BACHELOR OF ENGINEERING PROJECT ON

FACE-RECOGNITION BASED ATTENDANCE SYSTEM

Submitted By

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SYNOPSIS REPORT SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE DEGREE OF
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UNDER THE GUIDANCE OF

PROF. DR. ANAND TRIPATHI

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CERTIFICATE OF APPROVAL
For
Project Synopsis

This is to certify that

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Have successfully completed project titled

FACE-RECOGNITION BASED ATTENDANCE SYSTEM

IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE DEGREE OF
BACHELOR OF ENGINEERING
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2019-2020

UNDER THE GUIDANCE OF

PROF. DR. ANAND TRIPATHI

Signature of Guide | Head of Department

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DECLARATION

We declare that this written submission represents our ideas in our own words and where others' ideas or words have been included, we have adequately cited and referenced the original sources. We also declare that we have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in our submission. We understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

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DEDICATION

This thesis is dedicated to our professor **Prof. Dr. Anand Tripathi** (Vidyalankar Institute of Technology, Wadala, Mumbai) who has been our guide. He has the attitude and the substance of a genius. He continually and convincingly conveyed a spirit of adventure in regard to research and conferences and an excitement in regard to teaching.

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BE EXTC 2

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ABSTRACT

Face recognition system is one of the biometric information processes. Face recognition has been one of the most important and interesting field in past two decades. The need of automatic recognition and surveillance systems, its application is easier and larger than other biometric systems, so keeping all the parameters in mind we are aiming to prepare software-based face recognition system for college/school attendance.

Haar cascade is a machine learning object detection algorithm used to identify objects in an image or video. It is a machine learning based approach where a cascade is trained from lots of positive and negative images.

The system uses a combination of techniques in two topics; face detection and recognition. The algorithm is written in Python programming language, at first face detection is performed on live acquired images which are captured by the cameras present in the classroom with the help of Haar cascade algorithm. After that the recognition takes place and when the recognition process is completed it forms an excel, where all the students who are present in the class are listed in the excel sheet.

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INTRODUCTION

INTRODUCTION

Face recognition system are part of facial image processing application, as they use biometric information of humans and are applicable instead of fingerprints, iris and signature, etc. Because these types of biometrics are not much suitable for non - collaborative people. Face recognition system is usually used for people and security purposes in metropolitan areas. These systems can be used for criminal prevention, video surveillance, person verification and similar security activities. This system can also be used in corporative world and in education system too.

Face recognition system is a complex image-processing problem in real world application with complex effects of illumination, occlusion, and an imaging condition on the living images. It is a combination of face detection and recognition techniques in image analyses. The detection application is used to find position of the faces in a given image. Recognition algorithm is used to classify given images with known structured properties, which are used commonly in most of the computer vision applications.

Haar cascade is a machine learning object detection algorithm used to identify objects in an image or video and based on the concept of features proposed by Paul Viola and Michael Jones in their paper “Rapid Object Detection using a Boosted Cascade of Simple Features” in 2001. It is a machine learning based approach where a cascade is trained from lots of positive and negative images. It is used to detect objects in other images. Haar cascade is based on “Haar Wavelets” which is stated as: A sequence of rescaled “square-shaped” functions which together form a wavelet family or basis. It is based on the Haar wavelet technique to analyse pixels in the image into squares by function. This uses machine learning to get high degree of accuracy from what is called “training data”.

MOTIVATION

In today's automation era, every information is being processed by the machine with the artificial intelligence and used in many sophisticated applications. Biometric-based technologies include identification based on the physical characteristics like face, fingerprint, finger geometry, hand geometry, palm, iris, retina, voice and behaviour etc. Almost all the biometric technologies require voluntary action by the user but in face recognition can be done without any need of voluntary actions.

The main motive of this project is to improve manual attendance system by using biometric attendance system. There are many drawbacks in manual attendance system as the data of student's attendance is marked on papers and then evaluated by counting which takes a very long time. It is difficult to search particular data from this system and this could also allow impersonation and loss of data and the attendance sheet could also get lost.

So, to overcome these problems we are making a system by using face recognition for attendance systems for schools/colleges. This project will make attendance system easier to the users, fast and more effective compared to manual attendance system.

OBJECTIVES

The main goal of the project was to develop an attendance system based on face recognition. The system should be easy to implement, provide fast and accurate results and should be based on minimum amount of hardware. The main feature of system would be that it reduces manual process error by providing reliable and automated attendance and highly secure system as it is based on face recognition. Unlike other attendance system, students do not need to do any manual work to mark their attendance. Finally, the system will provide a report of present students in excel format. With this project we wanted to learn a lot about OpenCV, python language - its various packets such as numpy, pandas, pillow, tkinter, etc. We also understood about machine learning basics.

PROBLEM STATEMENT

Present attendance system is manual wherein the faculty either passes on a sheet of name of students, in this method all the students have to sing in row corresponding to their name, this method is highly susceptible to proxy or the faculty calls out names of students and those who are present respond verbally, for each student response the faculty needs to confirm visually to avoid proxy. Recent development in attendance system led to making use of biometric sensor attached to tablet. This new method is highly secure but it is similar to passing a attendance sheet in procedure. All the method involves every student to perform some task to mark their attendance. This leads to time consumption and in some case leads to unnecessary chaos in the class room. Hence, we need a system in which attendance can be marked with least involvement of student and teachers.

PROPOSED SYSTEM

The proposed system of Face recognition-based attendance system is to capture faces the students by make use cascaded Harr filter. The camera feed acts as the input to the system, this camera needs to be placed such that all the faces of students present in the classroom are captured. Before the system is used photos of all the students are placed in local memory and the model is trained using these photos. When system is activated faces fetched from camera feed are compared with the images in the local memory and recognition is done. Teacher using the system has to activate it and after a brief amount of time deactivate using keyboard. Once the system is deactivated an Excel list of names of all the students present in the classroom is created on the desktop.

Chapter 2

LITERATURE SURVEY

LITERATURE SURVEY

A facial recognition system is a technology capable of identifying or verifying a person from a digital image or a video frame from a video source. There are multiple methods in which facial recognition systems work, but in general, they work by comparing selected facial features from given image with faces within a database. It is also described as a Biometric Artificial Intelligence based application that can uniquely identify a person by analysing patterns based on the person's facial textures and shape.

Pioneers of automated face recognition include Woody Bledsoe, Helen Chan Wolf, and Charles Bisson.

During 1964 and 1965, Bledsoe, along with Helen Chan and Charles Bisson, worked on using the computer to recognize human faces (Bledsoe 1966a, 1966b; Bledsoe and Chan 1965). He was proud of this work, but because the funding was provided by an unnamed intelligence agency that did not allow much publicity, little of the work was published. Based on the available references, it was revealed that the Bledsoe's initial approach involved the manual marking of various landmarks on the face such as the eye center, mouth, etc., and these were mathematically rotated by computer to compensate for pose variation. The technology was able to match 40 faces an hour (each face took approximately 90 seconds to be matched) which was considered very impressive at the time.

Fast-forward to the modern day and facial recognition has become a familiar technology when using applications such as the iPhone X's Face ID capability or MasterCard Identity Check, passport e-gates at airports and other security and access control points. These solutions implement a consensual form of identity verification, as the user has a vested interest in being identified.

