International Journal of Engineering Research and Science & Technology

www.ijerst.org

ISSN : 2319-5991

Vol. 22 No. 2 (2026)

ijerst.editor@gmail.com

editor@ijerst.com

International Journal of Engineering Research and Science & Technology

ISSN 2319-5991 www.ijerst.com
Vol. 22, No. 2, 2026

Peer Reviewed, Referred & Indexed Journal

A Secure Blockchain-Based E-Voting System Using Elliptic Curve Cryptography and Django Framework

PULAGAM AKHILA NAGA VENKATA MADHURI

PG Scholar. Department of MCA, DNR College, Bhimavaram, Andhra Pradesh

K.Venkatesh

(Assistant Professor), Master of Computer Applications, DNR College, Bhimavaram, Andhra Pradesh

ABSTRACT

The rapid advancement of digital technologies has transformed various sectors, including governance and electoral systems. Traditional voting methods, whether paper-based or electronic, often face challenges such as lack of transparency, vulnerability to tampering, voter fraud, and inefficiencies in vote counting. To address these issues, this project proposes a secure, transparent, and efficient electronic voting system based on blockchain technology integrated with Elliptic Curve Cryptography (ECC) and developed using the Django web framework.The proposed system leverages blockchain technology to ensure immutability and transparency of voting records. Each vote cast by a user is securely stored as a transaction in a blockchain network, making it tamper-proof and verifiable. Smart contracts are utilized to automate voting processes such as voter registration, vote casting, and vote counting. This eliminates the need for a central authority and reduces the risk of manipulation.To enhance data security and privacy, Elliptic Curve Cryptography (ECC) is implemented for encrypting sensitive user information such as identity details. ECC provides strong encryption with smaller key sizes, making it efficient and suitable for web-based applications. Additionally, SHA-256 hashing is used to generate authentication codes, ensuring data integrity and preventing unauthorized modifications.The system includes multiple modules such as voter registration, candidate management, election scheduling, vote casting, and result analysis. Users can securely register and log in to the system, view candidate details, and cast their votes on the designated election date. The system prevents duplicate voting by verifying whether a user has already cast a vote. All transactions are recorded on the blockchain, ensuring transparency and accountability.A user-friendly web interface is developed using Django, allowing administrators to manage elections and users to interact with the system seamlessly. The application also provides real-time vote counting and result visualization, improving efficiency compared to traditional systems.The proposed system addresses key challenges in existing voting systems by providing enhanced security, transparency, and decentralization. It eliminates the risks associated with centralized control and ensures voter anonymity while maintaining data integrity. The integration of blockchain and cryptographic techniques makes the system robust against cyber threats.Overall, this project demonstrates the potential of combining blockchain technology with

cryptographic methods to build a secure and reliable e-voting system, paving the way for modern digital governance solutions.

Keywords: Blockchain ,E-Voting System ,Elliptic Curve Cryptography (ECC) ,Smart Contracts ,Django Framework ,SHA-256 ,Data Security ,Decentralized Systems ,Digital Governance

I. INTRODUCTION

Voting is a fundamental component of democratic systems, enabling citizens to express their opinions and elect representatives. Traditional voting systems, including paper-based ballots and electronic voting machines, have been widely used across the world. However, these systems face numerous challenges such as lack of transparency, risk of fraud, delayed result processing, and high operational costs.In recent years, the emergence of blockchain technology has provided new opportunities for developing secure and transparent voting systems. Blockchain is a decentralized and distributed ledger technology that ensures data immutability and transparency. Once data is recorded in a blockchain, it cannot be altered without consensus, making it highly secure and resistant to tampering.This project aims to develop a secure e-voting system by integrating blockchain technology with Elliptic Curve Cryptography (ECC) and a web-based interface using Django. The system ensures that each vote is securely recorded and cannot be modified or deleted. By using smart contracts, the voting process is automated, eliminating the need for intermediaries and reducing the chances of human error or manipulation.Security is a critical aspect of any voting system. To protect sensitive user information, ECC is used for encryption. ECC provides strong security with lower computational overhead compared to traditional encryption methods such as RSA. Additionally, SHA-256 hashing is used to generate secure authentication codes, ensuring data integrity and preventing unauthorized access.The system includes features such as voter registration, candidate management, election scheduling, vote casting, and result visualization. Users can register and log in to the system, view candidate details, and cast their votes securely. The system also ensures that each user can vote only once, preventing duplicate voting.The Django framework is used to develop the web application, providing a robust and scalable platform for implementing the system. It allows easy integration of backend logic with frontend interfaces, making the system user-friendly and efficient.The primary objective of this project is to enhance the security, transparency, and efficiency of voting systems using modern technologies. By leveraging blockchain and cryptographic techniques, the proposed system addresses the limitations of traditional voting methods and provides a reliable solution for digital elections.

