Industrial Engineering Journal
ISSN: 0970-2555
Volume : 53, Issue 5, No.12, May : 2024

FACIAL RECOGNITION ENABLED DIGITAL VOTING PLATFORM USING BLOCKCHAIN

M. Jayaram Professor, Dept. of CSE(Data Science), Sreyas Institute of Engineering and Technology, Nagole, Hyderabad, jayaram_258m@yahoo.com
Varanasi Venkata Akshay B.Tech Student, Dept. of CSE(Data Science), Sreyas Institute of Engineering and Technology, Nagole, Hyderabad
Chityala Sri Chaitanya B.Tech Student, Dept. of CSE(Data Science), Sreyas Institute of Engineering and Technology, Nagole, Hyderabad
Maganti Sailaja B.Tech Student, Dept. of CSE(Data Science), Sreyas Institute of Engineering and Technology, Nagole, Hyderabad
Kadukuntla Rishika Reddy B.Tech Student, Dept. of CSE(Data Science), Sreyas Institute of Engineering and Technology, Nagole, Hyderabad

Abstract:
The national democratic countries that upholds democratic principles, the citizens of that country retain the privilege of electing their representatives at both the state and national levels. Nevertheless, the intersection of democracy and technology has given rise to innovative voting methods, among which face recognition technology has emerged as a promising avenue for smart voting. The system leverages LBPH Face Recognizer for facial recognition, enabling remote voter authentication and eliminating the need for physical presence at polling stations. Our extensive examination of the referenced works substantiates the claim that such a system not only heightens accessibility and convenience for users, but also mitigates instances of voter fraud. We used the LBPH Face Recognizer for facial recognition and integrating with Ethereum blockchain for eliminating the voter fraud, granting tamperproof for voter data and integrity of voting process.

Index terms –
E- Voting, Face Recognition, LBPH, Blockchain, Ethereum.

I. INTRODUCTION

Voting is a crucial process in democratic societies, and ensuring its security and integrity is paramount. Traditional methods of voting, such as pen and paper ballots, have various vulnerabilities, including fraud, lack of traceability, and limited verifiability [1]. To address these issues, many are turning to Blockchain technology [2].

Blockchain technology functions as a digital ledger, maintaining a secure and tamper-resistant record of transactions and data [3]. Each transaction is added to a "block" and linked to the previous one, creating a continuous chain of data blocks. In the context of voting, transactions represent voting data, candidate details, and voter information [4].

There are several advantages to using Blockchain for voting purposes:

1. Decentralization: Blockchain does not require a central authority because it runs on a network of computers. Because there is no single point of control, this lowers the possibility of manipulation. [5].
2. Transparency: Every transaction on the blockchain is visible to all participants, allowing voters to verify that their votes were counted accurately [6].
3. Security: Blockchain secures data using cutting-edge cryptographic algorithms, making it very difficult for unauthorized parties to alter the information. [7].
4. Immutability: Data cannot be removed or changed once added to the blockchain. By discouraging fraudulent activity, this maintains the voting process's integrity.[8].

Furthermore, Blockchain is designed to continue functioning even if some computers in the network fail, making it a reliable system for recording votes [9].

In conclusion, Blockchain technology offers a promising solution to enhance the security and integrity of the voting process. By leveraging its decentralized nature, transparency, security features, and immutability, Blockchain can help ensure fair and trustworthy elections.

Traditional voting systems have long been marred by inefficiencies, security vulnerabilities, and concerns related to transparency.

Manual paper-based voting processes are prone to errors, logistical challenges, and incidents of fraud, compromising the integrity of elections. Additionally, as societies embrace digital transformation, there is a growing need for more accessible and technologically advanced voting solutions that can accommodate diverse voter demographics.

Previous attempts to introduce electronic voting systems often faced critical issues. Many lacked robust authentication mechanisms, leaving them susceptible to identity fraud and manipulation.

Centralized architectures raised concerns about single points of failure, and opaque processes fueled skepticism regarding the accuracy and security of the results. Furthermore, privacy concerns persisted, especially when dealing with biometric data.

II. LITERATURE SURVEY

Recent years have seen a considerable increase in interest in the application of blockchain technology to electronic voting systems because of its promise to improve election security, transparency, and public trust. Researchers have looked into a number of integration strategies for blockchain technology with electronic voting systems, frequently fusing it with other technologies like biometrics and face recognition. By outlining important discoveries and unresolved research issues, this literature review seeks to give a broad overview of the body of work that has already been done in this area.

Yash Mithapelli et al. [10] conducted a comprehensive review of the integration of face recognition and blockchain in online voting systems. They discussed the advantages of using face recognition for voter authentication and proposed a blockchain-based framework to ensure the integrity and security of the voting process. Similarly, N.Kannan et al. [11] presented an electronic voting system that leverages face recognition technology and blockchain for authentication and data integrity. Their study emphasized the importance of using biometric authentication to prevent identity fraud in online voting.

