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Online Voting System Based on Machine Learning

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Abstract: *The world's largest democratic nation is India, where we live. Therefore, it is necessary to guarantee that an equal voting process is used to elect the governing body. The one and only voting method available in India is offline, which is inefficient because it takes a lot of labor and longer time to process and broadcast the results. Therefore, a change that addresses these issues is necessary for the system to become effective. The proposed system is an AI-driven web application system, combining machine learning and facial recognition technologies one of the factor of two factor authentication technology to provide improved efficiency, security, and accessibility. The first factor involves face recognition and second factor is one-time passwords (OTPs) which is sent via email or SMS. This technique offers a novel approach to online voting by safely and reliably authenticating voters via the use of machine learning algorithms and face recognition technology. A facial recognition model is created using an extensive dataset and rigorous training procedures to confirm voter's identities both before and after the online voting process. Algorithms for machine learning constantly increase the model's accuracy by adjusting it to various face traits and contextual factors. To further guarantee the legitimacy and integrity of the election process, the system includes privacy protection, anomaly detection, and result validation features.*

Keywords: *Online Voting, Machine Learning, 2F Authentication, Face Recognition, One Time Passwords(OTP)*

1. INTRODUCTION:

Elections are the process by which voters exercise their constitutional right to vote, determining the configuration of the governing body and the ultimate course of public policy [1]. Voting is a crucial component of democracy, allowing individuals to engage in the decision-making process by choosing representatives and influencing public policy. It acts as a method of expressing choices, ideas, and common will on an extensive range of matters, from electing representatives of government to passing legislation and public projects [2]. Eligible individuals often cast votes to indicate their preference amongst opposing candidates or alternatives. These votes are then counted, and the results decide the final result of the elections or problem at hand [3].

The idea of web-based voting is not new, but its broad acceptance has been hampered by worries about confidentiality and identification. However, the combination of machine learning algorithms and face recognition systems offers a revolutionary answer to these problems. Using artificial intelligence, we can create an innovative online voting system that not only maintains the transparency of the political process but also encourages citizen engagement [4].

Machine learning algorithms improve online voting security by identifying irregularities and reducing dangers such as theft and intrusions. They constantly monitor voting trends and user behavior so as to react and guard against potential dangers. Face recognition technology provides an additional layer of identification and authentication by allowing voters to be identified and authenticated in real time using OTP technology [5]. This reduces the danger of identity fraud while

also improving connectivity for those with impairments and those living in distant places [6]. Both technologies improve the integrity of the voting infrastructure.

2. LITERATURE SURVEY:

Every democracy and institution are built on the voting process. There have already been numerous notable modifications to the voting process during the last few decades. There are several voting procedures employed, including electronic voting, paper ballot voting, and online voting, the SMS and Miss Calls Voting System, and others [7]. Here, we have looked at a lot of articles about voting systems.

As stated by the authors [1], this study offers an automated fingerprint system for voting utilizing Arduino to solve safety concerns about paper-based voting. The technology instantly verifies a candidate's identity and discreetly records all the voters' credentials. The primary purpose is to improve privacy, avoid redundancy, and decrease the problem for those administering polling. Users may vote using their thumbprints, which reduces polling time and allows for simple and precise tallying without the necessity for human intervention. The platform promises to save polling time while ensuring a confidential and effective voting approach.

In the words of the authors [2], this study delivers an online voting approach that is more secure and efficient than existing voting methods. The concept requires voters to enter a secure password to validate their vote, permitting them to vote from another place or at their preferred site. Automated vote counting saves time and allows the electoral board to release decisions immediately. Furthermore, the model includes face-based identification and OpenCV for verification. The system's user interface is designed using Flask and Python, image pre-processing and streaming of video are performed by computer vision, and an additional registration function that integrates frontal selfies is included. Users must provide a single-use code to validate their email addresses, and the platform is retrained to distinguish and comprehend new users when they register. Only individuals who are registered are able to vote once, and user recognition depends on face characteristics.

