VISVESVARAYA TECHNOLOGICAL UNIVERSITY

Jnana Sangama, Belgaum-590018

A PROJECT REPORT **(15CSP85)** ON

"Face Recognition Based Attendance System"

Submitted in Partial fulfillment of the Requirements for the Degree of

Bachelor of Engineering in Computer Science & Engineering

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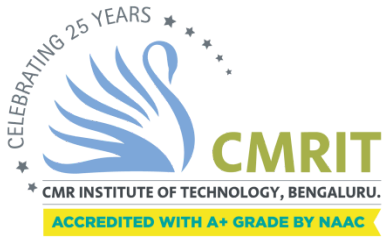

CERTIFICATE

Certified that the project work entitled **"FACE RECOGNITION BASED ATTENDANCE SYSTEM"** carried out by **Mr. Anush Devadiga**, USN **1CR16CS025**, **Mr.Arjun K Sharma**, USN **1CR16CS027**, **Mr.Arjun Sen**, USN **1CR16CS028,** bonafide students of CMR Institute of Technology, in partial fulfillment for the award of **Bachelor of Engineering** in Computer Science and Engineering of the Visveswaraiah Technological University, Belgaum during the year 2019-2020. It is certified that all corrections/suggestions indicated for Internal Assessment have been incorporated in the Report deposited in the departmental library.

The project report has been approved as it satisfies the academic requirements in respect of Project work prescribed for the said Degree.

Dr.Jacob Augustine	**Dr. Prem Kumar Ramesh**	**Dr. Sanjay Jain**
Professor	**Professor & Head**	**Principal**
Dept. of CSE, CMRIT	**Dept. of CSE, CMRIT**	**CMRIT**

DECLARATION

We, the students of Computer Science and Engineering, CMR Institute of Technology, Bangalore declare that the work entitled "**FACE RECOGNITION BASED ATTENDANCE SYSTEM**" has been successfully completed under the guidance of Prof.Jacob Augustine, Computer Science and Engineering Department, CMR Institute of technology, Bangalore. This dissertation work is submitted in partial fulfillment of the requirements for the award of Degree of Bachelor of Engineering in Computer Science and Engineering during the academic year 2019 - 2020. Further the matter embodied in the project report has not been submitted previously by anybody for the award of any degree or diploma to any university.

Place:

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ABSTRACT

Smart Attendance using Real-Time Face Recognition is a real-world solution which comes with day to day activities of handling student attendance system. Face recognition-based attendance system is a process of recognizing the students face for taking attendance by using face biometrics based on high - definition monitor video and other information technology. In my face recognition project, a computer system will be able to find and recognize human faces fast and precisely in images or videos that are being captured through a surveillance camera. Face recognition-based attendance system is a process of recognizing the students face for taking monitor video and other information technology. In my face recognition project, a computer system will be able to find and recognize human faces fast and precisely in images or videos that are being captured through a surveillance camera. Numerous algorithms and techniques have been developed for improving the performance of face recognition but the concept to be implemented here is LBPH. It helps in conversion of the frames of the video into images so that the face of the student can Feature-based approach be easily recognized for their attendance so that the attendance database can be easily reflected automatically.

ACKNOWLEDGEMENT

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CHAPTER 1

INTRODUCTION

1.1 Relevance of the Project

The idea of two technologies namely Student Attendance and Feedback system has been implemented with a machine learning approach. This system automatically detects the student performance and maintains the student's records like attendance and their feedback on the subjects like Science, English, etc. Automated Attendance System using Face Recognition proposes that the system is based on face detection and recognition algorithms, which is used to automatically detects the student face when he/she enters the class and the system is capable to marks the attendance by recognizing him.In this proposed system the student is requested to stand in front of the camera to detect and recognize the iris, for the system to mark attendance for the student. Some algorithms like Gray Scale Conversion, Six Segment Rectangular Filter, Skin Pixel Detection is being used to detect the iris.

1.2 Problem Statement

The goal of this project is to build, update and maintain an Attendance recording subsystem using facial contours as the biometric key.

EXISTING RECOGNITION SYSTEMS:

- *Fingerprint Based recognition system:* In the Fingerprint based existing attendance system, a portable fingerprint device need to be configured with the students fingerprint earlier.
- *Iris Based Recognition System:* In the Iris based student attendance system, the student needs to stand in front of a camera, so that the

camera will scan the Iris of the student.

- *Face Based Recognition System:* The facial recognition technology can be used in recording the attendance through a high-resolution digital camera that detects and recognizes the faces of the students.

PROPOSED SYSTEM AND SOLUTION:

The task of the proposed system is to capture the face of each student and to store it in the database for their attendance. The face of the student needs to be captured in such a manner that all the feature of the students' face needs are recorded and analysed to the existing record. The main working principle of the project is that, the video captured data is converted into image to detect and recognize it. Further the recognized image of the student is provided with attendance, else the system marks the database as absent

1.3 Objective

In this project we aim to build an Attendance marking system with the help of facial recognition owing the difficulty of the manual as well as other traditional means of attendance systems

1.4 Scope of the project

- Using this system we will able to accomplish the task of marking the attendance in the classroom automatically and output is obtained in an excel sheet as desired in real-time
- However, in order to develop a dedicated system which can be implemented in an educational institution, a very efficient algorithm which is insensitive to the lighting conditions of the classroom has to be developed.

- Also a camera of the optimum resolution has to be utilised in the system.
- Another important aspect where we can work towards is creating an online database of the attendance and automatic updating of the attendance.

1.5 Methodology

In order to obtain the attendance,positions and face images in lecture, we proposed the attendance management system based on face detection in the classroom lecture. The system estimates the attendance and positions of each student by continuous observation and recording. Current work is based on the method to obtain the different weights of each focused seat.

The technology aims in imparting tremendous knowledge oriented technical innovations these days. Deep Learning is one among the interesting domain that enables the machine to train itself by providing some datasets as input and provides an appropriate output during testing by applying different learning algorithms. Nowadays Attendance is considered as an important factor for both the student as well as the teacher of an educational organization. With the advancement of the deep learning technology the machine automatically detects the attendance performance of the students and maintains a record of those collected. In general, the attendance system of the student can be,

1. **Manual Attendance System (MAS)**
2. **Automated Attendance System (AAS)**

1.5.1 Manual Attendance System (MAS)

Manual Student Attendance Management system is a process where a teacher concerned with the particular attendance manually. Manual attendance may be considered as a time-consuming process or sometimes it

happens for the teacher to miss someone or students may answer multiple times on the absence of their friends. So, the problem arises when we think about the traditional process of taking attendance in the classroom.

