Secure Voting System Using Blockchain

Shruti Kamble, Manali Chavan, Shreya Shah, Devanshi Parmar
Department of Computer Engineering from Mumbai University, India
shrutikamble025@gmail.com, shahshreyaa02@gmail.com, parmardevanshi2626@gmail.com, manalichavan2004@gmail.com
Mr. Wasim Shaikh
Designation - Assistant Professor, Universal College of Engineering, Mumbai University, India
waseem.shaikh@universal.edu.in

Abstract*— An online voting system is a modern solution that can efficiently and securely facilitate the voting process for various groups and organizations. With rapid growth in technologies, the old voting methods can change to advanced voting methods. The proposed model is a Secure Web Application that has enhanced security features which include both authentication and authorization. Authentication is incorporated by using a unique identification key and authorization is done by using fingerprint. Voters are also being verified by a One-time password. The security in this project is implemented by using a 128-bit AES encryption algorithm and SHA-256 along with blockchain.

Keywords*— Secure Voting System, Blockchain, Aadhar Authentication, Verification, Transparency, Online Voting.

I. Introduction

Democracy is an important topic in the majority of modern societies. One of the key procedures in a democracy is the selection of representatives. Inactive citizens, fraud attempts, etc. are only a few of the various disturbances that this incredibly delicate procedure encounters. The nation of India is democratic. All Indian people have an Aadhar card, which serves as their digital ID, as they are all a part of the developing digital India. Due to the fact that it establishes each Indian's digital identity, the Aadhar card can be utilized for online voting. Electronic voting systems are used today and have some qualities that set them apart from traditional voting techniques as well as better features, such as accuracy, convenience, flexibility, privacy, verifiability, and mobility [3].

The problems were investigated in the voting systems in this project and attempted to propose the online voting model that can solve these problems. Using an efficient hashing algorithm technique, block formation and sealing, data collection, and result declaration by versatile blockchain method is needed to solve the issue of a high-end-to-end system that ensures security and privacy. This project proposes an online voting system that uses the Blockchain Ethereum to create a wallet with the credentials of the user. The elector will obtain an authenticated and tamper-proof personal ID. The voter will be getting the chance to vote in the form of a token which would be transferred anonymously from the voter's wallet to the candidate's wallet.

The vote can be cast from any geographical area for the voter's allotted constituency. Blockchain also helps to preserve voter's anonymity while still being open to public inspection. The proposed voting system uses a more stable, tamperproof blockchain (unchanged from voting modifications either by the voter or by any other third party) and is cost-effective. We would also extend the constraints of structure, engineering, design, and implementation in our society of the voting mechanism. Healthcare systems also improve the quality of life for individuals by fostering a deeper understanding of their health conditions and promoting sustained behavioral changes

II. Literature Review

A. *Secure digital voting system based on Aadhar authentication and by using blockchain technology - Prajakta Jagdale, Nisha Jaiswal, Priti More, Rucha Kale, Akshay Phalke in the year 2021.*

A high security password is checked in the main database before voting is allowed. The voter will be able to confirm if the vote is transferred to the correct candidate or party. A person from his or her allocated constituency may also vote. The tallying of the votes can

be done manually, thus saving the data.

B. *A P2P Digital Voting System for Elections in India- Asha Joseph, Shiju George, Robert K Samuel in the year 2022*

This paper explains why electronic voting machines (EVMs) are not suited for conducting a tamper-proof, corruption-free election and proposes a new method of voting based on peer-to-peer technology and cryptography.

C. A Secure online voting system using face recognition technology-Nazirah Abd Hamid, Citra Devi Nair Appunair, Ahmad Faisal Amri Abidin, Mohamad Afendee Mohamed, Mohd Fadzil Abdul Kadir, Siti Dhalila Mohd Satar in the year 2023.

