A Thorough Study on Securing Electronic Voting Data Through Blockchains

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Abstract- *Democratic country is defined by its fair and just elections. The transparent and safe conduction of election is the central goal of a Democratic country and is a very crucial job for the various authorities. Most of the commissions formed for the conduction of these elections have been stressed with the increasing number of voters and a large number of polling booths designed to facilitate the casting of the vote by every citizen that has reached the legal voting age. To provide efficient elections, all these votes from the voters must be secured. Therefore, to bolster the security of the votes and reduce the costs of conducting an election, the Blockchain paradigm is proposed. The blockchain is one of the most secure platforms that can guarantee tamper-proof results due to its robust architecture. The block is the main component that will store the votes and the chain is the structure that will secure the votes once they have been cast. The proposed methodology integrates the blockchain paradigm for tamper proof secure and trustworthy elections. The Blockchain approach also enables a high level of privacy that would also increase the likelihood of a higher voter turnout which has been plaguing our country of late*

Keywords- Blockchain, Hash key Generation,Key Validation.

I. INTRODUCTION

Democracy has been the most widespread and efficient form of governance in this world today. The central motto of democracy is “By the People, For the People”, this is a very important statement as a democracy performs an election where the people of the country vote for their representative for the actual governance of the country. This is a very crucial aspect of the country as the leader of the country is responsible for various different policies and laws that govern the day to day life for the people of the country. The elected representative is a member of the country and is from the people that elect him/her as a representative.

Therefore, democracy is an excellent system that gives the power to the citizens of the country where it is due. As the right to vote is essential as well as an important part of a democratic country. It can be concluded that the process of election and voting is one of the most important events of a democratic country. The conduction of election is a long and tedious process that is conducted by an unbiased and non-governmental agency called the election commission (EC). The Election commission is responsible for the management of the various resources required to conduct a fair and just election.

The first step in the long process for election is the registration of various voters as the list keeps increasing every day as more and more people reach the voting age. This list needs updating before the elections, this is done by manually visiting the various households by the election commission to identify and verify the various voters. After the list has been updated, the election commission prepares for the election by setting up polling booths in every constituency. The constituencies are divided according to the seats and the population of the area. The population density is taken into consideration while setting up polling booths so that the voters do not face any inconvenience.

The polling in India and most other nations is done through electronic devices known as EVM’s or Electronic Voting Machines. These machines are designed to be used for the purpose of recording the various votes that are being cast by the voters. The polling booths have been designed taking into consideration the number of voters that are going to vote in that particular constituency, to reduce overcrowding and also as a security measure to help the law enforcement agencies to maintain the law and order.

To ensure that every single person gets the chance to vote, the polling day is declared as a holiday. This is also due to the fact that some of the citizens travel a large distance to visit their constituency to vote on election day. The election commission also pays large amounts to ensure that the elections are conducted in a smooth and effective manner, from manning the polling booths with policemen to the people employed that perform he various duties and paperwork that is needed to be done to ensure that the elections are done in a proper manner.

The ballot boxes are filled on the voting day and all the ballots from all over the country are collected and stored in

a sealed container. The various sealed ballot boxes are shown to the representatives of each party to check for any discrepancies or errors. These containers containing the various voters' votes are transferred to a safe location where the officers count the votes for each constituency on the day of counting. These votes are then utilized to form a list that is sorted in ascending order and then the winner is declared.

The process of counting the various votes and efficiently and accurately displaying the results is a laborious process and can be subjected to a lot of error. The results can be highly modified and can be subjected to a lot of attacks as the counting is done manually and human error can be introduced easily. Due to the ballots being a physical entity, the chances of manipulation are very high and every election, some ballots are physically damaged during the relocation process or turn up missing. The ballot cannot be opened before the counting day and if it opens, the ballot is considered as tampered and is not considered in the final count. All of this would undermine all the efforts put in by the election commission.

The physical ballot is a very old practice that needs to be updated. As the Digital India movement is gaining traction in the country, it is imperative to study the implications of an E-Voting system. Such a system can help make the voting process more streamlined and convenient for the citizens. An E-voting system would allow the voters to cast their votes online, which would eliminate the need for a polling booth and the elaborate physical process. The reduction of the polling booths would also reduce the paper wastage along with increasing the voter turnout which has been quite low but steadily increasing since the Election. The advantages of shifting towards E-Voting are substantial but the only deterrent for many people is the problem of security in such an endeavor.

Blockchain framework is one of the most secure platforms that was originally developed for the purpose of maintaining an online notary due to its highly tamper-proof nature. This framework was developed by a group of scientists and was not used as much since its inception in the 1990s. This changed when Satoshi Nakamoto utilized the blockchain paradigm to implement a new form of Cryptocurrency. This brought the blockchain paradigm into the limelight and a lot of researchers started utilizing this platform in their applications to increase the security. The blockchain offers increased security due to its highly secure nature and the chaining effect that prevents any modifications to the data.

