A Thesis/Project/Dissertation Report
on

ATTENDENCE MANAGEMENT SYSTEM USING OPENCV

Submitted in partial fulfilment of the requirement
for the award of the degree of
BACHELOR OF TECHNOLOGY COMPUTER SCIENCE AND ENGINEERING (HONS.)

Under The Supervision of
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SCHOOL OF COMPUTING SCIENCE AND ENGINEERING DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING / DEPARTMENT OF COMPUTERAPPLICATION
GALGOTIAS UNIVERSITY, GREATER NOIDA
INDIA
December,2021

SCHOOL OF COMPUTING SCIENCE AND ENGINEERING
GALGOTIAS UNIVERSITY, GREATER NOIDA
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We hereby certify that the work which is being presented in the thesis/project/dissertation, entitled "ATTENDENCE MANAGEMENT SYSTEM USING OPENCV" in partial fulfilment of the requirements for the award of the submitted in the School of Computing Science and Engineering of Galgotias University, Greater Noida, is an original work carried out during the period of month, Year to Month and Year, under the supervision of Dr. Shobha Tyagi, Department of Computer Science and Engineering/Computer Application and Information and
Science, of School of Computing Science and Engineering, Galgotias University, Greater Noida the matter presented in the thesis/project/dissertation has not been submitted by me/us for the award of any other degree of this or any other places.
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This is to certify that the above statement made by the candidates is correct to the best of my knowledge.

Supervisor Name
Designation

CERTIFICATE

The Final Thesis/Project/ Dissertation Viva-Voce examination of Kundan Prakash (18021011562) Md Amir Azam (18021050135) has been held on _____ and his/her work is recommended for the award of B.Tech.

Signature of Examiner(s) Signature of Supervisor(s)

Signature of Project Coordinator Signature of Dean

Date: December, 2021
Place: Greater Noida

Acknowledgement

I would like to acknowledge the great efforts and precious time given by our faculty (Dr Shobha Tyagi) Assistant Professor Galgotias university Greater Noida, Uttar Pradesh School of Computing Science and Engineering. We were able to complete my job thanks to great advice and criticism. We'd also want to thank our parents for their constant support and care. Last but not least, without our team support , we would not have been able to do what we do.

Abstract

This paper will show how we can implement algorithms for face detection and recognition in image processing to build a system that will detect and recognise frontal faces of students in a classroom. “A face is the front part of a person’s head from the forehead to the chin, or the corresponding part of an animal” . In human interactions, the face is the most important factor as it contains important information about a person or individual. All humans have the ability to recognise individuals from their faces. The proposed solution is to develop a working prototype of a system that will facilitate class control for Kingston University lecturers in a classroom by detecting the frontal faces of students from a picture taken in a classroom. The second part of the system will also be able to perform a facial recognition against a small database. In recent years, research has been carried out and face recognition and detection systems have been developed. Some of which are used on social media platforms, banking apps, government offices e.g., the Metropolitan Police, Facebook etc.

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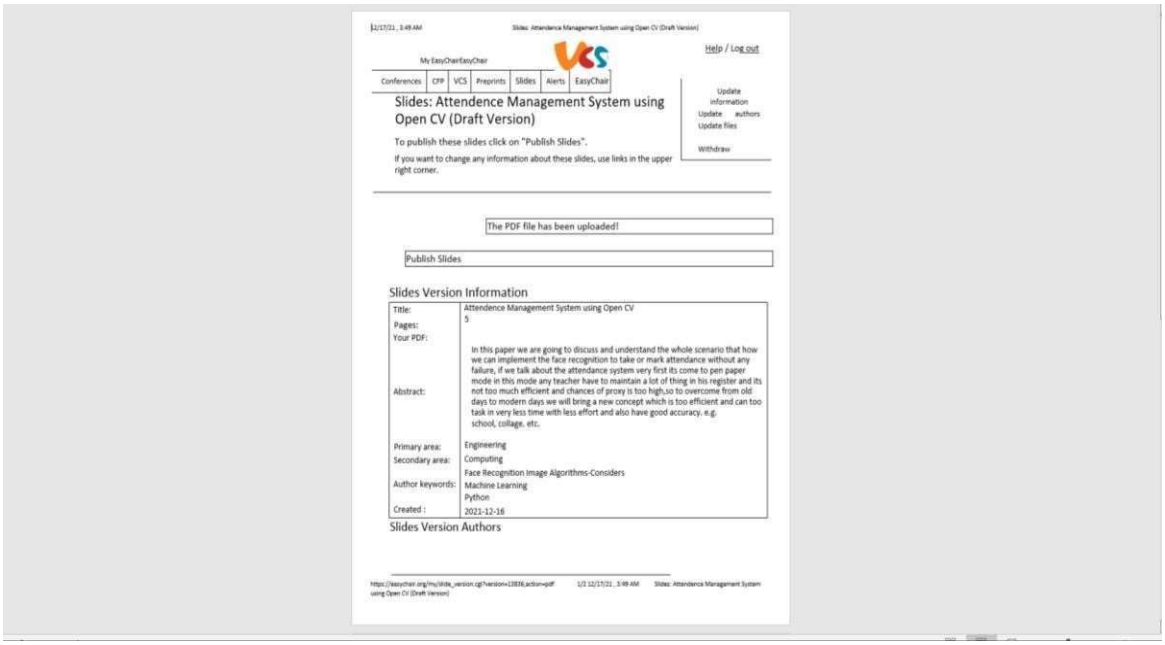
Chapter-1

