A Framework for Blockchain Based E-Voting System for Iraq

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Abstract—Election is a basic democratic tool that offers an official mechanism for the people to express their opinions in order to form a government by democratic means. Electronic voting has evolved into the most significant application of e-governance and e-democracy. Few countries have recently taken the opportunity to test and use electronic voting systems. Also, many countries expect that internet voting will become a reality during the next decade. In the conventional voting system, the electors authenticate themselves by displaying credentials; this move is open to the public and is validated by poll workers. During this authentication, they are manually checked before being eligible to vote. The standard system of voting is more costly and needs more human capital. Because of these factors, the whole world is heading toward the trend of e-voting. Electronic voting devices are supposed to be the answer to the shortages. A secure e-voting system must meet many criteria, including uniqueness, performance, fairness, stability, safety, authentication, and anonymity. Blockchain is a modern security solution, which is capable of securing e-voting system. Blockchain is distributed ledger. Each block contains only one transaction. Block chain provides security using cryptography and hashing. Blockchain provides a perfect infrastructure to provide secure e-voting netwms.ork. Blockchain along with smart contracts need hour to improvise an e-voting system. This paper presents a secure blockchain based framework for an e-electronic voting in Iraq.

Keywords—election, e-voting, blockchain, framework, security, authentication, smart contract

1 Introduction

Nowadays, one of the most essential government services, such as elections, puts a significant strain on those participating in the process due to the numerous limitations that must be imposed to the beneficiaries of this service. There are two groups of beneficiaries: candidates and voters. Voting is an effective way for the public to express their views on a particular topic or problem. Electronic voting is quickly becoming the most important application of e-governance and e-democracy. In other words, voting is essential to democracy [1].

The traditional election is normally held under the supervision of the government to ensure that the constraints are correctly applied during the election process and that only eligible voters are permitted to participate in the election process. This helps in avoiding any kind of forgery and attempts at multi-voting. Vote buying is one of the most notorious breaches of any government, and it is extremely difficult to regulate. Furthermore, in order to obtain the appropriate degree of privacy, security, and confidence, the procedure of human supervision over the voting process necessitates a significant amount of time and money. Furthermore, once the election is over, another issue arises: vote verifying and counting [2–4].

These need significant efforts on the part of humans, and no one error is tolerated during the process. This stage of the election is seen as a time-consuming procedure, and its accuracy is frequently questioned. These disadvantages compel the public to consider another voting method that can solve the aforementioned disadvantages. As a result of these issues, the entire globe is heading toward the trend of e-voting. Evoting technologies are believed to provide the solution to traditional voting system flaws. Few nations have recently taken the effort to test and implement electronic voting systems [5–7]. These computerized voting methods were also used in the recent elections in India, the world's biggest democratic democracy. Voting is the act of freely expressing one's preferences among publicly known options. Many nations anticipate that Internet voting will become a reality within the next decade. Individuals with impairments can readily access electronic voting [8–10].

They can utilize joysticks, headphones, sip and puff technologies, and foot pedals. These machines include touch displays that can show information in several languages as well as voting options in audio for visually challenged voters. These features make it easier and more pleasant for people with impairments to vote.

Electronic voting refers to voting machines that employ electronic ballots instead of paper ballots. Electronic voting, often known as e-voting, comprises optical scanning vote devices, punched cards, voting kiosks, and ballot and vote transmission by telephone, Internet, or private computer networks. Many cryptographers have advocated utilizing cryptographic techniques to create a safe e-voting system. The secure e-voting system must meet a number of criteria. Cryptographic approaches can partially meet the various requirements [11–13].

The asymmetric cryptosystem is the basis of all known electronic voting protocols including protocols two agencies, Blind signature and senses. The cryptosystem is asymmetric and is significantly more sluggish and complicated than the symmetric system. Furthermore, it is much harder for the typical user to follow these rules properly and to apply them [14, 15].

Vote is the most significant instrument in decision-making in democratic systems. Elections and referenda should thus be available to as many people as possible, in particular to those who live in various countries, both inside and outside Canada. These folks find it challenging to take part in elections. Elections directly affect a country's democracy, on the other hand. Furthermore, the conventional vote has several issues. It is so important to ensure that electronic polls are held [16–18].

