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Vote Chain - Secure Voting for the Future

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Abstract:
Voting is one of the most important processes in a democratic system, but traditional methods like paper ballots and electronic voting machines often face problems such as fraud, lack of transparency, and delays in result processing. To overcome these issues, this paper proposes "Vote Secure", a smart electronic voting system designed to improve security and reliability.The system uses facial recognition along with a PIN verification method to make sure that only authorized users can vote. Each vote is protected using AES encryption before storing it in the database, ensuring data safety and preventing misuse. The system also includes features like admin control, activity tracking, and real-time result updates to improve transparency.Overall, this approach provides a simple, secure, and efficient solution for modern digital voting systems.

Keywords: Electronic Voting System, Face Recognition, AES Encryption, Secure Voting, Biometric Authentication, Fraud Prevention, Digital Democracy, Online Voting System

I. INTRODUCTION

Elections are a fundamental component of any democratic society, enabling citizens to Elections play a key role in any democratic country, as they allow people to choose their leaders. For this reason, it is very important that the voting process is secure, transparent, and reliable. However, traditional voting methods such as paper ballots and electronic voting machines have several issues like impersonation, vote tampering, delays in counting, and high costs.

With the growth of digital technology, electronic voting systems are becoming more popular because they can make the process faster and easier. But still, many existing systems face problems related to user authentication, data security, and trust. Weak verification methods may allow unauthorized users to vote, and poor data protection can lead to information leaks.

To solve these problems, this paper introduces "Vote Secure", a web-based voting system that combines biometric authentication with encryption techniques. It uses facial recognition and PIN verification to ensure that only valid users can vote. In addition, AES encryption is used to protect the voting data. The system also includes different modules such as voter, admin, and result tracking to improve transparency and efficiency.

II. MODULES

The proposed **Vote Secure** electronic voting system is designed using a modular architecture to ensure security, scalability, and ease of management. Each module performs a specific function and collectively contributes to the secure and transparent execution of the voting process.

A. Voter Module

The Voter Module allows eligible users to register and participate in the election process. It manages voter details such as personal information, facial biometric data, and unique identification credentials. This module provides an interface for voters to log in, authenticate themselves, view the list of candidates, and cast their votes securely.

B. Authentication Module

The Authentication Module is responsible for verifying the identity of voters. It uses **face recognition** technology to compare the live facial image of the voter with the stored facial data. In addition to biometric verification, the module requires **PIN verification**, providing an extra layer of security. Only voters who successfully pass both authentication checks are allowed to proceed to the voting stage.

C. Candidate Module

The Candidate Module manages candidate-related information such as candidate names, symbols, and election details. This module ensures that only approved candidates appear on the voting interface. It allows administrators to add, update, or remove candidate data before the election begins.

D. Voting Module

The Voting Module enables authenticated voters to cast their votes. Once a voter selects a candidate, the vote is immediately processed and prepared for secure storage. This module ensures that each voter can vote only once, thereby preventing duplicate or fraudulent voting.

E. Encryption Module

The Encryption Module secures the voting data using the **Advanced Encryption Standard (AES)** algorithm. Before storing the vote in the database, it is encrypted to protect confidentiality and prevent unauthorized access or tampering. This ensures the integrity and privacy of each vote throughout the election process.

F. Admin Module

The Admin Module provides centralized control over the entire voting system. Administrators can manage voter registrations, approve candidates, monitor voting activity, and view audit logs. This module also enables real-time monitoring of election results while maintaining system security and transparency.

G. Results Module

The Results Module displays election outcomes in a clear and transparent manner. It allows administrators and authorized users to view real-time voting statistics and final results once the election concludes. This module helps build trust by ensuring timely and accurate result declaration.

H. Database Module

The Database Module securely stores all system data, including voter details, encrypted votes, candidate information, and audit logs. Strong access control mechanisms are implemented to protect sensitive information and maintain data integrity.

