Blockchain Based Voting System

Jatin Verma UG Student, CSE Chandigarh University Gharuan, India [21bcs9085@cuchd.in](mailto:21bcs9085@cuchd.in)

*Abstract*- Online elections can be conducted in a very safe, transparent, and impenetrable way with decentralised voting on the Ethereum blockchain. The Ethereum blockchain network serves as the foundation for this cutting-edge system, which is a decentralised application (dApp). Without depending on any centralised authority or middlemen, it enables voters to cast their ballots and view the results in real time. This system uses blockchain technology to make sure that every vote is permanently recorded on the blockchain ledger, making it nearly impossible for anyone or anything to change, remove, or manipulate the results that have been recorded.Online elections can be conducted in a very safe, transparent, and impenetrable way with decentralised voting on the Ethereum blockchain. The Ethereum blockchain network serves as the foundation for this cutting-edge system, which is a decentralised application (dApp). This system uses blockchain technology to make sure that every vote is permanently recorded on the blockchain ledger, making it nearly impossible for anyone or anything to change, remove, or manipulate the results that have been recorded. This decentralised voting system uses blockchain technology to overcome a number of issues with conventional voting procedures, including vote tampering, a lack of transparency, and reliance on outside parties. The system's decentralised structure eliminates the possibility of centralised manipulation by guaranteeing that no one party controls the process. Additionally, every vote cast has an auditable and reliable trail thanks to the immutability of blockchain records.

From small organisational polls to large-scale national elections, this method provides a dependable, affordable, and scalable way to conduct elections in a variety of contexts. By making remote voting possible for people who might otherwise encounter difficulties getting to polling places, it not only lessens the administrative load connected with conventional voting systems but also guarantees inclusivity. All things considered, decentralised voting on the Ethereum blockchain is a revolutionary use of blockchain technology to produce safe, effective, and equitable electoral procedures.

Keywords— Decentralised, Vote, blockchain

INTRODUCTION

A decentralized voting system built on the Ethereum blockchain has the potential to transform and revolutionize the way elections are conducted worldwide. Decentralised voting systems can successfully address and remove many of the enduring issues and hazards connected to conventional voting procedures by utilising the security, transparency, and immutability built into blockchain technology. These include issues such as vote tampering, lack of transparency, and vulnerability to corruption, all of which

undermine the integrity of electoral processes. Every voter in a decentralised voting system is given a distinct digital identity, which allows the system to confirm their eligibility to vote while protecting their privacy. Votes are safely stored on the blockchain, forming an irreversible record that cannot be changed, tampered with, or removed. This guarantees that the election's outcomes fairly represent the will of the electorate and are shielded from outside influence. The system's decentralised structure also makes it unnecessary for middlemen to control or monitor the voting process, like governmental organisations or electoral authorities. This reduction in reliance on centralized entities enhances the efficiency of the process and reduces its susceptibility to corruption or bias.

Furthermore, there is a chance that decentralised voting systems will greatly boost voter turnout. These systems get around logistical and geographic obstacles that frequently keep people from voting by allowing voters to cast their ballots from anywhere in the world as long as they have an internet connection. For instance, it is simple for people who live in remote areas, overseas, or with physical disabilities to take part in the election process. A more democratic and representative system is produced by this inclusivity, which encourages increased voter participation and may raise turnout. Beyond accessibility and security, a decentralised voting system has other advantages. Voters' trust is increased by the transparent nature of blockchain, which guarantees that all election-related procedures are subject to scrutiny. Confidence in the electoral process is increased by the capacity to independently confirm the accuracy of the results and the integrity of the system. Furthermore, the financial burden of traditional voting systems, which includes costs for staff, physical infrastructure, and supplies like paper ballots, can be lessened by the cost-effectiveness of blockchain technology.

All things considered, a decentralised voting system that makes use of the Ethereum blockchain could completely alter contemporary electoral procedures. It creates the foundation for a future in which democratic participation is bolstered and elections are free from corruption and inefficiency by making them more safe, transparent, effective, and accessible to a wider audience. It is anticipated that this revolutionary use of blockchain technology will result in a more equitable, inclusive, and reliable system for choosing representatives and reaching group decisions.

