Face Recognition Attendance System based on Real-Time Video

Eiti Jain
M.Tech Scholar,
RGPV Bhopal

Santosh Mishra
Assistent Prof.,
RGPV Bhopal

ABSTRACT
A person's face becomes their identification. Since the invention of computer vision applications, the strategies for exploiting this physical property have changed dramatically. c Every school, and collage library keeps track of attendance. Traditional approach for attendance is professor calls student name & record attendance. It takes some time to record attendance. Suppose duration of class of one subject is about 50 minutes & to record attendance takes 5 to 10 minutes. It is a waste of time for every lecture. To eliminate these losses, we're going to apply an automated picture processing procedure. Face detection and recognition systems are used in this unique technique. Face detection distinguishes face from non-faces, which is necessary for correct attendance. The alternative method is to use face recognition to track a student's attendance. By the proposed method (HAAR, AdaBoost and Deep Neural Network) we are getting an accuracy of 99.41 percent on the automatic face detection system.

Keywords
Video Processing, Face Recognition Technology, Face Recognition Attendance, Attendance System, Video Recognition.

1. INTRODUCTION
A technique based just on Viola Jones technique with face detection, following by the equalisation histogram for extracting features, as well as the (SVM) classifiers for facial recognition software was presented for developing an automation process for human identification and attending accountancy. developed an automated systems for face detection using the same method, as well as a classification for facial recognition software. These approaches, on the other hand, were based on traditional machines algorithms. A current FaceTime technique employs a cascaded deep neural network with face detection as well as a convolutional again for production of facial characteristics, which are subsequently utilised for recognition. Face identification using multi-task coalesced convolutions (MTCNN) and a Siamese neural network to capture facial features into a 128-element vector. Most commercially automation software utilizes close-up photographs of faces, with an open, well-lit face being the most important criterion for effective operation. Image process is done in steps, which is a time-consuming procedure. Face detection and recognition software application have rapidly grown as an information security technology throughout the world . a recent, specifically now, when acts of terrorism are on the rise, this technique has gotten a lot of attention. In the fields of public safety, civic economy, and home media, face identification system has a wide range of applications. The availability of staff must be recorded in the pipelines of normal businesses, that has become a fundamental obligation of the organisation. Needless mistakes frequently occur whenever these attending systems are designed. Using the present attendance tracking system for example, the study discovered it has a failure rate of around 5%, and that there'll be a phenomenon where palm prints could be hit, which has a significant impact on attendance effectiveness, especially for large participation sites where congestion is more likely. Workers swiped card with someone else is a problem with the cards attendance monitoring system, making it impossible to meet the goal of real-time attending. Face recognition provides greater accuracy and reliability than other two attendance methods as there are more locations for facial recognition software, which would be more exact than other methods. It is tough to congeal now that the situation has much improved. Despite the fact that China's studies into biometric technology was delayed, our scientific experts have caught up, and several key players in the area have created their own industrial positions. With the introduction of the big data age of today's world as well as the economic value of biometric technology, the future of this research and technology is quite bright, and there is a lot of market demand for it. Faces in surveillance recordings are frequently subjected to severe picture blur, posture shifts, and obstruction. Ding C has suggested a complete framework based on deep learning to tackle the issues of video-based facial recognition software (VFR) (CNN). To compensate for the lack of genuine instructional videos data, Ding C deliberately blur the training data made of clear still photos in order to build a fuzzy and strong feature representation. CNN is encouraged to automatically discover fuzzy insensitive data utilizing data for training made up of still photos and generated fuzzy data. Secondly, CNN has presented a trunks branching CNN model (TBE-CNN), that extracts complementary from the entire face picture and patched all around face sections Data, in order to improve the resilience of CNN characteristics to posture shifts and occlusion. The beginning of the 20th century face identification problem has been investigated by researchers such as V B Nemirovskiy. The description is based on grouping the closeness of the chromatic distributions of the split image's brightness clusters. Nemirovskiy V B employs three sorts of distances to determine closeness: There are three types of distances: cosine, Euclidean,and Leibler. For picture segmentation and grouping of proximity measures, a recursive neural network programming model is utilised. Face recognition attendance management system with actual video computation is favourable to business development and will have a good impact on future business development. The goal of this paper is to create a real-time video processing-based face recognition timesheet system. Four inquiry experiments were performed as part of this project: the prediction accuracy of a face detection system during exact check-in; the consistency of the face recognition timesheet structure utilising actual video preparation; study of a skip rate of the face detection and recognition attendance system using actual video

