Web-Based Online Voting System with Aadhar and Biometric Authentication

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Abstract-- Traditional voting methods frequently encounter issues like accessibility, management difficulties, and risks of fraud. To tackle these problems, this document introduces a Web-Based Online Voting System that aims to offer a secure, clear, and easy-to-use environment for voting. The suggested secure voting structure utilizes popular web technologies—HTML, CSS, JavaScript, PHP, and MySQL. Additionally, to ensure strict voter validation and prevent identity fraud, the system incorporates Aadhar number checks and instantaneous biometric capture using a webcam for faces or photos. The platform also includes an administrative interface for thorough management of voters and candidates, and automates the counting of results to ensure precision. This document outlines the system's design, methodology, implementation specifics, and the benefits compared to traditional methods.

Index Terms--Aadhar Verification, Biometrics, Cybersecurity, E-Voting, Online Voting System, Web Application.

I. INTRODUCTION

Democracy is fundamentally dependent on elections; thus the honesty of the voting method is crucial. While traditional paper voting systems are well-established, they face growing scrutiny for being inefficient, expensive, and vulnerable to manual interference or impersonation of voters. The swift advancement of internet technology has created opportunities for Electronic Voting (E-Voting) systems, which aim to improve accessibility and simplify the counting of votes.

This document presents an extensive Web-Based Online Voting System designed to advance organizational and community elections. By enabling voters to submit their votes from a distance through a protected online platform, the system significantly lessens the operational challenges associated with voting. Importantly, the system replaces outdated and less secure login options (such as basic passwords or SMS one-time passwords) with a strong two-tier authentication process that uses Aadhar number verification and real-time biometric checks through a webcam. These enhanced security measures guarantee that only authorized, registered individuals can engage in the election, promoting confidence and openness.

II. LITERATURE REVIEW

The idea of electronic voting has been thoroughly examined in scholarly writings. Initial versions largely depended on special voting devices situated at physical voting places. Although they enhanced counting speed, they did not address the issue of accessibility.

Subsequent Following research transitioned to virtual voting methods. Designs employing cryptographic techniques have been introduced to guarantee complete verification [2]. Nevertheless, numerous online voting systems face challenges with the "authentication issue"—confirming the true identity of the distant voter [5]. Some systems have suggested using OTP through SMS, yet this approach is susceptible to SIM card swapping and theft of devices. Recent progress in processing biometric information presents a promising alternative [3]. By integrating facial recognition or real-time photo capture associated with national identity registries [4] (like India's Aadhar), the suggested solution bridges the

significant issue of remote voter impersonation, further enhancing and refining current electronic voting systems.

III. SYSTEM ARCHITECTURE

The Online Voting System that operates on the web uses a traditional Client-Server design and is organized into several modules that work together.

A. Frontend (Client-Side)

The user domain has built using HTML, CSS, and JavaScript. It is designed to be highly responsive, ensuring accessibility across various devices (desktops, laptops). The frontend is responsible for capturing user inputs, interacting with the webcam for biometric verification, and displaying dynamic election data.

B. Backend (Server-Side)

Working with PHP and an Apache HTTP server (through XAMPP), the backend manages business rules. It safely processes login requests, checks biometric information and Aadhar details against the database, and enforces the regulation that each voter is allowed to vote only once.

C. Database Layer

A MySQL database serves as the main storage place. It handles several connected tables like the Voters Roster (which keeps information about registered voters, Aadhar numbers, and their voting status), the Candidates List (which holds candidate information and current vote totals), and Admin Accounts. Security and Authentication Module

This subsystem verifies the Aadhar number provided by the user. Upon successful Aadhar lookup, it triggers a biometric session, requesting webcam access to capture the voter's live image, ensuring the person logging in matches the registered identity.

IV. METHODOLOGY AND IMPLEMENTATION

The system's creation used an agile approach, which was broken down into stages of gathering requirements, designing, implementing, and testing.

A. Core Modules

1) Control Center: Higher-level access is provided to administrators so they can start elections, manage candidates by adding or removing them, supervise registered voters, and check the health of the system.

2) Registration and Verification of Voters: The verification process limits entry depending on the validation of the Aadhar number. When an Aadhar number provided is not found in the database, the system clearly denies entry with a message saying "User not authenticated," stopping unauthorized access.

Phase of Biometric Capture: By utilizing the HTML5 getUserMedia() API, the system connects to the camera on the user's device. This allows for a real-time capture of the voter's facial appearance, stopping the possibility of using still pictures to deceive the system.

3) Voting Platform and Result Counting: After logging in, the voter can see the list of candidates. The act of casting a vote starts a single database operation that increases the chosen candidate's count and updates the voter's state to 'voted'.

B. Implementation Environment

Development Stack: PHP, JavaScript, HTML5, CSS3. Database Environment: MySQL. Local Server: XAMPP (Apache).

V. RESULTS AND DISCUSSION

When implemented in a controlled testing setting, the system effectively oversaw every phase of an election. The incorporation of Aadhar verification efficiently eliminated unauthorized access attempts. The rigorous validation process promptly identified mismatched identities. The inclusion of webcams ensured a high success rate for obtaining voter photos on different supported devices, introducing a notable layer of biometric reliability. The admin dashboard efficiently obtained and showcased vote totals in real-time, operating smoothly during simultaneous voting sessions without any data concurrency issues.

ADVANTAGES AND LIMITATIONS

A. Advantages

Using multi-factor authentication that links national ID (Aadhar) with live biometrics greatly reduces voter fraud. Voters are able to cast their votes from anywhere, which decreases waiting times and boosts voter participation. This method removes mistakes made by humans when counting votes and significantly accelerates the release of results, while also lowering the requirement for physical polling places and paper ballots.

B. Limitations

The process of biometric verification needs devices that have a working webcam. Since it is an online platform, having constant internet access is essential for both confirming identity and sending in votes.

VI. FUTURE ENHANCEMENTS

Future versions of the software might include sophisticated AI facial recognition, using machine learning techniques to automatically compare the image taken from the webcam with the picture kept in the national ID/Aadhar database. Using decentralized ledger technology to establish a permanent record of votes, ensuring protection against tampering through cryptography, could also be explored along with creating mobile applications that work on both Android and iOS.

VII. CONCLUSION

The online voting system developed in this project serves as a strong and contemporary substitute for conventional voting systems. Utilizing user-friendly web technologies supported by a safe PHP and MySQL framework, the platform delivers a seamless smooth user interaction while ensuring strict data integrity. Importantly, tackling the weaknesses of remote voting through the innovative use of Aadhar number verification and real-time biometric capture via webcam guarantees that the system fulfills the rigorous security requirements of contemporary democratic methods. This research proves that secure, easy-to-use, and clear e-voting is very possible.

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