1. METHODOLOGY

A thorough procedure intended to take advantage of the security, transparency, and decentralisation built into the Ethereum blockchain to establish a reliable electoral system. Setting up the blockchain environment, which includes implementing a strong

smart contract on the Ethereum network, is the first step in the system. Voter registration, voter authentication, vote casting, and result computation are all handled by this smart contract, which forms the core of the voting process. In order to verify their legitimacy and stop fraudulent or duplicate voting, eligible voters are onboarded into the system by being assigned distinct digital identities, usually through the use of cryptographic keys. Voter credentials are safely stored on the blockchain during the registration process, guaranteeing resistance to manipulation or unwanted access. A user-friendly decentralised application (DApp) interface facilitates the actual voting process. Voters can cast their ballots remotely from any location with internet access thanks to this interface, which makes system interaction easy. The smart contract validates voters' interactions with the system, guaranteeing that only authorised participants can cast ballots and that each vote follows predetermined guidelines. It is nearly impossible to change, remove, or manipulate the data once a voter casts their ballot because it is permanently recorded on the blockchain. Because all transactions are visible to authorised stakeholders, the distributed ledger of the blockchain guarantees complete transparency in the voting process, promoting systemic trust. Voter identities are protected and vote data is encrypted using cryptographic techniques to improve security and data integrity. This guarantees that individual votes are kept private while the voting procedure is still open to auditors. The system also includes tools to identify and stop fraudulent activity, like trying to vote more than once or interfering with the network. By doing away with the need for middlemen like election officials or outside groups, blockchain technology dramatically lowers the possibility of bias, corruption, or election-related manipulation.

The smart contract automatically gathers and validates the results after the voting period is over. Transparency and accountability are ensured by the results being safely stored on the blockchain and made available to all parties involved for auditing and verification. Before being deployed, the system is thoroughly tested in controlled settings to guarantee its robustness and dependability. To find and fix any possible flaws or problems, this testing phase consists of functionality checks, security evaluations, and stress testing. Following successful testing, the system is made available for use in actual elections on the Ethereum mainnet. Not only enhances the security and accuracy of the voting process but also improves accessibility and convenience for voters. The system promotes wider participation by permitting remote voting, which enables people to cast their ballots from anywhere in the world. A more democratic election process with increased voter participation and turnout results from this inclusivity. Furthermore, the blockchain's decentralised structure makes sure that no one party can take over or alter the system, which strengthens election fairness and confidence. In conclusion, the blockchain-based voting system methodology overcomes the drawbacks of conventional voting methods by fusing cutting-edge technology with moral principles to produce a contemporary, safe, and transparent electoral system.

.

1. EXISTING SYSTEM

The voting methods currently in use in many nations are usually either electronic or traditional, each with unique characteristics and related difficulties. In conventional systems, voters use paper ballots to cast their ballots in person at designated polling places. Election officials manually mark these paper ballots before counting them. Despite being the mainstay of election procedures for many years, this approach has drawbacks and inefficiencies.

However, some nations have implemented electronic voting systems that enable voters to cast their ballots online or through specialised voting machines at polling places. Despite their efforts to increase productivity and decrease human error, these systems are not impervious to criticism, especially when it comes

to security and transparency. Notwithstanding these technological developments, there are still a number of serious drawbacks to both paper-based and electronic systems, which are listed below:

Lack of transpanracy : Voters frequently lack the means to confirm that their votes were counted correctly in traditional voting systems. Additionally, observers might have trouble guaranteeing the impartiality and equity of the vote-counting procedure. The inability of voters and election observers to verify whether the system functioned properly and without interference is exacerbated by the opacity of the underlying software or hardware in electronic systems.

Vulnerability to Fraud: Voting systems, whether electronic or conventional, are vulnerable to manipulation. During storage or transit, paper ballots may be replaced, tampered with, or destroyed. Similar to this, internet-based systems and electronic voting machines are susceptible to software flaws, manipulation, and hacking. It becomes extremely difficult to identify and address fraud when there is no trustworthy paper trail or strong auditing procedures in place.

Slow results: The announcement of election results may be delayed due to the labour-intensive and time-consuming nature of counting paper ballots.

Cost: Due to the need to hire poll workers, buy voting machines or paper ballots, and rent polling locations, operating a traditional voting system can be costly.