This is a "one-to-one" facial recognition event, one person in front of the camera being compared to one identity either on a passport or the app. In these scenarios, the hardware is specifically developed for the application at hand, therefore technically much easier to accomplish.

"One-to-many" facial recognition is a much harder problem to solve.

It's even more challenging when the aim is to achieve successful and accurate recognition on commonly available hardware like live CCTV feeds and standard computing hardware. And unlike in the 1960's where identifying a face every 90 seconds was acceptable; the

safety and security market requires near instant feedback on who a person matched against a watch list is.

The idea behind all facial recognition technologies is broadly the same: you start with an image of a person’s face (ideally a high quality one, although machine learning means that to a point, we can now even use video without reducing accuracy). A fully front facing image is best, think a passport photo, but machine learning and new software has made this more flexible.

Facial recognition was deployed in security services in various countries such as United States, China and Australia. The U.S. Department of State operates one of the largest face recognition systems in the world with a database of 117 million American adults, with photos typically drawn from driver's license photos. Although it is still far from completion, it is being put to use in certain cities to give clues as to who was in the photo. The FBI uses the photos as an investigative tool, not for positive identification. As of 2016, facial recognition was being used to identify people in photos taken by police in San Diego and Los Angeles (not on real-time video, and only against booking photos) and use was planned in West Virginia and Dallas.

In recent years Maryland has used face recognition by comparing people's faces to their driver's license photos. The system drew controversy when it was used in Baltimore to arrest unruly protesters after the death of Freddie Gray in police custody. Many other states are using or developing a similar system however some states have laws prohibiting its use.

The FBI has also instituted its Next Generation Identification program to include face recognition, as well as more traditional biometrics like fingerprints and iris scans, which can pull from both criminal and civil databases. The federal General Accountability Office criticized the FBI for not addressing various concerns related to privacy and accuracy.

In 2019, researchers reported that Immigration and Customs Enforcement uses facial recognition software against state driver's license databases, including for some states that provide licenses to undocumented immigrants.

2.1. Face Recognition based Attendance System:

This automated attendance system uses facial recognition. It proposes that system will detect student's face whenever He/she enters the class and marks their attendance using face detection and recognition algorithms. We will be taking images of students from college database for matching purpose. As the students will enter the classroom, with the help of detection and recognition algorithm students face and images from college database will be matched so that attendance is marked.

2.2. Existing Attendance System:

2.2.1. Manual Attendance System:

Manual attendance system is still used at many places like schools, colleges, companies etc. Schools and colleges have to track the attendance of students by which they come to know how many lectures he/she have attended. Similarly, in companies the management keeps a track of employees so they can recognize which employee is late and how to pay them. The traditional method involved signatures on paper sheets which is still being used in many institutions. Manual attendance is useful if there is a smaller number of people involved.

Advantages of Manual attendance-based system are:

1. No technology expenses.
2. Simple to implement.

Disadvantages of Manual Based Attendance System are:

1. Inaccurate
2. Can be manipulated
3. High possibility of human error

2.2.2. Biometric Fingerprint Attendance System:

Biometric devices have been used by man over a long period of time. Automation in Biometric devices was first seen in the 1960s. The Federal Bureau of Investigation (FBI) in the 1960s introduced the Indentimat, which started checking for fingerprints to maintain criminal records. The first systems measured the shape of the hand and the length of the

fingers. Although discontinued in the 1980s, the system set a precedent for future Biometric Devices.

Biometrics is a Greek word and combination of two words Bio and Metrics. Bio mean life and Metrics mean the measure. Biometrics term normally refers to the study of people's biological characteristics. Now biometric technology is widely used for a single person identification and security. We can use biometrics finger scanning technique for the employee attendance management system. Now day's biometric time attendance system are becoming popular to manage attendance system. Biometric attendance system works quite efficiently.

Biometric finger print scanner system works very efficiently and quickly.

Biometric system works on few basic principles:

1. First it takes image of the finger.
2. Finger scanner save specific characteristics of every unique finger and saved in the form of biometric encrypt key.

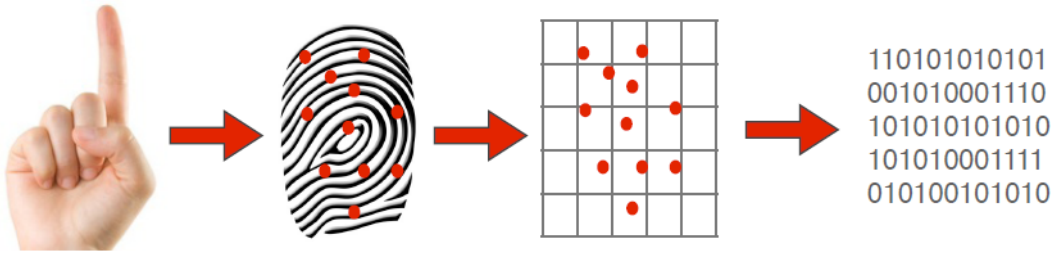

Fig 2.2.2.1. Working of Fingerprint Biometric System

There are basic two types of biometrics "Physiological" and "Behaviour". For biometric attendance system works physiological biometric technique is used.

Physiological:

Physiological biometric mean human characteristics, i.e. the shape and composition of the body. There are several ways to identify a human with the help of physiological biometric characteristics. The most commonly used physiological biometric identification can be done via face, fingerprints, hand geometry, retina, iris, signature, vein and voice.

Face: Physiological face verification can be used for identification of a person. With this technique person is identified through its facial characteristics and pattern.

Fingerprints: Finger print technique is also a part of physiological biometric. As we know that every human being fingerprint are different and unique from each other. So, we can

use this technique for biometric attendance system works. The accuracy rate of finger print scanning is very high and it is cheap technology. As compared to other physiological biometrics techniques like DNA, Iris and retina used for verification.

Retina: In physiological retina technique blood vessel at the back side of the eye is checked to match unique person retina. For this purpose, low frequency beam is used to scan retina.

Voice: The voice recognition technique can also be used for verification purpose. Each man voice tone, pitch and frequency always differ so this technique is not reliable. Because parody of any man is possible. Little change in voice because of cold or fever will stop and make it impossible to identify you.

DNA: The DNA of each human being is different and we can use this physiological biometric to identify any person uniquely. The accuracy rate of identification through DNA is very high, but this technique is very expensive.

Advantages of using biometric attendance system works.

1. Installation system of biometric attendance system is easy.
2. Biometric time attendance system works very quickly and its user interface is very friendly.
3. Accuracy rate of the biometrics attendance system is very high.
4. Finger print scanner equipment is inexpensive.
5. No one can fake or create replica your finger prints.
6. Employees can miss or forget his/her attendance cards, but not the finger.
7. Attendance system can manage a number of employee attendance data efficiently.
8. Biometric attendance system works take less than 5 seconds to recognize authorized person.
9. Biometric attendance system reduces manually data entry errors.

2.3. Viola Jones Algorithm:

The Viola-Jones Object Detection Framework is the first Detection model which availed Real-time detection rate in 2001 by Paul Viola and Michael Jones. This algorithm was created to overcome the problem of Face Detection. This algorithm can be trained according to our needs to detect various objects.

2.3.1. Prominent Features:

1. Powerful - Detection Rate is very high and very low error.
2. Face Detection only - The main goal of this model is to distinguish between faces and non-faces.
3. Real-time system: The reliability of the system is very high and Time delay is nearly zero.

