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# Secured Electronic Voting System using Blockchain Technology

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***Abstract:*** The paper aims to develop a model that would address the issues related to digital voting using blockchain technology. The issues with existing models and practices for voter identification cards and other forms of unique identification, delays in the distribution of results, and above all security concerns. Voting is an important part of democracy in any nation, and the present voting process uses either paper ballots or electronic voting machines. These processes have several drawbacks, such as poor voter turnout, vote-tampering, mistrust of the electoral authority, and voting fraud, which is always the primary concern when considering the use of computerized voting systems. Hence there is a need to have a safe system to safeguard information and prevent any hacks or cyber-attacks given the importance of the judgments at risk. Blockchain technology is one potential means of resolving the security challenges. The uses for blockchain technology are practically limitless. Blockchain is a distributed ledger system that enables peer-to-peer, decentralized network transfers of digital assets. The use of distributed ledger technology has significantly advanced this area. All of the transactions are gathered into a block. Voting on a blockchain can take advantage of various benefits such as decentralization, reliability, transparency, immutability, and privacy. An emerging topic is blockchain with smart contracts, which makes electronic voting more transparent, safe, and secure.

***Keywords***— Decentralized applications, Blockchain, , Solidity Smart Contract, ledger technology, Voting system.

## I. Introduction

Voters select their representatives in political and corporate governance using the voting system. In a democracy, we choose our representatives by casting ballots. Blockchain technology offers a decentralized voting node for online or electronic voting. Electronic voting systems have recently been developed using distributed ledger technologies, such as blockchain, because of the advantages of end-to-end verification. The decentralized, non-repudiation, and security features of blockchain make it an intriguing replacement for the current electronic voting methods. It is where board meetings and public votes take place. Initially just a chain of blocks, a blockchain is an expanding list of blocks linked by cryptographic connections. Each block contains the hash, date, and transaction details from the previous block. The purpose of the blockchain is to avoid data loss. Researchers in this subject are attempting to capitalize on benefits that are essential for voting applications, such as non-repudiation, transparency, and privacy. Blockchain technology has entered a new phase with voting. For many years, researchers have been working to find ways to lower the cost of elections without sacrificing election integrity by ensuring that electronic voting systems meet security, privacy, and compliance requirements. By replacing the traditional pen and paper method with new election technology, fraud may be minimized and voting process traceability and verifiability increased. Blockchain is a decentralized, unchangeable, and transparent public ledger. This new technology has three main features: (i)Immutability: Any suggestion to add a "new block" to the ledger needs to cite a previous iteration of the ledger. This creates an immutable chain and removes

manipulation of the integrity of the previous entries, which is where the term "blockchain" originates. (ii) Verifiability: The ledger is decentralized, distributed over several sites, and replicated. This ensures high availability and provides third-party verifiability by eliminating a single point of failure because each node maintains the agreed-upon version of the ledger. (iii) Distributed Consensus: Who is able to add the next new transaction to the ledger is decided by this distributed consensus method. Before a new suggested block of entries is put to the ledger, it must be approved by the majority of network nodes. These capabilities, which offer a security level higher than any known tracking system, are partially made possible by modern cryptography. Because of this, many people, including us, believe that blockchain technology has a lot of promise for use in developing a new, contemporary voting system.

## Ii. Literature Review

In the research paper[1], the focus is on exploring the potential of Blockchain-enabled e-voting (BEV) as a disruptive technology for the electoral process. BEV is presented as a solution to address prevalent concerns in voting, particularly voter access and fraud.The article argues that BEV, leveraging blockchain technology, can contribute to secure, transparent, and tamper-proof voting records.The benefits of BEV are discussed, emphasizing the generation of cryptographically secure voting records that are accurate, permanent, and transparent. BEV is seen as a potential catalyst for increased voter participation, offering flexibility for secure and cost-effective voting, especially in scenarios like corporate annual general meetings or situations where identity verification is a challenge. BEV is credited with the ability to expedite vote tallying, eliminate ambiguities, and enhance transparency for voters. The discussion highlights the shortcomings of traditional electronic voting platforms, pointing out vulnerabilities that BEV aims to address through blockchain's decentralized nature.However, the article acknowledges several challenges. These include the need for public confidence, potential hindrances due to the complexity of blockchain, concerns about software quality and scalability, energy consumption, and resistance from central authorities who might lose control with the adoption of BEV.The article concludes by suggesting that while BEV is still in a nascent state and full implementations for national elections are yet to occur, it holds promise in transforming the electoral landscape. The potential benefits include enhanced security, transparency, reduced costs, and increased voter participation, especially in regions prone to political violence during elections[2][3].

