EXPLORING THE POTENTIAL USE OF BLOCKCHAIN TECHNOLOGY IN ELECTRONIC VOTING

[#1]ADICHERLA RAMESH, Assistant Professor, Department of Computer Science and Engineering,

[#2]CH.VAMSHI RAJ, Associate Professor, Department of Computer Science and Engineering

MOTHER THERESA COLLEGE OF ENGINEERING AND TECHNOLOGY, PEDDAPALLY, TS.

ABSTRACT: The blockchain is a sophisticated piece of technology that is gaining popularity as a result of its use in digital currencies and other financial transactions. The blockchain technology keeps a close eye on the transaction process and gives users the ability to verify that the agreement reached during the transaction is accurate. This investigation places a significant emphasis on the electronic voting system, also known as the e-voting system, because the primary objective of this study is to investigate the various applications that could be made possible by blockchain technology. The traditional electronic voting techniques have been plagued by a number of shortcomings and restrictions for a considerable amount of time. The development of a trustworthy electronic voting system was the consequence of incorporating blockchain technology into a decentralized application. The recently put into place system is superior to the one that has been in place up until now in terms of justice, transparency, and adaptability. In addition to the use of a secret key, we will also make use of a digital signature in order to protect the confidentiality of voter information that is kept in the centralized database. In addition, the application built on blockchain technology offers high degrees of accessibility, confidentiality, and longevity. This results in a reduction in the costs associated with conducting a nationwide survey while simultaneously strengthening the system's stability and security.

Keywords: *Blockchain, Distributed E-voting Architecture, Electronic Voting, Electronic Ballot.*

1. INTRODUCTION

The modern era can be identified by the proliferation of technological advancements that are extremely complicated. As a result of the fourth industrial revolution, the government is only one of many institutions that is going through a period of transition right now. In recent decades, governments have become increasingly likely to utilize election management systems that are computer-based. As a result of Estonia's pioneering use of electronic voting in national elections, the Baltic nation is widely regarded as a leader in the development of cutting-edge voting technology. After that, Nigeria introduced computerized voting techniques to ensure that all parties would be treated fairly and that the process would be transparent. Following Switzerland's lead and using this method for state elections, Norway became the first nation to implement it for local council elections. Both the regular way to ballot labeling and the alternative voting method are meant to accomplish the same things for voters. When compared to the standard technique of voting, the dependability, security,

and fairness of the system that was just explained all see significant improvements when it is implemented. Approaches to electronic voting that have been used traditionally usually provide a number of challenges, most notably in terms of safeguarding the anonymity and identity of voters. However, incorporating blockchain technology into electronic voting systems is one potential solution that could successfully address the problems that have been described above. An analysis of 167 democratic governments, spanning a spectrum of democratic governance, was subjected to a comparative study. Rowena Cullen oversaw the work of three independent research teams who collectively carried out the examination. In order for the government to successfully construct a sustainable democracy, it is necessary for them to ensure public safety and provide a variety of benefits to the people. These advantages include, but are not limited to, access to medical care and educational possibilities, defense against external dangers, and assistance in deciphering the complexities of the tax law. Some governmental institutions have revised their voting procedures in order to implement improvements in response to recommendations made by the Election Commission.

Recent events have provided incontrovertible evidence that the system used to tally votes is flawed, and these incidences have shown this beyond a reasonable doubt. There is a historical tradition of the electoral process being less transparent and less fair than it should be. A sizeable section of the general population is also unaware that they possess certain rights under the law. In addition, there is a discrepancy between the actual distribution of voting power and the public's opinion of how their elected leaders manage matters pertaining to national security. This discrepancy exists because of the fact that the voting power is not evenly distributed. This problem has a significant influence on the economies of a number of nations, including Nigeria, India, Brazil, Pakistan, and Bangladesh. These worries are comparable to those that have been expressed in other countries. Tampering with elections, early voting, several attempts to vote, a lack of adequate law enforcement or auditors,