II. LITERATURE SURVEY (WITH EXISTING METHODS)

The concept of electronic voting has been extensively studied in recent years, with researchers exploring various technologies to improve security, transparency, and efficiency. Traditional e-voting systems often rely on centralized architectures, which are vulnerable to cyber-attacks and manipulation.Early research focused on improving voting systems using cryptographic techniques such as RSA and AES encryption. While these

methods enhanced data security, they still relied on centralized systems, making them susceptible to single points of failure. To overcome these limitations, researchers began exploring decentralized approaches using blockchain technology.Blockchain-based voting systems have gained significant attention due to their ability to provide transparency and immutability. Studies have shown that blockchain can ensure secure and verifiable voting by storing votes as transactions in a distributed ledger. Smart contracts further enhance the system by automating voting processes and ensuring fairness.Several researchers have proposed blockchain-based voting systems using platforms such as Ethereum. These systems utilize smart contracts to manage voter registration, vote casting, and result computation. However, challenges such as scalability, transaction costs, and privacy concerns remain.To address privacy issues, researchers have integrated cryptographic techniques such as Elliptic Curve Cryptography (ECC) into blockchain-based systems. ECC provides strong encryption with smaller key sizes, making it efficient for secure communication. Studies indicate that ECC is more suitable for resource-constrained environments compared to traditional encryption methods.Recent advancements have also focused on combining blockchain with hashing techniques such as SHA-256 to ensure data integrity. Hash functions generate unique codes for data, making it easy to detect any modifications.Despite these advancements, existing systems still face challenges such as user authentication, prevention of duplicate voting, and efficient handling of large-scale elections. Additionally, many systems lack user-friendly interfaces, limiting their practical adoption.The proposed system builds upon these existing methods by integrating blockchain, ECC encryption, and a Django-based web interface. It aims to provide a secure, scalable, and user-friendly solution for electronic voting, addressing the limitations of previous approaches.

III. EXISTING SYSTEM

Existing voting systems can be broadly categorized into traditional paper-based systems and electronic voting systems. Paper-based voting systems are widely used due to their simplicity and transparency. However, they are time-consuming, prone to human error, and require significant resources for management and counting.Electronic voting systems were introduced to improve efficiency and reduce manual effort. These systems use electronic machines or centralized servers to record and count votes. While they offer faster results, they are vulnerable to cyber-attacks, data manipulation, and system failures. The centralized nature of these systems makes them susceptible to single points of failure, which can compromise the integrity of the election process.Some existing systems use basic cryptographic techniques to secure data. However, these methods may not provide sufficient protection against advanced cyber threats. Additionally, many systems do not ensure complete transparency, making it difficult for users to verify the authenticity of results.Another major limitation of existing systems is the lack of voter privacy. Sensitive user information is often stored in centralized databases, increasing the risk of data breaches. Furthermore, many systems do not effectively prevent duplicate voting, leading to potential fraud.Blockchain-based voting systems have been proposed as a solution to these issues, but many of them are still in the experimental stage. They often lack proper integration with user-friendly web interfaces and may face challenges related to scalability and usability.Overall, existing systems suffer from limitations in security,

transparency, efficiency, and usability. These challenges highlight the need for a more advanced solution that combines blockchain technology, cryptographic techniques, and web-based platforms to ensure secure and reliable voting processes.

IV. PROPOSED METHOD

The proposed system is a **secure blockchain-based electronic voting system** that integrates **Elliptic Curve Cryptography (ECC)**, **SHA-256 hashing**, and a **Django-based web interface** to ensure transparency, security, and efficiency in elections. The system is designed to overcome the limitations of traditional and centralized electronic voting systems by leveraging decentralized blockchain technology.In this system, all voting operations such as voter registration, candidate management, vote casting, and vote counting are managed using **smart contracts deployed on a blockchain network**. Each vote is recorded as a transaction in the blockchain, ensuring immutability and preventing unauthorized modifications. Blockchain technology enhances trust by providing a transparent and tamper-proof ledger of all voting activities .To ensure data privacy and security, ECC is used to encrypt sensitive information such as voter identity (e.g., Aadhaar details). ECC provides strong security with smaller key sizes, making it efficient for web applications. Additionally, SHA-256 hashing is applied to generate authentication codes for verifying data integrity.The system includes mechanisms to prevent duplicate voting by checking whether a voter has already cast a vote. It also ensures that votes are cast only on the scheduled election date. The Django framework provides a user-friendly interface for voters and administrators, enabling easy interaction with the system.The proposed system improves security, transparency, and efficiency by combining blockchain decentralization with cryptographic techniques. It ensures voter anonymity, prevents fraud, and provides real-time result tracking, making it suitable for modern digital elections.

V. IMPLEMENTATION

The implementation of the proposed system is carried out using **Python, Django framework, Web3.py, and Ethereum blockchain**. The system architecture integrates backend logic, blockchain interaction, and frontend web interfaces.Initially, the blockchain environment is configured using Web3.py, which connects the Django application to a local Ethereum blockchain network. A smart contract is deployed to manage voting operations such as user registration, candidate addition, and vote recording. The contract stores all data in a decentralized manner, ensuring immutability and transparency.The system implements **Elliptic Curve Cryptography (ECC)** for secure data handling. Public and private keys are generated dynamically or loaded from stored files. Sensitive data such as voter Aadhaar numbers are encrypted using ECC public keys before being stored on the blockchain. The encrypted data is further hashed using SHA-256 to generate authentication codes, ensuring data integrity and preventing tampering.

The application includes multiple modules:

- **User Registration Module:** Stores user details securely after encryption.
- **Candidate Management Module:** Allows administrators to add candidates along with encrypted identity details.
- **Voting Module:** Enables users to cast votes securely. The system verifies whether the user has already voted and whether the election date is valid.
- **Result Module:** Calculates vote counts by retrieving data from the blockchain.

The Django framework handles HTTP requests and renders dynamic web pages. Users interact with the system through forms, while backend views process requests and interact with the blockchain. File handling is implemented for storing images and election date data.The voting process is secured by ensuring that each vote is recorded as a blockchain transaction. Once recorded, the vote cannot be altered or deleted. This guarantees data integrity and transparency. Research shows that blockchain-based voting systems significantly enhance trust and reduce manipulation risks .The system also includes validation mechanisms such as duplicate vote detection and authentication checks. These features ensure that only authorized users can participate and that each user votes only once.Overall, the implementation demonstrates how blockchain and cryptographic techniques can be integrated into a web application to build a secure and reliable e-voting system.

