

# A Study On Decentralized Voting System

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**Abstract** - Traditional voting methods in many nations confront various issues, including questions about transparency, security, and trust. This research study takes a novel method to address these concerns by utilizing the capabilities of blockchain technology to create a decentralized voting system. The suggested solution ensures transparency, tamper resistance, and verifiability in the voting process by exploiting the decentralized and immutable characteristics of blockchain. The system uses smart contracts to automate the implementation of voting rules, removing the need for intermediaries and lowering the possibility of fraud or manipulation. This paper delves into the technical components of the decentralized voting system, such as design, implementation, and security concerns. It also discusses the possible benefits and drawbacks of such a system, emphasizing its potential to promote democracy by offering a secure and trustworthy framework for conducting elections. The research findings contribute to the continuing discussion about using blockchain technology to transform the political process and pave the path for more inclusive and democratic societies.

**Key Words:** *Blockchain, Decentralized voting system, transparency, verifiability.*

## 1. INTRODUCTION

Blockchain is the technology that underpins cryptocurrencies like Bitcoin, but its applications extend beyond financial transactions. It is a distributed and decentralized digital ledger that records and validates transactions between computers or nodes on a network. A blockchain is a series of blocks that include a record of transactions. These blocks are connected in chronological order to offer a clear and immutable record of all transactions. This mechanism ensures that all participants agree on the validity of transactions and prevents double spending or unauthorized changes to the data.

The diagram made above is a representation of blockchain because we need better knowledge of blockchain to make a good e-voting system.

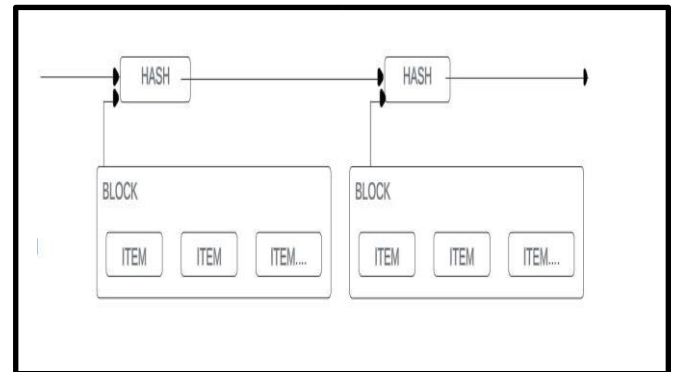


Fig-1. An illustration of blockchain

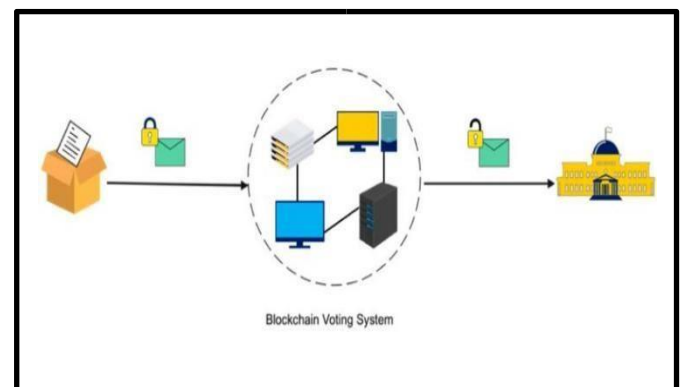


Fig-2. Working of blockchain

### 1.1 What is a decentralized voting system?

A decentralized voting system is a technique of running elections or decision-making processes in which authority and control are spread among several participants rather than concentrated in a single authority. It makes use of decentralized technology like blockchain to ensure the voting process is transparent, secure, and trustworthy.

Each participant has a copy of the voting ledger or database, which stores the records of votes cast, in a decentralized voting system. This distributed ledger is updated and maintained by numerous network nodes or computers, preventing a single entity from having total control of the system. The use of blockchain technology offers immutability since it makes it very impossible to change or manipulate votes once they have been recorded.

Decentralized voting systems aim to improve the integrity and trustworthiness of the electoral process by removing centralized authorities and integrating transparency and cryptographic security methods. Decentralized voting systems can include capabilities such as voter anonymity, results verifiability, and resistance to censorship. They have the ability to expand accessibility, lower costs, and allow for broader participation in decision-making, building a more inclusive and democratic society.

