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An Efficient Machine Learning Based Attendance Monitoring System Through Face Recognition

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ABSTRACT

In the modern technological era, face recognition is attracting greater attention. The two methods used to recognize a person are physiological and behavioral, including fingerprint, iris scan, voice scan, signature scan, palm scan, etc. For this type of recognition, human action must be involved like placing the finger on a scanner. While face recognition does not need any human action, so it is most successful than any other biometric identification method and also advantageous. It is not new technology for us; we have been using it in our daily lives. It plays an important role in retail crimes, unlocking phones, finding the missing persons, helping blind, facilitating secure transactions, validating identity at ATMs, diagnose disease, protecting law enforcement, student attendance system, etc. The face recognition system can be realized using the existing hardware, cameras and image capture devices. Identifying a face from an existing database is a challenging issue in face recognition. Poor image quality, inadequate illumination, the subject not looking directly at the camera, and other factors can all cause problems. The same person's face will look different depending on how they are feeling. As a person ages, it gets harder to identify their face since their size and color may also change. This article uses the suggested system's Android application to track attendance using face recognition. The proposed technique can be utilized to school and college participation records. The human face in the transferred to the server picture of that class can be perceived utilizing a calculation. The HAAR overflow classifier is being utilized to cut out the face in this case and distinguish it. The HOG approach is then used to extricate the highlights of the perceived face. In the closing stage, a SVM classifier is utilized to distinguish the person from our data set. At the point when the individual is recognized in the photograph, the participation for that specific class will be naturally appointed in the succeed sheet.

1. INTRODUCTION

The precision of the information gathered is the greatest issue, as indicated by the current participation the board frameworks. Beguiling this mechanism is unimportant. This is on the grounds that it's conceivable that the first individual who took the participation didn't really record it; as such, a particular individual's participation might have been recorded by an outsider without the organization's information, which endangers the information's veracity. For example, understudy B assisted understudy A sign for participation with night however understudy A had not really been available since understudy A was too sluggish to even consider making an appearance to the class. Be that as it may, on the grounds that no requirement was being applied, the framework dismissed this mistake.

One of the most valuable commodities in the world today is time. Man has consistently sought to find ways to make his labor easier throughout the many phases of civilization. The idea of automation was created because man was never content. The old marking attendance system has been replaced by an automated attendance system, which is a development in the field of automation. The teachers' jobs have become lot easier because to the attendance monitoring technology. The Attendance Management System is one application that requires face detection and recognition. Faces that are particularly recognizable to us as humans can be recognized. Nevertheless, there are situations when we may misidentify or confuse someone. Sometimes, though, we can recall a person's presence but not their name. In this concept, a computer will be used to assist in face recognition. A system called face recognition is used to verify or pinpoint a person's identification. Face recognition in the smart society has become more successful as a result of the widespread use of

smartphones and cameras. One of the few biometrics with great accuracy is face recognition. The person's image may be caught via a camera in real time or it may be a still frame from a video [1].

Face recognition was credited to Woodrow Wilson Bledsoe as its originator. He took note of the face's location on a tablet he called RAND. An electromagnetic wave-emitting stylus is included with this tablet. He manually entered the coordinates using that approach, then attempted to identify the faces using the database, but it was unsuccessful. Later, In the facial recognition sector, numerous people proposed their unique systems. Face recognition technology is used by Facebook as well to make it easier to identify faces in pictures that Facebook users upload.

R-CNN is utilized to foster facial acknowledgment frameworks like the HOG algorithm. Face Recognition in light of photographs is ordered utilizing four significant classes: all-encompassing procedure, highlight based strategy, model-based technique, and cross breed strategy. Comprehensive techniques accept the full face as its feedback, and face distinguishing proof is finished by transforming the countenances into vectors.