2.3.2. Stages of Algorithm:

The Viola Jones algorithm has three stages:

1. Haar Feature Selection
2. Adaboost Training
3. Cascading Classifiers

2.4. Haar Feature Selection:

Haar Filter is a Machine Learning based approach where the function is trained from numerous images given by the user. This cascaded function is used to detect Object and Faces in an image. This algorithm is used to classify the images with and without faces. After classification of images, the system has to extract the prominent features of the faces, for this process Haar features are used. These features are similar to convolutional functions. Each prominent feature is extracted from an image by removing pixels under white bounding box from pixels under the black bounding box. Due to this all sizes are achieved and any feature from the face can be extracted.

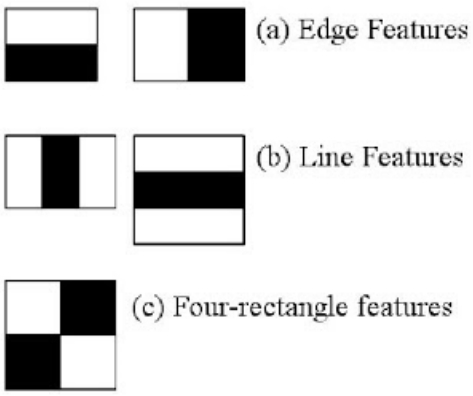

Fig 7.3.3.1. Haar feature selection

It needs a hefty processing power. The number of pixels in an image might be huge, even a small image of 100x100 can has features over 100000+. To solve this, they introduced the Integral images. Calculation of sum of pixel is much easier due to this technique. But out of all the features we extracted, only relevant features are selected out of those 100000+ possible features. This functionality is accomplished by the system called as Adaboost.

2.5. Adaboost Algorithm:

Adaboost is abbreviated from Adaptive Boosting. It is a Machine Learning algorithm based on creating a highly accurate prediction by combining many weak or incorrect results, founded by Yoav Freund and Robert Schapire This algorithm can be used along with many other suitable algorithms for better performance. It was the first practical boosting algorithm and remains the most used in various fields. The output of other algorithms is merged into a weighted sum that represents the final result of the Adaboost Classifier. Noisy data is the weakness of the Adaboost.

2.6. Cascading Classifiers:

The OpenCV library of Python consists of Trainer and Detector. We use this OpenCV library to train our face detection model. Firstly, we load our classifiers by their path. After loading the Cascade Classifiers, we take video input from the interfaced Camera. The video input will be converted into Gray-scale mode. Now when faces are detected, the classifier returns the positions of detected faces with the rectangle coordinates. Once the

location of face is found then the face will be denoted as Region of Interest (ROI) and with this same method we apply the eye detection on the same ROI.

2.7. Local Binary Pattern Histogram:

LBPH is a simple and very effective texture operator which labels the pixel of an image by thresholding the neighbour of each pixel and considers the result as binary number. Using the LBP combined with histograms we can represent the face images with a simple data vector.

2.7.1. Parameters of LBPH:

2.7.1.1. Radius:

This is used to build the circular local binary pattern and represents the radius around the central pixel. It is usually set to 1.

2.7.1.2. Neighbours:

This is the number of sample points to build the circular local binary pattern.

2.7.1.3. Grid X:

The number of cells in the horizontal direction. The more cells, the finer the grid, the higher the dimensionality of the resulting feature vector. It is usually set to 8.

2.7.1.4. Grid Y:

The number of cells in the vertical direction. The more cells, the finer the grid, the higher the dimensionality of the resulting feature vector. It is usually set to 8.

2.7.2. Working of Algorithm:

2.7.2.1. Training the Algorithm:

Initially we have to train the algorithm, this is done with the help of dataset with facial images of the people we want to recognize. An ID need to be set for each image, so that algorithm will use this information to recognize an input image and give an output. This process of setting the ID is done during training stage.

2.7.2.2. Applying the LBP operation:

The first step is to create a image that describes the original image in a better way, by highlighting facial characteristics. To do so the algorithm uses concept of sliding window, based on parameter radius and neighbour.

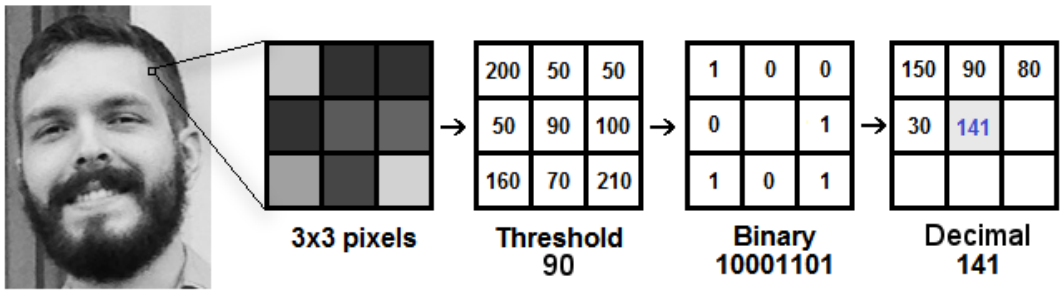

Fig 2.7.2.2.1. Practical application of LBP

2.7.3. Working of LBP operation:

First the image is converted into Gray scale. A part of image is isolated as a window of 3X3 pixels. This is simply a 3X3 matrix containing intensity of each pixel (0 - 255). The central pixel value is set to be the threshold value. This threshold is used to define new values for remaining 8 pixels. New binary values are set such that 1 for values higher or equal to threshold value and 0 for less values less that threshold value. Now the matrix will contain only binary values. All the binary values are concatenated to create a new binary value, this binary value is converted to decimal and set to the center pixel. At the end of this procedure (LBP procedure), we have a new image which represents better the characteristics of the original image.

2.7.4. Extracting the Histogram:

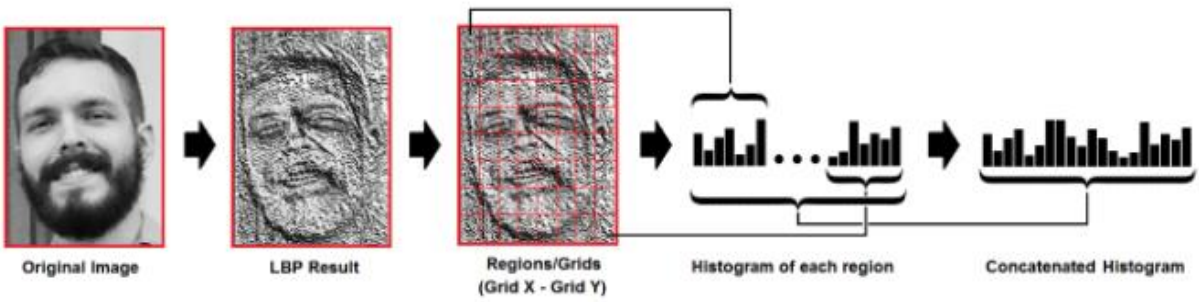

Fig. 2.7.4.1. Histogram extraction

Now with the help of image generate after LBP process, the Grid X and Grid Y parameters are used to divide image into multiple grids. As the image is a Gray scale image, each histogram will contain 256 positions (0-255) representing occurrence of each pixel. All such histograms are concatenated to create a bigger histogram. The final histogram represents the characteristics of the original image.

