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Smart Voting System using Facial Detection

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Abstract:* : *India being a democracy, that too world's largest, still conducts its elections using either Secret Ballet Voting or Electronic Voting Machines (EVM) both of which involve high costs, manual labor and are inefficient. So, the system must be optimized to be made efficient which would not leave room for unwanted means of voting. The current system requires the physical presence of every individual which is inconvenient to many people. This paper focuses on a system that uses faces to unlock the voting system just like in your phone and does not require physical presence to cast a vote as the traditional system does. The process is time-consuming as well. The entirely web-based system enables people to cast their votes from anywhere in the world. Using detection of faces decreases the chance of duplicating a vote and those who are registered prior to the election and are recognized by the system will be allowed to vote. Just like fingerprints, every face also has unique features like the distance between the eyes and eyebrows that remain unchanged with growing age which makes the system more secure. Hence, the approach makes the system the best way to vote.

Keywords: Online voting system, Smart voting, Voting, Face detection, Face recognition, Haar cascade.

I. INTRODUCTION

Elections are the foundation of any democracy as the true spirit of democracy lies in people choosing their own government. But, the way elections are conducted right now in our country has defects and loopholes which are being used to advantage by contestants and political parties. The current system has a lot of loopholes like the possibility of duplicate votes, rigging EVMs, faking the count, all of which tamper the true meaning of democracy. Moreover, the election conducting body, Election commission of India (ECI)uses Electronic machines for conducting elections in most of the places which is quite time-consuming, energy-consuming and should be done at an assigned place which is not comfortable to all. The EVMs have to be checked, transported, monitored with more human power and is an expense. The system we are proposing is a solution that addresses all the above concerns mentioned. Through the Smart voting system that uses Facial recognition, people who do not live in the same place or the old or someone who cannot wait in long queues for a long time will be benefitted. The voter can comfortably vote from anywhere and the possibility of duplication of the vote is also less through the same.

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This Online Voting System uses Image processing to detect voter's faces and matches it with the existing image present in the database. Facial features of the voters are the key information fed to the system to distinguish the eligible voters from the fake ones. More importantly, the system developed is entirely web-based which is very inexpensive compared to the present systems, very less manpower will be required if proper strong cyber-security is provided to the website. Hence, making it superior to the existing systems and is also, an authentic model.

II. LITERATURE SURVEY

A. Iris Detection in Voting System

In this paper, the author focuses on the Iris Detection of the voters. Voter's Iris is detected and once it matches, the system confirms the voter to be the eligible individual to vote by checking his/her Aadhar details. Once confirmed the voter will be allowed to cast the vote.[1] As the existing Aadhar database contains all the information about voter's Iris, fingerprints and other details like address, blood-group voter can be easily tracked and checked. This approach requires less manpower and highly secure.

B. Voting System using Fingerprint Recognition

The author focuses on biometric data of the voters to recognize the authentic voters. Once the biometric image is read the information will be sent to the web application through the microcontroller's serial port.

After matching the biometric image with the existing image in the database the server sends the message and displays it on the LCD confirming the owner's identity. If not confirmed, it displays the same as not eligible through LCD.[2]

C.Smart Voting

The proposed system in the paper has 3 security phases. Information of individuals above age 18 will be taken from the Aadhar database. In the first phase, the voters will be given an Id and password through the registered e-mail Id before the voting process. [3]

The second phase is validating the voter using fingerprints data and once confirmed voter will be allowed to cast the vote. After casting, as a part of the third phase, the voter id will be deleted leaving no second chance to vote again.

Aadhar details that were used by the voter will be locked to track the voter for further access. The count will be updated parallel.

D.Location-free Voting System with the help of IoT Technology

In the paper voting process is done through the smartphone using its fingerprint sensor.[4]

The fingerprint sensor of the phone will be linked to an application in the Smartphone to validate the voter and voter will be allowed to vote only on the day of the scheduled process. The voter can vote from anywhere and will be allowed to vote only once.