VI. ALGORITHMS

The proposed system utilizes several algorithms and techniques to ensure security, efficiency, and reliability in the voting process.

Elliptic Curve Cryptography (ECC):
ECC is used for encrypting sensitive user data. It provides strong security with smaller key sizes compared to traditional encryption methods like RSA. This makes it efficient for web-based applications and reduces computational overhead.

SHA-256 Hashing Algorithm:
SHA-256 is used to generate secure hash values for encrypted data. It ensures data integrity by producing a unique hash code for each input. Any modification in data results in a completely different hash, making it easy to detect tampering.

Blockchain Consensus Mechanism:
The system relies on blockchain consensus protocols to validate transactions. Each vote is verified and added to the blockchain, ensuring transparency and preventing unauthorized changes. Blockchain ensures immutability and auditability of voting records .

Smart Contract Algorithm:
Smart contracts automate voting processes such as registration, vote casting, and result calculation. They enforce rules such as one vote per user and prevent duplicate voting.

Vote Counting Algorithm:
The system iterates through blockchain records to count votes for each candidate. This ensures accurate and transparent result computation.

Duplicate Vote Detection:
A simple search algorithm checks whether a user has already voted by comparing user IDs with existing records.

By combining these algorithms, the system ensures secure communication, data integrity, and reliable voting operations.

VII. SYSTEM DESIGN

The system design follows a **modular and layered architecture** integrating blockchain technology with a web-based interface.

1. Architecture Overview

The system consists of four main layers:

- Presentation Layer (Django Web Interface)
- Application Layer (Business Logic)
- Blockchain Layer (Smart Contracts)
- Data Layer (Blockchain Storage)

2. Modules

a) User Module:
Handles user registration, login, and authentication. User data is encrypted using ECC before being stored.

b) Admin Module:
Allows administrators to add candidates, set election dates, and monitor voting activities.

c) Voting Module:
Enables users to cast votes. It validates user eligibility and ensures that votes are cast only once.

d) Blockchain Module:
Manages smart contracts and stores all voting transactions securely.

3. Workflow

1. User registers and logs in.
2. Admin sets election date and adds candidates.

3. User accesses voting interface on election day.
4. Vote is encrypted and stored on blockchain.
5. System verifies and records the vote.
6. Results are calculated and displayed.

4. Security Design

The system uses multiple security layers:

- ECC encryption for confidentiality
- SHA-256 hashing for integrity
- Blockchain for immutability

5. Data Flow

Input data from users is processed by Django, encrypted using ECC, hashed, and then stored on the blockchain. The blockchain ensures that data cannot be altered.

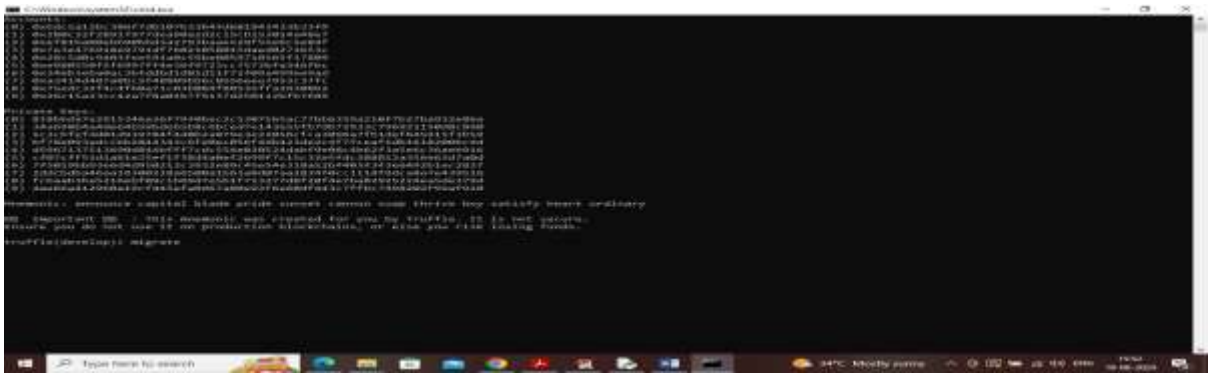
6. Advantages

- Decentralized architecture
- Tamper-proof data storage
- Transparent vote counting
- Enhanced privacy and security

Recent studies confirm that blockchain-based voting systems provide improved transparency and security compared to traditional systems