Ali Benabdallah et al. addresses the increasing issue of voter abstention attributed to the inconvenience of traveling to polling stations. The proposed solution suggests that remote e-voting can enhance voter participation by making the voting process more accessible and eliminating the need for physical travel[2]. The benefits include not only increased participation but also a reduction in risks and faster result processing compared to traditional paper ballots. However, the paper underscores the critical importance of ensuring robust security, reliability, and transparency in remote e-voting solutions to foster trust among citizens, particularly given the high stakes associated with elections.The primary focus of the paper is to review diverse e-voting solutions leveraging blockchain technology. Blockchain is recognized as a promising technical foundation for various IT applications, offering advantages such as the elimination of trusted third parties, decentralized transactions, and secure data storage. Additionally, the integration of smart-contracts technology in blockchain enables the automation and execution of agreements between users[4][5].

In this study[6], the authors address the persistent challenge of creating an electronic voting system that aligns with legal criteria. They introduce blockchain as a service for implementing distributed electronic transactions in electoral systems, emphasizing the need to overcome the drawbacks associated with this approach. Proposing a unique blockchain-based decentralized e-voting system, the study aims to enhance election security and modernize the traditional pen-and-paper method. Blockchain technology is positioned as a decentralized database with applications beyond finance, offering a trustless approach to voting that ensures all voters share the same level of trust without relying on a central authority. The methodology outlines the process of organizing elections, registering voters, conducting vote transactions, compiling results, and verifying votes, all facilitated by blockchain technology. The study concludes by highlighting the historical use of electronic voting, the advantages it presents, and the potential for blockchain to revolutionize e-voting.From my perspective, this study underscores

the critical need for an electronic voting system that aligns with legal criteria, introducing blockchain as a promising solution. The drawbacks and challenges associated with adopting blockchain as a service are acknowledged, and the study proposes a decentralized e-voting system to address existing flaws. The authors emphasize the significance of election security and the decade-long exploration of electronic voting systems[7]. Blockchain is portrayed as a decentralized database with versatile applications, particularly in ensuring a trustless and transparent voting process. The proposed methodology details the steps involved in implementing blockchain-based e-voting, offering a comprehensive solution to enhance the reliability and security of electronic voting systems. Overall, the study advocates for the transformative potential of blockchain in revolutionizing the electoral process.[8]

The paper [9] dives into the complexities of electronic voting, shedding light on issues like security and transparency. Despite Estonia leading the way in e-voting, a potential solution is explored introducing a blockchain-based system with homomorphic encryption to keep voter identities secure. Through tests on different blockchains, the system's efficiency is showcased, emphasizing the importance of decentralized e-voting platform management. As we witness the ongoing evolution of E-Government initiatives,attention is drawn to the transformative role of blockchain in e-voting. A versatile system that can adapt to various elections, leveraging a public blockchain for transparency and integrating security features such as face recognition and OTP is proposed. The key roles, suggesting potential consolidation for smoother organizational efficiency are identified. In exploring the proposed system, ability to ensure secure and transparent voting processes is highlighted. Testing results underscore its efficiency, especially when using a public blockchain for real-time transparency. While noting slight variations in network times, the system's potential to reshape the landscape of electronic voting is emphasized. Overall, blockchain as a promising solution applicable to a broad range of elections is positioned[10].

