ELECTRONIC VOTING USING ETHEREUM BLOCK CHAIN

Chavakula Hemanth, *Department of Information Technology JNTU Hyderabad,* Telanagana
hemanthchavakula19@gmail.com
Dr. V. Uma Rani, Dr.V.Sunita, Professor *Department of Information Technology JNTU Hyderabad,* Telanagana

Abstract—**Decentralized Online voting that is secure, transpar- ent, and impenetrable can be done through the Ethereum Block- Chain. It is a decentralized application that runs on the Ethereum blockchain that lets users cast ballots and see the results. No need for a middleman. This is not feasible under this system since the vote is stored on the blockchain, making it possible for anybody to tamper with or change the outcome. To guarantee an automated, transparent, and secure voting process, smart contracts are utilized. Conducting credible and equitable elections can be made dependable and affordable by implementing a decentralized system and using blockchain innovation.**
Index Terms—**Block-chain, Ethereum , MetaMask , Ganache, ETH , Admin and Voter**

I. INTRODUCTION

A distributed electronic ledger architecture known as "block-chain" allows users to authenticate transactions and interact securely and transparently over a network without the need for middlemen. The data is stored on a computer network since the technology is intended to be spread rather than being housed in a single database. This increases the difficulty of hacking and data tampering, ensuring system security and integrity. Blockchain technology took off after the introduction of Bitcoin. The first decentralized cryptocurrency was called Bitcoin. However, the technique has now been used to a number of industries, including supply chain management, banking, healthcare, and voting. Block-chain functions by creating data blocks that are connected by a chain, as the name would imply.A hash, or unique code, is contained in every block and is generated by the contents of the block. Then, using that hash to link the current brick to the one before it, the bricks are put together to form a chain.A block cannot be removed from the chain once it is introduced deleted or altered without the involvement of other network users. This makes the technology immutable and ensures the transparency and integrity of the data stored on the blockchain. When all is said and done, blockchain technology has the ability to completely transform the way we exchange and store data, making it more transparent, safe, and useful. By utilizing the security, transparency, and immutability of blockchain technology, a decentralized voting system based on the Ethereum Block Chain exhibits the potential to completely transform the way elections are conducted. Decentralized voting systems also mitigate many of the drawbacks and hazards associated with conventional voting methods. Voters in autonomous election processes are all uniquely identifiable online, and their ballots are recorded on the blockchain, making them impenetrable and unchangeable. Additionally, decentralized voting methods increase election efficacy and make it less vulnerable to manipulation and corruption by doing away with the need for middlemen, such government organizations, to supervise the process. Furthermore, by enabling voters to cast their ballots from any location in the globe with an internet connection, decentralized voting methods may increase voter turnout. A more liberal and inclusive electoral process with increased voter participation and turnout could result from this. All things considered, the election process might gain a great deal from a decentralized Ethereum-based voting mechanism Block-chain, increasing its safety, transparency, and accessibil- ity for all.A built-in Turing-complete programming language called Ethereum was created by the blockchain network and may be used to create a variety of decentralized applications, or Dapps. The "ether" coin is what powers the Ethereum network.

II. PRIOR KNOWLEDGE

A. Features of Ethereum

Ethereum supports the development and implementation of smart contracts. The primary

programming language used to generate smart contracts is called Solidity. An object- oriented programming language that is rather simple to learn is called Solidity. The Ethereum Virtual Machine (EVM) is intended to function as a runtime environment for creating and executing smart contracts that are based on Ethereum.Ether: The Ethereum network's cryptocurrency is called ether. On the Ethereum network, it is the sole method of payment that is accepted for transaction fees.Decentralized apps (Daaps): Dapps use a decentralized peer-to-peer network to run their backend code. In order to make calls and query data from its backend, it can have a frontend and user interface built in any language. They run on Ethereum and carry out the same task regardless of the context in which they are run. Decentralized autonomous organizations (DAOs) are democratic, decentral- ized groups that operate at a low level. Smart contracts or decentralized voting within the organization are the means by which DAO makes decisions.

