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Decentralized Voting System Using Ethereum Blockchain

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ABSTRACT

Electronic voting, or e-voting, offers fundamental advantages over paper-based systems, including increased efficiencyand reduced errors. The electronic voting system aims to boost user participation by enabling individuals to cast their votes from any location using any device with an internet connection. Blockchain, an emerging decentralized technology with robust cryptographic foundations, holds the potential to enhance various industries. Integrating blockchain technology into e-voting systems could address current concerns and challenges, providing a promising solution for improvement. This paper proposes a blockchain-based voting system designed to mitigate voting fraud, simplify the voting process, and ensure security and efficiency through face recognition. The lack of adequate transparency in many voting systems presents a significant challenge to building trust among voters, making it difficult for the government to secure their confidence. The failure of traditional and current digital voting systems lies in their susceptibility to exploitation. To address this, the paper suggests a framework employing effective hashing techniques to ensure data security. The concept of block creation and sealing is introduced, emphasizing the implementation of hashing algorithms. The proposed framework discusses the effectiveness of the polling process, detailing the implementation of an adjustable blockchain method involving utility establishment, contract formation, block creation and sealing, data accumulation, and results declaration. This approach ensures a dynamic and flexible application of blockchain technology.

Key Words*: Blockchain, E-Voting, Smart Contract, Face Regconition.*

I. INTRODUCTION

Blockchain can facilitate the implementation of a system that is immutable, transparent, and efficient, resistant to hacking attempts. The inability to alter or erase information from blocks makes blockchain the most effective technology for voting systems.

Blockchain technology is supported by a distributed network comprising various interconnected nodes. Each node maintains its copy of the distributed ledger, containing the complete history of all transactions processed by the network. There is no centralized system controlling the network. If the majority of nodes reach a consensus, they validate a transaction. This decentralized nature allows users to maintainanonymity. A fundamental analysis of blockchain technology, including smart contracts, suggests that itprovides a suitable foundation for e-voting and has thepotential to make electronic voting more acceptable and reliable.

1.1 Literature Survey

Extensive research preceded the initiation of our project, involving a thorough examination of numerous research papers featured in various publications. While conducting an in-depth literature review, several key terms and concepts emerged from our references, providing valuable insights into the subject matter.

