

E-Voting System Using Ethereum Blockchain

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Abstract In this project we are implementing Blockchain based E-Voting system which works as a decentralized server where multiple nodes will maintain user's voting data and if one node crashed or down then users can get voting data from other working nodes. In existing application single centralized server were managing all voting data and if this server hacked or down then all voting details will be unavailable and this server can be attacked or hacked and can alter vote counting data. Blockchain storage support immutable data storage which means data cannot be alter or hacked as each node in the Blockchain will verify each Block storage with the help of hashcodes. Blockchain store each record as transaction/block and associate each block with unique hashcode and this hashcode will be verified against any malicious data tamper which makes Blockchain secured and tamper proof. Algorithms: Ethereum is the public Blockchain software and include multiple algorithms such POW (proof of work), Hashcode verification, proof of stake (POS), ripple protocol consensus algorithm (RPCA), delegated proof of stake (dPOS), stellar consensus protocol (SCP), and proof of importance (POI). All data will be stored in Blockchain using Paillier encryption. Each hashcode for verification will be generated using SHA256.

I. Introduction

In traditional voting systems, data is typically managed by a single centralized server, making it a critical point of failure and an attractive target for cyber-attacks. If this server is compromised or crashes, it can result in data loss, manipulation of vote counts, and ultimately, loss of trust in the election outcome. Additionally, centralized systems lack transparency, making it difficult for stakeholders to independently verify the integrity of the voting process.

To address these challenges, blockchain technology has emerged as a promising alternative due to its decentralized and immutable nature. By leveraging Ethereum Blockchain, this project introduces a secure and transparent E-Voting system where votes are recorded as blocks, each validated through cryptographic hash functions and stored

across multiple nodes. Even if one node fails, others maintain the data, ensuring continuity and resilience. The system uses smart contracts for managing the voting process and integrates advanced cryptographic techniques like Paillier encryption and SHA256 to ensure both vote integrity and voter privacy. This approach not only secures the voting process but also fosters greater voter confidence in digital elections.

II. Literature Survey

1. **Swan, M. (2015) – “Blockchain: Blueprint for a New Economy”**
This foundational text explores how blockchain technology can transform traditional centralized systems into decentralized networks. Swan discusses potential blockchain applications in governance and voting, highlighting how smart contracts and distributed ledgers can ensure transparency, immutability, and trust—critical components for secure electronic voting systems.
2. **Zheng, Z., Xie, S., Dai, H., Chen, X., & Wang, H. (2017) – “An Overview of Blockchain Technology: Architecture, Consensus, and Future Trends”**
This paper provides a detailed analysis of blockchain architectures and consensus mechanisms such as Proof of Work (PoW) and Proof of Stake (PoS). It highlights blockchain's advantages in building secure, tamper-proof systems suitable for e-voting and compares traditional systems' vulnerabilities with blockchain's resilience.
3. **McCorry, P., Shahandashti, S. F., & Hao, F. (2017) – “A Smart Contract for Boardroom Voting with Maximum Voter Privacy”**
In this research, the authors propose a smart contract-based voting scheme that

maximizes voter privacy while maintaining verifiability. The use of Ethereum and cryptographic tools like zero-knowledge proofs offers insight into developing secure and privacy-preserving e-voting platforms.

4. **Narayanan, A., Bonneau, J., Felten, E., Miller, A., & Goldfeder, S. (2016) – “Bitcoin and Cryptocurrency Technologies”**

This book introduces the underlying principles of cryptocurrencies and blockchain. It explains how decentralized consensus and cryptographic hash functions make blockchain ideal for applications such as digital voting, ensuring each vote is recorded and verified without reliance on a central authority.

5. **Ali, R., Clarke, D., & McCorry, P. (2018) – “E-Voting with Blockchain: An E-Voting Protocol with Decentralisation and Voter Privacy”**

The authors design an e-voting protocol using Ethereum blockchain that balances decentralization with privacy. They discuss real-world challenges in blockchain voting systems, such as voter authentication and ensuring a single vote per user, and propose solutions based on Ethereum smart contracts and end-to-end encryption.