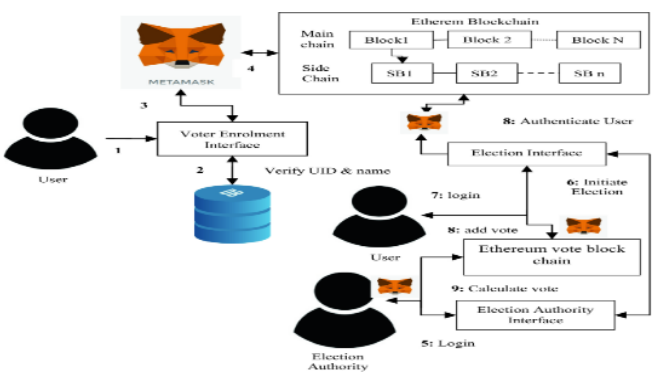
The proposed secure online voting system with biometric authentication able to verify and validate the authorized user with the accuracy rate of 90% for voting purposes and the system will be advantageous for users since it is convenient, reliable, energy-efficient, and time-saving.

D. Decentralized Based E-Voting System Using Blockchain Technology-Jyoti Jadhav, Pournima Ghude, Sandip Pashte, Aniket Sonawane in the year 2024.

This project presents a blockchain-based platform that optimizes system stability and transparency to promote a reliable voter-official interaction and enables blockchain which is scalable and utilizing adaptable consensus techniques.

II. Proposed System

Fig.1.0. Architecture of Secure Online System



The Fig.1.0 illustrates a blockchain-based voting system designed for security, transparency, and auditability. It uses Ethereum and MetaMask to manage voter identities and record votes on a tamper-proof blockchain. The Election Authority manages the election process and calculates the results from the blockchain data.

User Enrolment:

A user initiates the process by interacting with the "Voter Enrolment Interface". This likely involves submitting their personal information (e.g., name, unique ID).

The "Voter Enrolment Interface" verifies the provided information against a "DB" (Database). This database probably stores registered voter information. The system checks the user's UID (Unique Identifier) and name for validity. If the user is verified, the "Voter Enrolment Interface" interacts with "MetaMask". MetaMask is a popular cryptocurrency wallet and a gateway to blockchain applications (specifically, in this case, likely an Ethereum-based application). This interaction likely involves creating a blockchain identity or associating the user with a blockchain address, MetaMask interacts with the "Ethereum Blockchain". The diagram shows both a "Main chain" (Block 1, Block 2,... Block N) and a "Side Chain" (SB1, SB2, ... SBn). The sidechain may be used to improve performance or scalability.

Election Process:

The "Election Authority" logs into the "Election Authority Interface". This interface likely provides administrative functions for managing the election (e.g., defining candidates, starting/stopping the election).

The "Election Authority Interface" initiates the election via the "Election Interface". A verified user logs into the "Election Interface". The "Election Interface" authenticates the user via MetaMask. The user casts their vote through the "Election Interface," which adds the vote to the "Ethereum vote block chain". This vote is recorded as a transaction on the Blockchain. The "Election Authority Interface" retrieves and calculates the votes from the "Ethereum vote block chain." Because the blockchain is tamper-proof, this ensures an accurate and auditable count.

IV. Implementation:

A secure online voting system using Blockchain integrates modules for identity verification, encryption, and distributed ledgers to ensure eligible voters can cast private, immutable votes. Smart contracts automate vote counting, while real-time monitoring and audit trails enhance transparency. The system's decentralized nature, supported by a consensus mechanism, prevents manipulation and ensures election security and efficiency.

The modules are:

A. Login / Register Page

Initially, eligible voters create an account by providing necessary details through a secure registration page, ensuring their identity is verified. This procedure is streamlined, requiring users to fill in relevant information, including a valid government ID for authentication. Additionally, voters can log in easily using their credentials, allowing them to access their accounts and participate in the voting process securely.

B. Authentication page

The system captures user credentials, which are then encoded in a cryptographic format to ensure security. This encoded data is utilized for further authentication processes. As illustrated in the accompanying figure, the mechanism for securely encoding user information guarantees that only authorized individuals can access the voting platform, protecting against unauthorized access and ensuring the integrity of the voting system.

