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Smart Voting through Iris Recognition

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***Abstract*— The online voting system has been designed to prioritize ease of use and high security. Iris recognition technology is employed for voter authentication, ensuring accurate identity verification and enforcing the principle of "one person, one vote." The system is developed using dependable technologies such as Flask and MySQL, enabling users to register and cast their votes efficiently. To further enhance security, additional measures including One-Time Password (OTP) authentication and email verification are integrated. An administrative dashboard facilitates real-time supervision of the voting process. In addition to being fast and cost-effective, the system offers significant potential for scalable deployment, improving electoral transparency and preventing duplicate or fraudulent voting**

***Index Terms*— Iris recognition, biometric authentication, digital elections, voting system, facial recognition, voter and Database.**

I. INTRODUCTION

Elections are getting a huge boost thanks to technology being so common now. Think about the old way: terrible lines, people messing up the paperwork, needing tons of staff, and the constant worry about cheating. It all made voting feel slow and unreliable. That's why we need new systems that are clear, secure, and genuinely simple to use. The most exciting fix is biometrics, using something that belongs only to you—like the unique pattern in your eye—to confirm who you are. We focus on iris scanning because that pattern is one-of-a-kind and never changes, making it the perfect way to stop people from voting twice or impersonating someone else. We built our system to be easy and safe, using familiar tech like Python (Flask), OpenCV, and MySQL. To keep everything honest and locked tight, we added crucial security layers like one-time passwords, encrypted data storage, and a live monitoring dashboard for officials to watch everything in real-time. In short, this approach makes voting easy, quick, and completely honest for everybody.

II. LITERATURE SURVEY

A. Fingerprint and Iris based Voting System

The paper presents a secure and user-friendly online voting system that uses both fingerprint and iris recognition to improve elections, especially in a vast democracy like India. By combining these two biometric methods, the system makes voting quicker, safer, and more convenient for everyone. It checks each voter's biometric data against the Aadhaar database, linking it to their official Voter ID (EPIC). This two-step verification ensures that every voter is uniquely identified and prevents anyone from voting more than once.

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The iris recognition component is implemented using MAT LAB and involves a five-step process: capturing and prepro cessing the iris image, segmenting the iris using the Circular Hough Transform, converting the circular iris region into a rectangular format through Daugman's rubber sheet model, applying nonlinear normalization to maintain accuracy despite pupil size variations, and extracting features using a 2D Gabor f ilter to generate a distinct binary iris template. Verification is performed by calculating the Hamming distance via an XORoperation. Once a voter is successfully authenticated and confirmed as not having voted, they can cast their ballot. All votes are securely stored on a central server, allowing election officials to monitor voter turnout and manage election results efficiently.

B. Iris based Modern Voting System using Deep Learning Algorithm

The core of the paper is an innovative Iris Recognition Based Modern Voting System that utilizes a Deep Learning Algorithm to address long-standing issues with electoral integrity.The fundamental goal of this project is to fix the inherent shortcomings of traditional voting methods, such as paper ballots and Electronic Voting Machines (EVMs), which often struggle with accessibility, security, and accuracy. The proposed solution is a digital voting system that relies on a person's unique iris pattern for identity verification.

Key Strengths of the System : Fraud Prevention (Enhanced Security): By using a highly dependable and unique biometric, the system substantially reduces the potential for fraudulent activity, such as a single person voting multiple times or impersonating another voter.

Trustworthy Authentication (High Accuracy): Iris recognition is known for its high degree of precision and reliability. Its low false acceptance rate means it's extremely unlikely for an unauthorized individual to be incorrectly identified as a valid voter.

Inclusivity (Increased Accessibility): The system simplifies the process by removing the need for physical ID documents or voter registration slips, making voting easier and more accessible, especially for citizens who might face difficulties in obtaining or presenting traditional identification.

