Face Recognition Attendance System

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Abstract—***In this work we have proposed a Live Automated Attendance Marking System for institutional purpose. It is quite difficult to maintain manual attendance properly for a large number of students and maintain records of every class with day to day activities is a challenging task as there might be some human errors like a proxy. Moreover, taking attendance consumes lot of time which can be utilized in making the concepts much clear. Some automated systems have been developed to get rid of issues such as accuracy and fake attendance. To solve these issues, highly automated face attendance system is required. In this system we are supposed to make an algorithm learn using different machine learning models, that will automatically recognize a student based on his different facial features, whenever, he appears in front of the web cam, and afterwards the record will be automatically updated based on the recognition and detection. Whenever the camera detects any face, our system will check the information related to it in the created database with the help of image-recognition technique. But there are multiple cases and different circumstances under which the user takes the picture thus, the image recognition algorithm should be an invariant in viewpoint and illuminations. Finally, the best match will be selected by computing the distance between the vectors of the captured image and the image present in the created database.***

***Index Terms*— Capturing phase, deep learning algorithms, extraction phase, face recognition, HOG representation, SVM classifier.**

I. INTRODUCTION

Automated face attendance system based upon recognition is a system that uses countenance like eye Iris, nose, lips, men's beard to spot and verify an individual and automatically mark attendance. Real-time data are created and saved by the server. Unlike other sorts of biometric systems, like fingerprint which captures identity through touch, a face recognition may be a touch less way to take the attendance. In times of COVID-19 pandemic, a touch less system is an efficient precaution.

Also during this pandemic situation, the only answer to see the regularity of a student or employee is a few online attendance systems. Human work has been reduced to an excellent extent through this. We can situate the classroom camera ahead of the entry point which is able to acknowledge the pupils and save their arrival and departure time. With this information we will create some straightforward conditions to figure out if the pupils arrived late or if they left the classroom earlier. We can save that information inside the database so that it can be accessible from anyplace. After this, from the offline data or online data, the system will compute and check the face using face detecting technique. This detection will identify the face and therefore the facial characteristics like eyes, nose, lips etc. Attendance systems of old practices aren't quite efficient now a days to stay track on student's presence and activities during lecture specially when student enrollment within the academic institutions are increasing rapidly per annum.

II. SURVEY OF EXISTING AUTHORS

There are several bio-metric systems that are available within the market, but the key authentications are similar altogether. All of them have an enrollment feature during which the unique characteristics is stored within the server and then, identification and verification of the person take place. These two operations compare the bio-metric features of a saved template captured at the interval of enrollment of a student. Also there are some issues with other systems like the limitation on number of students recognized at a time, Camera problem, accuracy rate etc which are solved in our system to great extent. Our tool uses the facerecognition for the attendance of the students within the classroom without student intervention. The aim of developing the new attendance management system is to computerize the traditional methods of taking the attendance.

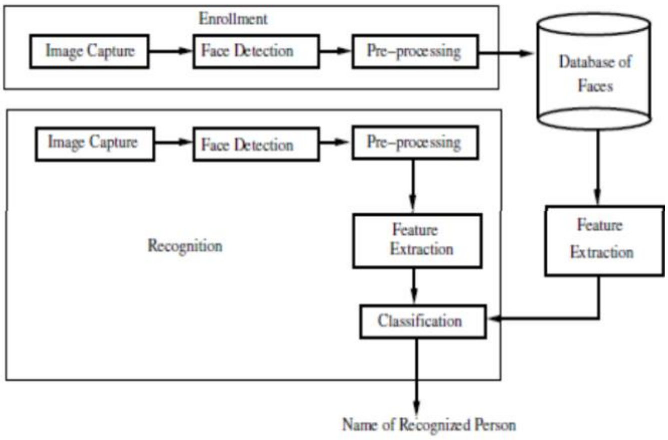


Fig. 1: Working of existing Model

III. PROPOSED FRAMEWORK

For our proposed face attendance model, we have to make a pipeline of steps to separately solve the phases and move the respective results of this phase to the subsequent phase. There are majorly two phases named as capturing phase and extraction phase. In the image capturing phase our system takes various snaps from different angles to avoid inaccuracy. This is the basic and most important phase since we need to look upon certain curtailments like lightning, distancing, illumination, density, facial-expressions, posing angle etc. Once it is done, we have to make sure that the format of these images in the database is either JPEG/JPG or PNG.As soon the camera finds the face it'll scan and compare it with the image already present in the file containing the images of students and if it matches, it'll obtain the corresponding date, name of student and the time it finds the student. If the camera detected time is the primary time the student is detected that day, the arrival timeis going to be assigned,, each subsequent detection on an equivalent day will automatically update the time of departing.

