FACE RECOGNITION ATTENDANCE SYSTEM USING PYTHON

[1]Miss. Rutuja Fasate, [2]Dr. Kashmira Kasat

[1]Student, [2]Head of the Department
[1]Electronics and Telecommunication Engineering
[1]Prof. Ram Meghe College of engineering and management, Badnera, Amravati, India

Abstract: To maintain a discipline and let students grasp utmost knowledge in schools, colleges and universities the attendance system was introduced. There are two conventional techniques to mark attendance of students in a particular class. One of them is by calling the roll number and the second is to take students sign on a piece of paper against their roll number. Hence there was a need to evolve this system in such a way that it could become user friendly, less time consuming and efficient. This is an automated system to assist the faculty in taking attendance of the whole class without any disturbance or time waste. The idea can encompass a large number application one of which include face identification, it will help save time and efficiently identifies and eliminates the chances of proxy attendance

Index Terms - **Attendance, face identification, Recognizer, OpenCV.**

I. INTRODUCTION

During this era of technology and automation we are still using the same old ways of classroom management. The most important thing in classroom is attendance which is directly linked to the academic performance of the students. The more efficient the attendance system the more is class participation and learning. In the past we were using techniques like roll numbering calling and signing against a particular roll number. These methods carry a high chance of proxy and are time consuming. We came across the idea of automating this process to through modern day technologies to get a well maintained and disciplined classroom. Facial recognition system along with suitable software will help meet the goals of this project. Facial recognition system is a derived innovation of image processing. Image processing deals with the extraction of needy data that can be related to digital image and in technology advancement it plays a unique role. Our core focus will be on receiving digital images and then making use of programs and algorithms to get useful Information out of it. As the pictorial information is fed the image processing work on it and make it useful human interpretation. That information from image processing will play a great role and help in various walks of life where it could be implemented. The applications of image processing are vast and can be applied in most scenarios where imaging data could be related to pre-determined algorithms. It was an advanced application of image processing and also is the core basis for our project. Our facial structure is a typical example of a multidimensional structure and need some recognition from advanced computational analysis.

II. PROPOSED SYSTEM

The purposed of this project is to mark the attendance using automatic face recognition technology. The system records video feeds from the camera and detects the faces in image format. The detected faces are compared with the code database and marked attendance within the Excel File. Using these Excel sheets we will generate a graph that shows the attendance of the entire class/Individual student. The function of the proposed system is to capture the face of every student and keep it for them to attend. The face of the expert must be taken in such a way that everyone can see what the student's face is like. There is no need for the teacher to be physically present in the classroom because the system records the video and then with continuous face processing steps is monitored and therefore the attendance is updated. All Individuals in the category must register themselves by entering the information they require so that their photos can be taken and stored within the database. During each session, a face is found in the live streaming video of the class. The recovered faces are compared with the existing images in the database. Once a match is found, attendees are marked on the appropriate reader. At the top of each session, a list of present students will be sent to the appropriate faculty in charge of the session.

III. METHODOLOGY

In this project we will propose a method that will give an overview of the approach to our project and the ways it should be done. It will led us to the development in this project in the most feasible and efficient way possible. After the students have been seated in the class the camera located at front with a certain height will take an image and starts the process of face detection using the techniques and methods .After this the program will automatically make a folder in the database having the students to be recognized. The already placed images of each student is taken and used from database for image recognition. The images will be fetched and compared with each of the entry in the database and hence will be checked whether the student is present in the class or not. If there is no match the program will move on to the next picture

IV. LITERATURE REVIEW

V.

Face recognition is one of the few biometric methods that possess the merits of both high accuracy and low intrusiveness. It has the accuracy of a physiological approach without being intrusive. Over past 30 years, many researchers have proposed different face recognition techniques, motivated by the increased number of real world applications requiring the recognition of human faces. There are several problems that make automatic face recognition a very difficult task. However, the face image of a person inputs to the database that is usually acquired under different conditions. There are some ways to pander to differences between the images and so the variations within the environment of the images and these approaches were implemented to detect the object [1]. These systems may additionally be utilized within the systems that detect the characteristics of the face [4].The foremost reason for using the grey-scale representation instead of using the colored image is that it simplifies the algorithm, and reduces the complexity, implementation time, and computational time the colored image may provide excessive and more information which is not sensible and it will also increase the computational time and results in the low performance of the organization [3].These proposed systems assumed the shape of the objects or illumination conditions. These assumptions were made for the generic object recognitions so there for these aren't sufficient for face recognition systems [4] .This approach is additionally used for identity verification and also has similar accuracy because of the grey-scale approach [5].It combines the facial information (i.e. dimensions of the face) with structural information by grouping the face Edge map into line segments [6]. These images captured could even be used as several independent models or are additionally used as a combined model to recognize the faces [6]. The same reasonable approach is utilized during this technique where 50 images are visiting be captured of the same student and these images are captured altogether under the environmental conditions [6].

STUDY OF EXISTING RECOGNITION SYSTEM

1. Fingerprint Based Recognition System*:* For a fingerprint-based departure system, the portable fingerprint device should be pre-configured with Individual fingerprints ahead of time. Later in the teaching hours or before, the coed should record fingerprints on the suspended device to ensure their daily presence. The point is that during the study it should be distracting to the eyes of individuals.
2. RFID (Radio Frequency Identification) Based Recognition System: In an existing RFID-based system, Co-ed should always carry good identification and place an ID with a cardboard reader to record their daily presence. The system is able to connect to RS232 and record attendees on a saved website. There is a possibility of fraudulent access that may occur. Some students may use another student's ID to verify their presence in the absence of the real student or themselves try to misuse it sometimes.
3. Iris Based Recognition System: In an Iris-based student travel program, the scholar should rotate in front of the camera, so that the camera will scan the Iris code. The scanned iris is compared with the individual data stored on the website and their presence should be updated. This reduces the paper and pen function of the college members of the institution. This also reduces the chances of being represented within the classroom, and helps maintain secure code records. it is a wireless biometric method that solves the issue of false existence and therefore the problem of setting up a compatible network.
4. Face Based Recognition System: Biometric detection technology will be used to record attendees with a high-definition camera that detects individual faces so the machine compares known faces with student faces stored within the website. When the face of the code is matched to a saved image, attendees are marked with the current website for further calculation. If the captured image does not match the existing student face on the website, this image is saved as a new image on the website. During this process, there is a chance that the camera will not take the correct picture or will miss the number of individuals in the picture

In the above discussed systems there are some problems. In RFID card system, the disadvantage is that it has fraudulent usage, Fingerprint system is time consuming and Iris recognition system has privacy invasion. So to overcome this problems we have designed this Facial Based recognition attendance system.

V. System Design

The main rule of the project is that the video captured by the camera is converted into an image for viewing. In addition, a known code image is also provided , otherwise the system will mark the site as non-existent.

