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"E-Voting Application – A Secure Online Voting System"

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ABSTRACT :

This project aims to enhance the effectiveness, security, and accessibility of electoral processes using a web-based E-Voting platform. Conventional paper-based voting systems tend to be resource-intensive, error-laden, and time-consuming, resulting in inefficiencies and possible tampering. This research overcomes these shortcomings by implementing a secure, scalable, and easy-to-use electronic voting platform that guarantees one-person-one-vote integrity.

The system utilizes contemporary web technologies such as PHP, MySQL, and JavaScript in providing safe voter authentication, vote storage in encrypted form, and live result calculation. The system enables role-based access control for Voters, Candidates, and Admins, providing functionalities such as candidate administration, voter validation, live election tracking, and auto-proclamation of results.

This electronic revolution increases transparency, lessens human error, and promotes more participation by enabling voters to vote remotely using an internetenabled device. The system is particularly beneficial for educational institutions, municipalities, and private organizations holding internal elections. The process involves requirement analysis, modular design, secure coding techniques, testing, and deployment. The E-Voting Application is designed with scalability and flexibility in mind to support reliable digital democracy..

KEYWORDS: Online Voting, Digital Elections, Secure Authentication, Role-Based Access, Computation of Results in Real Time, Transparent Voting, E-Governance.

INTRODUCTION

The E-Voting Application is a cutting-edge electronic solution that has been created to transform and secure the process of voting in various organizational and institutional settings. Traditional election procedures such as ballot papers and physical polling stations are typically cumbersome, resource-intensive and easy to manipulate or prone to human error.

This Web-based system offers a secure, scalable, and user-friendly interface to conduct elections on the Web. It utilizes technologies like PHP, MySQL, JavaScript, and HTML/CSS to provide secure voter authentication, encryption of vote storage, and automatic result calculation. By allowing qualified voters to vote from anywhere on the planet with Internet access, the system eliminates participatory logistical barriers to access and optimizes participation.

The system provides Voters, Admins, and Candidates role-based modules with clearly defined responsibilities and efficient election management. With real-time monitoring, logging, and strict verification, the system not only provides efficiency and ease of use but also facilitates integrity, transparency, and trust in electronic elections.

LITREATURE SURVEY/BACKGROUND

E-voting technologies have been a revolutionary innovation in international democratic politics, drawing a huge volume of attention from researchers, policymakers, and technologists. Greater dependence on digital infrastructure has motivated governments and institutions to learn from web-based voting systems as a way of enhancing electoral efficiency, turnout, and transparency levels. Various studies have investigated the viability of web-based voting systems, highlighting their potential to automate election processes, minimize human intervention, and overcome physical constraints of conventional polling stations.

A study by Gupta et al. illustrated that secure, easy-to-use internet interfaces can drive voters to the polling booth, especially among technologically advanced communities and citizens in far-flung regions. Their study illustrated that the application of identity verification procedures—like OTP-based login and Aadhaar-based authentication—could go a long way in securing online votes. The study by Sharma and Kulkarni also illustrated how blockchain and end-to-end encryption can be utilized to provide secrecy, integrity, and immunity from tampering and manipulation of votes.

Literature also discusses the problem of digital inclusiveness and data privacy. In Thomas and Mehta's study, although e-voting has its advantages, problems of digital illiteracy, uneven penetration of the internet, and lack of faith in distant mechanisms have to be addressed by public education

campaigns and technical support systems. They emphasize the need for strong legal frameworks and data protection legislation to provide voter confidence and system legitimacy. Furthermore, case studies in countries like Estonia and Switzerland are examples of national-level e-voting implementations. The research reveals that with sufficient cybersecurity infrastructure and voter education, internet voting can be an operational option even for large-scale public polls. Displaying results in real time, audit trails, and multi-level authentication are common recommendations in the literature to ensure accuracy and transparency.

Furthermore, role-based access control—voters, candidates, and administrators with individual rights—has been identified as a wise way of structuring and securing election procedures. Transparent logging and monitoring procedures, through which election commissions can monitor voting activity and settle disagreements effectively, are also supported by scholars.

Finally, the literature emphasizes the need to create secure, scalable, and inclusive e-voting applications. As much potential as the technology holds, it has to continue innovating if it is to solve ethical, infrastructural, and technical problems. By harmonizing technological development with effective governance policies, e-voting can be a powerful tool for reforming electoral systems globally.