2 Blockchain for providing security to e-voting system

2.1 The concept of blockchain

The list of transactions known as a block related to the encryption technology was created from the terms block and chain. There is a direct link between each block and the previous block header. A peer-to-peer network manages the Blockchain, which is a peer-to-peer blockchain. It is used to keep track of information and access it later. In addition to transactions, each block has a Block header. Hash, time stamp, nonce and Merkle root value of the preceding block header are all stored in the block header. In the block, there is no way to change the health information. One of the blockchain's most important applications is the elimination of inconsistencies [19].

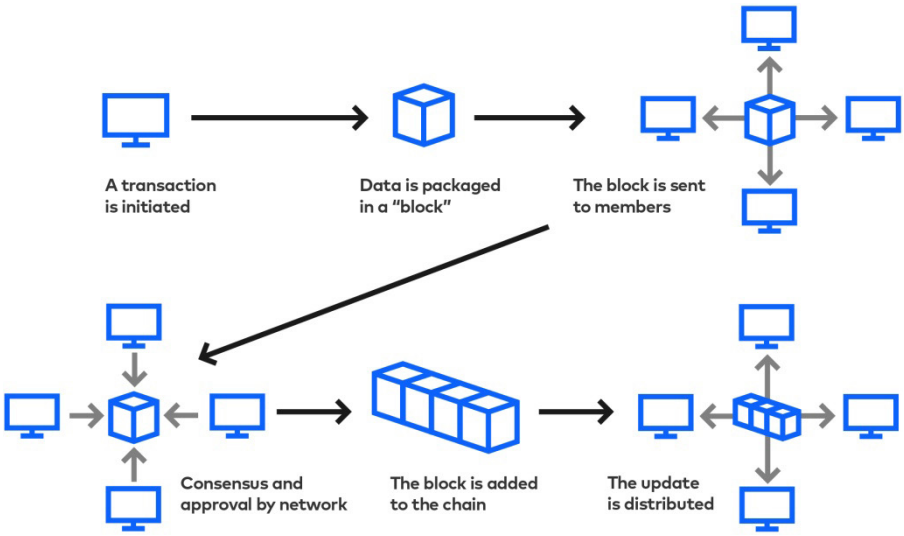

Fig. 1. Working of blockchain

The blockchain, as seen in Figure 1, is a distributed database of transactions. Users may share data with other services without the involvement of a third party and follow their transactions with other services. Records are not kept on a single server, but rather across a number of them, making it almost impossible to change or remove them. For example, trademarks and processers guarantee that every data entered onto the blockchain is authentic encouraging community members to trust one other [20, 21].

Keeping patient records require a ledger, which necessitates a large number of entries. Using blockchain technology, many types of real-world issues may be stabilized. For files created and not altered after a certain date, the year 2013 is shown by a document's time stamp. A cryptographic hash function is added to the patient's medical records. Patients' medical records are updated with a new timestamp based on the block timestamp that is mined. We cannot hack one block at a time; instead, we must hack all of them simultaneously [22].

It's interesting if IPFS and blockchain can work together. IPFS stores a massive amount of data, and its content address is immutable and offers a permanent link to the blockchain, which uses the content address as input. The timestamp is added to the results on the blockchain. IPFS is used to store the data, and the link between the two systems is recorded on the blockchain. Large amounts of information can not be kept in the blockchain, hence the hash value of the information is stored in the blockchain to ensure its integrity. The essential components of blockchain are a distributed network, a public ledger, and digital transactions.

Distribution in the form of a network P2P network design that all peers may access is based on an all-digital transmission system. Node implementations' rules are documented in the shared ledger lists. Peer-to-peer digital transactions will be checked and authenticated by each individual. Each record includes a unique cryptographic signature and time stamp, ensuring that it is secure and suited for long-term storage.

For the blockchain to work, the Consensus algorithm is essential. This algorithm ensures the secrecy and performance of information on the blockchain. As blocks are added to the blockchain, they are linked to the ones that came before. At the beginning, the transaction pool is filled with records, and the miner produces the block. Then, all miners in the network try to solve the mathematical problem; whomever solves the riddle first earns awards.

The block contains digital copies of all the records. Chronologically ordered blocks are used. Each record is encrypted and digitally signed to assure its legitimacy and consistency. All of the blocks are linked to each other in a chain of progression [11].

