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Blockchain-Based Voting System

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Abstract. Since the publication of Satoshi Nakamoto's white paper on Bitcoin in 2008, blockchain has (slowly) become one of the most frequently discussed methods for securing data storage and transfer through decentralized, trust-less, peer-to-peer systems. With the accelerated iteration of technological innovation, blockchain has rapidly become one of the hottest Internet technologies in recent years. As a decentralized and distributed data management solution, blockchain has restored the definition of trust by the embedded cryptography and consensus mechanism, thus providing security, anonymity and data integrity without the need of any third party. But there still exists some technical challenges and limitations in blockchain. The blockchain, with its own characteristics, has received much attention at the beginning of its birth and been applied in many fields.Voting is a very important process that takes place in almost every country of the world and many efforts have been made to improve the process over the years. In this report, the process of building an electronic voting system has been chalked out using Blockchain Technology. This new system will not only make the whole process much fairer but will also greatly reduce the time and workforce spent over it. This paper explains the prospects on which we can improve and also talks about the limitations of the system. An experimental set-up is also carried out with a proper result analysis to show the efficiency of the E-Voting System over the traditional process of voting.

Keywords: Bitcoin, peer-to-peer, innovation, data management, data integrity, Blockchain Technology, analysis, Voting.

1. Introduction

Before diving into the project, we need to get a rough idea of what blockchains are. A blockchain is a chain of blocks that contains information. It is a distributed ledger, open to anyone. Once data has been recorded inside a blockchain, it becomes very difficult to delete [3]. A block contains three parts: data, its own hash and the hash of the previous block. Once data is entered in any of the blocks, its hash changes and makes other blocks invalid. This is what makes blockchains difficult to edit. Computers nowadays have become fast enough to alter data and recalculate hashes, but blockchains work on the proof of work mechanism, which helps slow down the creation of new blocks [3]. What makes them so secure is the use of hashing and the aforementioned mechanism. It uses a peer-to-peer network that anyone can join. The peers have full access to the blockchain and blocks can only be added if all the peers approve of it, creating consensus [3]. To tamper with any of the blocks in the blockchain, you will tamper with all the blocks in the chain, calculate the proof of work of each block

and gain control of more than half of the peer-to-peer network [3]. This is almost impossible to do. Blockchains can be implemented using various programming languages like Python, JavaScript and the like.

Blockchains are constantly evolving too. One of the most recent developments is the creation of smart contracts, which are simple programs that can be stored on the blockchain and can be used to automatically exchange certain utilities based on certain conditions [3]. We have used this concept to produce a voting system which we think can go a long way in changing the World.

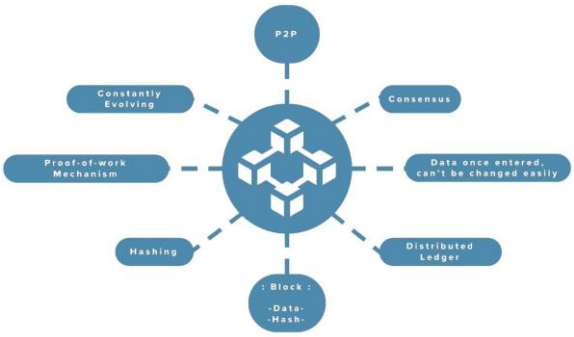

Figure 1: A brief introduction

Presently, two systems of voting are prevalent all around the world: the first being the Ballot System and the second being Voting via EVMs. Each of these voting systems have their own pros and one can be considered better than the other. There are considerable downsides to these systems as well. The Ballot System is expensive to carry out, there is wastage of paper and it is time consuming as well. EVMs can malfunction or be tampered with. Both of these systems are prone to Electoral Fraud, especially in countries where corruption is prevalent [1].

Implementing either of these systems for voting is time as well as resource hungry, especially in overpopulated areas. In countries like India, the scale of elections is mind boggling. In the 2019 General Elections the Election Commission of India had to reach 879 million eligible voters. This was done in seven phases over 38 days. The rules require a polling booth within 2km of every single registered voter, which meant setting up 1.035 million booths with 3.96 million electronic voting machines (EVMs), that were counted in mere hours at the end [2]. To carry out voting in such a large scale is not easy.

