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ELECTRONIC VOTING USING DECENTRALIZED SYSTEM BASED ON ETHEREUM BLOCKCHAIN

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ABSTRACT

Electronic Voting Using Decentralised System Based On Ethereum's Blockchain is a system made in the form of application used for Electronic Voting. This is done to solve the current problem on conventional electronic voting system where the integrity of the data can't be as certain and the result of the vote can be tampered malicious actors. To solve this problem, an electronic voting system will be built that store the data of election results on blockchain to ensure the integrity of the data. The creation of the system involves using the Solidity language, a Turing Complete programming language used on Ethereum. Source code that will be run will rst need to be compiled into Bytecode, which will then in turn run on Ethereum Virtual Machine. The finished program will then be decentralised using Blockchain.

KEYWORDS – *Blockchain, Decentralised System, Electronic Voting, Ethereum, Smart Government*

I. INTRODUCTION

E-voting is a common practice in society. But in cases where the choice has financial or political implications, it is not always clear how to guarantee that the verdict is honored. The most crucial elements are always accuracy, security, and privacy. One type of secure multi-party computation is secure electronic voting. During the voting process, a group of people make decisions that may or may not be kept confidential. For the majority of electronic voting systems to give every voter the same view, a reliable public bulletin board is required. Nonetheless, it is unclear from the election administrator whether or not the public bulletin board can be fully relied upon. Some individuals are aware that since the content on blockchain is publicly trusted, it can serve as a bulletin board. Blockchain functions as a decentralized database and offers novel instruments for establishing a decentralized and trustless system. The blockchain technology lacks a reliable central coordinator. Rather, the data block is locally stored on each node that makes up the blockchain. A peer-to-peer, decentralized network with open membership maintains blockchain. Initially, this technology is intended for the transfer of money. As Blockchain technology advances, scientists are attempting to apply it to different study domains, including the management of the Internet of Things, carbon dating, and healthcare. This led to the creation of Ethereum, which is regarded as a turning point in the blockchain's growth. Its programming language is Turing complete, and users can use the Ethereum network's smart contracts to implement its functionality. Blockchain has the potential to serve as the voting system's reliable public message board. Furthermore, the blockchain's smart contract functioned as a reliable computer whose output is accepted by the general public. But using blockchain to replace the bulletin board alone is a bad idea. Voters may find it difficult to sort through the large number of transactions and the difficulty of blockchain computation while using the voting protocol, which is implemented on Ethereum through smart contracts. With the Ethereum script, users can create the necessary smart contracts on Ethereum and use smart contracts to develop decentralized applications that have sophisticated features. To guarantee the validity of the outcome, the Ethereum network's nodes independently execute the contract code. The end result is verifiable by the public.

II. OBJECTIVES

Voting Electronically with a Decentralized System based on Ethereum Blockchain seeks to accomplish a number of goals, such as:
1. Transparency and Trust: The voting system uses blockchain technology to bring transparency to the voting process, enabling all parties involved to confirm the accuracy of the election results. Voters can feel secure knowing that their votes are correctly tallied and recorded since blockchain keeps an unchangeable and transparent record of all transactions.
2. Security: The Ethereum blockchain's decentralized structure guards against fraud and interference in the voting process. Because every vote is cryptographically secured and registered on the blockchain, it is very impossible for nefarious actors to change the voting results covertly.

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3. Accessibility: By allowing voters to cast their ballots remotely from any location with an internet connection, electronic voting systems built on blockchain technology can increase voter accessibility. This has the potential to boost voter engagement and turnout, particularly among those that have accessibility or mobility issues.
4. Audibility: The voting process may be thoroughly audited thanks to the usage of blockchain technology. By examining the blockchain records to make sure that votes are correctly recorded and counted, election authorities, independent auditors, and observers may confirm the election's integrity.
5. Decentralization: The voting method lessens reliance on centralized authority and intermediaries, including government agencies or election commissions, by utilizing Ethereum's decentralized network. The voting system is more resilient to manipulation, censorship, and single points of failure thanks to this decentralization.
6. Privacy: By encrypting and anonymizing individual votes, blockchain technology safeguards voter privacy in addition to transparency and integrity. To identify and tally votes while protecting voters' anonymity, decryption keys are only accessible to authorized parties, including election authorities.
7. Cost-Effectiveness: Blockchain-based electronic voting has the potential to lower expenses related to paper ballot production, distribution, and human counting as compared to conventional paper-based voting methods. Election organizers may save money if blockchain-based voting technologies simplify administrative procedures and eliminate the need for physical infrastructure.