production; face detection and recognition attendance tracking interface setup using real-time video sorting The experimental findings show that attendance management system delivers the predicted timing & attended outcomes using facial recognition and a computer, demonstrating that the entire methodology is feasible. Students who completed the attending sign-in system accomplished their responsibilities swiftly, got rid of the confusing roll call sign, and rapidly grasped the sign of operations and function. Future technology timing and form of attendance tracking conversions have made significant advancements, dramatically enhancing the rates of attending and the dependability of face recognition technology. It is worth of your researchers' further investigation and realisation.

Any organisation that wants to analyze its members' success in part dependent on attendees must keep track of their attendance. Automated tracking that is exact and time and cost efficient is thus a pressing demand for today's large companies and enterprises. The process of face recognition may be characterised as the comparison of a still digital picture still or frames of a video produced from a video file to face images or attributes of existing facial images with the aim of verifying or identifying an individual. This is accomplished by comparing facial traits from a picture to faces in a collection. Because of its common use in security devices, the method may be likened to other finger print or eye iris recognizer. It is preferred because it is contactless and non-invasive, despite the fact that it is less accurate than iris and fingerprints identification. This innovative, yet divisive technology offers a wide range of applications, including improved human-computer interaction, video surveillance, automated picture indexing, and video databases, among others. Figure 1 depicts the entire process in a diagram to help visualise the series of events.

Fig.1 Systematic flow of generic face recognition

Monitoring attendance of students in each session is a moment task for university professors, especially when courses are big. Facial recognition is a method of recognising or verifying a person's identity in photographs, films, or in live time. The attending system can track employee whereabouts and date of checking in/out, as well as the results will be recorded down. The attendance system will next process the information and provide timesheet records. Students face a tremendous hardship if punctuality is tracked by hand. To solve this issue, a smart and automatic attendance system is being built. One of the technologies for detecting people and monitoring their attendance is facial images. To use this technique, the problem of proxy and student been labelled current even if they're not physically there may be readily solved. The gadget would therefore save not just time, but also the dedication that professors were supposed to bring to each lecture.

Face identification system, which is used to autonomously locate faces on video or identify people, is gaining popularity. The definition of "recognition" is the attribution of the examined item to one of recognised classes. "Identifying" is the process of determining the identification of a known thing to a know one based on the similarity of recognised attributes. Recognition software has a wide range of uses, including intelligent safety and security systems, biometrics, safeguarding, verification, and attendee tracking, Machine vision, for example. Biometric identity methods are being created dynamically because traditional methods of identification, such like keys or passwords, do not give a high level of dependability. The face has a lot of benefits over other approaches for determining a personality:

• The individual does not have to be physically approached, and it's the most common method for bulk applications.

• There is no need for intricate or spend at least.

2. METHODOLOGY

Nowadays days, technology attempts to convey a large amount of knowledge-based technical advancements. Deep Learning is an intriguing subject that allows a machine to educate itself using data as inputs and then deliver an acceptable output throughout testing using various learning techniques. Nowadays, attendance is seen as a critical aspect for both students and teachers in educational institutions. With the progress of deep learning technology, the computer can now automatically recognise the kids' attending performance and keep records of it. In generally, a student's attendance management system can be kept in two different ways, namely,

- Manual Attendance System (MAS)
- Automated Attendance System (AAS).

Manual Student Attendance Management is a method in which a teacher in charge of a specific topic must manually called the students' names and record their attendance. Manually attention may be viewed as a time-consuming process, and it is possible that the instructor will miss someone, or that pupils will respond to the absences of their friends many times. As a result, the issue emerges when we consider the usual method of collecting class attendance. We use an Automated Attendance System to address all of these difficulties (AAS).

Nowadays days, technology attempts to convey a large amount of knowledge-based technical advancements. Deep Learning is an intriguing subject that allows a machine to educate itself using datasets as input and then deliver an acceptable output during testing using various learning techniques. Nowadays, attendance is seen as a critical aspect for both students and teachers in educational institutions. With the progress of artificial intelligence technology, the computer can now automatically recognise the kids' punctuality record and keep a record of it. In generally, a student's attendance management system can be kept in one of two ways: Manual Attendance System (MAS) or Automatic Attendance Management (AAS).