The HOG approach is utilized in this review for face acknowledgment. There are two cycles associated with face detection and face recognition. Face recognition should be possible by eliminating interruptions and commotion from a picture. For this, we are utilizing the HAAR cascade classifier. A model or calculation that characterizes input into bunches in view of qualities is known as a classifier. There are various kinds of classifiers, for example, guileless Bayes, perceptron's, choice trees, calculated relapse, etc. The utilization of a classifier relies upon the main pressing concern. We likewise utilize the HAAR cascade classifier for face discovery. We utilize HOG to extricate the highlights of the face after it has been recognized. The gradient in this case is just an arrow-like structure used to indicate the essential facial features, like the eyes, mouth, nose, and so on. Then, using the label created by the face recognition, we use SVM (Support Vector Model) to determine the name of the individual who has been identified.

2. LITERATURE REVIEW

An image enlargement technique for face recognition was proposed by Halidu et al. [1]. The PCA method is used for facial recognition. Its innovation is utilized in both security and amusement. It has become challenging to recognize the individual using the observation framework because of the bad quality of the film given by the camera's distance and angle. To tackle this issue, the picture goal should be expanded to successfully recognize an individual. The individuals can then be identified by comparing this improved image to the photographs in the database. In this work, three notable strategies for picture

Expansion-Closest Neighbor, Bilinear, and Rural-are explored. An information picture is first down tested to six distinct goals. The down-tested picture is then expanded to its unique size utilizing one of the three picture augmentation strategies depicted previously.

Wijaya et al. [2] and colleagues suggested a face descriptor based on discrete cosine transforms (DCT) coefficients. The face descriptor is comprised of predominant recurrence content recovered by discrete cosine transforms (DCT), shape data created from hu-moment, and nearby component data recuperated utilizing zone DCT.This face descriptor, which is based on DCT coefficients, aims to produce outstanding real-time face recognition results. In this study, the face descriptor's dimensionality is decreased using Predictive Linear Discriminate Analysis (PDLDA), and the KNN is employed as a verification method. Real-time face recognition technology as it is now being suggested seems to perform well in terms of accuracy, false negatives, and false positives.

Jiang et al. [3] suggested a procedure in view of scanty portrayal and element combination to work on the precision of face acknowledgment. To begin with, the photographs are switched over completely to grayscale, trailed by histogram adjustment, scale scaling, and smooth separating, for the preparation tests and test tests. Second, LBP, Gabor, and HOG highlights from facial pictures are recovered. The incomplete samples are subsequently subjected to the RSC classification test. The loss function is defined by the classification residual and the recognition outcome, and it is minimized by using the regularized least squares method to get the weight vector. The final classification result is then determined using the final residual and the weight vector.

To speed up the process of detecting faces, A Face Recognition algorithm based on Prewitt and CNN convolutional neural networks was proposed by Xiao and Gao [4]. The Prewitt operator and histogram equalization must be used to pre-process the image before performing this operation. In order to increase convergence, the learning rate is modified using the exponential decay method once the pre-processed images are fed into the CNN during training. To avoid overfitting, it used Dropout techniques and L2 regularization.

Kerimbekov and Bılge [5] suggested the Lorentzian metric for facial recognition. Based on unique properties of the Lorentz space, a novel Lorentz face recognition (LFR) method was developed for this system. According to Lorentz distance, the suggested method generates a similarity value for the new test sample. The closest neighbor approach determines a similarity value as 1 or 0, or the actual or fake face image, accordingly. Additionally, based on the Lorentz metric, we suggest the Lorentz Feature Selection (LFS). For dimensionality reduction, the LFS is employed. The proposed LFR approach is applicable, according on the experimental findings obtained from face data sets.

A face recognition framework in light of stacked convolutional auto encoded and sparse representation (SCAE) was created by Chang et al. [6]. to recognize profound features and the essential and basic features that are inferred utilizing customary methods. The sparse representation is an overall grouping computation that has demonstrated outstanding performance in demonstrating that the suggested framework can provide all of the more in-depth and theoretical highlights while having high precision.