Our implementation looks to simplify this process.

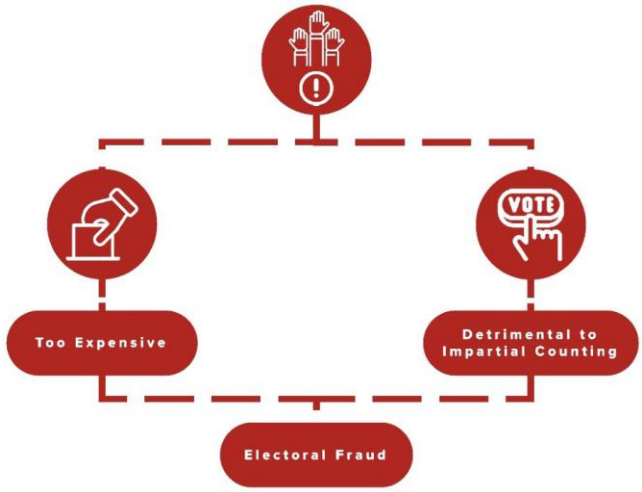

Figure 2: Disadvantages of present voting systems

2. Literature Survey

One of the most recent survey papers in the realm of blockchain and cyber security was performed by Salman et al. [9]. In this study, the authors highlight the challenges and problems associated with the use of security services in the centralized architecture in various application domains and provide a comprehensive review of current blockchain-enabled methods for such security service applications in areas of authentication, confidentiality, privacy, access control, data and resource

provenance, and integrity assurance in distributed networks.

A small number of studies in relation to blockchain and its broader impact have been published, and in this study, we will discuss them below to examine the differences between the topics selected by the authors and our research.

Yli-Huumo et al. conducted an SLR in 2016 to determine what research results had been published in relation to the general concept of blockchain technology [10]. They excluded legal, economic and regulatory research from their review and focused on papers about blockchain technology. They found that 80%of the research papers focus on Bitcoin projects, in particular on a common theme of security and privacy. Since 2016 the applications for blockchain have diversified, so our research looks to investigate what research works exist specifically in regard to cyber security and blockchain applications, and put it to good use.Towards the end of 2016, Conoscenti et al. conducted an SLR concerning the use and adaptability of blockchain, specifically in relation to loT and other peer-to-peer devices. Interestingly, they highlighted that the blockchain could be used for data abuse detection without the need for a central reporting mechanism. However, they did not look at the broader impact of blockchain on cyber security in general. Seebacher et al. provided an SLR in 2017 that highlighted the increasing impact of blockchain on service systems [11]. They recommended future work to include a review of real-world applications, which is the basis of our research as we look to see how blockchain can affect cyber security problems.

All the previous studies mentioned above answer questions related to the wider use of blockchain technology, but they do not examine specifically its use in improving cyber security solutions. Therefore, it is necessary to provide a fresh summary of the more recent research works, in particular in the realm of blockchain and cyber security, so as to guide new research activities [7].

3. Proposed Method

With the help of this application, we aim to eradicate the use of the aforementioned voting systems. We believe our implementation is going to be much secure and faster than the traditional implementations. With the help of a unique identification system and a secure blockchain based system, votes can be cast much faster, the vote count can be viewed in real-time and the chances of electoral fraud taking place will be minimized heavily because of the advantages of blockchains. We also aim to minimize the use of resources and time to a great extent and possibly use them where they are really needed. Overpopulated countries are expected to save a lot of resources and time, if our method is implemented properly.

This is how the application is going to work. The votes would be cast on the tap of a single button next to the party's symbol, and would be added to a blockchain-based database, in which the voters will be able to view the vote count in real time. There is no scenario of electoral fraud taking place because of how secure the database will be. The voters will be provided a 24-hour window to cast their votes in the application and as soon as the time runs out, the results of the election will be displayed right away.