1. Take a Video: The camera is positioned at a selected distance within the classroom to capture pre-video videos of perfect students of the class.
2. Divide as Frames in Video: The captured video must be converted to self-contained every second so that it can be easily accessed and seen by the students' faces in order to present the audience.
3. Face Detection: Face detection is a process by which an image, provided as input (image) is searched to investigate any face, after finding the face processing image cleans the face image so that the face can easily be seen.
4. Facial Recognition: After completing the face detection and analysis, it is compared with the existing face on the student website to review the Individual presence.
5. After Processing: Post-processing process includes the process of updating expert names on an excel sheet. An excel sheet is usually kept weekly or monthly to record student attendance.
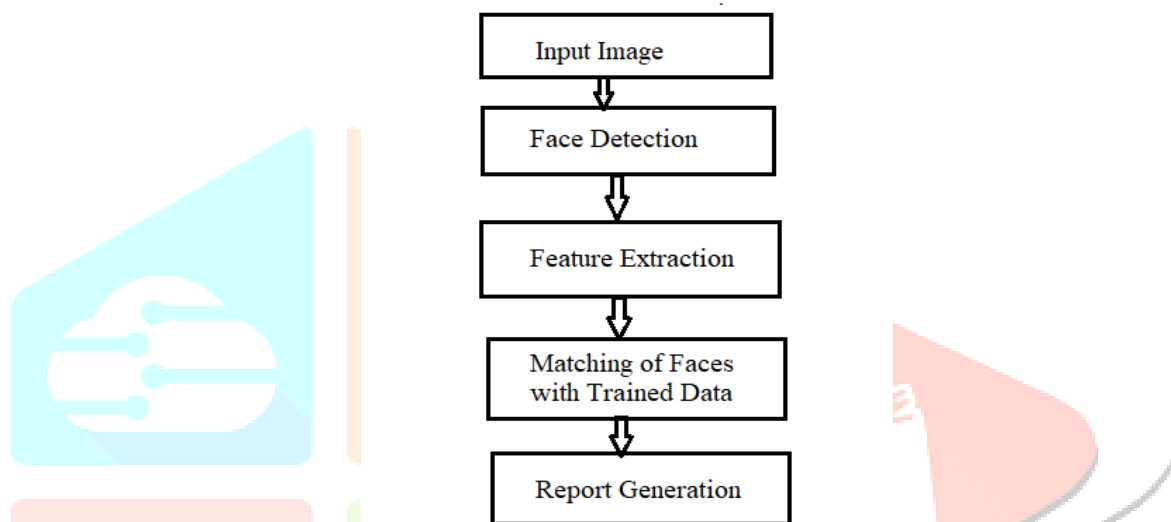
VI. System Workflow

Fig. 3.1 Operating process of face recognition attendance system

A described block diagram above can be explained simply in following ways:

1) Input the required information of the particular student such as name , roll   number, student ID, branch, email, contact number, address, class section, class teacher name, semester, etc.
2) Then take photo of each student using web camera or other external camera for storing in .jpg format.
3) This can be treated as the required stored data for identification of a specific student.
4) Then capture live image/video for recognition. The displayed image will have some of its parameter on completion of identification else it will simply indicate label for unknown user.
5) If the person is identified correctly the real time data and its attendance status will be stored in excel file generated automatically.

Software Used

OpenCV python software : OpenCV (Open Source Computer Vision Library) is a Python library that allows you to perform image processing and computer vision tasks. It provides a wide range of features, including object detection, face recognition, and tracking.
So , it is very important to install OpenCV. For installing OpenCV open your command prompt and type python. It will show your python version . Then type "pip install opencv-python".
VS code: Visual   Studio   Code,   also   commonly   referred   to   as VS   Code   ,is   a source-code   editor   made by Microsoft for Windows , Linux and macOS. Features include support for debugging , syntax highlighting , intelligent code completion , snippets , code refactoring , and embedded Git . Users can change the theme , keyboard shortcuts , preferences, and install extensions that add functionality
Tkinter : Tkinter is the standard GUI library for Python. Python when combined with Tkinter provides a fast and easy way to create GUI applications. Tkinter provides a powerful object-oriented interface to the Tk GUI toolkit. Creating a GUI application using Tkinter is an easy task
MySQL Database: The most important step is to create a database. A database is required where all the data of each and every student in a particular class is placed. The basic process in creating a database is to form a system that take images. For that we

will be using a camera module and pictures of each student registered in a particular class is taken. These pictures are taken and basic image processing technique is used to get data understandable by the computer and store it in .csv file

Algorithm Used

Haar Cascade Algorithm: It is an object detection system that can recognize faces in still photos or moving videos. In order to recognize a face, Haar cascade classifiers are trained on a large number of pictures, both with and without faces. This means that instead of choosing non-facial areas, Haar classifiers scan the window for faces. According to research , image processing and pattern recognition experts have found it difficult to reliably identify human faces. An object detection system called the Haar Cascade Algorithm may be used to find faces, pedestrians, objects, and facial emotions . Haar Cascade Classifier is one of the best detectors for face detection from a picture in terms of speed and accuracy . The most important component of the face detection Haar Cascade Classifier is the Haar characteristics. While the Haar Cascade Classifier features can detect any item , these features are utilized to determine if a feature is present in a particular picture. They work and focuses on precise eye-central localization using a webcam. Five distinct procedures were employed in the investigation. The study of Viola and Jones is depicted in Fig. below. A cascade function is developed using the various quantities of pictures, both positive and negative, in this machine learning-based technique. It is then utilized to find things in other images in that situation. To increase classification performance in this study, the system requires a large number of positive pictures (photos with faces) and negative images (photos without faces). Then I have to take the features out of it. According to Soo , "A Haar-like feature checks nearby rectangular areas at a certain location in a detection window, adds the pixel intensities in each region, and computes the difference between these sums."
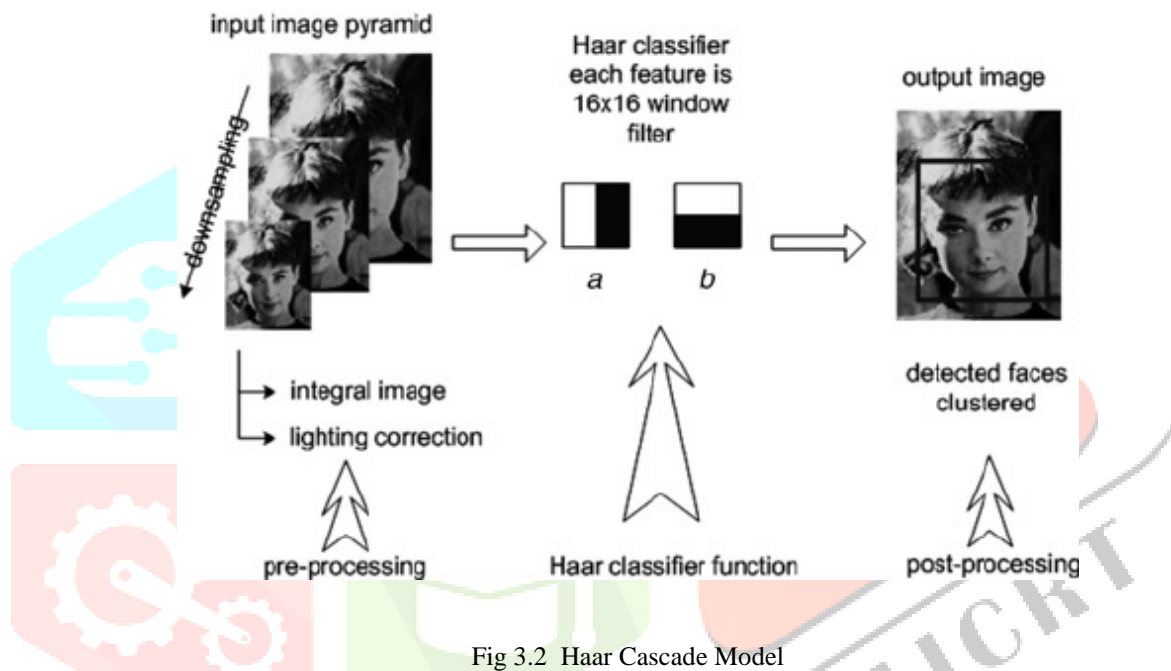