1.1 Introduction

In Face Recognition and Recognition Systems, the flow process begins with the ability to detect and detect front faces from the input device i.e. mobile. In today's world, it has been proven that students participate better during learning time only when there is effective classroom control. The need to involve higher education is very important. Comparisons can be made for pilots as described by Mundschenk et al (2011 p101) In the same way students need to be continuous during learning and one of the ways is to identify and name them. Therefore, a program like this will improve classroom control. From my own experience based on experience, during my time as a teacher, I saw naming the student gave me more control over the classroom and this attracted the attention of other students in the class to participate during lectures. Facial recognition and recognition is nothing new in our society. The human ability to know certain people is amazing. It is amazing how the human mind can persist in seeing certain people over time, despite the slightest change in appearance. Anthony (2014 p1) reports that, due to the amazing ability of the human brain to produce good image detection and human facial recognition, this has attracted a great deal of attention from researchers to use time to find algorithms that will duplicate active facial recognition on human electronic systems. Wang et al (2015 p318) states that "the face search procedure is called face detection. Face detection to search for faces with a variety of shapes, sizes and angles in images that have a complex and background light and that feeds the facial contours back. Face recognition processes images and identifies one or more faces in a photo by analysing patterns and comparing them. This process uses algorithms that extract features and compare them to a database to find similarities. In addition, in one recent study, Nobel (2017, p. 1), suggested that DNA techniques could alter face recognition technology, using video analysis software that could be improved as a result of further advances in research in DNA analysis. By doing so, camera based testing software is software that analyses DNA sequences, treating video as a genetic mutation similar to DNA, detecting and detecting human faces.

Publication/ Screen Shots



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Primary area:	Engineering
Secondary area:	Computing
Author keywords:	Face Recognition Image Algorithms-Considers Machine Learning Python
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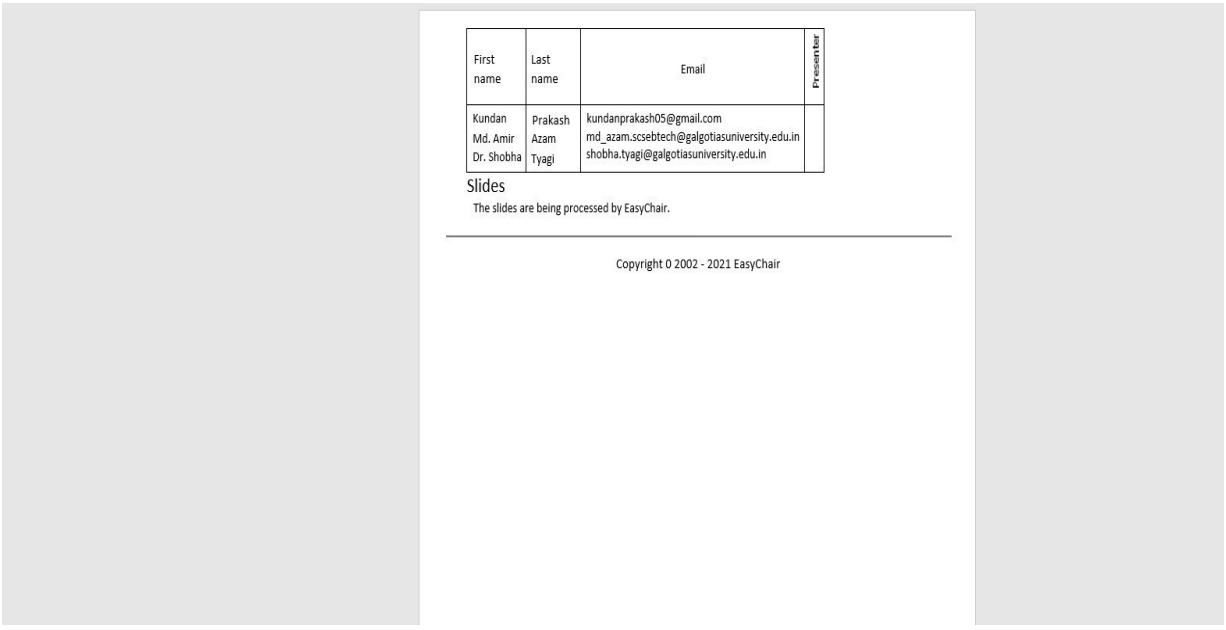

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1.2 Formulation of Problem

This project is being carried out due to the concerns that have been highlighted on the methods which lectures use to take attendance during lectures. The use of clickers, ID cards swiping and manually writing down names on a sheet of paper as a method to track student attendants has prompted this project to be carried out. This is not in any way to criticize the various methods used for student attendance, but to build a system that will detect the number of faces present in a classroom as well as recognizing them. Also, a teacher will be able to tell if a student was honest as these methods mentioned can be used by anyone for attendance records, but with the face detection and recognition system in place, it will be easy to tell if a student is actually present in the classroom or not.