III. LITERATURE SURVEY

This paper proposed a cryptographic online voting system using homomorphic encryption to ensure vote privacy and verifiability. Although secure, the system has high computational complexity and limited scalability [1]. This study introduced the Helios web-based online voting system with end-to-end verifiability and transparency. However, it is vulnerable to voter coercion and depends on secure client devices [2]. This work presented a blockchain-based online voting framework to improve transparency and prevent vote tampering. The system faces challenges such as high transaction costs and latency [3]. This paper proposed a hybrid blockchain and cryptography-based voting system to enhance voter anonymity and auditability. Despite improved security, system complexity limits practical deployment [4]. This survey analyzed existing online voting systems and identified major challenges including scalability, privacy, and public trust. It concluded that further research is needed for real-world implementation [5].

IV. FUTURE SCOPE

The proposed system can be further enhanced by incorporating advanced technologies to improve performance and scalability. Integrating blockchain can provide a decentralized and tamper-resistant

storage mechanism for votes. Developing a mobile-based version of the application would make the system more accessible to a wider range of users, including those in remote areas.
Future improvements may also include additional authentication methods such as fingerprint scanning or one-time passwords to strengthen security. Enhancing facial recognition accuracy using modern deep learning techniques can improve reliability under different environmental conditions. Moreover, the system can be expanded to handle large-scale elections by incorporating real-time analytics and intelligent monitoring to identify suspicious activities, making it suitable for nationwide deployment.

V. Algorithm

Step 1: Start the voting system.
Step 2: The voter opens the electronic voting application.
Step 3: The system captures the live facial image of the voter using the camera.
Step 4: The captured face is compared with the stored facial data in the database.
- If the face does not match, access is denied and the process is terminated.

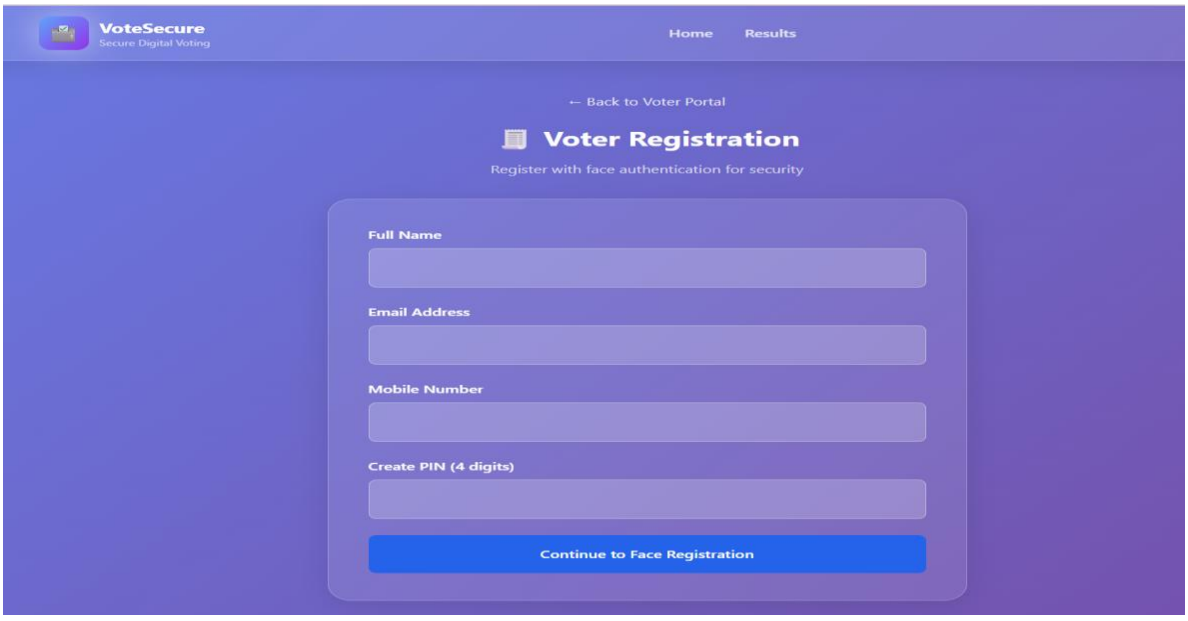
Step 5: If face authentication is successful, the system prompts the voter to enter their PIN.
Step 6: The entered PIN is verified with the stored PIN.
- If the PIN is incorrect, access is denied and the process is terminated.