B.   What is Ganache?

For the purpose of developing distributed applications for Filecoin and Ethereum quickly, Ganache is a personal blockchain. Ganache can be used throughout the whole devel- opment cycle, giving you the ability to create, implement, and evaluate your dApps in a predictable and secure setting.There are two kinds of Ganache: UI and CLI. A desktop program called Ganache UI supports Filecoin and Ethereum technolo- gies. For Ethereum development, we provide ganache, our more feature-rich command-line tool.

C.   Truffle

With the goal of making development easier, Ethereum Virtual Machine (EVM) offers a top-notch environment for development, a testing framework, and an asset pipeline for blockchains. Using truffle, you receive Compilation, linking, deployment, and binary management of smart contracts are in- tegrated in. sophisticated debugging featuring step capabilities, variable analysis, and breakpoints.Utilize the console.Enter your smart contract login credentials.Use Truffle Dashboard with MetaMask for deployments and transactions to safeguard your mnemonic.Scripts run by an external script runner in a Truffle environment.A console that allows for direct communi- cation between contracts.Contract testing that is automated for quick development.Framework for scriptable and extendable deployment and migrations.Network administration for many public and private network deployments.NPM package man- agement based on the ERC190 standard.Build pipeline that is configurable and supports tight integration.

D.   MetaMask

To manage your Ethereum private keys, use the mobile app and web browser plugin MetaMask. By doing this, it lets you communicate with decentralized apps, or dapps, and acts as a wallet for Ether and other currencies. In contrast to other wallets, MetaMask does not save any personal data about you, including your password, email address, Secret Recovery Phrase, or any private keys. You are still in complete control of your crypto-identity.

III.   LITERATURE REVIEW

A.   LITERATURE SURVEY ON ONLINE VOTING SYSTEM USING BLOCKCHAIN

The paper cited in [7]Profoundly progressed security strate- gies are essential to present viable online voting framework within the entire world. The perspective Openness and safety might represent a risk from worldwide race with the customary framework. Common races still utilize a centralized framework where one organization that oversees it. A few of the issues that can happen in conventional discretionary frameworks are with an enterprise with whole control over the foundation and re-sources, it is conceivable to control with the database. This paper supplies analysis of a few past voting framework that's utilized by distinctive nations and organizations. UAVs and net capture using interceptor UAVs).

A SYSTEMATIC LITERATURE REVIEW AND META ANALYSIS ON SCALABLE BLOCK CHAIN BASED ELEC- TRONIC VOTING SYSTEMS

this paper in [2], [10], Electronic voter registration systems must to cope with plenty of considerations pertaining to legitimacy confidentiality and authen-ticity of data, openness authentication. But blockchain technology provides an imag- inative solution to a great deal of these issues.The scalability

of Block-chain has risen as a fundamental barrier to realizing the promise of this technology, especially in electronic voting. This study seeks to highlight the solutions regarding scalable Block-chain-based Electronic-Voting systems and the issues linked with them while also attempting to foresee future developments. The assignment was completed through the use of a systematic literature review (SLR), which resulted in the selection of 76 English-language papers from renowned databases between January 1, 2017, and March 31, 2022. In order to assess time and cost, this systematic literature review aimed to identify prominent proposals, their executions, verification techniques, and diverse cryptographic solutions from earlier studies. It also lists performance metrics, the main benefits and drawbacks of various systems, and the most popular methods for making Block-chain scalable. It also lists a number of potential research directions for creating a scalable blockchain based electronic voting system. This study offers additional criteria for scalable voting solutions and aids in future research by keeping in mind all voting needs, benefits, and drawbacks of potential solutions before proposing or constructing any solutions.