- EXISTING SYSTEM

The Existing system is a manual entry for the Admin and also Faculty. Here the attendance will be carried out in the hand written registers. Maintaining the records for the Faculty is a tedious job. The retrieval of the information is not as easy as the records are maintained in the registers.

- PROPOSED SYSTEM

In order to overcome the drawbacks in existing system, a Web application has developed for daily attendance of students using face recognation. The system consists of two actors one is Admin and another is Faculty, Admin is a super user who can create any Faculty, Student, Class details and Broadcast SMS etc. Faculty user can able to update an Attendance which has been taken in the XL Sheets. It is made easy to access the attendance information of a particular student. The information regarding the attendance is sent by the Faculty to the admin for related class which has been taken using the XL Sheet given to them. This application is helpful in evaluating the attendance eligibility of a student. The purpose is to computerize the tradition way of taking attendance and generating of report automatically at the end or between of the session.

- Advantages of proposed system:

Ease up the process of attendance.

Easy Analysis of data.

Better user interface.

Reduced dependency on natural resources for paper.

Easy generation of summary of attendance.

Provide communication between Faculty and parents.

1.2.1 tools & Technology Used

1.	OPERATING SYSTEM(WINDOWS,LINUX)
2.	ANACONDA
3	PYTHON IDE

TECHNOLOGY

1	MACHINE LEARNING
2	FACE RECOGNATION
3	TIKENTER

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- Technical Feasibility: -

The system being developed is economic with respect to student attendance. It is cost effective in the sense that it has eliminated the attendance work completely. The system is also time effective because the calculations are automated which are made at the end of the month or as per the student requirement. The result obtained contains fewer errors and are highly accurate as the data is required.

- Economical Feasibility:-

The technical requirement for the system is economic and it does not use any other additional Hardware and software. The design part of the attendance monitoring system is divided into two sections which consist of the hardware and the software part. Before the software The design part can be developed, the hardware part is first completed to provide a platform for the software to work. Before the software part we need to install some libraries for effective working of the application. We install OpenCV and Numpythrough Python. 3.1

Hardware Development

- Camera Module with good mega pixels.
- Power Supply Cable
- 16Gb Micro SD Card Class 10 3.2 Libraries Development “3.2.1 OpenCV” OpenCV (Open source computer vision) is a library of programming functions mainly aimed at real-time computer vision. The OpenCV project was initially an Intel Research initiative to advance CPUintensive applications, part of a series of projects including real-time raytracing and 3Ddisplay walls. The main contributors to the project included several optimization experts in Intel Russia, as well as Intel's Performance Library Team. In the early days of OpenCV, the goals of the project were described as
- Advance vision research by providing not only open but also optimized code for basic vision infrastructure. No more reinventing the wheel.

- Disseminatevision knowledge by providing a common infrastructure that developers could build on, so that code would be more readily readable and transferable.
- Advance vision-based commercial applications by making portable, performance-optimized code available for free – with a license that did not require code to be open or free itself. OpenCV's application areas include:
- 2D and 3D feature toolkits
- Egomotion estimation
- Facial recognition system
- Gesture recognition
- Human–computer interaction (HCI)
- Mobile robotics
- Motion understanding
- Object identification
- Segmentation and recognition
- Stereopsis stereo vision: depth perception from 2 cameras
- Structure from motion (SFM) • Motion tracking
- Augmented reality To support some of the above areas, OpenCV includes a statistical machine learning library that contains:
- Boosting
- Decision tree learning
- Gradient boosting trees
- Expectation-maximization algorithm
- k-nearest neighbour algorithm
- Naive Bayes classifier
- Artificial neural networks
- Random forest
- SVM

Versions of OpenCV:

- Deep neural networks (DNN)The first alpha version of OpenCV was released to the public at the IEEE Conference on Computer Vision and Pattern Recognition in 2000, and five betas were

released between 2001 and 2005. The first 1.0 version was released in 2006. A version 1.1 "prerelease" was released in October 2008.

- The second major release of the OpenCV was in October 2009. OpenCV 2 includes major changes to the C++ interface, aiming at easier, more type-safe patterns, new functions, and better implementations for existing ones in terms of performance (especially on multi-core systems). Official releases now occur every six months and development is now done by an independent Russian team supported by commercial corporations.
- In August 2012, support for OpenCV was taken over by a non-profit foundation OpenCV.org, which maintains a developer and user site.
- On May 2016, Intel signed an agreement to acquire Itseez, a leading developer of OpenCV. Programming Language: There are bindings in Python, Java and MATLAB/OCTAVE. The API for these interfaces can be found in the online documentation. Wrappers in other languages such as C#, Perl, Ch, Haskell, and Ruby have been developed to encourage adoption by a wider audience. Since version 3.4, OpenCV.js is a JavaScript binding for selected subset of OpenCV functions for the web platform. Operating System Support: All of the new developments and algorithms in OpenCV runs on the following desktop operating systems: Windows, Linux, macOS, FreeBSD, NetBSD, OpenBSD. OpenCV runs on the following mobile operating systems: Android, iOS, Maemo, BlackBerry 10. The user can get official releases from Source Forge or take the latest sources from GitHub. OpenCV uses Cake. “3.2.2 NumPy” NumPy is a package that defines a multi-dimensional array object and associated fast math functions that operate on it. It also provides simple routines for linear algebra and fft and sophisticated randomnumber generation. NumPy replaces both Numeric and Num array

