The Future of Electronic Voting System Using Blockchain

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The Future Of Electronic Voting System Using Blockchain

Md. Razu Ahmed, F.M. Javed Mehedi Shamrat, Md. Asraf Ali, Md. Rajib Mia, Mst. Arifa Khatun

Abstract: Blockchain is cutting-edge technology and it has been gaining popularity for cryptocurrency and financial transactions. The transaction process is maintained by the blockchain, which can be used to verify the reliability of the transactional contract. The main effort in this study is the significant accessibility of block-chain based on other technologies including the electronic voting (e-voting) system. In particular, the traditional e-voting system has various limitations and challenges for a very long time. For building a secure e-voting system we have proposed a blockchain-based distributed application that offers fairness, transparency, and flexibility than the existing system. The paper presents a novel secured distributed database of the voter's information, and voter information will be deposited against their private key and digital signature in the central database. Finally, the block-chain based application allows solid robustness, privacy, and transparency which improves the system reliability, secure and reductions the expenditure of hosting a countrywide election.

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

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1 INTRODUCTION

We are living in the era of cutting-edge technologies. The fourth industrial revolution is already happening with diverse fields including government sectors [1]. In the last decades, many of the governments has begun being used to Electronic voting systems on their election [2][3]. Among the countries, Estonia was the very earliest adopter an electronic voting system for its national wide elections in the modern world [4]. After that, the electronic voting system was used for an open and fair vote in Nigeria [2]. Switzerland [5] was the very first-time user for their state elections and Norway was adopted to their council election [6]. For the traditional voting system to compare with an electronic voting system, basically two systems do their work likely to similar. Moreover, this electronic technique does provide reliable, secure, fair services than the traditional ballot system. But the traditional electronic system does not provide anonymity and integrity whereas blockchain-based e-voting can be solved these problems. Rowena Cullen et al. [7] presented a comparative study among democracy-based countries that have a certain amount of democracy between 167 countries out of 200 countries. To provide democracy, the government shall take some essentials to care such as security, health, education, international relations, tax, and other benefits for the peoples. The Election Commission has constructed the election process more operational in different governmental organizations.

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In recent time, there have been numerous instances where the election was observed that the balloting practice was not completely satisfactory and the election procedure have faced different issues with clarity and fairness, and most of the time peoples are very confused about their own rights. In addition, the real voting right does not reflect among the peoples in terms of configuration of the leaderships. For example, we can see that the scenario extremely found in peoples like Nigeria, India, Brazil, Pakistan, and Bangladesh [8]. The nature of these issues is very familiar to the above-mentioned countries such as false vote, pre-vote, casting redundant vote, lack of law enforcement and audits, political instability, lack of awareness, etc. So, in this case in today's world already going to adopt cutting-edge technology. Sate of the art blockchain has been applied to obtain benefits from the governments and different emerging sectors. Many of the studies show that the blockchain technology has gained significant impact on E-voting system. In 1981, David L. Chaum [9] introduced a very first blockchain-based electronic voting system in which the system used public-key cryptography and blind signature theorem. After this first announcement of the blockchain-based voting system, many of the researchers have shown their interests in this particular field [10][11]. Moreover, most of the study was focused on only electronic records and the online voting system. The E-voting system can make life easier to casting vote but on the other hand's threats to these traditional systems have always been a concern. The E-voting system we are going to recommend in this study will deal with the security concerns by using decentralizes Blockchain technology and open source code to develop the secure E-voting system.

