

SECURE ONLINE VOTING SYSTEM USING BLOCKCHAIN TECHNOLOGY

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ABSTRACT

Electronic voting systems have gained significant importance in modern democratic processes due to their speed, accessibility, and efficiency compared to traditional paper-based voting methods. However, existing electronic voting systems face major challenges related to security, privacy, transparency, vote manipulation, and centralized control. Many current e-voting platforms rely on centralized databases, which are vulnerable to cyberattacks, unauthorized modifications, insider threats, and single points of failure. These issues reduce public trust in digital voting systems and raise concerns about election integrity and voter confidentiality. Blockchain technology has emerged as a promising solution for building secure and transparent electronic voting systems. Blockchain provides decentralization, immutability, transparency, and cryptographic security, making it suitable for managing sensitive electoral processes. This project proposes a blockchain-based electronic voting system that ensures voter privacy, vote integrity, and transparent election management using a public blockchain network. The proposed system utilizes cryptographic algorithms, smart contracts, and distributed ledger technology to securely record and verify votes without revealing voter identities.

Keywords: Blockchain, Electronic Voting, Public Blockchain, Smart Contracts, Privacy, Transparency, Cryptography, Cybersecurity, Decentralized Systems.

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INTRODUCTION

Electronic voting systems have become an important part of modern democratic processes due to the rapid advancement of digital technologies and internet-based services. Traditional paper-based voting methods require significant human effort, time, and operational cost for managing elections. These systems often face problems such as manual counting errors, ballot tampering, delayed result processing, voter impersonation, and lack of transparency. To overcome these limitations, electronic voting systems were introduced to improve voting efficiency, accessibility, and speed. However, many existing electronic voting systems still suffer from security vulnerabilities, centralized control issues, and lack of public trust.

Most conventional e-voting platforms store voting data in centralized databases managed by election authorities or third-party organizations. Such centralized systems are vulnerable to cyberattacks, insider manipulation, unauthorized data modification, and single points of failure. Attackers may alter voting records, manipulate results, or compromise voter privacy. In addition, voters often cannot

independently verify whether their votes were counted correctly, which raises concerns about election integrity and transparency. Therefore, there is a strong need for secure, transparent, and tamper-resistant voting systems that can guarantee voter privacy and trustworthy election results.

Blockchain technology has emerged as a powerful solution for addressing these challenges in electronic voting systems. Blockchain is a decentralized distributed ledger technology that securely stores transactions across multiple nodes in a network. Once information is added to the blockchain, it becomes immutable and cannot be modified without network consensus. Blockchain provides important features such as transparency, decentralization, security, traceability, and cryptographic protection, making it highly suitable for electronic voting applications.

LITERATURE SURVEY

1. Blockchain-Based Electronic Voting System

Author: Zibin Zheng, Shaoan Xie, Hongning Dai, Xiangping Chen, and Huaimin Wang

This research explains the importance of blockchain technology in secure digital applications, including electronic voting. The authors discussed blockchain features such as decentralization, immutability, transparency, and cryptographic security. These features help prevent vote tampering, unauthorized modification, and centralized control. The study highlights that blockchain can improve trust in e-voting systems by allowing transparent verification of voting records while maintaining data integrity.

2. A Secure E-Voting System Using Blockchain Technology

Author: Freya Sheer Hardwick, Apostolos Gioulis, Raja Naeem Akram, and Konstantinos Markantonakis

This paper proposes a secure electronic voting framework using blockchain technology. The authors focused on solving problems such as voter authentication, vote privacy, duplicate voting, and result transparency. Smart contracts were used to manage the voting process automatically and securely. The study shows that blockchain-based voting systems can reduce election fraud and improve confidence in digital elections.

3. Blockchain for Electronic Voting System—Review and Open Research Challenges

Author: Ahmed Ben Ayed

This research presents a review of blockchain applications in electronic voting systems. The author explains how blockchain can provide secure vote recording, transparent result verification, and tamper-proof election management. The paper also discusses important challenges such as scalability, voter privacy, identity verification, and legal acceptance. The study concludes that blockchain is a promising solution for future e-voting systems.