2.7.5. Performing the Face Recognition:

The algorithm is now trained. Each histogram represents each image from the training datasets. For input images same steps are performed and histogram is compared. This is done using Euclidean distance formula.

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

The output of algorithm is the ID of the image with the closest histogram. The algorithm also returns calculated distance which is used as confidence measurement. The confidence measurement can be used to determine successful recognition of image.

2.7.6. Advantages of LBPH algorithm:

- LBPH Method is one of the best performing texture descriptors.
- The LBP operator is robust against monotonic Gray scale transformations.
- In LBPH each image is analyzed independently, while the eigenfaces and fisher faces method looks at the dataset as a whole.
- LBPH method will probably work better than fisher faces in different environments and light conditions. It also depends on our training and testing data sets.
- It can represent local features in the images.
- LBPH can recognize both side and front faces.

Chapter 3

SYSTEM DESIGN

METHODOLOGY

Face Recognition based attendance system works on series of steps as following:

- Images Database
- Training
- Face detection
- Face Recognition
- Attendance Marking

3.1.1. Images Database:

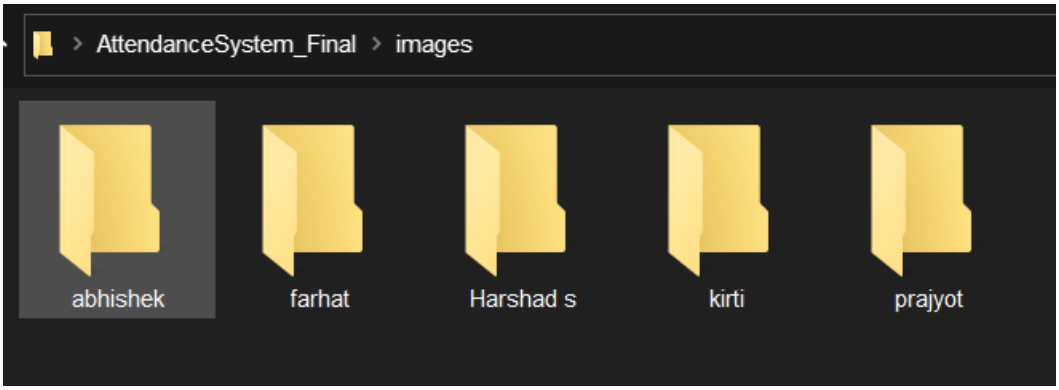

Fig. 3.1.1.1. Database of our Attendance System.

The Images Database is stored in the local memory of the system. It has a fairly simple architecture as shown above. A folder named "images" consist of multiple sub-folders, each belonging to individual student. These student sub-folders consist of images of students faces. The names of each sub-folders are the names of students, these acts as a label which are further used during recognition. This database is used for training the model and during Face recognition. This folder needs to at the same location as the application file, during training the model os walk is performed in order to access the images database.

3.1.2. Training:

By using the os walk method the images database is accessed. The images placed in the databases are used for training the model. Before they are used for training all the images are resized to same size. Now the images are converted into a Gray-scale images and further converted into numpy array. This numpy array is passed through a cascaded Haar filter. Once the training is complete a "trainner.yml" file along with "lables.pickel" files are created. The trainner.yml file is a configuration; it consists of trained data and label.pickle file is dictionary file where keys are names of student that is label and values are the generated Id. This pickle file is used during the face recognition process. This training needs to done under following conditions.

1. If the application is installed for the first time.
2. If the database of images is upgrade with new images.

3.1.3. Face Detection:

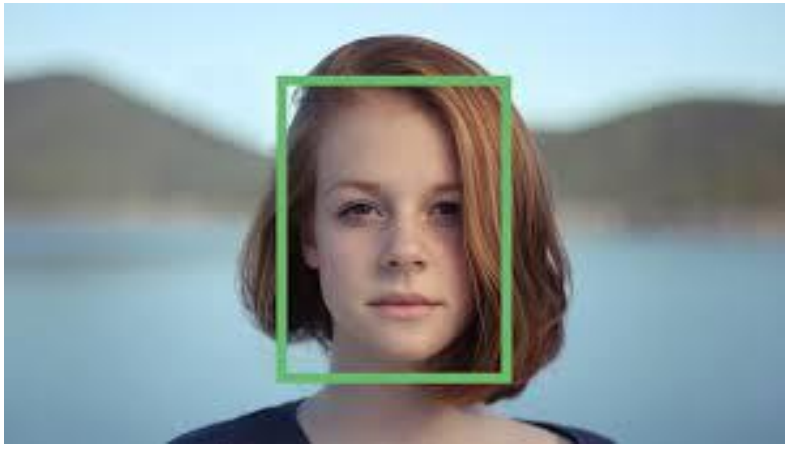

Fig. 3.1.3.1. Illustration of a Bounding box

Face detection is a process to find the location and size of the human face in a digital image. The live feed from camera is nothing but a stream continues images, these images are called as frames. These frames are converted in Gray scale. These Gray frames are passed to the "detectMultiscale()" function which creates a box around the region of face called bounding box. This function makes use of cascaded Haar filter to detect face. This generated box encloses the face, it is known as region of interest.

3.1.4. Face Recognition:

With the help of OpenCV a Local Binary Pattern Histogram recognizer is made. This recognizer is trained with the previously created "trainner.yml" file. Now the region of interest is passed to the recognizer with the predict function. This function predicts a label and associated confidence for a given input image. If the confidence falls within the range of forty-five to eighty-five Id is printed. With the help of pickle data, the id is replaced with name label. The process of face recognition is stopped using keyboard.

3.1.5. Attendance marking:

As long as the face recognition process is active the system will keep on identifying the faces in frame, all the identified faces labels i.e. Names are appended into a list. Since the process is active the system keeps on identifying same face again and again hence the list may contain same name repetitively. This stops only when a process of face recognition is deactivated. After deactivating a long list of names is created, to remove repeated names the list is converted into python dictionary. This dictionary keys as names and values as number of times names are repeated. Now this dictionary is converted into a list, hence all the elements in the list become unique. Now this list in converted into a data frame with the help of python package pandas and exported to Excel. Hence an Excel list of all the present students is generated.

TECHNOLOGY

3.2.1. OpenCV:

OpenCV is a library of programming function mainly focused on computer vision. This library is cross platform and free to use under the open source BDS license. The main uses of OpenCV library is made for face detection and face recognition.

3.2.2. Python:

Python is an interpreted, object-oriented, high-level programming language. It is used for Rapid Application Development, as well as for use as a scripting language to connect existing components together. Pythons simple, easy to learn syntax emphasizes readability and therefore reduces the cost of program maintenance. Python supports modules and packages, which encourages program modularity and code reuse. The Python interpreter and the extensive standard library are available in source or binary form without charge for all major platforms and can be freely distributed.

3.2.3. Necessary Dependencies:

Following are the python packages used for development of system.

3.2.3.1. NumPy:

It is used to convert the image into an array of numbers of same dimension as of image. Each number in the array represent the corresponding pixel vale at that position.

3.2.3.2. Pandas:

This is one of the most commonly used packages for data analysis. In our system this package is used to convert the list on names into a data frame which is further exported to Excel.

3.2.3.3. Tkinter:

This package is use to make a GUI for the system. It is used to create buttons and message box.