Based on the authors [3], this paper presents a remote voting procedure that makes use of facial recognition and OTP to enable individuals to cast their votes from anywhere. The technology captures the voters' faces before and during voting, and RFID tags are utilized to replace voter IDs. This technique also avoids the manipulation of votes. The suggested system overcomes conventional disadvantages, providing strong qualities such as accuracy, authenticity, and convenience while discarding the requirement for election law enforcement officials, ballots in paper form, or handheld devices.

As specified by the authors [8], this paper describes advancing technological devices from traditional to computerized casting. This approach saved time and allowed voting from anywhere by using PHP as the backend language and frontend web technologies involving HTML, CSS, JS, Bootstrap, and Microsoft SQL Server to manage data storage. It eliminates the necessity for conventional voting techniques by allowing individuals to vote at any moment and place they choose. Hybrid elections, in which electors are eligible to cast ballots in both conventional and online modes, have also been discussed. The system provides quick access, security, and productivity, preventing errors made by humans while saving time and paperwork. The platform also includes smart tickets, program highlights, voting choices, classifications, and notifications, making it a useful tool for both supervisors and voters.

As claimed by the authors [9], this article focuses on web-based method that enables voters to

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vote from everywhere by entering a secured IP address supplied by the government. The electoral commission gathers biometrics and facial pictures from voters and holds them within a database. These photos are evaluated on election day to make confident secure voting procedure. Similar to mobile phones, the electoral process unlocks with human faces and fingerprints. The strategy minimizes the quantity of fraudulent voters while taking less time. The research employs ten print pictures to determine the voter's genuine name. The method is more reliable and secure than the previous systems, with unique characteristics such as the separation between the two eyes and brows being constant regardless of age.

3. METHODOLOGY:

The proposed online voting system uses facial recognition technology and machine learning algorithms to enhance security and speed up the voting process. Face recognition technology ensures only qualified voters participate, while machine learning algorithms improve accuracy. Remote voting increases accessibility, voter participation, and reduces risks like voting fraud and identity theft [10]. Using machine learning real-time anomalies are detected, and voter privacy is protected through encryption and data security. This proposed approach ensures election processes integrity, transparency, and inclusion. The proposed system as two sides admin side and voter side.

Admin can view the complaint submitted by the voter and can also reply to that complain. After all process completed the admin can have to logout from the account.

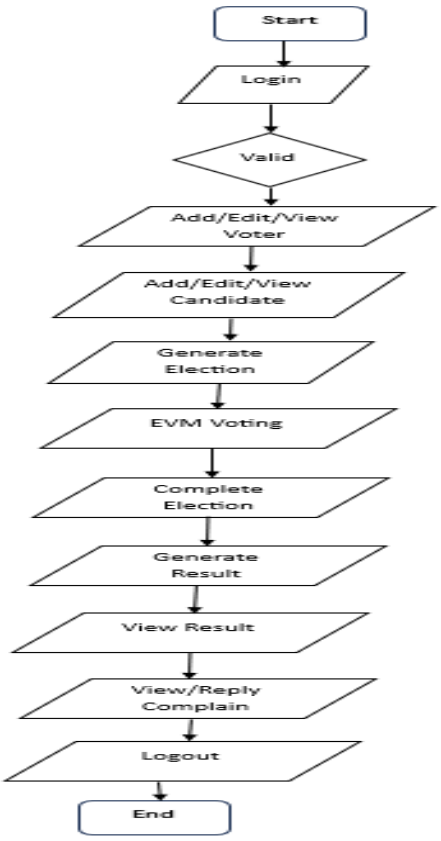

Fig.1.Admin flowchart

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The figure describes that admin (election commission) will login first then add/edit/view voter details, add/edit/view candidate details. Then admin will generate election. While election is running the online voters can vote online by logging into their account, but the voter who do not have facility to vote online can go to polling booth to vote, here admin will mark those voters who came to polling booth for EVM (Electronic Voting Machine) voting as voter voted by entering their voter id number. After election time is over the admin will complete the election. Then the admin will generate the result by adding the EVM votes with the online votes. Admin can also view the generated result.