E. Secure Reliable Multimodal Biometric Fingerprint and Face Recognition

The author focuses on the facial feature extraction using component-based face detector. Once all the features are extracted they are compressed to a single feature vector and it is fed to the recognizer. The whole process is implemented using MATLAB. [5]The same is done with the fingerprint images. Every pixel of the fingerprint images is analyzed whereas for facial images the distance between the facial marks or features is analyzed. The analysis is called principal component analysis. This approach helps to build a better version of the existing system.

III. EXISTING SYSTEM

Currently, voting systems are Electronic Voting Machines (EVM) and Secret Ballet Voting which require man-power and are time-consuming processes. Individuals above age 18 are eligible to vote. Voter's Id and others details are validated manually and only after confirmation he/she will be allowed to vote. The EVMs have to checked and transported to different parts of the country wherever the election is taking place. It also needs manual power and security. The counting of the votes casted in EVMs also needs manpower and takes an entire day and ballet voting is entirely manual. So, there are a lot of ways the counting and the voting to not be clean. Hence the current system can be made a lot better, more accessible and more efficient.

IV. PROPOSED SYSTEM

The designed and proposed smart voting system uses face recognition using image processing which is more secure than the already existing one. The main security level is where the system recognizes the face of the voter from the current database of face images given by the election commission. If the image captured matches the respective image of the voter in the database, then a voter can cast their vote in the election. Haar Cascade Algorithm is used to extract the facial features and to recognize the facial part of the image. Visual Studio and software like Python, HTML, and Django were used to create the online platform and to implement the algorithm.

V. METHODOLOGY

This proposed concept is an entirely web-based system so the basic features related are web-based technologies such as database creation, image processing properties which determine the software requirement of the system. This application will be available online on authorized government sites, whenever or whichever day authorized. The voters will be able to cast their votes by use of this website. Eligible voters will be validated by facial recognition. The voter will open the website on the day of elections. The server will be run as to whenever the Election Commission authorizes. The voters can open the website with the link or the IP address provide. For example, the website we created has the IP address as http://127.0.0.1:8000/. Once you open the website and click on the vote button, the voter's face will be captured with the help of whatever device they are using the website from like a laptop, PC or their mobile camera. The captured image will then be received by the server. The server goes through all the images in the database and tries to find a match in the registered ones. If a matching face is found, the voter is registered and recognized by the election commission and hence is allowed to vote. If a match is not found, the page will say he or she is not recognized and would not be allowed to vote.

The picture matched will be displayed along with their ID numbers and then be lead to the voting page where he or she can vote to any political party they prefer from the list of options displayed. Once they click on their preferred party, the choice cannot be changed and the rest of the options will be disabled as well. The server accepts the votes cast by the authenticated voters and stores them. The count of how many votes each political party's candidates will be stored as well. This way even the counting of votes is very easy and the commission or the candidates or the voters do not have to wait for days to know the results.

