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Pre- Synopsis

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Attendance Management System Using Face Recognition

1. Abstract

For a long time, face recognition has been a popular study area. Face recognition is a challenging problem to tackle, which draws academics to it. Face recognition technology is used in a practical way in an automated attendance system. We know that we can identify someone just by looking at their face, thus we are working on developing an automatic attendance system based on facial recognition. We used a high-definition camera in this paper, and the video captured by the camera is used by our model to detect and recognise human faces. We can recognise students in the class using this method, and their attendance is recorded in a csv file. In this research, we present a user interface that will assist professors in marking students' attendance from their computer screen.

In a classroom setting, keeping track of attendance during lectures is not only challenging but also time-consuming. There will always be a chance of proxy

attendance because the lecture had an exceptionally high number of students in attendance(s). Conventional techniques of attendance marking have been difficult to implement. A rising difficulty in the field of face recognition is the increasing demand for effective and automatic methods of recording attendance.

Today, practically everyone in the globe has access to the Internet. Since every digital device is linked to the Internet, people's work is made simpler. Today, the Internet of Things (IoT), computers, image processing, and machine learning are used to create a large number of gadgets. The system was created to evaluate student attendance and identify individual students when recording attendance. The system is implemented to create a face recognition-based classroom attendance system because the current manual attendance systems are becoming too time-consuming and difficult to maintain.

The traditional technique of taking attendance by pen-paper or registers used by organisations and institutions is no longer very efficient. Absentees' proxies are frequently used by their groups or acquaintances, rendering this key component of class surveillance useless. The pen-and-paper attendance system takes up a lot of time in class, whereas clever techniques provide the lecturer more time. It is easily manipulate able. As a result, many organisations and institutions have replaced it with biometric sensors that track attendance using students' or staff's fingerprints. However, due to covid-19, where touching anything is dangerous makes everything risky.
As we know, during the current covid-19 epidemic, governments of many nations have rigorous criteria for social distance that must be observed everywhere while keeping the issue of safety precautions in mind. Face recognition has been used to create an attendance tracking system for this purpose. Face detection, face pre-processing, database building, face training, face recognition, and attendance management are all steps of this face recognition system. This project focuses on the importance of face alignment, as well as how precise the image is and the False Acceptance Rate that can be observed. Face Recognition Grand Challenge (FRGC) processing is performed with up to 95% precision by the system.

Few students mark the fake attendance of their classmates by using their digital devices, specifically phones, and attempting to show the system the picture of their friend, but the system will display a warning message with a beep sound. The goal of developing a face-recognition system is to save time and make the system smart and efficient.

2. Introduction-

Facial recognition algorithms can identify people in images and real-time recordings. It is a biometric security layer. Voice, fingerprint, and eye recognition are examples of biometric security. We may use it in real time to unlock phones, discover missing people, aid forensic investigations, assist the blind, and so on. The primary goal of this

project is to create a facial recognition-based attendance system. Attendance systems with fingerprint scanners, RFID tags and readers, facial recognition, and location-based attendance systems are some of the systems that can be used for face recognition. The attendance system with a fingerprint scanner reduces proxy attendance.

The method using an RFID reader is faster, but there is a considerable risk of proxy attendance. Attendance systems that use facial recognition give authorised data, and the odds of proxy data entering are substantially lower than in other systems. At the time of enrolment, video is captured and images of students are stored using facial detection, recognition, and recording in a separate folder for each student in the proposed system. In real time, the student will enter the computer and show his or her face, which will be captured, the face will be detected and matched with the dataset images, the name and roll number of the current student will be displayed, and the attendance will be updated.

3. Keywords-

Opencv, Attendance Management System, Face Recognition, Flask, K-Nearest Neighbours, Joblib.

4. Proposed System-

The purpose of the proposed system is to record each student's face and preserve it in a csv file for future reference. This document uses the K-Nearest Neighbors algorithm. A K-Nearest Neighbour (KNN) algorithm is a type of supervised machine learning algorithm that is used for discrete objects to analyse visual imagery by classification. The student's face must be recorded in a method that detects all of the student's facial features, including location and posture. The instructor is not required to personally take attendance in the classroom since technology captures a video, which is subsequently analysed to recognise the face and update the attendance database. The main advantage of the paper is that the video data gathered is used to detect and recognise the student, and the data is converted into an image. Attendance also includes a recognisable photograph of the student; otherwise, it is listed as absent.
1. Image capture: Images of the students are recorded and sent to be detected using face detection.
2. Face Detection: The face identification procedure is substantially enhanced when a face detection technology is used.
3. Get the system up and running.
The photograph taken upon enrolment is utilised to teach the system, and the system is trained using these images.

5. Literature survey-

Facial Recognition Class Attendance Management System The traditional method of taking attendance results in proxy through friends, limiting efficacy. So we start with biometrics, which lacks dependability, and then we go with facial recognition technology, which is efficient and time saving. It operates in four stages: image capture, face detection, face comparison, and database attendance updating.

System for Managing Attendance In the ever-expanding virtual world, this research paper addresses whole-class attendance through face recognition, which captures the image of a human entity and compares it to an existing database, with an accuracy of 99%.

Face Recognition Algorithm Implementation for Biometrics Attendance System Based on Time Face recognition begins by extracting facial traits such as the width of the lips and the diameter of the pupil in the eyes and comparing them to an existing database. Many articles on facial feature extraction and face recognition implementations have been published. The main focus is on best face recognition up to 95% similarity.
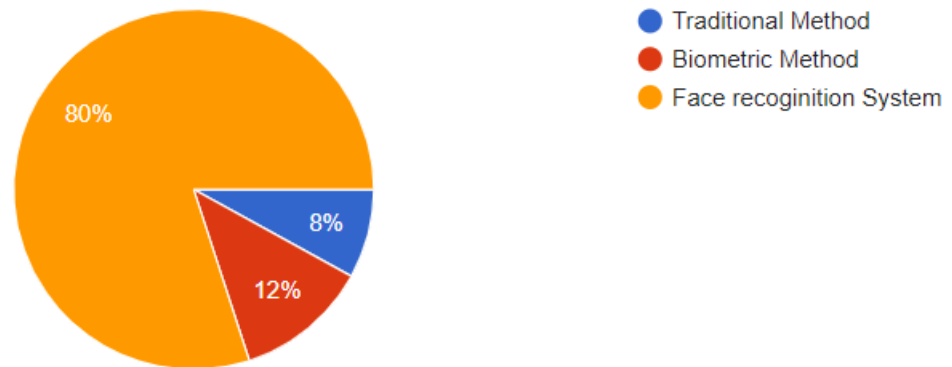
Face Recognition Attendance Monitoring System to make the various tasks of institutions and organisations more successful, a face recognition function that removes facial traits and converts them to number format is used. An automated postal system distributes mail to all students and employees.