A system for managing attendance automatically, without human intervention, was proposed by Nandhini et al. [7]. to replace the manual technique. In this technique, a camera is mounted in one location to record a video or take an image of the entire class. It is then transformed into frames. CNN uses a system resembling a multilayer perception with an input layer, output layer, hidden layer, and multiple convolution layers, pooling layers, completely linked layers, and normalization layers. The database is then accessed using the CNN method in order to identify the faces of the students. But in order to record all of the student's facial features, as well as to identify the student's posture and motions, the student's face must be captured.

Sujay et al. [8] proposed a technique for face detection utilizing extended LBP highlights and a multi-facet SVM classifier. The LBP is utilized to separate the highlights from every 3 by 3 grid that was made utilizing the Viola-Jones strategy to distinguish faces. After the Face picture has been pivoted multiple times, LBP Highlights are removed from it, and SVM is utilized to classify the Face picture for the FERET and Yale face information bases. The factors FAR, FRR, TSR, and EER are totally estimated.

A compact finger print attendance system was proposed by Mohamed and Raghu [9], determined to use biometric advancements to mechanize the participation cycle in instructive organizations. Without the educator's inclusion, the participation is recorded utilizing a convenient device. During class, the gadget can be passed about and used to record participation. To connote their participation in class, understudies would be expected to put their finger on a sensor. Its USB interface empowers correspondence with a host PC. The fingerprint attendance system's brain is the Fingerprint Module. This system employs the MIAXIS SM630 fingerprint module. This device is powered by a rechargeable battery. The teacher can control the device and attendance with the help of the host computer's GUI application.

Khan et al. [10] proposed Face detection and recognition utilizing Open CV, where PCA is one of the facial recognition system's techniques. The feature space needed to represent the data efficiently can be reduced from a considerable quantity of storage space with the aid of PCA. A wide 1-D pixel vector worked from a 2-D face picture in minimized essential space capability components is planned for facial acknowledgment utilizing the PCA. A self-space projection is the thing is being portrayed here. The significant still up in the air by deciding the vectors of the grid focused on a bunch of unique mark pictures. A camera-based ongoing face acknowledgment framework is fabricated and a calculation is developed using programming utilizing OpenCV, HAAR cascade, Eigenface, Fisher Face, LBPH, and Python.

Three different techniques-SVM, MLP, and CNN-have been introduced in Damale and Pathak's suggested model [11]. DNN is utilized to find faces. The photographs were given as a feature vector directly to the CNN module in the CNN-based method. The proposed model did, however, achieve good recognition accuracy for a CNN-based approach. Testing accuracy was achieved in the range of 87% (SVM), 86.5% (MLP), and 98% (CNN).

Extraction of SIFT and DRLBP characteristics for face recognition was recommended by Sushama and Rajinikanth [12]. To gain better face recognition performance, two computational and numerical techniques-Scale Invariant Element Change (SIFT) and DRLBP-are suggested for arranging the appearances. In this paper, the authors suggest a brand-new Artificial Neural Network (ANN) classification method for the classification of the human face. The face photos must first go through some pre-processing before SIFT can be used to extract the features of the face. Then, back propagation network (BPN) is used to detect human faces. Instead of employing them independently, combining SIFT and DRLBP results in more accuracy.

Patel and Yagnik [13] outlined the face acknowledgment approach and discusses how it operates. It also examines several face recognition techniques. It includes both remarkable natural circumstances and techniques that have a high degree of efficacy for brightening changes.

In a paper that Bhele and Mankar [14] presented, an effort was made to thoroughly review a wide range of facial recognition systems. This includes algorithms like PCA, LDA, ICA, SVM, ANN for acknowledgment, and many hybrid combinations of these tools. This audit looks at the range of strategies that have recognition barriers including light, present variety, and appearance.

Face recognition using various deep learning approaches were presented by Wang and Yan [15].