The Blockchain as the name suggests consists of block and a chain. The block contains the various different data that needs to be safeguarded, the chain is formed through an innovative process. The first block is referred to as the Genesis block from which the chain starts forming. The chain is composed of a hash key. The hash key is the data of the data, much like metadata, this key can help correlate to the data and contains its information. The chain is formed through the use of the hash key in the block of the consecutively next block.

Therefore, the hash key of all blocks is saved in the immediately next block forming a chain. This chain is highly resilient and breaking of which can indicate some form of malfunction or tampering that is done on the blocks. The tamper-proof nature is derived from this chain as modification of any block on the blockchain would change its hash key, this would be different from the original hash key. This would not correlate to the original hash key stored in the next block effectively breaking the chain. This ensures that any kind of modifications would be detected and prevented in the first place.

The Blockchain platform has the ability to secure even the voter's votes and help achieve a fair and tamper-proof election. The smart contract approach can offer even more security to the user and help increase the voter turn out as it would allow people to vote from the convenience of their homes. The voters could also check their votes and confirm if they have voted for the party of their choice or not. The Blockchain is an innovative concept that can help increase the security of the process by a large margin.

This paper dedicates section 2 for analysis of past work as literature survey and section 3 concludes the paper with feasible statemement of the literature study.

II. LITERATURE SURVEY

This section of the literature survey eventually reveals some facts based on thoughtful analysis of many authors work as follows.

X. Yang states that there have been numerous techniques that have been developed for the purpose of increasing the security of the voting process online. This is due to the fact that the elections are one of the most important events of the country and has the ability to internally stabilize the country. The process of an election through the physical means creates a large amount of wastage of paper and can lead to increased degradation of the environment. To ameliorate these effects the authors in this paper have proposed a secure and efficient technique that helps achieve online voting while keeping the system secure using homomorphic encryption [1].

The limitation of this paper is that the proposed technique has increased computational complexity.

Fridrick P. explains that an electronic voting system is the need of the hour as the manual voting process is highly time-consuming and also creates a substantial amount of waste. The physical process of the election utilizes extensive paperwork which is highly detrimental to our health as it creates a large amount of waste paper and other products that also harm our environment [2]. Therefore, the authors in this paper prose an efficient voting system based on the blockchain paradigm to help achieve a secure and effective technique for the conduction of fair elections online. The only limitation of this paper is that the technique has an increased time complexity that is observed.

K. Wang elaborates on the concept of data and its usefulness as it has become an important part of a human being's life. Data is being used extensively in various applications, and the most benefit has been to the Artificial Intelligence paradigm. Artificial intelligence utilizes the data that is being generated to achieve a valuable insight which can be further utilized to increase efficiency and also increase sales [3]. Due to the fact that data is one of the most crucial aspects and the current scenario which has turned the users highly cautious about their data and is usually not shared. But the blockchain paradigm has a solution to this effect by enabling tamper-proof transactions between the data sender and aggregator.

A. Qureshi introduces the idea of voting and democracy as it is one of the most popular forms of government all over the world. Most of the elections in the world are done through physical means which increases the amount of garbage and waste paper utilized for the purpose of an election. The increasing amount of waste has a negative impact which cannot be tolerated. Therefore, the authors have proposed an efficient and innovative concept for the conduction of an election electronically [4]. The proposed technique is highly secure which can be used to vote with convenience. The limitation of this paper is that it has not been tested efficiently by the researchers.

B. Shahzad states the paradigm of blockchain as one of the most secure and advanced mechanisms. The blockchain technology has been proven to highly tamper-proof and impervious to various different threats and modifications. Therefore, the blockchain paradigm is used in applications where the data needs to be secured effectively and prevent any modifications to the data. such an application is electronic voting where there is an utmost need for empowering the citizens and helping them make the voting process more streamlined, convenient and secure [5]. The limitation of the proposed technique is that it has not been implemented for analysis yet.

A. Singh explains that there has been an exponential growth in the electronic devices and other systems that have gone the digital route. Numerous applications have been developed for this transition and have been successfully deployed too. The authors exclaim that the voting process should also change and from being entirely physical to an electronic system where the voters can cast their votes online. Therefore, the authors have proposed a technique for electronic voting based on blockchain for securing the transactions. The methodology has been experimented extensively and yielded highly satisfactory results [6]. The limitation of this technique is the long wait times for the declaration of the results.

E. Belanger elaborates on the major security lapses that occur between a government and their citizen. This is a deciding factor that can change the course of any election in the country. The authors in this paper have demonstrated that the is political unrest following a widespread mistrust in the government by the citizens of Canada [7]. The election commission is on the pedestal for allegedly breaking the trust of the citizens and misleading them. all of this can be eliminated by the introduction of a secure electronic online voting system that would utilize the blockchain framework for providing tamper-proof security to the system. The limitation of this paper is that the authors have not extensively evaluated the proposed techniques.