For each image captured through the web camera, from an every object that it could capture we detect only frontal face features not the rare side features, thus detecting only the face and removing other parts since our recognition will be entirely based upon the face. The captured snaps of faces are stored in the database so that when the system finds any face, it could match it with these images stored in the database and mark the attendance. This phase in which facial features are extracted is referred as the extraction-phase.

Face recognition is done once we complete the extraction of facial features. The features which are already trained is compared with the detected face's features and if both of them matches together, then the student is recognized. After the recognition of the facial features, the proposed system is going to update in the student attendance in the database and after this entire procedure the testing images remain in its prior location for the future reference.

Following are three step process for detecting facial features:

A. *Training data*

For the server, we need to take the image from the HD camera or web camera. The dataset created is just for the purpose of training the system. For our proposed system, we have a dataset of five scholars which will contain name, department, roll number, and images of scholars in multiple directions and variations for better results. A minimum of 15 different snaps should be taken. We can store the info within the sort of separate folders distinguishing everyone from others.

B. *Capturing Phase*

Image capturing can be done in two ways, either by video streaming or manually through web cam. Capturing frame through live video streaming might give us results in minimal time, but, in case of some glitch such as inadequate mode of light, or something else sort of the same might result in failure of proper face detection.

C. *Face detection*

For face detection we make use of python face detection algorithm depending on the facial feature we need to detect. The faces from the snap captured will be stored..Just after the webcam or HD camera spots any face it'll immediately inspect if the student is within our proposed model or not, and if it is, then it'll fetch the details like date, name and the time the camera spotted him.. If this time is often the primary time this student is detected, the time of arriving is going to be designated, after this point is decided, all successive detection on an equivalent day will update the leaving time. The captured snap of faces is compressed into smaller images of resolution less than that of the colored picture. Face identification is one of the greatest attribute of the camera. The cameras can consequently detect all the faces in the frame, it can confirm that each one of the faces are focused before it captures the image. But here our purpose is to find the areas of the image in order to move on to the following step.

For finding the faces in a picture , we'll initiate by making out the given image monochrome, then our proposed model will check out every individual pixel in the image individually. So for this we will focus on the pixels that directlysurround that pixel and determine the difference in shades of the present pixel to the neighboring pixels. Then we would like to sketch the arrows called the gradients which will point out in which path the image gets darker and indicate the direction of flow from light to dark across the whole image. If we examine these pixels directly, highly dark and highly light images of an equivalent student will have completely contrasting pixel values. But by considering only the path in which the brightness gets changed, both will find an equivalent identical representation. This makes the matter much simpler to unravel. The initial image is converted into HOG representation which takes the main features of the picture without considering the brightness of an image. The final result, is, we have turned the first image into a really simpler representation which captures the essential structure of the face in a much simpler way.

D. *Face-Recognition*

This task can be subdivided into 3 steps, namely preparing the training–data set, training the face recognizing part and last but not the least the prediction part. The training data will be in the form of images captured through the web camera and stored in the database. For face recognition process we will use the python named as face recognition library.

We will provide an image of a student to record his facial identity.

- Our first model can determine if there is any face, and if yes then confirm its position on the exposure.

- Our next model can evaluate the facial parameters. We store this questionable encoded knowledge by associating them to the name so as that they're going to be differentiated with future images.

  Then, we offer a replacement unknown exposure thus identical method area unit reaching to be recurrent except that now.
- Our third model can contrast the criterion of the face with those it already is informed about..

Now we'll alter the "Add a face" method, by making a folder throughout that we tend to store the portrait footage of our staff and student. At the top , the value of "name" area unit reaching to be "unknown" or have the name of the student that match. Now it's going to automatically write all the pictures among the folder by associating them to the file name and then we'll apply it to all the frames of the video feed, then if there is a match, then send the knowledge to the API.

IV. API

In this section, we use Flask for API. Here the purpose is to urge the information from our face-recognition model and redistributing it to the front-end when requested. We need to add on a new student with his name and picture and make our system be able to delete/remove some only by recovering their names.

The steps for the task are as follows:

1. **Creating a path that will fetch the data of student from the database along with his name.**

   The user will acquire a name as a string value from a GET request of the front-end, then it makes a query to the DB and finally return the data that we get in JSON.