Input is passed through numerous "layer" of neural network models in deep learning models, each of which provides a reduced version of the data to the next layer.

The majority of algorithms perform effectively on datasets of just few thousand characteristics or columns. Unfortunately, an unorganized dataset, including one derived from a picture, has so many characteristics that this approach becomes inefficient or impossible. Machine learning algorithms can't handle 2.4 million parameters in a single 800-by-1000-pixel RGB colour picture.

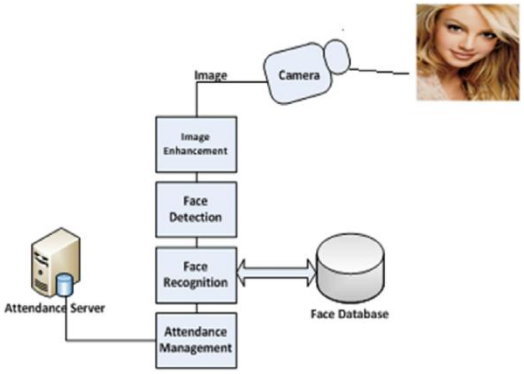

Fig.2 Face Recognition Attendance System Based

Even as image passes thru every neural network layer, deep learning methods learn more about it. Early layers learn to recognise low-level elements like edges, while later layers integrate those features towards a more holistic picture. A intermediate layer, for example, may image is determined to detect sections of an item in a shot, including a leg or even a branch, but a deep layer would detect the whole thing, including a dog or even a tree.

Principal Component Analysis (PCA)-Principal Components, or PCA, is a dimensional space approach for reducing the dimension of big data sets by converting a large collection of factors into a small one that retains the majority of the data in the huge array.

Naturally, lowering the amount of factors in a data set reduces accurate; nevertheless, the answer to dimension reduction is to exchange some accuracy for simplicity. Since small sets of data are simpler to study and display, and also because machine learning techniques can analyse data more easily and quickly without having to deal with superfluous factors.

To summarise, PCA's goal is to decrease the number of variables in a data collection while keeping as much information as possible.

3. PROPOSED METHOD

Just on PYTHON Graphical Interface, the proposed technique is used to detect the face from a video cameras recording frame (GUI). The Viola-Jones approach is credited with being the first object detection method to provide real-time tracking. Furthermore, because it is quick and adaptable in establishing a platform with a high detection, this approach is suitable for real-time application.

Attentional Cascade, Image integral, feature extraction, classifier with Image integral, Structure, and AdaBoost are three fundamental principles in the Viola-Jones Face Detection system that enable for the construction of excellent facial recognition that can be used in real-time applications.

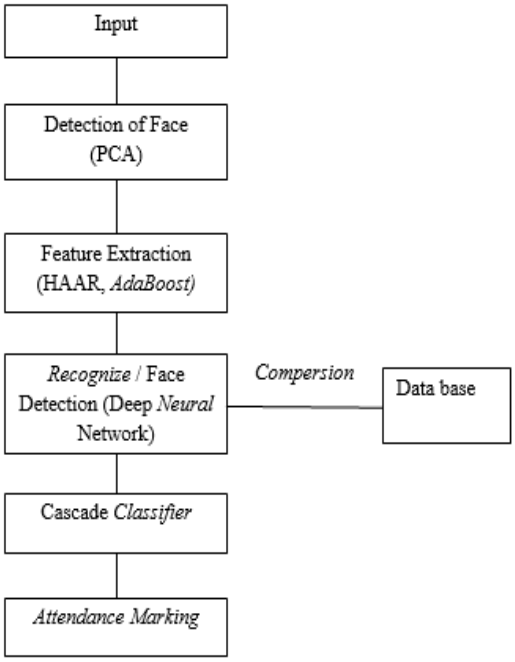

Fig. .3. Proposed Methodology

Face detection is currently utilised in a variety of areas, particularly on image-hosting services such as Picasa, Facebook , and Photobucket. The automatically tagging tool provides a new level to sharing photos among the individuals in the photo, as well as giving other people an indication of who the person in the photo is.