Face detection is used in an automatic attendance management system. The time-consuming and difficult-to-maintain manual approach will be replaced by an automatic attendance management system. We will look at attendance without the use of people in this investigation. Installing a camera in the classroom gathers photos, recognises faces, compares them to a database, and then records attendance. If a student's attendance is listed as absent, a note is issued to their parents informing them of their child's absence. There are several techniques for comparing faces. The procedure's Eigen face is the one. Eigen faces are a collection of Eigen vectors used in computer vision to solve the problem of face recognition.

Face Recognition Techniques for Real-Time Smart Attendance In today's academic system, automation is critical for analysing performance quality. Traditional practises in most organisations, such as calling names or signing papers, are both time-consuming and insecure. As technology advances, computer vision might be used to automate the human attendance method. In order to automate attendance without utilising paper and pen, it is important to use computer vision to recognise student face features. Teachers, students, and parents may check attendance at any time and from any location. Deep learning image processing is used to predict attendance more accurately, saving time and money. To deal with a Covid-19 scenario, the device includes a temperature check and hand sanitization mechanism.
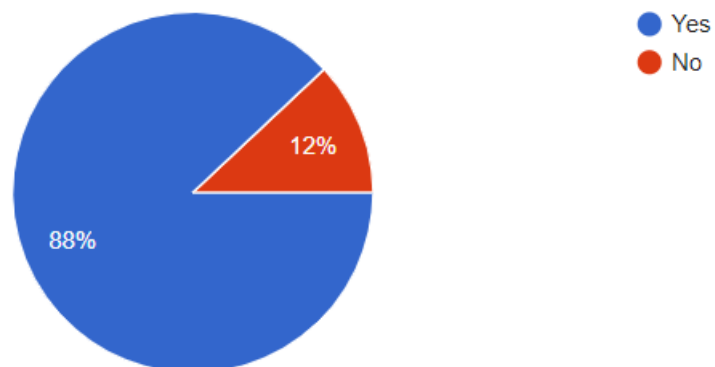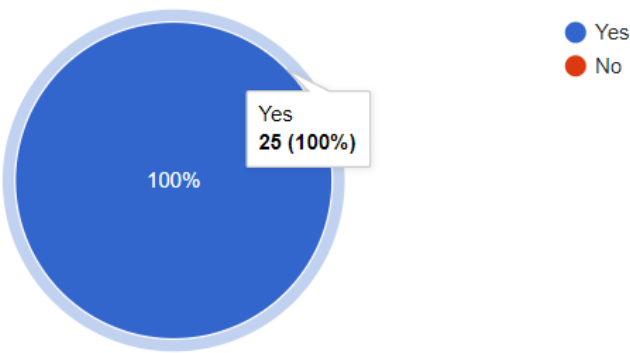
Which Attendance Method do you perfer?

25 responses

- ● Traditional Method
- ● Biometric Method
- ● Face recoginition System

80%

8%

12%

Do you think that face recogintion attendance system will save your time?

25 responses

- ● Yes
- ● No

12%

88%

Will this project be useful in your college?

25 responses

Yes: 25 (100%)
- Yes
- No

100%

Will this method be able to reduce proxy?

25 responses

- Yes
- NO

96%
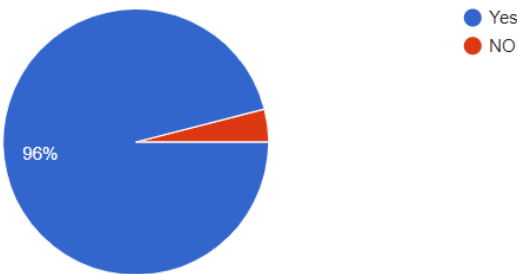
Suggestion

10 responses

It's a best way to reduce proxy

This is a good idea

I believe Face recognition is the best method for attendance in this modern growing world

I would surely prefer face recognition

Face recognition system will be time saving option

It can also be used in office and other companies also

Face recognition system or traditional method should be prefer

Great work go ahead.

Great Idea , should implement further

6. Problem Definition & Objectives-

The traditional attendance tracking method includes punch locks or some other sort of manual system. However, this method requires consistent human supervision.
1. The teachers need to hire student attendance sheet Excel to collect and file student attendance is lost.
2. Loss of instructional time production to search students on the attendance sheet.
3. Statistical information is not easily to be derived.
4. Attendance records are not communicated efficiently.

But fortunately, the evolving technology has led to the introduction of the automated attendance system that provides much better results. An automated attendance system using face recognition is easy to install and use. You don't have to learn anything complicated or extra to use it. With just a few clicks, you will get all the details related to attendance. Thus, we are now building an attendance management system using face recognition.

Objectives-

1. Spots the presence of attending students and providing the timing of the attendance marked.
2. Capable of storing maximum records and no need of manual attendance
3. Only students are responsible for making attendance of their own.
4. Download the excel sheet of the recorded attendance.

7. Methodology-

Step 1: Find a Face

First and foremost, we will construct facial patterns using the HOG algorithmic software.

The histogram of oriented gradients (HOG) is a feature descriptor that is used in computer vision and image processing to recognise objects. The approach counts the number of times a gradient orientation appears in a limited region of a picture.

We'll seek for the parts of the simplified images that seem the most like an original known HOG face pattern.

Finally, a bounding box around the identified face is drawn.

Step 2: Get 50 points and a new face.

The targeted face images are processed to provide 128 measures, which is a 128 dimensional unit hyper-sphere.

Step 3: Compile a list of 128 measurements.

The targeted face images are processed by a deep convolution neural network to provide 128 measurements, which correspond to a 128 dimensional unit hyper-sphere.

Fourth step: Implement Machine Learning algorithmic software.

Apply your favourite algorithmic programme for clustering, similarity detection, and classification in this final step. Because we're using face recognition, we'll take the classification route.

Because we train our classifier with K-Nearest Neighbour.

The technology not only recognises students' faces but also regulates access to the entrance by determining whether or not they are permitted entry. Additionally, the system was designed as an online Web Server, so any authenticated web client can access the attendance results. The professor can examine the attendance statistics from any computer browser linked to the Internet. The attendance is stored in a csv i.e. an excel sheet. The professor can easily download the excel sheet and keep a record of the attendance. It shows the exact date and time too.