4. Follow My Vote: A Secure and Transparent Online Voting Platform

Author: Adam Ernest

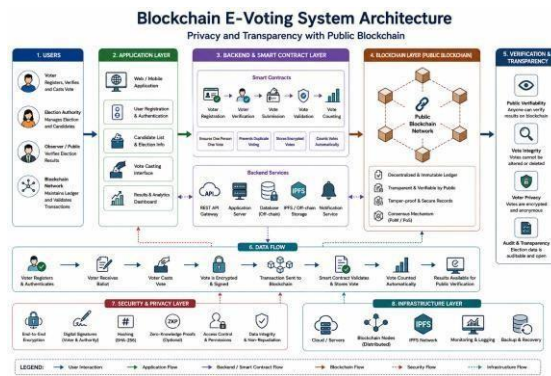
This work discusses a blockchain-based online voting platform designed to provide transparency and verifiability. The system allows voters to verify that their votes were recorded correctly without revealing their identity. The platform uses cryptographic techniques to protect voter privacy and blockchain records to ensure election transparency. The study demonstrates how public blockchain can improve voter trust in online voting.

5. Decentralized E-Voting System Using Smart Contracts

Author: Kshetri and Voas

This paper explains how smart contracts can automate election processes in blockchain-based e-voting systems. The authors describe the role of smart contracts in voter registration, vote validation, duplicate vote prevention, and vote counting. The study shows that decentralized voting systems reduce dependence on central authorities and improve election accountability.

SYSTEM ARCHITECTURE



IMPLEMENTATION

The **Blockchain E-Voting System** is implemented to provide a secure, transparent, and privacy-preserving voting platform using public blockchain technology. The main objective of the implementation is to allow voters to cast votes digitally while ensuring that every vote is authentic, tamper-proof, anonymous, and publicly verifiable.

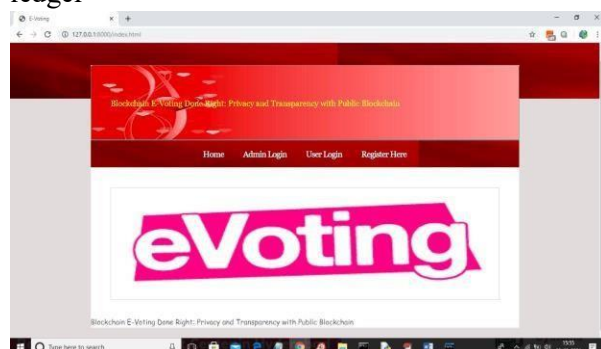
The implementation begins with **voter registration and authentication**. Each eligible voter registers through a web or mobile application by providing valid identity details. The election authority verifies the voter information and generates a unique digital identity or voting credential. This credential is used only for authentication and does not reveal the voter’s actual identity during vote submission.

After successful authentication, the voter is allowed to access the **vote casting interface**. The system displays the list of candidates or voting options. When the voter selects a candidate and submits the vote, the vote is encrypted using cryptographic techniques. Digital signatures are used to verify that the vote was submitted by an authorized voter. This prevents fake votes and unauthorized access.

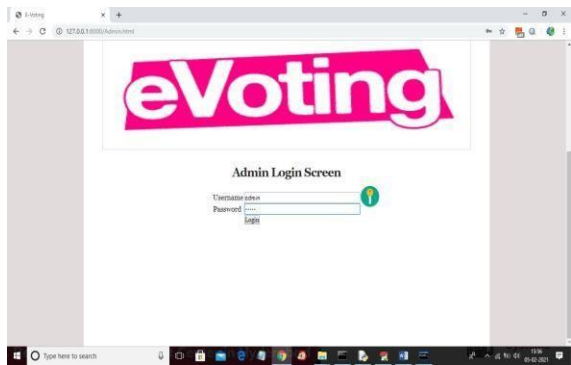
The core voting process is managed by **smart contracts** deployed on a public blockchain. Smart contracts automatically check voter eligibility, prevent duplicate voting, validate submitted votes, and record valid votes on the blockchain. Once a vote is stored in the blockchain, it cannot be changed, deleted, or manipulated because blockchain records are immutable.