3. PROPOSED SYSTEM

One of the key challenges in today's environment is security. In order to improve security issues, numerous technologies are being created. Face recognition is one of the technologies. We can also complete human tasks swiftly with the help of modern technology, such as taking attendance in each class. By utilizing this face recognition technology, this can be made simpler.

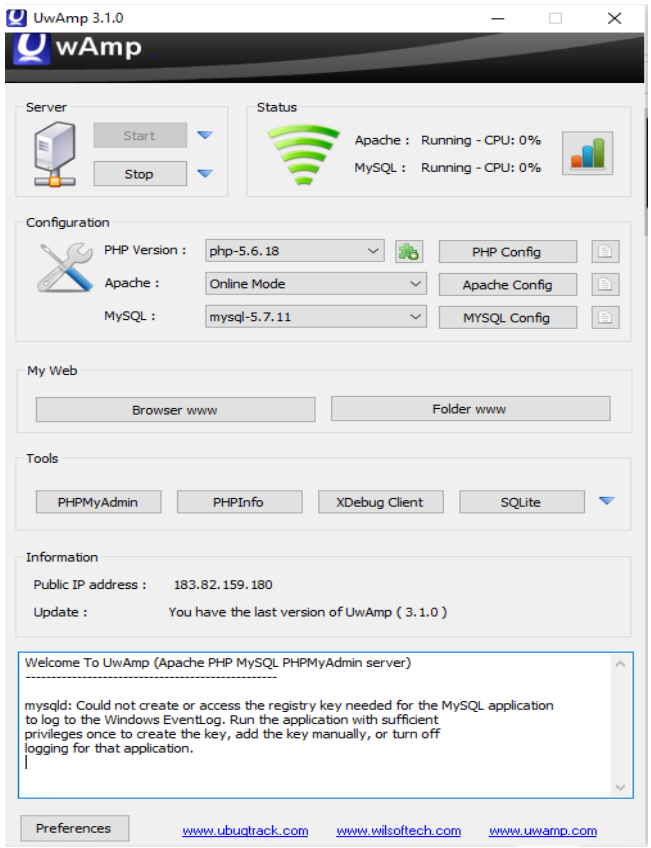


Figure 1. Server

We created an Android app for the suggested system. This program has capabilities including the ability to photograph users and submit those photographs to a server. The python code will be executed by the administrator whenever they need to know who was in class. The faces in the image will be recognized by the algorithms HAAR Cascade classifier and HOG Extractor, which will also update the attendance in the specific class excel sheet.

The teachers should introduce the Android application we created for the attendance Frame work.

Enact the WAMP server. WampServer is a Windows web improvement climate. It makes it conceivable to make web applications with PHP, Apache 2, and a MySQL data set. Moreover, dealing with your information bases is simplified

through PhpMyAdmin.

The IPv4 Address, which is the server's IP Address and should be provided in the Android application intended for this model to lay out the association, might be found once the WAMP server has been sent off by utilizing the order "ipconfig" at the order brief.

The Figures 1 and 2 show the server and how can we connect the server, when we are implementing the system.