1.5.2 Automated Attendance System (AAS)

Automated Attendance System (AAS) is a process to student in the classroom by using face recognition technology. It is also possible to recognize whether the student is sleeping or awake during the lecture and it can also be implemented in the exam sessions to ensure the presence of the student. Attendance of students will be taken by a real-time camera positioned at the door which senses anyone entering or exiting the classroom. The camera is trained in such a way that it differentiates shadows and photos.

The two common Human Face Recognition techniques are,

1. **Feature-Based approach**
2. **Brightness Based approach**

1.5.2.1 Feature-Based approach

The Feature-based approach also known as local face recognition system, used in pointing the key features of the face.

1.5.2.2 Brightness Based approach

brightness-based approach also termed as the global face recognition system, used in recognizing all the parts of the image.

CHAPTER 2

LITERATURE SURVEY

2.1 Implementation of classroom attendance system based on face recognition in class

The system consists of a camera that captures the images of the classroom and sends it to the image enhancement module. To enhance the captured image histogram normalization, median filtering and skin classification methods are used. Face detection is done using Viola-Jones algorithm. Initially face detection algorithm was tested on variety of images with different face positions and lighting conditions and then algorithm was applied to detect faces in real time video. Algorithm is trained for the images of faces and then applied on the class room image for detection of multiple faces in the image. The next step is face recognition, where a hybrid algorithm from PCA and LDA is used. The detected faces are cropped from the image and compared with the face database using an Eigen face method. The face database consists of templates of face images of individual students that was collected and stored by an enrollment process. In this way the faces of students are verified one by one and the attendance is marked on the server. A time table module is attached to the system to obtain the subject, class, date and time. Teachers come in the class and just press a button to start the attendance process.

2.2 Face Recognition-based Lecture Attendance System

The system consists of two cameras; one for determining the seating positions (fixed at the ceiling) and the other for capturing the students face (Fixed in front of the seats).To determine the target seat Active Student Detection(ASD) method is used to estimate the existence of a student on a seat. One seat is targeted and camera is directed to capture the image. The face image capture is enhanced and recognized and are recoded into the database. Every seat has a vector of values that represent relationship between the student and seat. Attendance is estimated by interpreting the

face recognition data obtained by continuous observation. The position and attendance of the student are recorded into the database.

2.3 Study of Implementing Automated Attendance System Using Face Recognition Technique

The proposed system has been implemented in three basic steps.The first step is face detection and extraction. The user stands in front of the camera and an image is captured, which is taken as input. The frontal face is captured by using the OpenCVHaarCascade method. After the face is detected, it is converted into a gray scale image of 50x50 pixels. The second step is to learn and train face images. The system needs to be initialized by feeding it a set of training images of faces. The PCA algorithm is performed on it. All the learned data is stored in an xml file. The third step is the recognition and identification. In this step the frontal face that is to be recognized, test face, is extracted from the image. The Eigen value for the test face is re-calculated and is matched with the stored data for the closest neighbor. Finding the closest neighbor is implemented as a function that computes distance from the projected test face to each projected training set. The distance basis here is "Squared Euclidean Distance." When a face is matched the corresponding information is obtained from the database. The log table is then updated with the system time to mark the attendance of that person.

2.4 Face Recognition Based Attendance Marking System

The system consists of a camera that must be positioned in the office room to take snap shots of the room. These images are then sent to an enhancement module where Histogram Normalization is used for the contrast enhancement of the image, Median Filter is used for removing noise from the image. To avoid false detection skin classification technique is used. This process first classifies the skin and then retains only the skin pixels and the other pixels are set to black. The enhanced image is then

sent to a face detection and recognition module. This requires MATLAB software version 7.6. Two databases are maintained, the first one is the Face database to store the face images and extracted features at the time of enrolment process and the second attendance database contains the information about the employees and is also used to mark attendance.

2.5 Attendance Management System Using Face Recognition

In this system, the CCTV is fixed at the entry of the class room and is used to capture an image of the entering student. The detected faces are stored in a database and is compared with the existing images using Eigen faces methodology. To identify if the student image is matching, a 3D face recognition technique is used.If a match is found, that image is processed for attendance management. For attendance management, the attendance will be marked for the student image matched and the information is sent to the server which controls the overall database of the student. The software is installed in a smart phone that would help to improve the report features.When the server receives the message of student who are absent that particular day will send an SMS to the parent of that particular student.

CHAPTER 3

SYSTEM REQUIREMENTS SPECIFICATION

3.1 Hardware Requirements

- Raspberry Pi either model A or B (running raspbian OS)
- Raspberry Pi camera
- Push button
- Servo motor
- Power source

3.2 Software Requirements

- **Python**: generally the language of choice for machine learning today.
- **Tensorflow**: an open-source machine learning and neural network toolkit. Tensorflow is the go-to library for numerical computation and large-scale machine learning.
- **scikit-learn**: Simple and efficient tools for data mining and data analysis.
- **scipy**: a free and open source library for scientific and technical computing.
- **numpy**: a Python library supporting large, multi-dimensional arrays with a large library of functions for operating on these arrays.
- **OpenCV**: an open-source library of functions aimed at real-time computer vision.
- To ensure fast read and write speeds a **non-traditional end program embedded RDMS, sqlite3** was used as opposed to a traditional client-server based database.

3.3 Functional Requirements

many advantages associated to using sqlite3 are,

a. Reading and writing from an SQLite database is **often faster** than reading and writing individual files from disk
b. The application only has to load the data it needs, rather than reading the entire file and holding a complete **parse in memory**.
c. **No application file I/O code** to write and debug.
d. SQL queries are many times **smaller** than the equivalent procedural code
e. SQLite database content can be **viewed** using a wide variety **third-party tools**.

CHAPTER 4

SYSTEM ANALYSIS AND DESIGN

4.1 Viola Jones Algorithm

In 2004 an article by Paul Viola and Michael J. Jones titled "Robust Real-Time Face Detection" was publish in the International Journal of Computer Vision. The algorithm presented in this article has been so successful that today it is very close to being the de facto standard for solving face detection tasks. This success is mainly attributed to the relative simplicity, the fast execution and the remarkable performance of the algorithm.