2.2 Features of blockchain

Blockchain has the following features making it a better alternative for business processes. The properties of blockchain are decentralization, transparent, immutable, autonomy, open-source, anonymity, and consensus.

a) Blockchain as a Data Structure: The transaction is recorded in a block on the blockchain, which serves as a record of the transaction. A genesis block is the first piece of the puzzle. There are more and more blocks being added as the volume of transactions rises. There was a connection between this block and the preceding block. This data structure is provided by the chain of blocks. Blockchains are designed to be tamperproof and immutable, however this is not always the case in practice.

b) Decentralized: Groups of the system make it as decentralized as possible, which is a vital point in blockchain innovation that works brilliantly. The asset may be stored by anybody and accessed over the web without the need for third-party assistance. Using a private key, you may save any transaction, such as crypto currency, documents, contracts, digital assets, etc., and access it in the future [23].

c) Consensus: In order for the blockchain to approve and trust transactions before they are added to the chain, a method known as consensus must be used. When a transaction violates one of the previously agreed upon rules, it is deemed void. Permission-less or permission-based deployments of blockchains are possible. The idea of a public consensus means that anybody may try to include transactions and contribute to the consensus process. Nodes participating in an agreement or adding transactions to the chain must be authorized and differentiated under permission-based norms.

d) Immutability: The transaction cannot be changed after it has been recorded on the ledger. Other transactions must be used to reverse a mistake if it occurs. Now that the transaction has been logged, it should be easy to find. Consensus among chain participants creates a transaction log that blockchain maintains.

e) Enhanced Security: The system is further protected by the fact that each transaction is encrypted. A complex mathematical technique known as cryptography serves as a defense against cyberattacks. For each transaction, the SHA256 method is used to generate a unique hash value, which is fixed in length.

f) Relative User anonymity: As a general rule, on blockchain, just the user's digital address is exposed, obscuring their identities. The blockchain is a permanent record of every transaction that has ever taken place. The transaction's hash value can be seen by everyone, but the user's identity cannot be found.

2.3 Literature survey

In recent years, Blockchain, the technology behind the original Bitcoin crypto currency, has garnered great global attention. It not only disturbs innovation in the payment sector but also provides possible answers for other sectors requiring confidence-building due to its remarkable qualities of the distributed ledger, its trustless system and its immutability. E-voting is a case in hand in which the features of blockchain enable an election process that is open, fair and globally verifiable. We discuss the conditions in this article, and then present Votereum, a blockchain-friendly e-voting system. The solution suggested is enabled by the Ethereum platform, with one server running the whole system, and the other handling all queries connected to blockchain. Rinkeby's test network will also be implemented to assess the feasibility and debate some safety issues, as outlined at the conclusion of this article. We then review the criteria and then proposes Votereum, a blockchain technology electronic voting system. The suggested solution is supported by Ethereum platform; one server is responsible for handling the whole system and all blockchain queries [24].

Electronic votes or voting electronically implies that conventional paper ballots are carried out for the electoral process. In order to implement the e-voting process on a wider scale, the security and dependability of such a system must be addressed. Blockchain technology launched in 2008 by Satoshi Nakamoto in the use of Bitcoin's cryptographic currency opens up the possibility for designing and development in the election process of casting and counting votes of a secure, transparent and decentralized system without third-party access and control [25].

Ethereum Blockchain is a decentralized voting platform that uses block chain technology to overcome trust concerns. We are offering a new way to a decentralized vote platform. The system key characteristics include guaranteeing data integration and

openness, and guaranteeing that every poll with guaranteed anonymity is subject to a single vote by mobile phone number. The Ethereum Virtual Machine (EVM) is utilized as a running environment in Blockchain [26].

Blockchain can decrease one of the main sources of database manipulation by using blockchain in distribution of datasets on E-voting systems. We will use the AES method to encrypt data collected from the fingerprint sensor. This research addresses the collection of vote results from all locations with blockchain algorithms [27].

This paper assesses the potential of distributed ledger technologies, by describing a case study, namely by selecting and implementing a blockchain-based application that enhances safety and lowers hosting costs for a nationwide electronics program. It has used the concept of blockchain to secure the data transaction. It uses one block to store only one vote. It prevents duplicate voting. Authentication mechanism is also improved up to a great extent [28].

Author [27] presented a system using intelligent and multi agent system principles for ABVS, which merges e-voting with blockchain technology into an end-to-end and non-remote Internet-based voting application. Three steps of initiation, voting, and counting stages, and verification are included in the suggested system. The advantage of ABVS e-voting system's agent-based approach is to increase voting security. Author [29] presented a system using intelligent and multi agent system principles for ABVS, which merges e-voting with blockchain technology into an end-to-end, non-remote Internet-based voting application. Three steps of initiation, voting, and counting stages, and verification are included in the suggested system. The advantage of ABVS e-voting system's agent-based approach is to increase voting security.