Example demonstrating NumPy:

```
from numpy import *
from PIL import Image
ar = ones((100,100),float32)
ar = ar * 100
for i in range(0,100):
ar[i,:] = 100 + (i * 1.5)
im = Image.fromarray(ar,"F")
```

Fig-1 Example to Demonstrate NumPy

The numpy namespace includes all names under the numpy.core and numpy.lib namespaces as well. Thus, import numpy will also import the names from numpy.core and numpy.lib. This is the recommended way to use numpy.

Chapter-2

2.1 Literature Survey

“Web Based Student Information Management”, S.R.Bharamagoudar et al., this paper assist in automating the existing manual system. It can be monitored and controlled remotely. This paper provides accurate information always. All years together gathered information can be saved and can be accessed at any time. The purpose is to design a college website which contains up to date information of the college. That should improve efficiency of college record management. “Attendance Management System G.Gangagowri et al., this system is used Way to SMS software. This software is used to send SMS easily to their parent’s. This system can store their data about the students and those cares absent student details. It is an efficient method to store the attendance in the Web Site rather than wasting the paper. It also updates the student report directly on the server reducing the faculty’s time on logging from the computer. “Online Student Attendance System”, P. N. Garad et al, in this project, we gave access to three user i.e. Admin, Student, Others. This project is based on client-server. Here, the serve is Tomcat and client is JSP. In this project teachers or the admin will be filling attendance and sending message to the student who is absent. They will have privilege to fill attendance form, update attendance form, send message to the guardian’s account whose child is absent, also those attendance is less than 75%, and they also have privilege to send message to the students whose fees are pending. he staff can also view the message whenever they want and also can modify the details of students. Parents have privilege to view attendance and to view message sent by the teacher. Students also have their account with the privilege to view message sent by the subject teacher and to view the attendance. “Web Based Coaching Institute Management System”, Mayuri Kamble et al, “Coaching Institute Management System” software developed for an institute has been designed to achieve maximum efficiency and reduce the time taken to handle the storing activity. It is designed to replace an existing manual record system thereby reducing time taken for calculations and for storing data. The system is strong enough to withstand regressive daily operations under conditions where the database is maintained and cleared over a certain time of span. The implementation of the system in the organization will considerably reduce data entry, time and also provide readily calculated reports. “Classroom Attendance Application”, Pranjul Khare1 et al, the scope of the project is the system

on which the software is installed, i.e. the project is developed as an ANDROID application, and it will work for a particular institute. Android is a mobile operating system (OS) based on the Linux kernel and currently developed by Google with a user interface based on direct manipulation. RAD approaches to software development have put less emphasis on planning tasks and more emphasis on development. It has revealed that an online system for recording and reporting students 'attendances is indeed a needed application in order to make the process more efficient and timesaving where more than 70% of the sample group agreed to that matter.

- Project Design

PHASE ONE

In Phase One We are going to build graphical user interface (GUI) for our project. The GUI of Our project is totally developed with help of Python(TKINTER MODULE). In GUI we are going to build a window that will take name , ID , Take picture , Train image and clear buttons As an input and after taking that input it will store it into the xml file. In face 1 we are generally construct the templete or user interface of our project.

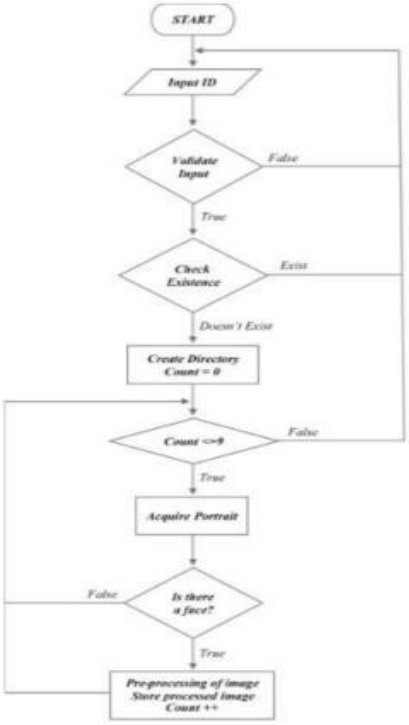

Fig2 :- Flow Chart of the image retrieval process

PHASE TWO

In Phase Two we are going to work on face detection . In which we are going to capture the images and save it in a file . after taking the images it would store the name , id in xml file . After taking the images we are need to train it after training it would take sample of 60 images and store it for

