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FaceChainVote: A Unified Blockchain-Driven AI Electoral System

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Abstract: ***Voting plays a crucial role in a democratic society, giving citizens a direct voice in governance. However, traditional voting systems in India are often plagued by challenges such as vote tampering, delays in result announcements, and inefficiencies in vote counting. Even current electronic voting methods face concerns like inconsistent implementation across states, security loopholes, and limited accessibility. To address these pressing issues, this project introduces a blockchain powered electronic voting system that ensures traceability, transparency, and enhanced voter authentication. The proposed solution leverages QR codes and facial recognition technology powered by CNN, linked with Aadhaar data for multi-layered verification. This combination provides robust voter identification, ensuring only eligible individuals can cast their votes. Voters can securely vote from any authorized booth, with each vote encrypted using 256-bit SHA hashing and recorded on a tamper-proof blockchain. Any suspicious attempt to alter a vote activates an instant "Vote Integrity Verifier Link" via SMS, allowing voters to confirm the authenticity of their submissions. Moreover, the system implements a self-tallying mechanism that enables accurate, same-day results without manual counting. By introducing a unified voting platform across all states, it simplifies and standardizes the electoral process nationwide. Overall, this project presents a secure, scalable, and transparent voting framework aimed at strengthening public trust and modernizing India's democratic infrastructure.***

Keywords: *Blockchain Voting, Facial Recognition Authentication, Self-Tallying Electronic Voting System*

I. INTRODUCTION

Voting is one of the most important rights in a democracy it gives every citizen the power to shape their government. But in India, the current voting systems still face major challenges. Traditional methods are slow, sometimes vulnerable to tampering, and often lead to delays in announcing results.

Even modern electronic voting machines aren't perfect they vary across states, can be difficult to access for some voters, and still raise concerns about security and transparency. This project aims to solve those problems by introducing a modern, high-tech voting system that combines blockchain technology with AI-based facial recognition.

Voters will be verified using QR codes and face recognition powered by CNN, linked with their Aadhaar ID for strong, multi-layered authentication.

This ensures that only legitimate voters can cast a vote and they can do it securely from any authorized polling booth. Once a vote is cast, it's encrypted and stored on a blockchain, making it impossible to change or tamper with. If anyone tries to interfere with a vote, the system instantly alerts the voter through an SMS with a "Vote Integrity Verifier Link", so they can check if their vote was recorded correctly. Another key feature is the self-tallying mechanism that automatically counts all votes, allowing same day result announcements without the need for manual counting.

And by creating a unified voting platform for the entire country, the system ensures consistency and smooth election management across all states. It is designed to make voting in India more secure, transparent, and efficient helping to strengthen trust in the democratic process for every citizen. This system not only addresses existing issues with India's electoral process but also future proofs it. It combines advanced technologies to protect the integrity of votes, speed up election outcomes, and make the system accessible and reliable for all citizens. Ultimately, the goal is to restore and strengthen public confidence in elections by providing a voting experience that is secure, transparent, and efficient a system that truly reflects the spirit of democracy in the digital age.

II. LITERATURE SURVEY

1) S.Jehovah Jireh Arputhamoni; A.Gnana Saravanan (2021). Online Smart Voting System Using Biometrics Based Facial and Fingerprint Detection on Image Processing and CNN, the aim of this project is the detection of face and fingerprint images, the number of fake voters can be reduced using Haar Cascade Algorithm.
2) Sunil (2020). Avoiding Phishing Attack on Online Voting System Using Visual Cryptography, this study introduces to maintain the security in online voting system using CAPTCHA code and Image Share technology.
3) Prabhu.A, Nizarahammed. R, Thirrunavukkarasu.P (2021). Smart Online Voting System,this study introduces to allows the user to vote offline as well if he/she feels that is comfortable using radio frequency identification (RFID) tags
4) Ramya Govindaraj Kumaresan P, K.Sree harshitha.(2020). Online Voting System using Cloud, this study proposes to implement online voting system with features like the schemes that the specific party has implemented, based on the features are going to vote.
5) Vishrant Khanna, Raghav Chabra (2020). The Next Gen Election: Design and Development of E-Voting Web Application , This paper is to come up with a new solution, does come with a small learning curve, citizens will have to be trained on how to exercise their right to vote online.
6) Bhattacharjee, S., & Choudhury, S. (2021). A secured e-voting system using blockchain technology. proposes a model for blockchain-based e-voting and discusses its benefits.