### 1.2 Features of blockchain voting

Blockchain technology has the potential to significantly improve e-voting systems' security, transparency, and dependability. In the context of an e-voting system, blockchain can be beneficial and significant in the following ways:

- 1) Physical verification: Physical verification is required to determine whether the fraudulent person voted using the identity of another voter.
- 2) Privacy: One of the most fundamental features of democratic voting is privacy. The privacy of voters must be protected. Nobody should know from whom a specific vote came.
- 3) Eligibility: This states that only eligible users can vote. Eligibility criteria can be different for different countries.
- 4) Coercion resistance: No one should be able to compel someone to vote, and they shouldn't be able to tell whether someone did so.[1]
- 5) Decentralization and resilience: The decentralized structure of blockchain ensures that the system is more resistant to attacks and attempts at manipulation thanks to its decentralized structure.
- 6) Increased accessibility and participation: Electronic voting platforms based on blockchain may increase accessibility by allowing remote participation of voters. This can help persons who can't physically get to polling places, such as abroad voters, disabled people, or residents of distant areas.
- 7) Immutable and tamper-resistant: A transaction becomes extremely hard to modify once it published on blockchain. The integrity of the voting process is ensured by the immutability, which makes it extremely impossible for hostile actors to alter vote records.
- 8) Security and encryption:Blockchain uses cryptographic algorithms through which vote can be encrypted and connected to a unique identifier,

assuring voter anonymity and privacy while preserving voting integrity.

- 9) Elimination of intermediaries: E-voting systems use blockchain, which can be used to automate the execution of voting rules, assuring accuracy and decreasing the possibility of human error or manipulation.

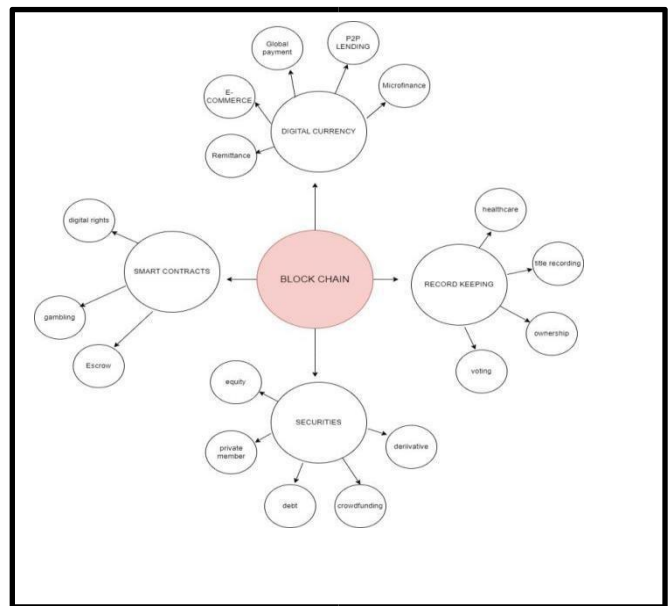


Fig-3. Features of blockchain

### 1.3 Limitations of e-voting system

1. *Security concerns:* The possibility of security lapses or hacking is one of the main issues with e-voting systems.
2. *Lack of transparency:*The use of complicated algorithms and encryption methods in e-voting systems can reduce transparency and make voting more difficult for people to understand.
3. *Accessibility issues:*The technology and abilities needed to efficiently use e-voting systems are not accessible to everyone.
4. *Technical glitches:*E-voting platforms may experience technical difficulties, such as software defects, hardware malfunctions, or connectivity challenges that could cause lost or erroneous votes and interfere with the voting process.
5. *Privacy concerns:*Privacy issues arise from the frequent gathering and storing of personal data in e-voting systems. Voter privacy protection becomes essential since any breach or illegal access to personal information may have serious repercussions.

In this paper we have tried to find possible solutions to all these problems and presented our idea about a secure decentralized voting system.

## 2. LITERATURE REVIEW

Blockchain and Decentralized voting systems have been trending research topics in recent years due to their potential in improving the lifestyle and usability of technology. In this section, we present a survey of existing work based on Blockchain and Decentralized voting systems