The figure describes that the voter has to first complete the registration process by giving the face id (scanning the face in camera) and setting the password. Voter can then login by username and password and can view their profile. Voter can view candidate details. Once election is started voter can login into the account and can vote online, first voter have to select a candidate from the list and have to give the face id (scan face in camera) if the face matches with the face given at the time of registration, then voter will be promoted for two factor authentication.

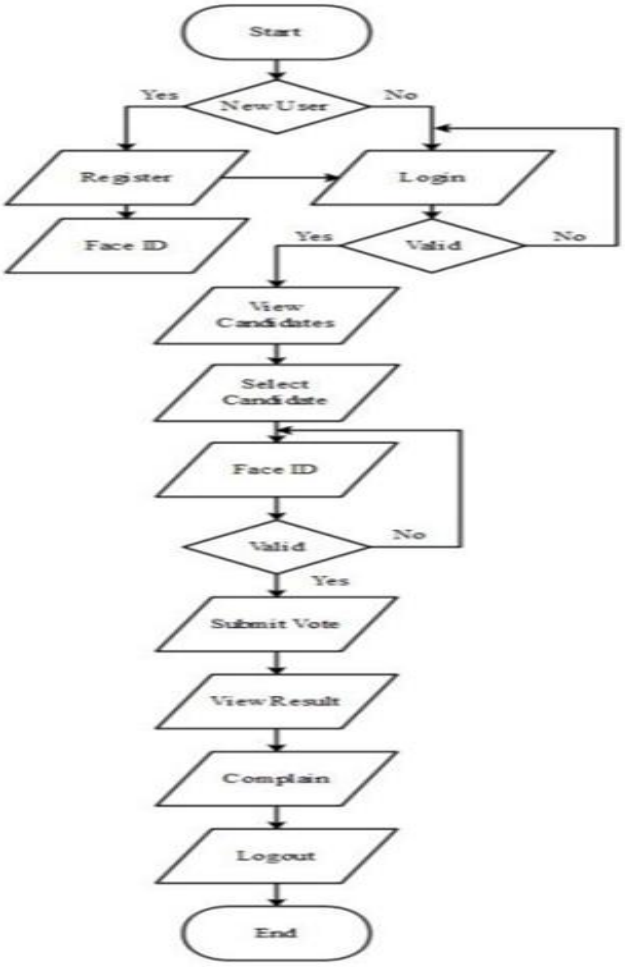

Fig.2.Voter's flowchart

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In two factor authentication, voter have to give the mobile one-time password which is sent to the voter's registered mobile number, if mobile one-time password verification successful then voter have to give email one time password which is sent to the voter's registered email address, if the email one time password verification is successful then the vote will be submitted. Once the result and report are generated the voter can view result and report. Voter can also complain to admin if voter finds anything wrong in the election process or has any problem, voter can view the complaint response given by the admin.
The methodology to show how the online voting system are suggested by machine learning and faced recognition in the following ways:

3.1 DataCollection and Preprocessing:

Data collection includes collecting a varied array of facial pictures from eligible voters to ensure representation across communities. Preprocessing methods such as lighting condition normalization, alignment, and augmentation to manage variables such as posture, expression, and occlusions are employed to enhance the quality of the data. Furthermore, techniques for data confidentiality are accustomed to safeguard voter's privacy. These preprocessing processes are critical for developing strong face recognition algorithms that can properly identify people face despite changing environmental and facial parameters. The system can successfully verify voters and protect the integrity and security of the online voting process thanks to careful curation and preprocessing.