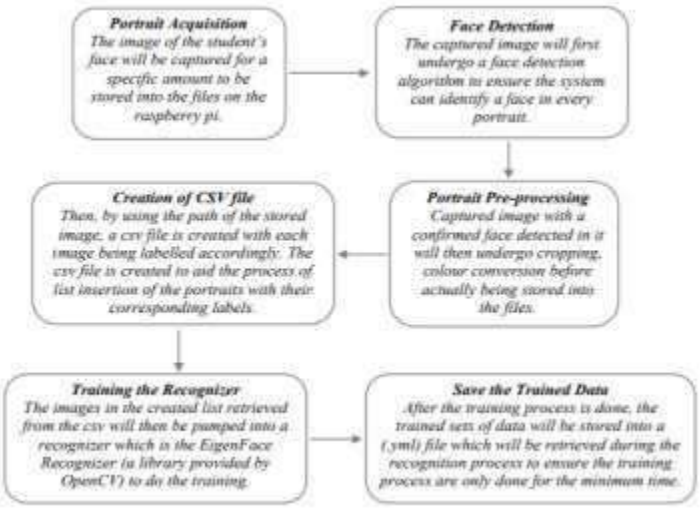

Fig:-3 The creation of the face database:

The face database is an important step to be done before any further process can be initiated. This is because the face database acts as a comparison factor during the recognition process which will be discussed in later section. In the process above, a csv file is created to aid the process of image labelling because there will be more than one portrait stored for each student, thus, in order to group their portraits under the name of the same person, labels are used to distinguish them. After that, those images will be inserted into a recognizer to do its training. Since the training process is very time consuming as the face database grew larger, the training is only done right after there is a batch of new addition of student's portraits to ensure the training is done as minimum as possible.

Before the attendance management system can work, there are a set of data needed to be inputted into the system which essentially consist of the individual's basic information which is their ID and their faces. The first procedure of portrait acquisition can be done by using the Camera to capture the faces of the individual. In this process the system will first detect the presence of a face in the captured image, if there are no face detected, the system will prompt the user to capture their face

again until it meets certain number of portraits which will be 10 required portraits in this project for each student. The decision of storing only 10 portrait per student is due to the consideration of the limited storage space in the raspberry pi because the total amount of students in the university is considered heavy. Then, the images will undergo several pre-processing procedures to obtain a grayscale image and cropped faces of equal sized images because those are the prerequisites of using the Eigenfaces Recognizer. Both of the processes mentioned above can be represented in the diagram below.

Fig-4 Pre-processing of data

Image Acquisition and Pre-processing procedures After the images are being processed, they are stored into a file in a hierarchy manner. In this project, all the faces will be stored in a hierarchy manner under the „database" folder. When expanding through the database folder, there will consist of many sub-folders which each of them will represent an individual where a series of face portrait belonging to the same individual will be stored in that particular sub-folder. The subfolders that represent each individual will be named upon the ID no. of that individual which is unique for every single individual in the institution. The whole process of image retrieval, pre-processing, storing mechanism is done by the script named create_database.py Hierarchy manner of the face database After a successful retrieval of facial images into the respective folder, a CSV files created to aid the next process of pumping the faces into the recognizer for the training process. The creation of the CSV file will be done based on a script named create_csv.py. In this project, the content of CSV file will look like the following format

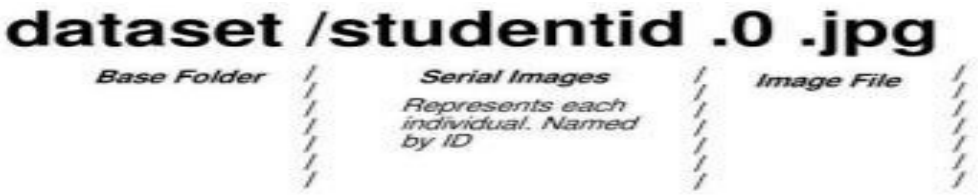

Fig-5 CSV Data Save

Structure of the content in the csv file After having sufficient images in the database, those images will then be inserted into a training mechanism. There are generally 3 different types of training mechanism provided in OpenCV 3.4 which are Eigenfaces, Fisher Faces, and Local Binary Patterns Histograms (LBPH). The recognizer that will be focused in this project will be the Eigenfaces recognizer. The concept behind Eigenfaces is simple – it recognizes a particular face by catching the maximum deviation in a face and then turning those identified variations into information to be compared when a new face arrives. In the training process, the csv file will be read to provide the path to all of the images where those images and labels will be loaded into a list variable. Then, the list will be passed into the training function where the training process will take a measurable time to run. The larger the face database, the longer the time will be needed to train those images.