The algorithm clicks 50 photos of every student in different facial expressions or in a still manner in order to train itself. We three of us were considered as sample test subjects in this system. The algorithm may require more than 30 photos if it has trouble identifying a particular pupil. Whenever the student who is registered to the system, shows up in the camera, the project identifies him/her and shows its name along with his or her serial number.

The facial recognition system developed is quite flexible. You can choose what you need for your organization.

Technologies used-

- Open cv-
  OpenCV is a video and image processing library and it is used for image and video analysis, like facial detection, license plate reading, photo editing, advanced robotic vision, and many more.
  Open CV is free of cost and an open-source library.
  Open CV is fast as it is written in C/C++ and Python language as compared to others.
  With less system RAM, OpenCV works better.
  It supports most of the operating systems like Windows, Linux, and macOS.
  OpenCV is a large open-source library for computer vision, machine learning, and image processing, and it currently plays a significant part in real-time operation, which is critical in today's systems. It can analyse photos and movies to recognise items, people, and even human handwriting. Python can process the OpenCV array structure for analysis when combined with other libraries

such as NumPy. We employ vector space and execute mathematical operations on these characteristics to identify visual patterns and their different features.

Uses of Open CV-

Image/video I/O, processing, and visualisation (core, imgproc, highgui)

Detection of objects/features (objdetect, features2d, nonfree)

Computer vision based on geometry (monocular or stereo) (calib3d, stitching, videostab)

Photographic computation (photo, video, superres)

Clustering and machine learning

Acceleration with CUDA.

An image can be defined as a two-dimensional function f(x, y), where x and y are spatial (plane) coordinates, and the amplitude of fat any pair of coordinates (x, y) is known as the image's intensity or grey level at that point.

In other words, an image is nothing more than a two-dimensional matrix (3-D in the case of coloured images) defined by the mathematical function f(x, y) at any point of an image, the pixel value describing how bright that pixel is and what colour it should be.

Image processing is essentially signal processing in which the input is an image and the output is an image or characteristics based on the image's requirements.

The three fundamental processes in image processing are as follows:

Adding the picture

Image analysis and manipulation

Output, which can be an altered image or a report based on image analysis.

- Flask-
  Flask is a web framework. This means flask provides you with tools, libraries and technologies that allow you to build a web application. In our case we have used, HTML, CSS Bootstrap and flask for creating our web page.

  Flask is defined as a micro-framework developed with WSGI and the Jinja 2 template engine.

  The following are the primary benefits of Flask:

  Setup and use are simple and its ability to design the structure of the web application.

- Pandas-
  Pandas is a Python library for manipulating data collections.

  It includes tools for data analysis, cleansing, exploration, and manipulation. Wes McKinney invented the moniker "Pandas" in 2008 as a reference to both "Panel Data" and "Python Data Analysis."

  Pandas enables us to examine large amounts of data and draw conclusions based on statistical theory.

  Pandas can clean up messed-up data sets and make them more understandable and meaningful.

  Relevant data is critical in data science.

Pandas provides data-related responses. For example, is there a relationship between two or more columns?

What is the average price?

Maximum amount?

Minimum value?

Pandas can also delete rows that are no longer relevant or contain incorrect values, such as empty or NULL values.

The head() method is a popular way to get a quick overview of the DataFrame. The head() method returns the headers and a specified number of rows, beginning at the top.

- Numpy-

  NumPy is a Python library for manipulating arrays.

  It also has functions for working with linear algebra, the Fourier transform, and matrices.

  Travis Oliphant designed NumPy in 2005. It is an open source project that you are free to use.

  NumPy is an abbreviation for Numerical Python.

  Why Should You Use NumPy?

  Lists in Python serve the same purpose as arrays, although they are slower to process.

  NumPy strives to produce array objects that are up to 50 times quicker than typical Python lists.

  The array object in NumPy is named ndarray, and it comes with a slew of helper methods that make dealing with ndarray a breeze.

  Arrays are often utilised in data science, where speed and resources are critical.

  NumPy is used to manipulate arrays. In NumPy, the array object is known as ndarray.

  Using the array() method, we can generate a NumPy ndarray object.

  NumPy is a Python library for manipulating arrays.

  It also has functions for working with linear algebra, the Fourier transform, and matrices.

  NumPy is an abbreviation for Numerical Python.

- Haar Cascade-

  Haar Cascade is a classifier that we have used in our project for face recognition. Haar extracts the different faces from the subject of frame. It also sets a boundary or box around each subjects' face.

- KNN Algorithm-

  KNN stands for K-nearest neighbours. Along with Haar Cascade we use KNN algorithm for the working or our facial recognition project. The k-nearest neighbours (KNN) algorithm is a straightforward supervised machine learning

algorithm that can solve classification and regression problems. It is simple to execute and comprehend.

KNN works by calculating the distances between a query and all of the instances in the data, then picking the number of examples (K) closest to the query and voting for the most frequent label (in the case of classification) or averaging the labels (in the case of regression).
K-Kindest Neighbour

The KNN algorithmic software is one of the few that can do regression and classification in supervised learning.

KNN is non-parametric, which means it does not make any assumptions and instead relies on the model structure given by the data.

KNN is known as memory-based or lazy learning because it learns by simply storing the representations of the training samples.

The majority votes of an object's neighbours are used to classify it. The category with the most similar k nearest neighbours will be assigned to the new example object.

Libraries used-

OpenCV2
Pandas
Numpy
Scikit-learn, joblib.

Haar Characteristics-

Haar features, which are similar to convolutional kernels, are used to detect characteristics in a picture. Haar features include line features, edge features, four-rectangle features, and so forth. Each feature is represented by a single value, which is calculated by subtracting the sum of pixels beneath the white rectangle from the sum of pixels beneath the black rectangle, as shown in The Haar cascade algorithm uses 24*24 windows to calculate 160000+ features in a window. An Integral image algorithm is introduced to simplify the work of calculating feature values. Because of its excellent detection accuracy and real-time performance, the Haar classifier-based technique is used for face detection. Haar-like features encode the difference in average intensity across the picture and are made up of black and white linked rectangles, with the value of the feature being the difference in the sum of pixel values in black and white areas. Haar-like features can be discovered at various scales and positions that are robust for detection. The use of an Integral image increases the computational speed of feature calculation. The number of Haar features accessible from a small image is enormous.