In another study, Shubham Ghule et al. [12] proposed a smart e-voting system that combines face recognition with blockchain technology. They highlighted the potential of blockchain to address security concerns such as tampering and unauthorized access to voting data. Additionally, Rihab H Sahib and Prof. Dr. Eman S. Al-Shamery [13] reviewed distributed blockchain technology for e-voting systems, emphasizing its decentralized nature and ability to ensure transparency and auditability.

Uzma Jafar et al. [14] conducted a review of blockchain for electronic voting systems, focusing on open research challenges such as scalability, privacy, and usability. They highlighted the need for further research to address these challenges and improve the adoption of blockchain in e-voting. Similarly, Santosh Kumar et al. [15] surveyed smart electronic voting systems using blockchain technology, discussing various implementation strategies and their implications for security and efficiency.

BalaMurali et al. [16] proposed a smart and secure voting machine using biometrics, highlighting the potential of biometric authentication to enhance the security and accuracy of the voting process. Their study emphasized the importance of integrating biometrics with blockchain to ensure reliable voter identification and prevent fraudulent activities.

Overall, the literature reviewed demonstrates the growing interest in leveraging blockchain technology for electronic voting systems. By combining blockchain with other technologies such as face recognition and biometrics, researchers aim to address key challenges such as voter authentication, data integrity, and security. However, several open research challenges remain, including scalability, privacy, and usability. To overcome these obstacles and fully utilize blockchain's promise to transform the political process, more study is required.

Industrial Engineering Journal
ISSN: 0970-2555
Volume : 53, Issue 5, No.12, May : 2024

METHODOLOGY

i) Proposed Work:

The proposed electronic voting system with face recognition on the Ethereum blockchain presents a comprehensive and innovative solution to address the shortcomings of traditional voting methods. Integration of face recognition technology ensures robust and accurate biometric authentication, reducing the likelihood of identity fraud and providing a secure means of voter verification.

The goal is to implement "dual authentication," a process that uses two methods to confirm a user's identity. One method relies on facial recognition, where the system checks if the voter's face matches their registered identity. The other method involves email OTP (One-Time Password) verification, where a unique password is sent to the voter's email. Through this dual authentication process, the aim is to ensure that only the genuine voter can access and utilize the system, thereby preventing unauthorized voting.

Utilization of the Ethereum blockchain provides an immutable and transparent ledger for recording votes. This transparency enhances trust in the electoral process by allowing stakeholders to independently verify the integrity of the results.

ii) System Architecture:

The proposed system architecture consists of two main components: the admin module and the user module. The admin module is responsible for managing party details, viewing party information, and viewing vote data. It includes functionalities such as adding party details, viewing party details, and accessing vote records. The user module allows voters to cast their votes securely. When a user selects the "Cast Your Vote" option, they are authenticated and presented with a ballot containing the list of parties. Upon selecting their preferred party, the vote is securely recorded using blockchain technology to ensure transparency and integrity. The architecture leverages a decentralized network of computers to store and validate the blockchain, ensuring reliability and resilience. Overall, the system architecture enables efficient management of party details, secure casting of votes, and transparent recording of voting data.

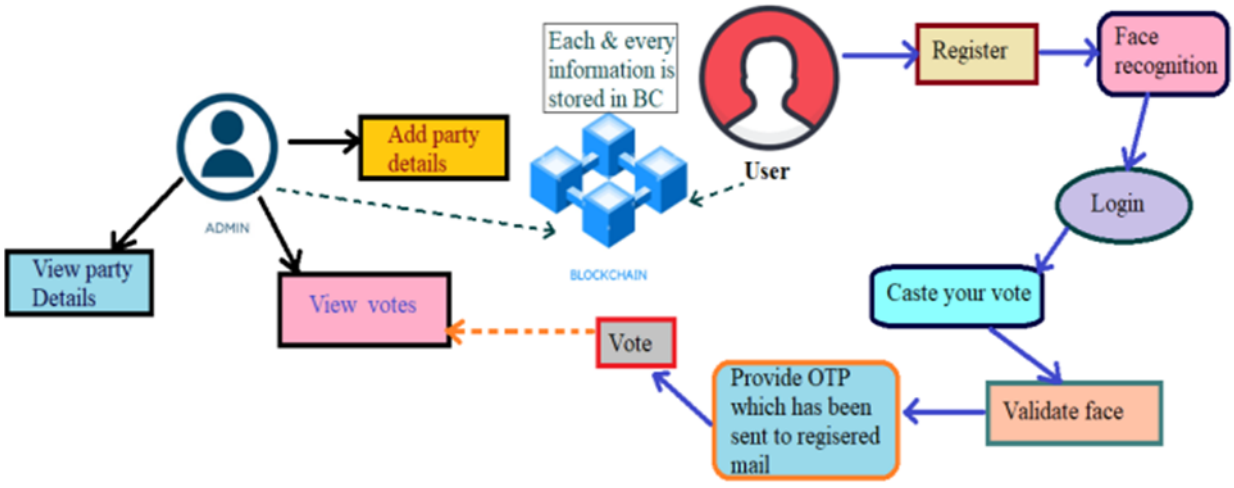

Fig 1 Proposed System Architecture for E-voting system using Ethereum Blockchain

iii) Modules:

To implement this project we used the following modules:

Register: In this module, eligible voters sign up to use the electronic voting system. Users provide their personal information, such as name, email, address, and identification details. The system validates and verifies the provided information, ensuring that only eligible voters are registered. Users may also need to upload a photo for identification purposes.

Admin Login: This module is for authorized administrators who manage the electronic voting system. Administrators enter their unique login credentials to access the system. Once logged in, administrators

can perform various tasks, such as adding or updating candidate information, monitoring the voting process, and generating reports.

Add Party Details: In This module, administrators add information about political parties participating in the election. This includes party names, logos, candidate lists, and any relevant details. The information is securely stored in the system and made available for voters to view during the election.

View Party Details: This module allows both voters and administrators to see information about the political parties and their candidates. Voters can use this information to make informed decisions about their votes. Administrators can review and update party details if needed.

View Votes: This module provides a summary of the votes cast in the election. It shows the total number of votes for each party or candidate, allowing administrators and the public to track the progress of the election.

User Login: The "User Login" module is for registered voters who wish to cast their votes. Voters enter their login credentials, which include facial recognition and email OTP verification, to access the voting interface. Once logged in, voters can proceed to cast their votes securely.

Cast Your Vote: In this module, voters make their selections for candidates or parties. They follow the on-screen instructions to choose their preferred options. The system ensures that each voter can only submit one valid vote, preventing duplicate votes. After casting a vote, the voter receives confirmation, and their choice is securely recorded in the blockchain-based system.

iv) Blockchain Integration:

The blockchain is like a highly secure digital storage place. It holds important information for our e-voting system, like votes casted, candidate details, and voter details. Each piece of information is put in its own digital "block" on the blockchain. These blocks are linked together, forming an unchangeable record of everything that happens on the e-voting system.

Blockchain also helps make sure that only the right people can vote. It does this by using facial recognition (checking if user face matches user ID) and email OTP (sending a special password to user email). This makes it really hard for someone else to pretend to be you and vote in your place

Blockchain stops someone from voting more than once. Once user cast his vote, the system records it on the blockchain, and that's it. User can’t vote again with the same identity. This ensures that the election results are fair and accurate.

Additionally, the system maintains data integrity by employing the Secure Hash method 256-bit, or SHA-256 method. Every block inside a blockchain is connected by a distinct hashcode. These blocks are kept up to date by several servers or nodes. Blockchain checks each block's hashcode before adding new entries. A separate hashcode is produced if any block data is altered, guaranteeing the data's integrity and immutability and setting off security alerts. As a result, the blockchain would instantly display any attempt to tamper with the voting data, such as changing voter information or a vote.

III. RESULTS AND COMPARISIONS

The potential to transform electoral procedures has led to a surge in interest surrounding blockchain-powered e-voting systems. A key advantage of these systems is their ability to enhance transparency and safeguard against vote manipulation by utilizing the decentralized and unalterable nature of blockchain technology. By recording each vote as a transaction on the blockchain, a transparent and traceable record is established. This not only guarantees the integrity of the voting process but also fosters trust among voters and stakeholders. Additionally, blockchain-based e-voting systems prioritize privacy by encrypting individual votes, ensuring anonymity without compromising the accuracy of the results. The security and instill trust in electoral processes, e-voting systems have implemented a robust strategy by integrating face recognition technology with ECDSA and SHA-256 cryptography hash values. This integration serves to authenticate voters through face recognition, otp verification effectively mitigating the risk of fraudulent activity and ensuring that only eligible individuals can partake in the voting process. Additionally, the utilization of ECDSA and SHA-256

cryptography reinforces the system by validating digital signatures and generating secure hash values for each vote, thus safeguarding against any attempts to tamper with or manipulate voting data.