III. Proposed Method

The proposed method introduces a secure and decentralized E-Voting system using the Ethereum Blockchain, aimed at eliminating the risks associated with centralized vote management systems. In this approach, all voting data is stored as immutable blocks across multiple nodes, ensuring data availability even if one or more nodes fail. Smart contracts are used to manage candidate registration, voter authentication, vote casting, and result viewing, enabling automated and tamper-proof vote handling. Voter identities are verified using AADHAR credentials encrypted with ECC and authenticated via SHA256, while vote data is stored using Paillier encryption. This system

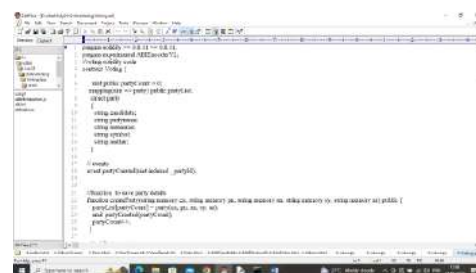
ensures that each user can vote only once, and any attempt to recast is automatically blocked. By combining blockchain transparency with strong cryptographic safeguards, this method provides a trustworthy, secure, and verifiable digital voting solution.

Results

To implement this project we have designed following modules

- 1) Admin will login to system using username and password as 'admin and admin' and then add candidate details
- 2) Admin will add voter details and give username and password to voter for future login to cast votes. All candidates and voters will be verified using AADHAR card and this card details will be saved using ECC encryption and can be authenticated using Sha256.
- 3) Admin will add election date
- 4) Admin can view count of votes secured by each candidate
- 5) User can login to system and then can view election date, if today is election date then only user can cast vote, if user already casted vote and try to recast then system will report error, only one time allow to cast vote.

We can save and get data from ETHEREUM Blockchain using Smart Contracts which will contains function to be called for data management. This contract function can be called from any programming languages and to implement Voting System we have designed below VOTING contract.

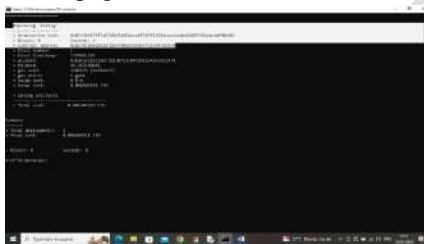


In above contract we have defined functions to save and get voting data and now this contract need to be deployed in Blockchain ETHEREUM tool using below steps

- 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



- 2)
- 3) 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



- 4)

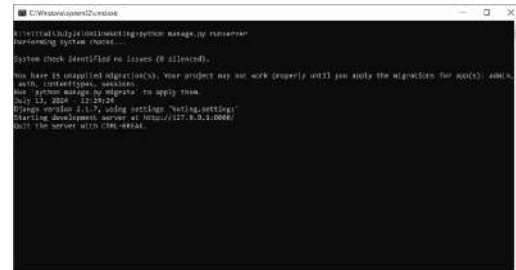
In above screen in white colour text can see 'Voting' contract deployed and running and got contract address also and this address need to specify in python program to call contract to manage voting data. In below screen showing python code calling contract using contract address



In above screen read red colour comments to know about Blockchain contract calling from PYTHON.

IV. RESULT

In above screen Voting contract deployed in Blockchain and now double click on 'run.bat' file to start python server and get below page



In above screen python server started and now open browser and enter URL as <http://127.0.0.1:8000> and press enter key to get below page



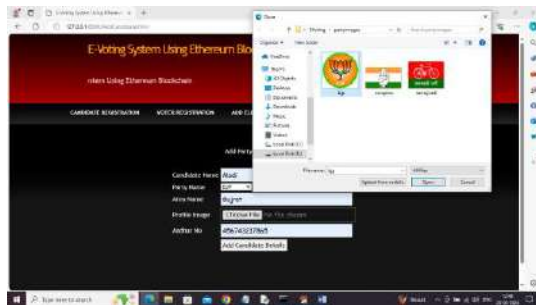
In above screen click on 'Admin Login' link to get below page