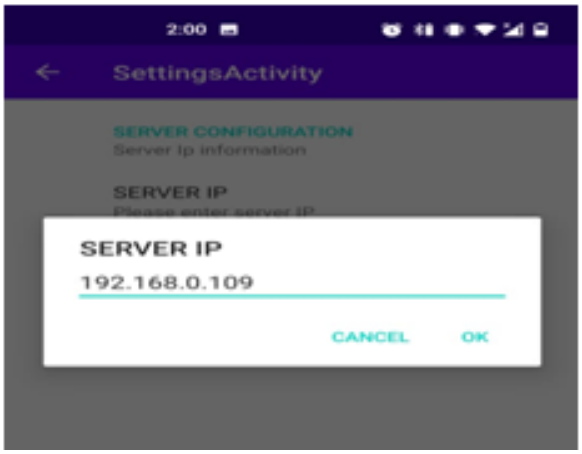


Figure 2. Connecting to server

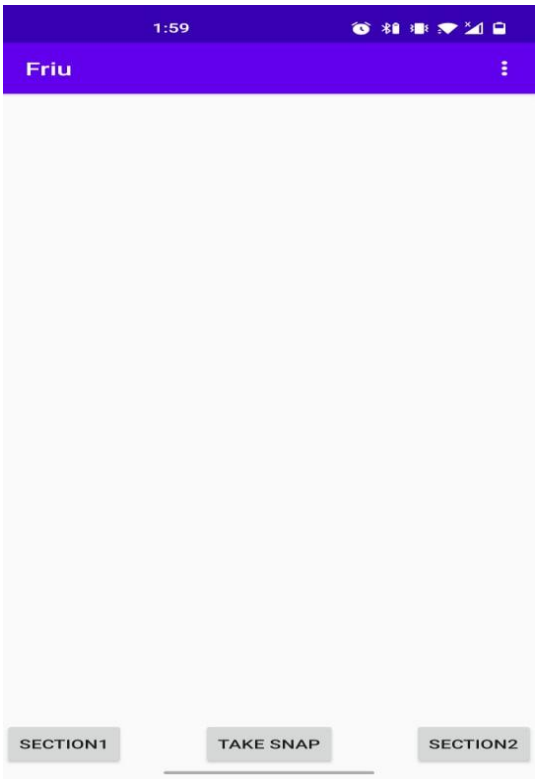


Figure 3. Main page

Figure 4. Files uploaded to server

After the connection is made, the Android application's home screen is reached as in Figure 3.

Select "TAKE SNAP" and then, depending on which area you want to submit the photo to, select either "SECTION1" or "SECTION2" after the photo has been taken. Index of the android file upload will be seen in Figure 4.

4. METHODOLOGY

The cycle's stream is all around portrayed in the block chart above. Subsequent to acquiring the picture, the HAAR cascade classifier will recognize the face by eliminating commotion. The highlights are a short time later extricated utilizing the Hoard extractor, and the SVM model is then used to distinguish the face. The name of the individual is at long last given as a recognizable mark. The HAAR cascade classifier can be seen in Figure 5.

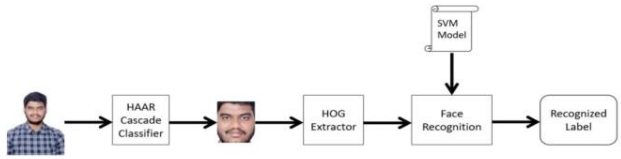


Figure 5. HAAR cascade classifier

HAAR CASCADE CLASSIFIER: Fast item recognition utilizing a helped fountain of Paul Viola and Michael Jones' work "Quick article discovery utilizing an of every 2001, "straightforward highlights" were addressed comparable to the HAAR cascade classifier. Both positive and negative visuals are trained using a cascade function. Images that portray the thing that our classifier should be able to recognize are considered positive. Images that are not of the object we're seeking for are considered negative. HAAR characteristics are incorporated into the noise removal strategy. Edge features, line features, and four rectangle characteristics are present in a number of HAARs.

Applying the aforementioned characteristics will produce the following results:

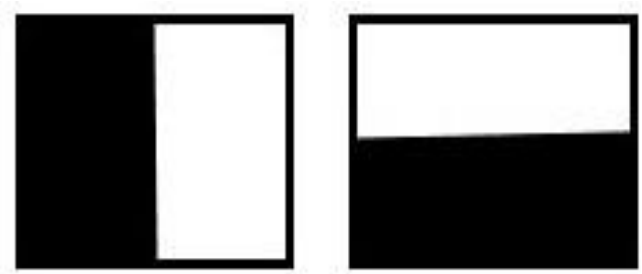


Figure 6. Edge features

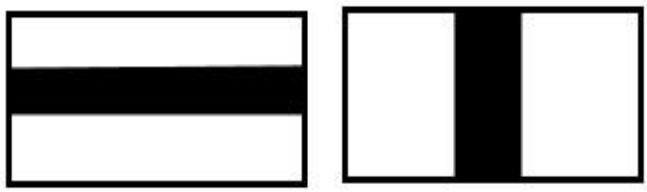


Figure 7. Line features

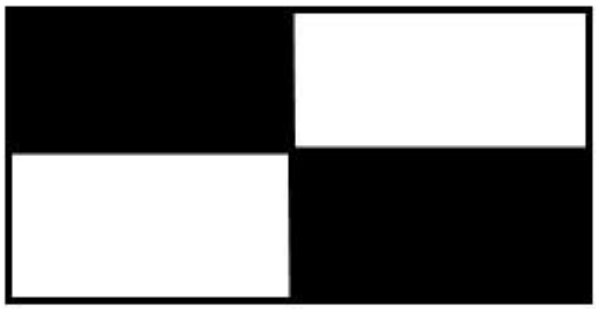


Figure 8. Four-rectangle feature

The progression of the cycle in HAAR is as displayed in the underneath figure.

It will first take the input and attempt to determine whether or not it is a face. It will leave the algorithm if it is not a face. If not, it will move on to the stage that looks for faces. The output of the aforementioned step will look like the image.

Edge features, Line Features, Four Rectangle features were seen Figure 6-8.

HOG (Histogram of Gradients Algorithm): A histogram of slopes will be utilized to remove the highlights from the face's distinguished elements. We should initially find the angles in the picture to do that. We are everything mindful that the picture is comprised of pixels. The pixel esteem unexpectedly transforms from a dark pixel (lower pixel number) to a white pixel (higher pixel number) after a specific measure of steps while moving from left to right, pixel by pixel. The feature extraction, Progression of the cycle in HAAR and its output can be seen in Figures 9-11.

Figure 9. Feature extraction

In the image, the face is not constantly in the same place. In some photographs, the subject's face may appear slightly off-center or only one side of the face may be seen. We still need to be able to recognize the face even then. We always wrap each image to place the lips and eyes in the same spot as a result. The top of the chin, the outside corner of each eye, the inner corner of each brow, and other landmarks are just a few examples of the 68 areas on the face that we will be able to recognize. The Figures 12 and 13 are representing HOG, Face landmark estimation.

The last stage in the process is the simplest. The only thing left to do is find the person whose measurements match those in our test photograph the most closely. We'll use an easy-to-use linear SVM classifier. Prior to picking how to separate your information into particular gatherings as per the marks or results you've chosen, it plays out a progression of profoundly complex information changes. This classifier will run for milliseconds. The result of the classifier is the name of the subject.

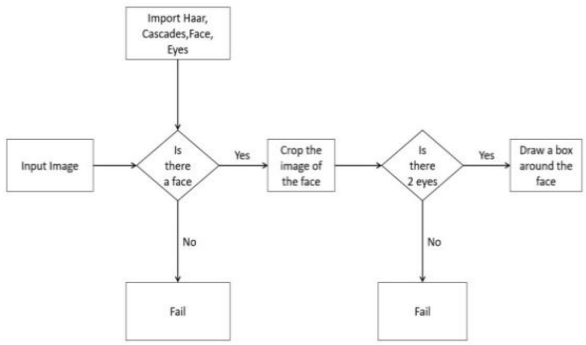


Figure 10. The progression of the cycle in HAAR

Figure 11. Output of the HAAR

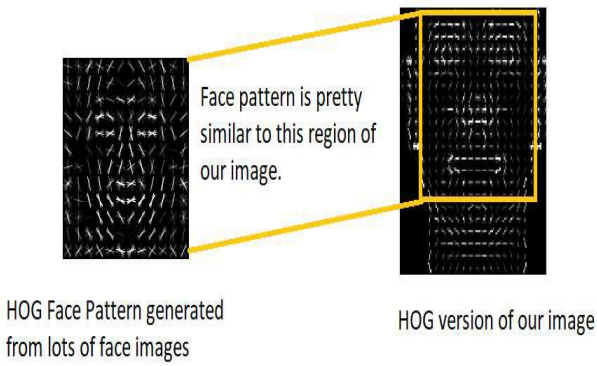


Figure 12. HOG representation

Figure 13. Face landmark estimation

5. EXPERIMENTAL SETUP

In the proposed system, firstly a path has to be set up where the code, image database and results of executions will be