Garg et.al in her paper gives knowledge about the techniques used to tackle voting challenges. Through paper it is discussed that in Decentralized System, focus is towards making simple, secure and anonymity Voting Process in the hand of the public.[2] Harsha et.al highlights in her paper popular blockchain frameworks along with application of blockchain. In this paper they are discussing the problems in the voting systems and are proposing the E-voting model.[3] Al-madani et.al provide an E-voting system with high security by using blockchain when the voter wants to access the E-voting system through the web application, there are requirements such as a web browser and a server. The voter uses the web browser to reach to a centralized database. The use of a centralized database for the voting system has some security issues such as Data modification through the third party in the network due to the use of the central database system as well as the result of the voting is not shown in real-time.[4] Srivastava et.al found the limitations of the election voting systems and proposed a novel voting model which can resolve these issues.[5] Yang et.al in their paper show that when the blockchain technology is combined with modern cryptography transparency, integrity and confidentiality can be provide. Moreover a decentralized online voting system is implemented with no hardwired restrictions. A security and performance analysis is also presented.[6] Garg et.al presents an analysis of the Voting System using an upcoming wellreceived technology. It starts by analyzing Blockchain technology its advantages and disadvantages. Along with explaining the steps took to prototype of the Voting System on DAPP. It explains the problems of current voting system and how blockchain technology can contribute to change in the voting system.[7] Lalitha et.al discusses the proposed solution to use an Online Voting System using Ethereum Blockchain which helps the voters to vote from any location. To be authenticated, the method requires voters to scan their face and fingerprint. The vote is encrypted using blockchain technology. It ensures that a voter can only vote for one candidate at a time. The system retrieves election results rapidly, lowering labor costs and counting errors.[8] Hjalmarsson et.al in order to develop a distributed electronic voting systems, assessed a blockchain application . The study offers a brand-new electronic voting system built on blockchain that solves some of the drawbacks of current systems and assesses

some of the well-liked blockchain frameworks in order to build an electronic voting system built on blockchain. In particular, they assessed the potential of distributed ledger technologies through the presentation of a case study; specifically, the process of an election and the development of a blockchain-based application, which enhances security and lowers the cost of holding a national election.[9]Indapwar et.al in her paper gives review of blockchain technology and how E-voting system will utilize it.[10]Alam et.al presented a transparent, secure, and private electric voting (E-voting) system. For an electronic voting system based on blockchain, an optimal algorithm is suggested. Data exchange between evoting devices to the nodes is accomplished through an internet of things (IOT)-based system. Additionally, a number of potential methods and advancements for voting circumstances is suggested in the paper.[11]Vairam et.al goal in the paper is to leverage blockchain technology to build a voting system that is transparent and secure. The Ganache tool is used to set up a local blockchain network. The metamask is employed to validate accounts.[12]

Isirova et.al in this paper offered a new notion for establishing a decentralized electronic voting system using blockchain technology . A secure voting procedure is offered by the two-level design without the need for redundant current (non-blockchain) technologies. The six steps in the proposed blockchain-based voting protocol ensure that all of the criteria put forth for these kinds of protocols, such as voting transparency and anonymity, are met. [13]

## 3. METHODOLOGY

In this paper we have presented a decentralized e-voting system using smart contracts in Solidity, which is the programming language for Ethereum smart contracts.

Below is a very a basic code of e-voting system just to show the working.

```
// SPDX-License-Identifier: MIT
pragma solidity ^0.8.0;
contract VotingSystem {
    struct Candidate {
        string name;
        uint256 voteCount;
    }
    mapping(uint256 => Candidate) public candidates;
    mapping(address => bool) public voters;

    event VoteCasted(address indexed voter, uint256 candidateId);
    constructor(string[] memory candidateNames) {
        for (uint256 i = 0; i < candidateNames.length; i++) {
            candidates[i+1] = Candidate(candidateNames[i], 0);
        }
    }
    function registerVoter() public {
        voters[msg.sender] = true;
    }
    function castVote(uint256 candidateId) public {
        require(voters[msg.sender], "Only registered voters can cast votes.");
        require(candidateId > 0 && candidateId <= getCandidatesCount(), "Invalid candidate.");

        candidates[candidateId].voteCount++;
        voters[msg.sender] = false; // Prevent double voting

        emit VoteCasted(msg.sender, candidateId);
    }
    function getCandidatesCount() public view returns (uint256) {
        return (bytes(candidates[1].name).length > 0) ? (candidates.length - 1) : 0;
    }
}
```

code of a simple e-voting in ethereum

How the code of a basic e-voting system is working:

1. In the presented code we have a Voting System contract that stores candidate information and tracks votes.
2. Each candidate is represented by the Candidate struct, containing a name and a vote count.
3. The candidates mapping is used to store candidate information, and the voters mapping keeps track of registered voters.
4. The register Voter function allows a voter to register by adding their address to the voters mapping.
5. The cast Vote function allows registered voters to cast their votes by specifying the candidate's ID. It verifies that the voter is registered and the candidate ID is valid before incrementing the vote count for the selected candidate. It also prevents double voting by setting the voter's registration status to false after voting.
6. The get Candidates Count function returns the total number of candidates registered in the voting system. For this, we have a Voting System contract that stores candidate information and tracks votes.