To maintain **voter privacy**, the system stores votes in encrypted form. The voter’s identity is separated from the vote, ensuring anonymity. Advanced techniques such as hashing and zero-knowledge proofs can be used to verify vote validity without revealing voter details. This provides both privacy and transparency.

The **public blockchain network** stores all valid voting transactions across distributed nodes. Since the ledger



In above screen click on ‘Admin Login’ link to get below screen



In above screen login as admin by giving username as 'admin' and password as 'admin' and then click Login button to get below screen

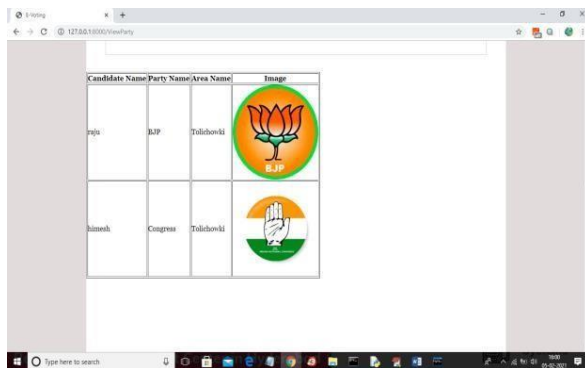
In above screen admin can click on 'Add Party Details' link to add party details



In above screen adding party and candidate details and then upload image and click on 'Open' button then click on 'Add Party' button to add party details



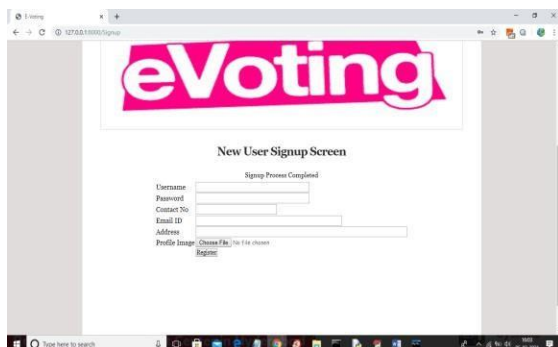
In above screen part details added and similarly you can add any number of party members and now click on 'View Party Details' link to get below screen



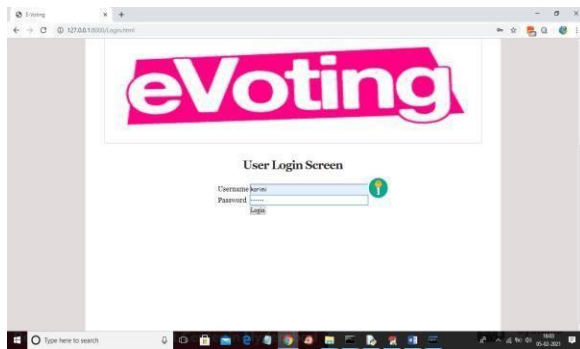
In above screen displaying add added party details and now click on 'Logout' link to logout as admin and then add new user



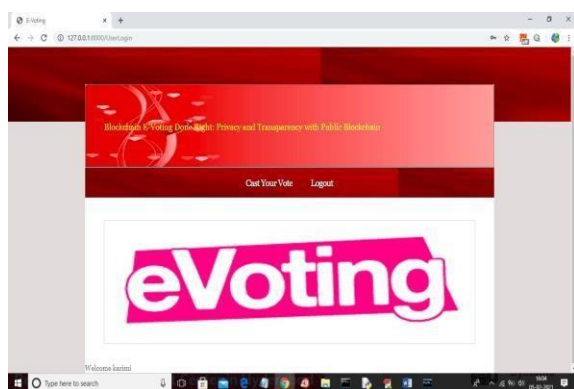
In above screen adding new user and then selecting his face photo taken from webcam and then click on 'Register' button to complete signup process. Here you have given images taken from phone but we need to capture from webcam for dataset as quality of webcam image and phone image vary and then problem comes in prediction.



