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ELEGANT VOTING SYSTEM BASED ON FACIAL RECOGNITION

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ABSTRACT

In the modern era, the traditional voting system has many drawbacks like lack of security, accessibility, accuracy, fairness, efficiency, and cost. At present, we are using EVM (Electronic Voting Machine) machines to cast our votes. This method also does not provide 100% accuracy, Thus we have come up with the "Elegant Voting System Based on Facial Recognition". This innovative approach enhances the efficiency, security, and accessibility of the electoral process, addressing various challenges associated with conventional voting methods. The system begins with the voter registration process, during which individuals are enrolled by providing a specific ID followed by capturing their facial features using cameras. These images are converted into BLOB data and are then stored securely in a database. During the voting process, the image captured will be compared with the stored image and access will be granted. Further voters can cast there respective votes.

KEYWORDS: Traditional voting, Electronic Voting machine, conventional, BLOB.

I. INTRODUCTION

The concept of Elegant voting system leveraging facial recognition is intriguing. In this system, the goal is to enhance the security and efficiency of the voting process by implementing advanced technologies. Traditional voting systems, on the other hand, often rely heavily on manual verification processes, resulting in a time-consuming and error-prone experience.

The Elegant Voting System Based On Facial Recognition stands out as a pioneering leap

towards modernizing and securing the electoral process. It offers a robust solution to the challenges associated with traditional voting systems. This work aims to transform the way elections are conducted, utilizing facial recognition technology to enhance security, efficiency, and transparency.

Traditional voting systems have historically depended on manual verification processes, where poll workers manually verify voter identities using documents such as ID cards or voter registration lists. This manual process, though somewhat effective, is vulnerable to human errors, impersonation, and fraud. Moreover, it can lead to long queues and time-consuming voting experiences, potentially disenfranchising citizens and diminishing overall voter turnout. This work goes beyond streamlining the electoral process; it also addresses data privacy and security concerns.

In today's age marked by data breaches and privacy issues, safeguarding voter data and biometrics is crucial to maintaining the integrity of the voting process.

With the implementation of facial recognition technology, the Elegant voting system has the potential to revolutionize the way we approach elections, ensuring a more secure, efficient, and transparent voting experience for all citizens.

II. LITERATURE SURVEY

There has been ongoing research and discussion on the potential of using facial recognition for voting system but it's important to understand that the concept of an "ELEGANT" solution remains quite challenging due to several ethical and technical complexities. So here are some of the research efforts in this area:

A Novel Method for Facial Recognition Based Smart Voting System Using Machine Learning". This paper involves the use of a facial recognition algorithm that is trained using deep learning techniques to recognize the faces of registered voters. The system captures the image of the voter's face and compares it to the pre-registered images in the database. If the face matches, the voter is allowed to cast their vote.[1]

Smart Voting System using Face Recognition". system aims to enable Indian voters to cast their votes from any location using facial recognition for identity 5 authentication. And system emphasizes biometric security, utilizing a voter database and a camera equipped computer for the authentication process.[2]

E-voting System using Face Recognition". EVM there is no module that can confirm if the citizens vote has been casted or not. E-voting system helps the user to cast the vote without visiting the polling booth We have 2 voting categories I-voting and SMS voting where as I-voting is done remotely via internet.[3]

Investigation of E-voting system using face recognition using convolution neural network (CNN)". Main advantage of E-voting system for the country is highlighted .For constructing E-voting systems every countries need to do great attention to verification & validation requirements. This scheme is to explore the positive effects of security & safety in online voting system.[4]

Smart voting system using facial recognition". Utilizes sophisticated facial recognition algorithms to accurately identify and authenticate voters based on their unique facial features. Requires individuals to register by providing their facial biometrics, which are securely stored in a database.[5]

Smart online voting system". Implements user-friendly interfaces on voting kiosks or mobile apps, allowing voters to initiate the facial recognition process. Performs real-time facial recognition during the voting process to verify the identity of the voter, reducing the risk of fraudulent voting.[6]

Real Time Face Recognition System Using Convolutional Neural Network,". Incorporates robust encryption and security protocols to protect the integrity of the facial biometric data, ensuring it is not susceptible to tampering or unauthorized access.[7]

