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InterVoteNet: Voting system using Blockchain

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Abstract: Voters have always viewed voting outcomes differently and with suspicion in centralized environments. The majority of electronic voting systems currently in use rely on centralized servers, which requires voters to trust the organizing body to guarantee the accuracy of the results. In order to address the trust difficulties, we present a novel strategy this article examines a novel voting platform utilizing blockchain technology, aimed at guaranteeing fairness and security without relying on centralized authorities for trust. This system's primary characteristics include ensuring data transparency and integrity, restricting voting to one vote per cell phone number per poll, and preserving voter anonymity. To achieve this, organizers of each voting event will deploy transparent, consistent, and deterministic smart contracts on the Ethereum Virtual Machine (EVM), which acts as the runtime environment for the Blockchain.

Index Terms **- Blockchain, Voting, Authentication, Ethereum, Solidity, Elections, Smart Contract, Security.**

I. INTRODUCTION

In modern societies, essential for ensuring public trust fundamental pillars of democracy. Voting as a cornerstone of democratic societies, enabling citizens to influence government and policy decisions. However, traditional voting systems face numerous technical challenges that compromise their integrity and effectiveness. First, these systems are vulnerable to fraud and manipulation, including ballot tampering and vote rigging, which undermine the trust in election outcomes. Additionally, the lack of transparency in vote counting and result verification makes it difficult to independently audit and verify election results. Security vulnerabilities are a significant concern especially in electronic voting systems susceptible to hacking and unauthorized access [1]. Moreover, administrative inefficiencies due to manual processes increase the likelihood of human errors and delay result tabulation. Scalability is another issue, as traditional systems struggle to efficiently handle large voter populations and complex election logistics. Furthermore, ensuring voter anonymity while maintaining a secure audit trail presents a significant technical challenge. Lastly, existing systems often fail to provide a seamless and accessible user experience, deterring voter participation and engagement [2]. These challenges have spurred the search for innovative solutions that can improve the security, efficiency, and reliability of elections.The rise of blockchain technology has generated significant interest in its potential uses in various domains, including e-voting systems. Blockchain, as a decentralized and immutable ledger, offers the promise of revolutionizing the way elections are achieved through transparency and immutable record of voting transactions [1-4]. By leveraging smart contracts on blockchain networks such as Ethereum, it becomes possible to design e-voting systems that ensure the integrity and anonymity of votes while mitigating associated risks, traditional centralized voting systems. This emerging technology ensures immutability of vote records, provides end-to-end transparency, enhances voter anonymity, reduces the risk of fraud and manipulation.

II. BLOCKCHAIN TECHNOLOGY AND ETHEREUM

The public, decentralized database with duplicates distributed across multiple nodes simultaneously is known as a blockchain. The ledger of transactions is not managed or maintained by a single authority in Blockchain. The legitimacy of the record's form is laid out through an agreement instrument among the approving hubs. The secure validation of the data integrity of a transaction is made possible by the use of Blockchain technology [3-4]. Conversely, the Ethereum Blockchain is a distributed, decentralized, an open-source computing framework that executes programs known as smart contracts. It is created to empower decentralization for applications, extending beyond just digital currency [6]. Using a Turing-complete scripting language and a virtual machine, the Ethereum Virtual Machine (EVM), it is accomplished. EVM is in some ways comparable to a versatile computing platform that mimics the functionalities of a Turing machine, within contrast to Bitcoin, which only takes into account Boolean evaluations of spending conditions [7-8]. Impacting the condition of an agreement on the Blockchain necessitates exchange charges which are valued in Ether (ETH). The distributed application platform is thought to run on ether as its fuel.

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III. Literature Review & Related work

The Transformation application of blockchain technology in E-Voting systems is explored. The advantages of blockchain, such as increased efficiency and productivity, as well as its potential limitations, are examined [1][2][3]. The proposed model is founded on the fundamental requirements of electronic voting, including voter verification. While acknowledging the benefits of blockchain, the paper also discusses its limitations in the context of E-Voting [4][5][6]. The shift from paper-based to digital e-Voting systems, emphasizing the properties and security issues of digital e-voting. It highlights utilizing blockchain technology to tackle security concerns and fulfill system requirements, offering opportunities for secure e-voting deployment [7][8][9]. Electronic voting, or e-voting, has been utilized since the 1970s and provides several advantages over traditional paper-based systems, such as enhanced efficiency and reduced errors. Nonetheless, widespread adoption of e-voting systems faces challenges in terms of resilience against potential faults [10][11][12]. Blockchain technology holds promise in enhancing the resilience of e-voting systems by leveraging cryptographic foundations and transparency. This paper presents a scheme for e-voting that aligns with fundamental requirements and achieves end-to-end provable, implemented using the Multichain platform [13][14][15].

The application of blockchain technology in electronic voting protocols offers a decentralized system that can provide characteristics such as data confidentiality, integrity, and authenticity [16][17][18]. The proposed A blockchain-based electronic voting protocol aims to establish a secure electronic election process. The paper also discusses the emerging challenges and limitations to be addressed. Overall, the paper offers a comprehensive overview of the proposed protocol [19][20][21]. Following an examination of existing voting systems that employ Electronic Voting Machines (EVMs) and their susceptibility to mitigate tampering risks, a blockchain-based online e-voting system has been proposed [21][22][23]. This decentralized system aims to provide security, transparency, and non-repudiation, offering a viable alternative to conventional centralized systems. The proposed system, built on Ethereum, demonstrates the potential for real-world implementation, mitigating the risk of manipulation in voting processes [24][25][26]. The paper delves into the security threats and attacks on blockchain systems, offering insightful reviews on potential enhancements and future research directions [27][28][29]. The study introduces a novel framework for recommender systems, BC-Rec, leveraging Blockchain technology. Blockchain serves as a decentralized data-sharing ledger utilized by e-commerce platforms to distribute shared data regarding users, items, and sellers.. Public Key Infrastructure (PKI) is employed to authenticate entities and ensure the integrity of the blockchain. The paper examines Blockchain overview, existing Public Key Infrastructure (PKI) for Blockchain and key management for Blockchain wallets, and proposes a Group Key Management scheme for secure group communication [30].