C. Voting page

Once the encoded vote is submitted, it is matched with the votes of other registered users. As understood, each vote will be unique to the individual voter. This matching process can also be viewed as verifying the authenticity of votes or voter identities. Once a match is confirmed, the vote is counted; otherwise, it is flagged as a new record in the system. In the context of ensuring election integrity, the scope of verifying votes expands as the system quickly analyzes submitted votes for any discrepancies. If a discrepancy is found, the election officials and relevant stakeholders are notified. If no issues are identified, the vote is securely recorded and counted in the blockchain, ensuring transparency and accuracy in the voting process.

D. Admin Page

A blockchain-based voting system is designed to ensure the integrity, security, and transparency of the electoral process. These features allow administrators to manage elections effectively, starting with the creation and publication of an election definition record on the blockchain. This record includes crucial details such as candidate names, voting criteria, and contest definitions. Admins also manage voter files and interact with voter identifier servers to verify voter eligibility, ensuring that only registered and eligible voters can participate. Additionally, admins oversee blockchain nodes to guarantee the security and integrity of voting data, manage public keys for authorized servers, and monitor votes in real-time as they are recorded on the blockchain. This real-time monitoring enables quick and accurate results declaration, further enhancing transparency. Furthermore, admins use auditing tools to review the voting process, ensuring compliance with regulations and the security of all transactions. Admin manage elections by adding candidates, monitoring votes, and declaring results.

E. Blockchain integration

Voting systems transforms the electoral process by leveraging its decentralized, secure, and transparent nature. Each vote is encrypted, recorded as an immutable transaction, and stored on a distributed ledger, ensuring tamper-proof data. Blockchain eliminates risks like vote manipulation or hacking by using cryptographic methods and consensus algorithms to validate transactions. It enhances voter privacy by storing only hashed data and public keys, maintaining anonymity while allowing voters to verify their votes. Additionally, smart contracts automate processes such as eligibility verification and vote tallying, improving efficiency and accuracy.

V.Result

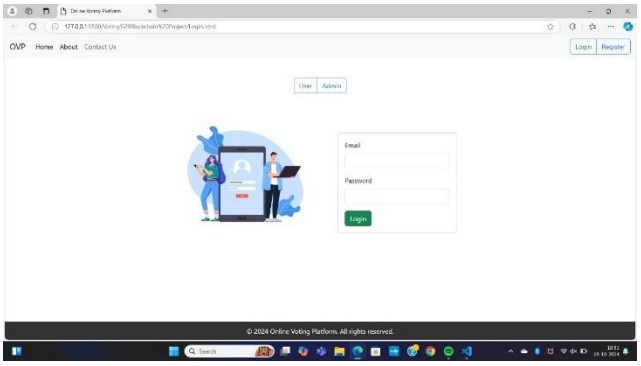


Fig.1.3 Login Module

In Fig 1.3, the login screen is displayed wherein if a person is a new user the person can register himself with the application, and if the user is an existing one they can log in with a valid user ID and password and thus log in for the further process. The user will sign in to the credentials in the authentication module after which credentials will be checked and the user will only be able to access the dashboard after the verification has been completed. The first process in the dashboard is the OTP Verification.

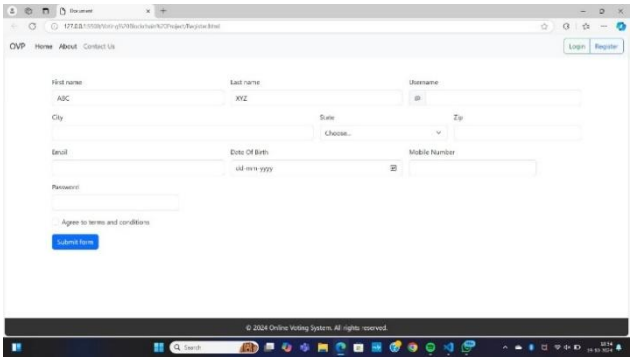


Fig.1.4 Registration Page

In Fig 1.4, the user can register by adding their personal information and by adding their mobile number for the authentication process, by which they will be able to proceed with the voting process.