3.2 Two Factor Authentication:

Two-factor authentication (2FA) with one-time passwords (OTP), additionally facial recognition and machine learning, improves security and reliability in online voting system. The voter's registered email address or mobile device receives a unique OTP developed by the system after submitting their face picture for authentication. Once the voter's face picture and OTP have been successfully verified, they can safely cast their ballot. By using two layers of verification, the likelihood of fraudulent voting attempts or illegal access is greatly decreased. Voters are accurately defined by means of machine learning algorithms that are constantly improving the facial recognition model, also, the OTP provides an extra degree of protection by requiring ownership of a registered device. Through the integration of OTP-based 2FA, machine learning, and facial recognition, the online voting security of the online voting system is doubled.

3.3 Face Recognition:

Facial recognition technology is essential for assuring the secure and reliable verification of voters. The method initially gathers a wide dataset of face photos and trains a reliable facial recognition model employing algorithms like LBPH (Local Binary Patterns Histograms) by means of machine learning techniques. Using facial feature recognition, this model learns to recognize people reliably while adjusting for changes in lighting, posture, and expression [11]. Voters use the system's interface to submit their facial pictures during the voting process. The voter's identification is subsequently confirmed by the face recognition model by matching the uploaded photo to the registered profiles [12]. The voter is allowed to safely cast their ballot if the match is successful.

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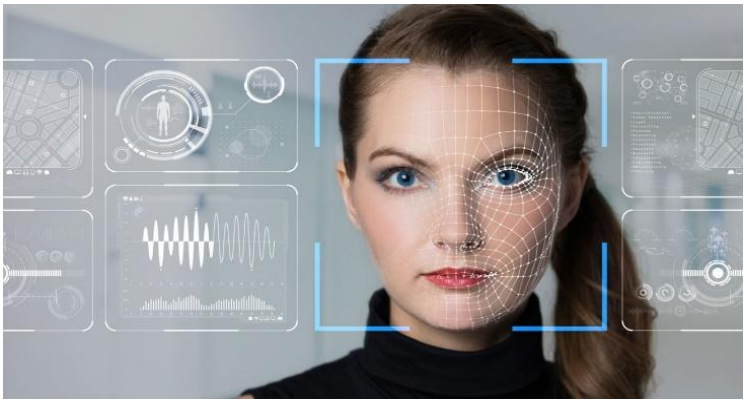

Fig. 3. Face Recognition

3.4 Machine Learning:

Machine learning plays an important role in many elements of the proposed system. First, the machine learning algorithms are used to train the facial recognition model., which enable it to recognize faces and recognize people correctly. These algorithms are always learning and adapting, which helps the model perform better over time and become more adept at handling changes in angles, lighting, and facial emotions. Anomaly detection via machine learning techniques is used to recognize and report unusual activity or attempts at fraudulent voting. Through pattern recognition and abnormal behavior analysis, the system can identify and stop unwanted access or modification. Furthermore, by examining voter preferences and habits, machine learning algorithms enhance user experience and engagement by optimizing the overall voting process.

3.5 PrivacyProtection:

Privacy is essential in the proposed system. To avoid unwanted access, facial images and OTP are used for authentication must be encrypted and kept securely. Strict access controls are set up to limit who is able to access sensitive data [13]. Furthermore, by training algorithms of machine learning without constantly collecting sensitive data, methods like federated learning are used to lower privacy issues. In addition, clear rules are set over the usage and preservation of data, and to carry out periodic reviews to verify adherence to privacy laws. The system maintains voter information security and reliability by giving priority to privacy protection measures, which would boost public confidence in the voting process [14].

3.6 LBPHFaceRecognizer:

A key aspect of the proposed system is the Local Binary Patterns Histograms, or LBPH algorithm. LBPH encodes texture information that is essential for accurate recognition by mining local binary patterns from face images. First, a variety of face picture datasets are gathered and preprocessed so as to train the LBPHFaceRecognizer model. This model adjusts to changes in lighting, position, and emotion to learn how to differentiate between many faces based on their distinctive patterns. Voter's faces are photographed and are then matched to enrolled profiles using the LBPHFaceRecognizer that has been trained. Voters are verified by successful matches, guaranteeing that only qualified people may safely cast their ballots online. The LBPHFaceRecognizer model is continuously improved by the system's learning algorithms, which also increase the model's accuracy and versatility over time.

