AUTOMATIC ATTENDANCE SYSTEM USING IMAGE PROCESSING

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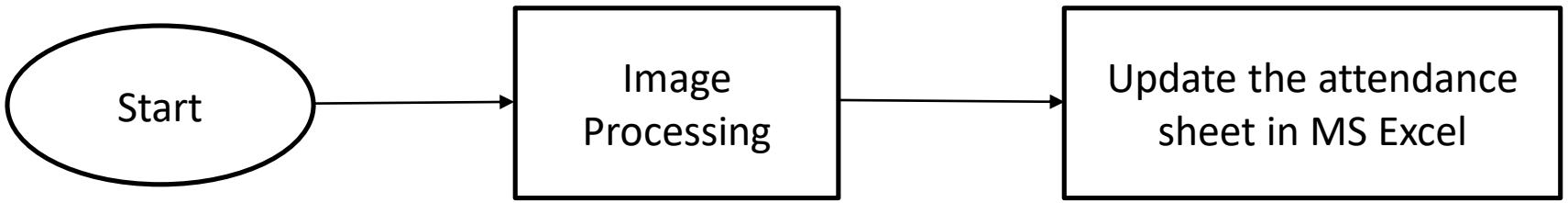
OBJECTIVES

- The objective of our project is to design software that can detect human faces by capturing images.
- Detect faces.
- Provides accurate detection.

SYSTEM FLOWCHART:



PROBLEM STATEMENT

- Nowadays students and faculties facing major problems in taking attendance.
- It takes more human and paper work.
- It may leads to human errors.
- Given an image, detect the presence of human face like objects and label them using rectangular regions.
- Mathematical Formulation:
    - two-class pattern classification problem
    - Detection problem
    - Hypothesis testing problem
- Solution:
    - Template matching
    - Feature matching
- Difficulties:
    - Face templates have too much variations:
        - Size, lighting, pose, facial wares (eye glasses), beard, etc,.