P. Sharma introduces the rising population of the Indian subcontinent which has led to the rapid increase in the number of vehicles on the streets. This is due to the substantial increase in the buying power of the citizens. The authors have also commented on the steady increase in the implementation of various advanced technologies that have contributed positively. The researchers, therefore, propose a distributed framework for a smart city for the management of the automobile industry [8]. The system has been implemented on a blockchain to increase its security. the limitation of this proposed methodology is that it does not have extensive application.

R. Cullen evaluates the various different government webpages of the country of New Zealand and commented on the quality and convenience of the users. The citizens of New Zealand have been approached to accurately assess the impact and effectiveness of government webpages. For the purpose of a thorough evaluation, the authors have conducted a vote where the residents have voted on the usefulness of the

Webpages and the user recommendation and complaints have been aggregated to help indicate their impact easily [9]. The authors utilized the Blockchain paradigm for this purpose which has performed excellently. The citizens have also indicated that there needs to be drastic changes to the Webpages to increase convenience.

S. Wolchok has analyzed and tested the Electronic Voting Machines or the EVM's that have been used for the purpose of election in the world's largest democracy India. The Government of India has been using these machines for a long time to register the votes that are being cast by the voters in India. The authors have experimented on the machines as there were allegations of some kind of tampering being done on these machines that resulted in maligned results [10]. The authors evaluated the machines and confirmed the tamper-proof nature of the machine and concluded that they are indeed a secure form of voting. The authors also recommended shifting to the online voting paradigm for increasing the security and accuracy of the system.

S. Aggarwal states that India is the largest democracy in the world, where the election is an important activity. The election takes place to elect the public representative for the various governmental positions in the governing body [11]. There have been several iterations of researches that have been performed to prevent any discrepancies and improve the security of the current system. The authors in this paper suggest an innovative E-voting scheme with the integration of blockchain which provides maximum security to the whole process. The authors have performed a study on the various existing methodologies for their drawbacks. The system has not been implemented to perform any performance measurements.

H. Wu explains that due to large advancements in technology, there has been a shift in the voting mechanism as many countries have shifted their focus from the manual voting towards the electronic voting to increase the trust and convenience for voters and the government. The voting system also needs to be decentralized and protected to ensure transparent and fair voting [12]. The authors have proposed a voting system that relies on the blockchain and smart contracts to enable higher security of the system and prevent any malicious activities and tampering of the process. The authors also implemented a bilinear pairing to further bolster the security of the voting procedure.

W. Zhang elaborates on the blockchain paradigm in detail in this paper, in the context of its use in designing an E-voting system that is highly secure and tamper-proof. The authors detail the various decentralized applications that are being designed with the blockchain platform in mind. The authors present a native blockchain paradigm that facilitates the users to vote online with tamper-proof security. The decentralized platform is one of the most secure and can help reduce the number of forgeries and other malicious manipulations that are done on a centralized system [13]. this is due to a single point of failure that can promote cheating and malicious behavior. The authors implemented their protocol with the help of Hyperledger Fabric and experimented extensively for the performance.

Teja K. [14] introduces the importance of voting and elections in a democracy. A democracy is a form of government where the people of the country vote on and elect their representatives for governing the country. This is done through EVMs or Electronic Voting Machines that are used extensively for the purpose of voting. But there have been many instances of various physical problems being faced by the election commission such as loss of ballot boxes and error in the votes. Therefore, the authors propose an e-voting paradigm based on the blockchain platform. The authors utilized the Ethereum framework to implement a decentralized voting system with the help of smart contracts. The limitation of this system is that the authors have not considered biometric authentication for authorization purposes.

Sathya V. [15]states that the conduction of election is the world's largest democracy is a logistical nightmare. Due to the large population, there is a need to get to all the various parts of the country to allow all the citizens to cast their votes and decide their representative. The voting in the country is done by the use of Electronic Voting Machines. These machines have become infamous as a lot of people have been concerned about the safety and the fairness of the voting techniques. Therefore, the authors present an innovative scheme of addition of the blockchain technology to the EVM which will increase the security of the existing process and help achieve fairness in the elections. The limitations of this study include the addition of a faster network that can be used to avoid vulnerabilities.

III. CONCLUSION

In this paper, various different approaches for an E-voting paradigm have been detailed. The process of manual voting through ballot boxes is very archaic and needs improvement, as it is highly inefficient and creates a lot of wastage and environmental degradation. Also, the voters need to be physically present to cast their votes and have to sometimes wait in a line for a long time to get the opportunity to do so, this can put off a potential voter as the increased effort is not deemed as fruitful enough. This decreases the

voter turnout and also decreases the overall effectivity of the elections. Therefore, the inclusion of blockchain in an E-voting implementation and their various related works have been outlined in this paper. These related works have given insight and helped achieve an efficient methodology based on blockchain which is will be elaborated in detail in the upcoming editions.

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