Fig 3.2 Haar Cascade Model

Local Binary Pattern Histogram (LBPH): It was first described in 1994 (LBP) and has since been found to be a strong feature for texture classification. Using the LBP combined with histograms we'll represent the face images with a straightforward data vector. As LBP is a visual descriptor it can even be used for face recognition tasks, as is commonly seen within the subsequent step-by-step explanation.

1.Parameters: the LBPH uses 4 parameters:

1.Radius: is the circular binary pattern that represents the radius around the central pixel. that will be 0 or 1.

2.Neighbours: it is the full number of sample points that are employed to form the circular binary pattern. If the quantity of sample points increases, the computational cost also increases so it's usually set to eight.

3.Grid X: It is the entire number of cells in an exceedingly very horizontal direction. If the number of cells increases the grid is better, and also the dimensionality of the resulting vector also will increases it is also usually set to eight.

4.Grid Y: It is the overall number of cells in an exceedingly vertical direction. If the number of cells increases the grid is better, and also the dimensionality of the resulting vector will increases it is also usually set to eight.

2. Training the Algorithm: First, we need to train the algorithm. To do so, we need to use a dataset with the facial images of the people we want to recognize. We need to also set an ID (it may be a number or the name of the person) for each image, so the algorithm will use this information to recognize an input image and give you an output. Images of the same person must have the same ID. With the training set already constructed, let's see the LBPH computational steps.

3. Applying the LBP operation: The first computational step of the LBPH is to create an intermediate image that describes the original image in a better way, by highlighting the facial characteristics. To do so, the algorithm uses a concept of a sliding window, based on the parameters **radius** and **neighbour**. The image below shows this procedure:
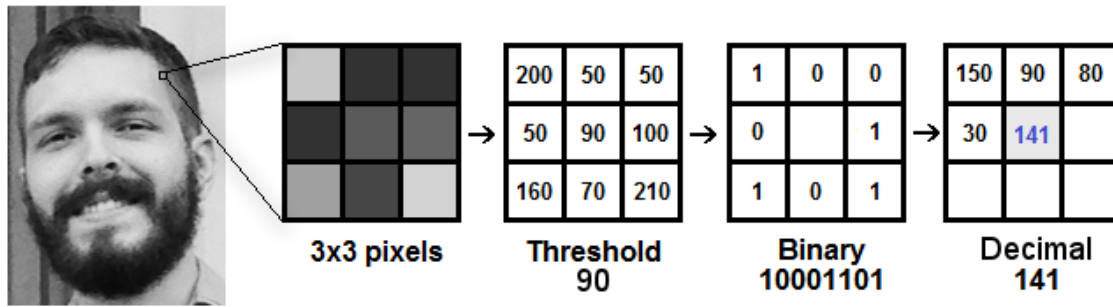
Fig 3.3.1 Generating Binary Pattern-1

Based on the image above, let's break it into several small steps so we can understand it easily:

- Suppose we have a facial image in gray scale.

- We can get part of this image as a window of 3x3 pixels.

- It can also be represented as a 3x3 matrix containing the intensity of each pixel (0~255).

- Then, we need to take the central value of the matrix to be used as the threshold.

- This value will be used to define the new values from the 8 neighbors.

- For each neighbor of the central value (threshold), we set a new binary value. We set 1 for values equal or higher than the threshold and 0 for values lower than the threshold.

- Now, the matrix will contain only binary values (ignoring the central value). We need to concatenate each binary value from each position from the matrix line by line into a new binary value (e.g. 10001101). Note: some authors use other approaches to concatenate the binary values (e.g. clockwise direction), but the final result will be the same.

- Then, we convert this binary value to a decimal value and set it to the central value of the matrix, which is actually a pixel from the original image.

- At the end of this procedure (LBP procedure), we have a new image which represents better the characteristics of the original image.

- **Note**: The LBP procedure was expanded to use a different number of radius and neighbors, it is called Circular LBP.
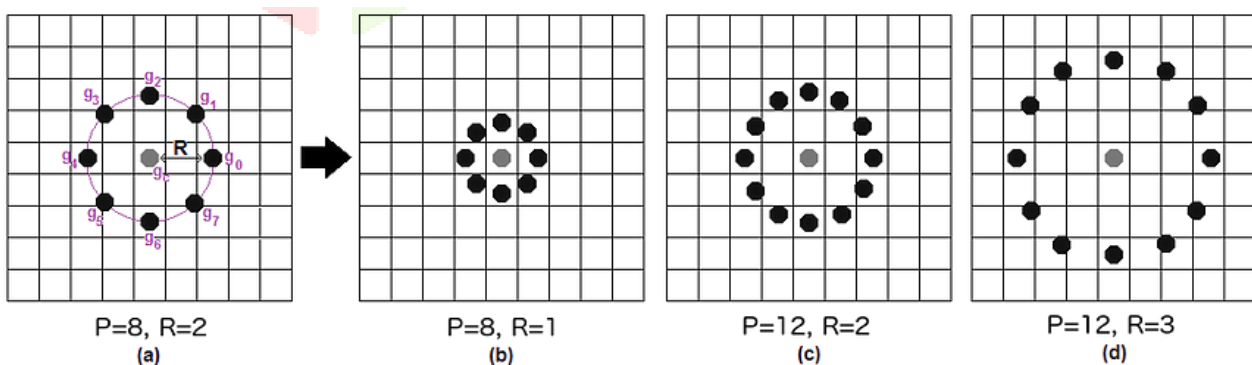

Fig 3.3.2 Generating Binary Pattern-2

It can be done by using **bilinear interpolation**. If some data point is between the pixels, it uses the values from the 4 nearest pixels (2x2) to estimate the value of the new data point.