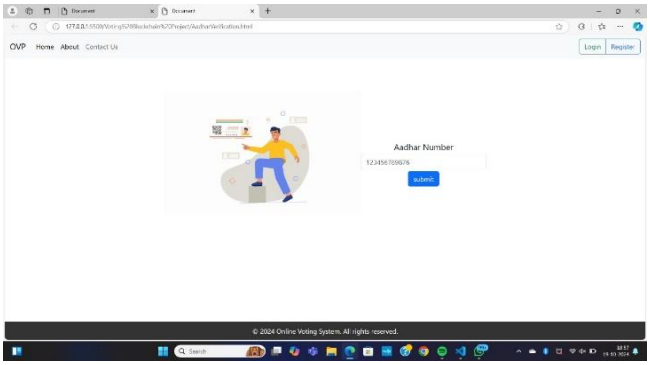
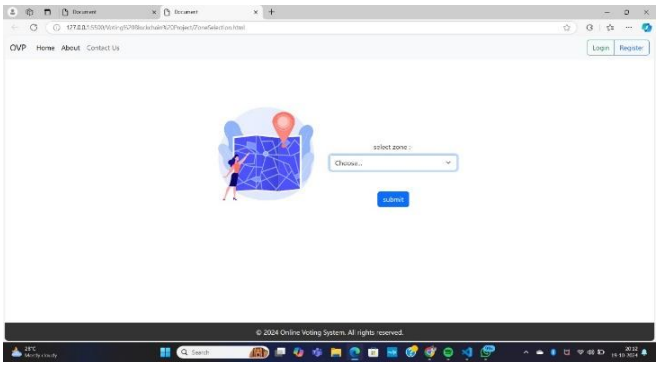


Fig.1.5 Aadhar Verification



In Fig 1.5, the user has to enter a valid Aadhar card number which should be linked to his registered mobile number which helps us to authenticate the user and will be able to process the further.

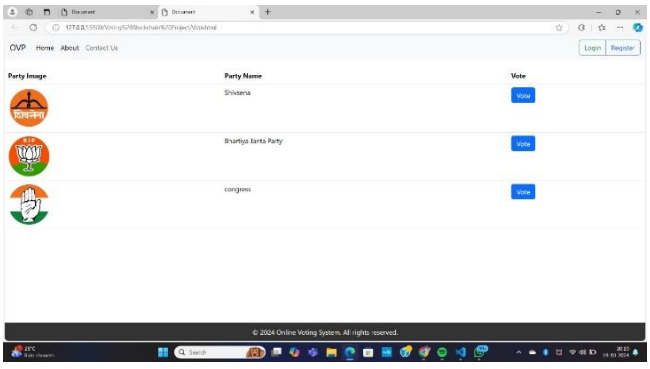


Fig.1.6 Zone selection

In Fig 1.6, after verifying the Aadhar card by entering the One-time password, the user jumps to the zone page where

they have to input their zone for the voting process.

Fig.1.7 Voting Page

In Fig 1.7, the user has now successfully been verified by their Aadhar card and has entered the zone, hence they will now be able to vote to any party they want.

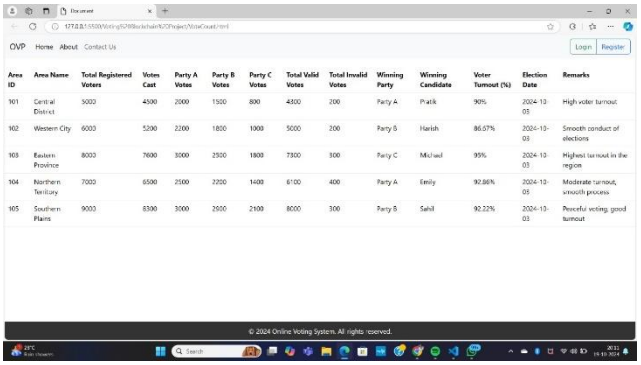


Fig.1.8 Vote's count(database)

In Fig 1.8, it displays the database which provides information on the total number of votes, the area name, remarks on the voting process, and the winning candidate for the admin to identify the party with the majority of the votes..