Cascade-

The detector scans a single picture multiple times, each time with a different size. When many faces exist in a picture, the algorithm focuses on removing non-faces and highlighting the most viable face area. Because the calculation cost for each window is quite large when a specific strong classifier is a linear combination of all the best features and is not suitable for evaluation. As a result, a cascade classifier is employed.

Cascade classifiers have several steps. All of the features are organised into stages, with each stage containing a strong classifier and a feature.

8. Architecture-
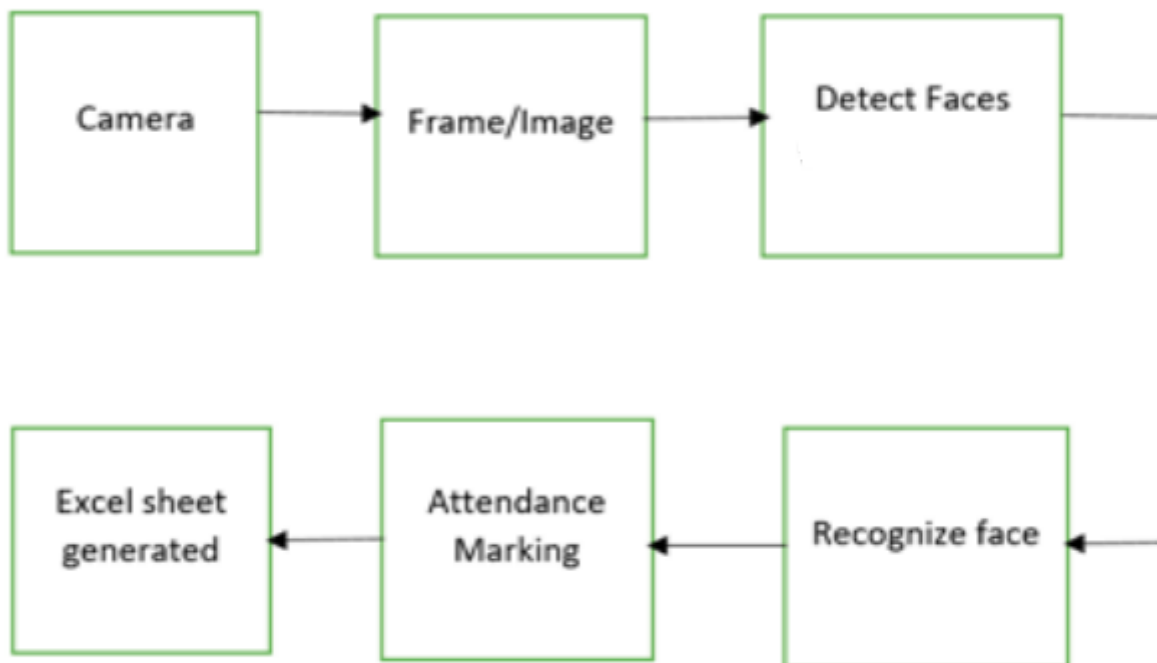
9. Algorithm-

All Faces are extracted from the picture frame (using haar cascades)
Stores the Face data as numpy arrays.
Read and display video streams, as well as take photos
Face detection and display of bounding box (haar cascade)
Flatten the largest grayscale face image and save it in a numpy array.
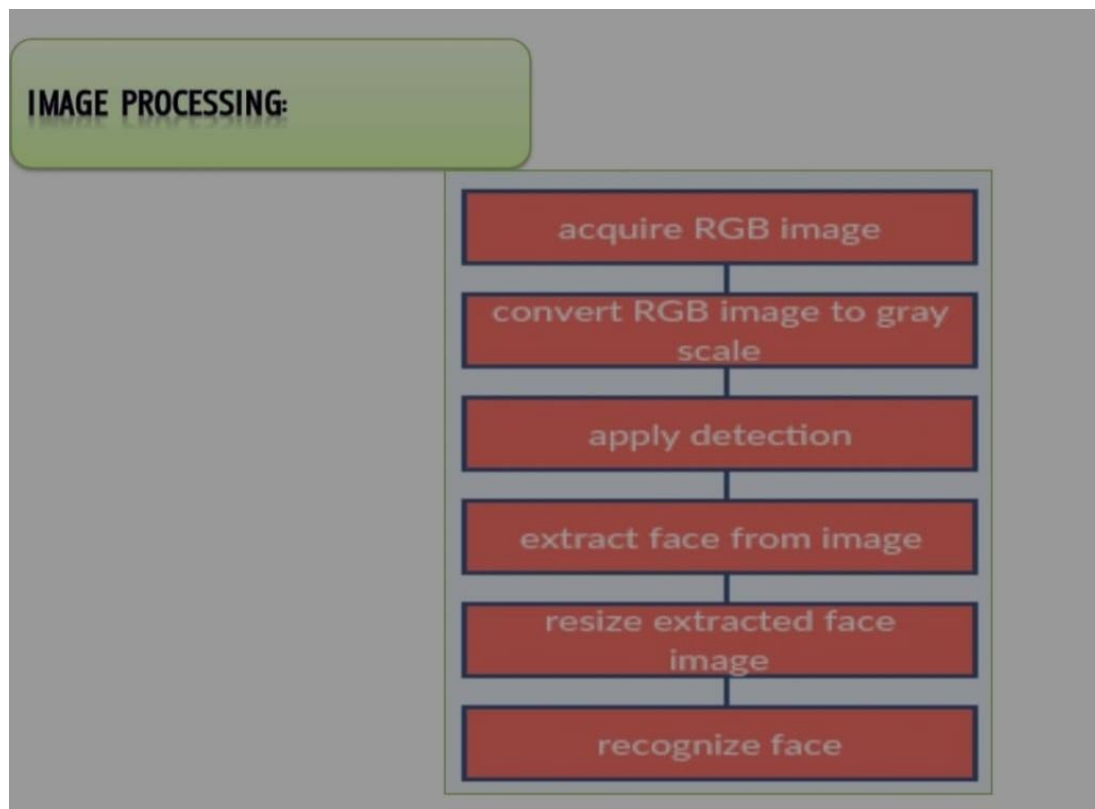Repeat the preceding steps for multiple people to generate training data.

1. We are importing the required libraries.
2. Defining the Flask App.

3. Functions that return today's date strings to use in the program ahead.
4. Initializing VideoCapture object to access WebCam.
5. Checking if the required folders are in place or not, If not create them.
6. A function that calculates the number of total registered users.
7. A function that extracts the face from an image.
10. A function that Identifies face using ML model.
11. A function that trains the model on all the faces available in the faces folder.
12. A function that extracts info from today's attendance file in the attendance folder.
13. A function that adds the Attendance of a specific user in our today's Attendance file.