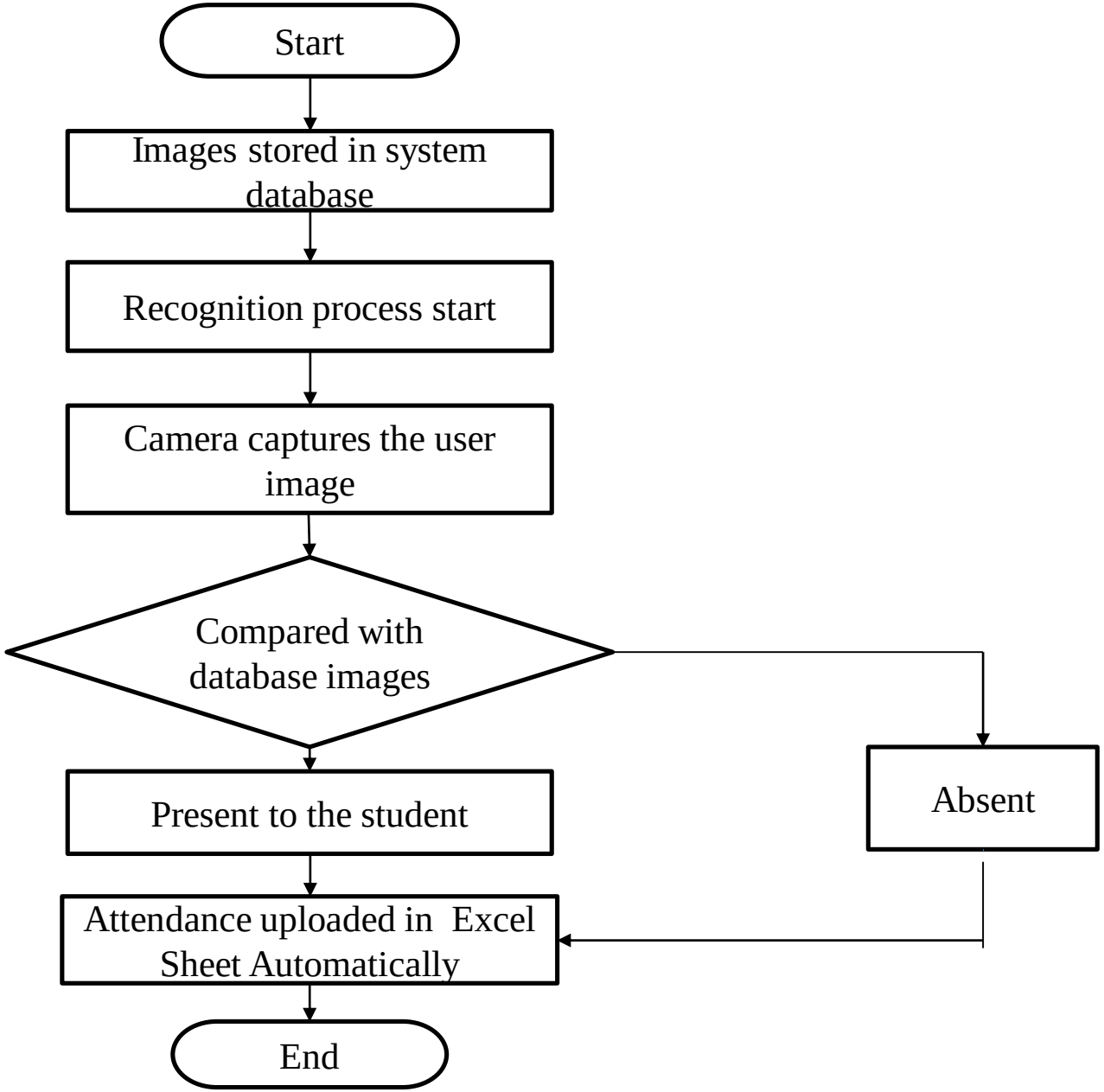
EXISTING SYSTEM

- Over the past several years, major improvements have been made to these baseline algorithms (LDA, PCA).
- In an experiment by Alice J. O'Toole, seven facial recognition algorithms were compared with humans on face matching tasks.
- Out of the seven algorithm, three were better at recognizing faces than humans.
- Existing Algorithms:
  - Principle Component Analysis (PCA)
    - Eigenface
  - Linear Discriminant Analysis (LDA)
    - Fisher face
  - Skin color based Algorithm
    - Red-Green-Blue (RGB)
    - YCbCr (Luminance-Chrominance)
    - Hue-Saturation Intensity (HSI)
  - Wavelet based algorithm
    - Gabor Wavelet
  - Artificial neural networks based algorithms
    - Fast Forward
    - Back Propagation
    - Radial Basis Function (RBF)

PROPOSED SYSTEM

- Three key contributions:
- Computing a rich live stream features using the .
- Learning algorithms, which selects a small number of critical visual features and yields extremely efficient classifiers.
- Combining cascade classifiers which allows background regions of the images.
- The attendance of the students can be stored in MS Excel sheet.
- Algorithms used in proposed system:
    - Principal Component Analysis (PCA)
    - Linear Discriminant Analysis (LDA)
    - Local Binary Pattern Histograms (LBPH)

ARCHITECTURAL DIAGRAM



SYSTEM REQUIREMENTS

Operating System :

- Windows 10 (version 1909)

Software :

- VS code or Python IDLE
- Anaconda OpenCV Python
- openCV-contrib-Python
- Python libraries

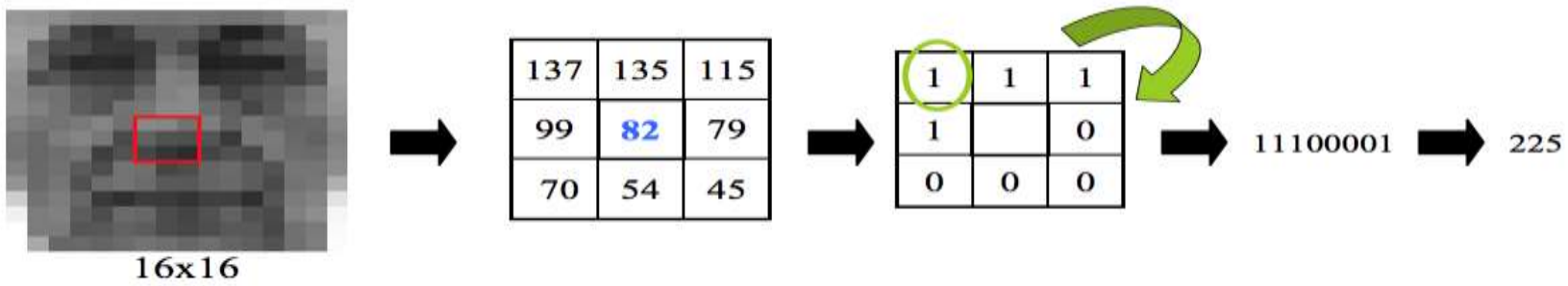
ALGORITHM DESCRIPTION

LOCAL BINARY PATTERN HISTOGRAMS:

- 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 results as a binary number. It is circular LBP.