The scale invariant detector The first step of the Viola-Jones face detection algorithm is to turn the input image into an integral image. This is done by making each pixel equal to the entire sum of all pixels above and to the left of the concerned pixel. This is demonstrated in Figure 4.1

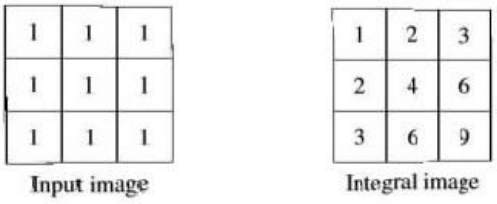
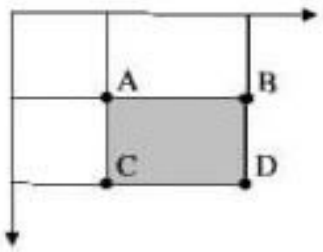


Figure 4.1 - Viola Jones algorithm

This allows for the calculation of the sum of all pixels inside any given rectangle ug only four values. These values are the pixels in the integral image that coincide with the corners of the rectangle in the input image. This is demonstrated in Figure 4.2



Sum of grey rectangle=D-(B+C)+A

Figure 4.2 Sum of Pixels

Since both rectangle B and C include rectangle A, the sum of A has to be added to the calculation.

It has now been demonstrated how the sum of pixels within rectangles of arbitrary size can be calculated in constant time. The Viola-Jones face detector analyzes a given sub-window using features consisting of two or more rectangles. The different types of features are shown in Figure 4.3

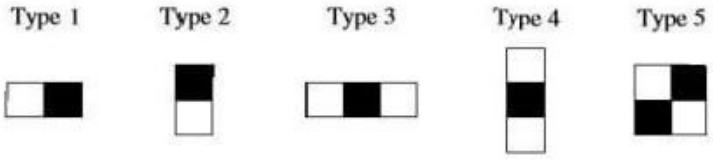


Figure 4.3 Different Types of Features

Each feature results in a single value which is calculated by subtracting the sum of the white rectangle(s) from the sum of the black rectangle(s).

4.2 Proposed System

In order to obtain the attendance,positions and face images in lecture, we proposed the attendance management system based on face detection in the classroom lecture. The system estimates the attendance and positions of each student by continuous observation and recording. Current work is based on the method to obtain a real-time face recognition by placing a camera at the entrance of the classroom. In this project we aim to build an Attendance marking system with the help of facial recognition owing the difficulty of the manual as well as other traditional means of attendance systemsBuilding a solution that can be implemented in existing IoT set ups. Making the solution highly robust and scalable. A physically connected camera system will be used to acquire video footage from which frames containing facial information will be extracted. The acquired images will then be pre-processed first,

then then fed to a facial detection algorithm for determination of facial features. The identification algorithm will then be used to determine the identity of the captured face with a pre-existing database.

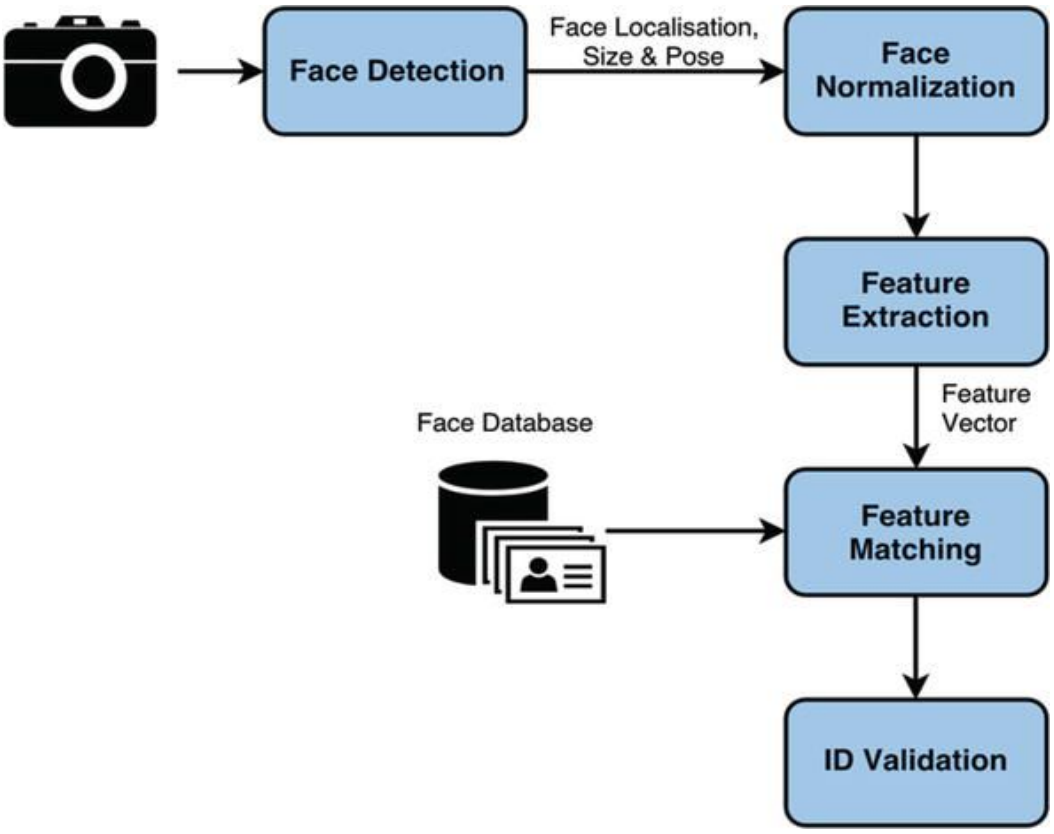


Figure 4.4 Proposed system

- This project uses the **Local Binary Patterns Histograms (LBPH)** in OpenCV to perform face recognition.
- **Local Binary Pattern** (LBP) is a simple yet very efficient texture operator which labels the pixels of an image by thresholding the neighborhood of each pixel and considers the result as a binary number.
- LBPH algorithm is based on 4 parameters,
  - **Radius**: the radius is used to build the circular local binary pattern and

represents the radius around the central pixel. It is usually set to 1.

- **Neighbors**: the number of sample points to build the circular local binary pattern. Keep in mind: the more sample points you include, the higher the computational cost. It is usually set to 8.
- **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.
- **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.

- 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 **neighbors**.
- **Suppose we have a facial image in grayscale**,
  - 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.