The Author [30] suggested e-voting with the permitted blockchain technology dubbed Crypto-voting. Cryptovoting is implemented utilizing two connected blockchains. The first records voting and voting processes, the second the ballots and outcomes. The technology indicates that network consensus nodes are anonymised. Smart contracts perform voting procedures and outcomes. The suggested system optimizes the validation process effectiveness, the assignment of votes by candidates, the automatic administration of electoral lists, the security of the voting time outside the country, the integration of the voting secrecy process and the automatic and reliable method of ensuring the voting security. The Cloud's blockchain is protected by architectural concerns such as privacy tools.

The work in [31] focuses on reducing the delay induced by the distance between two electoral machines (wait times for results). The system's synchronization would have a performance problem if the whole country had a single blockchain. A tiered architecture is therefore created that spread chains throughout levels to reduce latency. Communication methods are regularly used to communicate the levels which will require time between levels, as the lower level consists of the node chain where people execute their votes and the higher level consists of a chain cluster that stores data from the lower level.

Researchers [32] presented a decentralized system for electronic vote via blockchain, the system is composed of three modules, and the usage of biometric information for user validation is hashed – Message-digest version 5 (MD5) user verification. Dynamic voting loads depend on the location and the voting location of the person. After voting, the voter should be issued an ID for recognition. The voting party is responsible for producing the eligible votes and paying the voting cost for the address of Bitcoin,

which is automatically established inside this backend, to the Election Authority(EA). The EA has its own bitcoin address and publishes the results. In order to create an ID to the candidate, the voter needs to register in the RA to establish an ID. The elector should register in the Registration Authority (RA). The voting expenses for Bitcoin's address to voters are zero after they vote, thus there is no possibility that a vote will be repeated more than once.

Researchers [33] have suggested a system where each user enters into the system with an ID and a fingerprint detection. Each transaction is covered by intelligent contracts enhancing confidence, firmness and simplicity in the system. Each node produces a private and a public key before the start of the voting process. Each node in the network is sent with a public key. Each node gathers votes from all voters, when an election takes held. When this procedure finishes, the nodes pause until a block is created (a vote is considered an individual block that is impossible to be tampered). A node will distribute the completed digital signature of the block to all nodes using block chain training turn rules to ensure that all nodes are in the block chain.

3 Blockchain based framework for e-voting system for Iraq

Figure 2, shows a blockchain based framework for E-voting in Iraq. This framework consists of voter registration, voter authentication, voting, smart contract, blockchain, vote data base and public key infrastructure as main components.

Voter registration is the first step in framework. Voter registers in e- voting system using their national identity number. Users' details are already stored in national identification data base. A biometric device will also be used to collect biometric details of voter. This will help in voter validation. Once voter validation is done, unique key is shared to voter. In Voter authentication, keys are matched. If authentication is fixed then the voter is allowed to cast vote. Authentication step increase security. It prevents unauthorized user to cast vote.

After proper authentication, voter casts vote. Each transaction is stored in smart contracts. Smart contracts also help in preventing in duplicate voting and voting more than once pr user. One block contains only one vote. Intelligent contracts are significant parts of codes, which can be incorporated and carried out as planned in each blockchain update phase. E-voting is another fashionable, yet essential, internet services issue. The smart contracts blockchain is a strong option for safer, cheaper, safer, transparent and easier-to-use e-voting systems. Ethereum and its network are one of the most suited because to its consistency, its broad use and the supply of intelligent contracts logic. E-voting systems must be safe since duplicated votes should not be allowed and visible while at the same time ensuring the privacy of the participants.

The continuously evolving idea of the blockchain, the backbone of the renowned Bitcoin crypto-currency, has unambiguously launched the new age in the Internet and online businesses. While most people primarily focused on bitcoin and other cryptocurrencies, many administrative and financial processes may now be transferred online safely as on-line services, due to the unavoidability of blockchain. Its intelligent contracts and numerous characteristics that overcome old methods make blockchain a strong tool.