Step-by-Step :

- Parameters – Radius, Neighbors, Grid X and Grid Y.
- Training the Algorithm.
- Applying the LBP Operations.
    - 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).



Formula:

- Local Binary Pattern do this comparison by applying the following formula:

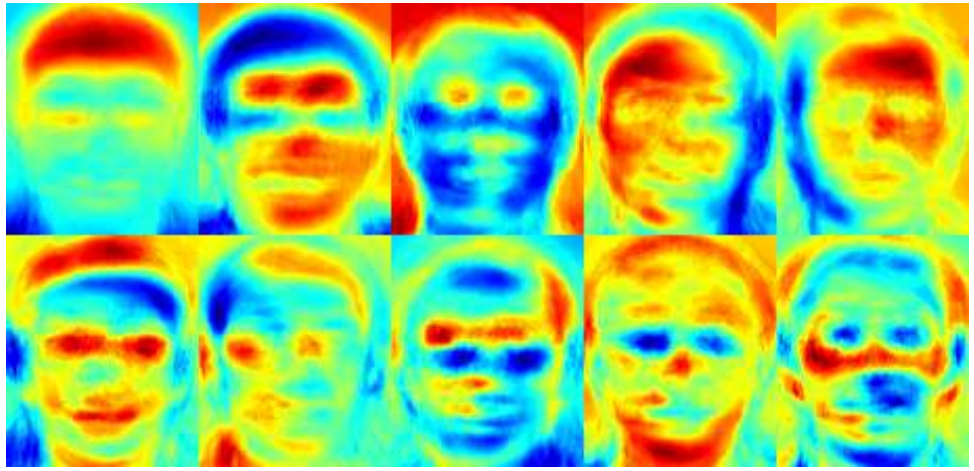
$$LBPH(Xc,Xy) = \sum_{n=0}^{7} s(in-ic)\,2n$$

where ic corresponds to the value of the center pixel (x,yc), in to the value of eight surrounding pixels.

- It is used to determine the local features in the face and also works by using basic LBP operator.
- Feature extracted matrix originally of size 3 x 3, the values are compared by the value of the center pixel, then binary pattern code is produced and also LBP code is obtained by converting the binary code into decimal one.

EIGENFACE (PCA):

- EigenFaces algorithm looks at all the training images of all the persons as a whole and try to extract the components which are important and useful (the components that catch the maximum variance/change) and discards the rest of the components.
- This way it not only extracts the important components from the training data but also saves memory by discarding the less important components.
- These important components it extracts are called **principal components**.
- Below is an image showing the principal components extracted from a list of faces.



FORMULA :

Fourier series :

$$f(x) = \frac{a_0}{2} + \sum_{n=1}^{\infty}[a_n cos(nx) + b_n sin(nx)]$$

Average face vector :

$$\Psi = \frac{1}{M}\sum_{i=1}^{M}\Gamma_i$$

Covariance matrix :

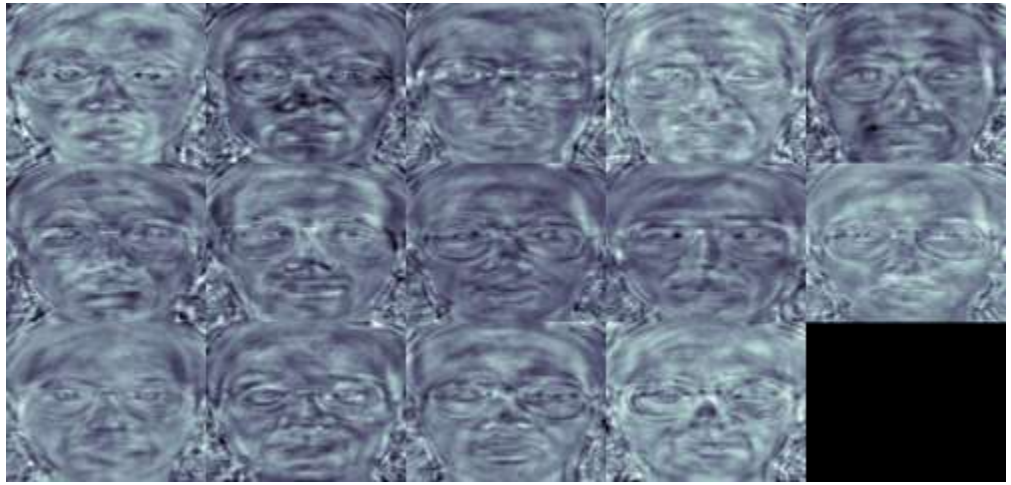
$$C = AA^T$$

$$A = [\Phi_1, \Phi_2 \ldots \Phi_M]$$

$$\Phi_i = \Gamma_i - \Psi$$

FISHERFACE :

