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E-Voting System Using Blockchain

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Abstract: *Electronic voting, or e-voting, has been around since the 1970s and is better than paper-based systems because it's faster and has fewer mistakes. But there are still problems, especially making sure it's reliable. Blockchain is a new technology that could help with this. This paper talks about using blockchain to make e-voting better. It explains how blockchain can make e-voting fairer and more reliable by using things like cryptography and transparency. The paper also describes a specific e-voting scheme using blockchain and how it's been tested. Overall, it shows that using blockchain can make e-voting trustworthy and easy to check.*

Keywords: electronic voting, e-voting, blockchain, reliability, cryptography, transparency, resilience, efficiency, verification

I. INTRODUCTION

Fair elections are important not only for democracy, but also for ensuring voter participation and accountability. The votingprocess plays a key role in this, and electronic voting technology has the potential to increase voter participation, confidence and satisfaction with the election. Elections have long been an issue of concern to society, as they are the primary way for citizens to express their will through the election of political and administrative representatives. The effectiveness of this process largely depends on people's trust in it. At the same time, traditional voting systems preserve confidentiality and simplicity, increasing trust in the democratic process. . These include high transportation costs, limited access to remote areas and people with disabilities, risk of corruption and human error, and general inefficiency. In addition, global events such as the COVID-19 pandemic have further highlighted the limitations of traditional elections, resulting in decreased voter turnout and questioning the integrity, fairness, andeffectiveness of the system. Trust has evolved and become deeply embedded in the digital world. Blockchain technology has emerged as a revolutionary force that can solve many shortcomings of voting and electronic systems. Blockchain provides a clear, transparent and secure solution that increases the integrity, security and transparency of the election process. The technology enables the management of transactions (one repeated across many nodes) ensuring data integrity and reliability. Case studies on the implementationof blockchain-based electronic voting system. Morocco's current paper system requires voters to go to the polls, identify themselves and relyon a voting process that is lengthy, expensive and prone to human error. The introduction of blockchain-based systems can solve these problems by enabling remote voting, thereby increasing accessibility and reducing logistics costs. A faster and easier way to vote. However, current electronic voting systems are often opaque and vulnerable to cyber attacks, centralized control and regulation. Blockchaintechnology, with its decentralization and cryptographic security, can mitigate these risks and provide a more transparent and transparent voting process. capacity. The main question guiding our research is: Does a blockchain-based electronic voting system increase the integrity, security and transparency of Moroccanelections? This research is very important because it is related to the basic principles of democracy and aims to develop and strengthen voters. important issues such as efficiency and final results. Our research aims to fill these gaps by using the unique features of blockchain technology to provide anonymity, integrity,accuracy and evidence in voting. Solana blockchain is known for its speed, scalability, and security, adding a layer of efficiency and innovation to our process.

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II. PROBLEM STATEMENT

Developing a User-friendly Blockchain-based E-voting Application for Transparent and Private Voting.This problem statement targets the creation of an intuitive and accessible e-voting application that employs blockchain technology to guarantee voter privacy, transparency in the voting process, and ease of use for the general public.

III. LITERATURE SURVEY

Blockchain Technology:

Blockchain isnamed for its structure, which comprises a chain of interconnected blocks. Each node in this network holds a copy of a distributed ledger containing the entire history of transactions. Data is added to a block through a process known as mining, and each block includes ahash of the preceding block, forming a continuous chain that starts with the genesis block. This structure is similar to a linked list. Blockchain is immutable, meaning that data can be appended but not deleted or altered.

Blockchains can be public, where anyone can read or write data, or private (permissioned), where only authorized individuals can perform these actions.

Existing E-Voting Systems and Enhancements with Blockchain.

Since 2005,Estonia has been utilizing an electronic voting(I-voting) system. This system is based on anational ID card issued to all citizens, whichserves as an encrypted file for uniqueidentification and various services. To vote, a citizen must insert their ID card into a reader, granting them access to the voting website. Voter eligibility is verified upon entering thenecessary credentials. Votes can be cast andmodified until four days before election day. Votes are then forwarded to a storage server,encrypted, and stored until the end of the onlinevoting period. The votes are later transferred to a vote-counting server via DVDs, decrypted, andcounted to produce election results. However, this system is susceptible to client-side attacks and server malware, raising security concerns due to the centralized authority and database. Translating this process to a blockchain networkcan enhance reliability and address manipulation concerns. A proposed system involves two blockchains: the vote blockchain and the voter blockchain. During registration, a voter's detailsare recorded as a transaction on the voterblockchain, and they receive a vote token.Voters are authenticated using three pieces ofevidence: an identification number, a registration-generated password, and a ballotpaper. Once authenticated, a new transaction iscreated on the voter blockchain, indicating theuser's right to vote. Upon voting, this transactionis removed from the blockchain.