In the AdaBoost approach, wavelet features are used to characterise both face and non-facial pictures. In the Eigen Face technique, the feature vector of a face and nonface picture is generated using (PCA). PCA is also used to compress the provided data vector. The position of a face or a face region with facial characteristics is determined using a face detection algorithm (eye, nose, lips etc). In social situations, the face is our primary centre of attention, and it plays a crucial role in transmitting identity.

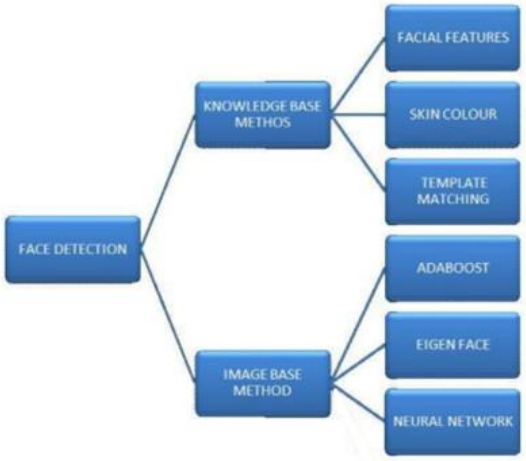

Fig 4: Face Detection System

The supplied information vector is compressed using PCA. In DNN, the kernel function is used to characterise face and non-face pictures. The pattern of the human face provides important information concerning human face recognition.

Windows scanners or a divided region can be used to apply template matching.

Step 1: Prepare the training faces.

Obtain the face images I1, I2, I3, I4, ..., In (training faces). The representations of the face must be centered and of the same proportions.

Step 2: Set up a data set.

Each face image in the database is converted into a vector and located in a training set S.

S = {Γ1, Γ2, Γ3, … … Γ*n* }.....(1)

Dimension Reduced Matrix

$$\begin{matrix}\Gamma_1 & \Gamma_2 & \Gamma_3 & & \Gamma_N\end{matrix}\begin{bmatrix} a11 \\ a12 \\ a13 \\ \vdots \\ aMN \end{bmatrix}\begin{bmatrix} a11 \\ a12 \\ a13 \\ \vdots \\ aMN \end{bmatrix}\begin{bmatrix} a11 \\ a12 \\ a13 \\ \vdots \\ aMN \end{bmatrix}\ldots\begin{bmatrix} a11 \\ a12 \\ a13 \\ \vdots \\ aMN \end{bmatrix} = \begin{matrix}\Gamma_1 & \Gamma_2 & & \Gamma_N\end{matrix}\begin{bmatrix} a11 & a12 & \ldots & a1n \\ a21 & a22 & \ldots & a2n \\ a31 & a32 & \cdots & a3n \\ \vdots & \vdots & \vdots & \vdots \\ aMN1 & aMN2 & \cdots & aMNn \end{bmatrix}$$

Step 3: Calculate the average vector of the face.

The average face vector (φ) is calculated based on the formula:

$$\varphi = \frac{1}{n}\sum_{i=1}^{N}\Gamma_i \quad \text{.....(2)}$$

$$\begin{bmatrix} \frac{a11+a12+\cdots+a1n}{n} \\ \frac{a21+a22+\cdots+a2n}{n} \\ \vdots \end{bmatrix} \quad \text{.....(3)}$$

Step 4: Subtract the mean/average face vector.

The original faces are subtracted with the average face vector and the output result is stored in the variable Φi

$\Phi i = \Gamma i - \varphi i = 1,2, \ldots, n$.....(4)

Dimension Reduced Matrix Mean Face φ

$$\begin{bmatrix} a11 & a12 & \ldots & a1n \\ a21 & a22 & \ldots & a2n \\ a31 & a22 & \cdots & a3n \\ \vdots & \vdots & \vdots & \vdots \\ aMN1 & aMN2 & \cdots & aMNn \end{bmatrix} - \begin{bmatrix} \frac{a11+a12+\cdots+a1n}{n} \\ \frac{a21+a22+\cdots+a2n}{n} \\ \vdots \end{bmatrix} = \begin{bmatrix} b11 & b12 & \ldots & b1n \\ b21 & b22 & \ldots & b2n \\ b31 & b22 & \cdots & b3n \\ \vdots & \vdots & \vdots & \vdots \\ bMN1 & bMN2 & \cdots & bMNn \end{bmatrix}$$

Step 5: Calculate the covariance matrix.