- This algorithm is an improved version of EigenFaces algorithm.
- The drawback of EigenFace is **images with sharp changes (like light changes which is not a useful feature at all) may dominate the rest of the images** and you may end up with features that are from external source like light and are not useful for discrimination at all.
- In the end, your principal components will represent light changes and not the actual face features.
- Fisherfaces algorithm, instead of extracting useful features that represent all the faces of all the persons, it extracts useful features that discriminate one person from the others.
- This way features of one person do not dominate over the others and you have the features that discriminate one person from the others.
- Below is an image of features extracted using Fisherfaces algorithm.



FORMULA :

Let X be a random vector with samples drawn from c classes:

$$X = \{X_1, X_2, \ldots, X_c\}$$
$$X_i = \{x_1, x_2, \ldots, x_n\}$$

The scatter matrices S_B and S_W are calculated as :

$$S_B = \sum_{i=1}^{c} N_i (\mu_i - \mu)(\mu_i - \mu)^T$$
$$S_W = \sum_{i=1}^{c} \sum_{x_j \in X_i} (x_j - \mu_i)(x_j - \mu_i)^T$$

, where μ is the total mean :

$$\mu = \frac{1}{N} \sum_{i=1}^{N} x_i$$

And μ_i is the mean of class $i \in \{1, \ldots, c\}$:

$$\mu_i = \frac{1}{|X_i|} \sum_{x_j \in X_i} x_j$$

MODULES

Module 1 :

Testing camera - Capturing images - Captured image can be stored.

Module 2 :

Part – 1 :

Face detection - Database creation in respective folder for images - Data can be stored automatically in SQLite3 database – Data can be fetched in Excel Sheet.

Part – 2 :

Training the database images – YML file generated.

Module 3 :

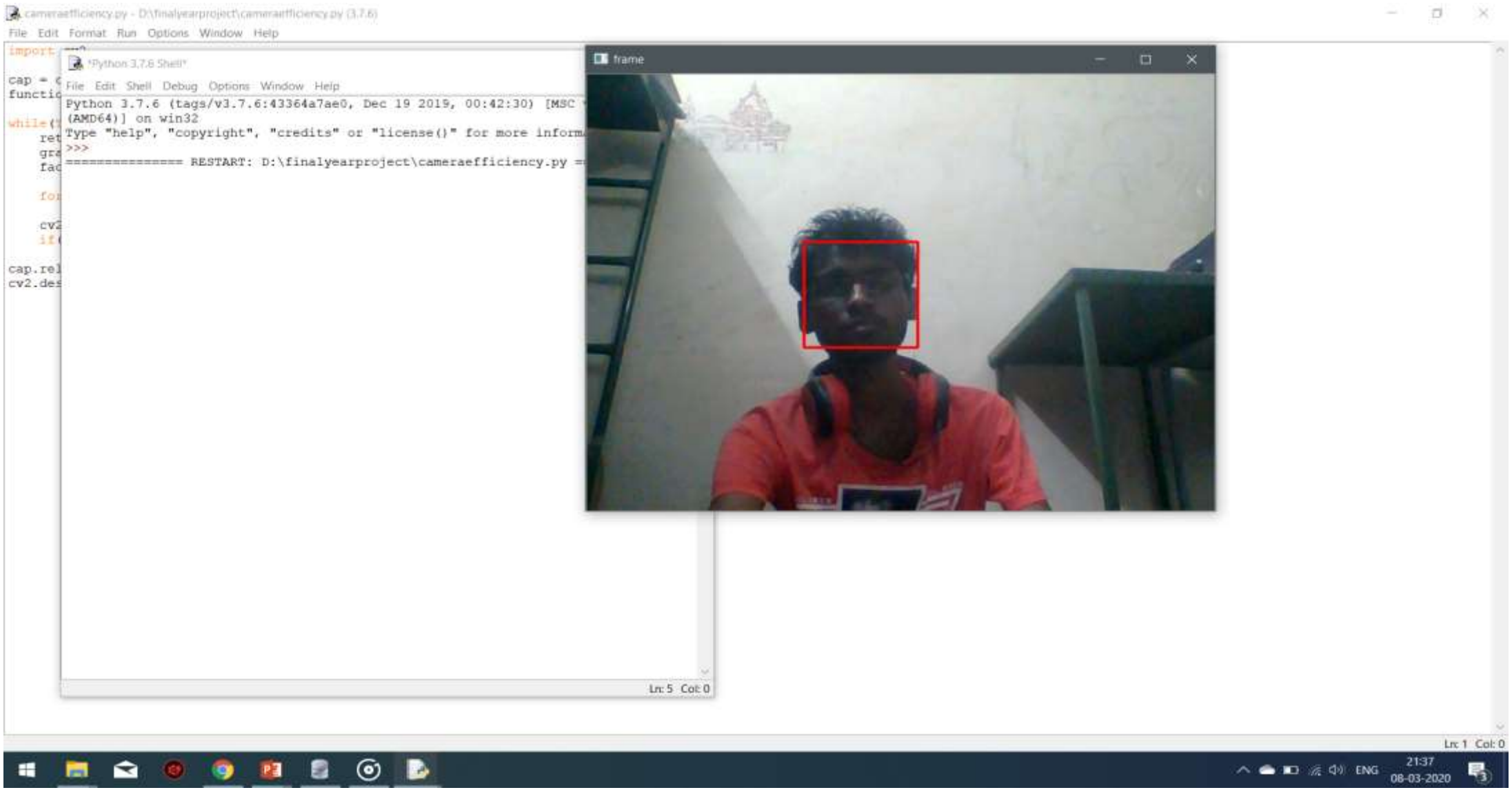
Face recognition – Predict the face of the person – Details of the person saved in database (attendance will be marked) – Data can be fetched in Excel Sheet.