Centralisation: A lot of conventional voting systems are centralised, which means that a limited number of people have control over them. This may give rise to the possibility of power abuse or voting process manipulation.

Limited Accessibility: Voters with disabilities, limited mobility, or other issues may find it difficult or impossible to travel to certain polling locations as required by certain voting systems. Voters may become disenfranchised as a result.Explain the current system.

1. PROPOSED SYSTEM

The Ethereum blockchain-based proposed decentralised voting system seeks to transform the electoral process by offering a safe, open, and impenetrable election-conducting platform. The system ensures that no single party has control over the voting process by utilising blockchain technology to do away with the need for centralised authorities. Election integrity is improved by this decentralisation, which also lowers the possibility of fraud or manipulation. The Ethereum network's smart contracts are essential to automating the voting process because they guarantee that each vote is safely recorded and unchangeable, protecting the election results from manipulation. Additionally, the system ensures voter anonymity, which preserves process transparency while safeguarding the privacy of individual voters. The accessibility of the proposed system, which enables voters to cast their ballots from any location with an internet connection, is one of its most notable features. Because there is no longer a need for actual polling places, voting is more accessible and convenient, particularly for people with disabilities or those who live in remote areas. Another benefit is that the system is more affordable because it uses fewer resources than traditional voting methods, like paper ballots, poll workers, and physical infrastructure. Furthermore, election results are made available as soon as the voting period concludes thanks to blockchain technology's real- time nature, which reduces delays and boosts efficiency.

A number of important goals are addressed by the suggested system, such as improved accessibility to increase voter turnout, enhanced security to prevent vote tampering, and improved

transparency by enabling voters to confirm the procedure. By offering a system that is not only transparent but also verifiable and impenetrable, it also seeks to increase public trust. All things considered, the decentralised voting system promises to completely transform the electoral process and guarantee a more equitable, effective, and reliable democratic process.

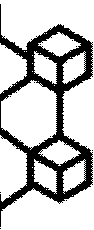
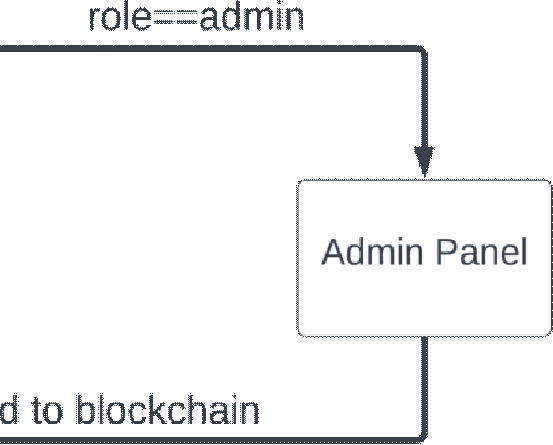
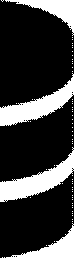
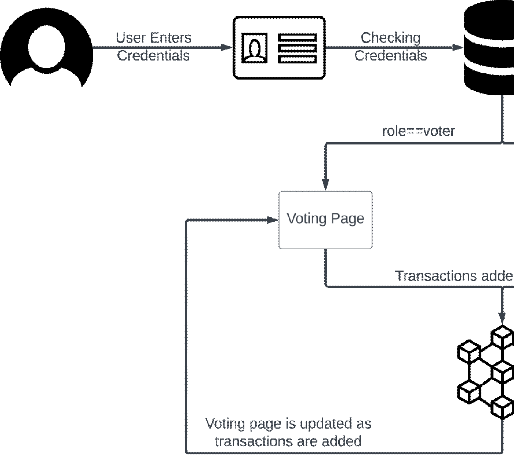
election process efficiency. Blockchain technology ensures quick and precise results by instantly tallying votes and making them visible at the conclusion of the voting period. By doing away with the delays that come with manual counting and reporting, this feature produces an election result that is both efficient and trustworthy. The project has effectively demonstrated how blockchain technology can improve security, transparency, accessibility, and efficiency, thereby revolutionising conventional voting systems. The system's decentralised structure guarantees that the voting process is free from manipulation, and its affordable and intuitive design makes it a workable option for contemporary democracies. This project strengthens the democratic ideals of inclusivity and fairness by tackling the shortcomings of current voting procedures and laying the groundwork for a reliable and forward-thinking method of holding elections.