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IV. Proposed system

The envisioned decentralized voting system utilizing Ethereum blockchain technology aims to deliver a secure and transparent method for elections. By employing smart contracts on the Ethereum network, it ensures secure, anonymous voting and maintains the integrity and immutability of the voting data. This approach is designed to bolster voter confidence in the election process and minimize the chances of fraud or tampering.

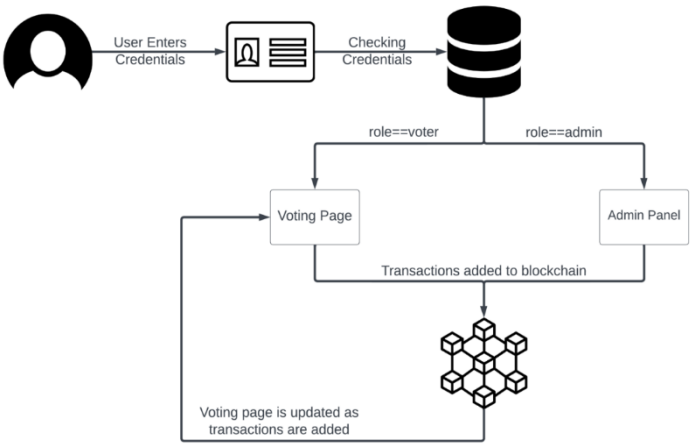

Figure 1. System Architecture

Figure 1 shows a voting system using blockchain. Users log in and choose to be either voters or admins. Voters go to a voting page, cast their votes, which are recorded securely on the blockchain to prevent changes. Admins manage the system through an admin panel. This setup ensures transparency and fairness by updating votes instantly and preventing tampering, aiming to improve elections with a reliable and accessible voting method.

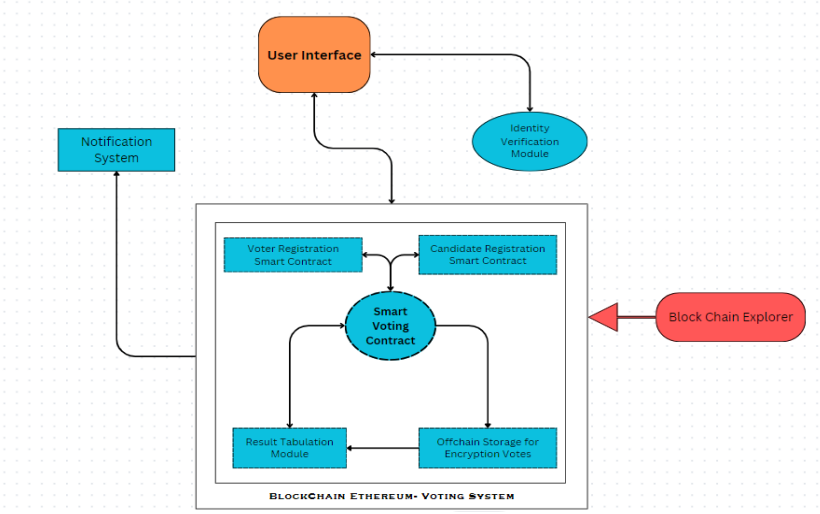

Figure 2. Framework of InterVoteNet

Figure 2. depicts a blockchain-based voting system using Ethereum technology. It includes a central "Smart Voting Contract" connected to components for voter and candidate registration, result tabulation, and encrypted vote storage. Users access the system via a "User Interface," with secure authentication handled by an "Identity Verification Module." A "Notification System" and "Blockchain Explorer" enhance transparency.

This setup showcases the automation and security provided by smart contracts, ensuring votes are verifiable and resistant to tampering. We have employed a number of technologies, including the contract-based programming language Solidity, to evaluate our suggested approach. We used JavaScript, CSS, and HTML to develop the entire front. Additionally, we developed our system using the open-source language Python. In addition to this, node.js was utilized to run the Python code outside of the web browser. The communication with Ethereum blockchain networks was facilitated via Web.js. Truffle is used as the development framework for Ethereum blockchain applications. Apps such as Ganache, MetaMask, Fast API, and so on were also utilized. Figure 3, Figure 4, and Figure 5 displays the voters log-in, candidate credentials, and vote casting respectively respectively.

Figure 3. Voter Login Interface

Figure 4. Candidate Credentials and Voting Date Selection

Figure 5. Vote Casting Interface

V. Conclusion And Future Work

Utilizing Ethereum Blockchain for decentralized voting creates a secure and transparent election system. This technology defends vote integrity through its tamper-proof structure, offering a reliable platform for elections. As user experience, scalability, and integration with advanced technologies improve, this approach could transform the democratic process, enabling trustworthy and efficient voter participation. It marks a crucial advancement towards fostering a more accountable and participatory democratic society.

Future developments in decentralized voting systems could introduce features like real-time vote tallying, robust voter identification methods,complicated data analytics for voter behavior insights, and integration with technologies such as artificial intelligence and biometrics. These improvements will boost the efficiency, security, and accessibility of the voting process, making it more inclusive and reliable.

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