Step 7: If both face recognition and PIN verification are successful, the voter is authenticated successfully.
Step 8: The system displays the list of approved candidates to the voter.
Step 9: The voter selects a candidate and submits the vote.
Step 10: The system encrypts the vote using the **Advanced Encryption Standard (AES)** algorithm.
Step 11: The encrypted vote is securely stored in the database.
Step 12: Audit logs are updated to record voter activity and vote submission details.
Step 13: A confirmation message "Vote Submitted Successfully" is displayed to the voter.
Step 14: The administrator can monitor votes and view real-time results through the admin dashboard.
Step 15: Stop the process.

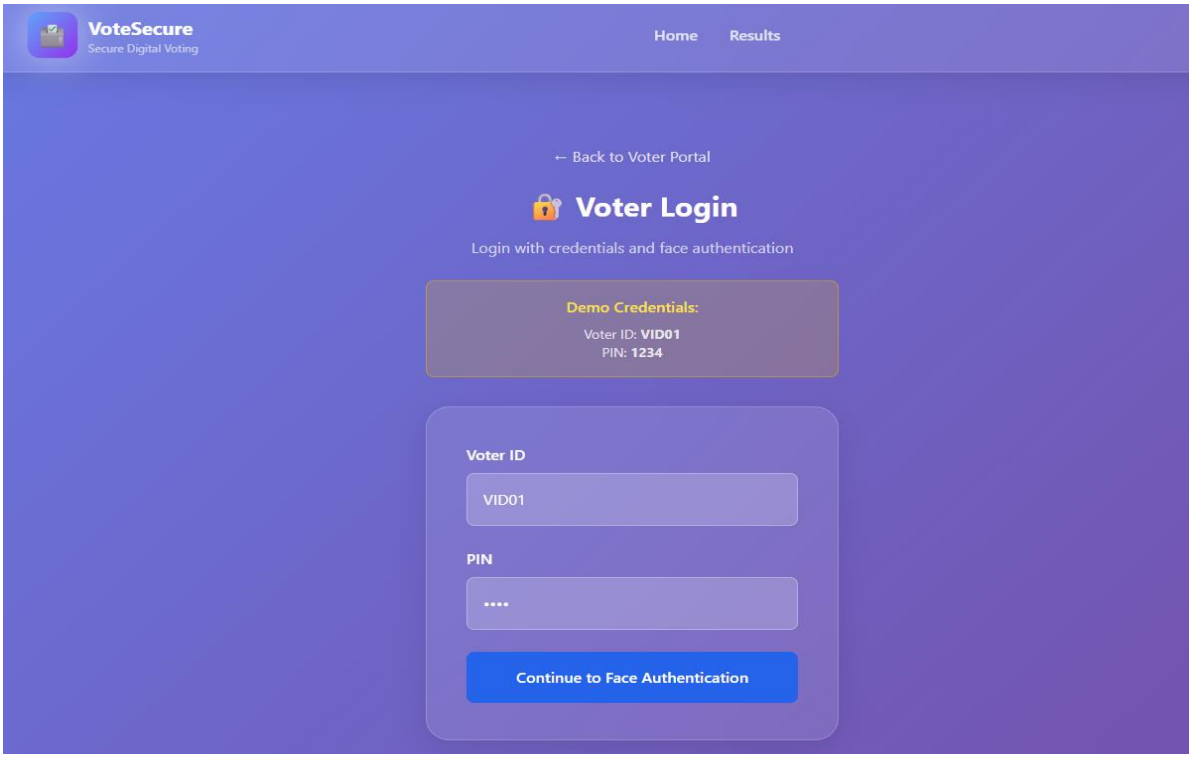
VI. Result

Main Page

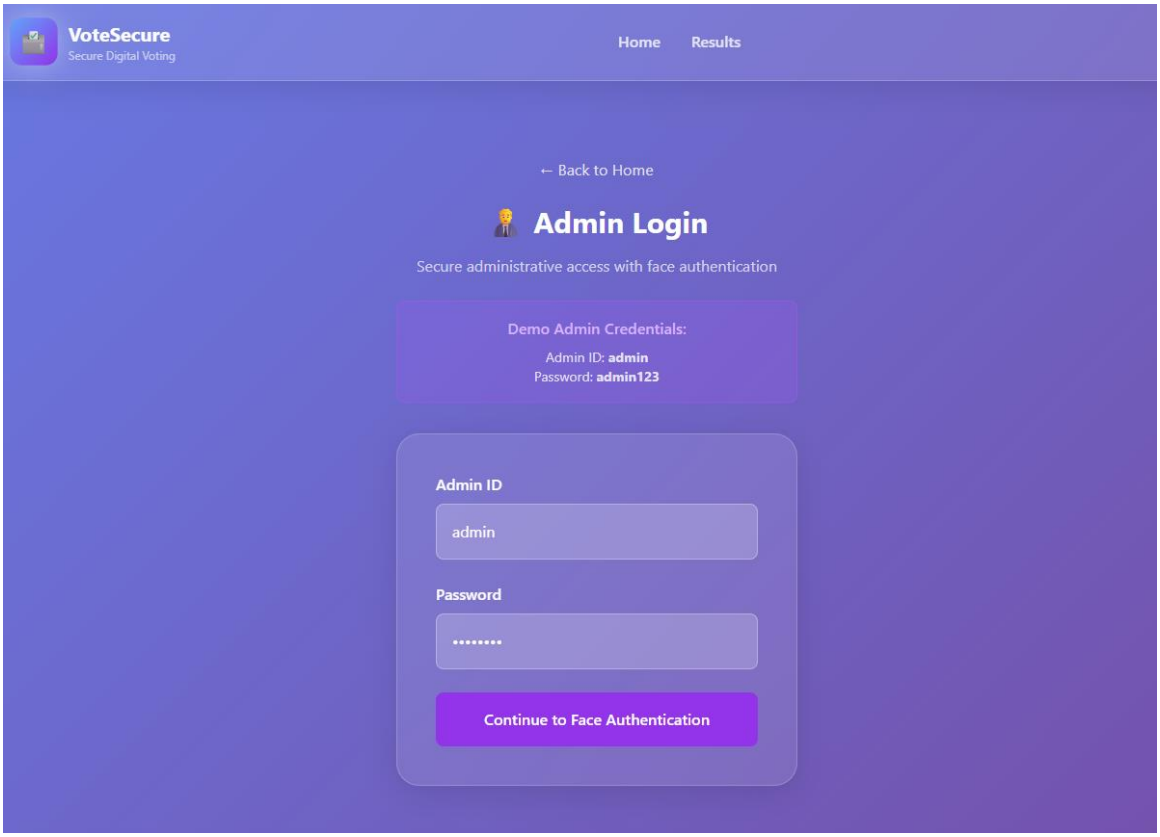
Voter's Page



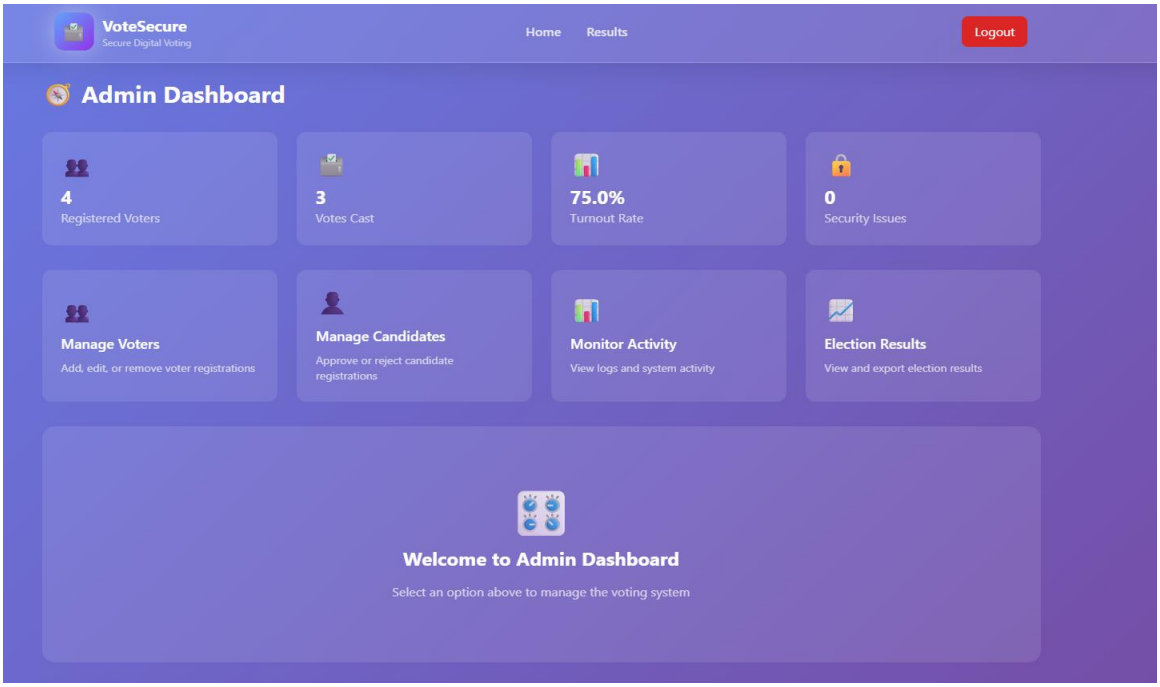
Voter's Registration Page