Online voting system," International Journal for Research in Applied Science and Engineering Technology. Includes features to accommodate voters with diverse needs, such as those with disabilities, ensuring an inclusive and accessible voting experience.[8]

A Novel Method of E-Voting System Using Biometrics Thumb Impression and Face Recognition,". Establishes a comprehensive audit trail to track and monitor each step of the voting process, enhancing transparency and accountability.[9]

E-Voting System Using Facial Recognition,". Seamlessly integrates with existing election infrastructure and databases to cross-reference voter information.[10]

III. METHODOLOGY

Methodology is a way of going about something Systematically, particularly a way of conducting research. It is a set of methods and a particular activity or process. In research, methodology refers to the way in which a researcher plans, conducts, and evaluates a study. It is a critical component of research, as it ensures that the study is well-designed, rigorous, and produces valid and reliable results.

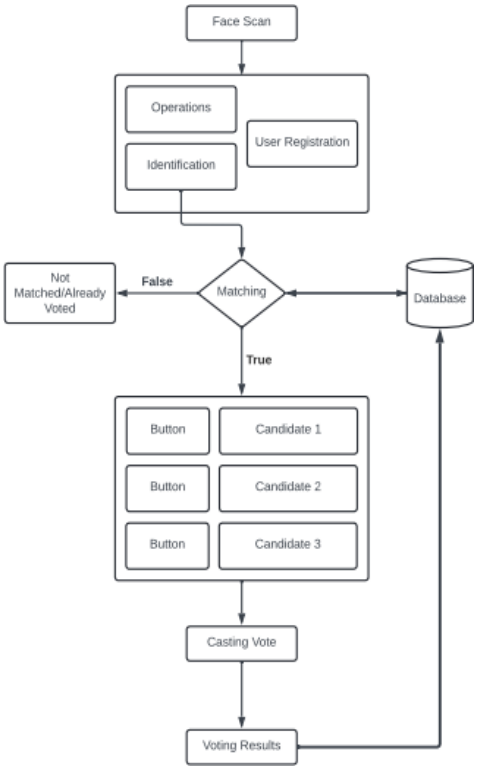


Fig. 1: System Architecture.

1. Voter registration

The voter at very beginning goes through the registration phase by providing the specific ID and by capturing the facial images during this phase under controlled lighting and pose conditions. Further these images will be converted to the BLOB images and will be stored in the database.

BLOB (Binary Large Object)

Blobs are generally considered as images, audio, or video data. Blob refers to a group of connected pixels or regions in a binary image that shares a common property. These regions are nothing but contours in OpenCV with some extra features like blob/contour orientation, centroid, color, area, mean, and standard deviation of the pixel values in the covered region,

etc. It pre-processes the captured images to enhance their quality and extract relevant features. Blob technology may be used to identify and isolate facial features such as eyes, nose, and mouth which can then be used for recognition.

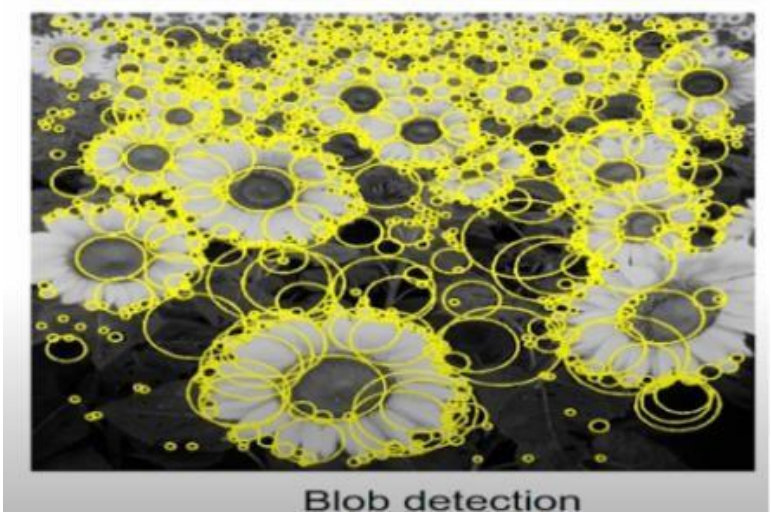


Fig. 2: Blob detection.

It compares the extracted facial features against the stored facial templates in the database using matching algorithms, Blob technology can assist in matching corresponding blobs from the captured image with those in the templates.