#### 4. PROPOSED DESIGN OF DECENTRALIZED VOTING SYSTEM

To make a good decentralized voting system much more conditions and security is required. Decentralized voting system is the future so we propose some additional features for the voting system.

Step wise guide of the proposed solution:

**Step-1.** First the users will open the site.

**Step-2.** User login to the e- voting application through a government id used while making the account. The id may be driving licence, aadhar card, PAN card or rashan card.

*(The credentials will be verified with the earlier information if the information is correct the user will be logged in and if information is not matched one more chance will be given before the account is blocked for 3 hours.)*

**Step-3.** Now when the user is logged in other details will be checked like date of birth, age, death/alive with the official documents.

*(If verified successfully the person will be forwarded to to the voting page. But if the details are not mtaching the person will not be allowed to vote)*

**Step-4.** On the voting page all the options will be available from which the voter can choose whom to vote.

**Step-5.** Once an option is selected confirmation is required.

*(After the confirmation the voter will be automatically logged out from the application and the voter will not be able to login to give another input. Following the principle of one person one Voter.*

**Below a flowchart is given for a better understanding of the proposed design of decentralized voting system with addition security features included.**

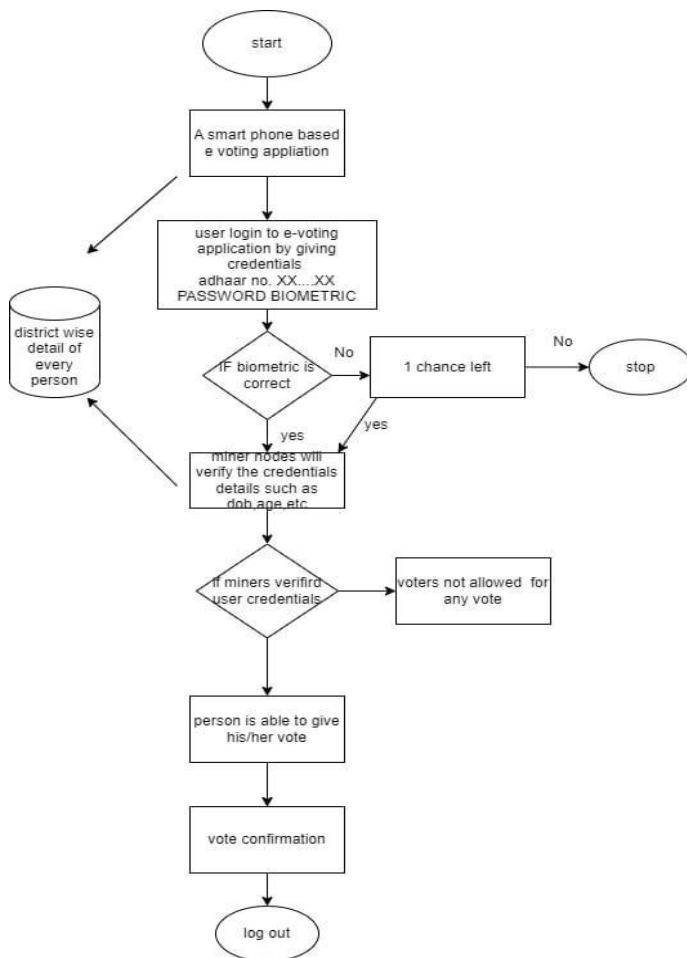


Fig-4. Flowchart of proposed e-voting system

### 3. CONCLUSION

In conclusion, Blockchain-powered, decentralized voting systems have the potential to completely transform election procedures by enhancing voting's security, accessibility, and transparency. The successful integration of this technology into actual voting scenarios will significantly rely on teamwork, continued study, and a dedication to overcoming the obstacles in the way. By utilizing the potential of blockchain-based voting, we can improve democracies and guarantee that every citizen's vote is heard in a safe and effective manner. In order to ensure that voting systems are resilient against potential attacks and weaknesses, security audits and testing must be given top priority in future research and development in this field. Additionally, it will be essential to include a variety of stakeholders in the design and implementation process, such as people, electoral commissions, and government officials, in order to increase public acceptance and confidence in these unique voting systems.

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