The covariance matrix is used to calculate the eigenvectors and eigenvalues. However, AAT have an $MN \times MN$ dimension that is extremely large to calculated. AA^T and A^TA have the same eigenvalues and their eigenvectors can be related as $ui = Avi$.

$$c = \frac{1}{n}\sum_{i=1}^{N}\phi_i\phi_i T = AA^T, (MN \times MN)$$

.....(5)

$$A = [\phi 1 \phi 2 \ldots . \phi n], (MN \times n) \quad \text{.....(6)}$$

where A is the matrix of the concatenation of the column vectors after removing the mean face.

Step 6: Obtain the eigenvectors and eigenvalues.

$ui = Avi$, $i = 1,2,3, \ldots . n - 1$.....(7)

ui is the eigenvector of AA^T whereas vi is eigenvector of A^TA. Eigen values of A^TA, are calculated and sorted. Eigen values less than 1 are eliminated so the number of non-zero eigenvectors may be less than (n-1). Eigen face is the principal component distribution of facial image.

Step 7: Projection of facial image to Eigen face.

$\Omega i = UT(\Gamma i - \varphi)$, $i = 1,2, \ldots , n - 1$ (9) In order to produce the projected image Ωi, the facial expression was projected on the Eigen Face using the equation. $\Gamma i - \varphi$ as the centered vector which the mean face is removed. Steps 1 to 7 are used to train the training image set and only step 1,2,3,4 and 7 is required for the test image. Step 5 and step 6 are not required for the test image, as the Eigen face is only required to be computed once during training. The Mahalanobis Distance is used as distance classifier to calculate the shortest distance between the projected image and projected test image for recognition.

3.1 HAAR

Haar characteristics are made up of two or three rectangle. Candidates' faces are scanned and examined for Haar characteristics relevant to the current stage. The weight are constants that the learning method generates. As seen in Fig. 4.4, there are many different types of characteristics.

Fig. 5. Examples of Haar features

Areas of white and black regions are multiplied by their respective weights and then summed in order to get the Haar feature value.Each Haar element has a values that is determined by multiplying the size of each rectangle by their corresponding weights, then adding the results together. To use the integral picture, you can quickly calculate the area of each rectangle. Using the integral picture, you can find the total of all the pixels above and to the left of any corners of a rectangular. Because L1 has been deducted twice, it must be put back in to acquire the right rectangle area. Using the positions of the integral picture, the surface of the rectangles R, denoted as the rectangle integral, may be determined as follows: L4-L3-L2+L1.

3.2 AdaBoost

Face detection is a computer algorithm that detects the location, size, and posture of a person's face in a photo or video sequences. Face detection is a hot topic in the computer vision world; finding a human face in an image is critical for applications including face identification, video surveillance, HCI, database administration, and searching picture databases. Viola and Jones created the most successful face identification method based on the Adaboost classifiers. Although their system proved successful in detecting faces, it has issues with false alarms, which may become more difficult in the existence of a complex backdrop. False positives can cause issues in an applications and require further postprocessing to eliminate. We offer a probabilistic strategy to adjust the scoring system of the Adaboost algorithm as our contribution to reducing the amount of false positives, which involves the extension of important concepts and supported experimental findings over the previous versions.

The Adaboost method is adaptive in the sense that it boosts misclassified data from prior classifiers during training by giving it a higher weight than correctly classified data. The incoming data collection and accompanying categorization labels make up the training database. Over the training data set, Adaboost continually calls a weaker learning ability. At each level, the most optimum parameters of weak learning algorithms are determined, resulting in the lowest classification error. A best classifier is a weak training classification with optimum parameter for a specific training stage. The intake data set is originally weighted evenly; but, throughout the training process, the weaker training algorithm emphasises the misclassified data more than the perfectly classified material. This is performed by increasing the weights of the miscategorized data in relation to the properly classified data at each iteration. The following are the major phases of the Adaboost method for efficiently classifying data. In transmembrane identification, a neural network is a widely utilised approach. Its concept is to construct a hierarchical system out of a huge number of simple calculating units. Each basic unit can only perform quick arithmetic, but a system made up of components in complex configurations might provide a difficult problem. The neural network technique has also obtained good results in facial recognition. BP network, self-organizing connections, convolution systems, and other regularly utilised networks are examples. There's enough training examples to potentially recognise all faces if the networks is large enough. While neural networks offer certain benefits when it comes to recognize faces, they have also significant flaws.