political upheaval, a restricted public's knowledge, and other scenarios analogous to these are some of the challenges that have been listed above. As a direct consequence of this, modern society makes use of the most cutting-edge technologies. The implementation of blockchain technology has been beneficial to a lot of economies and governments in developing countries. The implementation of blockchain technology has been proved in a significant number of studies to have a profound impact on the procedure of electronic voting. In 1981, blind signature theory and public-key cryptography were combined by David L. Chaum to build the first electronic voting system. Blockchain, also known as a decentralized ledger system, was the technology that was utilized. Many people who work behind the scenes in the business have shown a substantial amount of curiosity and enthusiasm in light of the recent presentation of the first voting system based on blockchain technology. Additionally, the majority of the studies concentrated on the use of digital records and online voting as the primary research topics. By implementing electronic voting, the time it takes to vote might be cut down significantly. It is vital to keep in mind, however, that traditional voting systems have always been met with a great deal of skepticism. The most recent studies recommend developing a trustworthy electronic voting system that makes use of open-source software and the distributed ledger technology known as Blockchain. This move is being taken with the intention of addressing existing concerns regarding safety.

2. METHODOLOGY

The Blockchain

At the moment, topics such as Bitcoin, blockchain technology, and cryptocurrencies are receiving a lot of attention. It is generally agreed that Satoshi Nakamoto was the first person to develop the technology behind blockchains. The Blockchain is a decentralized system for record keeping that is primarily composed of discrete data units known as blocks. Each block includes transaction data as well as the date when the record was initially

created, as well as a hash value that identifies the block that came before it. There are a few names for the first block, but the most common ones are foundational block and genesis block. The hash value of the current block is the default value because there was no hashing operation performed on the block before this one. The main building blocks of the Blockchain are illustrated in Figure 1. In order to compute the hash value for each block, the encryption operation makes use of the SHA-256 algorithm. Using this particular cryptographic technique, the one-of-a-kindness of each block is increased.
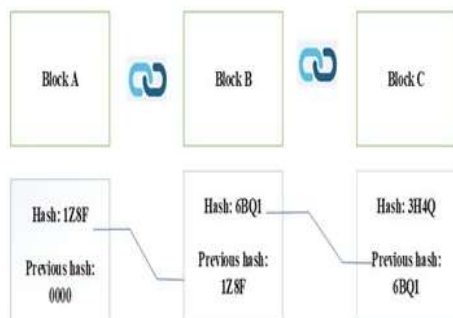
encased in blocks, transactions are then subjected to further scrutiny in the form of an evaluation and investigation. Figure 2 is a graphical representation of the electronic voting system, which also includes an explanation of the thought process that went into developing the Blockchain-based approach. Figure 3 provides a visual representation of the Django dependency architecture that is utilized by the electronic voting system.

Fig. 1. An exploration of the core principles that underpin the blockchain technology.

Experimental Setup

This article uses a concrete illustration to discuss an electronic voting system that is based on blockchain technology. The structure has two distinct components all together. This individual switches between linking and suppressing functions at regular intervals. People are able to select a ballot using their voter identity while they are in the process of voting. Following that, a verification procedure is carried out by making use of a private key. It is strongly recommended that the public key be stored in the settings.py file in advance of the event. After that comes the thorough review and recording of the votes and signatures, which are both taken into consideration. After that, the ballot is methodically produced, and it is then sealed in order to maintain its confidentiality. Voting takes place in this section of the presentation inside the confines of a single unit referred to as a block, which also functions as a transaction. On the screen is displayed a graphical illustration of the mining process that needs to be completed. For the development of N, it is vital to work with data that is both exact and dependable. After being

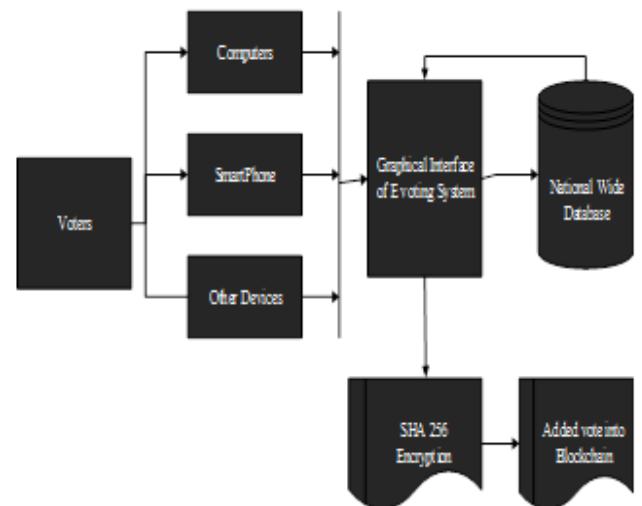## Number of changes in velocity direction