In above screen admin is login and after login will get below page



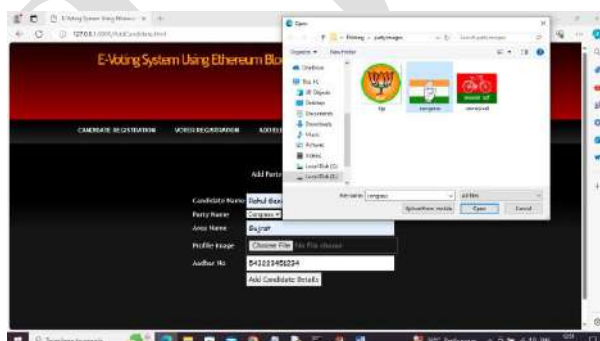
In above screen admin can click on 'Candidate Registration' link to get below page



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



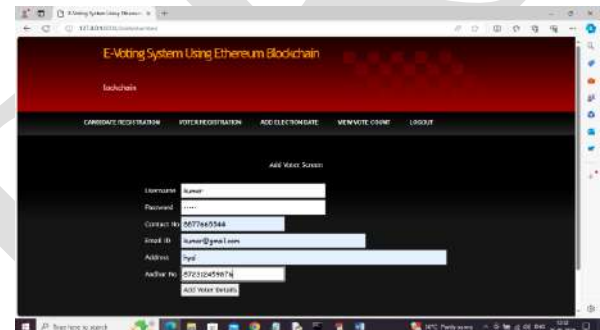
In above screen in blue color second and third line can see AADHAR SAH256 authenticated code along with ECC encrypted data. In white color text can see candidate details added to Blockchain and I am displaying all log details obtained from Blockchain after storing details and in above log can see Blockchain transaction no, block no, transaction hash code and many other details and similarly you can add any number of candidates. In below screen adding another candidate



In above screen admin adding another candidate details and press button to get below page



In above screen another candidate details added and now click on 'Voter Registration' link to get below page



In above screen admin adding voter details along with username and password and then press button to get below page



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



In above screen click on button to add election date and get below page



In above screen election date added and now click on 'View Vote Count' link to view all parties and their vote count



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 is login and after login will get below page



In above screen in last two line user can see welcome message along with election date and today is 13th july only so he can cast vote and now click on 'Cast Your Vote' link to get below page



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



In above screen in last line user can see 'Vote Accepted' and if user try to cast again then will get below error



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

V. Conclusion

The implementation of a blockchain-based E-Voting system using Ethereum significantly enhances the security, transparency, and reliability

of digital elections. By replacing the traditional centralized server model with a decentralized architecture, the system ensures that voting data is tamper-proof and accessible even if individual nodes fail. Smart contracts manage vote recording and retrieval, ensuring immutability and trustworthiness through hash verification. Encryption techniques such as ECC and SHA256 further safeguard voter identities and vote integrity. This approach not only secures the voting process but also builds public trust by enabling verifiable, auditable, and resilient electronic elections, making it a promising solution for future digital governance.

References

- [1] M. Swan, *Blockchain: Blueprint for a New Economy*, O'Reilly Media, 2015.
- [2] Z. Zheng, S. Xie, H. Dai, X. Chen, and H. Wang, "An Overview of Blockchain Technology: Architecture, Consensus, and Future Trends," in *Proc. 2017 IEEE International Congress on Big Data (BigData Congress)*, 2017, pp. 557–564.
- [3] P. McCorry, S. F. Shahandashti, and F. Hao, "A Smart Contract for Boardroom Voting with Maximum Voter Privacy," in *Financial Cryptography and Data Security*, Springer, 2017, pp. 357–375.
- [4] A. Narayanan, J. Bonneau, E. Felten, A. Miller, and S. Goldfeder, *Bitcoin and Cryptocurrency Technologies*, Princeton University Press, 2016.
- [5] R. Ali, D. Clarke, and P. McCorry, "E-Voting with Blockchain: An E-Voting Protocol with Decentralisation and Voter Privacy," in *Proc. 2018 IEEE European Symposium on Security and Privacy Workshops (EuroS&PW)*, 2018, pp. 47–56.