2. Facial Recognition

The voter stands in front of the camera and their face is scanned, further the system compare the scanned facial image with the photo associated with the presented ID. If a match is found, the system displays the confirmation message and grants access to the voting interface.

If there is a mismatch the system politely informs the voter and offers alternative verification methods.(e.g. answer security questions etc.)

3. Vote Casting

After facial recognition phase the vote casting prompt will open where the voters will cast their desired votes.

4. Voting result

After casting vote the result will be directed to the database and it will be stored.

IV. FACE DETECTION USING HAAR CASCADE

Face detection, which is the major part of this work is done by using the Haar Cascade method which is a machine learning object detection algorithm used to identify objects in an image or video. The algorithm is trained to detect a face by using a lot of positive and negative images. Firstly, the picture is converted into a grey-scale, and then it detects Haar features-sequence of square-shaped functions. Then it uses classifiers to detect the face (1) and not a face (0). This face detection happens in four stages. The first being, detection of Haar features, second being, using integral images, third stage is Adaboost and fourth is the cascade of classifiers.

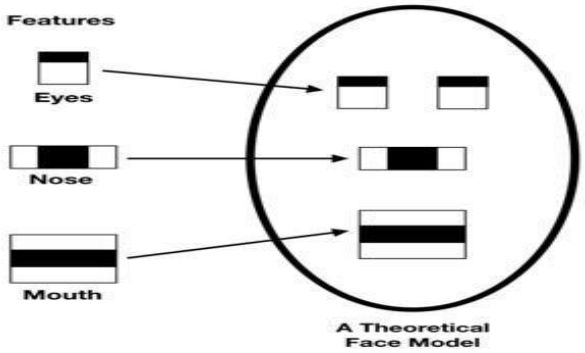
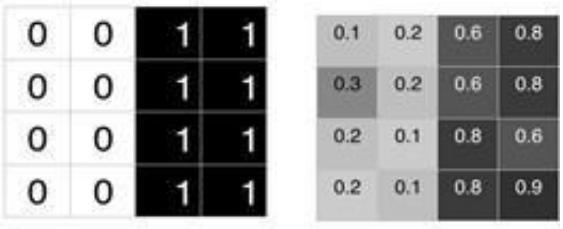


Fig. 3: Picture showing Haar-features.

A. Detecting Haar features

Before Haar features, image pixel intensities were used for face detection which is a lot of effort and work, therefore Paul Viola and Michael Jonesused Haar wavelets which detect faces taking smaller subsections of a face at once into consideration compute sum of their pixel intensities and then find the difference between these sums. This is further explained in detail below. For black and white image pixel values are 0 or 1(ideal case) but in real cases, we have normalized greyscale image as shown in the bottom box containing pixel values which are usually between 0 and 1.



(a) **(b)**

Fig.4: Pixel intensities of detected Haar-features

(a) ideal case (b) real case.

According to the Viola-Jonas algorithm, to detect Haar-like

Δ = dark – white Eq. (1)

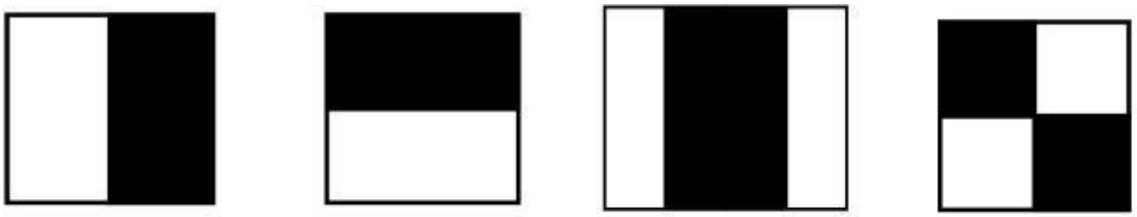
features present in an image, below formula should give a result closer to 1. The closer the value is to 1, the greater the change of detecting Haar feature in the image

Δ=dark 1(x)-white 1(x) Eq (2)

Ideal case: $\Delta = (1/8)*(8) — (1/8)*0 = 1$

Real case: $\Delta = (1/8)*(5.9) — (1/8)*(1.3)=0.575$

Haar features are very effective in detecting rectangle-like features, thereby making it a very functional face detection technique. For example, the figure 3(b) below can be an eye. The darker region being the eye and the lighter region corresponding to the cheek part of the face. As eyes are the darkest parts of the face compared to the rest of the face usually in the grey scale images or otherwise, they are detected first. Another example is figure 3(a) could be the nose as the bridge of nose is usually elevated and is darker than the cheek part of the face. This is how Haar features that are good at detecting lines and edges detect the face or subsections of the face first.