4. RESULTS

Captions The overall real-time human detection and face recognition framework consist of video input then captured, face detection, face value detection, face recognition and attendance record. The system's framework is depicted in Figure 6. The system begins with a picture obtained from the entry video camera. Two cameras were employed, one for entry records and the other for exit records, one at the entrance door and the other at the departure door. Attendees' faces were photographed and sent into the system for face detection. The technology will detect the face once it has been spotted. First, take an image from a camera and detect a face, then use a har and deep learning algorithm to categorise the object of the face and gather face value features, then compare with the existing data base. The face recognition module compares the picture of the recorded face to the photographs in the face database. Finally, the database was updated with the attendance information of identified attendees as well as the time collected during detection. At the exit door, the same procedure is followed, with two separate timings being recorded for the final computation of engaged time for each attendance.

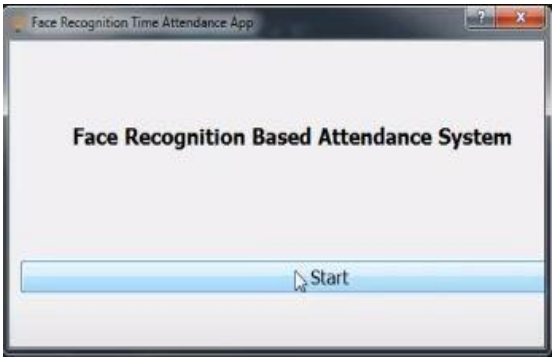

Fig6: Face Recognition initialize

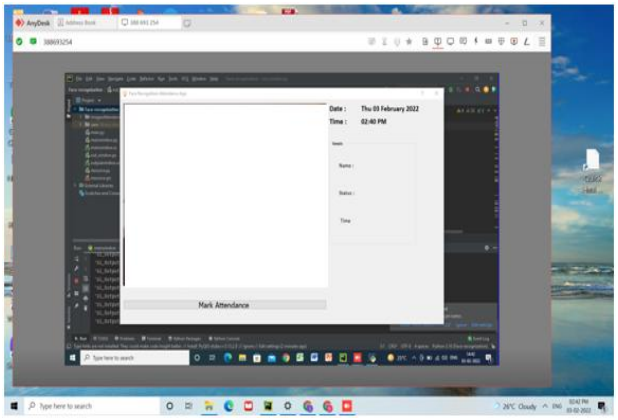

Fig. 7 : Initialize Recognition Window

When Rashmi clicked the photo for the first time, the photo of rashmi was not being mentioned in her camera, after that when she took the second photo, her photo appeared in it.

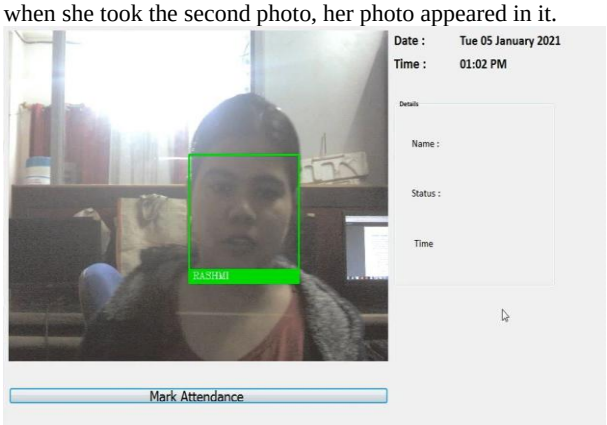

Fig. 8 Face Recognition

This photo of Rashmi is visible in the figure 8 picture and through that photo we can count the presence of Rashmi and no one can cheat in it because first the camera will recognize the face, only then the presence of Rashmi will be there. , if the face camera does not recognize the face, then at that time there will be absence of Rashmi.