III. PROPOSED SYSTEM

The proposed voting system is designed to fix many of the problems we see in traditional voting methods, like tampering, identity fraud, and delayed results. By using advanced technologies such as blockchain, facial recognition, and multi-level security checks, this system aims to make elections more secure, faster, and fully transparent. To make sure only eligible voters can cast their vote, the system uses a strong two-step verification process the voter scans a QR code. Then, the system uses facial recognition powered by AI specifically, a type of algorithm called a CNN to verify the person's face. This facial data is cross-checked with Aadhaar records, ensuring the person is who they claim to be. This process reduces the risk of voter fraud or impersonation and adds an extra layer of security to the voting process.

All votes are encrypted and recorded on a blockchain, which acts like a digital ledger that can't be changed or hacked. Once a vote is cast, it's permanently stored and cannot be altered or deleted by anyone. If someone tries to interfere with the votes in any way, the system detects it instantly and sends out an alert—keeping the election fair and secure. Instead of relying on slow and error-prone manual counting, this system uses a self-tallying mechanism. It automatically counts the votes as they come in and provides same-day election results—quickly and accurately. This not only speeds up the election process but also helps avoid any confusion or manipulation during counting.

To build trust with voters, the system includes a "Vote Integrity Verifier Link". After voting, if anything unusual happens with your vote, the system will send you an SMS alert with a link that lets you verify your vote was recorded correctly. This gives voters peace of mind and adds a layer of transparency to the entire election process. This new voting system brings together the best of modern technology to solve real-world problems in elections. It offers secure voter authentication, tamper-proof voting, fast results, and full transparency making it a smarter, safer, and more trustworthy way for people to vote in a digital India.

IV. IMPLEMENTATION

The implementation of the project brings together several modern technologies to build a voting system that is secure, transparent, and easy to use. The system is carefully designed to provide a smooth experience for both voters and election officials, while also ensuring strong backend support and data protection. The part of the system that users interact with the front end is built using HTML, CSS, JavaScript, and React.js.

These tools help create a responsive, clean, and user-friendly interface that works well on desktops, laptops, tablets, and smartphones. the system uses Python and Flask to handle all the complex tasks like processing data, handling login requests, and connecting to the blockchain. Flask is a lightweight and efficient web framework that allows the backend to respond quickly and reliably. All the important data like voter information, vote logs, and candidate details is stored securely in a MySQL database. This database acts like a digital vault, keeping sensitive election information safe organized.