- FILES INCLUDED

There are in total 5 python scripts, 1 bash file, 1 csv file, 1 yml file and 1 folder needed in the face database creation part. 3 of the python scripts will be included in the bash file for 2 reasons. Firstly, it is to provide convenience to the user whenever they wanted to register images for new students. By running those script in bash, the user can avoid some ambiguous steps such as tuning to the cv environment before the script is being able to run from terminal because the bash file will handle the environment tuning. Secondly, the csv file creation and also the training process can be automated after the images are added. This function is crucial as it forces the yml file to be up to date before any recognition process is done just in case the user mistakenly missed this step. Python scripts:firstpage.py, dataset_capture.py, recognizer.py, training_dataset.py, mail.py Bash file: prepare_gallery.sh (stored in /usr/local/bin/) Yml file:trainer.yml Folder name:data Relationships between these files

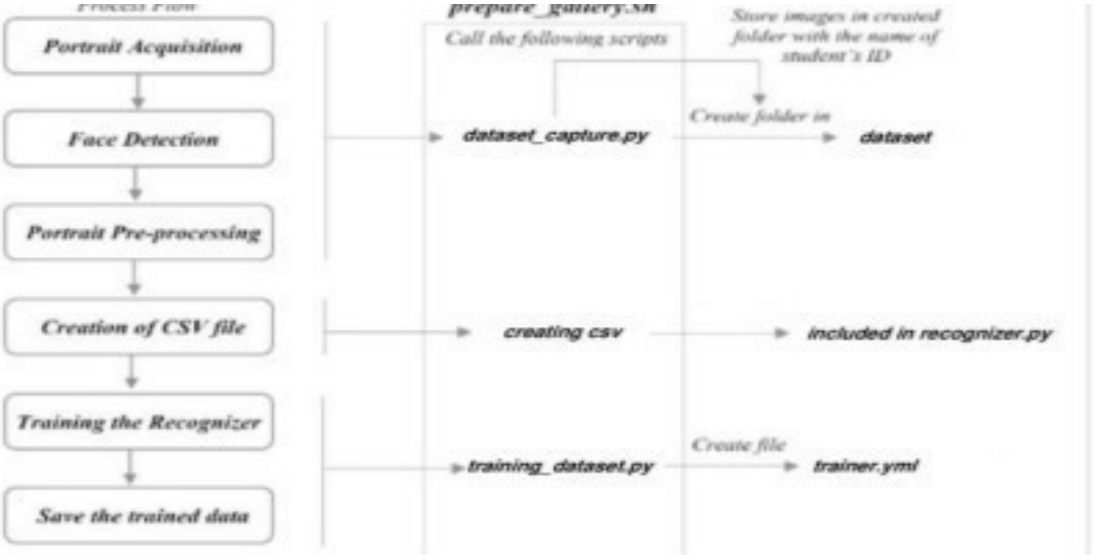

Fig-6 Relationship between files

Chapter-3

3.1 Results and Discussion

The proposed system is a software system which will mark attendance using facial recognition. In this project we used OpenCV module integrated with Python which will helps the institution to make the attendance process easy and efficient. The system comprises of Computer, HD Video Camera and Wi-Fi module or Internet. Steps of Working:

- Initiate the firstpage.py python script.
- Create a DATASET of the student by entering his ID Number.
- Train the dataset, Aiml file is created.
- A picture of the class is taken, and the RECOGNIZER python file is initiated.
- Attendance is taken by cropping the faces in the picture and comparing with the faces in the database.
- If a face is matched, the responding name with PRESENT status is marked in a EXCEL file with the current date and time.
- The EXCEL file can be mailed by entering the email after initiating the MAIL python script.

