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Mobile Voting Framework Using Blockchain Technology and Multi-Factor Authentication

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Abstract: Decentralized Voting System Using Ethereum Blockchain Proposes Open, Tamper-proof, and Secure A blockchain-based election platform that does away with fraud and provides anonymity for the voter. The system features by integrating safe voter authentication with JWT and utilizing Ethereum's decentralized architecture. A simple user interface would allow voters to vote by remote control while a reliable alternative to the existing voting mechanism An admin panel facilitates election management. The project demonstrates the capabilities of blockchain in revolutionizing the voting Process with transparency, security, and efficiency.

Keywords: Blockchain, M-Voting, Mobile Devices, Multi-factor authentication, Voting.

I. INTRODUCTION

1) The integrity of elections is crucial for democratic governance. Traditional voting methods often face challenges such as tampering, fraud, and lack of transparency. Blockchain technology offers a decentralized, secure, and immutable alternative for voting systems. This project aims to develop a Decentralized Voting System using Ethereum Blockchain to address these issues. By leveraging blockchain's transparency and cryptographic security, the system ensures tamper-proof election processes. Features like JWT-based voter authentication and a user- friendly interface make the system accessible and secure for both voters and administrators.

2) One of the most problematic phases in m-voting is the managing of the votes which is the process of ensuring that casted votes cannot be altered or tampered with while also ensuring transparency in order to provide assurance not only to the citizens but the Election Management Body (EMB) as well. A centralized database was utilized to store the votes but is susceptible to DDoS attacks and since its being managed by an administrator, the stored votes could be changed by the admin or by a malicious insider. Blockchain technology which is a distributed ledger that manages an ever-increasing list of records protected from any form of revision or tampering was proposed as a means to mitigate these issues. It is de-centralized so as to avoid a single point of failure with the group working together to confirm legitimate new transactions. The blockchain serves as a public ledger of transactions which cannot be reversed. Deleting or changing data in a blockchain is computationally improbable. Since mobile devices don't have enough resources to be a miner/node on the blockchain network, another means was needed for mobile devices to be able to send their transaction or votes to the blockchain pool to be stored.

3) Authentication is the process of proving who you claim to be which usually requires a mechanism for identification that can verify one's identity prior to granting them access and some of this includes PIN, Password, Smart Card, Security Tokens, etc. One major issue noted was that previous m-voting techniques made use of a centralized database that tends to be susceptible to DDoS attacks and tampering by a malicious insider or the admins themselves. Blockchain technology was proposed as a means to mitigate this issue but was being used with the concept of bitcoin in mind which was a lot more tasking on the mobile devices due to the fact that they do not have enough computing resources to support it and would also require a very powerful system(s) to run the nodes of the blockchain. In order to combat this, cloud computing was introduced which offers beneficial services

4) One such service is Blockchain as a Service (BaaS) which enabled clients to create, host and utilize their own blockchain applications on the cloud-based infrastructure while the cloud service provider deals with all the essential undertakings to keep the infrastructure active and operational. The use of these resources would seem very expensive but cloud computing offers a PAY-AS-YOU-GO or pay-as-you-use which is a payment method that charges dependent on utilization, diminishing the expense of setting up the blockchain infrastructure. A blockchain database makes use of blockchain technology to build a permanent record that could contain any data such as time/date, ownership, and transaction details which are permanently stored in the record.

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A. What IS Mobile Voting Framework Using Blockchain Technology and Multi-Factor Authentication

An extremely secure mobile voting framework, which is built on blockchain technology and Multi-Factor Authentication, MFA. This is an open, user-friendly framework designed to facilitate electronic voting by mobile devices.

The mobile voting framework with blockchain and multifactor authentication will ensure secured, transparent, and accessible elections. 1. Blockchain Technology i. Suggests that the votes are not tamperable. ii. Provides transparency with a distributed ledger, enabling real-time verification of votes. iii. Builds confidence since the storage of data in nodes deconcentrates it. 2. Multi-Factor Authentication (MFA): i. Voters' identity verification by having various layers, which include ii. Password/PIN (something you know). iii. Biometric verification (something you are). iv. Something you have- Device verification. v. Guards against unauthorized access to the voting system. This combination offers a secure, transparent, and user-friendly mobile voting system, eliminating fraud and ensuring voter self-assurance.

II. LITERATURE SURVEY

1) Blockchain-Based E-Voting System: A Secure Framework [J. K. Roy & A. Gupta, International Journal of Cryptography and Security, 2020], This study introduces a blockchain-based e-voting system in order to improve the transparency and security of an election. That defined the immutability and auditability is devoid of two-factor real-time, fully-integrated solutions for addressing the problem of scaling. Mechanisms.
2) Securing E-Voting via Implementation of 2FA and Blockchain [P. S. Nair & R. K. Menon, Journal of Emerging Technology and Innovation, 2021] Two-factor authentication is under research by employing a blockchain as a tool for access restriction and voter identity validator. The implementation aspect is not discussed and did not subject to performance evaluation for large-scale election scenarios.
3) Distributed Ledger in E-Voting: Challenges and Opportunities [A. B. Patel & M. S. Reddy, Blockchain Technology Journal, 2022] This is the ability that a DLT will build security as well as anonymity in the conduction of an election. Voters. Determines the possibility of general acceptance. It never bothered concerning usability by the ordinary citizen or cost factor of including such a blockchain-based system in the implementation at scale.