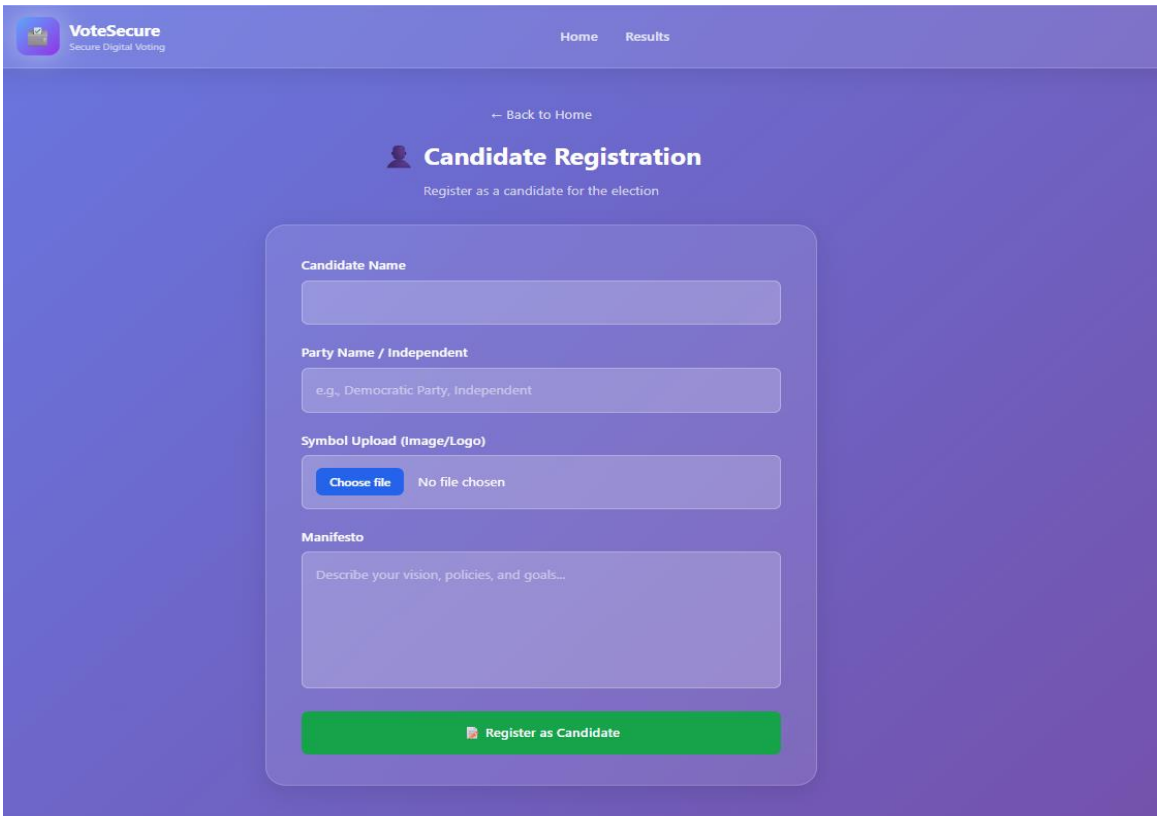
Voter's Login Page



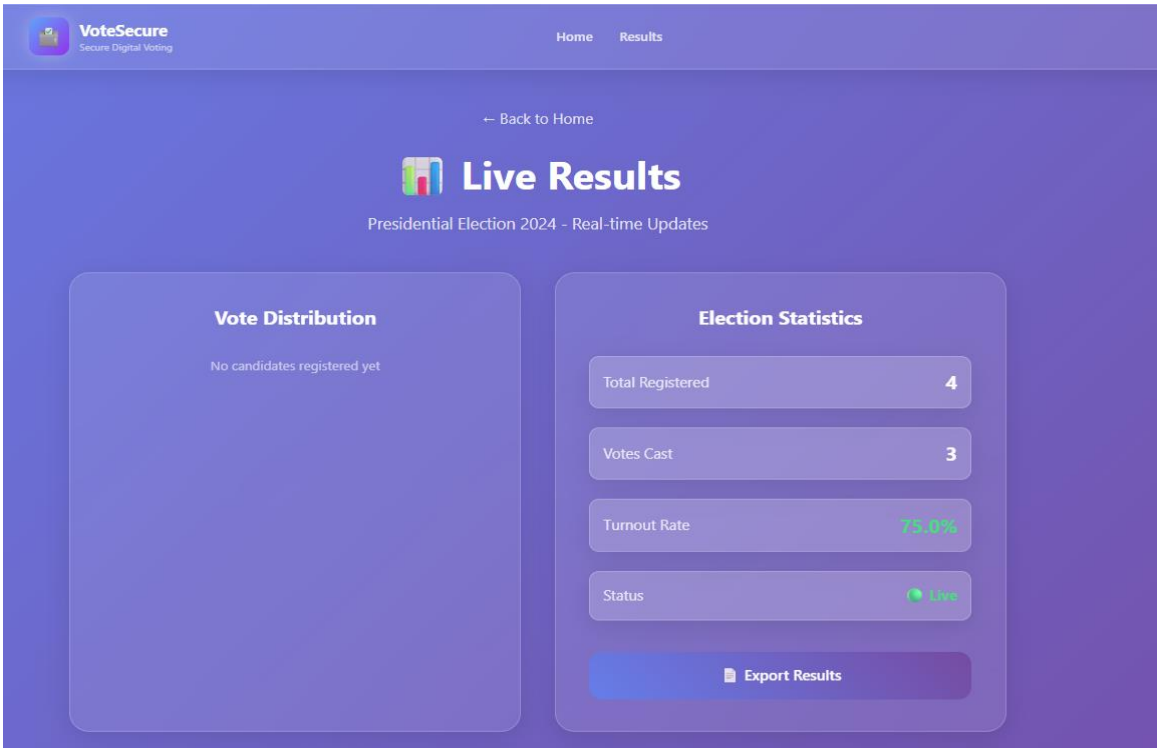
Admin's Login Page



Admin's Dashboard



Candidate's Registration Page



Results Page

VII. Conclusion

The Vote Secure system provides a better solution compared to traditional voting methods by using modern technologies. The use of facial recognition and PIN verification helps in making sure that only valid users can vote, which reduces fraud and duplication.The encryption of voting data ensures that the information remains safe and cannot be easily tampered with. Features like activity logs and real-time results improve transparency and trust.Overall, the system makes the voting process more secure, faster, and reliable. It also has the potential to be improved further and used in real-world applications.

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