The Open vote network proposed by Uzma Jafar [4] was the first release of a self-counting internet protocol that granted security and privacy through Ethereum. Open Vote Network supported a small voting size of 50–60, a choice by design but still failed to stop miners from illegal activities on the system. Hsueh C.W [6] presented a decentralized and ingenuous electronic voting protocol.The voting system (Date) required a minimum degree of confidence between candidates. The date provided the ability to do large-scale electronic elections, which OVN lacked. Regrettably, this proposed system was also functional enough to provide security from DoS attacks because the authority needed for auditing the vote after the election wasn't available. While using Ring Signature, which keeps users' privacy, it was hard to coordinate several signers**.** Shahzad et al. [9] presented a reliable blockchain-based voting protocol. On a minor scale, it promised to solve anonymity, security, and privacy problems in blockchain systems. [13]However, this protocol wasn't problem-free; this paper used a mathematically complex and resource-demanding algorithm. It needs a vast supply of energy to process.Another issue arises from the involvement of third parties because there is a risk of fraudulent activity and data leaks. Shiyao Gao [3] proposed an auditable blockchain- based voting technology. They also modified the algorithm method to make it resistant to DoS attacks. It notonly accepts the anonymity of the voter, but it also helps the audit process. However, the proposition analysis demonstrates that if voting is small scaled, privacy and efficiency gains for election are considerable. Depending on the size, some efficiency is sacrificed to give higher privacy. Haibo Yi [11] proposed a Blockchain-based Voting Scheme that employed blockchain technology to increase voting security in a peer network. A technology placed on distributed ledger technology can be used to prevent vote manipulation. Protocol was developed and tested on a peer network using Linux computers.[14] Thistechnology makes the involvement of external parties necessary and is unsuitable for centralized use in a systemwith various agents. With this system using a distributed technology, securing multi-functional computers can prevent the issue. If the calculation is complex and there are too many voters, compute expenses become significant, if not prohibitive. Khan, K.M. [5] proposed a blockchain-based electronic voting protocol. Their experiments also provide fascinating insights into how specific characteristics, such as interactions between various parameters and security and performance indicators within an organization, affect the system's overall scale value and reliability. [12]It became clear. According to the author's proposal, the election operation needs the implementation of unique and hash- able addresses for voters and candidates. Voters use these addresses to vote for candidates. However, severe drawbacks of this model were revealed. Kohonen Ref. [7] is one of the early pioneers of the most famous face recognition system, which employed a simple neural net using network of Eigenfaces by approximating eigenvectors through face images autocorrelation matrix. Although, the method was not very successful to be practically implemented in a real-life environment due to associated high demand for normalization and positioningwhen run in a large database with many types of faceconditions. In harnessing and improving the work of Kohonen, Kirby and Sirovich in 1990 as in Ref. [10], directly calculated the Eigenfaces using algebraic manipulation with fewer than 100 faces to implement facial recognition, which was further improved by Turk and Pentland in 1991 as in Ref. [8] by determining the exactlocation and scales of faces and also the use of coding residual error originated from Eigenfaces, but in a minimally constrained environment. [2], authors have implemented face recognition based on convolutional neural network which consist of three convolutional layers, two pooling layers, two fully connected layers and one regression layer. For training and feature extraction Stochastic gradient decent algorithm is used. In [1], authors have proposed the face recognition system using improved CNN with the development of computer vision and artificial intelligence. Author have tested the model for activation function accuracy, dropout layer accuracy and overall system accuracy

II. BLOCKCHAIN FOR E-VOTING

Blockchain is currently a growing trend across various industries, encompassing a significant segment of businesses. The distinctive feature of a blockchain network is its dynamic data set, continually updated across all nodes within the network. The three core components of a blockchain are segregation, transparency,and consistency.

The term "Blockchain" originated from its structure, combining blocks and chains to form a complete transaction ledger. It employs cryptographic strategies, and each block is linked above the preceding one. Functioning as a decentralized database, Blockchain is managed by a peer-to-peer network for storing and accessing information. Every block includes a block header with a hash title, timestamp, nonce, and Merkle root value, ensuring the immutability of health information posted inthe forum.

A key purpose of Blockchain is to prevent tampering, serving as a secure and standard transaction record. It enables information transfer among select parties without involving third parties, enhancing security. Instead of relying on a single server, Blockchain stores data on various computers, making it challenging to alter or delete.The well-designed cryptographic features surrounding theprocess ensure the importance of any data embedded in the blockchain, fostering trust among participants.

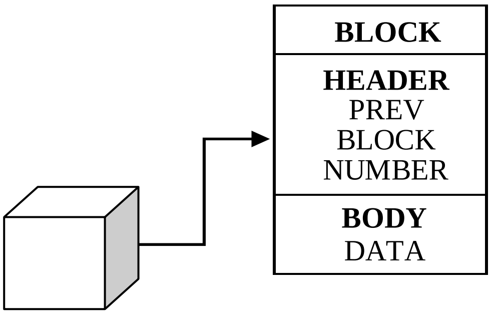


Fig 1. A Block in block chain

2.1 Properties of Blockchain

The fundamental properties of blockchain include distribution, transparency, consistency, independence, open source, anonymity, and reliability.

a. Blockchain serves as a structured data system, encompassing a list of functions organized into blocks. It commences with an initial block known as the first block, and with each subsequent transaction, additionalblocks are appended. Each new block is linked to the preceding one, creating a connected chain of information. The design of a blockchain is typically deliberate and uncluttered.

b. Decentralized: A shared organizational framework is indicative of a fragmented approach, representing a key aspect of robust blockchain development. This structure allows anyone to store and subsequently access applications through the web independently, eliminating the need for external support. It facilitates the secure exchange of various assets, includingsecurities, records, contracts, and computer assets. Users can access these exchanges in the future with theassistance of a secret key.