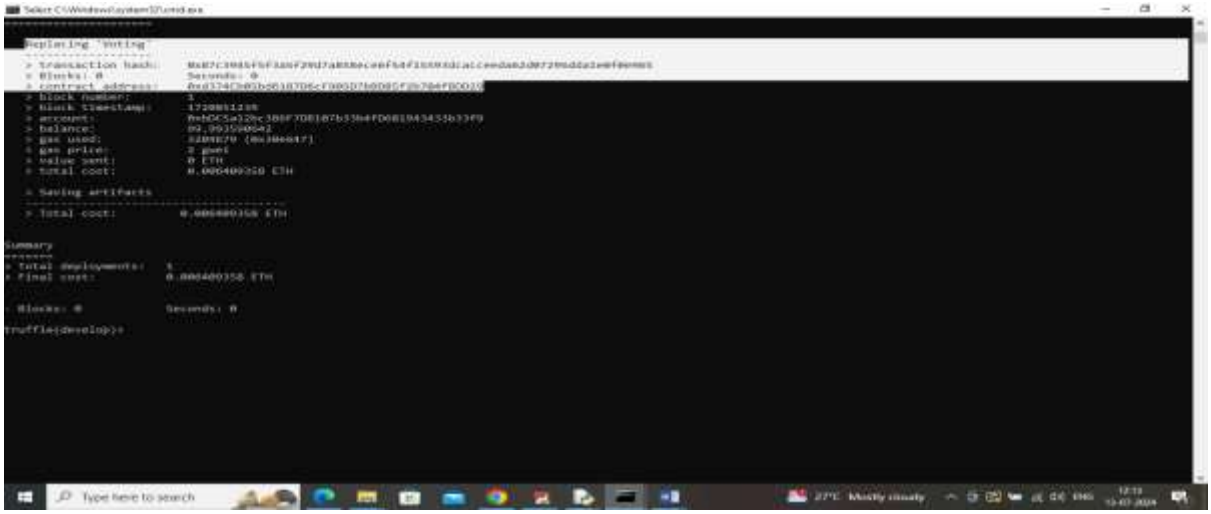
SYSTEM DESIGN IMAGES

1) First go inside 'hello-eth/node-modules/bin' folder and then look and find for 'runBlockchain.bat' file and then double click on that file to get below page

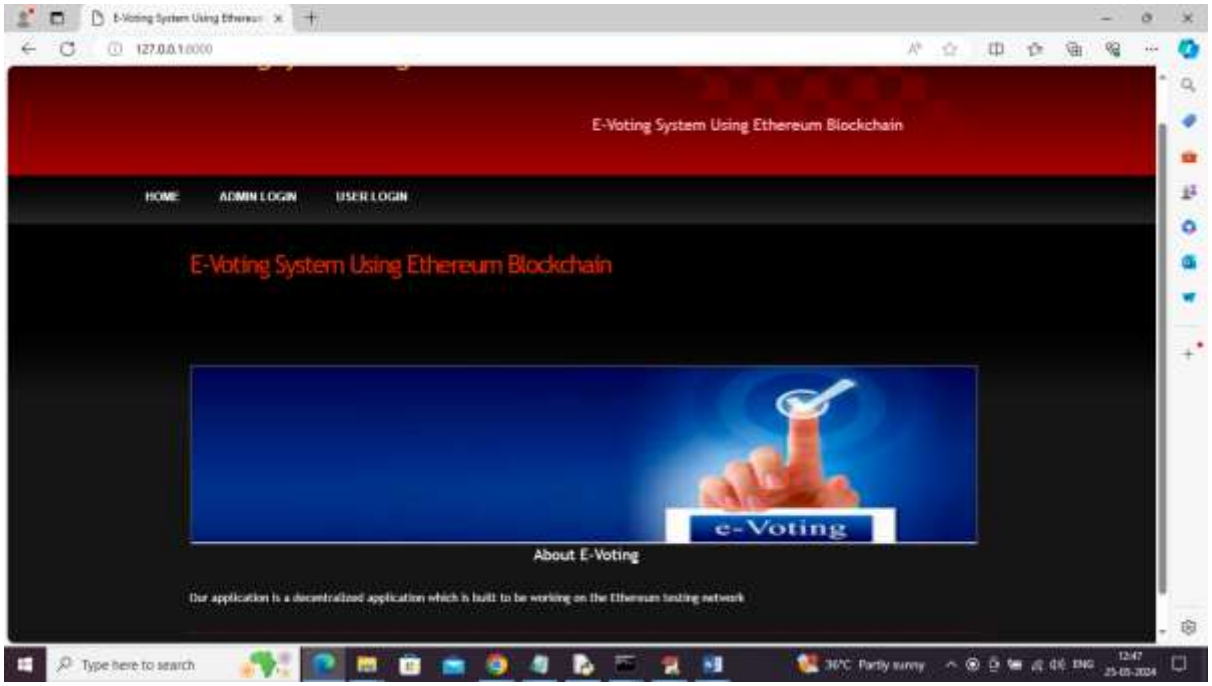


International Journal of Engineering Research and Science & Technology

2) In above screen Blockchain started with default private keys and accounts and now type command as 'migrate' and press enter key to deployed contract and get below page