2 METHODOLOGY

2.1. The Blockchain

In this present time, Bitcoin, Blockchain, and Cryptocurrency are very hot topics nowadays. Blockchain was first invented by a person name of Satoshi Nakamoto [12]. The Blockchain mainly contains a list of information which is called blocks and it is a kind of distributed ledger. In each block, it is containing the transaction data, time of the records, a hash of the previous block. With the first block, it is called the genesis block or foundation block. Basically, it has no previous hash and this block contains some default hash value. The basic

Blockchain blocks are illustrated in fig. 1. Moreover, each of the blocks is identified by their hash value and this hash is generated using SHA 256 encryption algorithms [13].
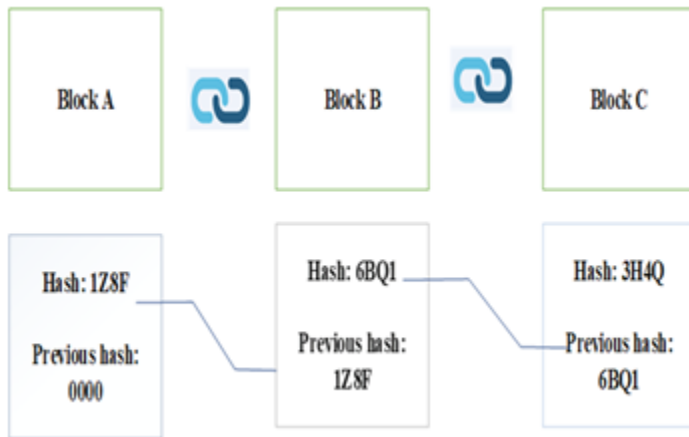

Fig. 1. *The basic Concepts of Blockchain.*

2.2. Experimental Setup

In this study, we present a blockchain-based e-voting simulation that includes mainly two parts: 1) Block and 2) Chain. The voters can choose a ballot with a voter's ID, which is then signed using a private key. (The public key must be added to settings.py first.) The ballot and the signature are then verified. Finally, the ballot is sealed (mined). In this part of the demo, one block contains the ballot (as transaction). The mining process is shown using the console. To generate N transactions with valid data. Seal them into blocks and after that, it will explore the transactions and blocks. Fig. 2 shows that the logic of the Blockchain-based E-voting system. And fig. 3 shows that the Django dependency model of the E-voting system.

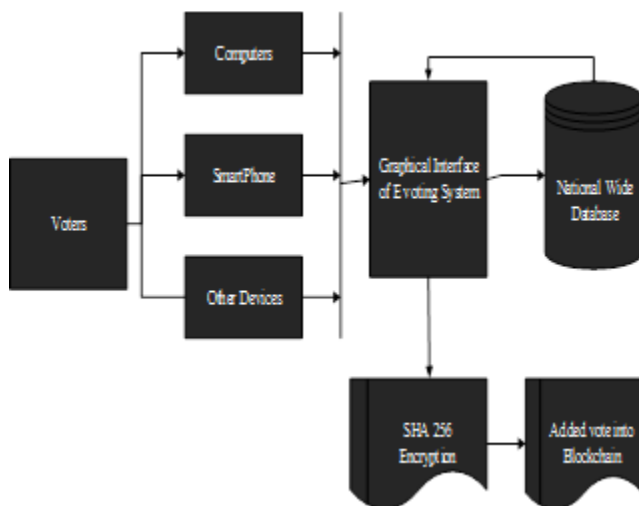### Number of changes in velocity direction