2. **Creating a path to get the data of the 5 last students discovered by the camera.**

   The user will receive a GET request from the front-end, it queries the database to fetch the last five entries and remit the solution to the front-end as a JSON.

3. **Creating a path to add a student in the proposed system.**

   The user will acquire a GET request with an image and a name from the front-end, then we'll add it to the student's folder and send back a success message to the front-end.

4. **Creating a path to get list of all the students name in the system**

The user will acquire a GET request from the front, enter the user's folder to urge the name of all the pupils and remit this list to the front as JSON.

5. **Creating a route that will delete a user with his name**

   We acquire a GET request from the front –end with the name of the student as a string to delete it. Then the API access the student's folder and delete the image with the corresponding name.

V. FINDING THE STUDENT'S DETAILS FROM ENCODING

This is really the simplest step within the entire process. All we need to undertake to perform is locate the student in the DB of known folks having the measurements very close in proximity with our test image with the help of any fundamental ML classification algorithm. We'll use an easy linear Support Vector machine (SVM) classifier, but many other classification algorithms could also work.

All we'd like to try to do is instruct the classifier which will absorb the measurements from a replacement test picture and tell which known student is the match that is closest. The implementation of this SVM classifier just takes milliseconds. The result is that the name of the student over the image even with several poses in sideways faces.

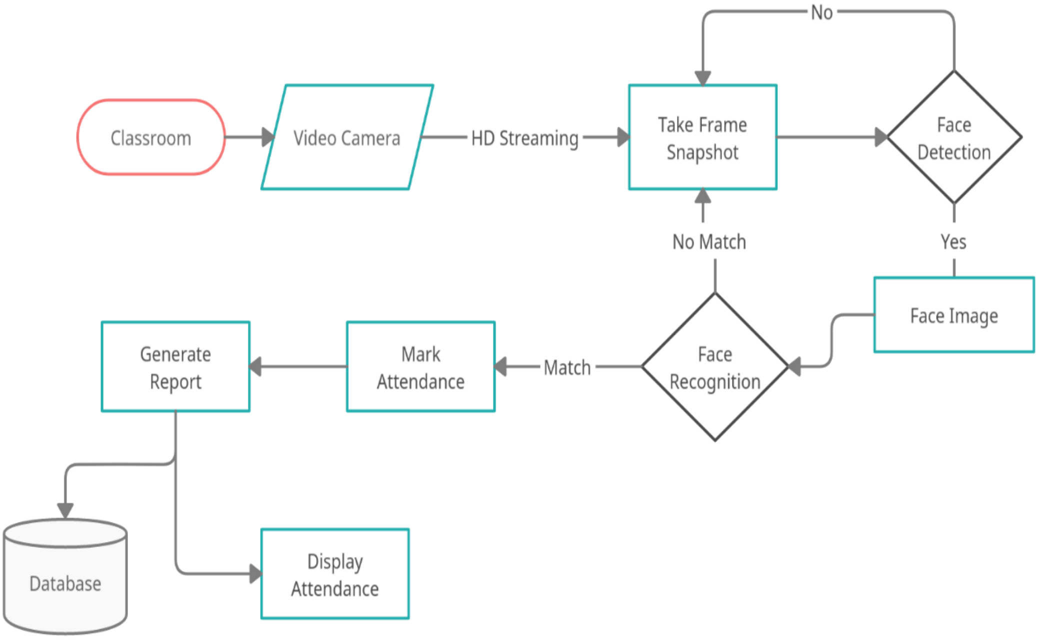
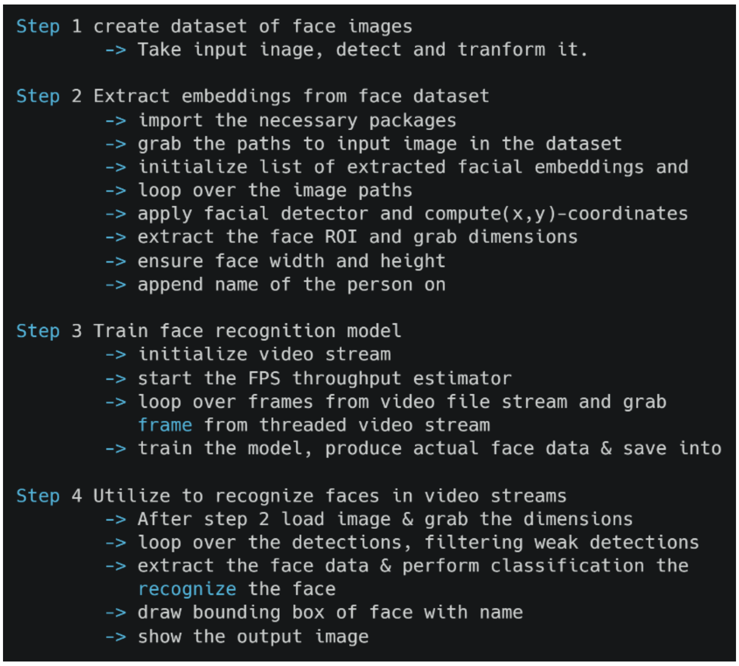