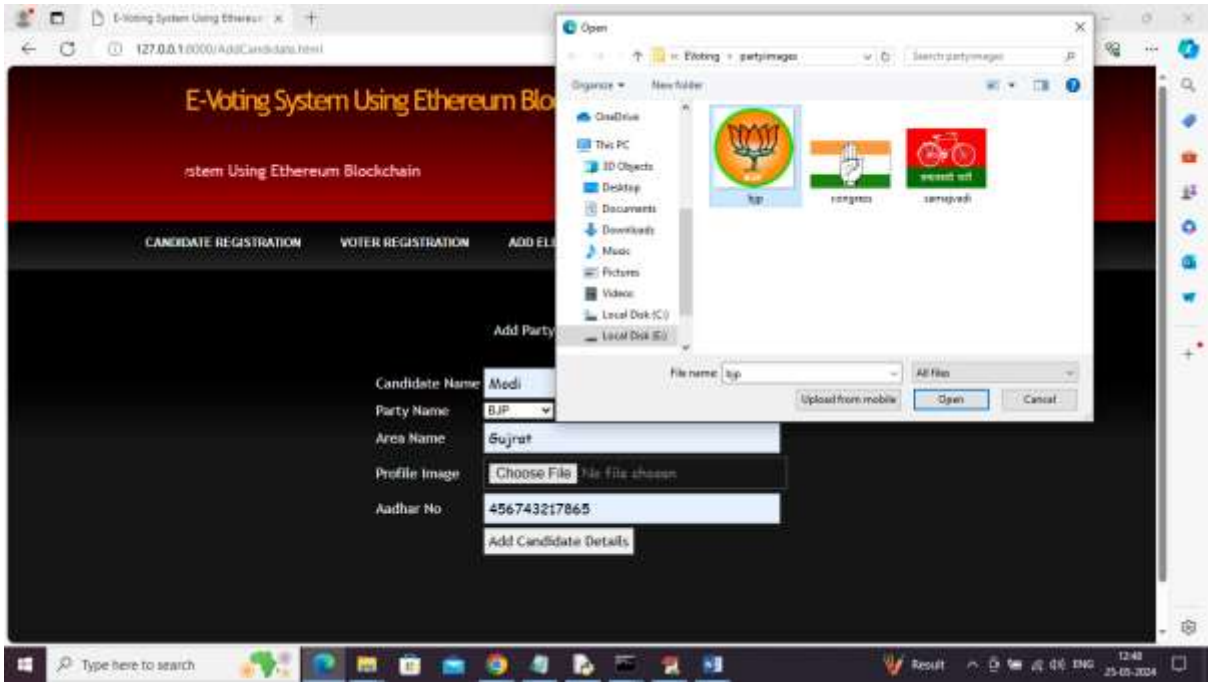
3) 

In above screen in white colour text can see 'Voting' contract deployed and running and got contract address also and this address need to specify in python program to call contract to manage voting data. In below screen showing python code calling contract using contract address