3.2.3.4. Pillow: This is an image processing package. It is used to resize the image in database before training.

SYSTEM REQUIREMENTS

3.3.1. Hardware Requirements:

3.3.1.1. Minimum Specifications:

A Computer running on a minimum specification of:

1. Any 1 GHz processor or faster 32-bit (x86) or 64-bit (x64)
2. 1 GB of RAM for 32-bit or 2 GB of RAM for 64-bit.
3. 1 GB of storage memory on HDD.
4. A Standard Definition Camera (480p).

3.3.1.2. Recommended Specifications:

A Computer running on a recommended specification of:

1. Any 1 GHz processor or faster 32-bit (x86) or 64-bit (x64)
2. 2 GB of RAM for 32-bit or 4 GB of RAM for 64-bit.
3. 10 GB of storage memory on HDD.
4. A High Definition Camera (720p or 1080p).

3.3.2. Software Requirements:

1. Python Interpreter.
2. Advanced Text Editor with Integrated Development Environment (IDE) in our case ‘Sublime Text 3’.
3. Drivers to run third-party camera.
4. Python libraries viz. ‘tkinter’, ‘numpy’, ‘opencv’, ‘pickle’, ‘pandas’, ‘pillow’, ‘os’.

DESIGN

3.4.1. Block Diagram:

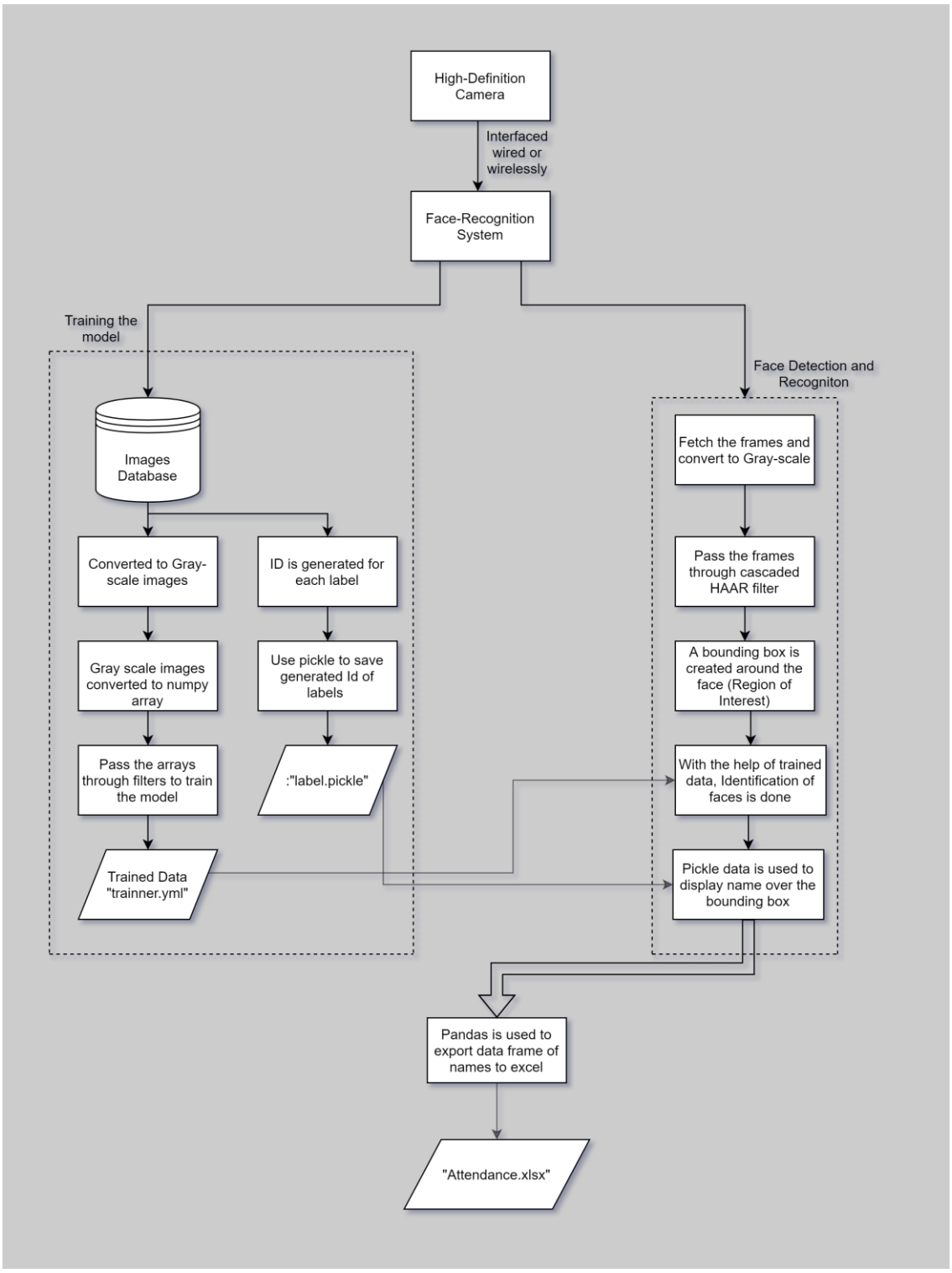

Fig 3.4.1. Block Diagram of our System

3.4.2. Python Program Code:

```
import tkinter as tk
from tkinter import messagebox
from tkinter import *
root = tk.Tk()

def main():
    import numpy as np
    import cv2
    import pickle
    import pandas as pd

    face_cascade = cv2.CascadeClassifier('cascades/data/haarcascade_frontalface_alt2.xml')
    eye_face = cv2.CascadeClassifier('cascades/data/haarcascade_eye.xml')
    #profile_face = cv2.CascadeClassifier('cascades/data/haarcascade_profileface.xml')
    recognizer = cv2.face.LBPHFaceRecognizer_create()
    recognizer.read("trainner.yml")

    name1=[]
    labels={"person name":1}
    with open("labels.pickle","rb") as f:
        og_labels=pickle.load(f)
        labels={v:k for k,v in og_labels.items()}

    #Capture the input from the system camera
    cap = cv2.VideoCapture(0)

    while(True):
        # Capture frame-by-frame
        ret, frame = cap.read()
        gray = cv2.cvtColor(frame, cv2.COLOR_BGR2GRAY)
    #face bounding box
        faces=face_cascade.detectMultiScale(gray, scaleFactor=1.5, minNeighbors=5)
        for(x,y,w,h) in faces:
            #print(x,y,w,h)
            roi_gray= gray[y:y+h, x:x+w]
            roi_color= frame[y:y+h, x:x+w]

            id_,conf=recognizer.predict(roi_gray)

            if conf>=45 and conf <=85:
               print(id_)

            print(labels[id_])
            font=cv2.FONT_HERSHEY_SIMPLEX
            name=labels[id_]
            name1.append(labels[id_])
            color=(255,125,205)
            stroke=2
            cv2.putText(frame, name, (x,y), font, 2, stroke)

            img_item= "my-image.png"
            cv2.imwrite(img_item, roi_gray)

            color= (255, 0, 0)
            stroke= 2
            end_cord_x= x+w
            end_cord_y= y+h
            cv2.rectangle(frame, (x,y), (end_cord_x, end_cord_y), color, stroke,cv2.LINE_8)
            #eye bounding box
            eyes=eye_face.detectMultiScale(roi_gray)
            for(ex,ey,ew,eh) in eyes:

                cv2.rectangle(roi_color,(ex,ey),(ex+ew,ey+eh),(0,255,0),2)

        # Display the resulting frame
        cv2.imshow('frame',frame)
        if cv2.waitKey(20) & 0xFF == ord('q'):
            break


 # When everything done, release the Capture
    cap.release()
    cv2.destroyAllWindows()

    name2=name1
    NList=[]
```

```
    popo=list(og_labels.keys())
    s=set(popo)
    name1=list(dict.fromkeys(name1))
    NList=[x for x in name1 if x in s]
    NList=["PRESENT STUDENTS"]+NList

    filename="attendance"
    df = pd.DataFrame(NList)
    df.to_excel(r'C:|Users|Vaibhav|Desktop|vaibhav|be project|FaceRecog|New_attendance.xlsx', index
= True)

    t = Text(root)
    for x in NList:
        t.insert(END, x + '|n')
    t.pack()

btn=tk.Button(root,text="Start Attendance",command=main,padx=5,pady=5,relief=GROOVE,width=15)
btn.pack()

def FaceTrain():
    import os
    from PIL import Image
    import numpy as np
    import cv2
    import pickle    #pip install opencv-contrib-python

    face_cascade = cv2.CascadeClassifier('cascades/data/haarcascade_frontalface_alt2.xml')
    recognizer = cv2.face.LBPHFaceRecognizer_create()

    BASE_DIR =os.path.dirname(os.path.abspath(__file__))  #to find the location of faces_train.py in os
    IMAGE_DIR= os.path.join(BASE_DIR, "images")           #to find files called images in same file

    current_id=0
    label_ids={}
    y_labels=[]
    x_tain=[]

    for root,dirs,files in os.walk(IMAGE_DIR):
        for file in files:
            if file.endswith("png") or file.endswith("jpg"):
                path=os.path.join(root,file)
                label=os.path.basename(os.path.dirname(path)).replace(" ","-").lower()