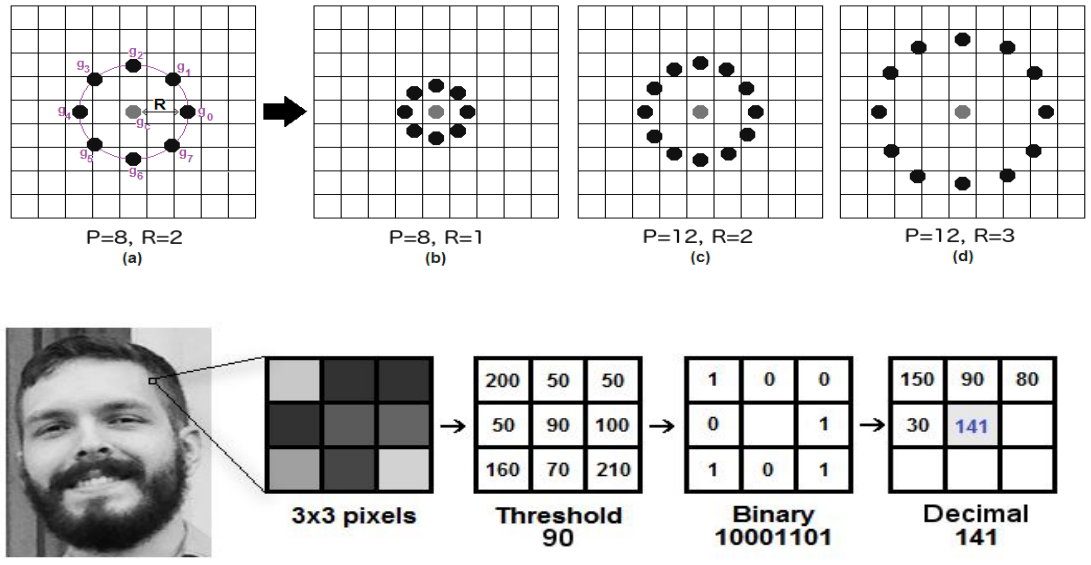


Figure 4.5 - Generating Binary Patterns

- As we have an image in grayscale, 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.

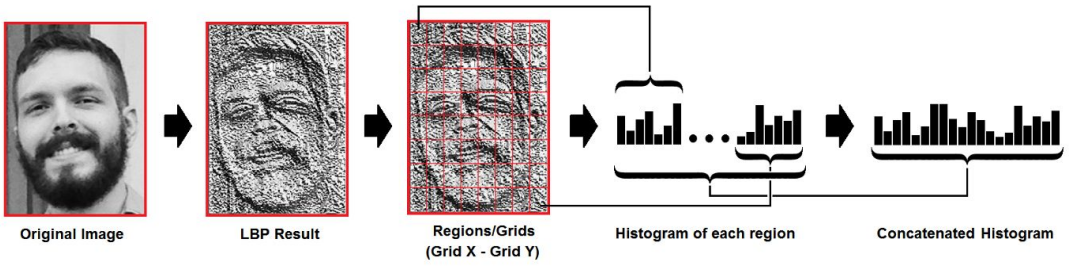


Figure 4.6 - Histograms

CHAPTER 5

IMPLEMENTATION

5.1 Algorithm

```
import sys
import numpy as np
from PIL import Image
import imutils
# path to haar cascade file for face detection
cascadePath = "haarcascade_profileface.xml"
faceCascade = cv2.CascadeClassifier(cascadePath)
recognizer = cv2.face.createLBPHFaceRecognizer()
def get_images_and_labels(path):
     i=0
     image_paths = [os.path.join(path, f) for f in
os.listdir(path) if not f.endswith('.sad')]
     images = []
     labels = []
     for image_path in image_paths:
          image_pil = Image.open(image_path).convert('L')
          image = np.array(image_pil, 'uint8')

image = imutils.resize(image, width=min(500,
image.shape[1]))

nbr=int(os.path.split(image_path)[1].split(".")[0].replac
e("subject", ""))
```

```
            faces = faceCascade.detectMultiScale(image)
            for (x, y, w, h) in faces:
                images.append(image[y: y + h, x: x + w])
                #
cv2.imwrite("subject02."+str(i)+".jpg",image[y: y + h, x:
x + w])
                # i=i+1
                labels.append(nbr)
                cv2.imshow("Adding faces to traning set",
image[y: y + h, x: x + w])
                cv2.imshow('win',image[y: y + h, x: x +
w])

recognizer.train(images, np.array(labels))
recognizer.save("cont.yaml")
```