The UI or main page of our project-

1. Our main page routing function.
2. This function will run when we click on Take Attendance Button.
3. This function will run when we add a new user.

4. Our main function which runs the Flask App.

IMAGE PROCESSING:

acquire RGB image
convert RGB image to gray scale
apply detection
extract face from image
resize extracted face image
recognize face
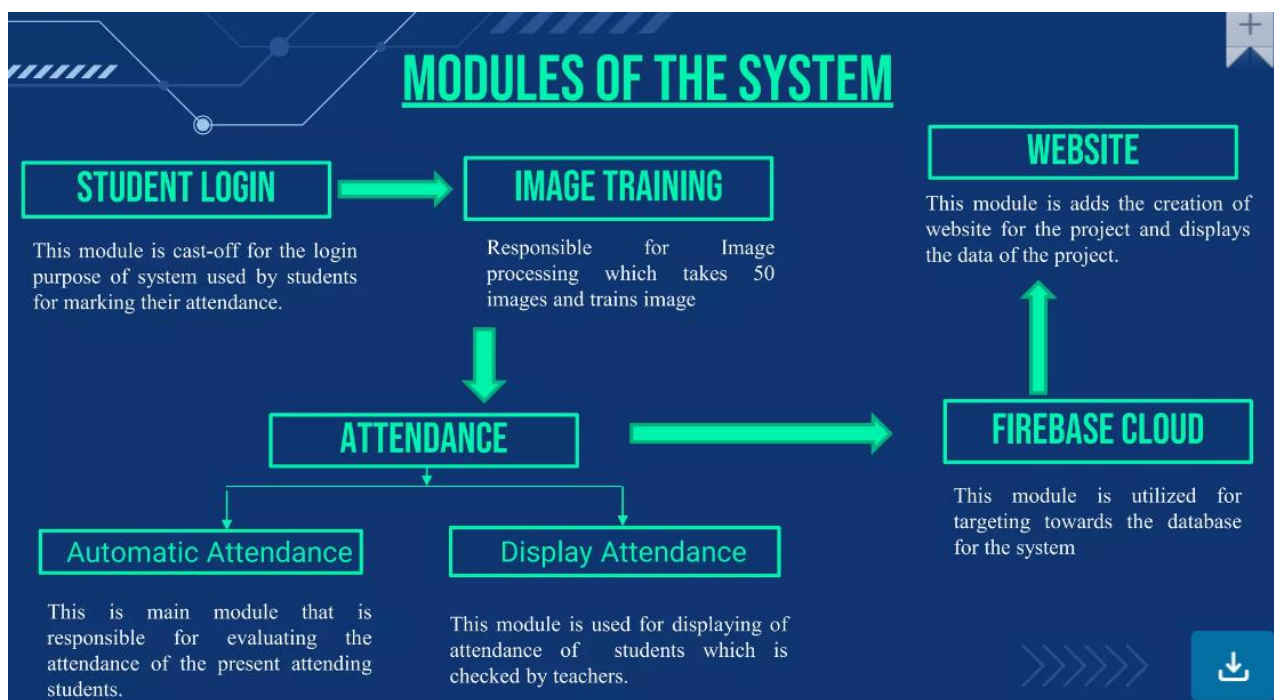
8. **Dataset-**

Over the years, Opencv has published various haarcascade models for object identification from photos. These models feature a face, eyes, a human, and several things. These models are available for download from OpenCV. Cascading is a subset of chaining in which each intermediate object is the same. To achieve this goal, the bar must return self.
haarcascade_frontalface_default.xml is the dataset that we have used for our project. We simply subtract the total of pixels under the white region from the amount of pixels under the black region to generate features for each of these five rectangular sections. Surprisingly, these characteristics are crucial in the context of face detection: Eye areas are often darker than cheek areas. The nose area is brighter than the eye area.
As a result of these five rectangular regions and their corresponding difference of sums, we can form features that can classify different parts of a face.

a) Edge features

b) Line features

c) four-rectangle features
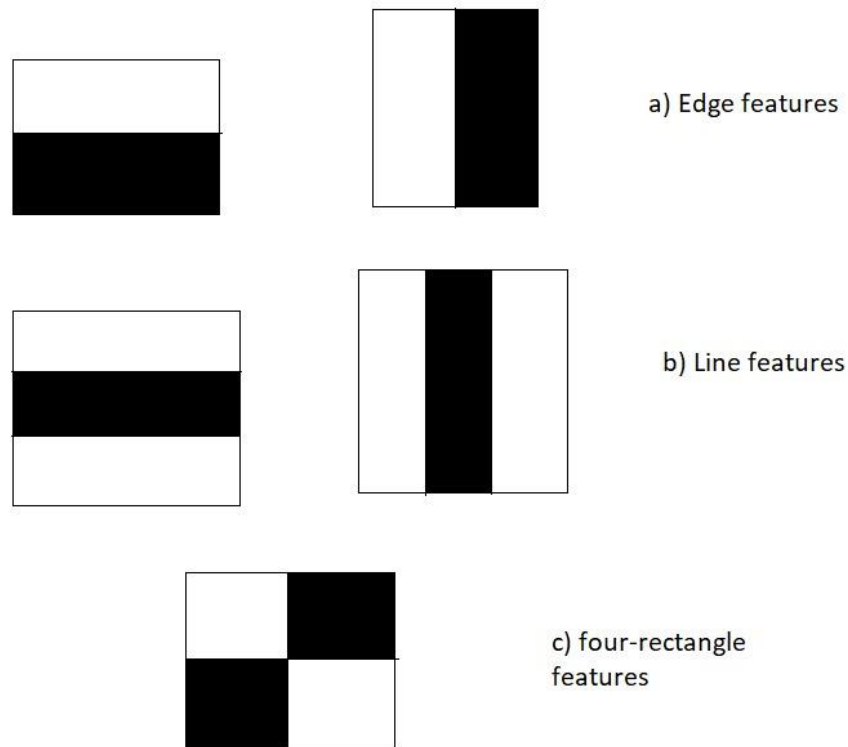
Because integral pictures are used, Haar cascades are extremely quick at calculating Haar-like characteristics (also called summed area tables).