                #print(label,path)
                if not  label in label_ids:
                    label_ids[label]=current_id
                    current_id += 1

                id_=label_ids[label]
                print(label_ids)

                pil_image = Image.open(path).convert("L")  #gray scale
                size = (1024,1024)
                final_image = pil_image.resize(size, Image.ANTIALIAS)

                image_array=np.array(final_image, "uint8") #convert image into numbers
                #print(image_array)
                faces= face_cascade.detectMultiScale(image_array, scaleFactor=1.5, minNeighbors=5)
                for (x,y,w,h) in faces:
                    roi= image_array[y:y+x , x:x+w ]
                    x_tain.append(roi)
                    y_labels.append(id_)

    #print(y_labels)
    #print(x_tain)

    with open("labels.pickle","wb") as f:
        pickle.dump(label_ids, f)

    recognizer.train(x_tain,np.array(y_labels))
    recognizer.save("trainner.yml")

    messagebox.showinfo("Message","Training complete")

btn2=Button(root,text="Train Faces",width=10,command=FaceTrain)
btn2.place(relx=0.5,rely=0.5,anchor='sw')
btn2.pack()
root.mainloop()
```

Chapter 4

EXPERIMENTS AND RESULTS

EXPERIMENTS

4.1. Feasibility study:

Feasibility of a project is a study that if a project is worth the cost of time and resources. This study needs to be done very carefully, if not done properly this may lead to huge wastage of time and resources to individual or organization.

4.1.1. Technical Feasibility:

Technical feasibility focus on the technical resources ie. software and hardware available to the organization or individual. This help to determine whether the technical team can convert this idea into a working system. The software required for our project are Sublime Text3 text editor, Python IDLE, OpenCV. All the required software are open source. The only hardware required is a camera. This can be an external camera or inbuilt camera.

4.1.2. Economic Feasibility:

This involves cost/benefit analysis of this project. This project developed is majorly software based hence there is no cost involved. For the development of project an inbuilt camera was used. During implementation, camera interfacing can be done.

4.1.3. Operational Feasibility:

This assessment involves undertaking a study to analyze and determine whether and how well the organization’s needs can be met by completing the project. The main objective of the project is to implement face detection method for attendance marking process, simplify and minimize the involvement for user of the system and completely make it independent of people whose attendance is to be marked.

4.1.4. Resource Feasibility:

The number of people working for the project and the technical resources provided are deemed to be adequate of nature after due analysis and hence resource feasibility of the project is good.

TESTS AND RESULTS

4.2.1. Testing Trainer module:

The objective of this test is to find out if the trainer module works as per desire. Once the training is complete it is expected to associate same labels to photos within a student folder which will be used during prediction and to generate a trainner.yml folder which will hold the configuration data of trained images.

```
{'amitojas-d': 0, 'ashitosh-k': 1, 'gayatri-k': 2, 'harshad-s': 3, 'priti-b': 4, 'vaibhav-s': 5}
{'amitojas-d': 0, 'ashitosh-k': 1, 'gayatri-k': 2, 'harshad-s': 3, 'priti-b': 4, 'vaibhav-s': 5}
{'amitojas-d': 0, 'ashitosh-k': 1, 'gayatri-k': 2, 'harshad-s': 3, 'priti-b': 4, 'vaibhav-s': 5}
{'amitojas-d': 0, 'ashitosh-k': 1, 'gayatri-k': 2, 'harshad-s': 3, 'priti-b': 4, 'vaibhav-s': 5}
{'amitojas-d': 0, 'ashitosh-k': 1, 'gayatri-k': 2, 'harshad-s': 3, 'priti-b': 4, 'vaibhav-s': 5}
{'amitojas-d': 0, 'ashitosh-k': 1, 'gayatri-k': 2, 'harshad-s': 3, 'priti-b': 4, 'vaibhav-s': 5}
[Finished in 8.5s]
```

Fig 4.2.1.1. Faces training module

cascades	2/9/2020 6:20 PM	File folder	
images	2/9/2020 6:21 PM	File folder	
Face_recog	3/22/2020 1:10 PM	PY File	3 KB
Face_train	2/9/2020 6:29 PM	PY File	2 KB
labels.pickle	2/27/2020 9:20 AM	PICKLE File	1 KB
trainner.yml	2/27/2020 9:20 AM	YML File	3,333 KB

Fig 4.2.1.2. Project Library

Hence after performing the test we observe,

1. Label ID is generated for all the training data (*Fig 4.2.1.1.*),

2. New files viz. labels. pickle and trainner.pickle are generated (*Fig 4.2.1.2.*)

4.2.2. Testing Face detection and recognition module:

Here we compile our code to see if face detection is being performed. If a face is being detected by our system, a bounding box will be generated around it. To perform test on face recognition module first the system is trained with students' images database.