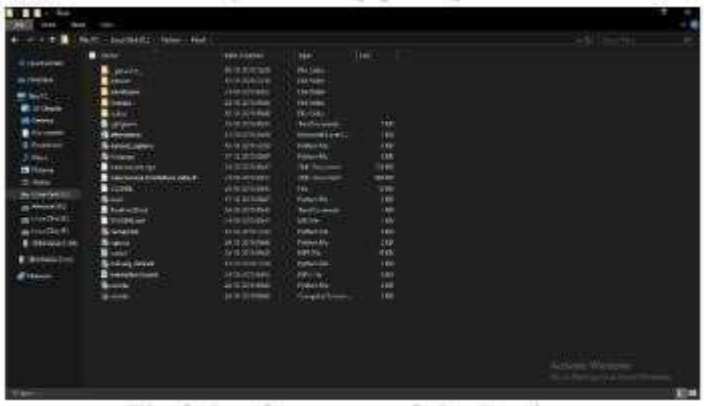

Fig :-8 Project contain

Fig 8.2 – firstpage.py

Fig 8.3 – Create Dataset

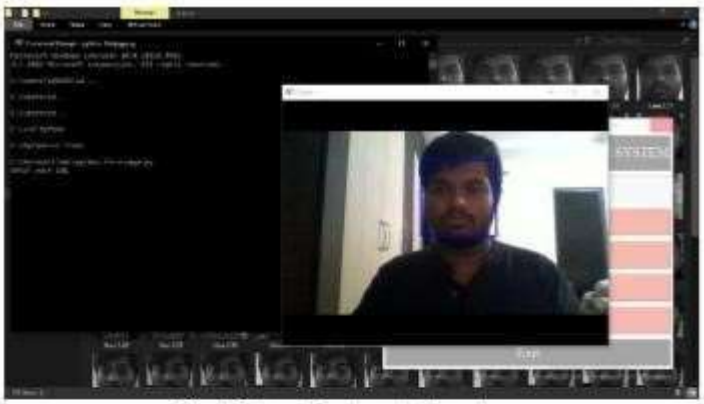

Fig 8.4 – Dataset Capture

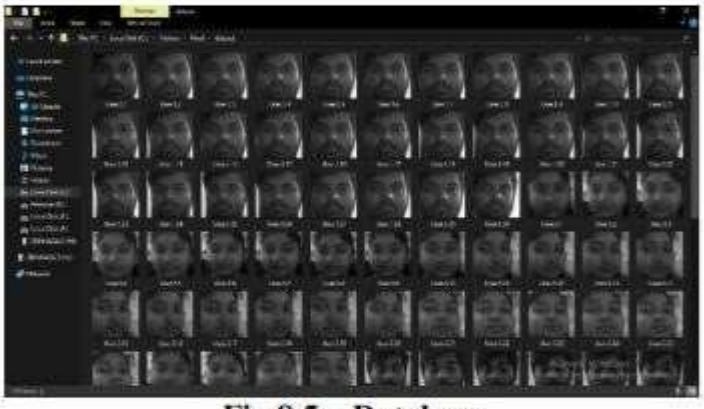

Fig 8.5 – Database

Fig 8.6 – training_dataset.py

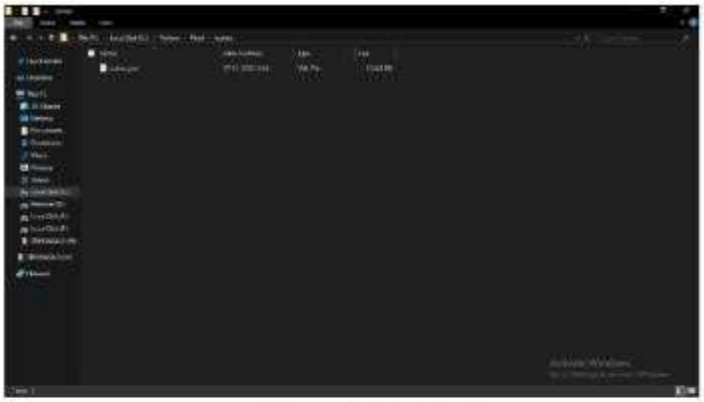

Fig 8.7 – trainer.yml

Fig 8.8 – recognizer.py

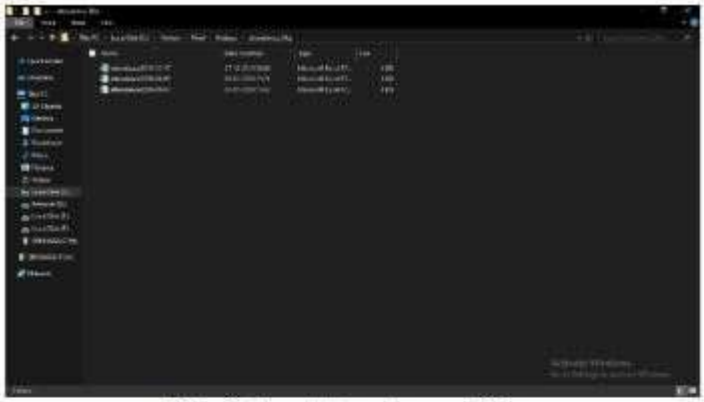

Fig 8.9 – Attendance Files

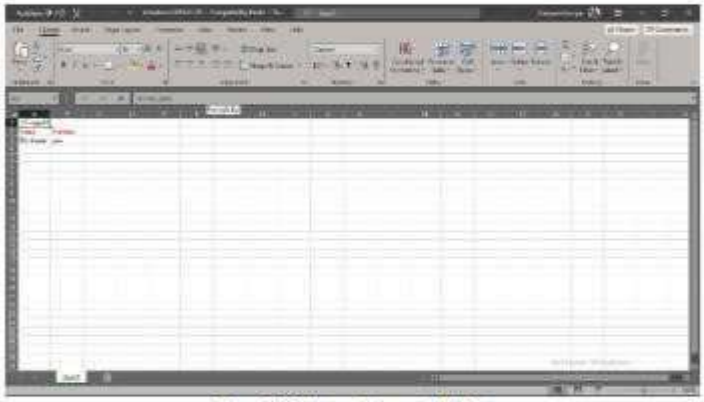

Fig 8.10 – Excel File

Fig 8.11 – mail.py

Fig 8.12 – Mail Sent

Fig 8.13 – Downloaded File

3.2 Discussion

As time passes worldwide, the COVID-19 pandemic poses greater challenges for humans. Over the past two years, leaders in biometric systems, such as FLIR Systems, Zkteco, among others, have launched proposals for updated access control and temperature detection. They also highlight the products previously launched by the companies Sense Time, Telpo, and Herat. All of this is focused mainly on temperature control in airports and high-traffic places, with which the development of easy recognition systems has been relegated. As previously mentioned, the regular use of face masks has directly affected facial recognition systems. This has altered the usual development of activities and delayed innovation processes. For example, Apple's Face ID is designed to identify users based on the mouth, nose, and eyes, which must be ffigully visible.