4. Extracting the Histograms: Now, using the image generated in the last step, we can use the **Grid X** and **Grid Y** parameters to divide the image into multiple grids, as can be seen in the following image:
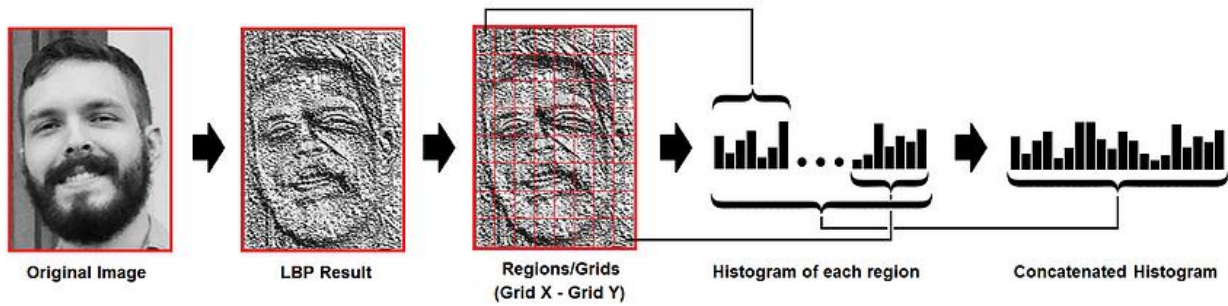

Fig 3.3.3 Histograms

Based on the image above, we can extract the histogram of each region as follows:

- As we have an image in gray scale, each histogram (from each grid) will contain only 256 positions (0~255) representing the occurrences of each pixel intensity.

- Then, we need to concatenate each histogram to create a new and bigger histogram. Supposing we have 8x8 grids, we will have 8x8x256=16.384 positions in the final histogram. The final histogram represents the characteristics of the image original image.

The LBPH algorithm is pretty much it.

5. Performing the face recognition: In this step, the algorithm is already trained. Each histogram created is used to represent each image from the training dataset. So, given an input image, we perform the steps again for this new image and creates a histogram which represents the image.

- So to find the image that matches the input image we just need to compare two histograms and return the image with the closest histogram.

- We can use various approaches to compare the histograms (calculate the distance between two histograms), for example: **euclidean distance**, **chi-square**, **absolute value**, etc. In this example, we can use the Euclidean distance (which is quite known) based on the following formula:

$$D = \sqrt{\sum_{i=1}^{n}(hist1_i - hist2_i)^2}$$

- So the algorithm output is the ID from the image with the closest histogram. The algorithm should also return the calculated distance, which can be used as a '**confidence**' measurement. **Note**: don't be fooled about the 'confidence' name, as lower confidences are better because it means the distance between the two histograms is closer.

- We can then use a threshold and the 'confidence' to automatically estimate if the algorithm has correctly recognized the image. We can assume that the algorithm has successfully recognized if the confidence is lower than the threshold defined.
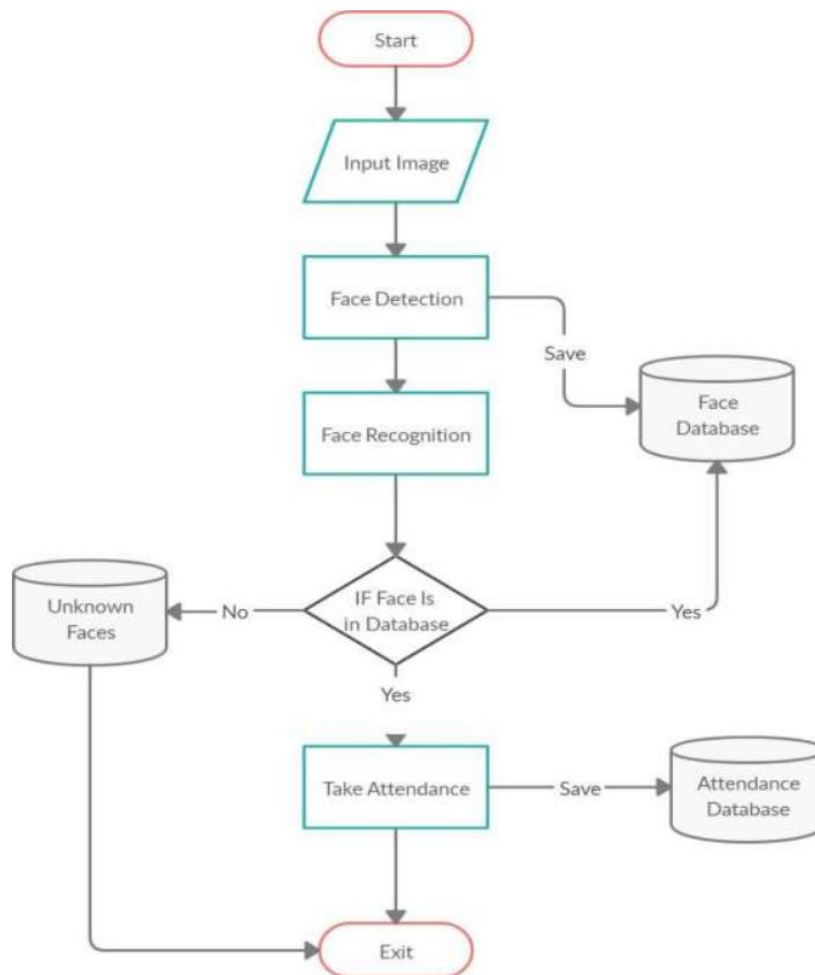
VII. Flowchart

Fig 3.4 Flowchart

The flowchart of the proposed system is shown in fig 3.4. Initially we have to input an image through the use of camera which can be inbuilt or externally connected. Then we will send this image for storing purpose in database. The other details like name, student ID, roll no, contact information and course details are also stored simultaneously in the database. After this we will perform the steps for recognition. If the face is in database, face will be search in database matched else it will be labeled as unknown. If the face is matched then it will mark the attendance and save it in database and the program will be end. In this way flowchart will get executed.

