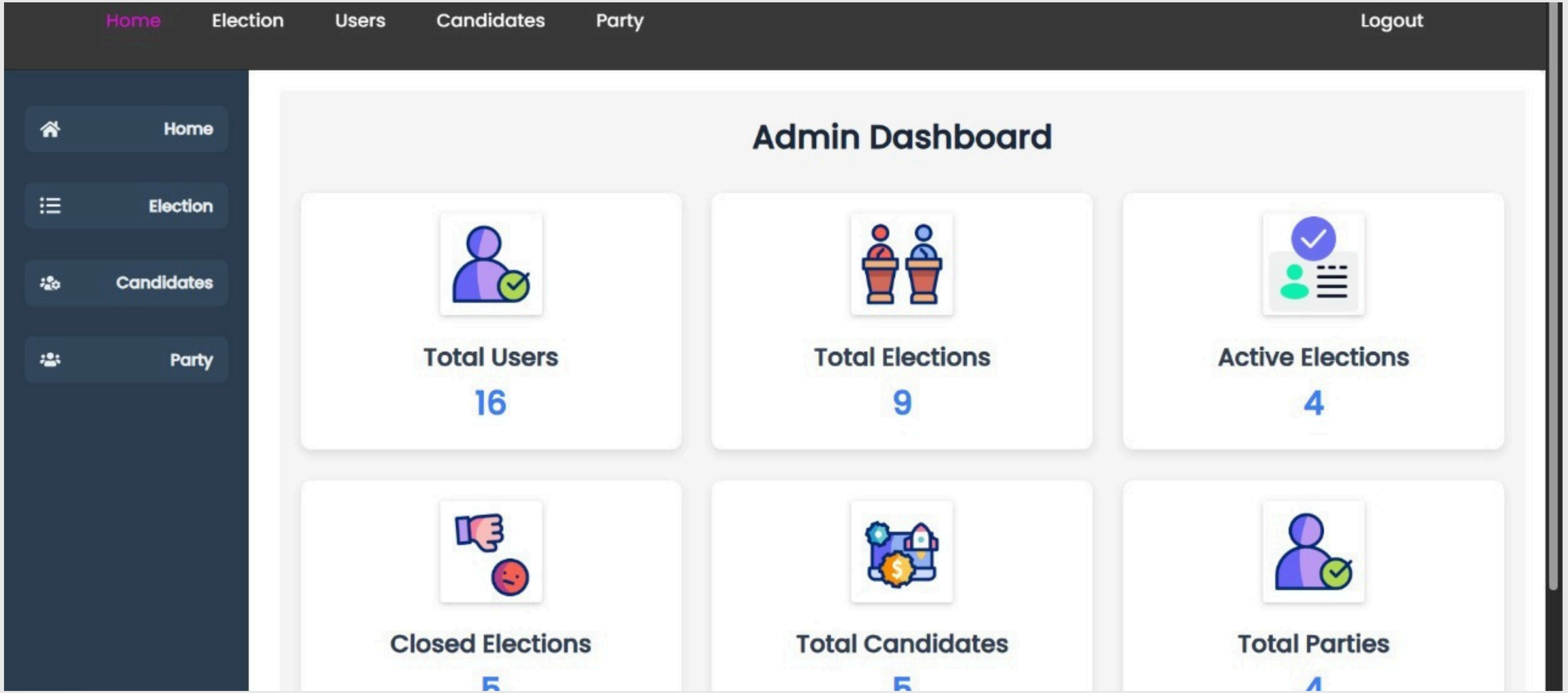
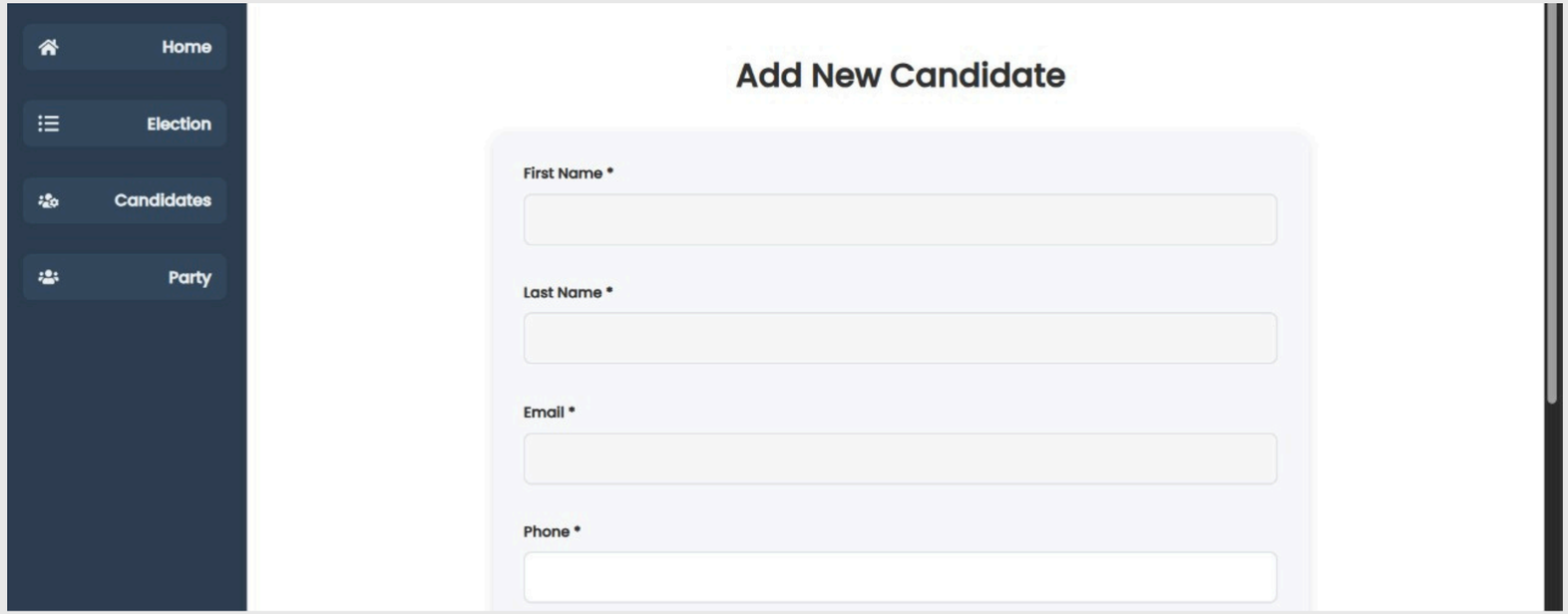