C. Consistency: Consistency in a blockchain frameworkrefers to the way it allows and trusts transactionsbefore adding them to the chain. If any transaction violates the agreed-upon terms, it is consideredinvalid. The blocks in the chain are then propagated toa permission-based network, which may involve a license or authorization process. The community agreement specifies that anyone can attempt tovalidate transactions and participate in the consensus.In license-based networks, nodes need authorization and monitoring to contribute to or facilitate transactions on the chain.

III. E-VOTING USING BLOCK CHAIN

Blockchain is emerging as a crucial innovation, finding applications across various domains. While distributed applications, such as text sharing, have been present since the inception of the internet, their application in secure and consistent transactions gained prominence around 2008, notably with the advent of Bitcoin. The awareness of the advantages offered by blockchain technology has since grown among individuals and organizations.

A particularly noteworthy application of blockchain is in the realm of e-voting. As technology progresses, email voting is poised to become a standard practice. Electronic voting hasthe potential to enhance the electoral process by making it faster, more straightforward, and cost-effective. Additionally, it can increase voter turnout and support compulsory voter participation systems. Security is a paramount concern in electronic voting, and blockchain technology, with its distributed environment, provides an ideal solution by preventing interference with votes.

In conclusion, the increasing awareness of blockchain's benefits has led to its adoption in various sectors, with e- voting standing out as a promising application. Electronic voting, facilitated by blockchain, not only streamlines the electoral process but also addresses security concerns, ensuring the integrity of the voting system.

The main advantages of a blockchain voting system are:

I. Transparency

II. Security

III. Anonymity

IV. Processing time

3.1 Architecture of project

The project's actual architecture involves the admin creating a voting instance by deploying the system on a blockchain network (EVM). Subsequently, the admin establishes an election instance, providing details such as candidate information. Likely voters connect to the same blockchain network to register, and upon successful registration, their details are sent to the admin's panel for verification. The admin verifies the registration information, including blockchain account address, name, phone number, and facial match. If the information is valid and matches the records, the admin approves the user, allowing them to participate and cast their vote in the election. Once approved, registered users cast their votes for their preferred candidates on the voting page. The admin concludes the election after a certain period, depending on the election's scale. This action closes the voting, and the results are displayed, announcing the winner at the top of the results page. The working process of the project is outlined in this architectural description, with attached screenshots of the website for clarity.

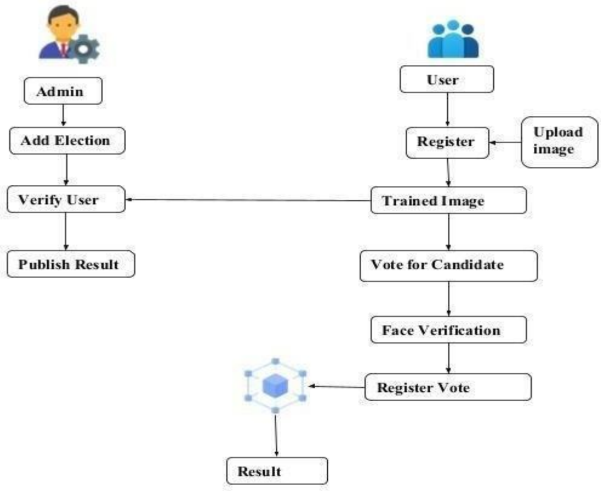


Fig 2. Architecture of voting system

IV. METHODOLOGY

In developing a blockchain-enabled electronic democratic framework, we assess existing and previous e-voting systems, considering various processes such as defining roles, evaluating structures, addressing security and legal concerns. Throughout this paper, the system designed is referred to as EVOTE.

