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E-VOTING SYSTEM USING ETHEREUM BLOCKCHAIN

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Abstract - Ethereum introduced decentralized applications (DApps) to leverage blockchain's potential, distinct from the cryptocurrency buzz dominating discussions. Ethereum offers a robust platform for DApp development, utilizing the Ethereum Virtual Machine (EVM). With increasing smart contract integration, Ethereum's ecosystem strengthens, as these self-executing contracts govern transactions while ensuring consensus among all participants. In democratic societies, the demand for a transparent and secure electronic voting platform is high. Ethereum, with its expansive network, is an ideal choice for such projects. Our implementation focuses on a decentralized, blockchain-based voting system. Multiple nodes collectively store voting data, ensuring redundancy. In case of node issues, users can access their data from operational nodes, enhancing system reliability. This contrasts with traditional centralized servers, prone to hacking or failures that compromise data accessibility and integrity. Blockchain's immutable data storage prevents tampering, as nodes independently verify each block using cryptographic hash codes. Unauthorized changes trigger immediate alerts, enhancing security and trust in the voting system.

Keywords: **Smart Contracts, Electronic Voting, Blockchain Technology, Transparency, Data Integrity, Redundancy, Decentralization, Immutable Data, Trustworthy Voting, Ethereum Virtual Machine (EVM), Consensus Mechanism, User Security and Democratic Governance**

1 INTRODUCTION

Electronic voting methods are currently in their nascent stages of development. Our choice to delve into this sector is driven not only by its recent advancements but also by the existing dearth of solutions to the challenges posed by e-voting. In the realm of e-Government, we witness a surging popularity, underscoring the significance of digitizing fundamental citizen services, starting with elections.

E-voting stands as one of the pivotal public arenas ripe for transformation through blockchain technology. However, this evolution brings forth new challenges, chief among them being the imperative need to secure elections to a degree at least as robust as traditional voting systems. In response, we are committed to crafting a secure electoral process that alleviates concerns about potential abuses within the system.

Blockchain has, in recent years, emerged as a trusted technology in various online applications. Our e-voting technology adopts a blockchain-based approach to manage all electoral procedures. Its primary advantage lies in the elimination of the need for absolute trust in a centralized authority responsible for conducting elections. Our system's integrity remains impervious to external influence. Furthermore, we address the issue of transparency, a pivotal factor in voter confidence. Blockchain offers a solution that enables open scrutiny of stored data and processes, fostering a clear understanding of data handling procedures.

In terms of security, our technology stands as a superior alternative to conventional blockchain-free e-voting platforms, promising enhanced safety and integrity in the electoral process.

1.1 Overview of the Project

The proposed voting system serves as a viable replacement for Electronic Voting Machines (EVMs), offering decentralization with an HTML front-end and a blockchain back-end. The smart contract, coded in Solidity, plays a pivotal role and contains candidate names along with their symbols. Within this system, every alteration to the blockchain is referred to as a "Transaction." Transactions serve as the bridge connecting the external world to the Ethereum network, allowing for the modification or update of data stored within the network. In this endeavor, we present a blockchain-based electronic voting system that leverages smart contracts to ensure secure, cost-effective elections while safeguarding voter privacy. This approach not only addresses the limitations and adoption challenges of electronic voting systems but also enhances election security, integrity, and transparency. The transparency inherent in blockchain technology facilitates rigorous auditing and comprehension of the election process, aligning with the fundamental requirements of a robust voting system. These attributes, stemming from decentralized networks, have the potential to imbue more democratic principles into election procedures, particularly in direct election systems. To enhance e-voting openness, transparency, and independent auditability, blockchain technology emerges as a promising solution. This project delves into the exploration of blockchain's potential and its applicability within the realm of electronic voting schemes.