C. Innovating Elections Smart Voting Through Facial Recognition Technology

The project called "Innovating Elections: Smart Voting through Facial Recognition Technology" is about creating a safe and clear online voting system for India. It aims to update the old-fashioned way of voting by using facial recognition to make things more secure, accurate, and easy for everyone. To make sure only real voters can cast their ballots, the system uses a three-step check: each voter's unique voter ID, an Election Commission ID, and their face, which is verified using special software that recognizes unique facial features. This technology uses smart computer programs to compare live images to a stored database, making sure the right person is voting.

The system includes several parts like an admin panel, user friendly interface, and a central database connected through the internet. It might also use even smarter technology, like deep learning, for better accuracy in recognizing faces. One big advantage is that people can vote remotely from any approved device or place, making voting more accessible. With automatic vote counting and confirmation steps, the process is faster and more trustworthy. Overall, the system hopes to make elections smoother, harder to cheat, and based on advanced artificial intelligence to support India's democracy. This new approach tackles problems like voter fraud, long lines, and mistakes in manual voting, while aiming to build voter confidence and improve election transparency.

D. A Real-Time Voting Process That Redirects Facial Recog nition

The paper by Dr. Venkata Harshavardhan Reddy Dornadula and his team introduces a secure electronic voting system that addresses the vulnerabilities of traditional methods like paper ballots and electronic voting machines (EVMs) by integrating facial recognition and IoT technology. This system, built around a Raspberry Pi, webcam, LCD screen, and GSM module performs real-time voter verification by capturing and comparing unique facial and retinal data against a registered database to ensure the voter's identity. By leveraging these unique biometric features, the system actively prevents double voting and includes buzzers to alert in case of repeat attempts. Upon casting a vote, the system promotes transparency and trust by displaying a confirmation on the LCD and sending a notification to the voter's phone. While it offers an affordable, real-time, tamper-proof approach using deep learning and embedded technology—a key advancement for secure digi tal governance—it does face challenges concerning lighting dependency, hardware reliance, and scalability for nationwide elections.

III. EXISTING SYSTEM

In most places today, casting a ballot still feels incredibly outdated. We're relying on the same old paper ballots or those basic electronic machines, and election staff still have to manually check every ID card. While the

systems are meant to keep elections organized, they constantly struggle with trust, transparency, and simple speed. Take paper ballots: they're vulnerable to simple mistakes like tampering, or complex problems like people voting more than once, not to mention errors when counting them up. The EVMs aren't perfect either; they rely way too much on human oversight during the ID check process, which slows things down and creates an opportunity for manipulation.

Even when we try to upgrade, using methods like finger or face recognition, we run into real-world issues. Fingerprint scanners fail if your hands are dirty, injured, or simply worn out. Facial recognition systems struggle with low-light situations, and they get confused when people's appearance changes over time, or if they wear things like hats that cover their face. It's a massive hurdle to make these technologies work reliably for every person in every environment. These flaws and slow, imperfect checks—whether done by a person or a machine—are precisely why we see endless lines at the polls, which ultimately makes the community doubt the security of the whole election.

Voter verification- whether manual or partially automated- often results in lengthy lines, particularly in large polling places.The bottom line is, our existing voting systems fail to provide a strong, automated, and tamper-proof way to verify voters. That lack of trust is a huge issue and likely pushes people away from participating. We desperately need to switch to smarter, hands-free biometric technology that is completely secure and reliable. Iris recognition is the clear solution. It f ixes all those old technical and institutional headaches, giving everyone a voting process that is simpler, faster, safer, and completely dependable.

Figure 1. Existing System

IV. PROPOSED SYSTEM

We're rolling out a new voting website that uses a scan of your eye, specifically your iris—to guarantee every vote is secure and one-of-a-kind. It's a clean web application powered by Flask, using OpenCV and MediaPipe for the eye scan, and a MySQL database to manage all the details and keep everything transparent and accurate. There are a few simple steps. The process begins with registration, where voters share their personal information and take a secure iris scan that saves their unique pattern, or biometric template. When it's time to vote, the system scans your eye one more time to match it against that saved template, confirming your verified identity corresponds exactly with your biometric data. Once cleared, you cast your ballot! Your vote is then safely recorded with your identity information, including both your face and your iris data for total accountability.