III. METHODS AND MATERIALS

A. System Architecture

1) Frontend

Developed using React.js for interactive user interface. The voter can register, get verified, and cast votes.

Backend: Using Fast API to manage API endpoints.

Node.js for the server-side logic and integration with Ethereum.

2) Smart Contracts

Written in Solidity to define the election process, candidate registration, and vote counting. It is deployed on the Ethereum blockchain.

Database: MySQL for non-sensitive data like voter profiles and candidate information. Authentication is considered for secure voter login and session management.

Blockchain: Ethereum blockchain to maintain unforgeable ballots.

MetaMask wallet integration for the users to interact with the blockchain.

Voter Registration: Users sign up with personal information, authenticated with JWT.

3) Candidate Management:

Admins invite candidates through the administrative panel.

Voting: Voters authenticate, view candidate information, and cast votes. The vote is then recorded on the Ethereum ledger.

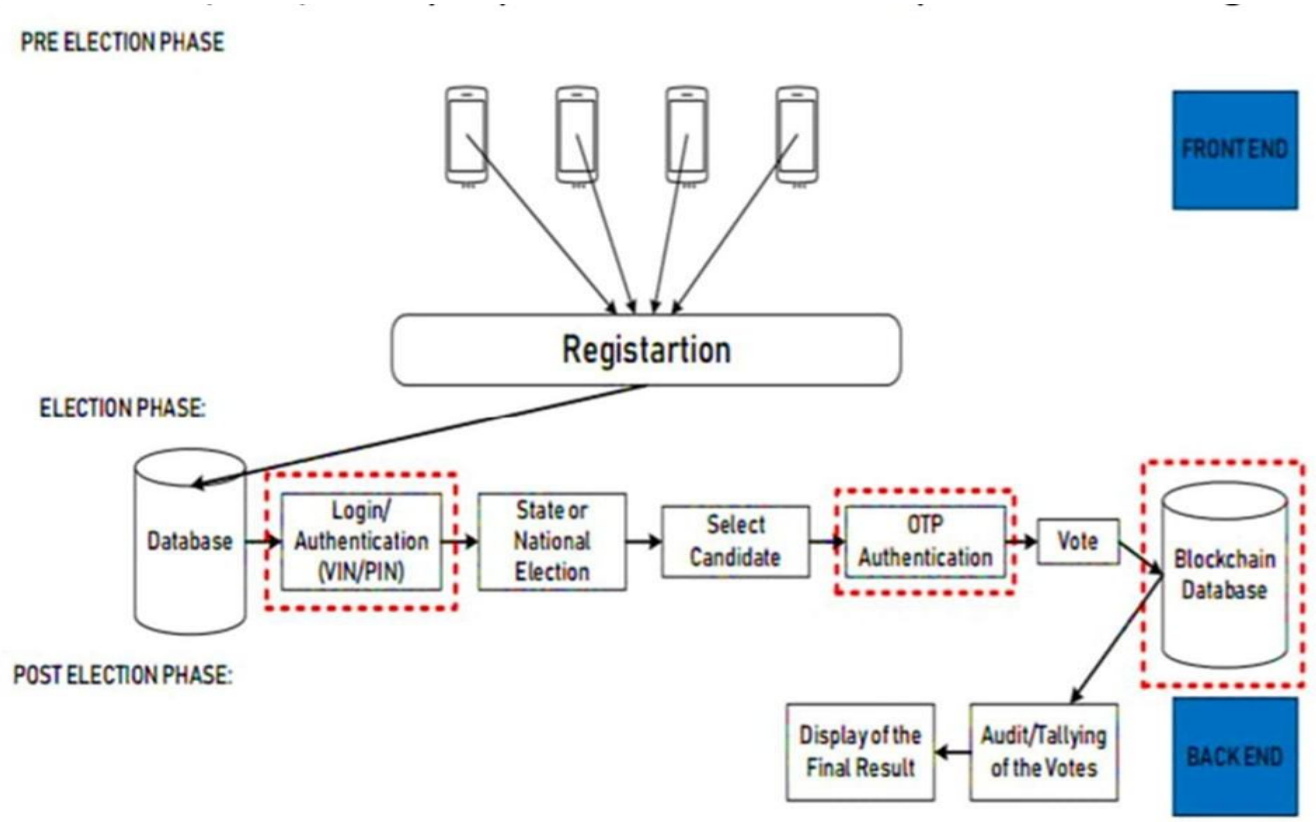
Result Compilation: Smart contract automatically calculates the results and displays them on the admin panel. Tools & Technologies:

Frontend: React.js

Backend: Fast API, Node.js Blockchain: Ethereum, MetaMask Database: MySQL

Programming Languages: Python, JavaScript Flowchart

Flow Chart



IV. OUTCOME

The implemented system provides:

An anonymous vote system from electorates via a secure platform. Tamper-proof voting record using Ethereum in transparency. Blockchain.