1.2 Scope and Objective

The primary objective of this project is to leverage Blockchain technology to develop an efficient voting system that empowers voters to cast their ballots conveniently from remote locations. This innovation has the potential to significantly reduce organizational expenses while boosting voter participation. Traditional processes such as printing ballot papers and setting up physical polling stations become obsolete, as voters gain the flexibility to cast their votes wherever they have an Internet connection. The project's core aim is to establish a voting system that prioritizes transparency and security through the implementation of Blockchain technology. This Blockchain-based voting system utilizes smart contracts to facilitate ticket validation and vote tallying in a decentralized manner, all subject to scrutiny by the election commission. With this system in place, hackers would face insurmountable challenges trying to breach an entire network of computers and access the data. In the current landscape, there is a growing presence of open-source Blockchain voting platforms. These open-source solutions offer distinct advantages, primarily their transparency and absence of restrictive algorithms, enabling both citizens and institutions to review functionality and enhance security. Numerous startups are dedicating their efforts to developing open-source web-based voting systems.

2 SYSTEM ANALYSIS AND DESIGN

2.1 Introduction

The most exhilarating and formidable phase within the life cycle of a project is undoubtedly the system and design stage. The term "design" encapsulates the vision of the final system and the intricate process through which it comes to life. It encompasses the technical specifications that will guide the implementation of the candidate system. In essence, design can be defined as "the art of employing diverse techniques and principles to meticulously define a device, a process, or a system with enough precision to enable its tangible realization."

The ultimate aim of the design phase is to chart how the output will be generated and in what specific format. Simultaneously, it delineates the structure for both input data and database files, ensuring their alignment with the requirements of the envisioned output. The processing aspect is meticulously addressed during program construction and rigorous testing procedures. As the journey through this phase nears its conclusion, comprehensive details related to system justification and an assessment of the candidate system's potential impact on users and the organization are methodically documented and presented for evaluation by management, serving as a pivotal step toward implementation.

The significance of software design can be distilled into a single, resounding word: "Quality." Design furnishes us with a tangible representation of the software, one that can be scrutinized for its quality. It stands as the conduit through which customer requirements are translated into a fully realized software product or system. Without a robust design, we run the risk of constructing an unstable system prone to failure with minor alterations, challenging to test, or one whose quality remains elusive. Hence, software design stands as an indispensable phase in the development of any software product.

2.2 System Requirements

A system of Minimum 8GB RAM & installed the following packages and Softwares.

1. Python
2. Visual Studio
3. NodeJS
4. Django
5. MySQL

Libraries Used:

1. Web3:

Web3.py is a versatile Python library designed for seamless interaction with the Ethereum network. Widely employed in decentralized applications (dApps), it serves as an invaluable tool for executing various operations, including transaction management, smart contract interactions, block data retrieval, and a multitude of other functionalities. This library, Web3.py, offers a language-specific client interface tailored for Ethereum, enabling developers to effortlessly engage with existing data stored on the Ethereum blockchain. Through Web3.py, the possibilities are extensive, allowing users to initiate or process new transactions on the blockchain and retrieve data from the blockchain with ease.

2. Twilio:

Twilio stands as a web application programming interface (API) that offers software developers a powerful toolkit to seamlessly integrate various communication functionalities into their Python applications. This includes features like phone calling, messaging, video, and two-factor authentication. Without Twilio, delving into the intricacies of interacting with standard telephone networks, sending and receiving phone calls and text messages, can be an immensely challenging endeavor, particularly if one lacks familiarity with specialized telecommunications protocols like the Session Initiation Protocol (SIP). Twilio's API serves as a pivotal abstraction layer, simplifying the complexity of telecommunications processes. As a developer, you can harness the convenience of your preferred programming languages and frameworks to effortlessly incorporate these communication features into your applications, thanks to Twilio's user-friendly interface.

2.3 Feasibility Study

Maintaining consistency is a fundamental aspect of any project, and the literature survey plays a pivotal role in achieving this. It represents a critical step in the development process. In software development, authenticity and availability of resources are paramount. The literature survey serves as a compass, guiding us to discover existing knowledge and its relevance in the current context. It allows us to explore past work, assess its applicability in today's landscape, and gauge its impact. A key determinant of successful development is the synergy between innovation and practicality. As a project advances from the innovation phase to the implementation stage, it's essential to monitor and manage the support and resource flow. This phase is akin to a research endeavor, where extensive investigations are conducted to inform and guide the project's trajectory. In essence, the literature survey is the cornerstone of informed decision-making and sustained progress in the development journey.