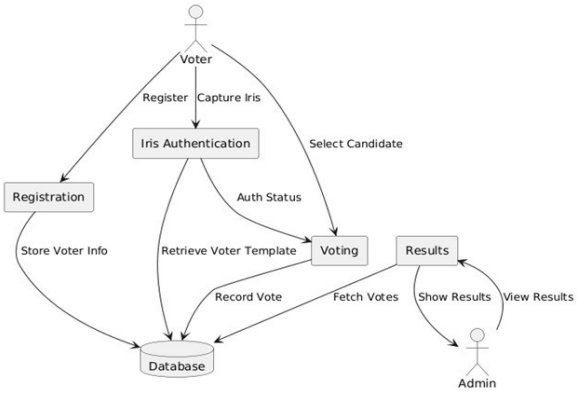

Figure 2. System Architecture

At the core of the entire protocol is the inventory of an extensively mapped database that allows for the connections between voters and candidates concerning the votes cast, but most importantly it is a timely and true means of fulfilling all of those connections- an independent and auditable record. The system design is centered around three components: an interface for a simple voter web-page environment; a backend system for the image processing and matching the iris to the user; and a MySQL database-system for the safeguarding of information. This systemic design allows for voting to be a convenient, rapid, secure and reliable process while also providing election officials a way to educate, manage and audit the voting process with the utmost confidence.

V. METHODOLOGY

The suggested electoral system utilizes biometric voter credentialing based on face and iris recognition, and is designed to similarly adopt a structural technology-based approach towards secure credentialing, data management and user experience. In this method, biometric processing begins with the registration of a voter, where they provide their sensitive personal information in the form of their name, along with a unique voter id- and an iris and face images were automatically captured in real-time using the webcam. The iris features are ultimately stored within a secure MySQL DataBase storage.

During the voting process, the registered voter's iris will again be scanned in real-time and a verification will occur with the pre-stored template image, using commercially available pattern matching algorithms to determine whether or not to verify the user. Once verified, the user will land on the page where the cast will see the candidates and cast their vote and the system will subsequently securely record the vote in order to prohibit multiple voting.

To achieve improved efficiency and reliability, the system uses a Python Flask backend framework with OpenCV and MediaPipe for the purposes of iris recognition and image processing. The frontend was developed using Bootstrap 5 as a simple web facing portal for the voters. The process relies on OTP or email verification during voter registration as an additional measure of security. The administrator module en ables election officials to view voter information, view results, and create visual reports via MatPlotLib. All together, this structured process provides a system that can offer extremely high speeds and accurate in authentication while ensuring transparency, scalability, and reliability; an overall safe and practical approach to a modern digital election experience.

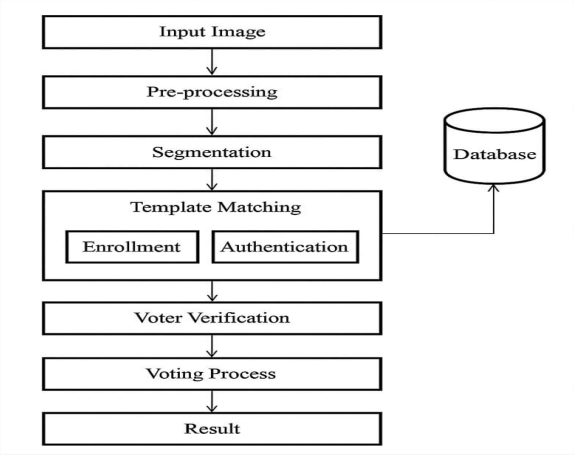

Figure 3. Flow Diagram

VI. RESULTS

The Smart Voting Through Iris Recognition System (BioVote) brings a secure and trustworthy upgrade to elections, focusing on the voter's unique identity. During registration, voters simply provide their personal details such as name, Aadhaar number, and phone number, while the system captures an unforgeable snapshot of both their face and iris using a standard webcam. These highly secure biometric details are then safely stored for reliable authentication on voting day. Similarly, election officials easily register candidates by entering their name, party, and symbol, which are immediately displayed on a dynamic list for complete transparency and simple management.