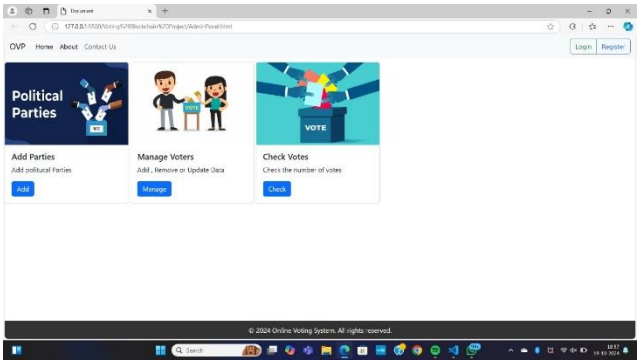


Fig.1.9 Admin Page

In Fig 1.9, it shows how only the admin can add new parties in the area, manage the voters which include adding or removing of a voter due to any possible reason and to view the votes which again will only be accessible to the admin.

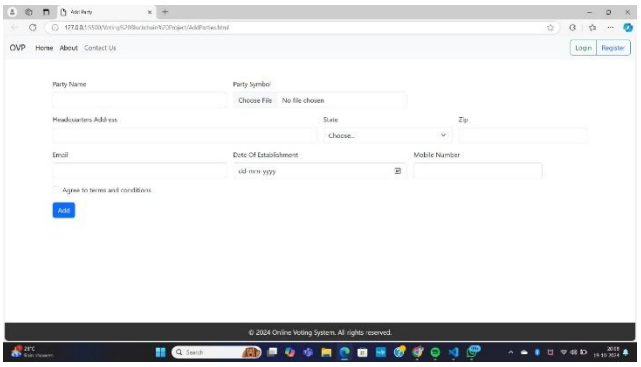


Fig.2.0 Add parties

In Fig 2.0, the admin will be able to add new political parties by adding their party name, party symbol, establishment date, and mobile number necessary for the candidates to know about the new party.

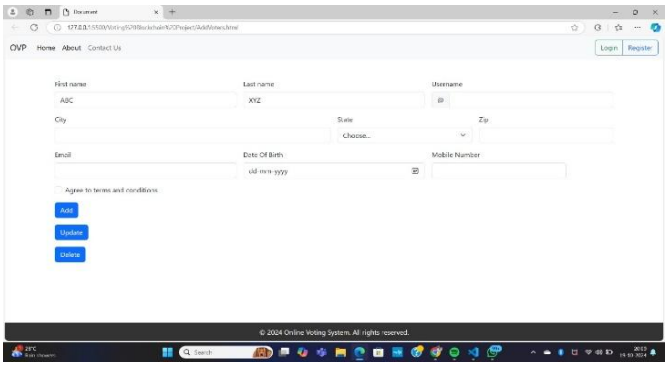


Fig.2.1 Update page

In Fig 2.1, the user will now be able to update their details if they added any wrong information then they will be able to delete any incorrect values, due to which they will have a smooth voting process.

VI. Discussion and Conclusion

The concept of incorporating online voting systems to make the public election process cheaper, quicker, and easier is a compelling one in modern society. Having the electoral process cheap and fast, normalizing it in the electorate's eyes, removing a certain control barrier between the elector and the elected official, and putting some pressure on the elected official. It also opens the door to a more transparent type of democracy that requires electors to speak their will on specific bills and initiatives.

We have deployed an online-based blockchain voting framework in this project where smart contracts are used to

allow secure and cost-effective elections while preserving the secrecy of the voters. Compared with previous research, we have shown that blockchain technology provides a new opportunity for democratic countries to move from the pen-and-paper election scheme and paperless direct-recording electronic voting machine (DRE) to a more cost-effective and time-efficient election scheme, thus mounting the security measures of the current scheme and offering new accessibility.

VII. Future Scope

The current system uses Ethereum which is a public blockchain. It is permissionless as nothing is standing in the way of participation and anyone can engage with a consensus mechanism, scaling obstacles have been encountered and throughput is relatively weak. [2]. To avoid such issues consortium blockchain can be used which combines elements from both public as well as private blockchain. The current project is built for small organizations, but in the future, we will build it as a national voting system. In addition to the present fingerprint module which is used for authorization a facial recognition module would be incorporated for better security.

VIII. Reference

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