The overall goals of the Electronic Voting Using Decentralized System Based on Ethereum Blockchain are to preserve the values of openness, privacy, and decentralization while enhancing the voting process's integrity, security, accessibility, and efficiency.

III. LITERATURE SURVEY

Voter authentication: There are a number of distinct approaches to voter authentication. Voter authentication can be achieved, according to Kriti Patidar and Dr. Jain, by the use of private key cryptography, which voters must have access to before the election. [7]An authoritative figure should register voters, and during that process, keys for the voters must be created and given to them. Similar to Cosmas Krisna Adiputra, he proposes that a public-private key infrastructure be established, whereby the electoral commission, or another election manager, creates a key pair (PE; SE) for the election that is then used to encrypt and decrypt voter messages. Subsequently, every voter must produce a unique key pair. (PV X; SV X) denote the key pair of voter X.

Afterwards, the voter uses this key pair to sign the message that she created. In order to be eligible to vote, voters must register their public key PV X with the electoral commission using a designated, legitimate ID. After confirming each voter's identity, the electoral commission either accepts or rejects the matching public key PV X and adds it to a public list, depending on whether the voter is eligible or not. In this plan, it is imperative that every voter retain their public key confidential and provide it exclusively to the ruling body. Friðrik Þ. Hjálmarsson[6] has a different idea; he plans to use a 6-digit pin that voters can use to authenticate themselves. Each voter will be recognized and authenticated by the system by presenting their Auokenni electronic ID and the matching 6-digit PIN in the voting booth. If someone knew the PIN for each associated electronic ID, they could vote for more than one person without supervision.With the development of technology, many nations have chosen to use electronic voting methods. To ensure fairness, any voting system must adhere to the principles of impartiality and transparency. Additionally, the electronic voting process must be safeguarded against denial-of-service (DDOS) attacks and cyberattacks, as these actions have the potential to impact voting procedures' processing times and potentially compromise voting fairness. [2]In this paper, a blockchain-based network security mechanism for voting systems is established.

Any user on the blockchain can certify data integrity, which satisfies requirements of transparency and impartiality in voting systems. Additionally, the distributed architecture of the blockchain mechanism can prevent system shutdown resulting from harmful cyber-attacks.

IV. METHODOLOGY

The following steps outline the approach that was taken during this project's work.The aforementioned problems with the existing voting mechanism necessitate certain improvements. This can be accomplished by substituting the current system with a new one that will reduce voting fraud and improve the accuracy of both the voting and counting processes.
•Three login methods would be available through the Online Election System: admin, user, and user registration. This online voting system, which voters can use to log in and exercise their right to vote, will be used to maintain voter information.
•Upon voter registration, the following information will be requested: Full name, age, Aadhaar card number, mobile number, email address, and verification will be required before access is granted.Voter identification from Aadhaar will be requested when wanting to cast a ballot. After voter authentication, he may cast a ballot for any candidate on the list.

•A voter may only select one candidate per election.
BLOCKCHAIN: Blockchain technology can be used to create systems that are transparent, efficient, unchangeable, and impervious to hacking. The blockchain is the best technology for voting systems since data on blocks cannot be altered or removed. The

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distributed network that underpins blockchain technology is made up of numerous interconnected nodes. The distributed ledger, or information, which houses the whole history of all the transactions the network has handled, is replicated on each of these nodes. The network is not managed by a single, centralized system. Nodes accept a transaction if the majority of them concur.Users on this network can maintain their anonymity. Sensible contracts and blockchain technology, when analyzed from a basic perspective, indicate that e-voting can be conducted on a suitable foundation and that e-voting may become increasingly dependable and accepted.

Fig.1: Workfow on how Solidity code deployed and executed on EVM

Proposed Plan of Work

We are taking into consideration two modules for our proposed work plan, which will be finished in three stages. Here are the two modules:

1. The application's front end
2. Blockchain implemented on the back-end with Solidity.

The connection and testing of these modules will be covered in the last step, which will cover each of these modules individually.