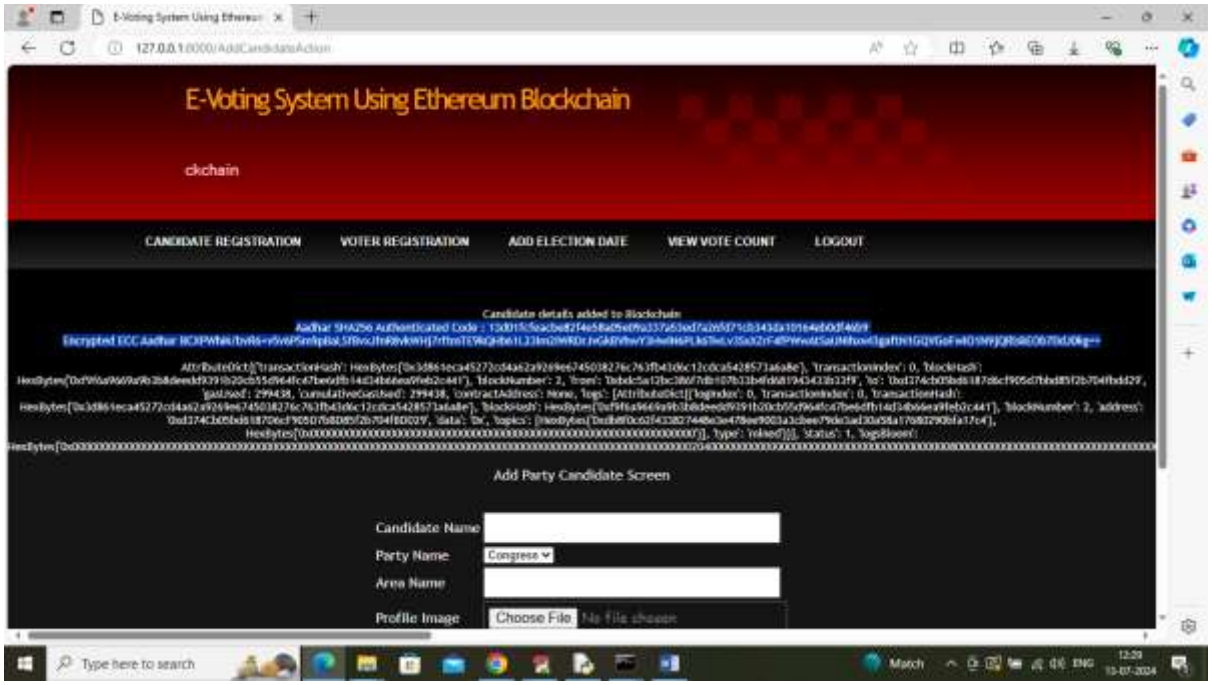


In above screen click on 'Admin Login' link to get below page

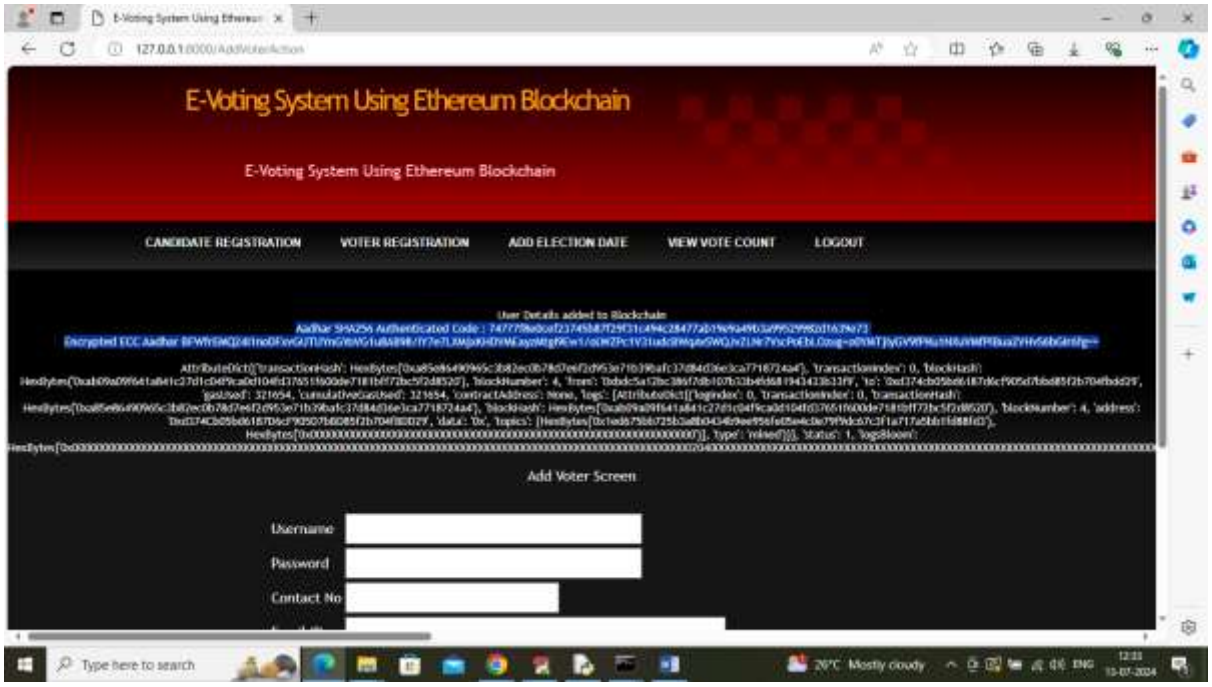
International Journal of Engineering Research and Science & Technology



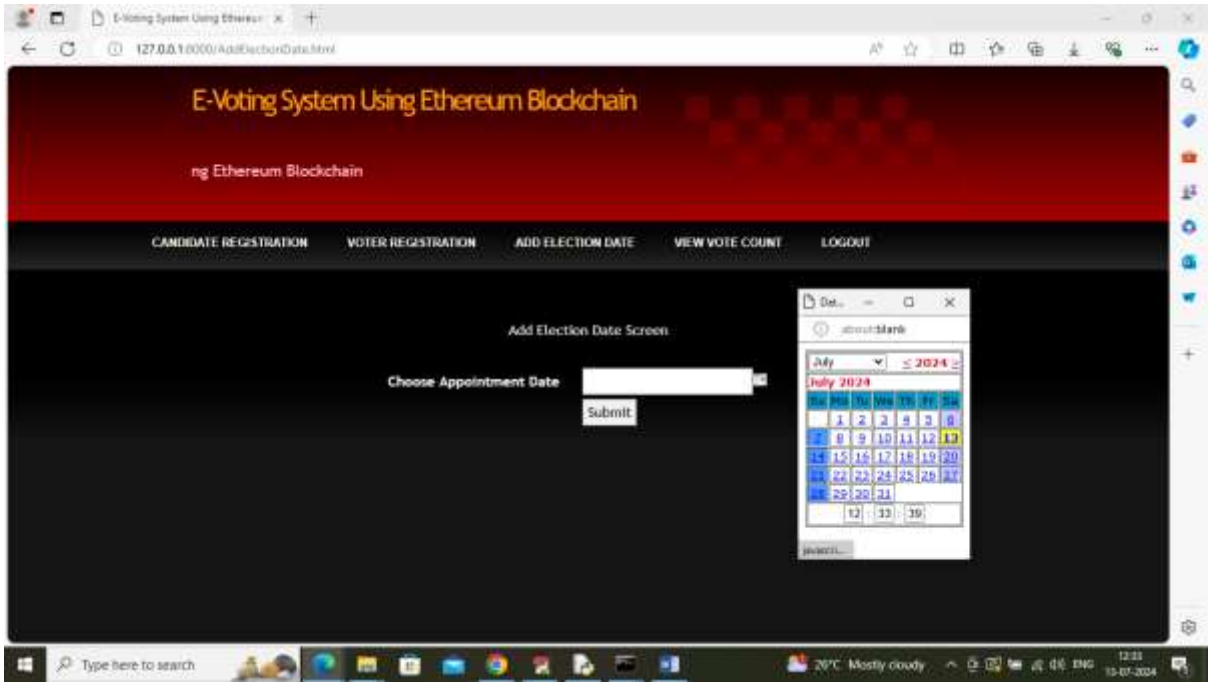
In above screen adding candidate details and then uploading party symbol and then click on 'Add Candidate Details' button to add details to Blockchain and then get below details



In above screen in blue color second and third line can see AADHAR SAH256 authenticated code along with ECC encrypted data. In white color