Model	Technology Used	Security Measures
E-voting using Blockchain	Blockchain technology, cryptography	Immutable ledger, cryptographic hashing, consensus algorithm(pow)
E-voting in Estonia	Blockchain technology, cryptography	ID verification, secure transmission protocols, audit trails
E-voting using Aadhar Virtual ID	Biometric authentication, encryption	Biometric verification, encrypted data transmission, secure ID generation

Table 1: Existing Models for E voting

S. No	Technologies Used	Security (%)
1	Ethereum+POW	82.50
2	Hyperledger +POA+POS	90.72
3	Ethereum+POS+ECDSA	95.75

Table 2: Comparison with Existing Models

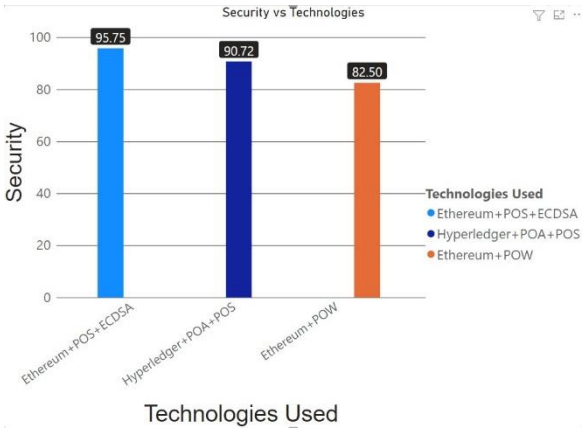

Fig.2 Graphical Analysis of Security

IV. CONCLUSION

In comparing Blockchain-Based E-Voting Systems with initiatives like "Towards Remote E-Voting: Estonian Case" and "Aadhar integrated with blockchain technology," etc. by incorporating facial recognition technology into e-voting systems stands out for its enhanced security features. The combination of facial recognition and OTP validation significantly boosts security by adding layers of authentication and ensuring that the voter's identity is verified securely before casting a vote. This integration not only mitigates the risk of fraudulent activities but also instills confidence in the integrity and transparency of the e-voting process.

Moreover, leveraging blockchain technology further strengthens the security and transparency of the e-voting system. The immutable nature of blockchain ensures that once a vote is cast, it cannot be altered or tampered with, thus preserving the integrity of the election results. Additionally, the use of virtual IDs based on Aadhar adds an extra level of authentication, linking each vote securely to a verified individual. Overall, combining facial recognition, OTP validation, blockchain, and Aadhar-based virtual IDs creates a robust and secure e-voting system that upholds the principles of democracy while safeguarding against potential threats and vulnerabilities.

REFERENCES

[1] Source: "Voting Technology: The Not-So-Simple Act of Casting a Ballot," Brennan Center for Justice, URL:https://www.brennancenter.org/our-work/research-reports/voting-technology-not-so-simple-act-casting-ballot
[2] Source: "Blockchain Voting: The End to Election Fraud?,"Cointelegraph, URL:https://cointelegraph.com/news/blockchain-voting-the-end-to-election-fraud
[3] Source: "Blockchain Explained," Investopedia, URL: https://www.investopedia.com/terms/b/blockchain.asp
[4] Source: "How Blockchain Voting Works," Blockgeeks, URL: https://blockgeeks.com/guides/blockchain-voting/
[5] Source: "Decentralization in Blockchain Technology: An Overview," Medium, URL: https://medium.com/@preethikasireddy/how-does-ethereum-work-anyway-22d1df506369
[6] Source: "The Role of Transparency in Blockchain Technology," Medium, URL: https://medium.com/@matthewcarano/the-role-of-transparency-in-blockchain-technology-5b2f9381e46f
[7] Source: "Blockchain Security: What Keeps Your Transaction Data Safe?," CoinDesk, URL: https://www.coindesk.com/learn/security-privacy/blockchain-security
[8] Source: "Blockchain 101: What is Blockchain and How Does it Work?," IBM, URL: https://www.ibm.com/cloud/learn/blockchain
[9] Source: "Blockchain Resilience: What Makes a Blockchain System Resilient?," Blockonomi,
[10] Yash Mithapelli, Atharva Nair, Rushikesh Kulkarni, Silkesha Thigale, et. al., “FACE RECOGNITION AND BLOCKCHAIN INTEGRATION IN ONLINE VOTING SYSTEMS: A COMPREHENSIVE REVIEW” published in irjmets open Access, available at
[11] N. KANNAN, M. MATHANKUMAR, G. MULLAIVENTHAN, B. NIVASHKANNA; et. al., “ELECTRONIC VOTING SYSTEM USING FACE RECOGNITION WITH BLOCKCHAIN TECHNOLOGY ” published in ijariie open Access, available at
[12] Shubham Ghule , Mayur Bhondave , Pournima Mishra , Vaibhav Survase , Prof.Alka Kulkarni, et. al., “Smart E-Voting System with Face Recognition by BlockChain Technology” published in ijarcce open Access, available at
[13] Rihab H Sahib and Prof. Dr. Eman S. Al-Shamery, et. al., “A Review on Distributed Blockchain Technology for E-voting Systems” published in iopscience open Access, available at