PROPOSED WORK/SYSTEM

1. System Overview:

The approach is based on the automation and protection of the election process using a secure and accessible online system. The system eliminates the use of polling stations, paper ballots, or manual verification procedures. The system provides registered voters with the choice of voting online using secure authentication procedures. All the votes are encrypted electronically, stored, and processed as they are counted to ensure transparency, privacy, and instantaneous generation of results. The key components of the system are :

- User Authentication : Verifies voter identity using OTP, email authentication, or Aadhaar authentication before giving access to the voting portal.
- Candidate Management : Allows the admin to add, update, and change candidate profiles and election data.
- Vote Casting : Face detection and segmentation of the face region from the input image by utilizing Haar Cascade Classifier.
- Vote Encryption : Encrypts all votes using a cryptographically secure algorithm to avoid tampering and ensure confidentiality.
- Real-Time Monitoring : Enables admins to track voter turnout and system status in real-time to ensure transparency and control.
- Result Computation : Automatically tabulates encrypted votes and displays real-time results accurately with no human involvement.
- User Interface : A responsive, clean web interface for administrators, candidates, and voters to utilize respective functionalities.

The system architecture is modular and future-proofed to include other security options like blockchain or biometric authentication. As it is founded on web technologies like PHP, MySQL, and HTML/CSS/JavaScript, the platform is scalable, easy to maintain, and high performance.

The system is most appropriate to be used in schools, business organizations, community surveys, and any other organization that would like to conduct secure, fast, and transparent elections with little or no human intervention.

2. System Architecture

The design of the E-Voting Application is developed as a modular pipeline consisting of user authentication, casting of votes, vote encryption, computation of results, and oversight. It consists of the following major components :

1. Input Layer (User Authentication) :

- · Voter credentials are authenticated through OTP, email, or Aadhaar-based authentication mechanisms.
- The site allows only registered voters to use the site and cast their votes.

2. Vote Casting Interface :

- A simple and user-friendly interface is given to the users to select their preferred candidate.
- A single vote per voter can be made in an election session.
- The system disables voting options once submitted to prevent multiple votes.

3. Vote Encryption Module :

- All the votes are encrypted using secure cryptographic algorithms like RSA or AES.
- The votes are encrypted and saved in the database to avoid any kind of tampering or interception.

4. Vote Storage & Validation :

- · Encrypted vote cast with anonymous voter ID hash to provide anonymity and traceability without exposing voter identity.
- System detects duplicate voting attempts through token/session verification.

5. Result Computation:

- The votes are decrypted only after the election.
- The system automatically and accurately counts results without any intervention.
- · Integrity tests are conducted before declaration of final results.

6. Reporting and Monitoring:

- A dedicated admin dashboard offers :
 - Real-time monitoring of voters' turnout.
 - User activity logs and vote submission status.
 - Automated reporting in Excel or PDF format.
- Admins can also :

- o Manage candidates and election parameters.
- View statistics and export results.
- Securely reset or archive elections.

METHODOLOGY

- Registration and User Verification: The initial process of the system is the registration of the eligible voters through secure means. The user must enter valid credentials such as Aadhaar, email address, or mobile number to authenticate. A One-Time Password (OTP) is conveyed to authenticate the voter before granting access to the system.
- Secure Login Procedure : Following successful registration, voters login through a secure interface. The process protects against unauthorized access using session management, multi-factor authentication, and captcha verification.
- Encryption of voting and casting : Once authenticated, the voters are presented with a voting screen containing the list of all admissible candidates. The vote cast is encrypted using public key cryptography to provide confidentiality and prevent tampering with or tracing the voter's identity.
- Voting Count and Result Calculation: Every vote that is encrypted is validated and securely stored in a database. Vote hashing and timestamping are used to detect and deter vote attempts or system abuse.
- Voting Count and Result Calculation : All the votes are decrypted using the private key once the voting session ends, and results are
 automatically calculated. The system keeps the calculation of results transparent and accurate using checksum and audit verification
 methods.
- Monitoring and Administration : There is an admin interface which enables election officials to track the polling process in real time, see voter histories, manage candidates, and export report of results. Data and logs are securely stored for auditing.

RESULT AND DISCUSSIONS

The E-Voting Application built showed immense promise in securely handling electronic voting processes. System stability and real-time performance were optimal during testing in a simulated environment, with secure authentication and simple vote casting. The identity of the voter was properly authenticated with OTP-based verification, and encryption methods maintained the privacy of every vote.

Encrypted votes were recorded and saved properly, and result computation was done free from any human error, as there was no human intervention involved in the process. The system was also safe from common problems such as multiple voting and tampering with the database.

While the solution provides effective attainment of basic objectives, it was found to have some downsides—such as the need for a good internet connection and training of users to avoid invalid attempts. Despite these, the application is a strong, open, and scalable electronic solution for school, community, and organizational voting.

CONCLUSION

The E-Voting Application provides a secure, efficient, and easy-to-use means of having elections in a digital medium. Through the replacement of paperbased voting systems, it reduces fraud, lessens workload, and speeds up result processing. The use of encryption, OTP verification, and safe storage makes the system more reliable and trustworthy.

Its modular architecture facilitates straightforward customization to accommodate various types of elections, making it perfect for small- to mid-sized organizational application. Although there are some technical issues like user mistakes and internet reliance, overall performance justifies its capability to transform elections using digitalization.

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