Working Interface of System
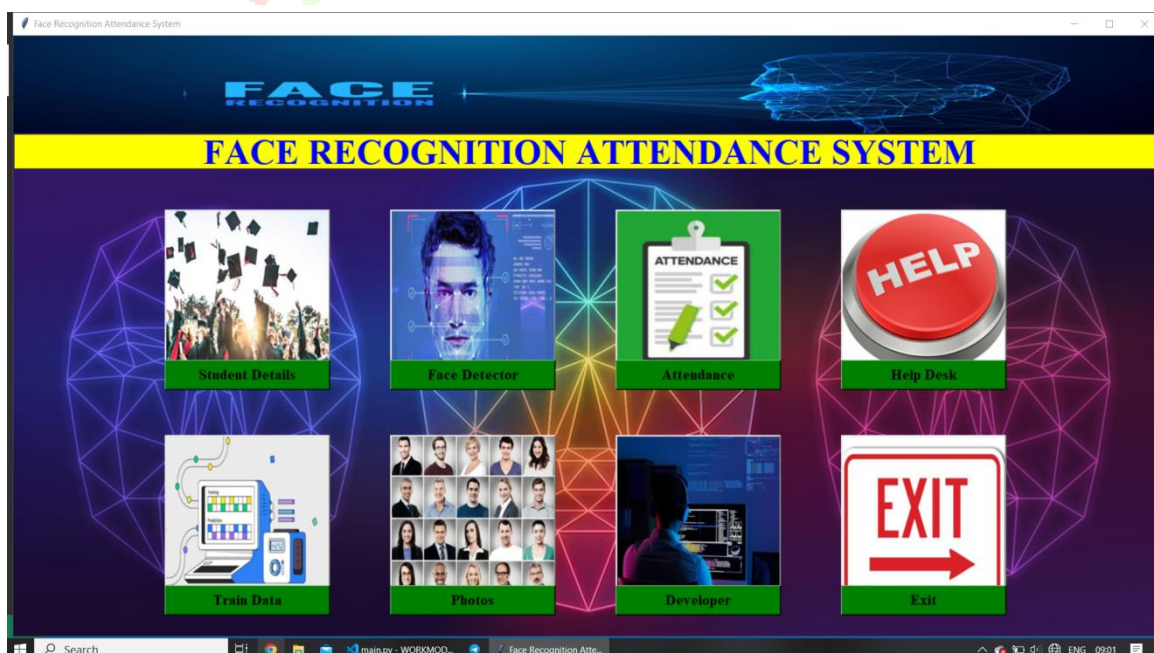
Fig 3.5 Opening Interface

This is the opening interface of the system. On successful execution of the program this GUI will appear. Here you will see the various icons/buttons with its functioning name below image. Clicking the particular button will open another GUI window performing specialized task. As we can see, here total of 8 buttons are used . You can add more if you want. This interface is totally created using Tkinter library in python.
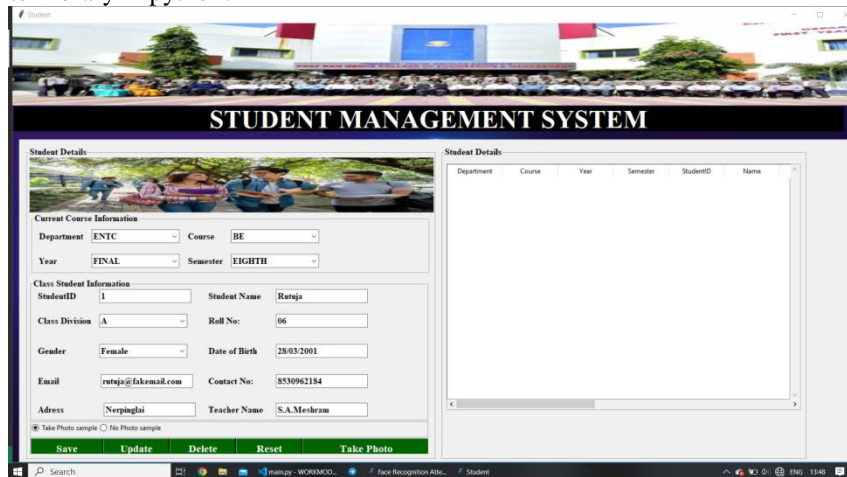

Fig 3.6 Student Details Button Window

On clicking the student details button on opening interface this type of window will appear. Here various entry fields and combo boxes can be seen . The details need to be stored are typed here. There two radio buttons used for photos option weather you wish to take a photo or not. There are several operating buttons at the left bottom of the window . Using this buttons we can save , update, delete and reset the stored details. The take button will launch a camera . This can be a web camera or any external integrated camera. The camera on opening will automatically take 50 sample photos of a same person . This captured photos will be stored in folder in the form of .jpg format. This all will be the converted gray scale images of the captured sample photos.
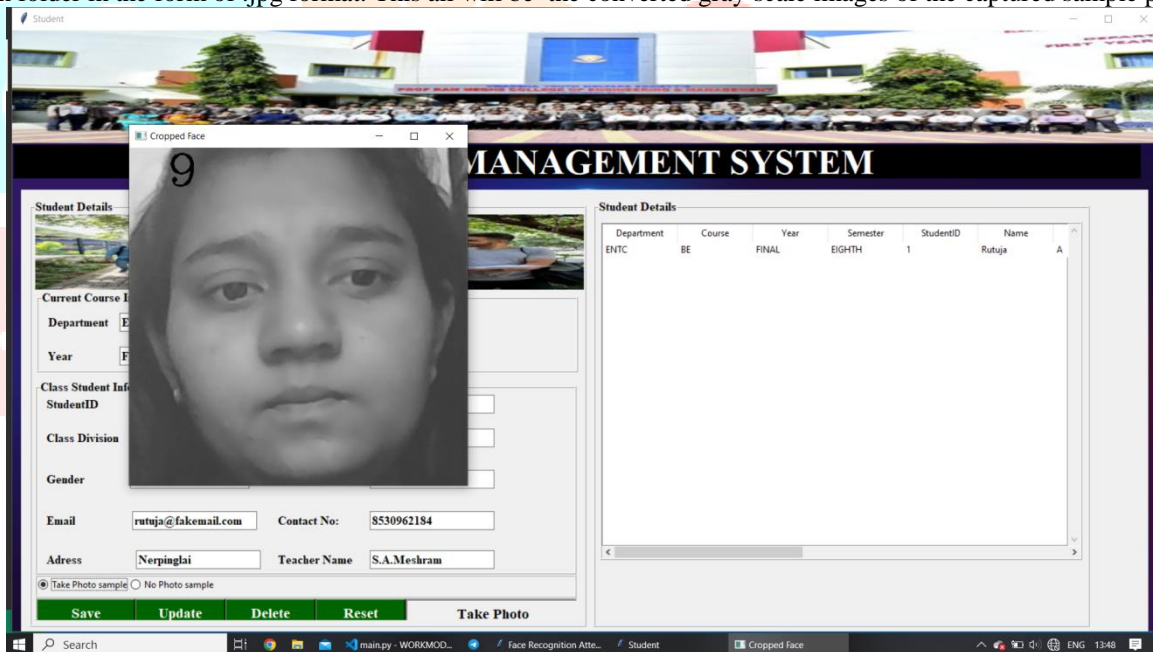