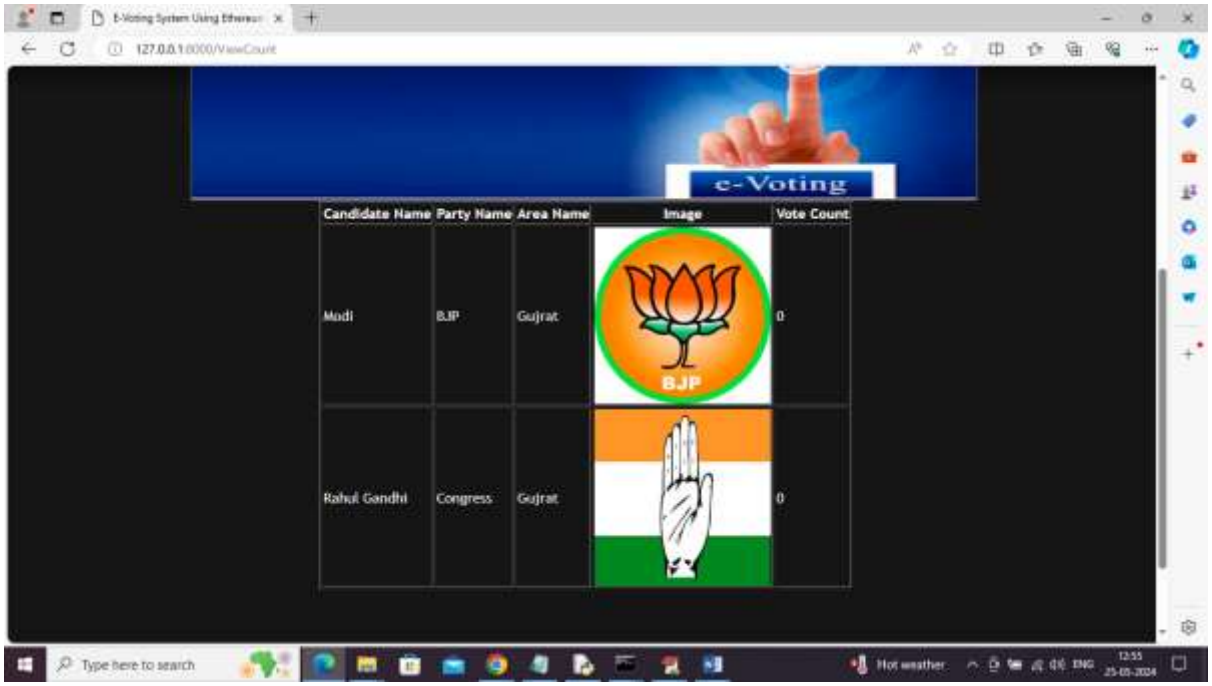


In above screen user details added and similarly you can add any number of users and now click on 'Add Election Date' link to get below page



In above screen admin will select desired date from calendar to get below page

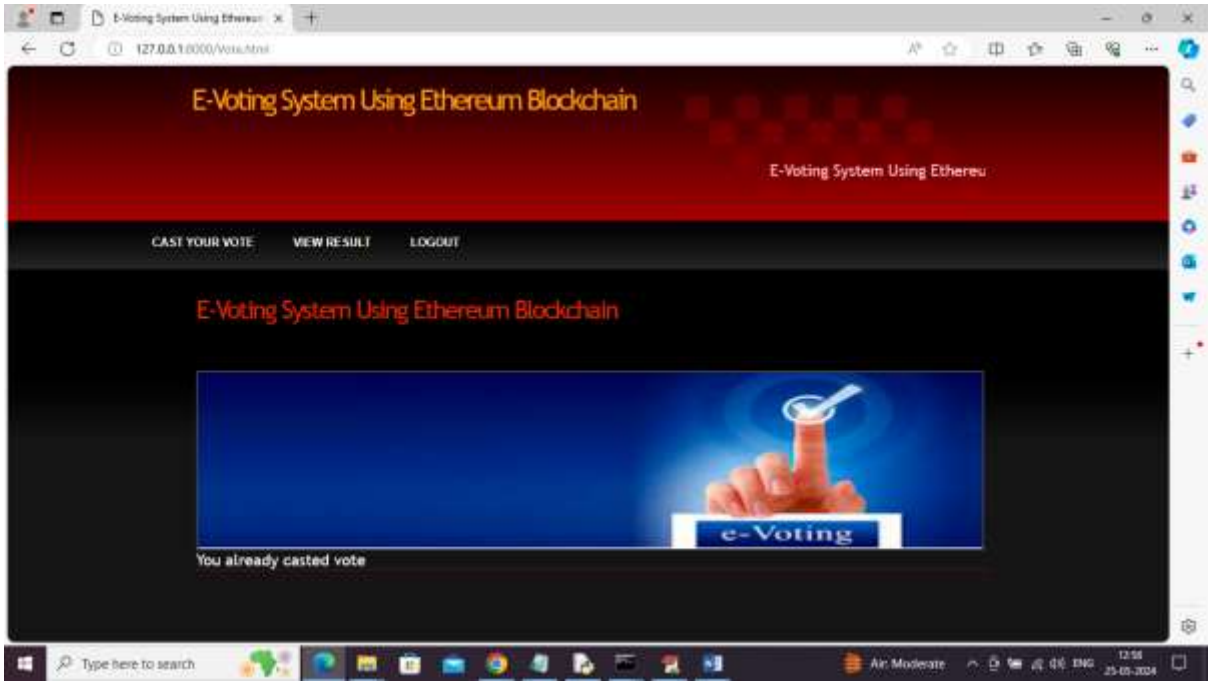
International Journal of Engineering Research and Science & Technology