Fig 2: Workflow of the system

A. PROPOSED METHOD

- In our proposed model we require few basic things like the HD camera which is usually placed in the classroom, so we will select the HD camera for video streaming which will identify the faces, this video streaming can also be seen in our project.
- After the selection process next step is to grab the single frame of the video in which all the pupils can be seen.
- Now, our model will process one frame at a time to make it more efficient and clear.
- With the help of facial recognition library our model will inspect if there is any face in the processed frame, if after processing our model does not find any frame then it returns to the step 2 and again checks the video streaming.
- In this step our system will differentiate between the faces in the video and the encoded faces in the database. If the match is found then we will proceed to further steps else we return to step 2 and continue from it.
- Now the data is exported in JSON format to the API and the name of matched student is displayed onto the frame.
- The attendance is marked and displayed in the GUI and others details like arrival, departure time is also mentioned.
- Release the handle to the HD camera again as long as the lecture continues.



```
Step 1 create dataset of face images
        -> Take input inage, detect and tranform it.

Step 2 Extract embeddings from face dataset
        -> import the necessary packages
        -> grab the paths to input image in the dataset
        -> initialize list of extracted facial embeddings and
        -> loop over the image paths
        -> apply facial detector and compute(x,y)-coordinates
        -> extract the face ROI and grab dimensions
        -> ensure face width and height
        -> append name of the person on

Step 3 Train face recognition model
        -> initialize video stream
        -> start the FPS throughput estimator
        -> loop over frames from video file stream and grab
           frame from threaded video stream
        -> train the model, produce actual face data & save into

Step 4 Utilize to recognize faces in video streams
        -> After step 2 load image & grab the dimensions
        -> loop over the detections, filtering weak detections
        -> extract the face data & perform classification the
           recognize the face
        -> draw bounding box of face with name
        -> show the output image
```

Fig 3: Pseudo code

The methodology of our system is very simple, we will start from our input image also known as test image , this input image is sent to the face detection model which will process the image with the image in the video, if the face is recognized then the image of student along with other details like time, name is sent to the API which will display the data else it returns to the face detection processing and continues till we get the closest possible match. The processed data is also stored in the database for future reference. The implementation is shown in the figure below.