Fig 4 - Admin Dashboard

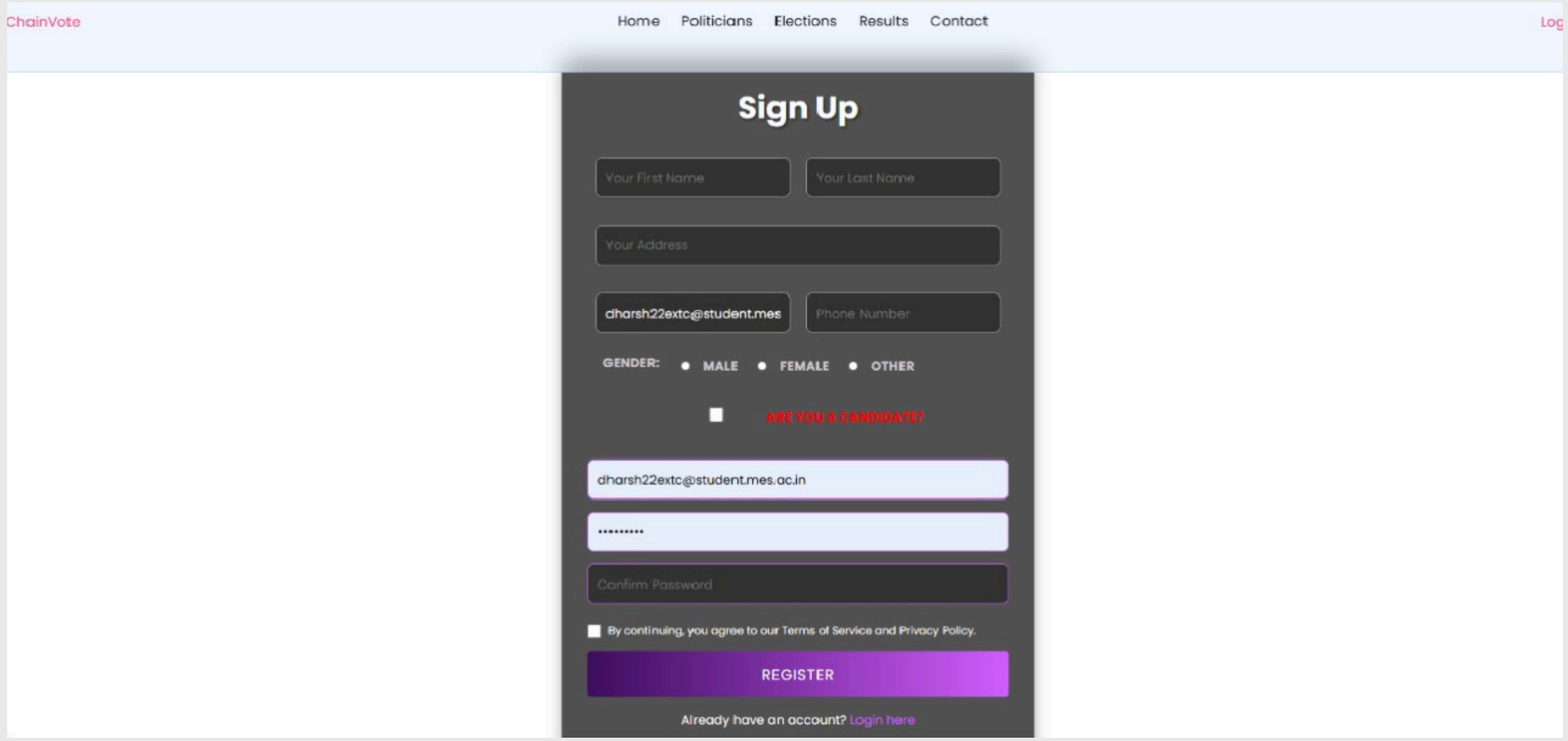
1.Addition of candidate

The Admin calls the add Candidate