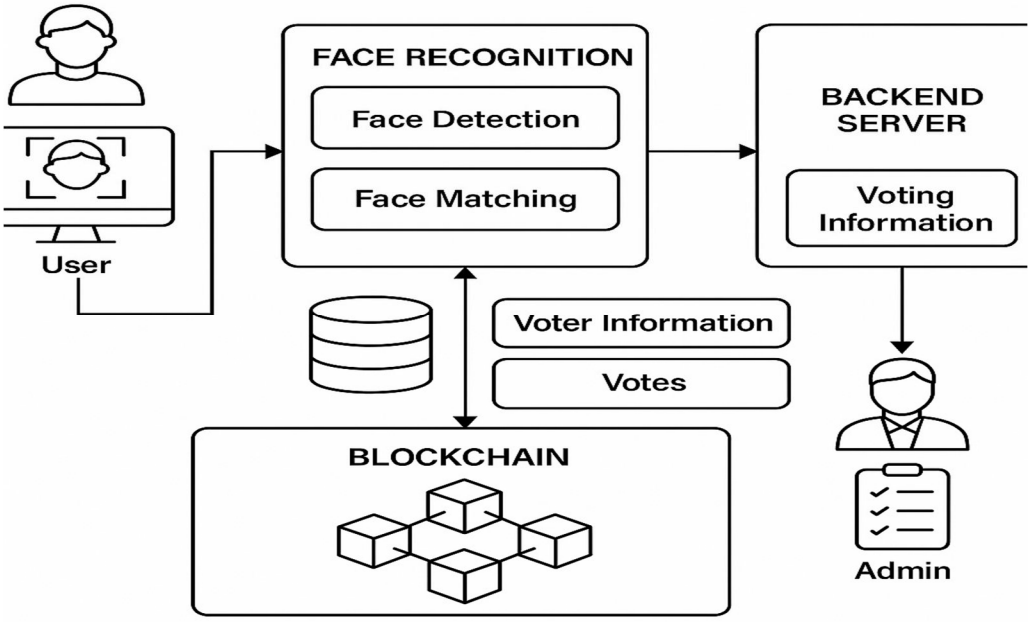


Fig.1 Architecture diagram

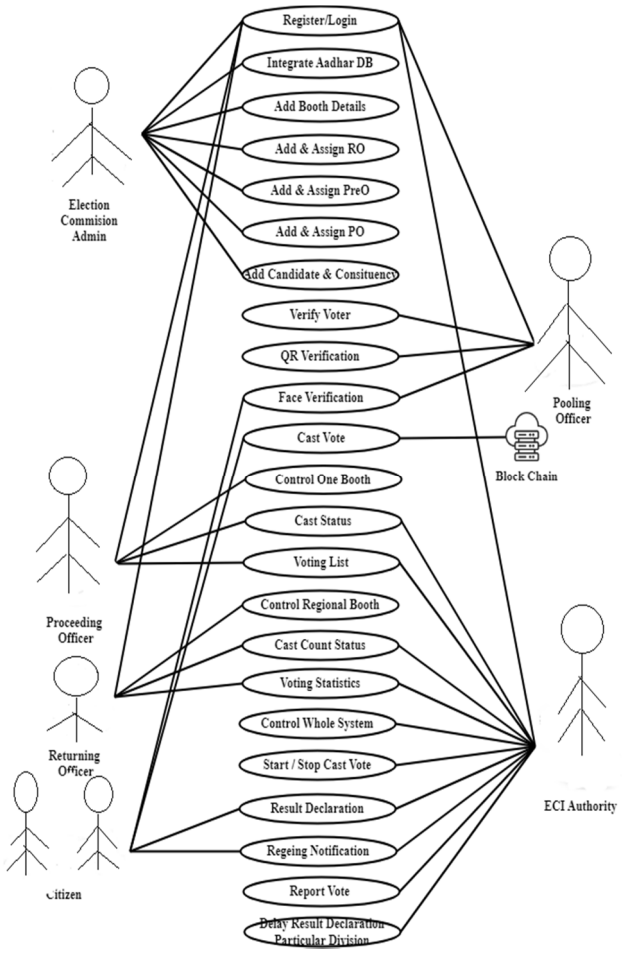


Fig.2 Usecase diagram.

V. DISCUSSION AND RESULTS

A. *System Accuracy*

The voting system delivers a high level of accuracy across all key components as it has facial recognition feature used by CNN algorithm, so it correctly verifies voter identities in about 97% of cases, ensuring secure and reliable authentication. The blockchain ensures 100% data integrity, meaning once a vote is recorded, it cannot be changed or tampered with. The self-tallying mechanism is also highly accurate, correctly counting votes with 99.9% precision and generating results within minutes of polls closing. Overall, the system operates with an estimated accuracy of around 98%, making it a highly dependable and secure solution for modern digital voting.

B. *Self-Tallying Mechanism*

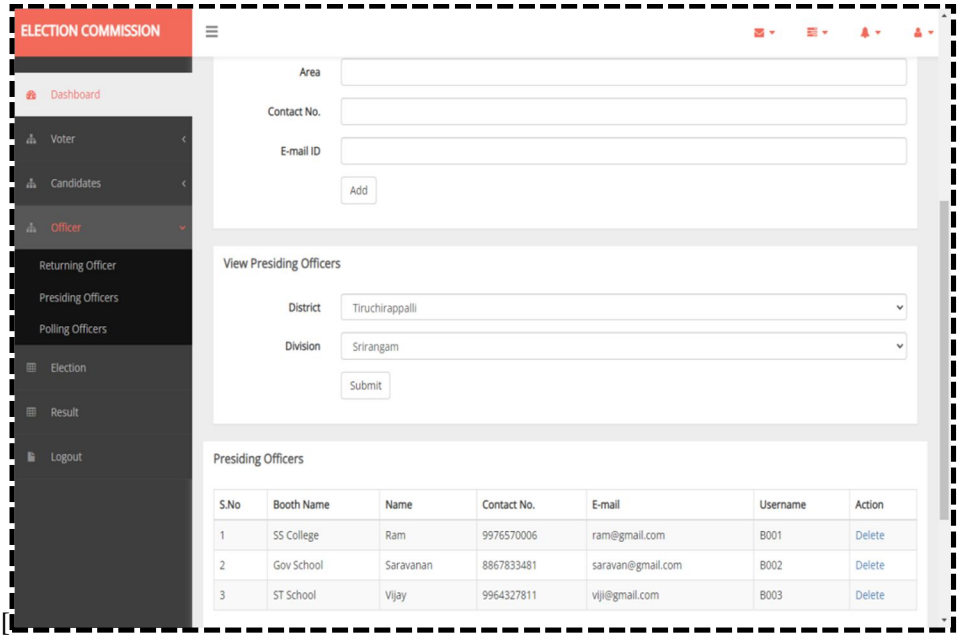
The self-tallying mechanism is designed to automatically count votes as they are submitted, removing the need for any manual counting. Each vote is securely recorded on the blockchain, and the system keeps track of the totals in real time. Once the voting period ends, the system instantly compiles the results and generates the final count within minutes. This not only speeds up the entire election process but also eliminates human errors, reduces the risk of manipulation, and ensures that results can be announced quickly and accurately often on the same day.