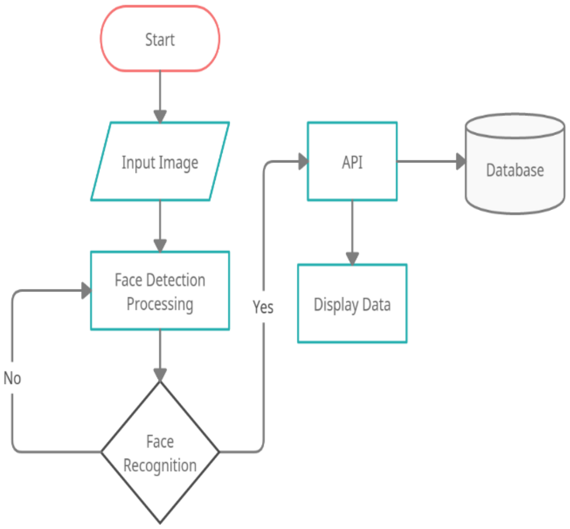


Fig 4: Block Implementation of Face Attendance System

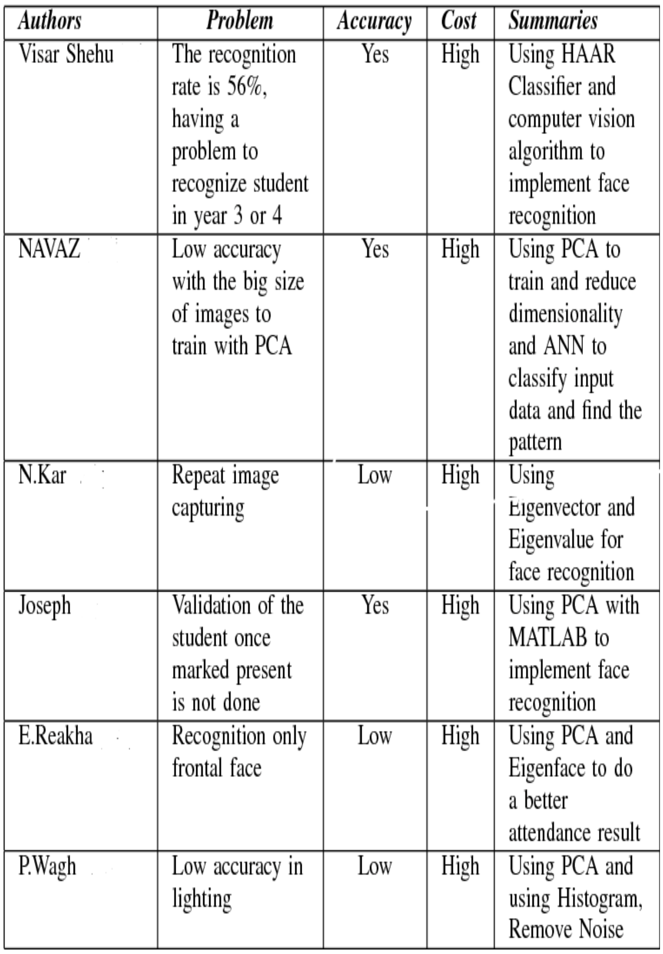
VI. RESULT AND DECLARATION

With the help of this system, the users will be provided with mainly four part namely front-end, back-end, database and face recognition. For creating the front end we've used React which is most suitable for processing the information in real time and makes it very easy to create interactive user interfaces. For back-end, we've used Python Flask for creating an API that requests the data and return the answer. For the database, we use PostgreSQL and for face recognition we have used python library called Face recognition library. In the GUI section there are four parts, Video Feed of the classroom which contains the video streaming of the entire classroom as soon as we enable our system and the cameras placed in the classroom, the other part is called Search for student which displays details such as date, name, arrival time, departure time, Is late and left early. In this section search button is also placed for finding these details about a particular student. The third section is for last arrivals which display the details of 5 last arrived students that can be refreshed with the help of refresh button placed on the top of this section. The last section of the GUI comprises the most important part of our attendance marking system i.e. the Admin section through which the admin can add or delete the student as there may be some optional subjects for which only few students have opted for.

A. *COMPARATIVE ANALYSIS*

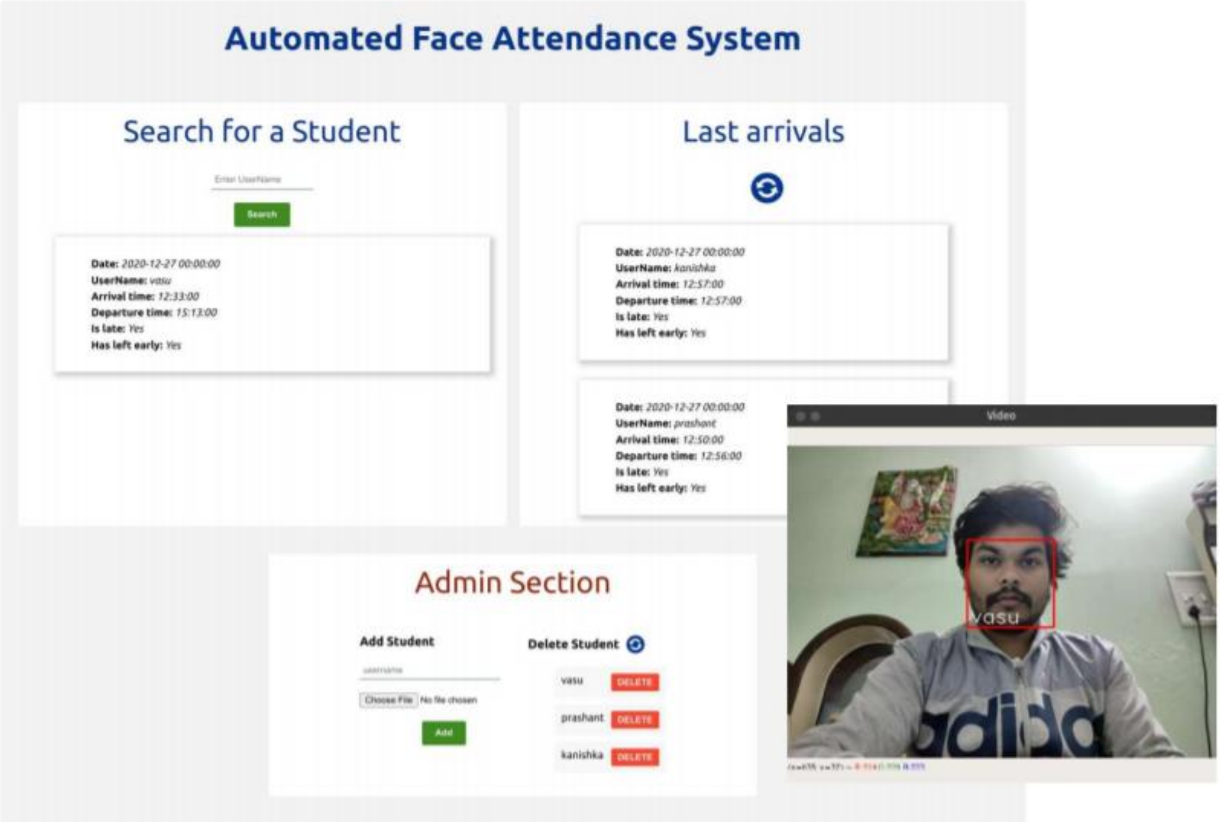
Our proposed system will calculate the attendance subject-wise with the assistance of the data-set of scholars created before the popularity process, whenever time for corresponding subject arrives the system automatically starts taking photos employing a HD camera placed within the classroom and find whether person faces showing within the given frame or not is matched with the training data-set. With the introduction of this attendance system, skipping classes for college kids without the staff's knowledge would become difficult. Also it provides us the details such as date, name, arrival time, departure time, is late and left early.