4. RESULT:

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In proposed system results are produced based on votes that have been verified. Voter's identities are verified using Two-factor authentication (2FA) technology, guaranteeing that only those who are authorized may cast a ballot. Voting data is analyzed by machine learning algorithms to produce rapid and reliable results. Secure vote tallying is ensured by the technology, which also keeps transparency and integrity intact. Furthermore, anomaly detection systems find and highlight any anomalies or dishonest behavior, guaranteeing the validity of the findings. By utilizing cutting-edge technology, the system generates outcomes that are effective, dependable, and trustworthy, thereby enhancing democratic values and encouraging voter confidence.

Fig.4.Voters home page

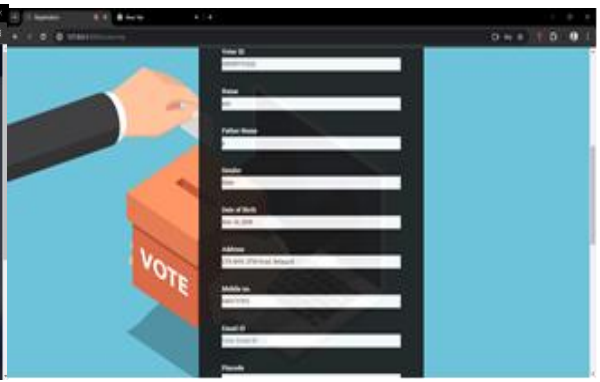

Fig. 5. Registration page

Fig.6.Login page

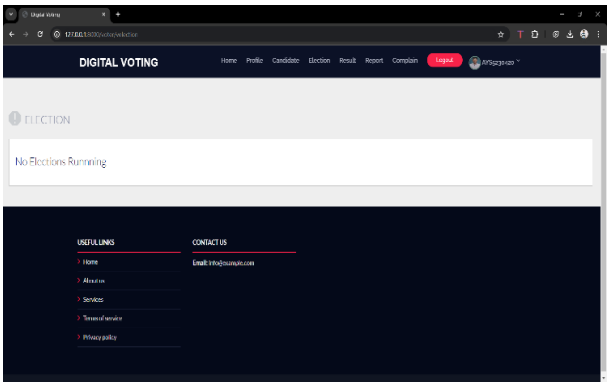

Fig.7.Election page

Figures 4 to 7 shows voter side pages where voter has to first register by filling all the personal details with voter id number and face image for verification and after registration voter has to login with the username password and OTP send to their registered number. After login voter will get the permission to cast their vote.

And figures 8 to 11 shows the admin side pages which are only accessed by the authorized admin. Admin has the permission to add candidates eligible to stand for election and also generate the election and add voters to the database.

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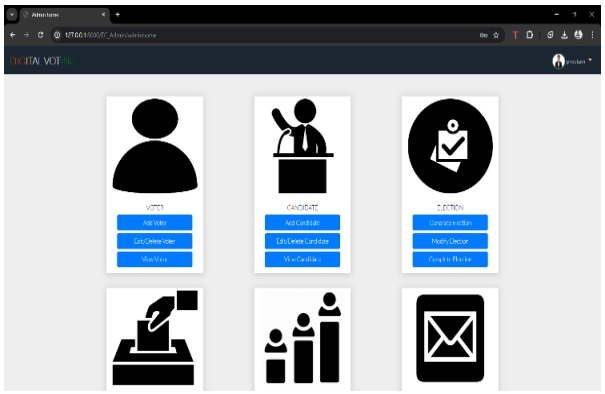