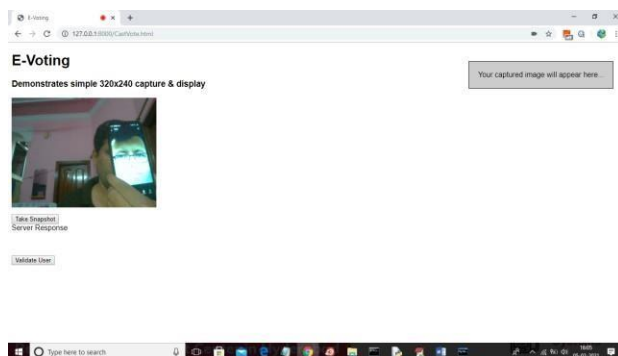
In above screen signup process completed and now login as this user to cast vote



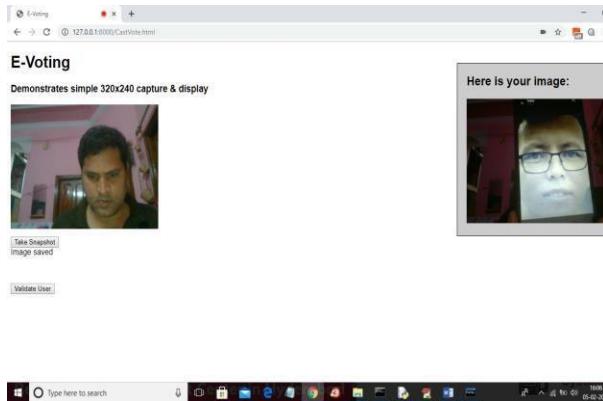
In above screen application first authenticate user by using his login details and once after successful login then user will get below page



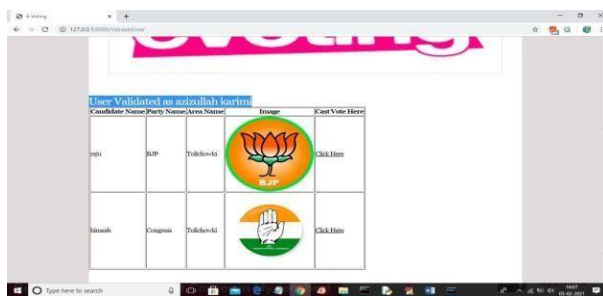
In above screen user can click on 'Cast Your Vote' link to get below webcam screen



In above screen webcam is running and then by showing person face we need to click on 'Take Snapshot' button to capture his face



In above screen person faces is capture and now click on 'Validate User' button to validate user

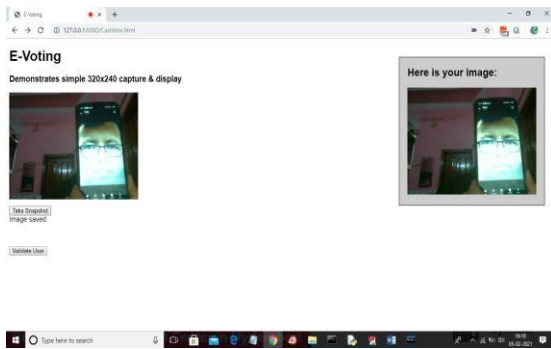


In above screen in blue colour you can see user is identified as 'azizullahkarimi' and then displaying list of candidates and now user can click on 'Click Here' option to cast his vote and to get below screen

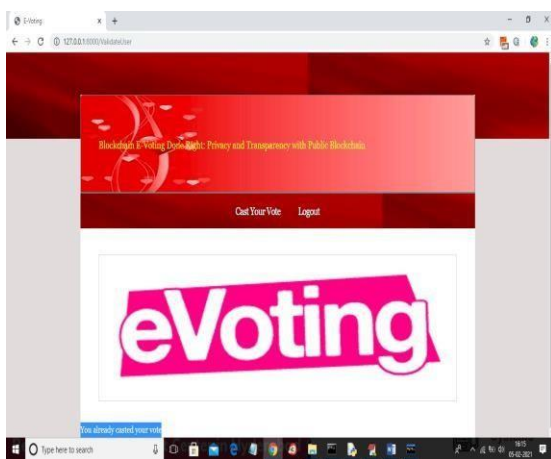


In above screen as this is the first vote so block will be added to Blockchain with block No as 1 and we can see Blockchain created a chain of blocks with previous and