EVOTE aims to provide a real-time online application for voting, applicable to selections of any scale. It is designed to accommodate voting processes in organizations, villages, suburbs, and national elections. The application is intentionally kept simple to ensure compatibility with older systems in villages.

In our electoral system, we define the election as a smart contract, making it an agreement among participating nodes. This smart contract encompasses the definition of each role participant, the election process, and the terms and conditions during the election. Each participant must be designated a specific role, and individuals may hold the same or different roles depending on their involvement in the election process. This streamlined approach ensures clarity and efficiency in the electoral system powered by blockchain technology.

a) Administrators

Administrators are responsible for overseeing all election operations. They perform essential tasks such as ensuring the validity of the election, managing the closure of the selection period, overseeing the calculation process, and facilitating the disclosure of results .

b) Voters

A voter, the primary participant in an election, casts a voteafter verifying eligibility through self-certification. They canupload their election votes, vote, and confirm their choice.

c) Constituency Nodes

Administrators enhance the election process by employing smart contracts with designated constituency nodes for each region. These nodes authenticate voters through smart contracts. Once a voter is verified by all constituencynodes, their vote is processed and added to the blockchain.

4.1 Election as a smart contract

In our political decision framework, we define an election as a smart contract. In our organization, the election represents the agreement among participating nodes. The smart contract, when defined, includes specifying the rolesof each participant, the election process, and the terms andconditions governing the entire electoral procedure.

4.2 Election Process with Face recognition

In a voting system, CNNs (Convolutional Neural Networks) offer advancements in security and efficiency. Employing image recognition capabilities, CNNs can authenticate voter identities, reducing fraudulent registrations and enhancing overall security. Moreover, CNNs can analysis ballots, ensuring readability and authenticity, thereby streamlining the vote-counting process and minimizing errors. By integrating CNN technology, voting systems canattain higher reliability, transparency, and resistance to manipulation, thus fostering trust among voters and safeguarding the integrity of democratic processes. The application of CNNs in voting systems not only enhances accuracy but also reinforces the democratic principles of fairness and inclusivity in electoral processes.