A user-friendly administration interface to manage the candidate and follow the results. Real-time voting status is available through the blockchain.

System testing checks

1) Effective voter verification.

2) Non-alterable voter registration.

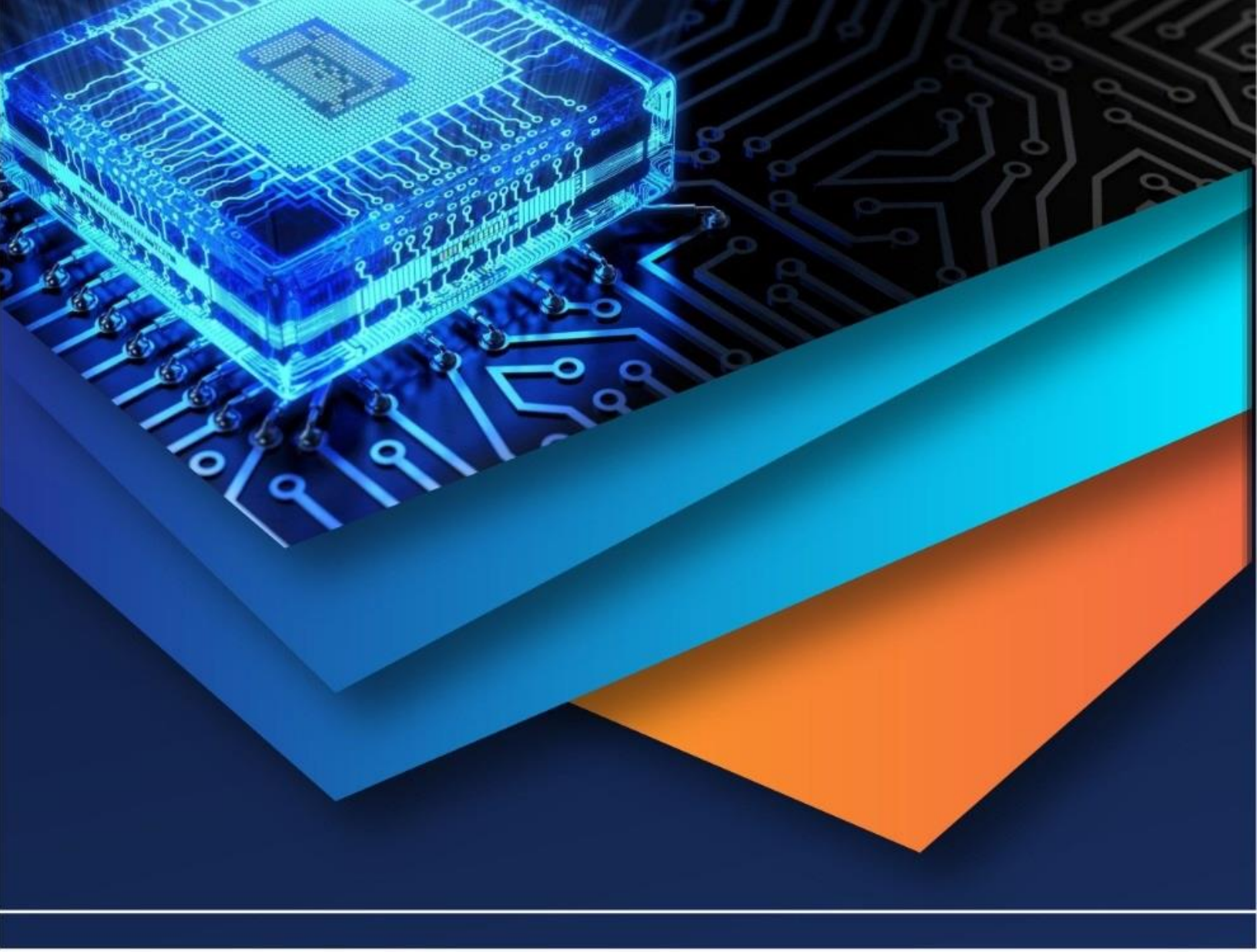
3) The result compilation is accurate and transparent.

V. CONCLUSION

Decentralized Voting System using Ethereum Blockchain: The key to conducting safe and transparent elections. Combining blockchain technology with strong authentication and authorization, the system addresses other challenges like tampering and lack of trust in traditional voting methods. This project shows the possibilities' blockchain can bring about a revolution in the electoral. This makes the process safer, more transparent, and accessible.

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