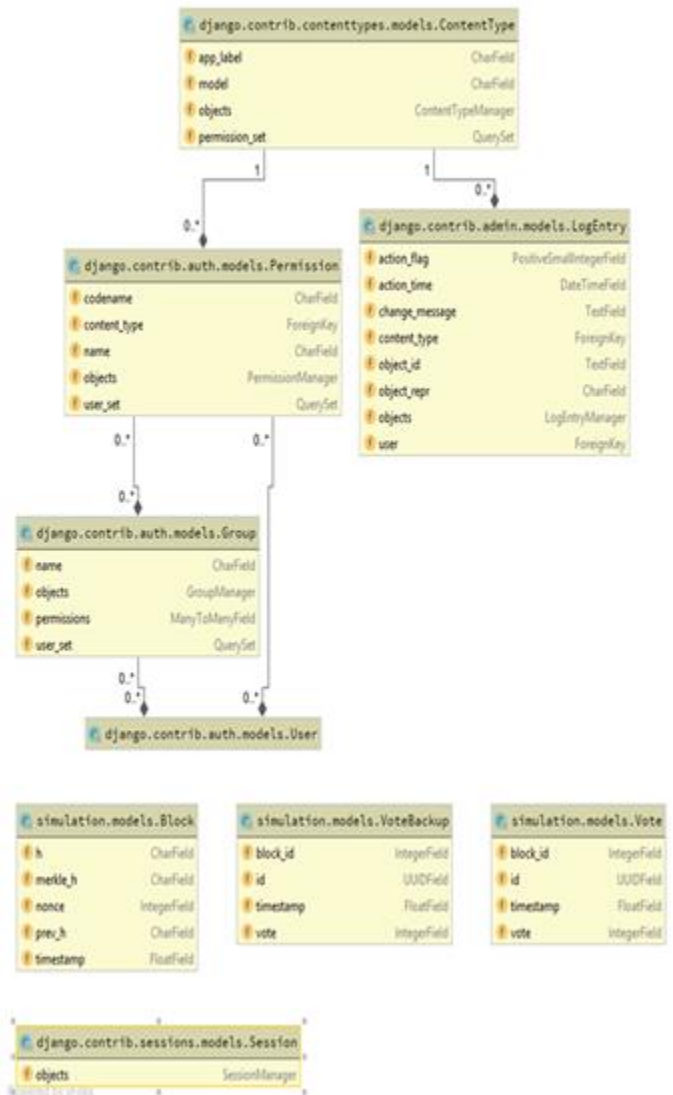**Fig. 2.** *The logic of the Blockchain-based E-voting system.*

Fig. 3. *The Django dependency model of Blockchain-based e-voting system.*

2.3. Tools and Software

In the present study, all analysis was implemented in Python version 3.7.0 and Django 2.1.2 using PyCharm IDE. The version of the encryption library was pycryptodome 3.6.6 [14].

3   RESULT AND DISCUSSION

Our E-voting systems present all of the elements of a secure E-voting system including four main parameters [15] such as i) Anonymity, ii) Authentication, iii) Accuracy, iv) Verifiability. The E-Voting system should allow anonymity during and after the election and only listed users can cast their votes. After that vote must be accurate, no duplicate and redundant vote cannot be counted. The main reliability and flexibility of this system is verifiable. In this Blockchain-based E-voting system, it may occur a problem like when multiple users cast their vote at a time that will be linked to the previous hash. Therefore, we used the Longest Chain Rule for a solution to this problem [16]. However, A blockchain-based e-voting system is mostly

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secure than the traditional voting system in terms of transparency and fairness [17]. We developed a blockchain-based e-voting system (simulation) for the research community and real-world applications. Firstly, the voters can cast their votes with a private key (Fig. 4) and they can generate a signature for sign in the E-voting system. Hence, voters can seal the vote (Fig. 5) to add to Blockchain.
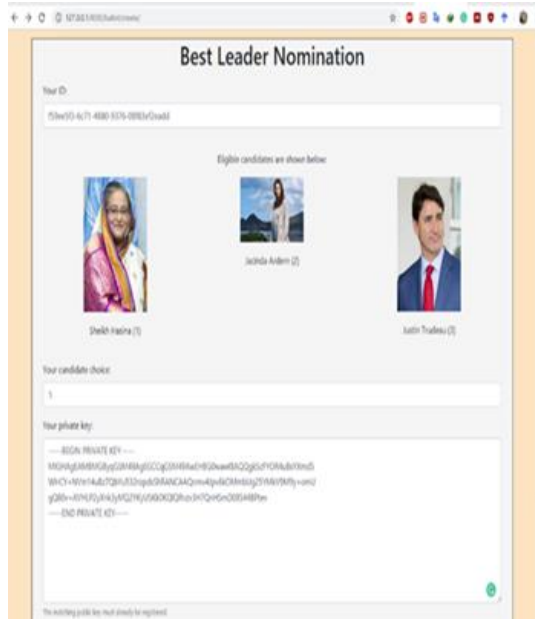
Fig. 4. *Voters can cast their vote with private key.*