In the same way, other important companies worldwide, such as Go from Amazon and Walmart's "Store of the Future", are affected, as they use this technology to interact with their customers.

There are independent investigations as in [55], where Google resources have been used to develop systems for detecting the use of masks, but with still low yields. As can be seen in the bibliography presented, during the advancement of this pandemic, CNNs have been used as a priority for the diagnosis of the disease. Various standard training methods have been used, such as EfficientNet and y ResNet-34 , as well as other proprietary ones such as nCOVnet [42]. Similarly, for face mask use detection systems, several methods have been tested, such as RCNN , VGG-16 [47], MobileNetV2 , SVM , InceptionV3 , and y SRCNet . All of them have been analyzed and it is determined that using Mobile-NetV2 would have efficient results, with a low consumption of computational resources. In addition, when comparing the efficiency of the various systems, it is found that this proposal is competitive, as it has 99.65%, only surpassed by (100% in both cases). From the point of view of facial recognition, a similar proposal has not been found, which clearly shows the added value offered. By having a precision greater than 99%, the starting hypothesis is corroborated, establishing variability in this type of system and also adding robustness. Table 5 presents a comparison of this proposal with the other works.Other proposals in face detection have also reviewed, but with the ocular recognition variant, as seen in [52,53]. However, it should be clarified that focusing on the human eye represents a different approach than the one analysed in this document. In addition, this would require the acquisition of other hardware and software components that would increase the requirements presented. This document seeks to capture the upper part of the face, i.e., eyes, eyebrows, forehead, and hair. Thus, it has been shown that this approach can be successful. On the subject of convolutional neural networks, the most important thing is to have a good database (thousands of observations). This is not a rule, but the larger the database, the better the resulting model, as, in a certain way, more characteristics are extracted and a model that represents them can be generalized. It does not matter if there are many or few classes (people); for each class (person), a considerable number of observations is needed (images, database, etc.). This type of architecture is ideal when it comes to artificial vision, as it is demonstrated in the literature that convolutional neural networks are leading the advances in artificial vision, which is why this architecture is chosen, in order to have the best possible results, as the topic of facial recognition is an area where the system should fail as little as possible. The small number of people is not a problem, because the proposal is aimed at access control, which is a structured environment, in order for a restricted area to be limited to 10 or fewer people with

entry authorization. In addition, the literature reviewed presents cases with the same performance for differentiating people with and without a face mask.

Chapter 5

5.1 Conclusion

Before the development of this project. There are many loopholes in the process of taking attendance using the old method which caused many troubles to most of the institutions. Therefore, the facial recognition feature embedded in the attendance monitoring system can not only ensure attendance to be taken accurately and also eliminated the flaws in the previous system. By using technology to conquer the defects cannot merely save resources but also reduces human intervention in the whole process by handling all the complicated task to the machine. The only cost to this solution is to have sufficient space in to store all the faces into the database storage. Fortunately, there is such existence of micro SD that can compensate with the volume of the data. In this project, the face database is successfully built. Apart from that, the face recognizing system is also working well. At the end, the system not only resolve troubles that exist in the old model but also provide convenience to the user to access the information collected by mailing the attendance sheet to the respected faculty whether people are wearing a mask or not, the accuracy is 99.65%. When evaluating the facial recognition model with the test data of people who do not use a mask, an accuracy of 99.96% is obtained, and for those who use a mask, an accuracy of 99.52% is obtained. In this way, the basis for future research that can expand the study in this field is established. In the bibliographic review, the use of MATLAB has been evidenced as an alternative proposal that could provide a lower number of false positives that should be evaluated. It is also proposed to investigate new extraction architectures that can be compared with Face Net, and to thus choose the best one. One important thing to note is that the system has difficulty detecting certain faces when wearing a mask. This problem is due to the fact that initially, the Open CV Deep Learning based face detector was being used and it is not designed to detect faces with masks. It could also be observed that the face recognition stage is not robust when the detected face presents a certain angle of inclination. However, this is not a problem of great impact, as this application is oriented to access control and at this point, the person must maintain a firm and straight posture in front of the device that acquires the image. Therefore, as a future work, merging the first and second stages in the same model and creating an own algorithm that directly searches for a face with and without a mask should be considered. This avoids first using the Open CV face detector and then classifying faces with and without mask. This will further reduce the processing

time and make the model more robust. In addition, it is proposed that in the future, a comparative study of the models used for the transfer of learning can be carried out in order to determine the best model and network trained in unfavourable evaluation conditions. Once the final models have been trained, they can be compressed and deployed on low-cost embedded devices such as Raspberry Pi or mobile devices.

5.2 Future Scope: -

This project hopes to develop a Web app with high quality user interface. In future we may be extended to include feature such as:

- Data management
- Regular call and SMS on absent & present

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