- Phase 1: During this stage, we will work on the front-end module and create the user interface that is interactive for both administrators and users. Research on integrating blockchain technology into decentralized applications will be conducted concurrently.
- Phase 2: Using the Ethereum framework, we will create the Blockchain, cover the back-end module, and turn the system into a decentralized application.
- Phase 3: During this step, the platform will be tested and two separate modules will be connected. Partition of the First Phase

We have considered 2 main modules which are as follows:

A. Admin- The admin module is divided into 5 components

1. Dashboard: Information such as the number of parties and voters will be displayed using a variety of charts.
2. Add Candidate – The administrator can add candidates using this function if they are running for office. The candidate will appear on the user's side after it has been added.
3. Create Election: The administrator can create elections with this capability. Voting by a user is only possible after the administrator creates the election. Between the start and end dates, a user can cast a vote.
4. Election Details: The administrator can amend election details, including the start and end dates, in this area.
5. Candidate Details: All of the candidates that the administrator has added will be seen in this section. If an incorrect entry is made, the administrator can change the candidate's details.

B. User- The user module is divided into 3 components Dashboard-

1. Information about parties and their candidates can be seen on the user dashboard. All of the candidate's information is visible to the user.
2. Voter Registration: The user must first register in this section before he can cast a ballot.
3. Voting Area: Only the person who has registered will be sent to this page, where he can cast his ballot.

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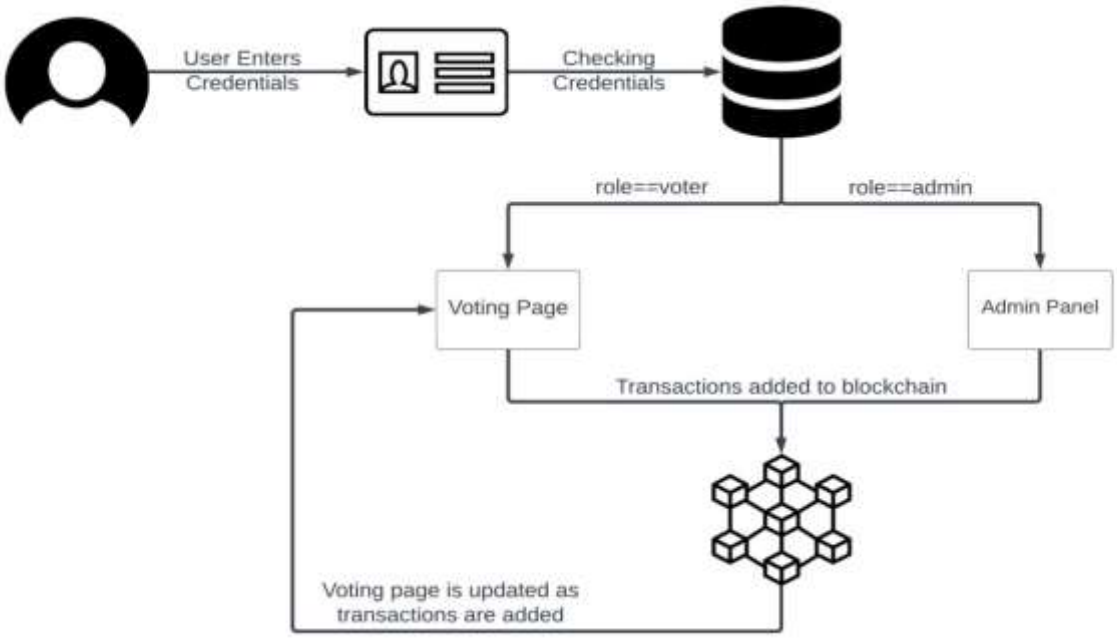

Fig.2: System Architecture

User enters the credentials (voter id & password) and they are matched with the database. If the match is found user is either redirected to admin page or voter page as per their role corresponding to the credentials in the database. Once the admin is logged in he/she can start the voting process by adding candidates and defining dates. Voter can vote once the voting process has been started. Once the voter has voted the transaction is recorded to the blockchain and the voting page is updated with real-time votes
Advantages of Proposed System:

- Decentralization ensures that no party controls the voting process.
- Transparency throughout the voting process.
- It is tamper proof.
- Voters can vote from any part of the world.
- This method of voting is cost effective.
- The results are provided in real time.