In this article, author addresses the shortcomings of current digital voting systems by proposing a solution leveraging blockchain technology. Recognizing issues like low transparency and security concerns in traditional methods, the project focuses on testing an e-voting system with smart contracts on the Ethereum network. The goal is to harness blockchain's decentralized and transparent features to enhance the accuracy, anonymity, scalability, and speed of electronic voting.In the democratic context, voting is crucial, and this project seeks to enhance the existing voting methods by integrating blockchain technology. The report emphasizes blockchain's potential to address challenges like security and transparency, highlighting its decentralized nature and end-to-end verification benefits. By proposing the utilization of smart contracts on the Ethereum network, the project aims to create a more secure and transparent digital voting experience, showcasing blockchain's cryptographic security and transparency features through wallets and the Solidity language [11].

The paper navigates the landscape of online voting, spotlighting blockchain technology as a game-changer. It acknowledges the appeal of online voting for its accessibility benefits but underscores its current challenges—security risks, transparency issues, and manipulation concerns[12]. The review positions blockchain as a potent remedy, emphasizing its decentralized and transparent nature to ensure the legitimacy and security of electronic voting. While recognizing privacy and speed concerns in current blockchain applications, the review calls for ongoing enhancements. It concludes by outlining crucial conditions for any voting system and advocates for further research to address scalability and refine blockchain-based solutions.In my perspective, this concise review offers a compelling narrative on how blockchain can revolutionize online voting. It aligns with my belief in secure and transparent voting processes and encourages responsible innovation. The focus on challenges and improvement resonates with my commitment to embracing transformative technologies for a more robust democratic system.[13]

**Iii. Drawbacks Of Existing System**

Voting is an integral part of a democratic society. It is a decision making mechanism and security plays an important role in voting. The existing systems are:

1. Ballot System : In India, before 2004 there was a paper-based voting system. This is called the ballot Paper system. It is placed in the election booth and is used by the voters.

2. Electronic Control System : In order to overcome duplication and damage of ballot problems electronic voting machines were introduced. It stores and assembles votes, used by poll workers.

## Iv. Proposed System Design

Nodes are basically the voters. Voters are connected to the blockchain network. Blockchain Network is the smart contract, it checks for a voter's identity and decides accordingly if the voter is eligible or not. The Secure Hash Algorithm (SHA) is used to create hash values. It is superior to the MD5 technique since it is impossible to recover the original data from an SHA-generated hash value. Therefore, it is safe. Signatures are produced using the DSS (Digital Signature Standard) algorithm for security reasons. The voter will login by providing his eligibility details then it will check for voters age, if the voter is not eligible he/she can't vote. If the voter is eligible to vote then it will generate the OTP, the voter has to verify the OTP. Once the OTP has been verified the voter can see the list of candidates and can vote accordingly. The block diagram of the proposed system is shown in Fig 1 and the data flow diagram is shown in Fig 2.