(a) **(b)** **(c)** **(d)**

Fig. 5: Some common Haar features.

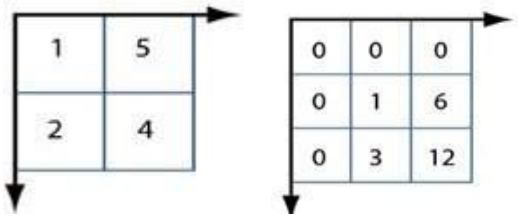
(a) Vertical edge feature (b) horizontal edge feature

(c) Line feature (d) four rectangle feature

B. Integral images

A huge amount of features are returned by the above computation. To decide, what features should be taken into consideration, integral images are used. It is a specialized algorithm designed to generate the sum of values in a rectangular subset of a grid.

The goal is to reduce the number of computations needed to obtain the summations of pixel intensities within a window.



(a) **(b)**

Fig. 6: The generated sum of values in a rectangular subset of a grid. (a) input image (b) integral image.

C. Adaboost

Besides being numerous, features might also be irrelevant. Among the features, we obtain how can we decide which ones are good? Here good means a feature that is part of the face. Adaboost both selects the best features and the weak ones and trains the classifiers that use them.

'Strong' classifier is constructed as a linear combination of weighted simple 'weak' classifiers by the algorithm. Here a strong classifier means one which has less error rate, one which will definitely be a part of the face and a 'weak' classifier is the one that has less than 50% error rate so we know that it mostly will be a feature that belongs in the face region. Therefore, we use Adaboost to combine these weak classifiers into on strong classifier that will lead to the detection of a face.

V. TESTING

Test was conducted by placing the user face in front of the web-camera of the system. The test cases are as in the table 1 below.

Table I: Test Cases.

Sl No	Test Case Description	Input	Expected Output	Actual Output	Result
1	Person Detection	Web-cam Input	Video Stream	Video Stream	Pass
2	Mask Detection	Web-cam Input	Detected	Detected	Pass
3	Face Recognition	Web-cam Input	Detected	Detected	Pass
4	Vote Casting	Party Selected	Voted Successfully	Voted Successfully	Pass

VI. RESULTS

This is the User Interface of the Smart Voting System.

Fig. 7: User Interface.

The admin login page is shown in fig.8 this page consist of voters list, parties list and votes

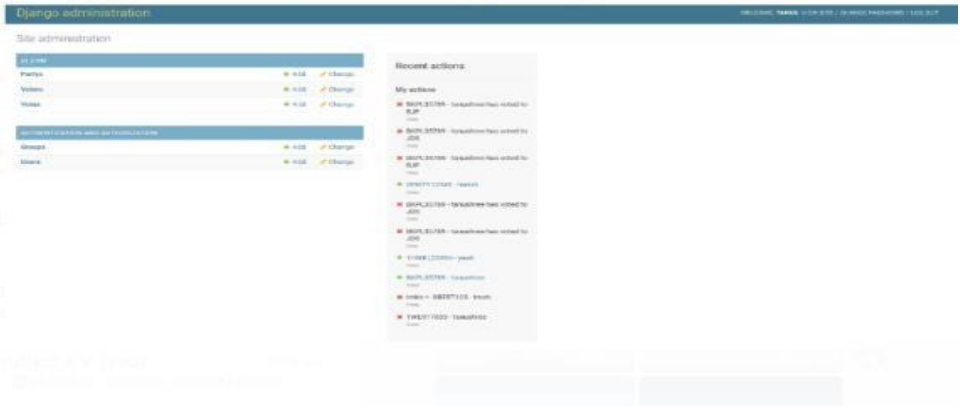


Fig. 8: Admin page.

Fig 9 is the party registration page where different elected parties are added here

Fig. 9: Party registration.

Fig 10. is the voter admin page where voters are registered by adding name, Adhaar number, pan number, Phone number and other personal details.