V. CONCLUSION

**Figure 1** System Architecture

The Ethereum blockchain-based decentralised voting system offers a ground-breaking method of updating elections and getting around the drawbacks of conventional voting procedures. Voter fraud,

The voter ID and password that the user enters are compared to



manipulation, and a lack of

confidence in electoral

the database. Depending on their role

and the database

systems are all addressed by

the use of blockchain

credentials, the user is either taken to the admin page or the voter

technology, which guarantees

a safe, transparent, and

page if a match is found. The administrator can add candidates impenetrable voting process. The system eliminates the

and set dates to begin the voting process after logging in. Once

need for a central authorit

due to blockchain's

the voting process has begun, voters can cast their ballots. The voting page is updated with the most recent votes as soon as the voter casts their ballot, and the transaction is noted on the blockchain.

IV. RESULT

The decentralised voting system project demonstrates how well it addresses the main issues with conventional voting procedures.

immutability and decentralisation, which reduces the possibility of power abuse and guarantees that every vote is accurately and impartially recorded and counted.

The decentralised system's transparency is one of its main benefits. Voters and election observers have more faith in the process because all votes are recorded on the blockchain, making them publicly visible and verifiable by anybody. Voters can verify whether their votes were

The system guarantees voting process transparency, security, and tamper-proof functionality by utilising the Ethereum blockchain. The blockchain securely stores voter information and votes,

counted correctly thanks to the system's inherent

transparency, which increases the election's accountability and fairness. Furthermore, the election process as a whole

making it nearly impossible to change or manipulate the records.

is transparent because smart

contracts automate and

This lowers the possibility of fraud or unapproved changes and increases confidence in the electoral process. Additionally, the implementation of smart contracts ensures a smooth, error-free, and effective system by automating crucial voting process tasks like voter verification and result computation. The project's conclusion emphasises how decentralisation in elections has

control a number of processes, including voter registration, authentication, and result computation, making them publicly verifiable. Because voters no longer need to physically visit polling places, this system offers increased accessibility and convenience. The ability to vote from any

major advantages. The system reduces

the possibility of

location with an internet connection removes obstacles for

manipulation or abuse of power because it does not depend on a single authority to supervise or control the voting process.

voters who are elderly, disabled, or live in remote areas. Election inclusivity and voter turnout are enhanced by this

Because voters can independently confirm every step of the

voting process, from casting ballots to tallying results, decentralisation also promotes greater transparency. Blockchain's immutability guarantees that all data recorded is permanent, which makes the system reliable and strong against disagreements or accusations of bias. Another important goal of

improved accessibility. One ignificant benefit over traditional systems is that voters can participate online, which lowers the expenses and logistical difficulties associated with setting up physical polling places. The system guarantees a substantial decrease in election-

the project was accessibility, and the system has succeeded in this

regard by enabling voters to cast their ballots from any location with an internet connection. In addition to making the system more user-friendly, this feature promotes increased voter turnout, especially among people with disabilities or those who reside in rural areas. The system's cost-effectiveness is aided by the elimination of logistical obstacles like the requirement for physical polling places and manual vote counting. By reducing reliance on human resources, smart contract automation of processes lowers operating costs and eliminates errors brought on by manual interventions.

The project shows voting results in real time, greatly increasing

related expenses and time. Conventional elections frequently entail significant expenses for staffing, infrastructure setup, and manual vote counting. Many of these costs are eliminated by the decentralised system's process automation and use of blockchain technology for safe voting and tallying, which results in a more effective and economical solution. Additionally, the system's speed enables real-time vote tallying, which guarantees quicker results and minimises the delays frequently observed in conventional elections.

This decentralised voting system presents a viable substitute for conventional election procedures. It is a useful instrument for holding contemporary, equitable, and trustworthy elections since it improves security, transparency, accessibility, and efficiency by utilising blockchain technology and smart contracts. Governments and organisations around the world can implement the system to increase election confidence and protect the democratic process.