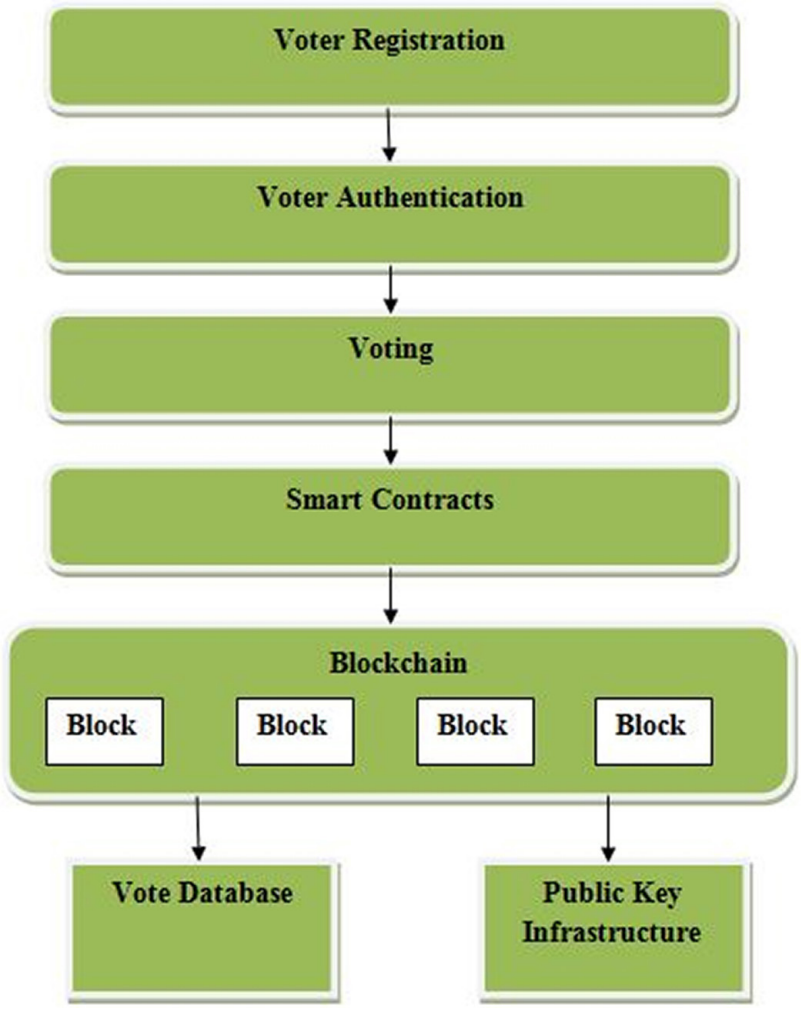

Fig. 2. BSEVI – block chain based secure framework for e-voting in Iraq

The blockchain is described as a developing, decentralized and distributed technology which promises to improve many elements of many businesses. Expanding e-voting to blockchain would be the answer to remove the problems of the current e-voting system. The vote is stored in voting database and a key is marked as used in the public key infrastructure. At the end of election, votes in database are counted and the result is declared.

4 Expected results

This proposed framework combines blockchain, smart contracts and etherum for e-voting. Voting casts following correct authentication. In intelligent contracts, every

transaction is kept. Intelligent contracts assist in avoiding more than once pr users in duplicating voting. There is just one vote in one block. Intelligent contracts are important elements of the programs that may be integrated in each blockchain upgrade phase and carried out as intended. This proposed framework provides security, facilitates voting, saves cost, reduces manpower, improves authentication, prevents duplicate voting, provides accurate counting of votes, and provides a transparent election procedure. This will also improve the voting percentage.

The access to the internet connectivity and the reach to electronic gadgets are required for voters. So, a country needs strong ICT infrastructure to achieve e-voting at national level.

5 Conclusion

Election is a basic democratic tool that offers an official mechanism for the people to express their opinions in order to form a government by democratic means. Electronic voting has evolved into the most significant application of e-governance and e-democracy. Few countries have recently taken the opportunity to test and use electronic voting systems. Many countries expect that internet voting will become a reality during the next decade. This paper has presented a secure blockchain based framework for electronic voting in Iraq. The smart contract blockchain is a strong option for safer, cheaper, safer, transparent and easier-to-use e-voting systems. Ethereum and its network are one of the most suited because to its consistency, broad use and provision of intelligent contracts logic. This suggested architecture provides security and convenience for voters, cost savings, less personnel, enhanced authentication and an elimination of duplicate voting. It also ensures correct vote counting, and provides a transparent election system. This will also result in a higher vote percentage.

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