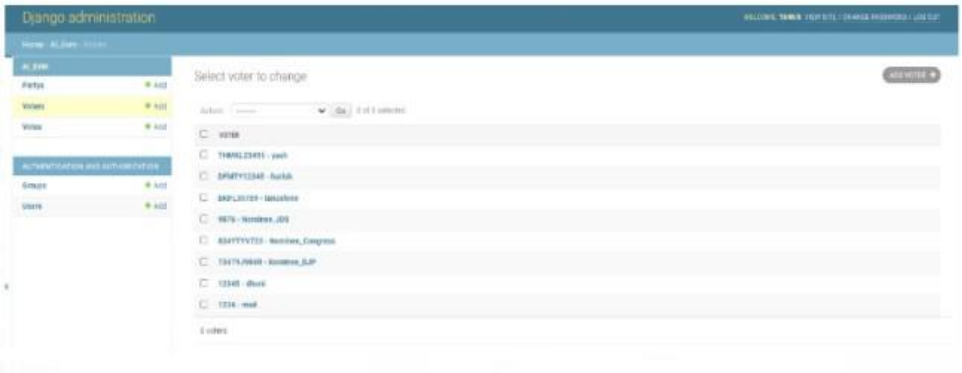


Fig. 10: Voters admin page.

Fig 11. Is the page where the voters choose between the different parties for voting.

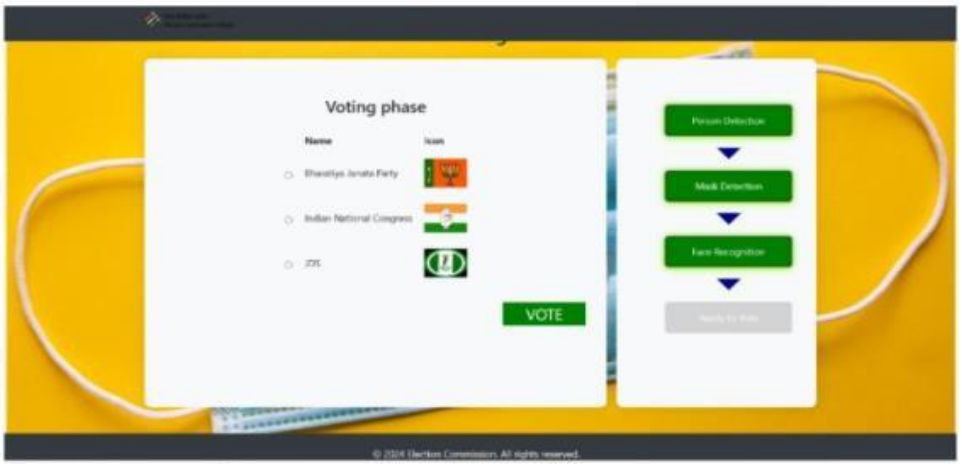


Fig. 11: Voting Options.

Fig 13. This page shows the result of the voting which is confidential and can only be accessed by the authorized person.

Fig. 13: Voting result sheet.

VII. CONCLUSION

The features that is extracted from the face of the voter are different from one person to another person. By extracting all the features, it generates a unique face id that is the unique face identification number for a person and stored in the database. Later on, whenever the image of the voter is captured, it verifies with the images stored in the server database with help of the Haar Cascade algorithm that can detect objects in images. If the voter matches with the image in the server database, it will display "Authorized Voter!" and he/she can cast their vote. When the voter doesn't coordinate with the images stored in the server database, it will display "Un-Authorized Voter!" and he/she cannot cast their vote. This reduces fake voting. In future enhancement, the developers could be able to develop automatic voter verification by extracting details like voter ID, a mobile number just by scanning face, as we are entering them separately in the proposed system.

VIII. FUTURE WORK

Future work might focus on the iris recognition algorithms for faster and more reliable identification ensuring compatibility with various hardware setups and addressing privacy concerns through robust encryption methods for storing and processing iris data. the process typically includes capturing an image of the voters iris using specialized cameras, extracting unique features from the iris pattern, and comparing these features against a data base to authenticate the voters identity by integrating iris detection into the voting the system could enhance security and accuracy prevent voter fraud, and ensure that each vote is cast by a legitimate voter.

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