5.2 Flowchart

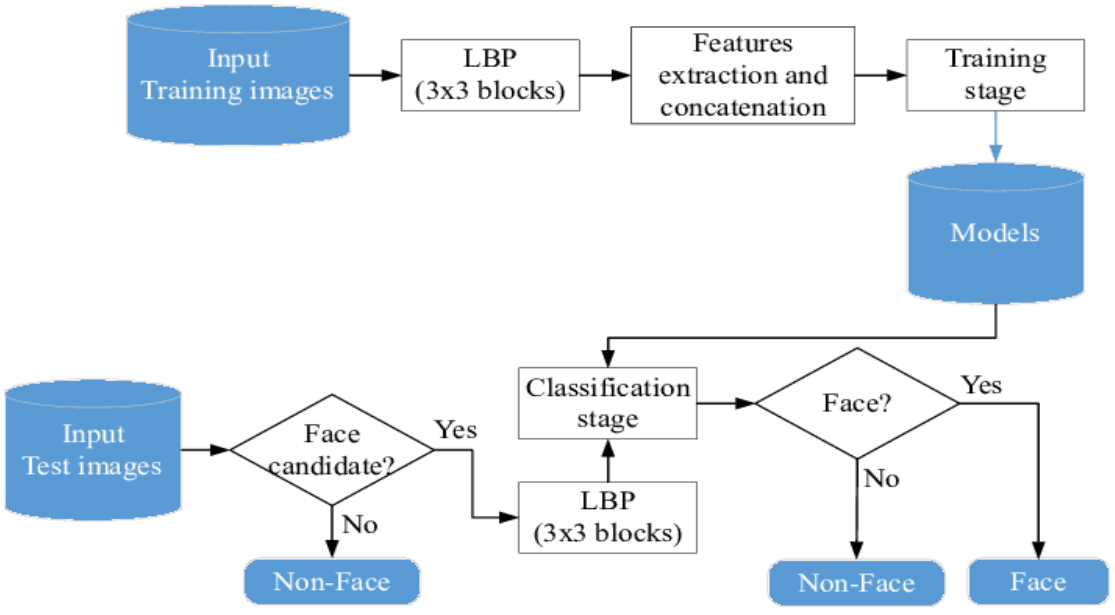


Figure 5.1 - Flowchart

5.3 Parameter Comparison

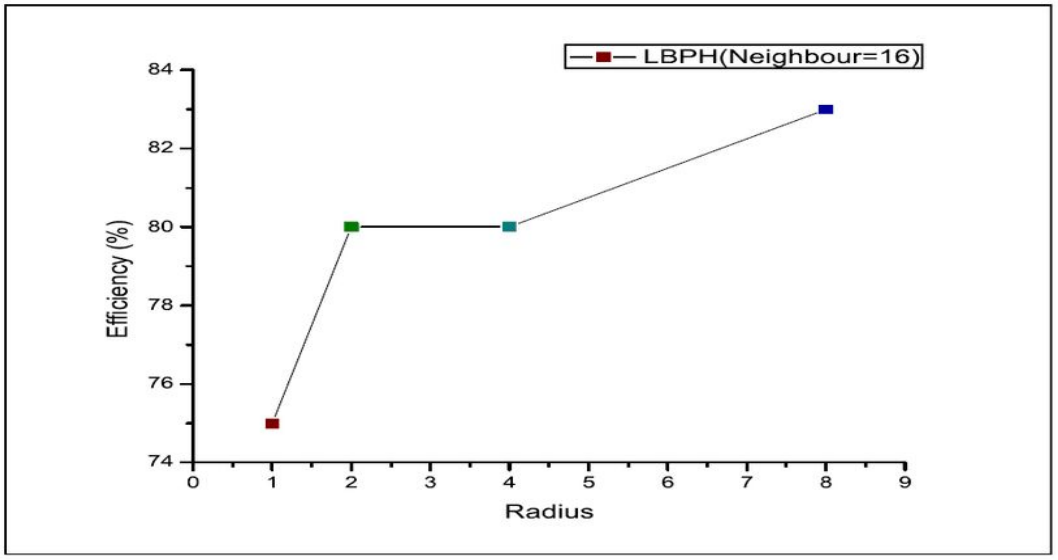


Figure 5.2 - Radius vs Neighbour

5.4 Dataset

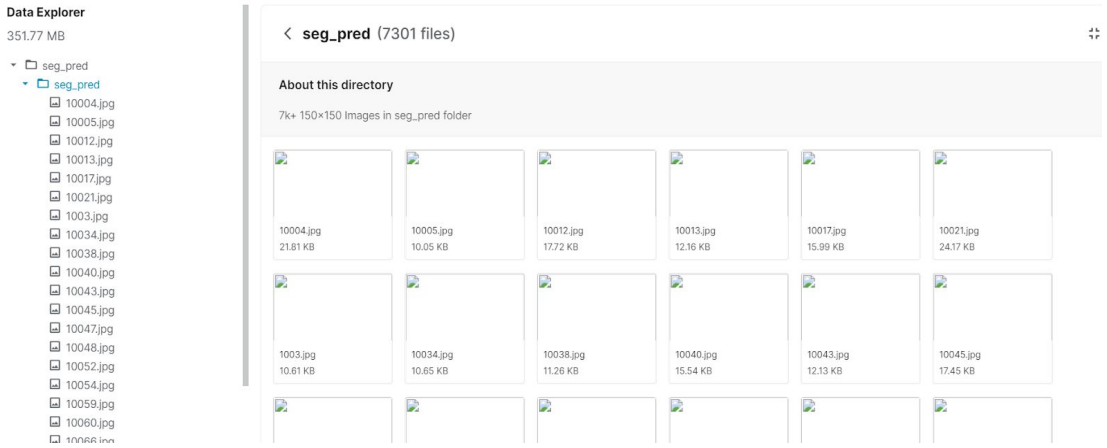


Figure 5.3 - Dataset Pictures

CHAPTER 6

RESULTS AND DISCUSSION

6.1 Dataset Creator

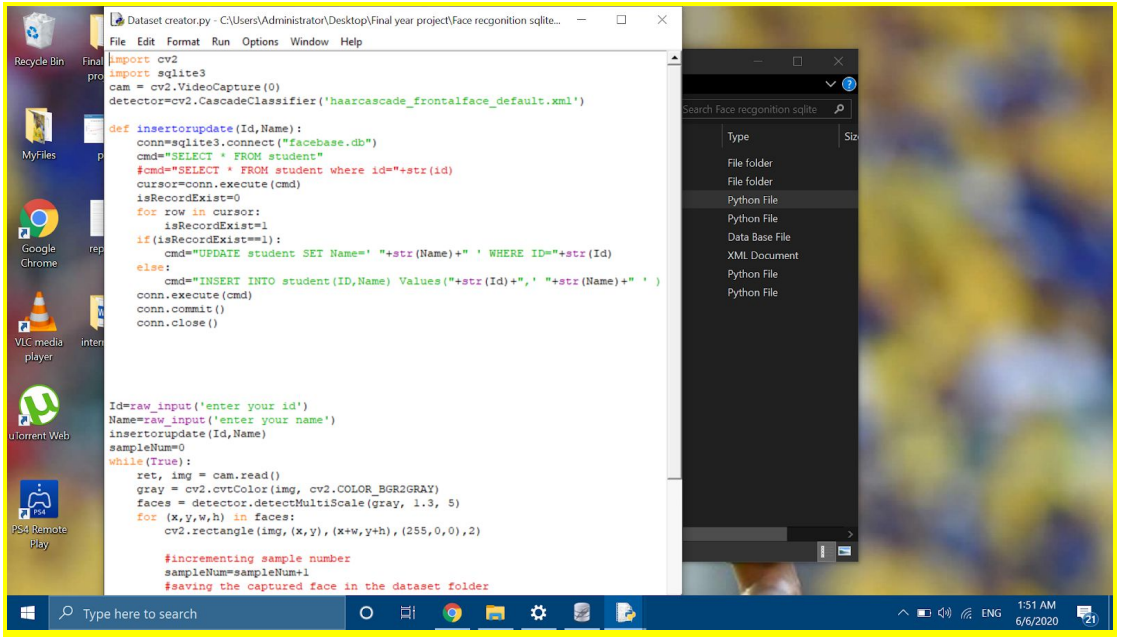


Figure 6.1 - Dataset Creator Code

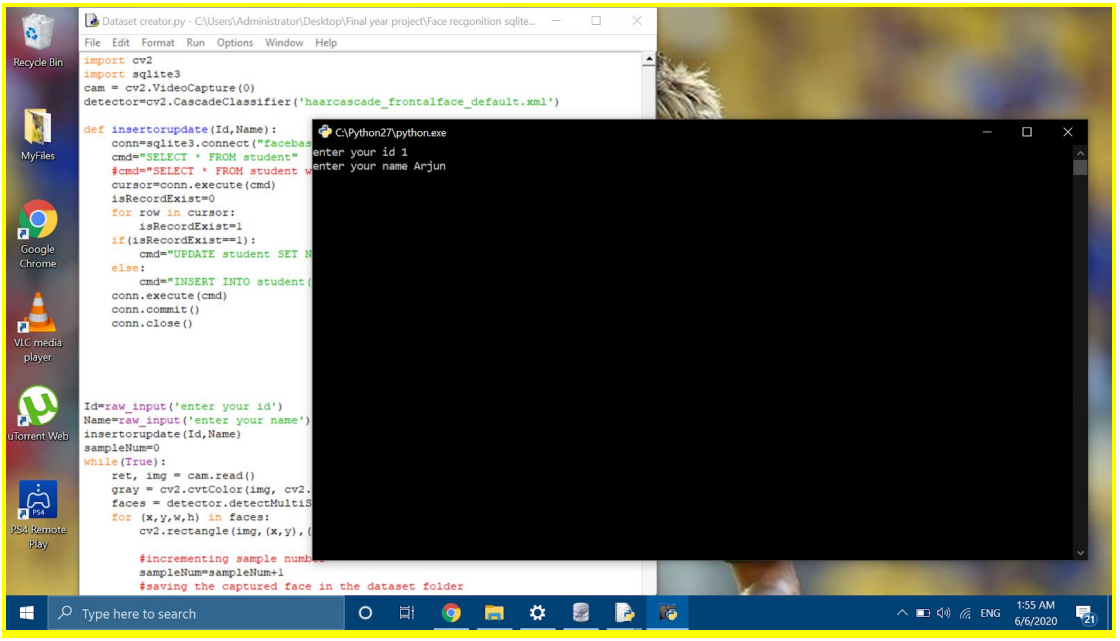


Figure 6.2 - Dataset Creator Terminal

6.2 Trainer

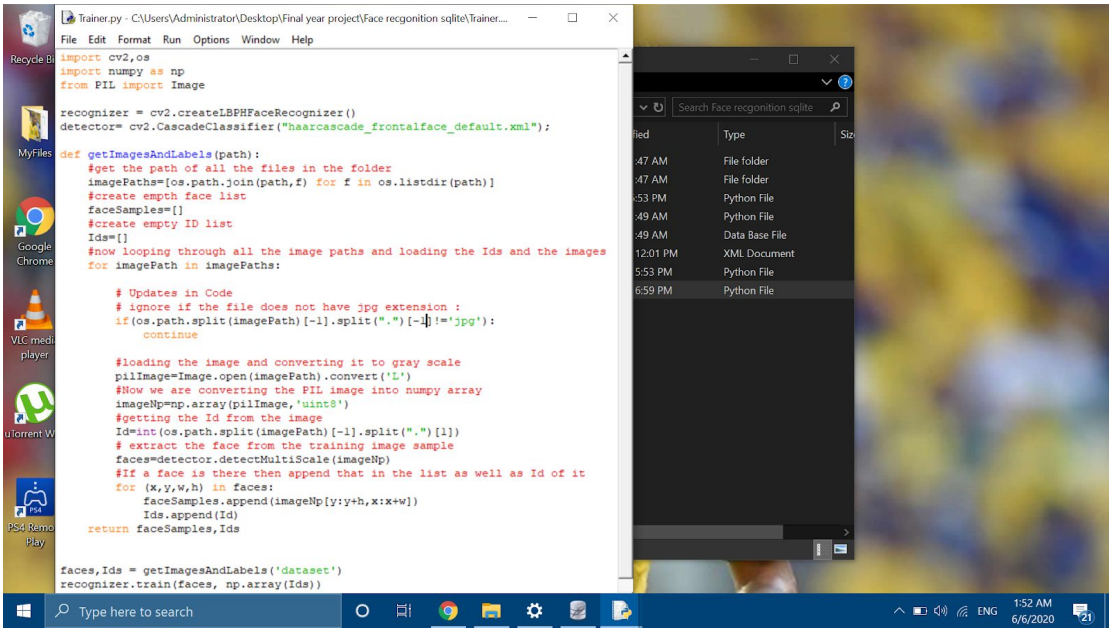


Figure 6.3 - Trainer

6.3 Detector

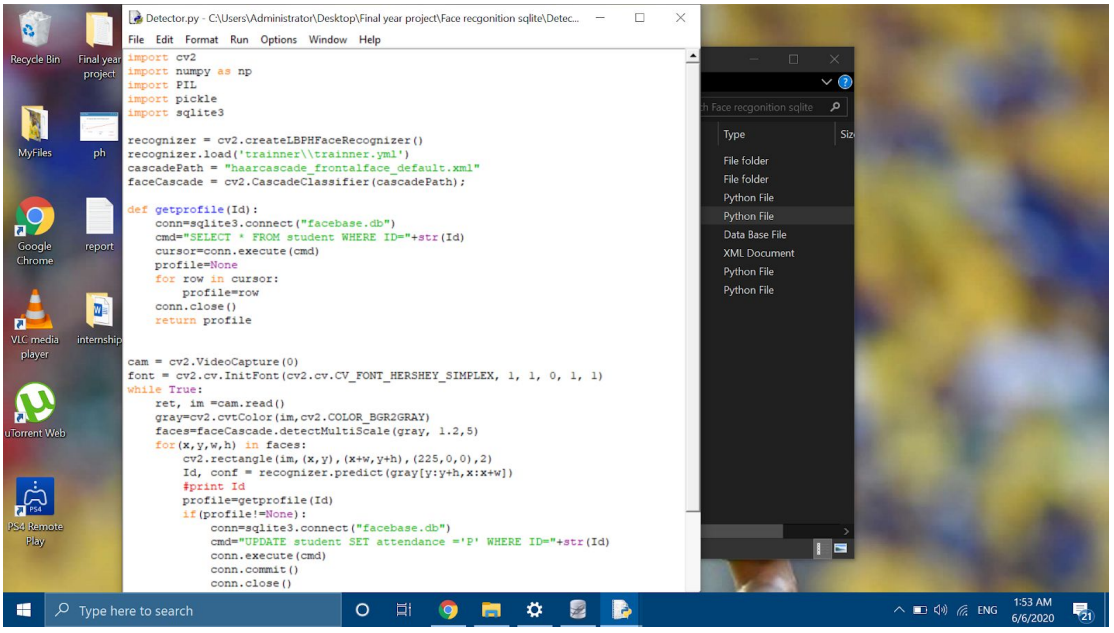


Figure 6.4 - Detector