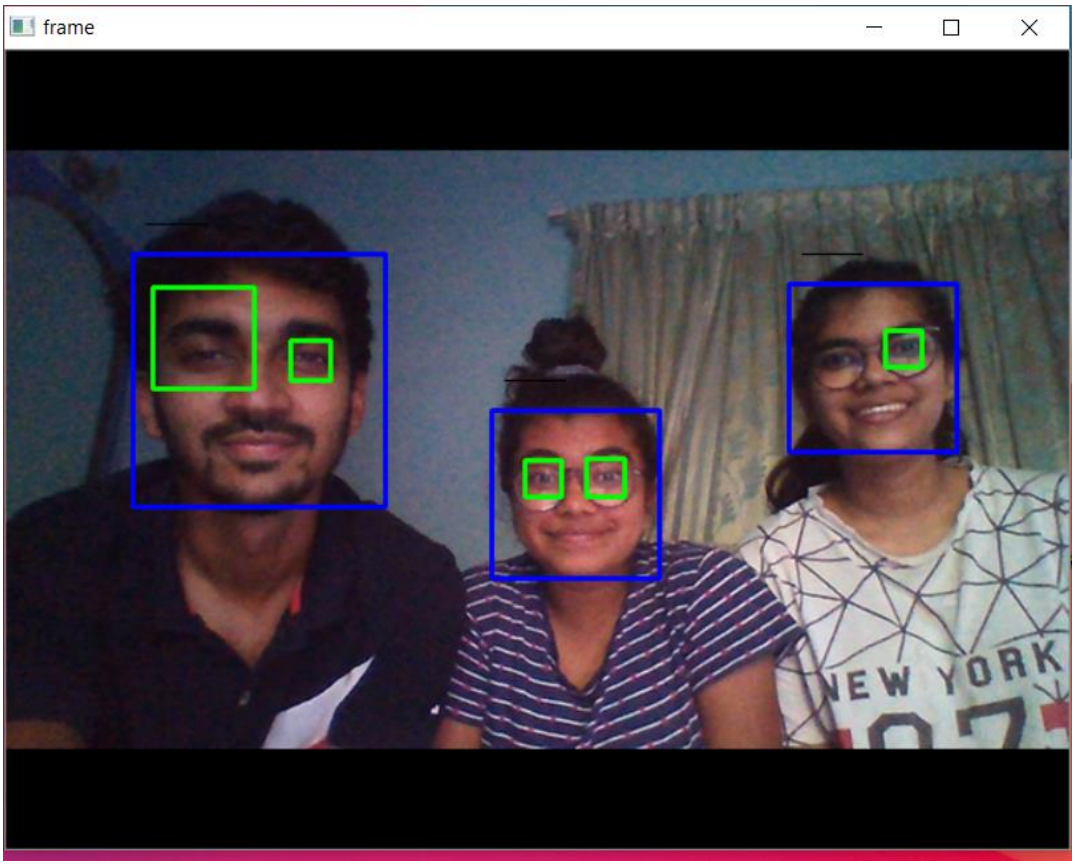

Fig 4.2.2.1. Test and Results

```
['gayatri-k', 'harshad-s', 'vaibhav-s']
[Finished in 12.4s]
```

Fig 4.2.2.2. Output list of present students

Hence, we observe that,

1. Face is being detected by our system.
2. Multiple faces are being detected in a single frame.
3. Multiple faces are being recognized in a single frame.
4. The process of face detection gets terminated when keyboard key 'Q' is pressed. As the process ends the list of all the recognized names is displayed in the terminal.

4.2.3. Testing GUI and updating of excel:

In this test we check our GUI and also check weather attendance excel get updated.

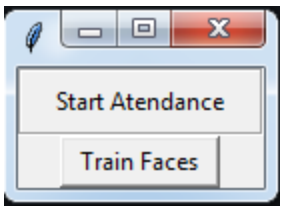

Fig 4.2.3.1. Command buttons

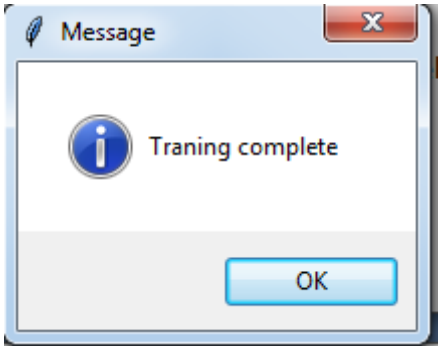

Fig 4.2.3.2. Message box created after completion of training.

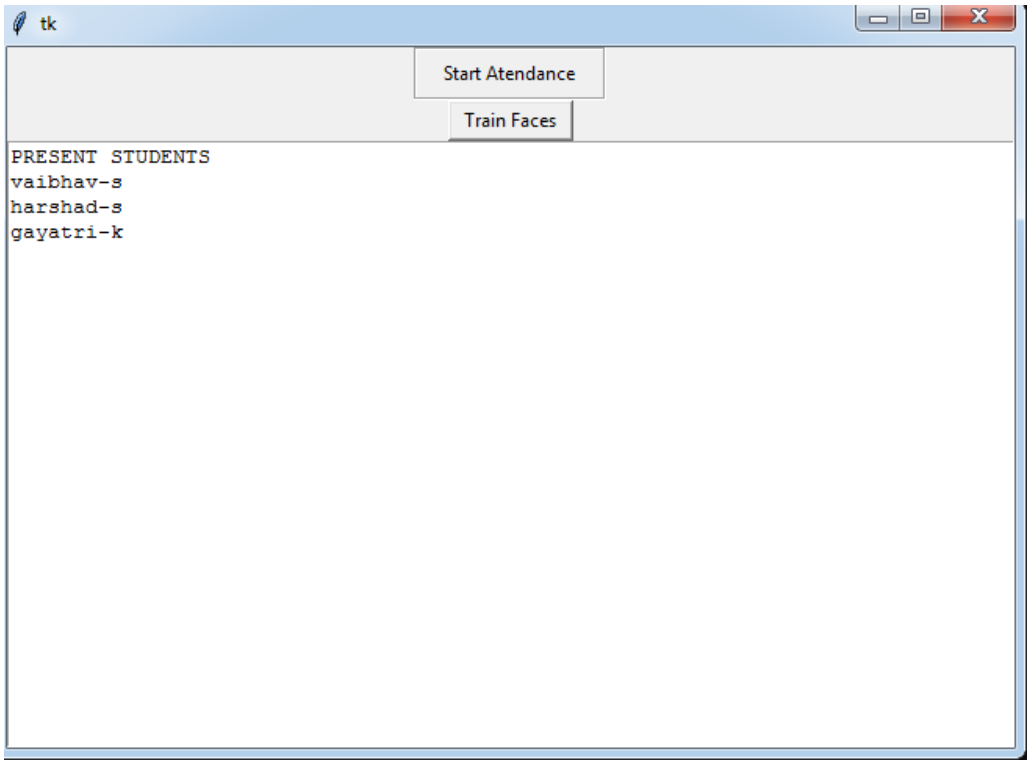

Fig 4.2.3.3. Generated list of present students.