VI . FUTURE WORK

Although the Ethereum blockchain is used for voting in the current system, future research could look into integrating other blockchain platforms or layer-2 solutions to improve transaction speed and lower gas fees, which Ethereum can have during times of high network congestion. Additionally, as the number of voters rises, it is imperative to optimise the system for higher transaction throughput. For this, investigating more scalable blockchains like Polkadot, Cardano, or Solana might be taken into consideration. By using sophisticated cryptographic techniques like homomorphic encryption and Zero-Knowledge Proofs (ZKPs), the voting system's security can be further enhanced. These methods can give voters more privacy and anonymity while preserving the integrity of the election and guaranteeing that their votes stay secret. By preventing identity theft and guaranteeing that only eligible voters cast ballots, the system's security can be enhanced by implementing biometric security and multi-factor authentication for voter identity verification. The system's worldwide adoption will depend on its ability to support more languages and geographical areas. The system can be made more inclusive by creating features and interfaces that cater to a variety of demographics, including people with disabilities. Users in remote locations with poor internet connectivity will also have better access thanks to the integration of mobile and low- bandwidth solutions.

Future efforts should also focus on making the platform more accessible and putting in place an intuitive user interface. Voters of all technological backgrounds will be able to participate with ease if the voting process is made simpler and the system is made more user-friendly. In order to enable transparent audits of the complete voting process, a thorough auditing and monitoring system should be created to track and validate votes. This would guarantee the system's dependability and transparency in upcoming elections by adding another level of accountability and trust.

Furthermore, there exists opportunities to improve the system's flexibility and scalability to manage extensive datasets and changing user requirements. This might entail investigating distributed computing paradigms, like edge and cloud computing, to enable real-time processing and analysisof enormous amounts of data. The system could be able to dynamically modify its categorization and tagging strategies based on user interactions and feedback by incorporating mechanisms for continuous learning and adaptation, such as online learning algorithms and feedback-driven models. This would ensure the system's relevance and effectiveness over time.

Finally, expanding the system's capabilities to enable community-driven content organisation and collaborative tagging may promote an inclusive and participatory approachto information management. Through user-contributed insights, annotations, and classifications, the system can leverage community intelligence to enhance content accessibility and organisation, thereby generating a more varied and comprehensive knowledge ecosystem.

VII . REFERENCES

1. Buterin, V. (2013). **"A Next-Generation Smart Contract and Decentralized Application Platform"**. Ethereum Whitepaper. Retrieved from https://ethereum.org/en/whitepaper/
2. Nakamoto, S. (2008). **"Bitcoin: A Peer-to-Peer Electronic Cash System"**. Retrieved from https://bitcoin.org/bitcoin.pdf
3. Rainer, J., & Sascha, H. (2020). **"Blockchain- Based Voting Systems: A Systematic Review"**. International Journal of Computer Science and Network Security, 20(2), 1-6.

Retrieved from https://[www.ijcsns.com/](http://www.ijcsns.com/)

1. Fuchsbauer, G., & Velichkov, B. (2017). **"Towards Decentralized Voting on the Blockchain"**. In Proceedings of the 2017 IEEE European Symposium on Security and Privacy.

IEEE, 397-412. DOI: 10.1109/EuroS&P.2017.63

1. Kumar, A., & Goud, B. (2019). **"Blockchain- Based Voting System for Secure and Transparent Elections"**. Journal of Theoretical and Applied Information Technology, 97(16), 4294-4301. Retrieved from https://[www.jatit.org/](http://www.jatit.org/)
2. Zhang, H., & Deng, R. (2021). **"Decentralized Voting Systems: Challenges and Solutions"**. Journal of Cryptographic Engineering, 11(4), 419-434. DOI: 10.1007/s13389-021-00266-4
3. Bhamare, P., & Patil, S. (2020). **"Blockchain- Based Voting Systems: A Survey of the State of the Art"**. International Journal of Computer Applications, 176(1), 36-42. Retrieved from https://[www.ijcaonline.org/](http://www.ijcaonline.org/)
4. Zohar, R., & Prazeres, J. (2020). **"Security and Privacy in Blockchain-Based Voting Systems"**. In Proceedings of the 2020 IEEE Security and Privacy Workshops (SPW). IEEE, 60-69. DOI: 10.1109/SPW2020.00021