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Blockchain Based E-Voting

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Abstract - *Elections play an essential role in any democracy. Elections give the people a right to choose whichever political party or independent candidate they deem fit to govern the country. This entire process requires safeguarding the anonymity of the voter and the surety that the votes cast are not tampered with at any time. The current voting system seems to be lacking in these crucial aspects and can be easily tampered with to favor a specific candidate or political party. The paper elucidates the requirements of building electronic voting systems and identifies the legal and technological limitations of using blockchain as a service for realizing such systems. Through this paper we intend to use blockchain technology to safeguard the identity of the voter and to make sure that vote cast cannot be tampered with under any circumstances. Doing so will protect the democratic rights of all the citizens. We also intend to address the problems faced in the Blockchain based Voting System (BVM).*

Key Words: **blockchain, smart contracts, SHA-256 encryption algorithm, impenetrable, shared database**

1. INTRODUCTION

Elections form the backbone of democracy wherein people elect their political representatives and decide the composition of the government. Holding free and fair elections on a state and national level is integral to upholding the principles of democratic set up in India. Its truism that a single procedural misstep in the process of conducting the elections can create an array of potential issues for the voters. The current Voting system has many drawbacks which include lack of transparency, ill sense of security, easy manipulation, remote and not widespread. To counter all these issues researchers have been focusing on e-voting systems which reduce bias and help everyone cast a vote irrespective of their location.

1.1 Blockchain

Blockchain is the concept of storing digital information, *i.e.,* "block", in a publicly available database by linking them to each other, *i.e.,* "chain". These blocks are interconnected using a special code sequence that ensures the security and privacy of data.

There are three parts to the blockchain:

i The blocks which store transaction related information such as the date and time of the transaction [6].

ii The information regarding the concerned parties for the particular transaction. Their information is protected and ensures no indulgence of any other third party [6].

iii Each one of these blocks are provided with their own unique hash code which can be used to tell them apart from similar such blocks. Two blocks are connected to each other using their respective hash code thus forming a virtual chain [6].

1.2 Benefits of Blockchain based Voting system

Where the traditional voting system lags to provide transparency using blockchain it can be achieved. Using blockchain votes can be tracked and counted while being visible to everyone and assuring voters a safe and untampered voting system.

- Blockchain ensures the security of votes by introducing a seemingly impenetrable system[3].
- Anonymity is provided to the voters while voting to encourage more people to take part in the voting system.
- Tackling the processing time in traditional system blockchain can gather and process votes quickly and efficiently.
- In case of manipulation of the system such as stealing or change of votes, the changed data could be identified easily as other connected nodes are in sync[4].
- Providing the solution to DDoS attack, this attack might result in few nodes becoming online but once the nodes are brought back and synced the system will work avoiding any single point failure, ensuring consistency and availability[1].
- Considering long run use, the system is considered to be cheaper and safer than any other standard database applications in the long run[1].
- Online voting provides an increase in participation of voters by giving accessibility to the elderly, disabled, and reluctant youth.

1.3 Drawbacks of Blockchain based Voting system

Though Blockchain based e-voting system is a write-once, append-many ledgers allowing private and secure registration information and ballots which can be transmitted over internet[4], its use might lead to:

- Introduction of new risks and vulnerabilities.
- Need for a more robust encryption algorithm[1].
- With immature practice and still at hold needing some technical evolution, it cannot be used for national elections owing to its energy consumption to perform authentication and validation[5].
- Scalability is one of main concerns that is there is decrease in the performance rate with increase in execution rate[5].
- Transparency is also one such issue which needs to be addressed and resolved using consensus and synchronization algorithms[1].
- Opposition from political leaders due to shift of power from centralized authority might lead to resistance from government.
- Needing time to gain public confidence and trust.
- Requires a more complex design with focus on better software and management skills.

Overall, though having many drawbacks but can be worked upon over time.

2. LITERATURE REVIEW

The paper proposes a novel electronic voting system based on blockchain that addresses some of the limitations in existing systems and evaluates some of the popular blockchain frameworks for the purpose of constructing a blockchain-based e-voting system [5].

The paper proposes a solution using blockchain to eliminate all disadvantages of conventional elections. security and data integrity is provided theoretically. Voters' privacy is ensured in the system and decrease in waiting time for result declaration is proposed in the system [2].

Using Blockchain for E-Voting might promote more voter participation. Due to the ease of access and a user-friendly UI voting can be made simpler and accessible to all. Blockchain helps to safeguard the privacy of the voters and also ensures the credibility of the voting. Using blockchain also reduces the time taken to tally votes and hence reduces the chances of any tampering with the result and also provides the voters with the necessary transparency which is lacking in the current voting practices [7].

The authors have started with the identification of gaps of the current e-voting system, benefits offered by blockchain based e-voting system, research topics and proposed solutions published in blockchain based e-voting system, discussion about various models to be used and finally the future research direction for such system.

With current e-voting systems introducing software, hardware and communications infrastructure vulnerabilities, security and penetration risk resulting in loss in transparency and trustworthiness, the blockchain not only provides us with this but also privacy, security and instant results without any manipulation.

Various models have been discussed with more focus on Ethereum which provides smart contracts, integration qualities and a wide range to create and deploy decentralized applications [8].