Fig 3.7 Take Photo Button Working

The above screenshot shows the functioning of take photo button. The current screen is freezed on 9 th sample while capturing total of 50 images. As we can see , the stored details can be viewed on right side of window . There's also a scroll bar feature present .
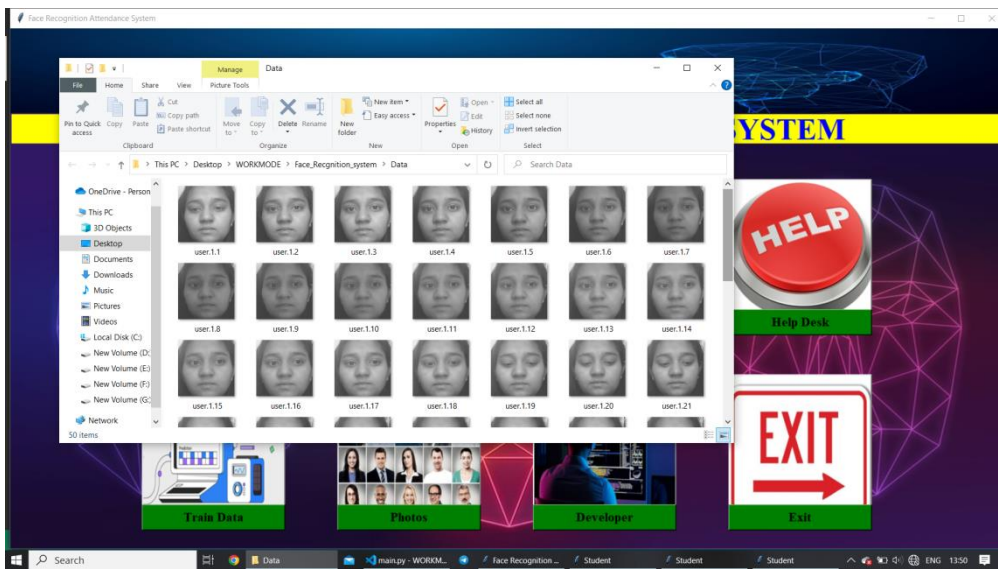
Fig.3.8 Photos Button Window

This the screenshot of the folder in which stored image samples are present. This window can be opened by clicking the photos button present on opening interface.
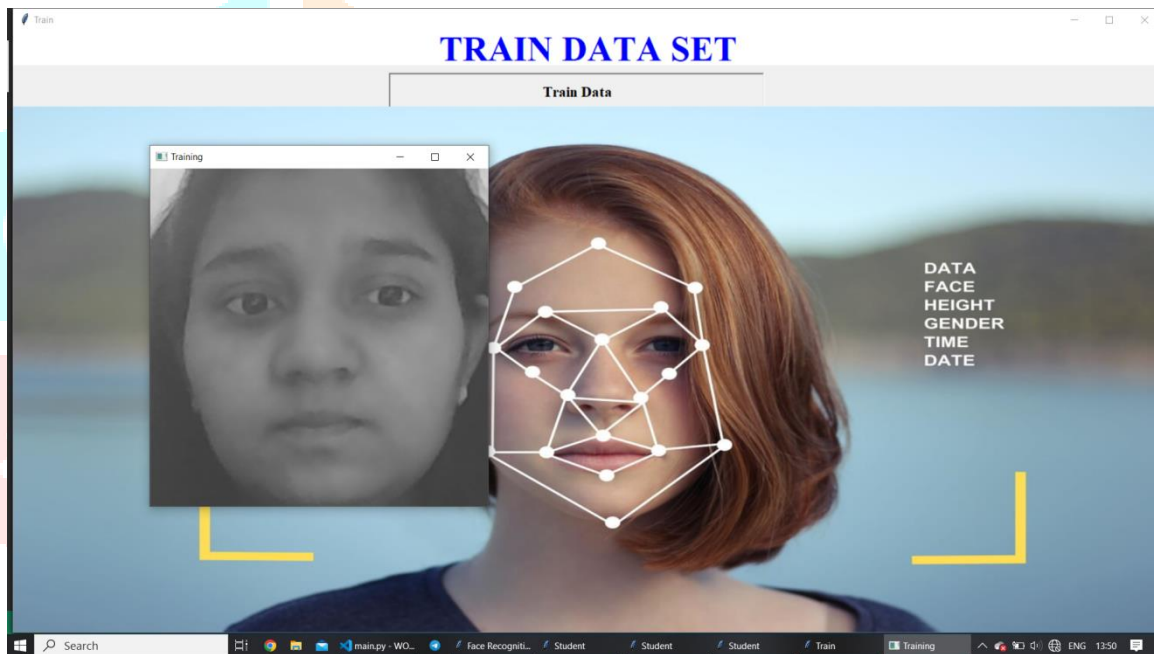

Fig 3.9 Train Data Button Window

On clicking the train data button on opening interface this window will appear . Sampled photos are send here for training purposed using a algorithm.
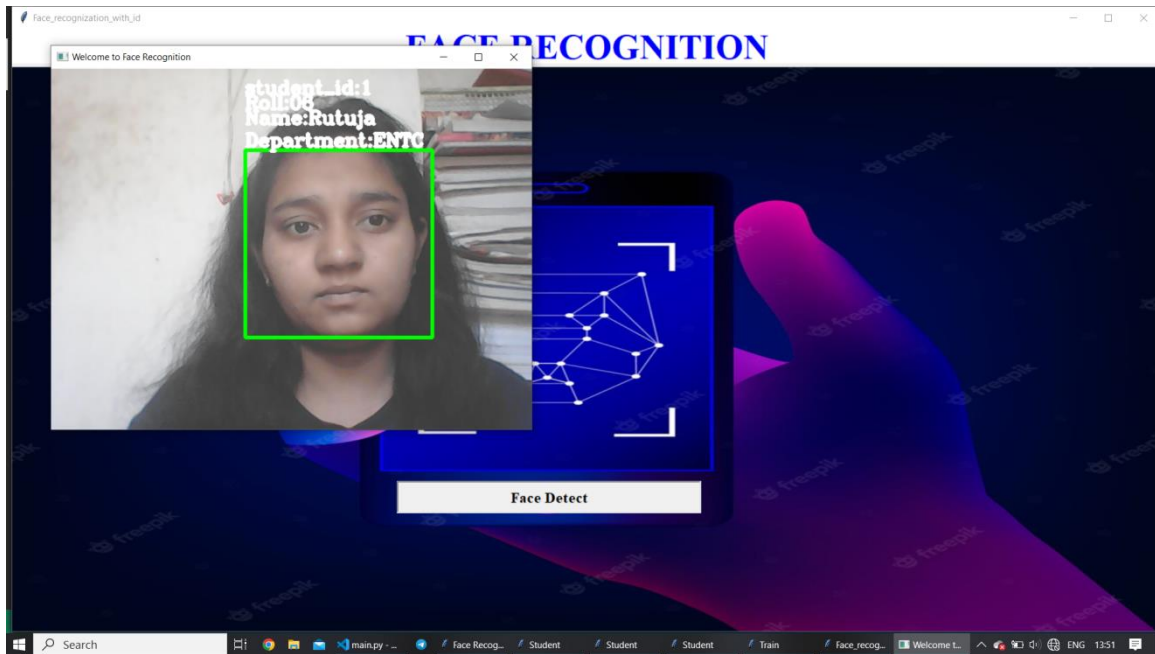
Fig 3.10 Face Detector Button Window