B. A SURVEY OF BLOCK-CHAIN BASED ON E-VOTING SYSTEMS

The paper cited in [3], [11]Block-chain Technology has received a lot of attention lately as a distributed and de- centralized public ledger within a peer-to-peer network. This technology creates a tamper-proof digital platform for data storage and sharing by applying a linked block structure and establishing a trustworthy consensus method to synchronize data alterations. We believe that blockchain technology has a lot of potential applications in interactive online systems, in- cluding voting, supply chain, and Internet of Things platforms. The purpose of this survey is to provide light on some recent developments on the privacy and security concerns related to blockchain-based electronic voting. We concluded our article with a comparison of the security and privacy requirements of the current blockchain-based electronic voting systems.

C. SURVEY ON VOTING-SYSTEM USING BLOCK-CHAIN TECHNOLOGY

This paper [4], Information technology use has, in certain respects, revolutionized in many sectors. E-voting is said to be a symbol of modern democracy. While research on the topic is still emerging, it has mostly focused on the technical and legal issues instead of taking advantage of this technology and implementing it for good cause. Usefulness of e-voting will function better in comparison to the current framework. The

word Vote means to choose a Candidate from a given list of Candidates who will lead the organization or the group. Voting's primary objective is to get people used to casting ballots in a way that ensures everyone votes to choose their leader. Most countries in the world, India is no exception, had trouble voting. Voting is still carried out in countries in physical mode. This physical mode process is not safe as it can be manipulated by members of voting commitment. There are numerous problems, including voting stations being too far and improper voting tools. The proposed flagship internet-based online voting system supported by Block-chain technology solves this very problem. Block-chain technology uses encryption and hashing techniques with which it makes voting secure. In this case, each vote is considered as a unique transaction. A private Block-chain is created using a peer to peer network where we store voting transactions. This application is programmed in such a way so that the details of voting are abstract from the user. Users will be given enough time for voting with the system running. This paper's primary goal is to develop a novel, original solution that doesn't require any technical knowledge. Since voting is in online mode, increased voter turnout is likely. In this project, the concept of developing an Electronic-Voting system using Block-chain technology is implemented.

IV. A SURVEY ON SMART-ELECTRONIC-VOTING SYSTEM USING BLOCKCHAIN TECHNOLOGY

This paper [5], [12]India is the world's largest democracy with a population of more than 1 billion; India has an elec- torate of more than 668 million and covers 543 parliamentary constituencies. Voting is the bridge between the governed and government. The past few years have seen a resurgence of focus moving on to technology used in the voting process. The current voting system has many security holes, and it is difficult to prove even simple security properties about them. A voting system

that can be proven correct has many concerns. A government exists for a number of reasons to use electronic systems are to increase elections activities and to reduce the elections expenses. Still there is some scope of work in Electronic-Voting system because there is no way of identification by the Electronic-Voting system whether the user is authentic or not and securing Electronic-Voting machine from miscreants.The goal of the suggested solution is to create a high-security voting machine that is compatible with blockchain technology, hence enhancing user security and transparency.

V.   SURVEY ON BLOCKCHAIN-BASED ELECTRONIC VOTING

This paper [6], [13]With the growing awareness of democ- racy in society, voting is becoming an increasingly important channel in numerous application circumstances for fully de- veloping democracy. In the Internet era, electronic voting has replaced traditional paper voting due to its low cost, high efficiency, and low error rate. The fact that the data from the electronic voting system is stored in a central database causes
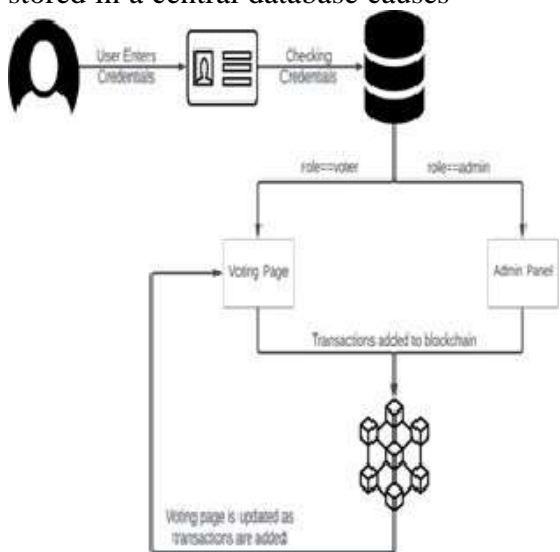

Fig. 1. System architecture

the following problems: voters cannot confirm the outcome of the vote; voting data is not sufficiently open and transparent, making it simple to falsify and tamper with; and users' privacy may be jeopardized. Fortunately, blockchain technology can make up for the shortcomings of the current voting process.