Over the previous couple of years, with the advancing technology and with the enlargement deep learning algorithms, face recognizing technique has done immensely well which open on to us to a replacement way of solving the difficulty of the student's attendance marking with the thought to mark the presence of scholars during a class.



Authors	*Problem*	*Accuracy*	*Cost*	*Summaries*
Visar Shehu	The recognition rate is 56%, having a problem to recognize student in year 3 or 4	Yes	High	Using HAAR Classifier and computer vision algorithm to implement face recognition
NAVAZ	Low accuracy with the big size of images to train with PCA	Yes	High	Using PCA to train and reduce dimensionality and ANN to classify input data and find the pattern
N.Kar	Repeat image capturing	Low	High	Using Eigenvector and Eigenvalue for face recognition
Joseph	Validation of the student once marked present is not done	Yes	High	Using PCA with MATLAB to implement face recognition
E.Reakha	Recognition only frontal face	Low	High	Using PCA and Eigenface to do a better attendance result
P.Wagh	Low accuracy in lighting	Low	High	Using PCA and using Histogram, Remove Noise

Fig 5: Comparative analysis of study



Date: 2020-12-27 00:00:00
UserName: vasu
Arrival time: 12:33:00
Departure time: 15:13:00
Is late: Yes
Has left early: Yes

Date: 2020-12-27 00:00:00
UserName: kanishka
Arrival time: 12:57:00
Departure time: 12:57:00
Is late: Yes
Has left early: Yes

Date: 2020-12-27 00:00:00
UserName: prashant
Arrival time: 12:50:00
Departure time: 12:56:00
Is late: Yes
Has left early: Yes

Fig 4: Working of face attendance system

VII. Conclusion

Through the analysis of results, the aim of this research is achieved in identifying the best suited algorithm for automated face attendance system with respect to the selected dataset having the highest accuracy of 98% among the selected algorithms. Lightning conditions and other necessary environmental factors might vary, depending on the locations. Usually, system have been tested on the locations, owes proper lightning , and maximum accuracy has been noticed. Not only environmental factors , but the students on whom it is to be tested owes different facial features, for instance varying hair styles , beards , wearing specs or not and much more. Thus , a main conclusion on which we reached is that, we can develop a fast , secure and most efficient system , by replacing manual systems with less accuracy and reducing human efforts to a great extent .Proper attendance can be managed with proper details of leaves and exact entry-exit time and whether the student is late or has arrived early in the class with a feature of adding and deleting the student details as there might be some optional subjects ,so the admin has the power to add and delete the names of student for a particular subject. Major pros included is time saving to a huge extent, would help to get rid of stationary material and other human resources required for the same purpose .Also with the help of this system there are very less chances of fake attendance and the teacher can devote more time for solving the queries and making concepts clear.

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