Face detector button on opening interface will open this window. It will launch a camera. The camera will search a face for detection purpose and will display the details of that person if detected successfully else will display unknown.
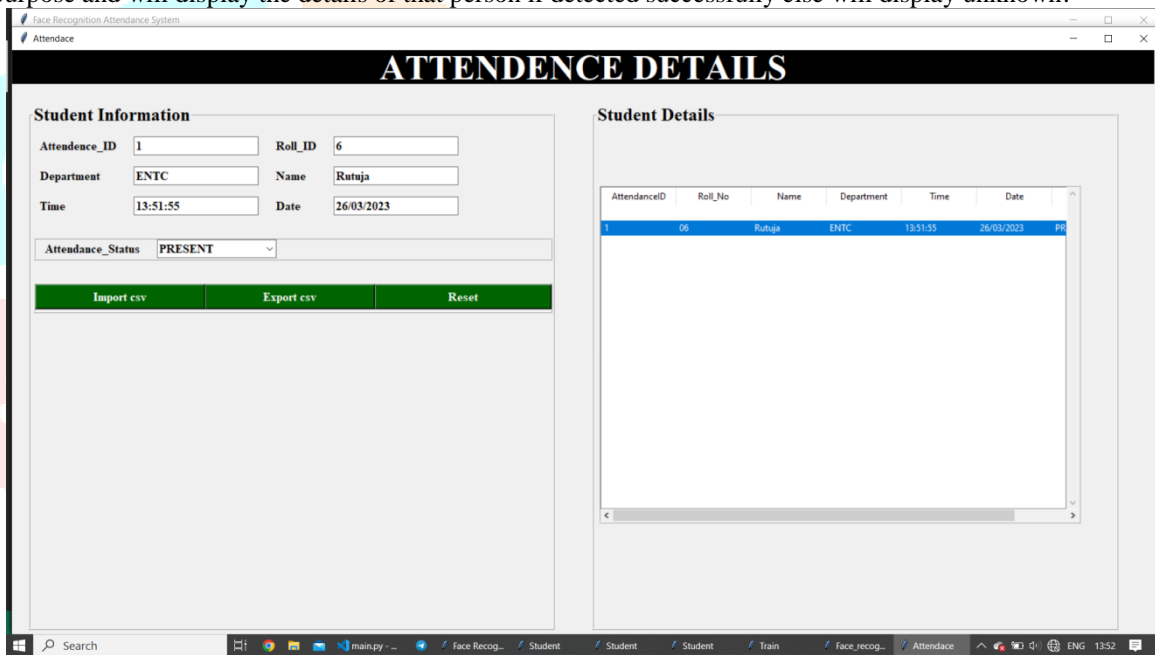

Fig 3.11 Attendance Button Window

Attendance details are stored in .csv file if the person is detected successfully. The real time data is stored in that file. We can see this by clicking on import csv button which will take details and will display on right side of the window. This details can be exported by export csv button which will lead us to an create excel file.
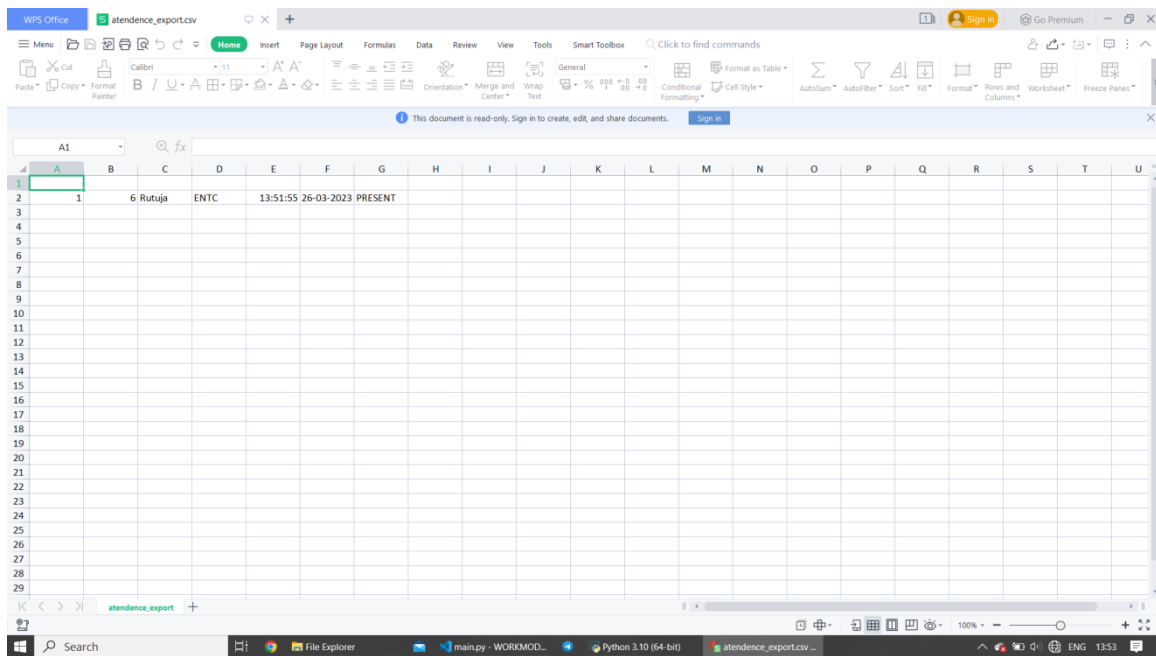
Fig 3.12 Excel File view

This is the exported excel file. Hence attendance status of a particular person is stored without any human interruption.
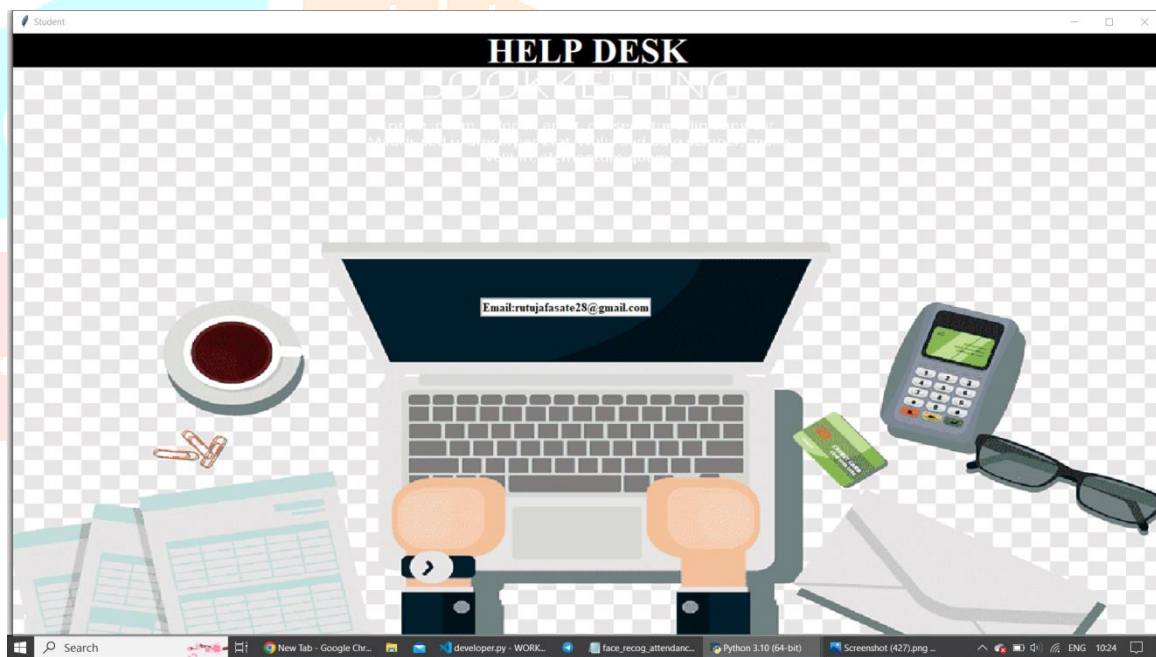