V. RESULTS

Our output screens are as follows:

1. Connecting to Server

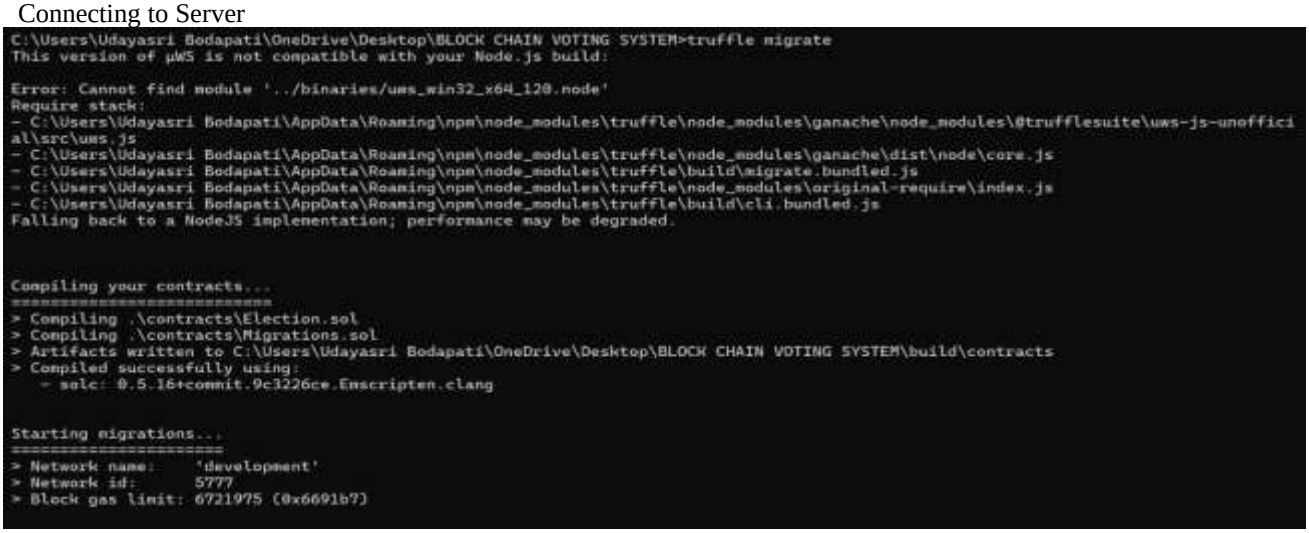

Fig.3: Connecting to Server

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2. Connecting to Server

```
2_deploy.js
===========

   Replacing 'Election'
   --------------------
   > transaction hash:    0x0f390bec8db6b7664a837afbb93e2ce8b5af5cf2770e3efc45723f966f7314e3
   > Blocks: 0            Seconds: 0
   > contract address:    0x9b3C305108c63F437b5d0fBEaB5ecb03D28eEefe
   > block number:        3
   > block timestamp:     1711523213
   > account:             0xA0710ced75d8AC4c948389B09316d0F9e7ec0952
   > balance:             99.997249922192417373
   > gas used:            642952 (0x9cf88)
   > gas price:           3.175945351 gwei
   > value sent:          0 ETH
   > total cost:          0.002041980415316152 ETH

   > Saving migration to chain.
   > Saving artifacts
   -------------------------------------
   > Total cost:     0.002041980415316152 ETH

Summary
=======
> Total deployments:   2
> Final cost:          0.002600458540316152 ETH
```