3. PROPOSED SOLUTION

3.1 E-Voting System

In order to ease the process and make it more efficient, multiple servers will be made. Each of these servers will act as a checkpoint during the voting process for each and every vote. Every voter's vote must pass through a set number of checkpoints and meet specific requirements before being counted as a vote in the final counting phase.

The servers are hierarchical and are as follows:

1. The Constituency Servers: These are the servers that will receive the votes from voters within their respective constituency.
2. The City Servers: These servers receive votes cast by the voters from the Constituency Servers.
3. The State Servers: These servers receive votes from the City Servers
4. The EC Server: This is the final server to which all the votes from the various City Servers will be sent.

In all the servers, the final result including the distribution of votes will be displayed at the end of the voting when all the votes have been cast. Before that only the number of votes cast will be displayed to protect the privacy of the results.

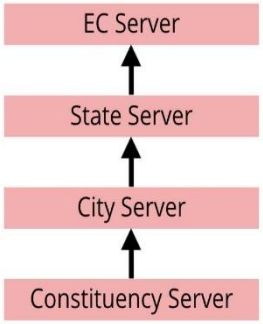

Fig -1: Data Flow

Using such a system it will become easier to narrow down any problems that occur during the voting process. It also reduces the load on the individual servers.

3.2 Working of a Blockchain in an E-Voting system

What a blockchain does is enable the distribution of the data stored in that database across multiple network nodes located in different places. This not only adds redundancy but also preserves the accuracy of the data stored there; for example, if someone tries to change a record at one database instance, the other nodes won't be changed, preventing a bad actor from doing so. All other nodes would cross-reference one another and be able to quickly identify the individual who tampered with Bitcoin's transaction history. This approach aids in creating a clear and precise sequence of events. This prevents any one node in the network from changing the data it contains.

Consequently, the details and History is unchangeable, such as the history of cryptocurrency transactions. A blockchain may store a variety of data, including legal contracts, state identifications, or a company's goods inventory. Such a record may be a list of transactions (such as with a cryptocurrency).

Step 1:

a) The first transaction added to the block will be a special transaction that represents the candidate.

b) This transaction acts as the foundational step and is not considered as a vote. In this step the user inputs their details, i.e., name, age, address, constituency, etc [7].

Step 2:

a) The information provided by the user in the previous step will be cross-referenced against the government database.

b) This acts as the verification step. Without verification the process will not continue forward [7].

Step 3:

a) After the verification, the user will be allowed to cast their votes. Following which their votes will be given a SHA-1 one way hash encryption in order to secure the vote from any form of external interference [7].

b) Doing this also prevents any form of manipulation of the user's votes [7].

c) As soon as the user's block is provided with an encryption, the block will be given a timestamp, and will be sent to the next checkpoint, which will be treated as a pointer for the last made change to the blockchain. This timestamp will be checked at the next checkpoint in the process [7].

Beyond this step, if any changes occur to the information stored in the block, the timestamp will be updated and checked at the next checkpoint. If the timestamps do not match the voting will fail.

Step 4:

a) This step includes adding this block to the blockchain by connecting it to the node of the next checkpoint [7].

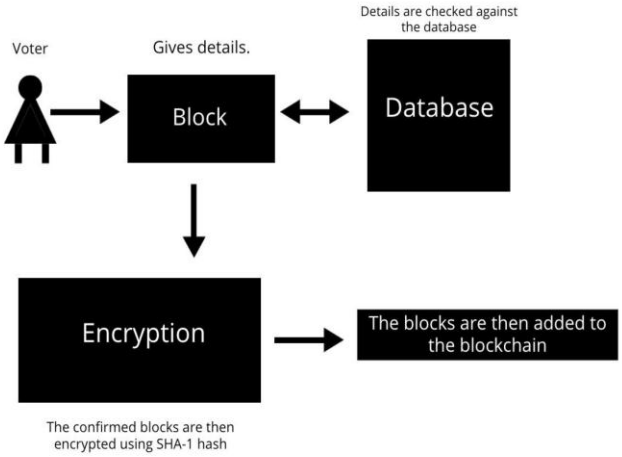

Fig -2: Workflow of E-Voting System

4. CONCLUSION

With the help of an advanced technology like blockchain the privacy of the voters while also maintaining transparency in the voting process to ensure that there is no involvement of any third-party members that might affect the credibility of the voting result. Since blockchain uses encryption as a

means to safeguard data no single party will have complete access to the entire voting process. Blockchain provides for an easy and cheap alternative to the traditional methods of voting. This will lead to an increase in the amount of voting done. This proposed system will prove to be successful in a majority of cases with only a few drawbacks.

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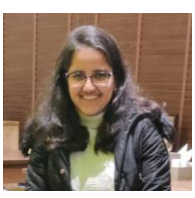
BIOGRAPHIES

Palak is a final-year Computer Engineering students, always vigilant for new opportunities in the field of technology and ready to learn and work it as and when she hears about them.



Gurleen is a final-year undergraduate Computer Science Engineering student who is passionate, and inquisitive about applying statistics and machine learning to tackle problems of the real world.

Final year Computer Engineering Student from Thakur College of Engineering and Technology. An avid learner and an enthusiastic coder.

Aaryan is a final-year computer engineering student with a keen interest in analyzing data and uncovering insights to make data-driven decisions in business.