They are also particularly effective in feature selection because to the algorithm. Most importantly, they can detect faces in images regardless of their location or scale. The OpenCV package keeps a library of pre-trained Haar cascades. The majority of these Haar cascades are utilised for one of two things:

Face recognition

Detection of eyes

Detection of the mouth

Detection of full/partial bodies

Other pre-trained Haar cascades are available, including one for detecting Russian licence plates and another for detecting cat faces.

Using the cv2, we may load a pre-trained Haar cascade from disc.

Function CascadeClassifer
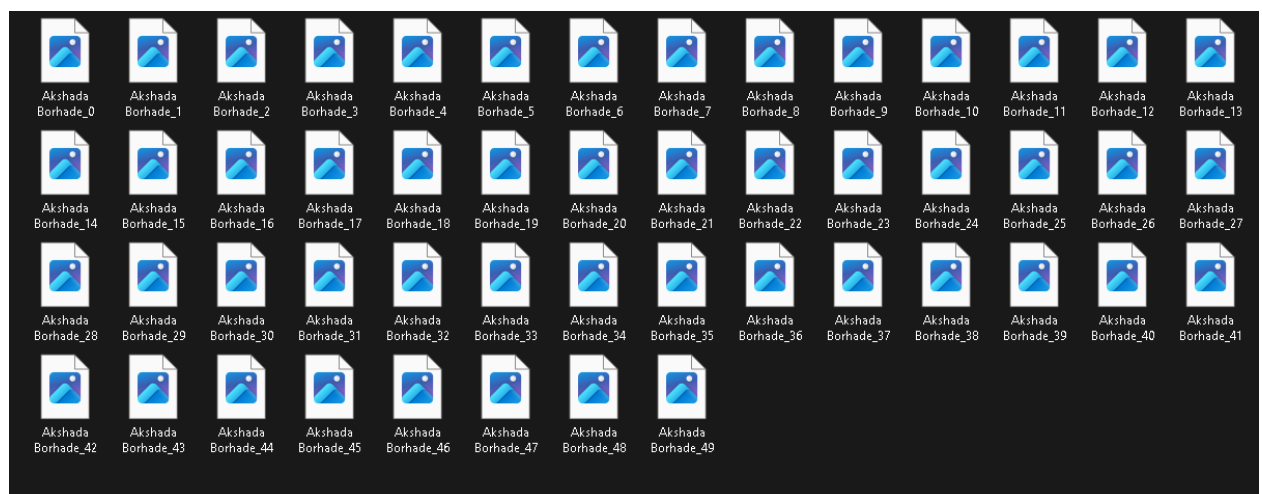
9. **Experiment Results-**

The following are the snapshots of our project-
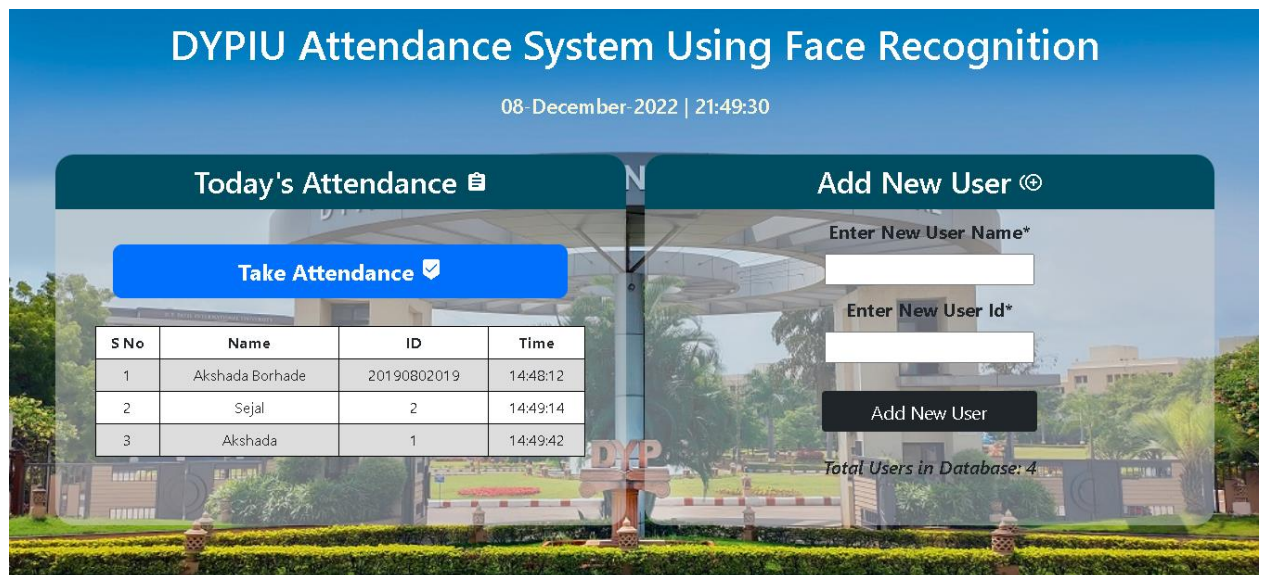
According to the new user, a separate folder is created for each user along with his id i.e. PRN during his or her enrolment which consists of 50 images of them-
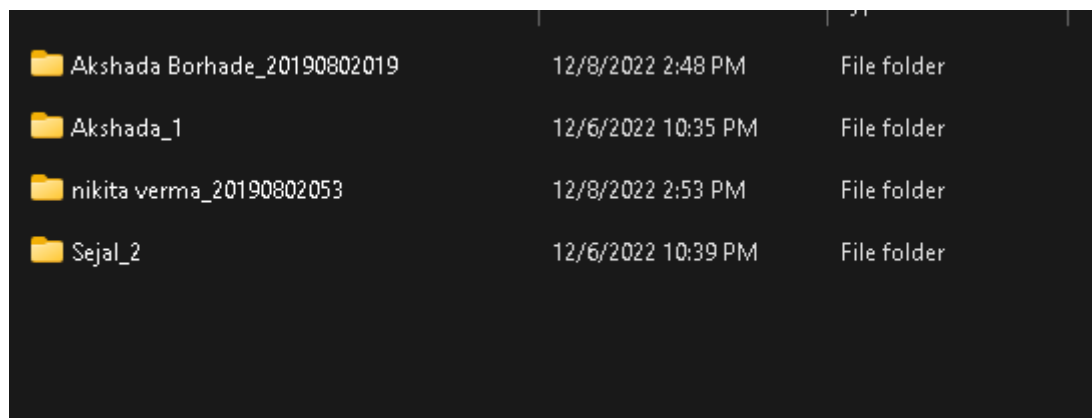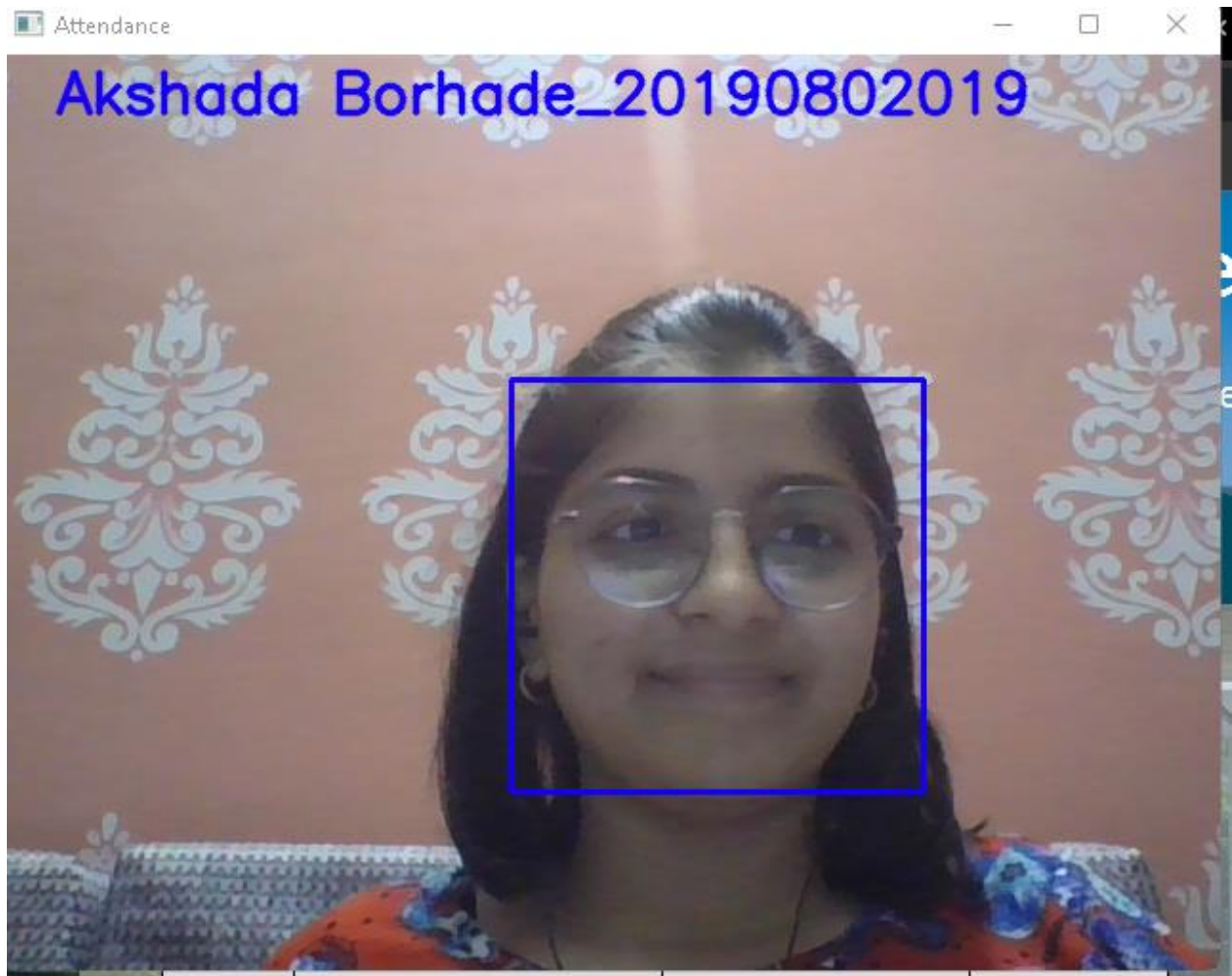