function from the smart contract to add an candidate.



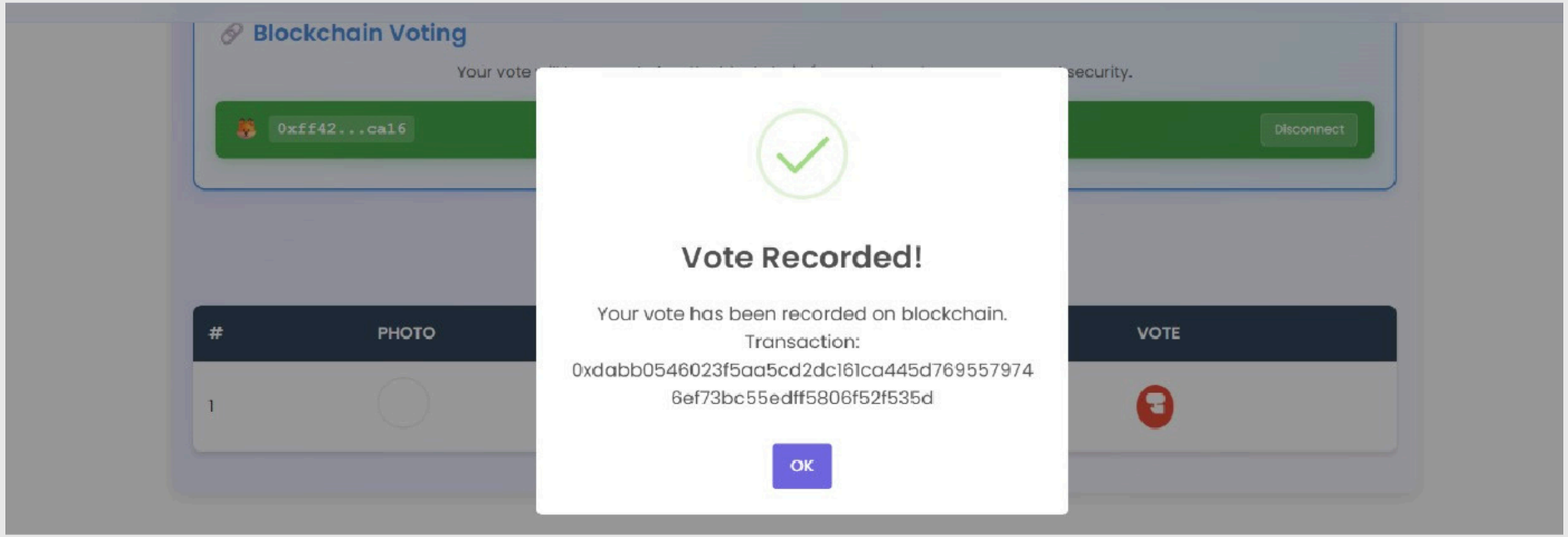
2.Registration of voter.