Fig.8. Admin page

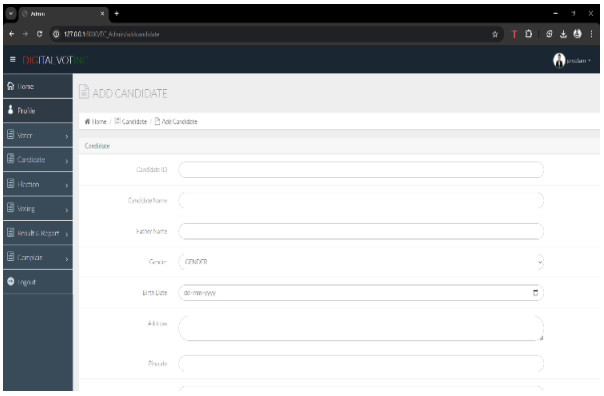

Fig.9. Add candidate page

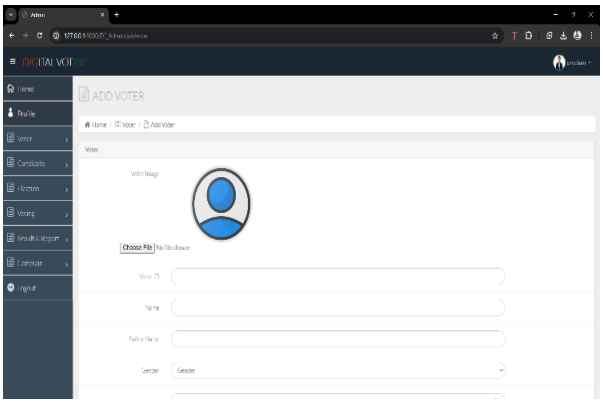

Fig.10. Add voter page

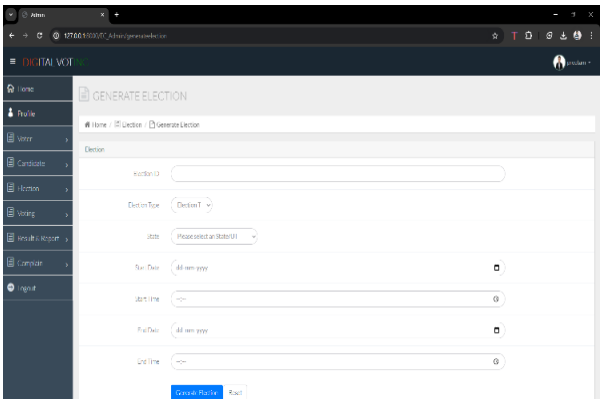

Fig. 11. Generate election page

5. CONCLUSION:

The current lifestyle does not provide much spare time. People nowadays are occupied with life to the point that they frequently forget or do not have the time to cast their vote. Furthermore, even if they meet the eligibility requirements, those residing overseas will not be allowed to vote since the existing voting procedure is conducted physically, that is a lengthy, time-consuming, and unsecure process. To overcome these problems a system is proposed, which integrates two factor authentication which is face recognition and OTP and machine learning technology, which represents a substantial breakthrough in election procedures. These methods improve security measures by using face recognition to make sure only eligible voters may safely cast their votes. The system's

accuracy and efficiency are enhanced by machine learning algorithms, which also help the system recognize and respond to changing trends. Adoption of 2FA adds an extra degree of protection to the authentication process, usually including a mix of something the user owns (like a mobile device) and something they know (like a password). By doing this, the dangers posed by password-based assaults are reduced and it is made sure that only voters with permission may use the online voting system.

Employing machine learning techniques allows the system to detect abnormalities and flag suspicious behaviors, which protects the voting process's integrity. The system can adapt to changing patterns and changes in face characteristics via continuous learning techniques, which improves recognition accuracy and reliability. The online voting method has multiple benefits such as greater accessibility, convenience, and participation. Through the provision of remote voting, the method enhances inclusion and increases voter turnout. In addition, efficient procedures lower administrative burden and improve total productivity.

In the future, the machine learning-based online voting system may see improvements in voter authentication algorithms, security measures, scalability, and the integration of blockchain technology for more transparency and resistance to tampering.

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