Fig.4: Connecting to Server

3. Voter Sign up page

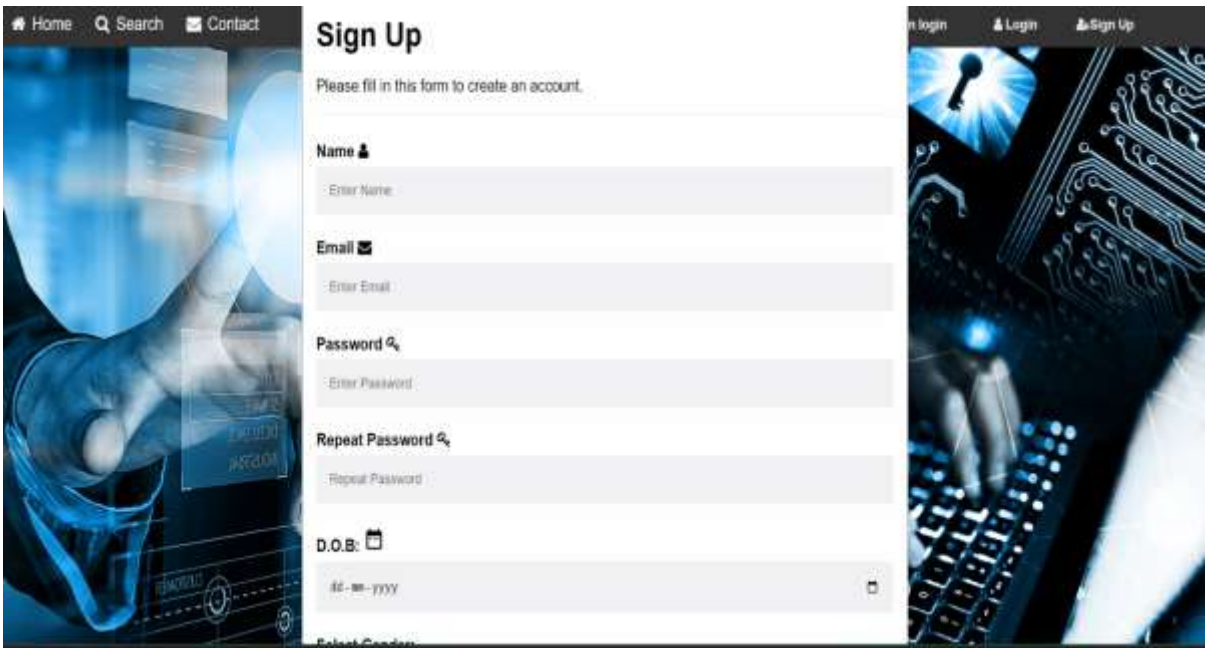

Fig.5: Voter Sign up page

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4. Voter Log in page

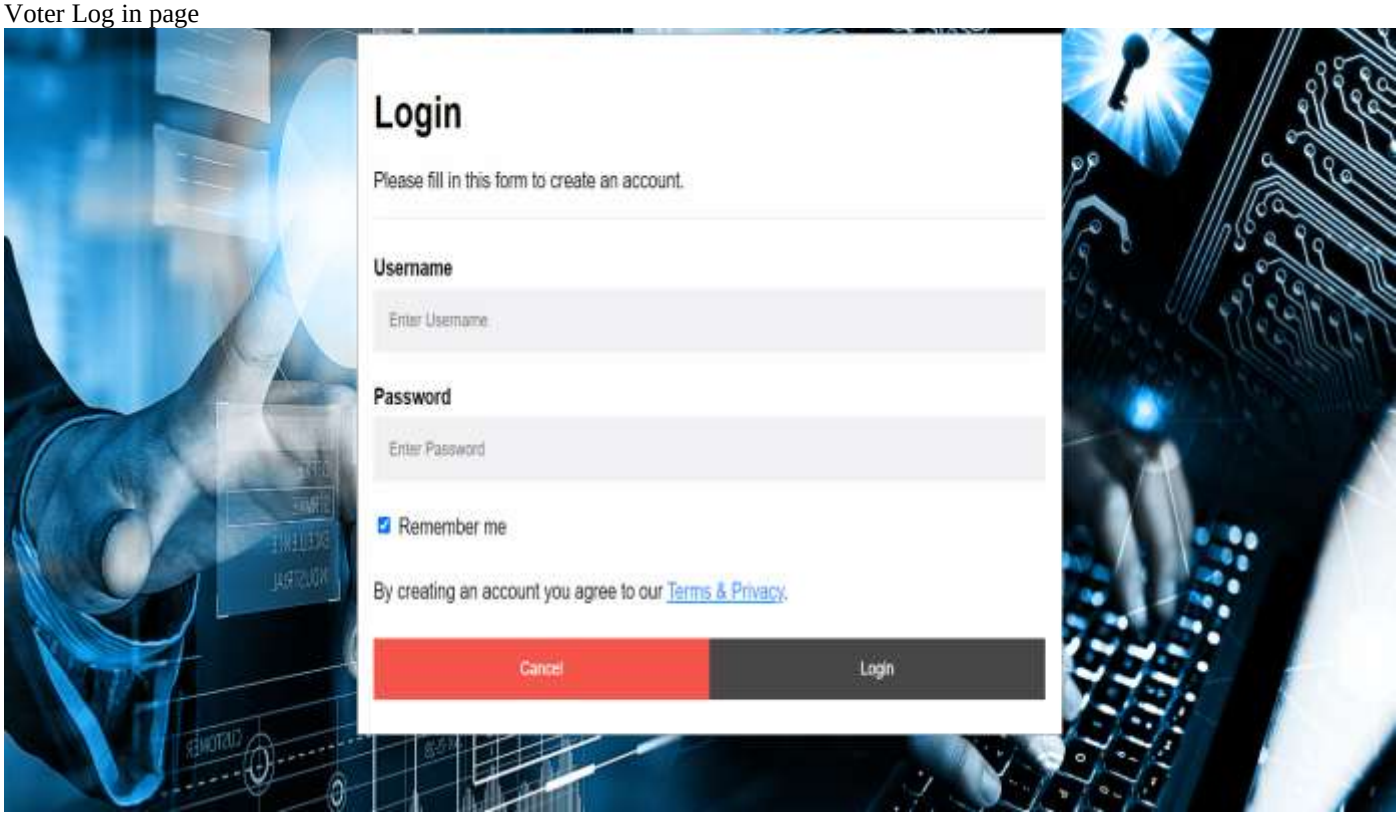

Fig.6: Voter Log in page

5. Voters Casting Vote

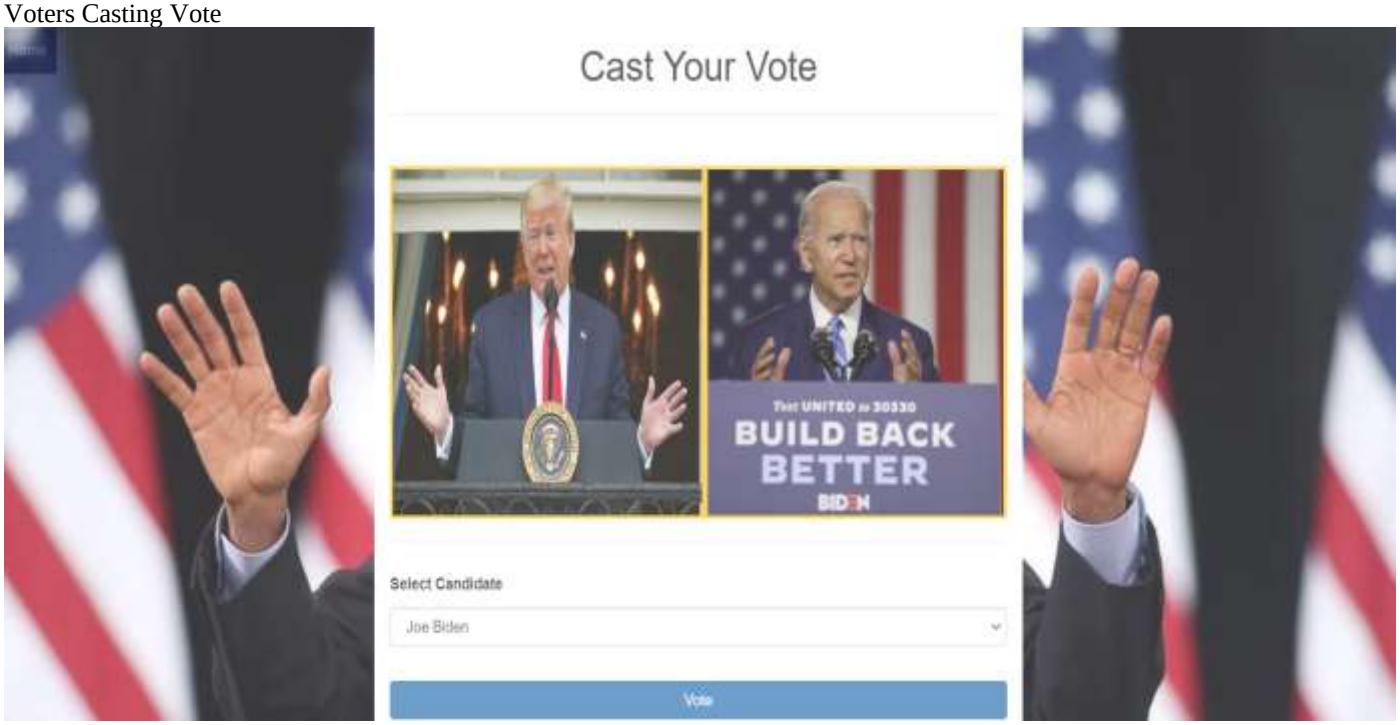

Fig.7: Voters Casting Vote

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6. Admin Login page

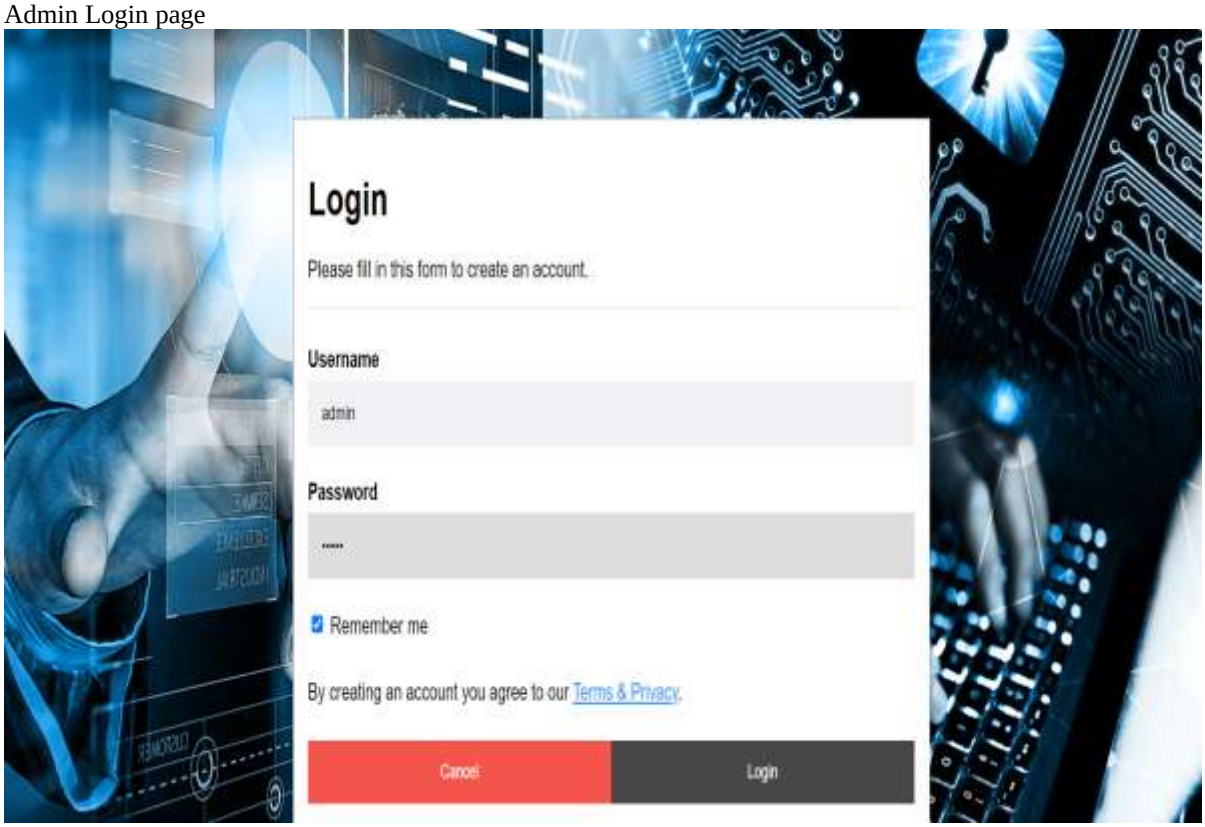

Fig.8: Admin Login Page

7. Admin Checking Results

Fig.9: Admin Checking Results

VI. CONCLUSION

Decentralized Voting with Ethereum Blockchain offers a robust and transparent solution for secure elections. By leveraging blockchain technology, it ensures the integrity of votes and provides a tamper-proof platform. With continued enhancements, including improved user experience, scalability, and integration with other cutting-edge technologies, it has the potential to revolutionize the democratic process and empower citizens to participate in a trusted and efficient voting system. It represents a significant step towards building a more democratic and accountable society.

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VII. FUTURE SCOPE

In future iterations, the decentralized voting system can be enhanced by implementing additional features such as real-time vote counting, secure voter identification mechanisms, advanced data analytics for voter insights, and integration with emerging technologies like artificial intelligence and biometrics. These enhancements will further enhance the efficiency, security, and accessibility of the voting process, making it more inclusive and trustworthy.

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