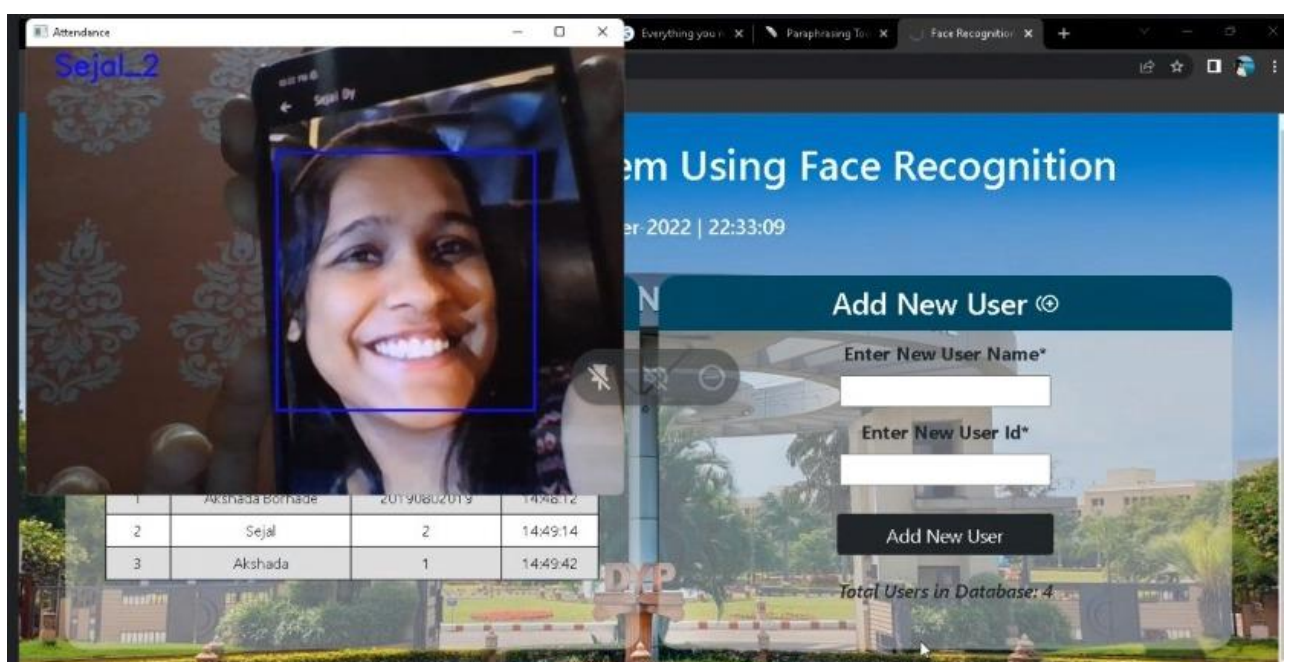An example of a users' sample folder with their photos-