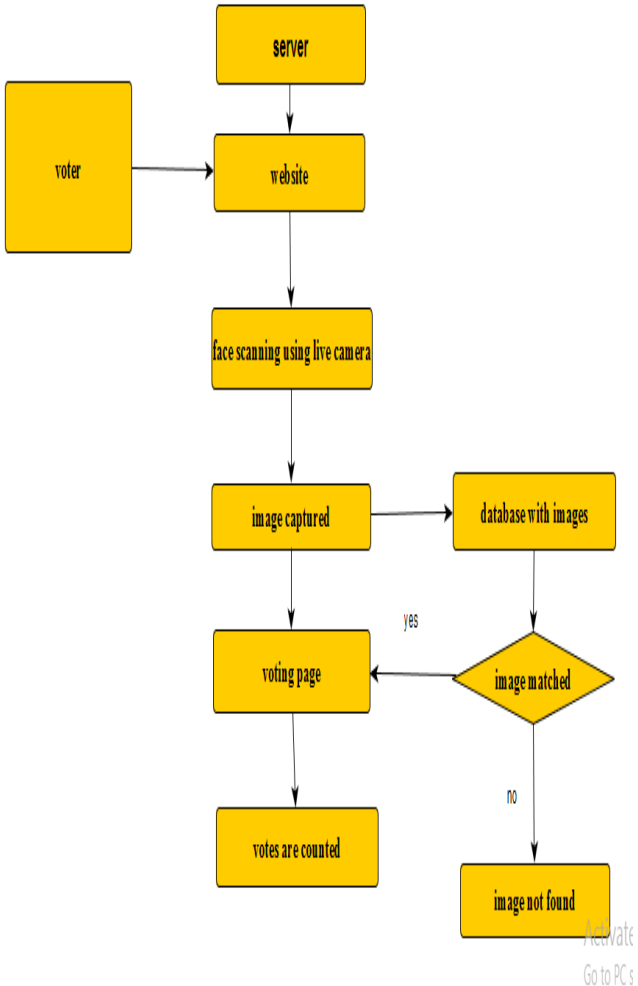


Fig.1: Picture showing Haar-features

VI. FACE DETECTION USING HAAR CASCADE

Face detection, which is the major part of this project 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.

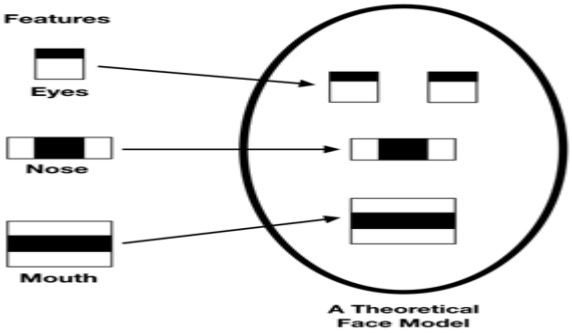


Fig.1: Picture showing Haar-features.

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.

0	0	1	1
0	0	1	1
0	0	1	1
0	0	1	1

(a)

0.1	0.2	0.6	0.8
0.3	0.2	0.6	0.8
0.2	0.1	0.8	0.6
0.2	0.1	0.8	0.9

(b)

Fig.2: Pixel intensities of detected Haar-features (a) ideal case (b) real case.

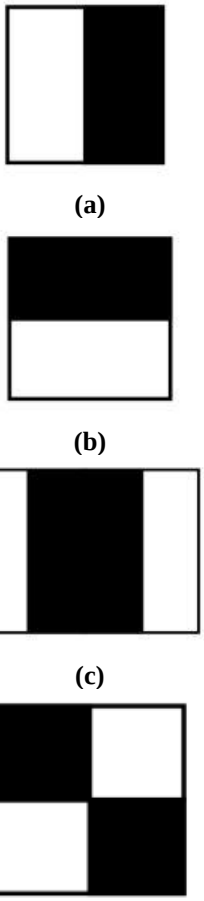
According to the Viola-Jonas algorithm, to detect Haar-like features present in an image, below formula should give a result closer to 1. The closer the value is to 1, the greater the change of detecting Haar feature in the image

$\Delta = dark - white$ Eq. (1)

$\Delta = \frac{1}{n}\sum_{dark}^{n} I(x) - \frac{1}{n}\sum_{white}^{n} I(x)$ Eq. (2)

Ideal case: Δ = (1/8)*(8) — (1/8)*0 = 1
Real case: Δ = (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)

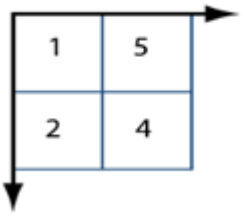
Fig.3: Some common Haar features (a) vertical edge feature (b) horizontal edge feature (c) line feature (d) four rectangle feature

B. Integral images

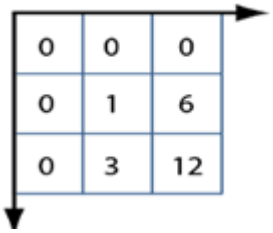
A huge amount of features are returned by the above computation. To decide, what features should be taken into consideration, integral images are used. It is a specialized algorithm designed to generate the sum of values in a rectangular subset of a grid.