C. *User Interaction and System Integration*

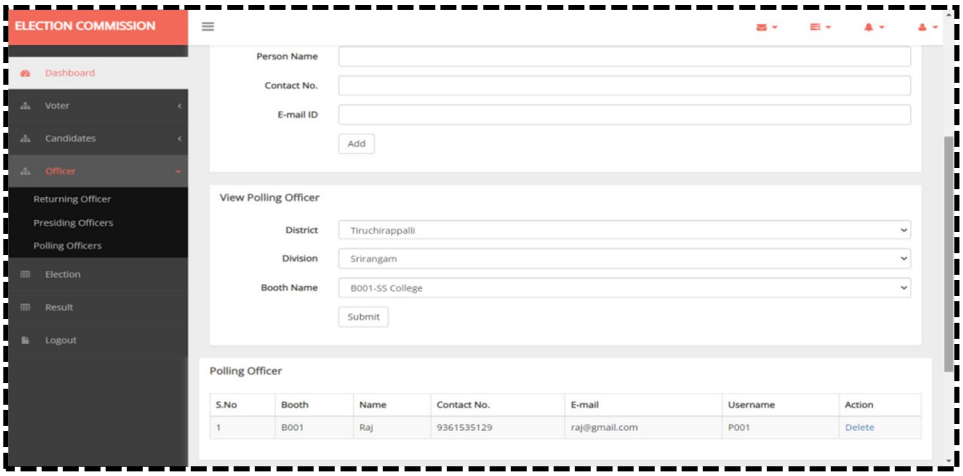
The system is designed to be easy for both voters and officials to use. Voters interact with the platform through a clear and user-friendly interface where they log in, scan a QR code, and use facial recognition to verify their identity. Once verified, they can cast their vote securely. Behind the scenes, different parts of the system like the front-end, the back-end , the blockchain, and the database all work together smoothly through APIs. This seamless integration ensures a fast, secure, and reliable voting experience from start to finish.

D. *Scalability and Security*

The system is built to handle voting on a large scale, making it suitable for local, state, or even nationwide elections without slowing down or crashing. It can support millions of voters at the same time, thanks to cloud-based technology and efficient backend processing. On the security side, it uses strong encryption and blockchain technology to protect every vote from being changed or tampered with.



[A] Presiding page



[B] Polling page

VI. CONCLUSION

In conclusion, this project presents a modern, secure, and transparent alternative to traditional voting systems. By using blockchain technology, it protects every vote from being altered or tampered with, helping to build trust in the election process. The system also uses Aadhaar based authentication along with OTP verification to make sure that only eligible voters can take part. Every vote is securely recorded and cannot be changed, which adds a strong layer of transparency and accountability. The system is made up of several important parts, including voter registration, vote casting, and vote verification each one designed to work smoothly and securely. With a simple and user friendly interface that makes the process easy even for people who may not be tech savvy. Voters can use the platform without confusion, and election officials can manage everything more efficiently.

Because the system is directly connected to a secure blockchain, every action from registering a voter to casting and verifying a vote is safely tracked. This not only improves the reliability of the results but also increases confidence among the public that the election was fair and accurate its user friendly interface and seamless connection to the blockchain, the platform offers a reliable and efficient voting experience for both citizens and election officials.