2.4 Technical Feasibility

This project, Blockchain based voting System needs the support of web based technology being implemented for other useful systems in our society. It requires PC's and Mobile Phones with normal configuration for Intranet access. Election commissioners have their own PC for managing the entire voting process. Thus, it is technically feasible to implement the new system here.

2.5 SDLC Methodology

The document plays a vital role in the development of life cycle (SDLC) as it describes the complete requirement of the system. It means for use by developers and will be the basic during the testing phase. Any changes made to the requirements in the future will have to go through a formal change approval process.

SPIRAL MODEL was defined by Barry Boehm in his 1988 article, "A spiral model of Software Development and Enhancement".

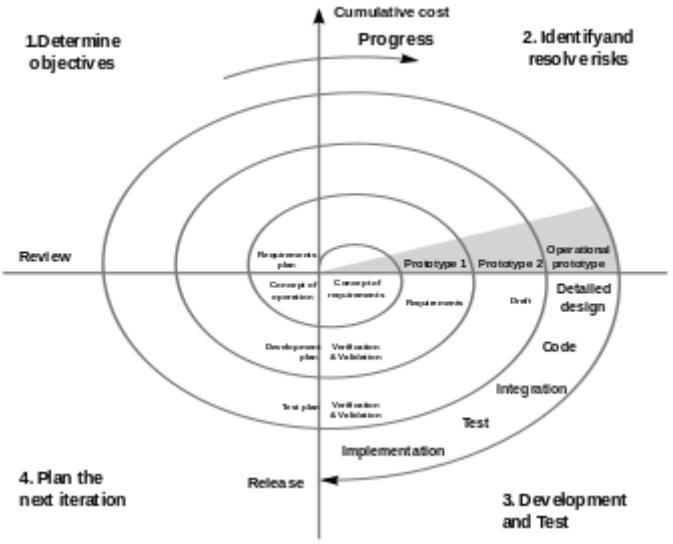

Fig.2.3 Flowchart of SDLC

STAGES IN SDLC

- Requirement Gathering
- Analysis
- Designing
- Coding
- Testing

3.6 System Architecture Diagram

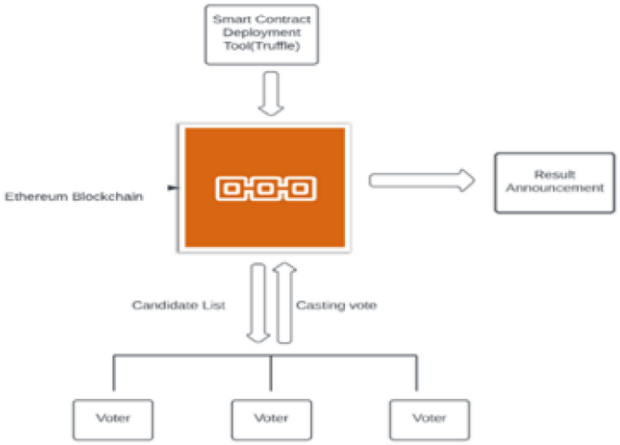

Fig.3.6 Diagram of System Architecture

3 IMPLEMENTATION

3.1 CREATION OF BLOCKCHAIN:

For implementing this proposed work an Ethereum block chain network is used. It is a decentralized open source blockchain network featuring smart contract functionality. In the Ethereum platform, the crypto currency used here is Ether. It uses Proof of Work as the consensus algorithm where the one who can quickly solve a problem using the computation power can add a new block to the network. The blockchain arrangement takes care of vote tampering problems. [14] used the Ethereum block chain network for online voting application. In blockchain, each and every block is chained with its next block and its previous block. Hence if the hackers tries to access the Block N then it will be notified to Block N+1, and the changes in Block N+1 also reflect in Block N+2 and so on. The hash value of Block N+1.

3.2 MODULE DESCRIPTION

3.2.1 ADMIN

In this module, the admin has to login by using a valid user name and password. After login successfully he can do some operations such as Registering candidates, Setting up the Elections, Display the Results. Here the entire election process is controlled by the admin and admin can reset the elections.