Voter can Register to the Election to Cast the Vote



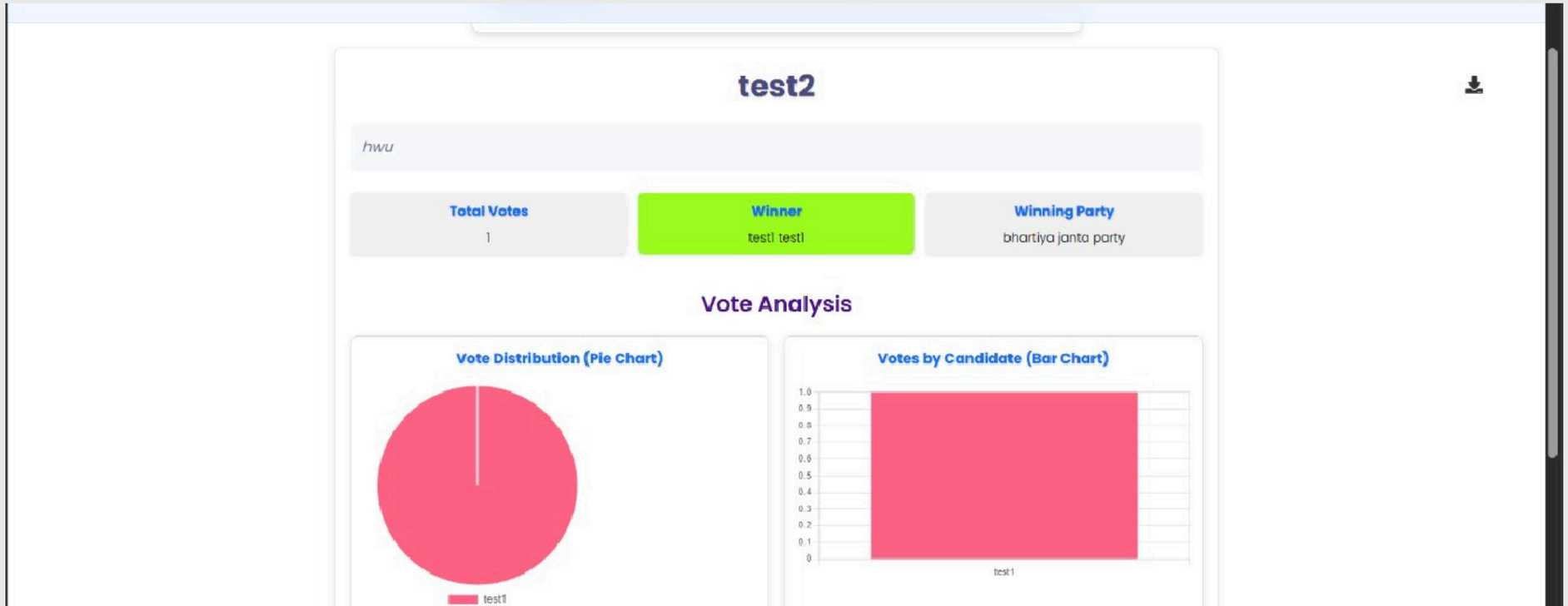
5.Voting

The registered voters cast their vote to a candidate.



6.Result

Theadmin calls the getResults function to see the results.



Conclusion & Next Steps

Conclusion:

01

- Chain-Voteprovides a secure, decentralized, and transparent voting solution.
- Smart contracts eliminate tampering and ensure accurate election results
- The system is user-friendly, making it accessible even to non-technical users.

Next Steps:

02

- Complete smart contract testing on testnet.
- Optimize frontend/backend integration.
- Deploy on live blockchain for a real-world pilot election.

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