stored. Distinct way must be characterized in the program to accept the pictures as information and run the code on a bunch of pictures powerfully. In the below figure, path choosed for the proposed system is “F: //Training”.

Face_recognition, listdir, and other libraries must be installed in the IDE in order to accomplish some of the main actions. These libraries will make it easier to accomplish the training and detection tasks required by the suggested system. Face_recognition, listdir, and other libraries must be installed in the IDE in order to accomplish some of the main actions. These libraries will make it easier to accomplish the training and detection tasks required by the suggested system.

The URL must be customized to include a specific folder for storing student photos (one student face per image). It's crucial to remember that each image must be kept with the name of the matching student visible in it. The path set up can be seen in Figure 14.

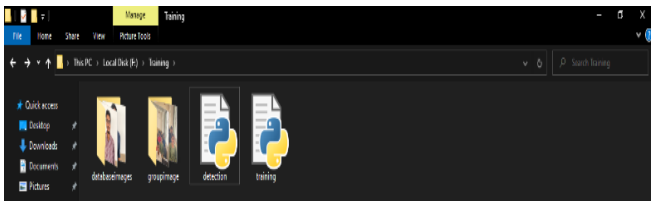


Figure 14. Path

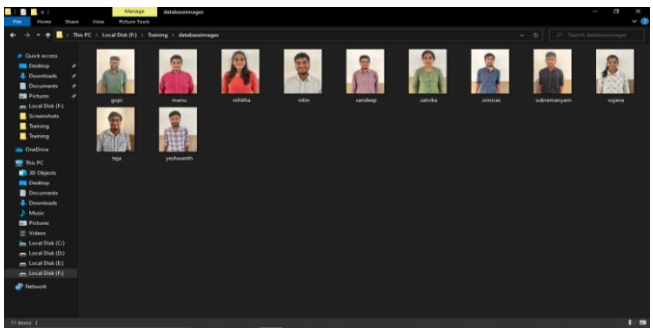


Figure 15. Database folder

The application will actually want to acknowledge each picture as a contribution at a time and encode the particular substance of the understudy present in that picture once the way has been made and appropriately characterized. Each picture should be in.JPEG design, which should be guaranteed. Figure 15 represents the Database Folder.

Training:

A rundown of pictures will be utilized as info, and the essential encoding will be finished.

The HAAR Cascade classifier receives all of the photos and uses them to recognize faces and remove noise.

Each of these images has a pixel count and a recognized label with a name provided.

Two distinct text documents are utilized to contain the encoding data, which incorporates the groupings and related name of the face in that specific picture. Code for saving the previously mentioned information in two different text records.

The accompanying image displays every sequence that might be used to encode the persons in the picture. These were produced using the HOG Extractor and HAAR Cascade classifier. Encoding sequences and names can be seen in Figure 16 and 17.

The following image shows the all possible sequence encoding names of people in the image. These are produced using the HOG Extractor and HAAR Cascade classifier.