Fig 3.13 Help Desk Button Window

Screenshot for Help Desk Icon on opening page. Here email of developer is displayed. Anyone can mail on the same if facing any issue.
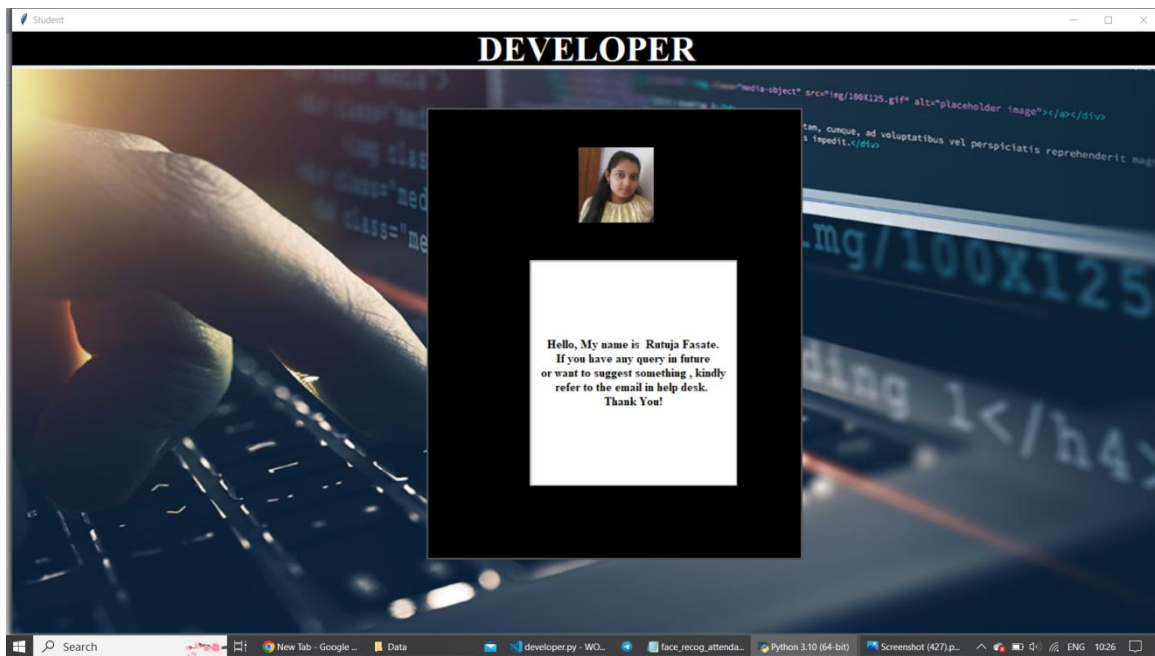
Fig 3.14 Developer Button Window

This can be opened on clicking developer icon on front page. The person details of the developer of the system is displayed here.
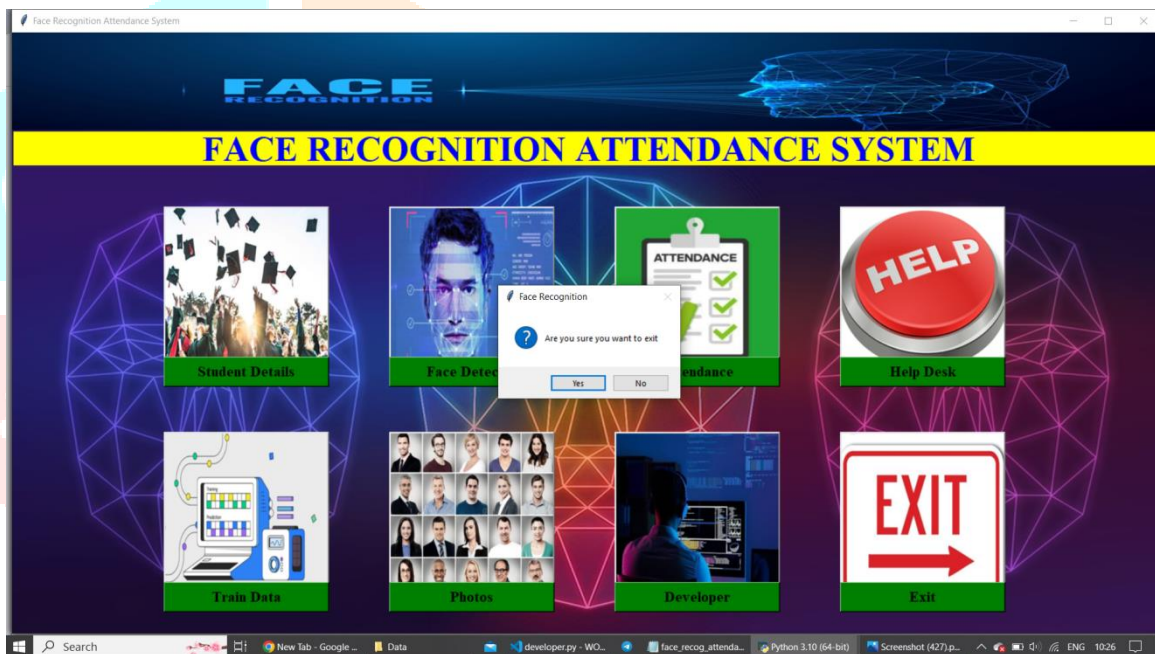

Fig 3.15 Exit Button POP-UP Window

On clicking the exit button a pop up window will appear asking if you want to exit or wish to return. On clicking yes the application will get closed and if clicked no it will return to main window.

VIII. Conclusion:

This project describes a facial recognition-based automated student attendance system. By comparing the input photographs that were derived from the attendance images registered with, the suggested solution offers a way to identify the individuals. With the use of an input facial picture that was taken from a frame of the recorded video, the suggested method identify and locate faces. Additionally, it offers a way to see the attendance information. With advances in digital technology ,the quality of facial verification in face recognition attendance system has improved and acceptance rate is high. Its' appeal is enhanced further by their fast image processing time . The facial recognition attendance provides an additional layer of protection to the workplace.

IX. FUTURE SCOPE

 This concept will always have room for new development ..
1. Algorithm used can be modified such that it is effective in identifying the faces irrespective of the poor lighting conditions.
2. The system can also be extended to allow better face recognition algorithm in which rotational features of face can be detected efficiently at various angles.

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