VI.   METHODOLOGY

The goal of the proposed decentralized voting system utiliz- ing the Ethereum Block-Chain is to offer an open and impen- etrable method of holding elections. The solution ensures the integrity and immutability of the voting data while enabling safe and anonymous voting through the use of Ethereum network smart contracts. This would lower the possibility of fraud or manipulation and boost voter confidence in the electoral process.

A. Advantages

Decentralization ensures that no party controls the voting process. Transparency throughout the voting process.It is tam- per proof.Everywhere in the world is able to cast a ballot.This method of voting is cost effective.[F]The results are provided in real time.

VII.   SYSTEM ARCHITECTURE

This would increase voter trust in the election process and lessen the possibility of deceit or manipulation. User enters the credentials voter id and password and they are matched with the database. If the match is found user is either redirected to admin page or voter page as per their role

corresponding to the credentials in the database. Once the admin is logged in he she can start the voting process by adding Candidates and defining dates. Voter can vote once the voting process has been started. Once the voter has voted the transaction is recorded to the Block-chain and the voting page is updated with realtime votes.
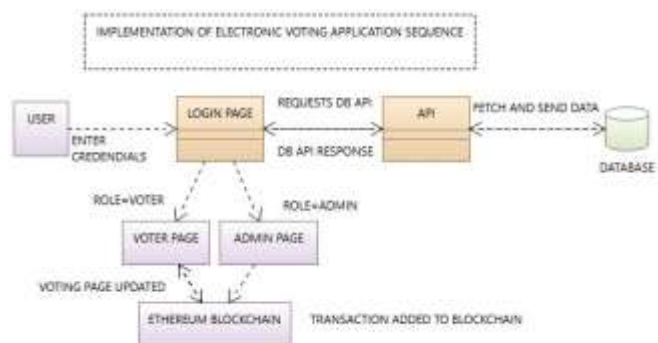

Fig. 2. Implementation

A. Voter

The voter module is intended for anyone who meet the requirements to cast a ballot. It provides functionalities related to the voting experience and ensures the integrity and security of the votes. The main features of the voter module include Voters can securely authenticate themselves to access the voting system using their unique credentials.[B]Voters can access information about the Candidates running for various positions, such as their names, parties, and other relevant details.Voters can verify the status their votes and make certain that the decisions they make are accurately recorded in the Block-chain.

B. Admin

The admin module is designed for administrators or election officials responsible for managing and overseeing the voting system. It provides functionalities to configure and monitor the voting process. The main features of the admin module include Admins can set up the system parameters, such as defining the start and end dates of the voting period, Candidate registration, and other administrative settings. Admin can manually verify the Candidate and can start the voting process.

VIII.   IMPLEMENTATION

All voter data is entered into the currently in use Mysql database prior to election day. The administrator can select the dates for voting and add candidates. The user's credentials are the only way he can log in.The block chain contains a record of each transaction.By committing the transaction in metamask, the administrator can verify the transaction

IX.   EXPERIMENTAL RESULTS

Fig. 3. Login Page

Fig. 4. Adding Candidates

Fig. 5. User Login Page

FIG. 6. VALIDATING THE VOTES

X. CONCLUSION

Decentralized Voting with Ethereum Block-chain offers a robust and transparent solution for secure elections. By leveraging Block-chain technology, it ensures the integrity of votes and provides a tamper-proof platform. With continued enhancements, including improved user experience, scalability, and integration with other cutting-edge technologies, it has the potential to revolutionize the democratic process and empower citizens to participate in a trusted and efficient voting system. It represents a significant step towards building a more democratic and accountable society.