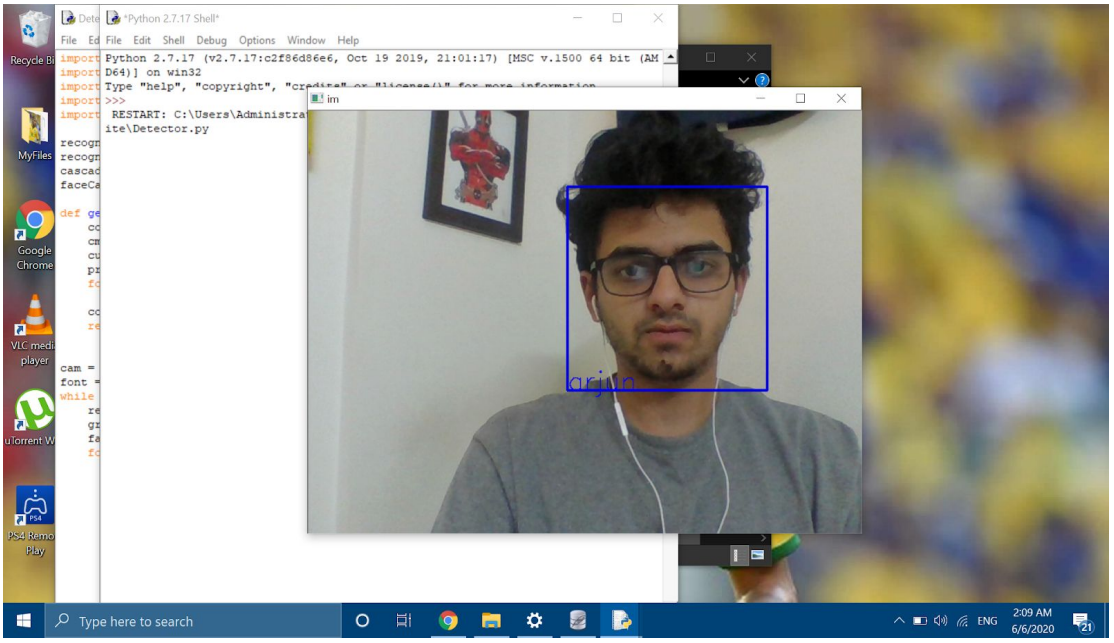


Figure 6.5 - Face Detection

6.4 Database Before Attendance

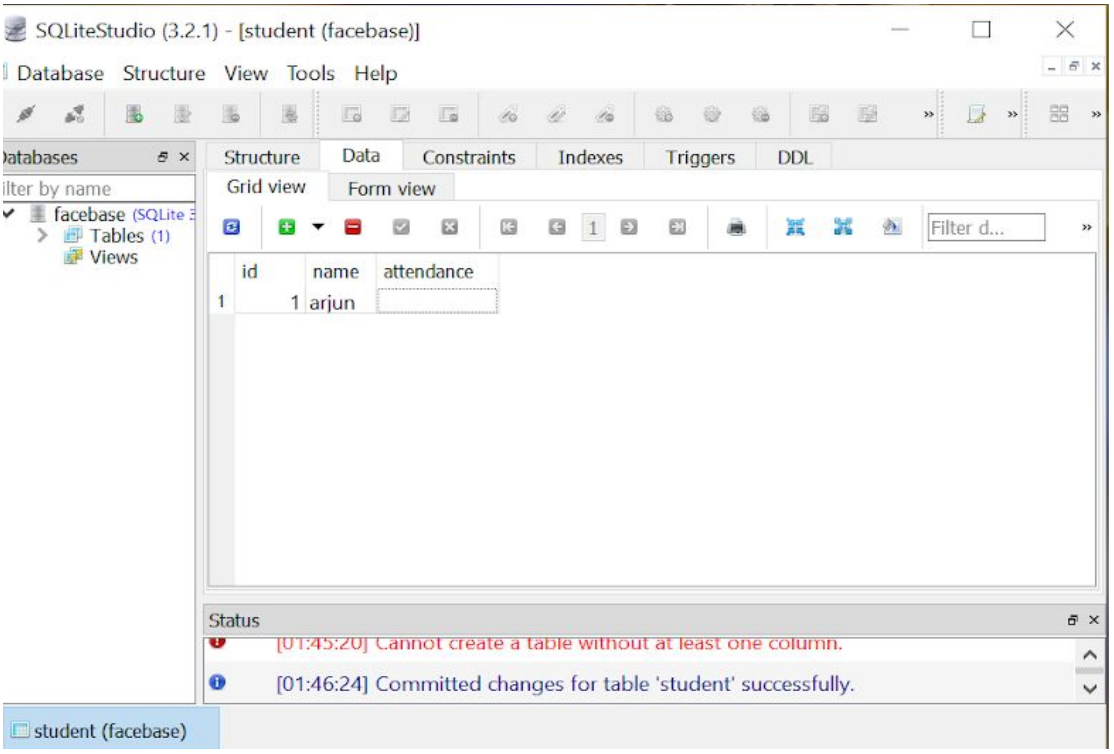


Figure 6.6 - Database Before Attendance

6.5 Dataset

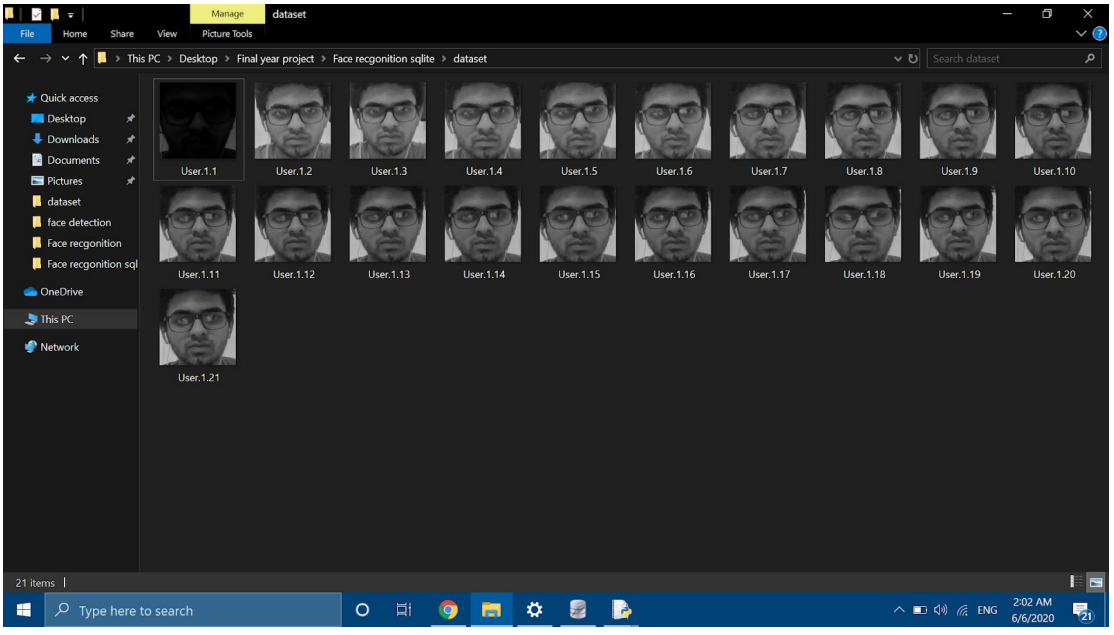


Figure 6.7 - Dataset

6.6 Database After Attendance

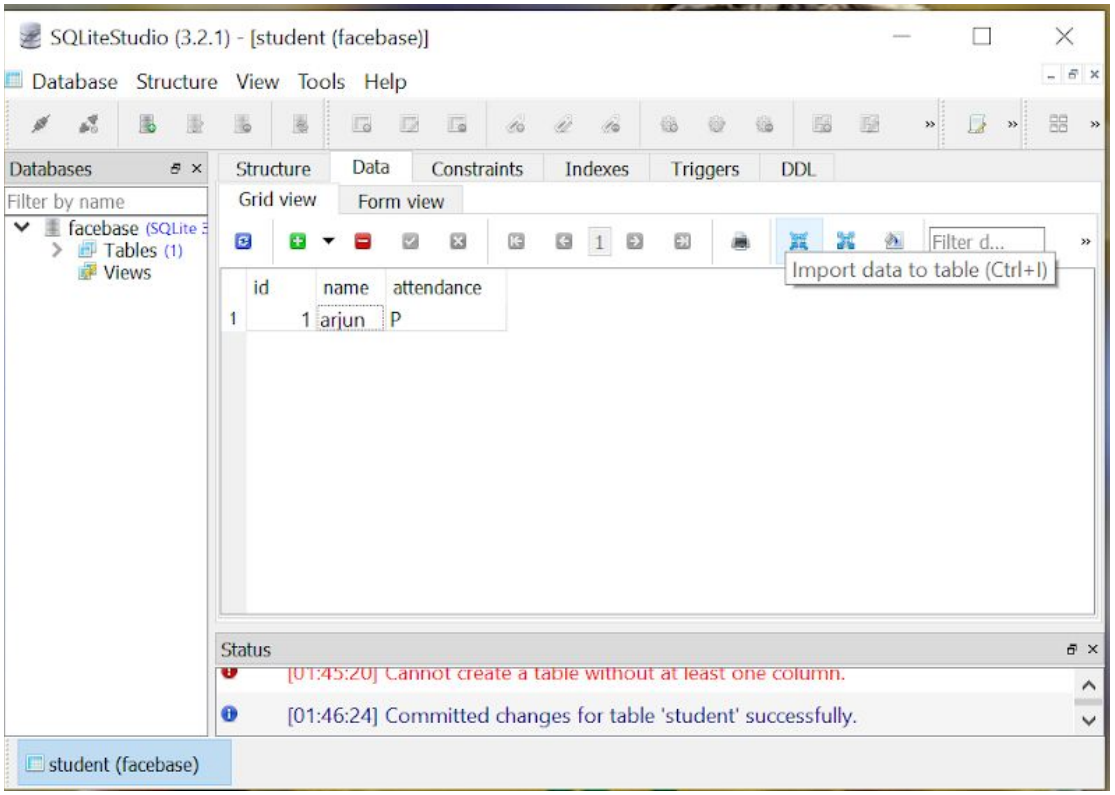


Figure 6.8 - Database After Attendance

CHAPTER 7

TESTING

7.1 Testing

Sl.No	Action	Inputs	Expected Output	Actual Output	Test Result
1	Capture Images	A Person's Face	Images are Captured and Stored	Images are captured and stored	Pass
2	Train the image Dataset	Stored images of a face	Create Histograms and store values	Histograms are created and values are stored	Pass
3	Face Recognition	A live stream of a person's face	Name of detected person is displayed on the screen	Name of detected person is displayed on the screen	Pass
4	Update attendance for multiple people at once	Multiple faces from a live video stream	Update Attendance for all faces detected	Attendance is Updates only for a single face	Fail
5	Detect more than 7 faces	7 people facing the camera	Detect all 7 faces facing the camera	Only 5 faces are detected at a time	Fail

Table 7.1 Testing

7.2 Testing Accuracy Numbers

Test no	Number of images	Positive	Negative	Accuracy
1	200	185	15	92.5%
2	200	187	13	93.5%
3	300	279	21	93.0%
4	300	282	18	94.0%
5	300	286	14	95.3%

Table 7.2 - Testing Accuracy Numbers

CHAPTER 8

CONCLUSION

- The proposed facial recognition based auto attendance system is **many times more efficient** than it's fingerprint or RFID based counterparts as **no manual intervention** is required.
- Saves time as the system works for **several people simultaneously**.
- The program is relatively **lightweight** and can be run on **inexpensive hardware**.
- The input device could be **integrated** to a complete **Raspberry Pi system** or could be anything other device like a mobile phone or a webcam.

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