A three-tier architecture is proposed for scalability: National, Constituency, and Local. Local tiers consist of polling stations linked to a constituency node, which in turn is connected to the national nodes responsible for mining transactions. Votes are encrypted using public and private keys, and constituency nodes generate distinct key pairs. The public key is used by polling stations to encrypt votes, which are then propagated across the network. This design enhances security by isolating encrypted data, ensuring that compromising a single key only affects votes from a specific constituency.

Requirements

The key features and requirements ofblockchain-based e-voting systems include:

- Public Verifiability: All stakeholders canverify the entire election process and results.
- Individual Verifiability :Each voter canconfirm that their vote is accurately recorded.
- Dependability and Reliability : Utilizing asymmetric-key cryptography and blockchain mechanisms to protect against attacks. Digital signatures validate votes, ensuring only legitimate votes are added to the blockchain.
- Consistency : Through consensusmechanisms, all nodes hold the same copy of theblockchain, reflecting the same final result post- election.
- Auditability: The entire process can be auditedif necessary.
- Anonymity: Ensures voter privacy with no linkbetween voters and their votes, achieved throughcryptography and zero-knowledge proofs.
- Transparency: The process is open to public scrutiny while maintaining security.

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- Scalability: Digital signatures like short- linkable ring signatures support a large number of voters.
- Eligibility: Ensures only eligible individualscan vote.
- Authentication: Voters are authenticated using a unique voter ID and other credentials.
- Fairness: Results are not live-streamed; votes are counted post-election to prevent centralized control.

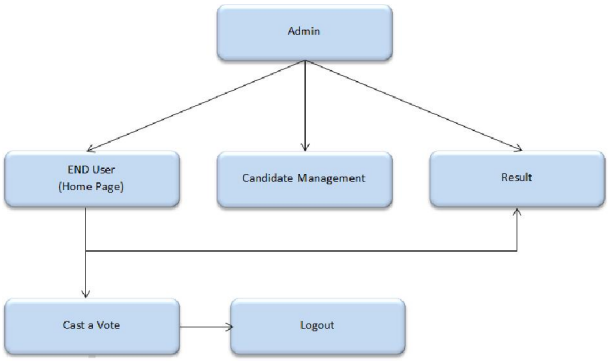
Blockchain Methodology for E-VotingSystems

A blockchain-based e-voting system typicallyinvolves:

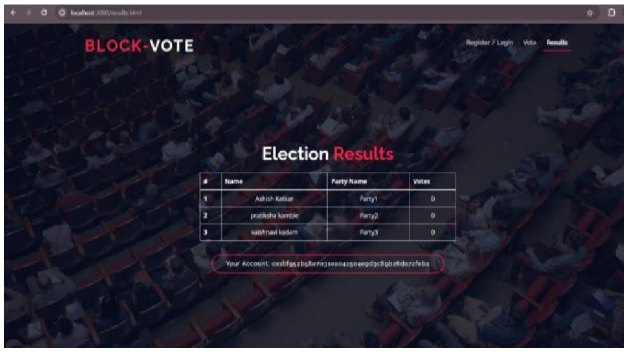
- Smart Contract Admin
- Voting Process Admin/ AuthorizationOrganization
- Smart Contract
- Voters

These entities collaborate to ensure a secure, transparent, and efficient voting process. Blockchain technology can revolutionize voting systems by addressing the limitations of traditional and current electronic voting methods, ultimately enhancing democratic practices.

IV. DESIGN & IMPLEMENTION



Diagram



Implementation

V. FUTURE SCOPE

The future scope of E-Voting systems using blockchain technology is highly promising. Blockchain ensures transparency, immutability, and security, reducing fraud and enhancing votertrust. Future advancements may integrate zero- knowledge proofs for privacy, scalable consensus algorithms like sharding for handling large electorates, and decentralized identity (DID) systems for secure voter authentication. Additionally, smart contracts can automate vote tallying and results publication. The integration with quantum-resistant cryptography will further secure E-Voting against future threats. These innovations will lead to more robust, scalable, and secure electoral processes globally, transforming democratic participation in the digital age.

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VI. CONCLUSION

Using blockchain for e-voting is a really promising idea. It solves a lot of problems with traditional voting systems by making sure they're secure, reliable, and private. When we design e-voting systems with blockchain, we canmake sure that everyone can check that theirvote was counted correctly. This technology alsohelps with things like making sure only eligible people can vote and keeping everything fair. Thebest way to implement this is with a framework called Hyperledger Sawtooth, which can handle lots of votes quickly and efficiently. We stillneed to do more research on using frameworks like this for real-world voting, especially for big elections. But this research shows that blockchain can make voting better and could even be used in other important areas like finance and supply chains.

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