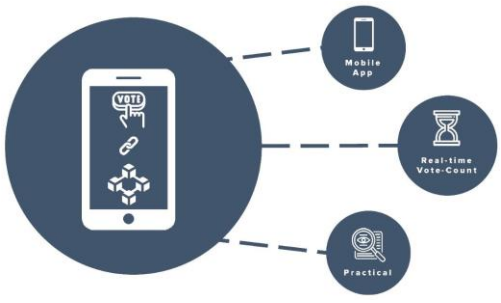

Figure 3: The working of the proposed system

4. Experimental Set-up

Two dummy elections were organized with two dummy candidates to test the efficiency of our system and how it fared against the traditional ballot-based voting system.

5. Result Analysis

1. ln the ballot-based election, 70 percent of the voters had cast their votes and 5 percent of them were declared invalid. It took two days to set-up the polling booths and ballot papers. The voting process was to last 1 day only. The results were declared 2 days later. We observed that out of the valid votes, the winning candidate received 85 percent of them.

Total Number of Voters	Total Number of Votes Casted	Number of Valid Votes	Number of Invalid Votes	Number of Votes Received by the Winning Candidate
5000	3500	3325	175	2826

Table 1: Tabulated results of the ballot-based election

2. ln the application-based election which lasted for a day as well, 95 percent of the voters had cast their votes. It took a few hours to set-up the database for the votes to be stored and counted and the results were declared as soon as the allotted time for voting was over. The voters were able to see the vote count in real-time, and this time, the winning candidate received 90 percent of the valid votes. Paper Consumption was lowered too, as there was no need for the ballot papers.

Total Number of Voters	Total Number of Votes Casted	Number of Valid Votes	Number of Invalid Votes	Number of Votes Received by the Winning Candidate
5000	4750	4515	235	4065

Table 2: Tabulated results of the application-based election

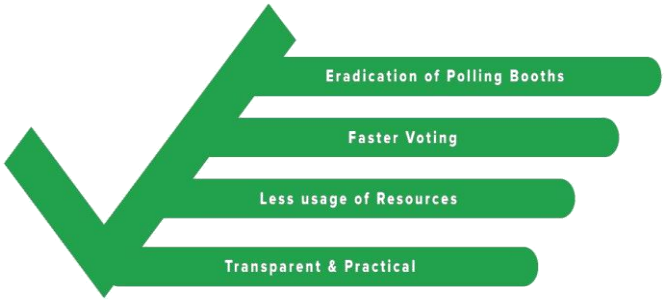

Figure 4: Advantages deduced during the result analysis

6. Conclusion

Figure 5 represents some of the few challenges we faced.

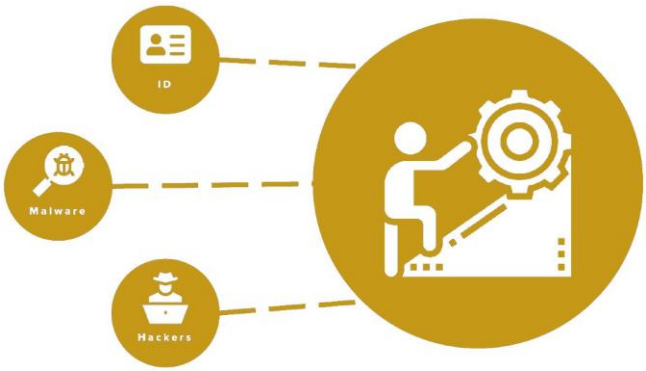

Figure 5: Challenges

In conclusion, we can say that once this method is successfully implemented, it could go a long way in revolutionizing the world. Not only will the voting process become easier, the results of the elections will be out faster too. This system will also improve with age, as blockchains are constantly evolving. If implemented properly, it could completely eradicate electoral fraud and other discrepancies. The resource usage would go down significantly, allowing the government to invest more on important concerns. It will help boost development to a great extent, especially in countries that need to develop to keep up with the evolving world. This would in turn, ensure better quality of life in these places and would encourage people to live an honest life.

Figure 6: Conclusion

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