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

So when a certain window is chosen, this algorithm computes cumulative sum of the pixel intensities row-wise and column-wise, which reduces the number of operations that have to be performed to detect is a window is useful or not. By useful it means if the window is a part of the face we need to detect. If we consider the below given boxes as a subset of a face where the numbers are pixel intensities, we have to do 1+5+2+4 for the left side table, which is 12. Whereas, on the right, we have a table with cumulative sums, row-wise and column-wise, here all you have to do is 12+0-0-0, which is equal to 12. We have considered a simple computation here, but with increasing sizes of subsets, the computation using integral images are much faster, less time-consuming and effective.



(a)



(b)

Fig.4: 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.

D. Cascade of classifiers

In an image, there are face-regions and non-face regions.We group the features that are detected from subsections into different stages of classifiers and apply them one by one. The window that has failed in the first stage will be discarded. We don't consider the remaining features in it. The second stage of features will be applied and the process is continued only if it passes the first stage. Required face region is the window that passes every stage. Hence a cascade is used so as to save time, energy and effort by not putting every subsection or window through all the stages. The window will go through all the stages if only it has a face feature. Whenever the cascade sees that it does not belong in the face region, the window gets discarded and all the smaller windows that pass through all the stages combine to form one big window which results in the face that is being detected.

VII. RESULTS

An online website is created using HTML and all the software codes are implemented using Visual Studio. The designed system is superior to the existing systems and is highly secure. The algorithm used makes the system unique and efficient. It makes sure that the voter is validated before the voting process. By using the Smart Voting System the count of fake votes automatically reduce and may cease to occur and also makes the whole voting and counting of the votes easier, energy-efficient, accessible and more secure.