Fig. 2. The thought process that went into developing the electronic voting system based on Ethereum.
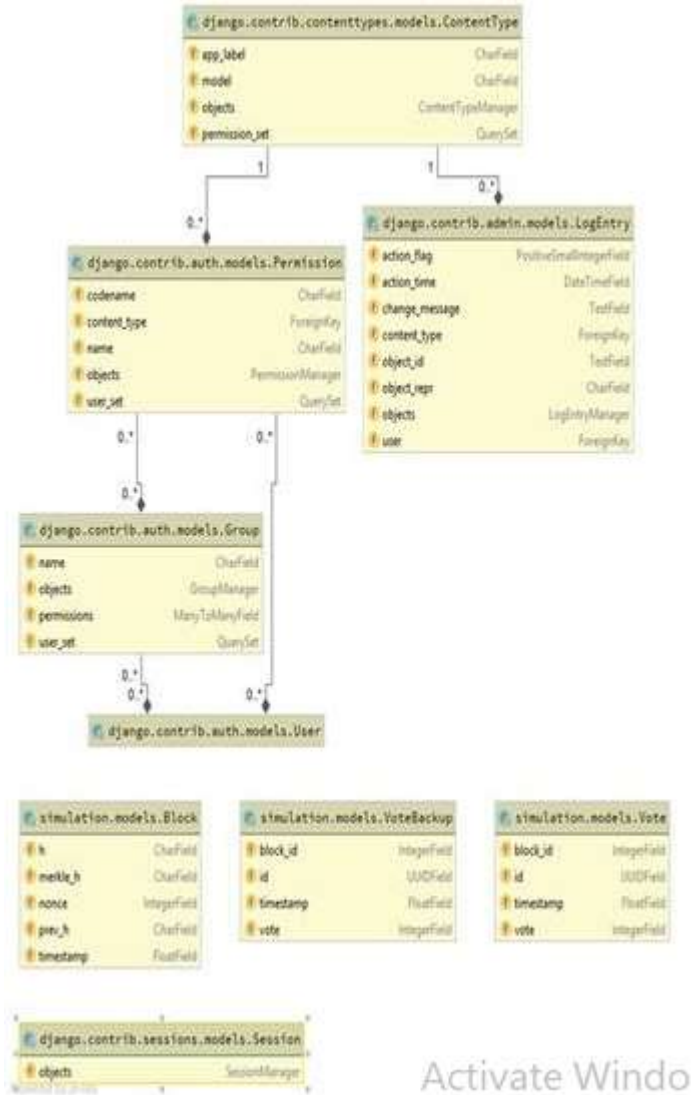
Fig. 3. In this work, the Django dependency model is studied in the context of an electronic voting system that is enabled by Blockchain technology.

Tools and Software

In this particular experiment, the only integrated development environment (IDE) that was utilized was PyCharm. In order to conduct the investigation, Django 2.1.2 and Python 3.7.0 were required. The pycryptodome library, namely version 3.6.6, was combed through to find the appropriate encryption tool.