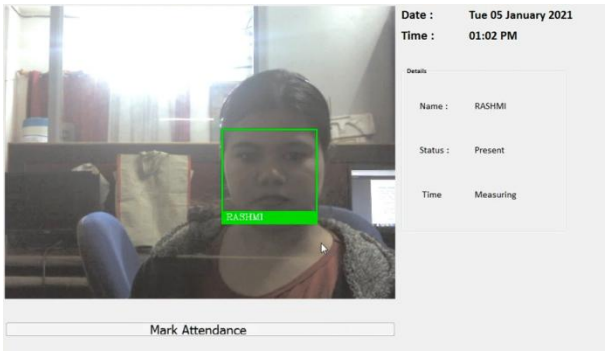

Fig. 9 Face Mark Attendance

The present work consists of photographs of four different photographs in a collection of faces for the evaluation process. Model transitions such as random crop, random transition, and face orientation are added to create different images of the same face to obtain more facial features. Some facial features can be obtained from a small dataset using the above image transformations. "In this part, the task is proposed in two classroom sessions and is referred to as "Testing Session 1" and "Testing Session-2". Test session -2 consists of a component of the test dataset, with different faces, visibility and lighting. The detected and detected face is shown in Figure (1).

This is exactly the situation where the participants for such lectures are accordingly identified and the CSV file is generated and sent to the faculty concerned. Attendees are labeled with the date and time of lecture for eti found in a column next to their name. In the last tab, average attendance is estimated, as photographs are revised in additional lecture sessions. The Rashmi names identified from the proposed model are then saved in a csv file and sent to the respective professors, as was done in test Session-1.

Accuracy : You should read about True positive and True negative, false positive and negatives. With this formula of your

Accuracy=(TP+TN)/(Total).

face recognition accuracy cab be measured according to the percentage of the recognized faces per the total number of tested faces of the same person.

Accuracy= (Recognized faces(TP)/ Total number of tested faces(TF))x100

	Total Faces(TF)	Proposed Method
True Positive (TP)	50	50
False Positive	50	0
False Negative	50	3
Detection Accuracy Rate		100%

Table No-5.1 Comparison of methods and accuracy

S.No	Author	Method	Accuracy
1.	Qiuyan Li	Face Recognition API	94 %
2.	Mohd Suhairi Md Suhaimin	Real-time mask detection	73.3 %
3.	Hao Yang	Video Image Recognition System	96%
4.	Shubhobrata Bhattacharya	An automatic attendance management system	85%
5.	Proposed	HAAR,*AdaBoost and* Deep Neural Network	100%

In the above given comparison table, author Qiuyan Li searched on Face Recognition API, whose accuracy is 94 percent. Mohd Suhairi Md Suhaimin did a search on real-time mask detection, which has an accuracy of 73.3 percent. Hao Yang did research on Video Image Recognition System, whose accuracy is 96 percent. Shubhobrata Bhattacharya did research on an automatic attendance management system, whose accuracy 85%. By propoposed method we get 99.41% accuracy.

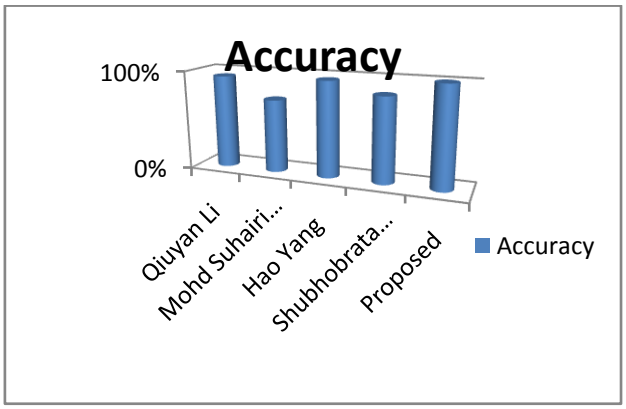

Fig. 10 Accuracy Graph

5. CONCLUSION

Dissertations presented come with some great features. As the system used Haar cascade model for feature extraction. This model works well for feature extraction as it uses integral pictures and a boosting technique that speeds up the detection method and aids in the selection of the best features. So that, when the machine is being trained no other extra things come into the frame. With LBPH the Haar Cascade classifier can recognize faces from any angle, even a student is not looking at the camera and if the head is tilted. The system can recognize faces when the student has glasses. It can also take attendance of multiple students at the same time. The system is quite complex. After using the proposed model, we get 100% percent accuracy, for an inexperienced person taking attendance will not be so easy. The main disadvantage is that, because it is a face recognition-based attendance system, the dataset must be updated frequently, and the system will go blind if there is no power supply. Attendance may be interrupted due to technical fault.

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