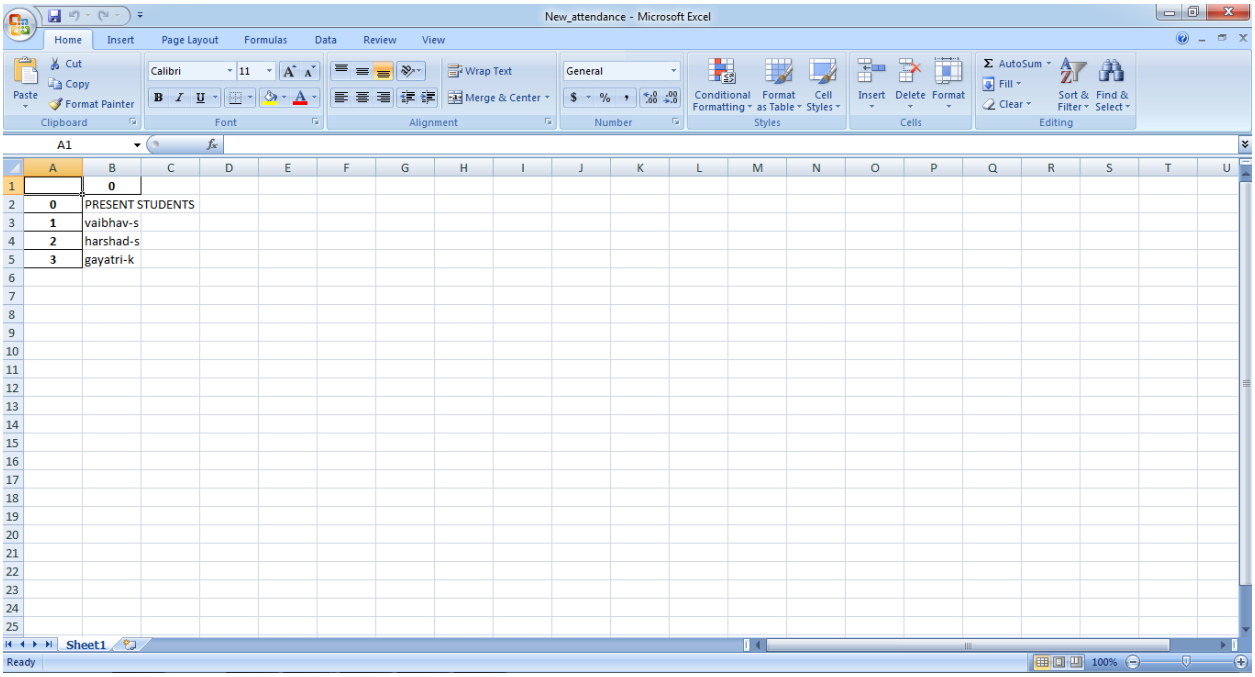

Fig 4.2.3.4. Excel output

Excel updated after completion deactivation of recognition process.

Hence after completing the test we observed that the GUI is completely functional and the attendance excel list gets updated after deactivating the face recognition process.

Chapter 5

CONCLUSION

CONCLUSION

We have achieved an Image Recognition technique using Python Environment to monitor the student attendance in a school/college/organization. The simulation results have been successfully verified and the system has been tested for various data sets. Our script successfully processes the video input to match the data sets. We have implemented our algorithm on various data sets and found that it successfully marks attendance or absence in a particular organization.

Therefore, our main goal of obtaining a portable efficient Attendance management system at a very low cost is accomplished.

Chapter 6

FUTURE SCOPE

SCOPE OF PROJECT

6.1. Find missing person:

Face recognition can be used to find missing children and victims of human trafficking. As long as missing individuals are added to a database, law enforcement can become alerted as soon as they are recognized by face recognition—be it an airport, retail store or other public space.

6.2. Tracking students in Schools or College premises:

Face recognition has the potential to track student's presence in premises. Traditionally, attendance sheets can allow students to sign another student, who is bunking. But by using face recognition we can ensure students aren't skipping class and track them. Surveillance systems can be used to scan students' faces and match their photos against a database to validate their identities.

6.3. Control access to sensitive areas:

Face recognition can work as a means of access control to ensure that only authorized individuals get into facilities like labs, boardrooms, bank vaults, training centers for athletes and other sensitive locations.

6.4. Aid Forensic Investigations:

Facial recognition can aid forensic investigations by automatically recognizing individuals in security footage or other videos. Face recognition software can also be used to identify dead or unconscious individuals at crime scenes.

6.5. Validate identity at ATMs:

It seems likely that face scans will eventually replace ATM cards completely since face recognition is such a powerful identity authentication tool. But in the meantime, face recognition can be used to make sure that individuals using ATMs cards are who they say they are. Face recognition is currently being used at ATMs in Macau to protect peoples' identities.

Chapter 7

TIMELINE OF OUR PROJECT

TIMELINE CHART

Sr. No.	Week	Activity
1.	Week 1 Week 2	Discussed various project idea with the project guide.
2.	Week 3	Finalization of project idea with project guide.
3.	Week 4 Week 5	Referred paper on face recognition-based attendance system by various authors and publications.
4.	Week 6 Week 7	Find the problem statement and referred the books related to image processing and machine learning
5.	Week 8	First project Review
6.	Week 9 Week 10 Week 11	Studying machine learning techniques, Python language and OpenCV.
7.	Week 12 Week 13	Understanding working oh Haar filter and Local Binary Pattern Histogram Algorithm.
8.	Week 14	Second Project Review
9.	Week 15 Week 16 Week 17	Creating face recognition and face detection module.
10.	Week 18	Creating database and testing the face detection module.
11.	Week 19 Week 20	Improving the database and testing the face recognition module.
12.	Week 21 Week 22	Learning to create a GUI for the system.
13.	Week 23	Combining both the modules and creating a complete GUI for the system.
14.	Week 24	Discussed with the Guide about the final outcome of project and corrections to be made.
15.	Week 25	Interfacing mobile camera using third party software.
16.	Week 26	Creating an installable file for the system and testing it on other computers.
17.	Week 28	Complete project is ready.

Chapter 8

REFERENCES

REFERENCES

1. Nandhini R, Duraimurugan N, S.P. Chokkalingam, “Face Recognition Based Attendance System” ISSN: 2249-8958, Volume-8, Issue-3S, February 2019.
2. Gondole D., Salunkhe P. A., “Face Recognition Based On Local Binary Pattern” ISSN: 2395-1990, Volume-4, Issue-1, 2018.
3. Sawhney S., Kacker K., Jain S., Singh S. N., Garg R., “Real-time Smart Attendance system using Face-recognition Techniques” 978-1-5386-5933-5/19/ 2019 IEEE.
4. Viola P., Jones M., “Rapid Object detection using a Boosted Cascade of Simple Features” Accepted Conference on Computer Vision and Pattern Recognition 2001.
5. Ahmad F., Najam A., Ahmed Z., “Image-based Face Detection and Recognition: State of the Art”.
6. https://docs.opencv.org/3.4/db/d28/tutorial_cascade_classifier.html
7. http://www.willberger.org/cascade-haar-explained/
8. https://www.cs.princeton.edu/~schapire/papers/explaining-adaboost.pdf
9. https://becominghuman.ai/face-detection-using-opencv-with-haar-cascade-classifiers-941dbb25177
10. https://opencv-python-tutroals.readthedocs.io/en/latest/py_tutorials/py_objdetect/py_face_detection/py_face_detection.html#haar-cascade-detection-in-opencv
11. https://www.researchgate.net/publication/262875649_Design_of_a_Face_Recognition_System
12. https://www.securityinformed.com/insights/evolution-facial-recognition-body-cams-video-co-7121-ga.1535016202.html
13. https://en.wikipedia.org/wiki/Facial_recognition_system
14. https://solutiondots.com/blog/biometric-attendance-system-works/
15. https://en.wikipedia.org/wiki/Biometric_device
16. https://www.mantratec.com/Solutions/Biometrics-Attendance-System
17. https://www.bioenabletech.com/biometric-attendance-system.html