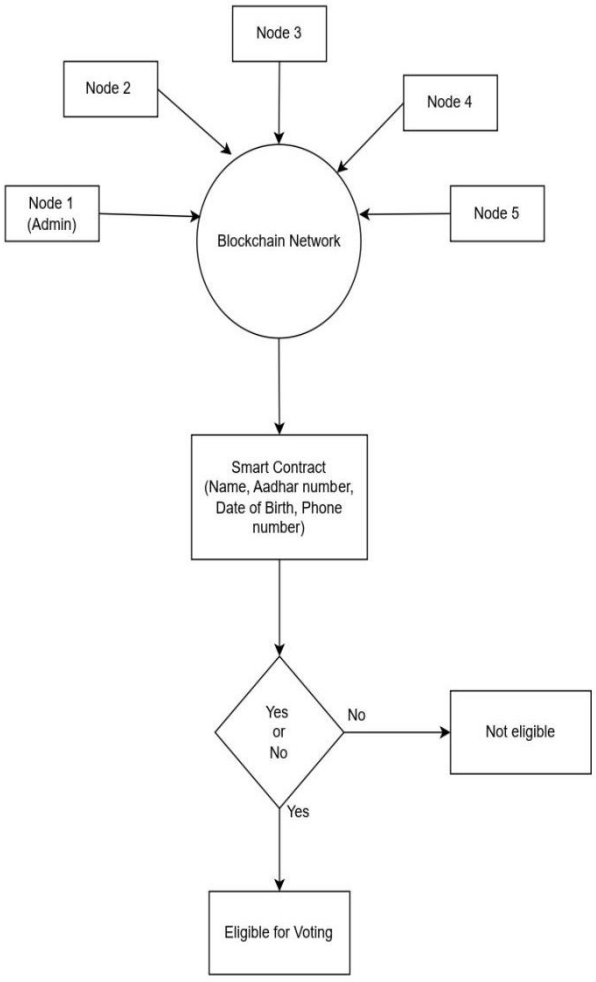


**Figure 1: Block diagram of the Proposed System**

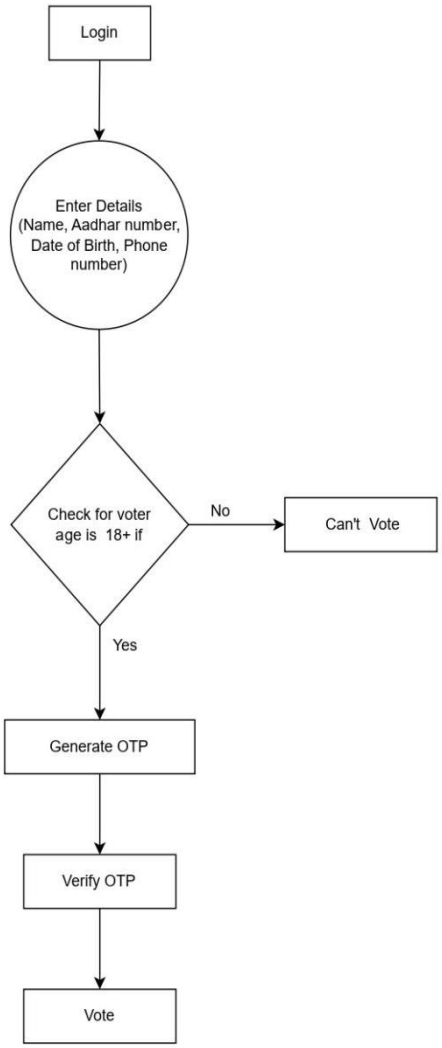


**Figure 2: Data Flow Diagram**

## V. Results

The user registers himself on the registration form by filling the necessary details such as name ,age, and phone number. A sample of registration form is shown in fig. 3. After filling the details, a QR code is generated which is to be scanned by the user and he gets the OTP out of it, then he has to enter the OTP. Once the OTP is verified, he is redirected to the voting page. The OTP verification page is shown in fig.4. The user has to create a metamask account to vote. On the voting page, the name of the candidates and the vote count is shown.

The user has to enter his public key (given by the metamask) as the voter id and then he can vote to the candidate of his choice from the list of candidates. Once the voting is done metamask sends the transaction confirmed notification and the vote count is updated. The list of candidates with number of voters is visible in Fig 7. The transaction confirmed page is demonstrated in fig.6.