VII. FUTURE ENHANCEMENT

In the future, this blockchain-based online voting system can be improved to become even more secure, accessible, and useful for a wider audience. One way to enhance security is by adding (MFA), like using an OTP or a secure mobile app, to give voters an extra layer of identity verification. The system could also be expanded to support international elections by including multiple languages, adapting to different countries' election laws, and considering cultural differences making it suitable for global use. Another useful addition would be a voter education section within the platform. This could help voters learn about the voting process, the candidates, and key election updates, helping people make more informed decisions and increasing voter participation. The system can also include a transparent, blockchain-based audit trail so that every step of the election process can be tracked and verified. This would boost public trust by proving that the election was fair and secure. In addition, connecting the platform with national and local election commission systems would help manage election data more efficiently and stay in line with official rules. Looking ahead, creating a mobile app would let voters cast their votes directly from their smartphones especially helpful for peoplemobility.

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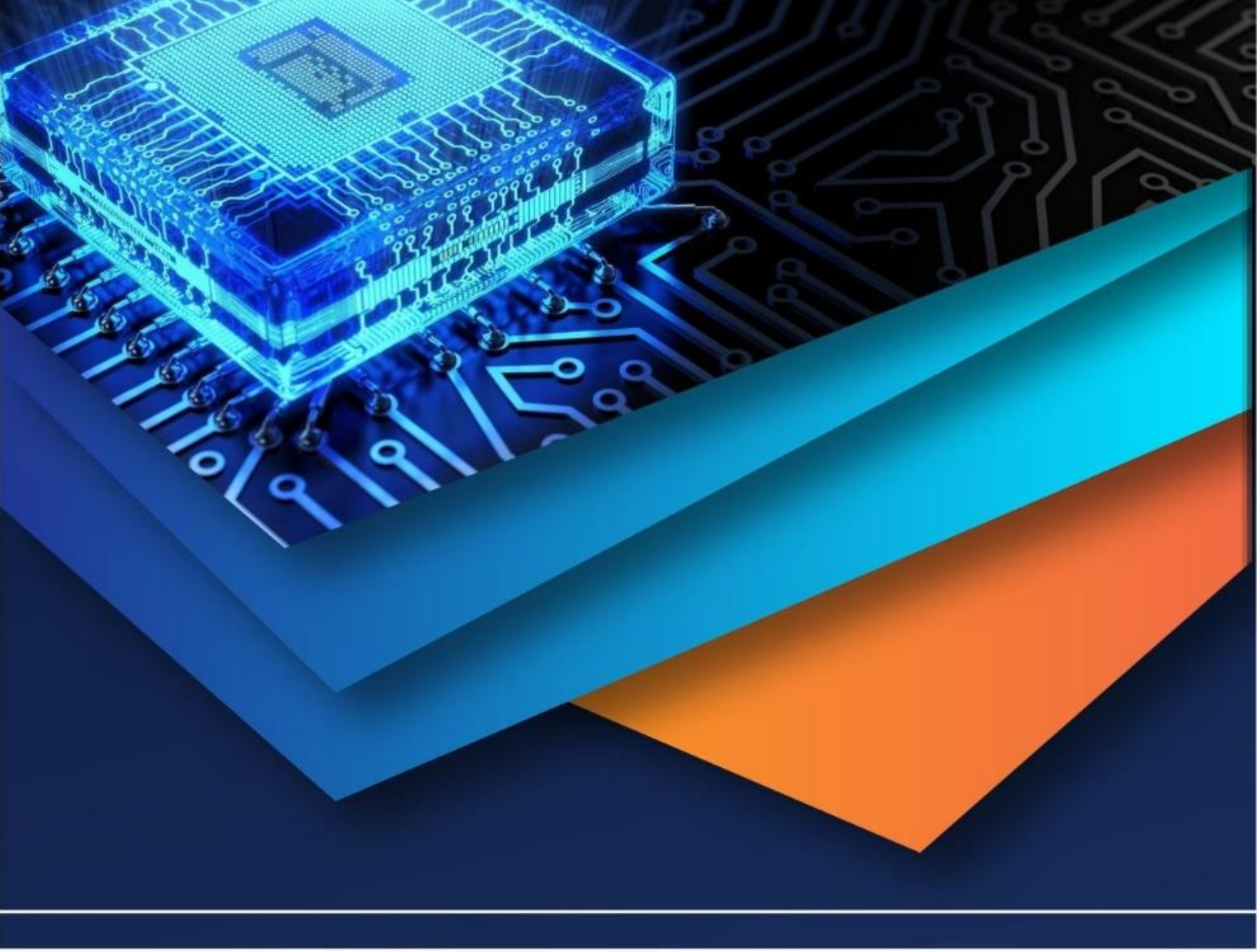

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