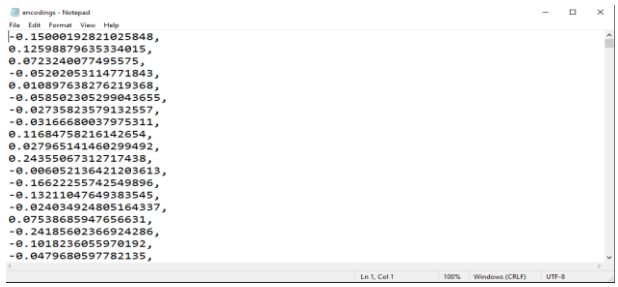


Figure 16. Encoding sequences

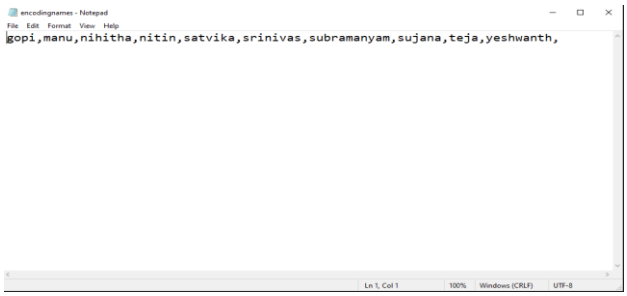


Figure 17. Encoded names

6. RESULTS AND DISCUSSION

The first step in the suggested system is to find the faces in a group image, recognize the faces, and match the encoded faces with the stored encoded sequences that were learned during the training stage. Code to perform the reverse process that is used in order to detect from the encoding sequences is as shown in the figure below.

```
for face_encoding in face_recognition.face_encodings(new_picture):
    counte=4
    deviation=0.6
    while counte>1:
      results = face_recognition.compare_faces(feature, face_encoding, deviation)
      counte=results.count(True)
      deviation=deviation-0.02
```

Figure 18. Detection

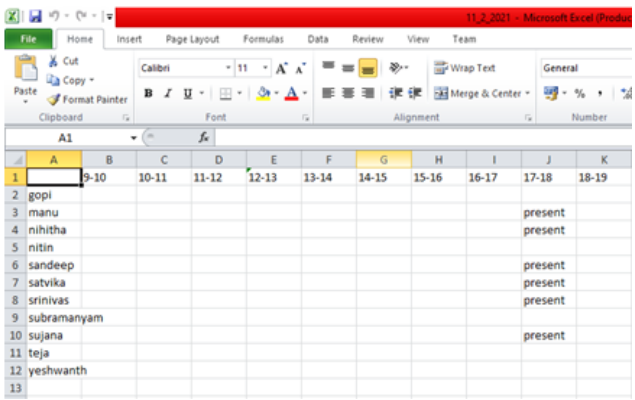
Figure 19. Input image

The input Image is uploaded to the server using the mobile application that was developed. A timestamp will be included in the image's name, allowing attendance data to be captured for a specific time period on a particular day by identifying that time on a certain day. Detection of the face, Input image and output can be seen in Figures 18-20.

After the whole detection code for the suggested system has been executed, a new image with the student's name and face highlighted in a rectangular box will appear in the project folder. The attendance marked in Excel sheet can be seen in Figure 21.

The attendees will be noted in the excel sheet for the individuals shown in the input image.

Figure 20. Output



	A	B	C	D	E	F	G	H	I	J	K
1		9-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	18-19
2	gopi										
3	manu									present	
4	nihitha									present	
5	nitin										
6	sandeep									present	
7	satvika									present	
8	srinivas									present	
9	subramanyam										
10	sujana									present	
11	teja										
12	yeshwanth										
13											

Figure 21. Attendance marked in the Excel sheet

7. CONCLUSION AND FUTURE SCOPE

Last but not least, in this study, we developed an Android app and linked it with an improved facial recognition technique that provides high accuracy and can identify a person in a variety of lighting and angle situations. As a result, this concept can be applied broadly in universities and other educational institutions, which help professors' jobs go more quickly. It might be extended further in the future as well. Both hospitals and schools can make use of it. It can be utilized for a variety of things, such preventing ATM fraud. The most effective method for identifying double voters will be face recognition technology; alternative methods include checking drivers' licenses, identifying and confirming terrorists at airports, train stations, and shopping malls, and identifying and certifying drivers. On social networking sites, face recognition technology is now widely used, and adoption is growing swiftly.

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