V. SCREENSHOTS:

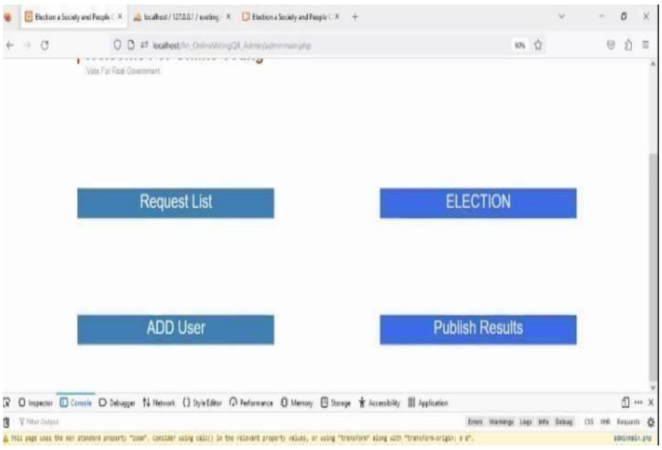


Fig.3. Admin view of the platform

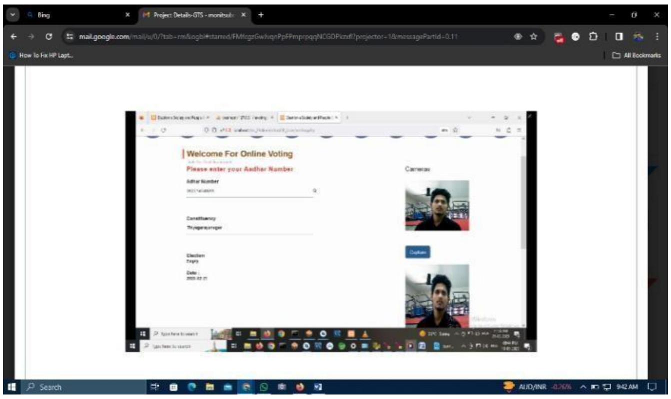


Fig.4. Face Recognition Process

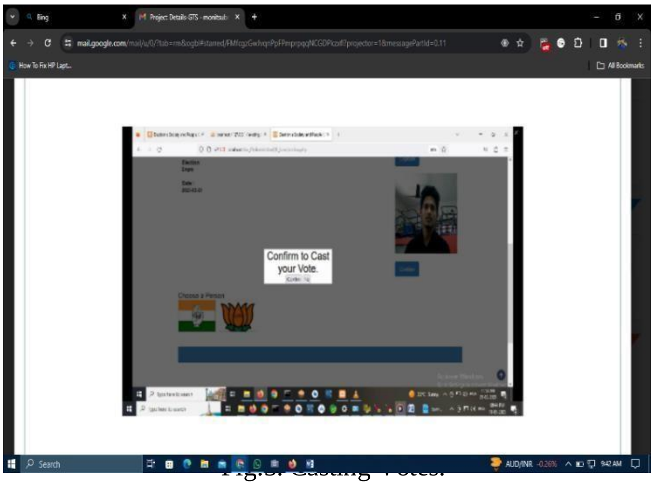
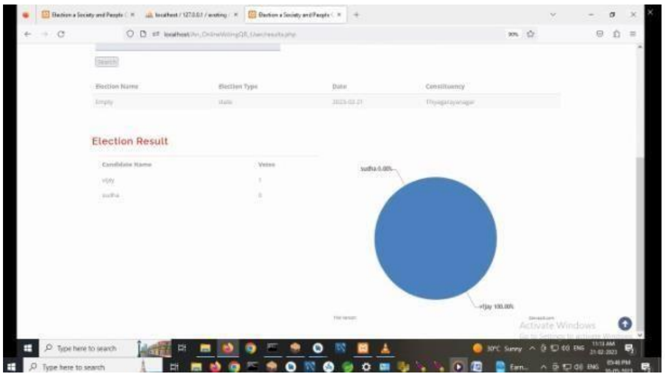


Fig.5. Casting Votes.


Election Name | Election Type | Date | Constituency
Empty | state | 2023-02-21 | Thyagarayanagar

Election Result

Candidate Name	Votes
vijay	1
sudha	0

Fig.6. Result Publishing

VI. RESULT

The findings presented in Fig. 5 highlight the potential of blockchain technology in facilitating remote voting processes. Our study delves into the integration of blockchain technology within a transparent voting system's smart contract. The existing blockchain-based voting system operates through three distinct phases: authentication, voting, and tallying. These phases allow for simultaneous authentication and voting by multiple users, followed by the tallying phase after the completionof voting. In our proposed system, the authenticationphase remains predefined, while the voting and result phases run concurrently. This modification enables the proposed system to uphold the core principle of openly displaying real-time results to all voters, empoweringthem to select their desired leaders.

VII. CONCLUSION

Our proposed blockchain-based voting system aims to establish trust between the government and voters by ensuring the safety of voting integrity. This approach enhances transparency and trustworthiness in the voting process. Our solution allows voters to cast their votessecurely over the internet, eliminating the need to visit a voting booth. Advanced registration prevents proxy voting and double voting. The system is fast, highly secure, easily maintains all voting information, and is efficient and flexible, resulting in a significant increase in voting percentages. Implementing online voting has the potential to minimize or eliminate human errors. It offers reliability, handles multiple modalities, and provides scalability for large elections. Online voting is particularly beneficial as itdoes not require geographical proximity, enablingparticipation from individuals such as soldiers stationed abroad.

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