In this experiment, we used 500 transactions and 20 blocks for our simulation results. Each of the blocks contains 25 (Fig. 6) votes of the E-voting system.
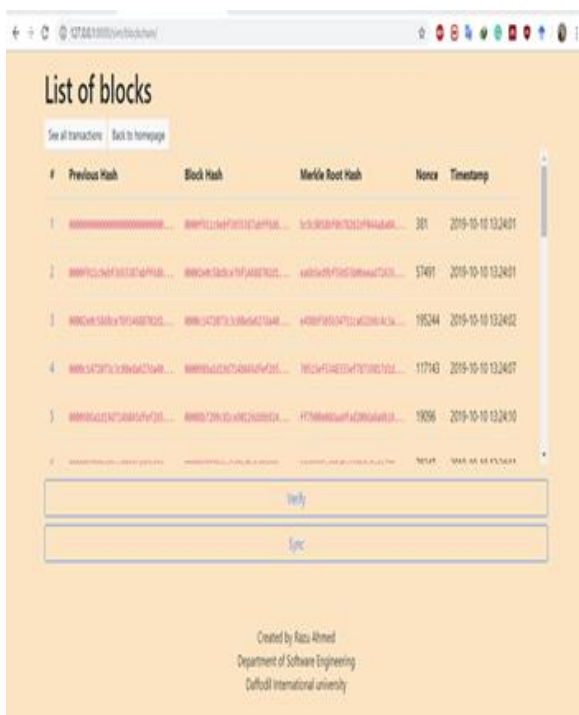

Fig. 5. *The Sealing Process of the Voting System.*

Fig. 6. *List of all blocks in the E-voting System.*

Finally, Fig. 7 shows all of the confirmed votes in the blockchain-based E-voting systems including voter ID, timestamp, hash value, and blocks. This system has some limitations as this system is vulnerable in that malicious attackers install malicious software into the device which will be used for casting vote. Another limitation is voters can vote only one time and it cannot be withdrawn. In summary, we highlighted research trends and challenges in relation to the Blockchain-based E-voting system. We are currently developing the real-time application for casting vote from any devices and anywhere in the world.
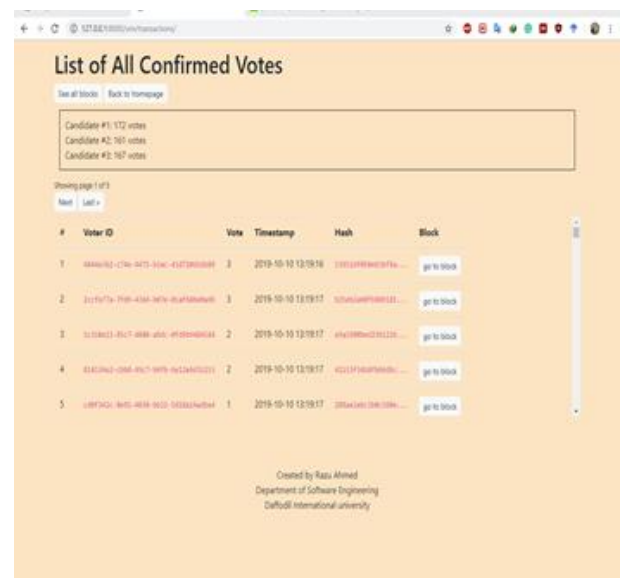
Fig. 7. *The Confirmed Votes of the Blockchain-based Voting System.*

4 CONCLUSION
In this work, we introduced a Blockchain-based secure E-

voting system that enables the decentralized database to cast vote in a modern way. We have shown that blockchain technology can solve the security, transparency, fairness and trust issues and it is offering to reduce the barriers of E-voting systems. The Blockchain technology will be openly verifiable and distributed so that nobody will be capable to corrupt it. We as well presented the drawbacks with our E-voting system, which will be adopted in the upcoming study.

5 ACKNOWLEDGMENT

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