3. RESULT AND DISCUSSION

The electronic voting system that is now under consideration possesses all of the characteristics that are necessary for a reliable system. These characteristics are as follows: i) the ability to protect voters' personal information; ii) identification processes that are highly secure; iii) a high level of voting precision; and iv) the capability to undergo exhaustive audits. It should be illegal for anyone not registered to vote to cast a ballot, and the privacy of voters should be protected both before and after the election by any electronic voting system used. In order to arrive at the final tally, only votes that are authentic and absolutely necessary will be factored in; votes that have been counted previously or are deemed superfluous will not be included. It is anticipated that this technology will come equipped with inherent qualities such as dependability and adaptability. This Blockchain-based electronic voting mechanism could have complications if a large number of voters cast their ballots at the same time and were linked to the previous hash. As a direct consequence of this, the Longest Chain Rule was selected as the approach to take in order to resolve this issue. When values such as transparency and fairness are taken into consideration, it is generally agreed that an electronic voting system that is based on blockchain technology is more reliable than the conventional voting technique. The development of an electronic voting system that is based on blockchain technology has the potential to be implemented in educational as well as real-world contexts. Electronic voting is an option for participants, provided they have access to a secret key and can create a signature that is compatible with the electronic voting system (see Figure 4 for more information). Before submitting their vote to the Blockchain, voters can protect it using this functionality by encrypting it with a password (as seen in Figure 5).
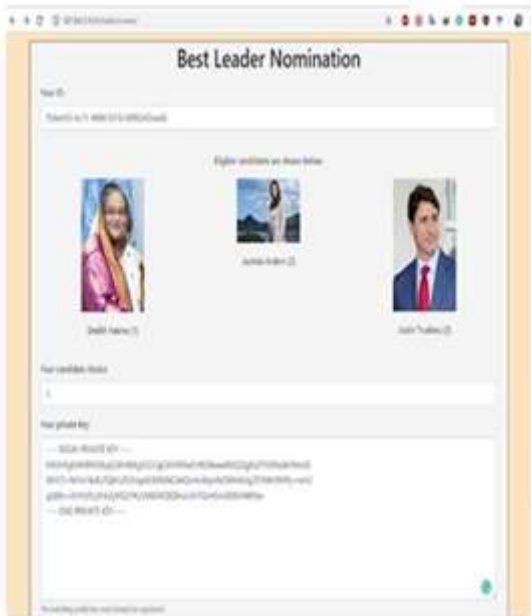
Fig. 4. The voting rights of individuals can be exercised through the use of a private key.

The purpose of this experiment was to manufacture false data for examination, and it utilized twenty blocks and five hundred transactions. As seen in Figure 6, each block is made up of 25 separate ballots that are cast by their respective voters.

Fig. 5. the method that is followed in order to protect voting equipment.

Fig. 6. The following is an explanation of each component that makes up the electronic voting system.

Figure 7 provides a detailed illustration of the representation of validated ballots in electronic voting systems that are enabled by blockchain technology. The data that was specified earlier includes essential pieces of information, such as the name of the voter, the date, the hash value, and the structure of the data among the blocks. This method, unfortunately, suffers from a variety of shortcomings. The possibility that the voting machine could be infected with malicious software is the most significant threat. Keep in mind that each voter is only allowed to cast one ballot, and that after a ballot is cast, there is no way to change or modify the initial selection that was made on the ballot. This is another important fact to keep in mind. This investigation will come to a close by taking a look at the current condition of the industry as well as the challenges that come along with blockchain-based electronic voting systems. Our group is now working on a dynamic application that will soon make it possible for voters to cast their ballots on a variety of devices from any location in the world.
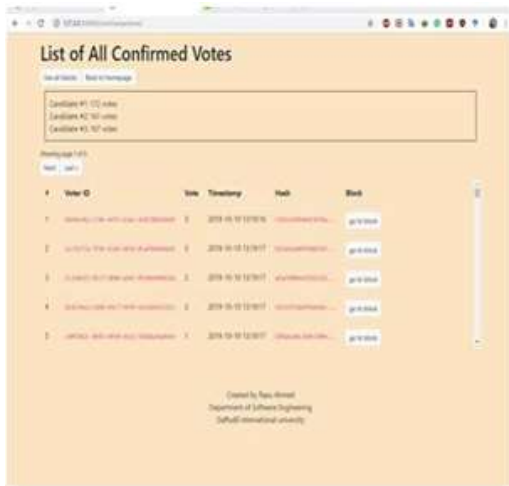
Fig. 7. Blockchain technology is utilized within the voting mechanism to provide ballot verification.

4. CONCLUSION

This piece examines a secure blockchain-based electronic voting system that is built on decentralized ledger technology and that enables voters to cast ballots without having to rely on a centralized authority. According to the findings of research, blockchain technology has the potential to overcome concerns regarding security, fairness, trust, and transparency, which would make it possible for electronic voting systems to gain widespread adoption. In order to objectively validate this phenomenon, a number of controlled studies had to be conducted. The blockchain is extremely resistant to attempts made by hackers thanks to the open architecture and inherent decentralization that it employs. In addition, we discussed the shortcomings of our electronic voting method, which is going to be utilized in a research endeavor in the near future.

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