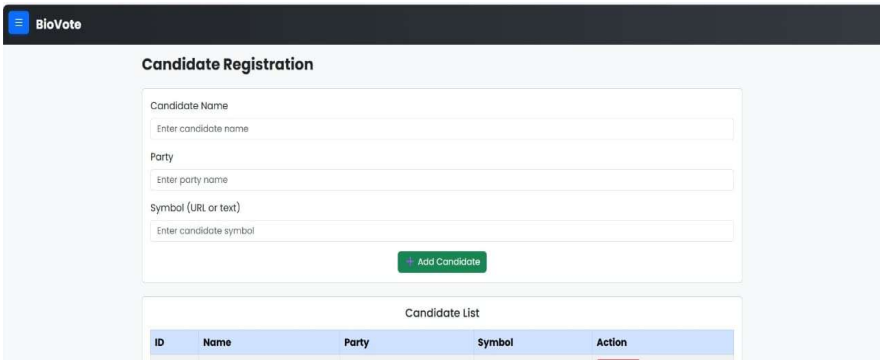

Figure 4. Candidate Registration

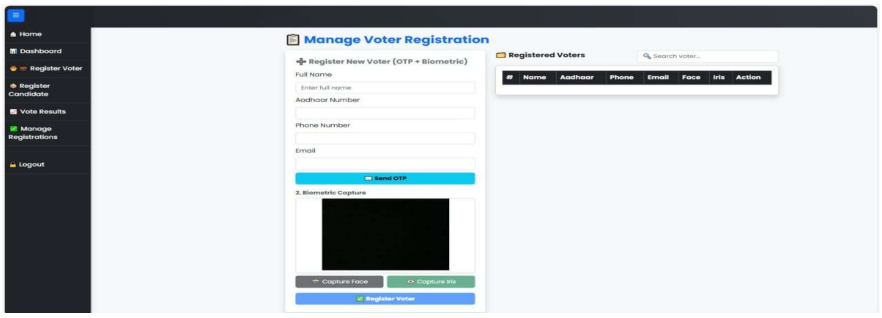

Figure 5. Voter Registration

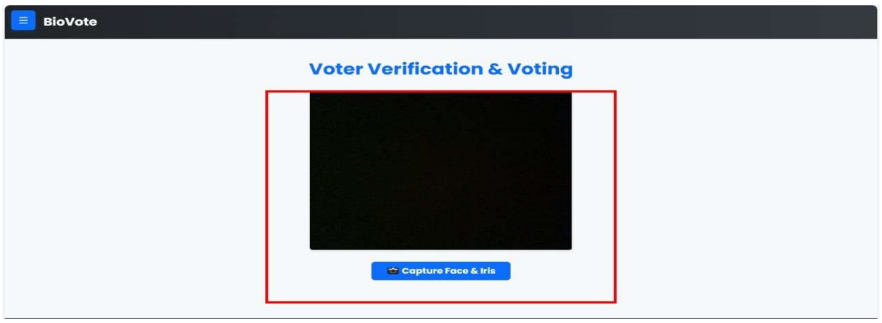

Figure 6. Voter Verification and Voting

Figure 7. Web Camera

VII. CONCLUSIONS

The adoption of an iris recognition-based Smart Voting System brings a significant leap forward in both security and reliability compared to traditional voting methods. Leveraging unique iris features for voter identification virtually eliminates issues like impersonation, double voting, and manual errors. Biometric authentication not only strengthens transparency and builds trust in the electoral process, but also streamlines the entire voting experience, making it more efficient and user-friendly. Integrating advanced machine learning and image process ing techniques further enhances the credibility and operational efficiency of elections. With these

technologies at the core, the smart voting system offers a robust, convenient, and se cure solution to longstanding issues in electoral management. Overall, iris recognition represents a cutting-edge replacement for outdated systems, substantially improving the integrity and functionality of modern voting processes.

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