When the user gets enrolled and when he or she takes attendance for itself the model detects the users' face and shows his or her name above the face like shown below-
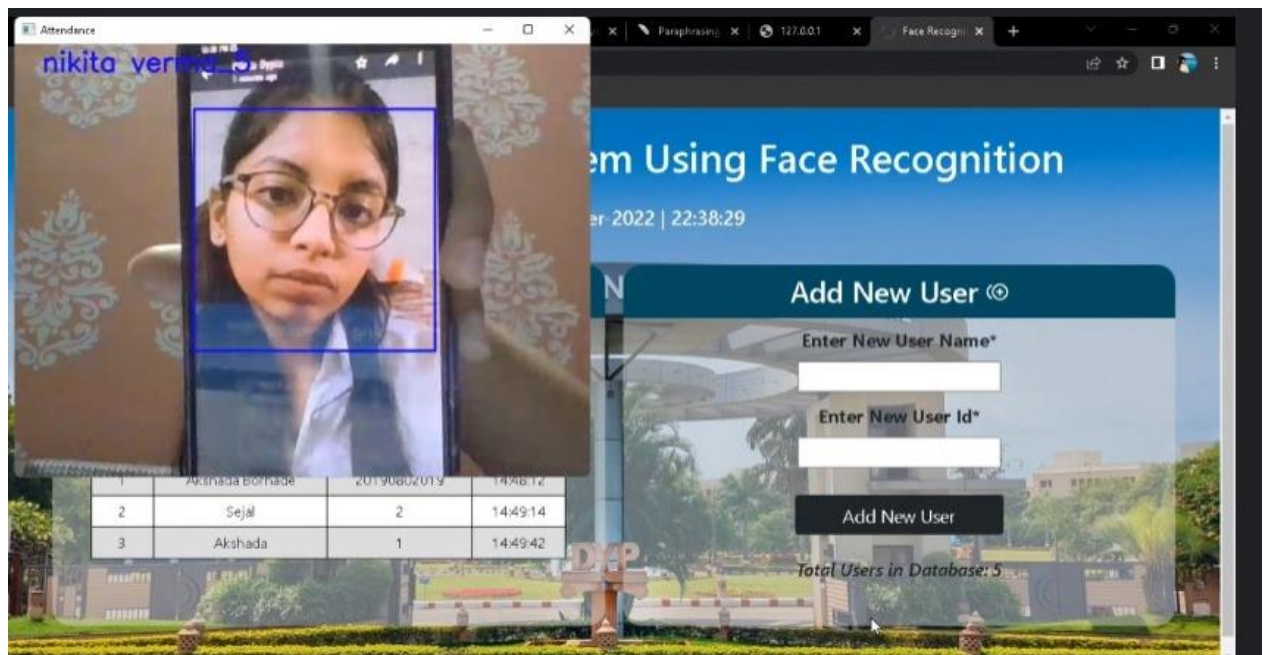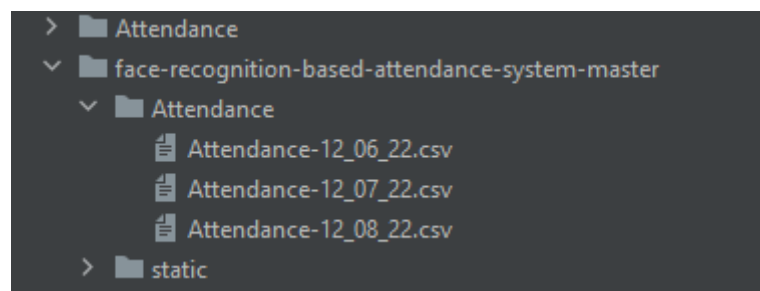
User 1- Akshada Borhade

User 2- Sejal Bhattad-

User 3- Nikita Verma-

According to the dates a different csv i.e. excel sheet is created that holds the records of the students' attendance.

10.Conclusion-

The evolving technology has led to the introduction of the automated attendance system that provides much better results. An automated attendance system using face recognition is easy to install and use. With just a few clicks, you will get all the details related to attendance. Thus, considering all these advancements we have made a project- attendance management system using face recognition.

This study proposes a simple and logical approach to evaluating attendance using facial recognition techniques. The goal of building an attendance tracking system based on facial recognition is to eliminate traditional human mistakes. It is a modern-day imperative to use such a system following the covid-19 epidemic. It made attendance tracking precise and cost-effective. It can even determine how much time a student or staff member is present. The given approach is safe, secure, and easily available to users based on their needs. This system will be a valuable asset to many organisations and institutions, and it has the potential to supersede all previous approaches to attendance monitoring, such as pen-paper or fingerprint scanning.

The ultimate goal is to help students take their studies and lessons seriously so that professors may quickly finish the complete curriculum without spending a lot of time on systematic attendance procedures. Typically, a quarter of the lecture time is squandered on attendance simply, making it difficult for teachers in school to complete the whole curriculum before exams arrive. We intend to develop a model that is effective, time-efficient, and simple to use, not only for staff members but also for students.

11. **Future Scope-**

It is a perfect and suitable project to avoid proxy attendances in college, schools and any other organisation. The future scope of this project can be shifted from the professor's laptop to a wide screen or monitor that can capture the whole class seated in one go, once all the users are enrolled or registered, the system thus can identify each of them distinctly from one another.

Mobile device software is unlocked using facial recognition technology. Visidon App lock, independently produced Android Marketplace software, uses the phone's built-in camera to photograph the user. Facial recognition is used to verify that only this individual has access to the applications that they have chosen to secure.

Another application could be a portable device that helps people with prosopagnosia recognises their acquaintances. The project's future scope can be combined with hardware components such as GSM, via which a monthly list of defaulter pupils can be delivered to the mentor.

Additionally, an application may be created to assist students in keeping track of their attendance. It can also be used in offices where a large group of employees sit in a hall and their attendance is automatically marked by capturing a video, but the accuracy of the recognition must be improved for this.

12.**References-**

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4. Class Attendance Management System using Facial Recognition- Research Gate
5. Face Recognition Attendance System for Students- UK Essays
6. AUTOMATIC STUDENT ATTENDANCE SYSTEM USING FACE RECOGNITION PROJECT
7. REFERENCE NO.:39S_BE_1465