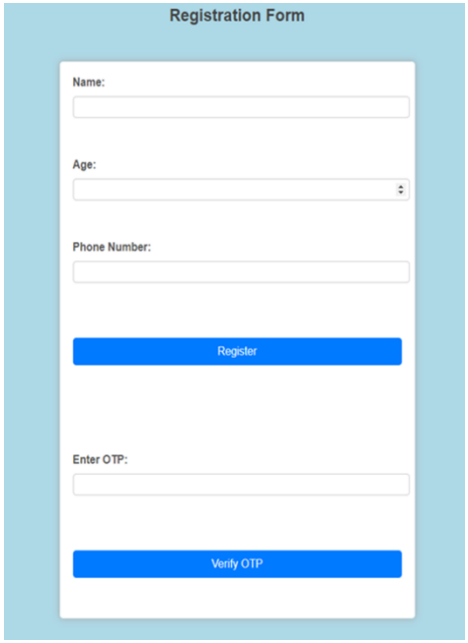


**Figure 3: Registration Form**

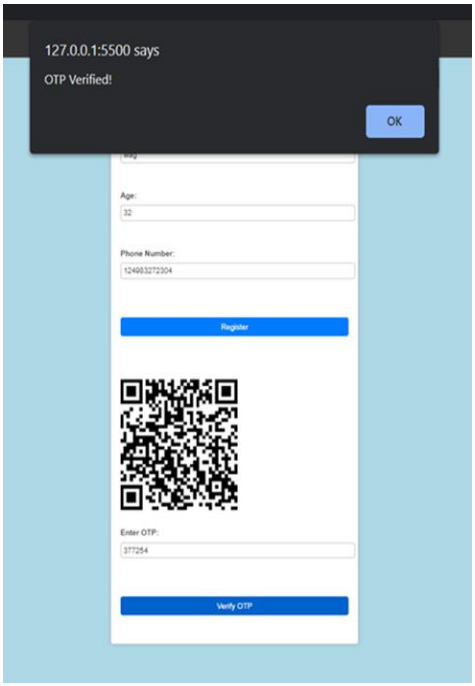


**Figure 4: OTP Verification**

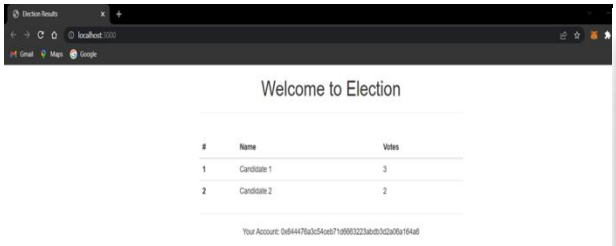


**Figure 5: Voting**

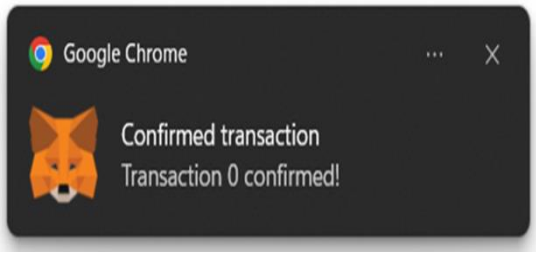


**Figure 6: Transaction Confirmed**

## Vi. Conclusions And Future Scope

Current research on blockchain-based voting systems is examined and assessed in this study. Information on the state of current electronic voting techniques is presented before the blockchain concept and its uses. The shortcomings of the current electronic voting systems are then outlined and discussed, as well as how the blockchain concept enhance electronic voting, current blockchain-based electronic voting solutions, and potential directions for further research. To reduce the workload of setting up an election booth and conducting elections in physical form and to improve the existing voting system, Blockchain technology based a secure, transparent and decentralized way of voting system is proposed in our paper. A blockchain based electronic voting system is designed which has the ability to vote from any place and prevent any tampering with votes. Even Non-Resident Indian can cast their votes as it is totally online.

Many academics believe that the blockchain can function as a suitable mechanism for a decentralized electronic voting system. Furthermore, the voting records maintained in these proposed systems are visible to all voters as well as outside observers.However, we discovered that most articles on blockchain-based electronic voting recognized and handled similar problems. These issues were divided into five groups: consensus, general, coin-based, integrity, and privacy. Numerous research gaps pertaining to e-voting must be considered in future studies. There may be further issues that need to be resolved with attacks on scalability, a lack of transparency, the usage of unstable technologies, and pressure resistance. As additional testing is required for blockchain-based electronic voting systems, we are not fully aware of all the risks associated with the security and scalability of such systems. Blockchain-based voting processes can have unknown security concerns and weaknesses. Blockchain technologies require more and more advanced managerial and software architecture skills. These significant issues ought to be thoroughly investigated using past knowledge throughout the voting process itself. Because of this, electronic voting systems ought to be used in limited test sites initially, and then expanded. Significant security vulnerabilities still exist in the internet and voting equipment. Conducting electronic voting over a reliable and secure internet will require significant security breakthroughs. It was found that, despite seeming like the best option, the blockchain system's shortcomings hindered it from effectively addressing the problems with the voting method. This study showed that there are still many technological obstacles to overcome and that blockchain systems have issues that need further attention. For this reason, it's critical to recognize that blockchain technology in an electronic voting system is still in its infancy.

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