3.2.2 USER MODULE

In this module, the Voter has to login by using a valid user name and password. After login successfully he can do some operations, such as registration and vote to the candidate from the list of given candidates. After the voting is completed the voter can see the results here. The results are sent to the registered phone number.

3.2.3 RESULTS

The blockchain component represents the entire data storage architecture and operates voting. The blockchain may be developed using public blockchain technologies, such as Ethereum or a private blockchain, for instance Hyperledger. The advantages of the public blockchain are that it provides all transaction and block information to all users and this is why it has better trust than the private blockchain. This trust is in the context of a regular user who is not state-of-the-art and wants to view all information. The private blockchain can provide the same level of trust, but it has to be shown by data by an organization. It does not limit what blockchain should be used in the proposed architecture. Both blockchain types can provide the same amount of trust. The platform chosen is the organizational decision to create elections.

Units Voting security is based on blockchain and a smart contract is carried out that belongs to the Blockchain processing system. After a configuration, the intelligent contract is released to the blockchain network. Contains times, candidates, or other properties in the configuration. The published intelligent agreement cannot be edited or altered to make the vote transparent. A list of users who are qualified to vote can be found on this smart contract. A key distribution must be followed by the access list that is made by the major authority.

4 CONCLUSION

4.1 CONCLUSION

This project provides an Electronics voting system which is deployed on the Ethereum network. Many research works proved that the block chain technology helps in improving the existing system hence it also provides a better way to conduct the Election. It also used to evade the drawbacks of centralized voting systems. After the Votes are casted by the voters, it is stowed as immutable and tamper-proof. This addresses the security issues with the current e Vm system. Though it provides transparency, as the transactions are visible to everyone, it conserves voter's confidentiality and secrecy. It helps in announcing the result fast. It takes more than 2 weeks to announce results in the current system. The voting results are publicly auditable. In future the frontend UI of the application can be improved to show the election statistics and any other authentication methods can be integrated to further add security and trust to the voting system.

4.2 FUTURE WORK

In future the frontend UI of the application can be improved to show the election statistics and any other authentication methods can be integrated to further add security and trust to the voting system. Our proposed system achieves better security by auditing shared data. But still, we must extend this system by adding deduplication and data dynamic operations as future scope. A mobile application can be developed so that the user can install it and cast their vote, which improves the accessibility.

4.2.1 Limitations:

Electronic voting (e-voting) systems offer potential benefits such as increased accessibility, reduced human error, and faster result tabulation. However, they also come with several limitations and challenges that need to be carefully addressed to ensure the integrity and security of the voting process. Here are some limitations of e-voting systems:

Security Concerns:

a. Cybersecurity Threats: E-voting systems are vulnerable to hacking, malware, and other cyberattacks that could compromise the confidentiality, integrity, and availability of the voting process.

b. Insider Threats: Even with stringent security measures, insiders with access to the system (e.g., election officials, software developers) can potentially manipulate the results.

c. Lack of Voter Authentication: Ensuring that the person casting the vote is indeed the eligible voter can be challenging, leading to concerns about voter impersonation.

Accessibility and Inclusivity:

a. Digital Divide: E-voting assumes access to technology and the internet, potentially excluding individuals who lack access or familiarity with these tools.

b. Accessibility for Disabled Voters: E-voting systems must accommodate the needs of voters with disabilities, including those who rely on assistive technologies.

Transparency and Accountability:

a. Lack of Voter Verifiability: Some e-voting systems do not provide voters with a way to independently verify that their votes were recorded accurately.

b. Auditability: Ensuring a verifiable and auditable paper trail can be challenging, making it difficult to conduct post-election audits.

Complexity:

a. Technical Complexity: E-voting systems can be complex, making it difficult for voters to understand the process fully. This complexity can lead to errors and mistrust.

b. Software Bugs and Glitches: Like any software, e-voting systems can have bugs and glitches that may affect the voting process.

Cost:

a. Implementation and Maintenance Costs: Developing, deploying, and maintaining e-voting systems can be expensive, and this cost can be a barrier for some jurisdictions.

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