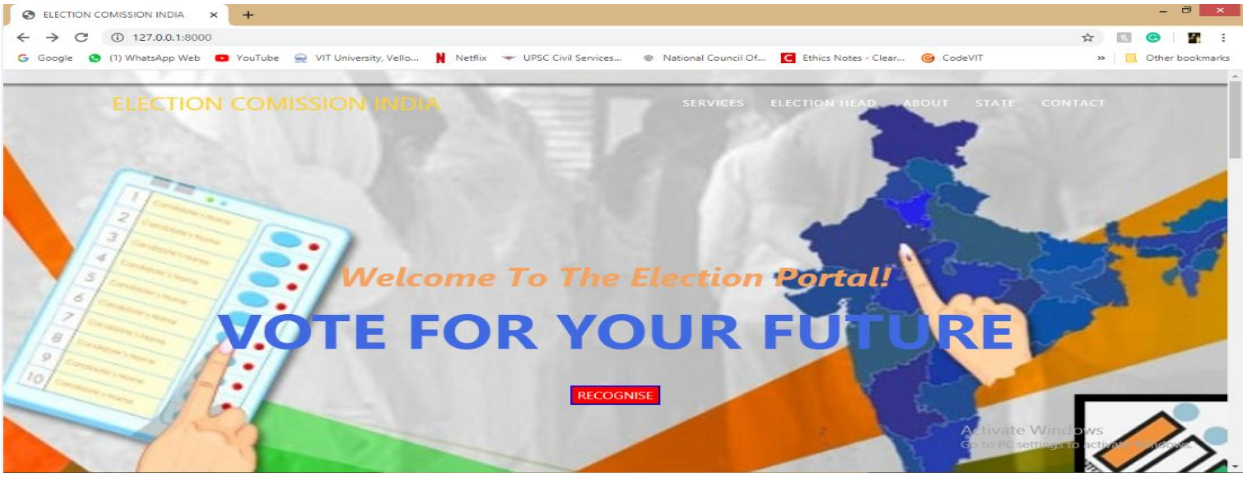


Fig.5. website for voting where face recognition takes places using live camera

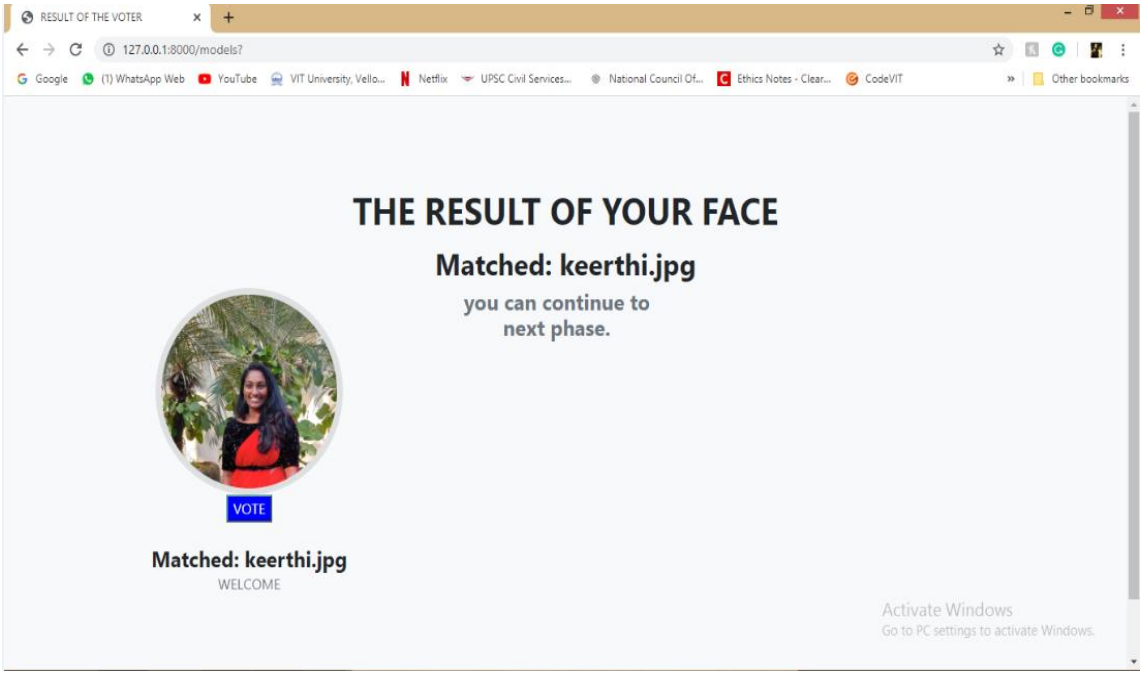


Fig.6. After a face is matched from one of the faces in database

Fig.7. the page where voting for preferred political party takes place

VIII. PROSPECTIVE IMPROVEMENTS

We could add more layers of security by adding verification of unique identification numbers like Aadhar card and verification could be voter ID number. Finger print verification can also be included besides face recognition if Aadhar database is connected as it has iris and fingerprints connected to Aadhar number. This entire system would be more efficient and accessible as an IOS or an android application.OTP generation can also be a part of the verification system if the voting app is made. Then the face recognition can happen with the phone camera itself.OTP generation can also be a part of the verification system.

IX. CONCLUSION

This paper discusses an approach which is more accessible, secure and efficient than the existing system which has many defects such as lengthy process, time taking, not being secure enough, bogus voting.Unique features like the distance between the eyes and eyebrows never change regardless of aging. The designed system is also less time-consuming, inexpensive and a hassle-free way of conducting the election process, making smart voting a better way to vote.

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