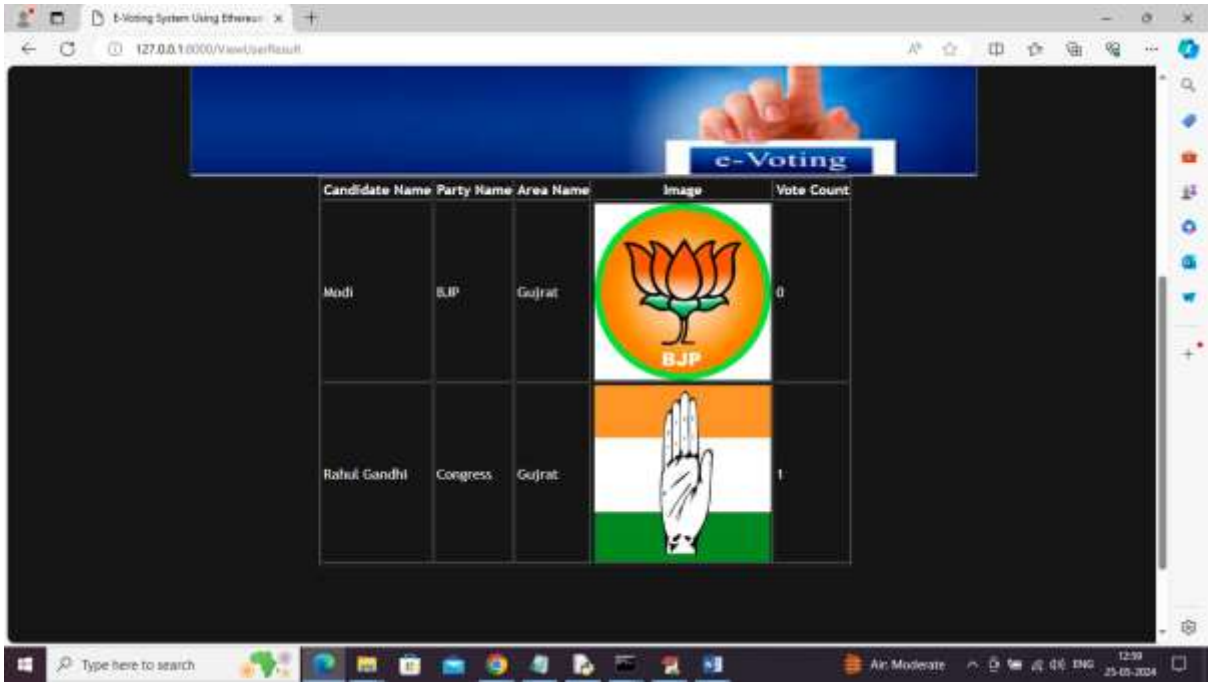
In above screen admin can view all candidate details and count is 0 as no vote casted yet and now logout and login as user

In above screen user can view list of all candidates and then click on ‘Click Here’ link beside any desired candidate name to cast vote and get below page

International Journal of Engineering Research and Science & Technology



In above screen user got error as 'Vote already casted' and now user or admin can click on 'View Result' link to get count details



In above screen can see vote count for each candidate and in above screen Rahul Gandhi count increase from 0 to 1.

Similarly by following above screens you can add candidate, voter and cat vote details to manage voting online

VIII. CONCLUSION

The proposed blockchain-based e-voting system demonstrates a secure, transparent, and efficient approach to modernizing electoral processes. By integrating blockchain technology with cryptographic techniques such as ECC and SHA-256, the system addresses key challenges in traditional voting systems, including fraud, lack of transparency, and data manipulation.The use of blockchain ensures that all voting transactions are immutable and verifiable, enhancing trust in the electoral process. Smart contracts automate voting operations, reducing the need for manual intervention and minimizing errors. ECC encryption protects sensitive user information, ensuring privacy and confidentiality.The Django-based web interface makes the system accessible and user-friendly, enabling seamless interaction for both voters and administrators. The system also incorporates mechanisms to prevent duplicate voting and ensure that votes are cast only during the designated election period.Despite its advantages, challenges such as scalability and real-world deployment remain. Research indicates that while blockchain enhances transparency and security, large-scale implementation requires further optimization .Future work may focus on improving scalability, integrating advanced cryptographic techniques such as zero-knowledge proofs, and enhancing user authentication mechanisms. Additionally, the system can be extended to support mobile platforms and real-time analytics.In conclusion, this project highlights the potential of blockchain and cryptography in transforming voting systems. It provides a robust foundation for developing secure digital election platforms and contributes to the advancement of e-governance technologies.

REFERENCES

1. · Berenjestanaki et al., 2023. *Blockchain-Based E-Voting Systems: A Technology Review*.
2. · Ohize et al., 2024. *Blockchain for Securing Electronic Voting Systems*.
3. · Revelo et al., 2026. *Systematic Evaluation of Blockchain-Based Voting*.
4. · Sharp et al., 2024. *Blockchain-Based E-Voting Mechanisms Survey*.
5. · Wang et al., 2024. *Efficient Blockchain Voting Scheme*.
6. · Wang et al., 2024. *Confidential Verifiable E-Voting Scheme*.
7. · Kusi & Asoma, 2025. *Blockchain Voting Privacy & Scalability Review*.
8. · Singh et al., 2023. *Decentralized Blockchain Voting Survey*.
9. · Vladucu et al., 2023. *E-Voting Meets Blockchain*.

10. · Sahasra et al., 2023. *Smart Contracts in Voting Systems*.

11. · Spanos et al., 2023. *EtherVote Blockchain Voting System*

12. · Li et al., 2025. *Collectively Secure Blockchain Voting*

13. · Kiashemshaki et al., 2025. *Scalable Blockchain Voting Framework*

14. · Azad et al., 2025. *Quantum Blockchain Voting System*

15. · Additional IEEE/Springer papers (2023–2025) on blockchain voting and cryptography