current hash code validation. Now try again with same user to cast vote



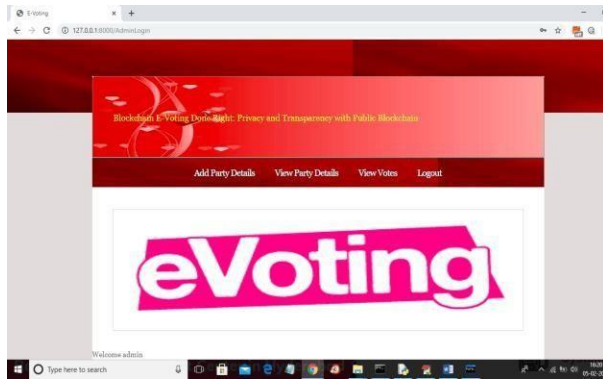
In above screen same user trying again and below is the result



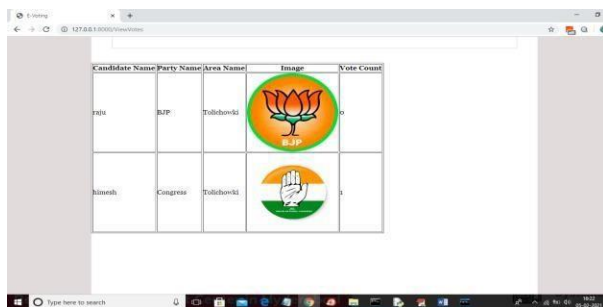
In above screen if same user try again then will get message as 'You already casted you vote' and now logout and login as 'admin' to get vote count



In above screen login as admin and after login will get below screen



In above screen admin can click on 'View Votes' link to get below screen



In above screen admin can view all vote counts.

CONCLUSION

The proposed Blockchain-based E-Voting System provides a secure, transparent, decentralized, and privacy-preserving solution for modern electronic voting processes. Traditional voting systems and many existing electronic voting platforms suffer from problems such as vote tampering, centralized control, lack of transparency, delayed result processing, and voter privacy concerns. These limitations reduce public trust in election systems and increase the risk of election fraud. Blockchain technology effectively addresses these challenges by providing immutable data storage, distributed consensus, cryptographic security, and transparent verification mechanisms.

The implemented system uses public blockchain technology along with smart contracts to ensure secure voter authentication, vote validation, duplicate vote prevention, and automatic vote counting. Each vote is encrypted and stored as a blockchain transaction, making it impossible to alter or delete voting records after submission. The decentralized architecture removes dependence on centralized authorities and reduces the possibility of insider attacks or unauthorized modifications. At the same time, the system preserves voter anonymity through encryption and cryptographic techniques, ensuring that individual voting choices remain private.

The proposed framework improves election integrity, accountability, and public confidence by allowing transparent verification of election results. Smart contracts automate election operations, reducing human errors and operational complexity. The system also supports faster result generation, secure auditability, and efficient election management compared to traditional voting approaches.

FUTURE WORK

The future enhancement of the Blockchain-based E-Voting System mainly focuses on improving scalability, privacy, efficiency, accessibility, and large-scale deployment for real-world election environments. Although blockchain technology provides strong security and transparency, several advanced technologies can be integrated to further improve the performance and reliability of electronic voting systems.

One important future improvement is the implementation of advanced cryptographic techniques such as Zero-Knowledge Proofs (ZKP), Homomorphic Encryption, and Ring Signatures. These techniques can provide

stronger voter anonymity and allow vote verification without revealing voter identity or voting choices. This will enhance privacy preservation in public blockchain voting systems.

Another future enhancement involves improving blockchain scalability and transaction speed. Public blockchains may experience delays and higher transaction costs during large-scale elections involving millions of voters. Future systems can integrate Layer-2 solutions, sharding, and optimized consensus mechanisms such as Proof of Stake (PoS) to increase voting efficiency and reduce network congestion.

The integration of biometric authentication technologies such as fingerprint recognition, facial recognition, iris scanning, and voice verification can further improve voter authentication and prevent identity fraud. Multi-factor authentication mechanisms can strengthen election security and ensure that only authorized voters participate in elections.

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