A. Future Enhancement

In future iterations, the decentralized voting system can be enhanced by implementing additional features such as real- time vote counting, secure voter identification mechanisms, advanced data analytics for voter insights, and integration combining cutting-edge technology like biometrics and arti- ficial intelligence. These enhancements will further enhance the efficiency, security, and accessibility of the voting process, making it more inclusive and trustworthy.

REFERENCES

[1]   N. Kshetri and J. Voas, "Blockchain-Enabled E- Voting,"IEEESoftware,vol. 35, pp. 95-99, jul 2022.

[2]   Jafar, U., Ab Aziz, M. J., Shukur, Z., Hussain, H. A. (2022). A System- atic Literature Review and Meta-Analysis on Scalable Blockchain-Based Electronic Voting Systems. Sensors, 22(19), 7585.

[3]   Abuidris, Y., Kumar, R., Wenyong, W. (2019, December). A survey of blockchain based on e-voting systems. In Proceedings of the 2019 2nd International Conference on Blockchain Technology and Applications (pp. 99-104).

[4]   Shanthinii, S. P., Usha, M., Prittopaul, P. (2023). A Survey Based on Online Voting System Using Blockchain Technology. In Computer Vi- sion and Machine Intelligence Paradigms for SDGs: Select Proceedings of ICRTAC-CVMIP 2021 (pp. 209-216). Singapore: Springer Nature Singapore.

[5]   Eldho, M., Vindhuja, K., Nair, P., Simi, M. S. (2022). Survey on Existing Online Election Systems.

[6]   Xiao, S., Wang, X. A., Wang, W., Wang, H. (2020). Survey on blockchain-based electronic voting. In Advances in Intelligent Network- ing and Collaborative Systems: The 11th International Conference on Intelligent Networking and Collaborative Systems (INCoS-2019) (pp. 559-567). Springer International Publishing.

[7]   Jafar, U., Ab Aziz, M. J., Shukur, Z., Hussain, H. A. (2022). A System- atic Literature Review and Meta-Analysis on Scalable Blockchain-Based Electronic Voting Systems. Sensors, 22(19), 7585.

[8]   Hardwick, F. S., Gioulis, A., Akram, R. N., Markantonakis, K. (2018, July). E-voting with blockchain: An e-voting protocol with decentral- isation and voter privacy. In 2018 IEEE International Conference on Internet of Things (iThings) and IEEE Green Computing and Commu- nications (GreenCom) and IEEE Cyber, Physical and Social Computing (CPSCom) and IEEE Smart Data (SmartData) (pp. 1561-1567). IEEE.

[9]   Canessane, R. A., Srinivasan, N., Beuria, A., Singh, A., Kumar, B. M. (2019, March). Decentralised applications using ethereum blockchain. In 2019 Fifth International Conference on Science Technology Engineering and Mathematics (ICONSTEM) (Vol. 1, pp. 75-79). IEEE.

[10]   Hajian Berenjestanaki, M., Barzegar, H. R., El Ioini, N.,and Pahl,
A.   (2023, July). An Investigation of Scalability for Blockchain-Based E-Voting Applications. In International Congress on Blockchain and Applications (pp. 134-143). Cham: Springer Nature Switzerland.

[11]   Ahmed, M. R., Shamrat, F. J. M., Ali, M. A., Mia, M. R., Khatun,
M. A. (2020). The future of electronic voting system using blockchain. International Journal of Scientific Technology Research, 9, 4131-4134.

[12]   Navya, A., Roopini, R., SaiNiranjan, A. S., Prabhu, B. J. (2018). Electronic voting machine based on Blockchain technology and Aad- har verification. International Journal of Advance Research, Ideas and Innovations in Technology, 4(2).

[13]   Adiputra, C. K., Hjort, R., Sato, H. (2018, October). A proposal of blockchain-based electronic voting system. In 2018 second world con- ference on smart trends in systems, security and sustainability (WorldS4) (pp. 22-27). IEEE.