MODULE DESCRPTION

MODULE 1 :

- Camera will be tested for its working efficiency.
- The images of the individual person can be shown in live stream.
- The images can be captured in live stream.
- The faces of the person can be detected in live stream.
- The images of the person can be captured.
- The images may vary from one another.
- The images can be stored for testing.

IMPLEMENTATION OF MODULE 1:



MODULE 2 :

DATABASE :

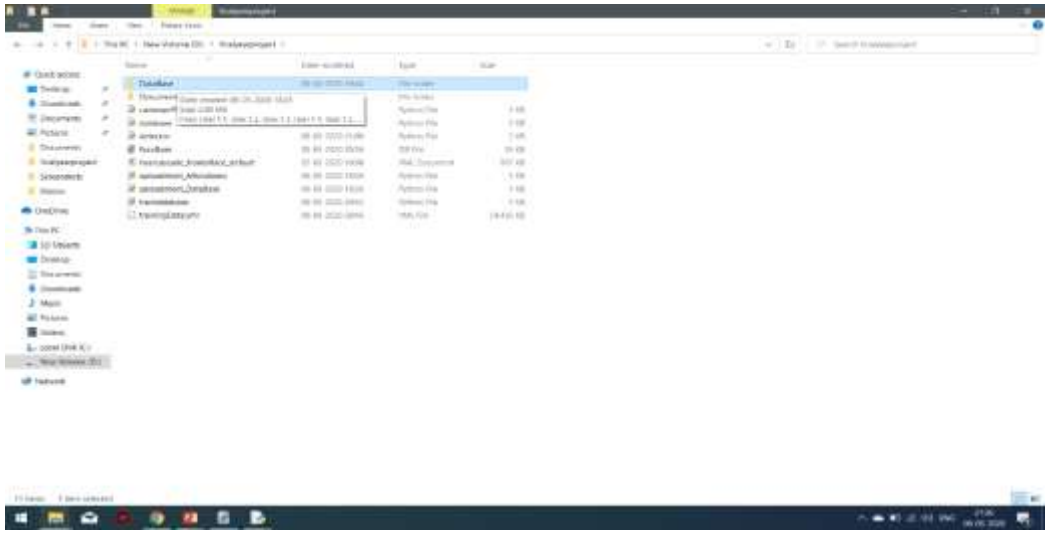
- Database is created manually by entering the details of the individuals.
- Camera captures the images of the individual’s for detecting the faces and stores the images in the respective folders of the individuals in the database.
- The data of the individuals are stored in SQLite3 database.
- The image of the individuals shown with their id.
- Whenever the data are needed, the data can be fetched to the Excel Sheet from the database according to their roll number.

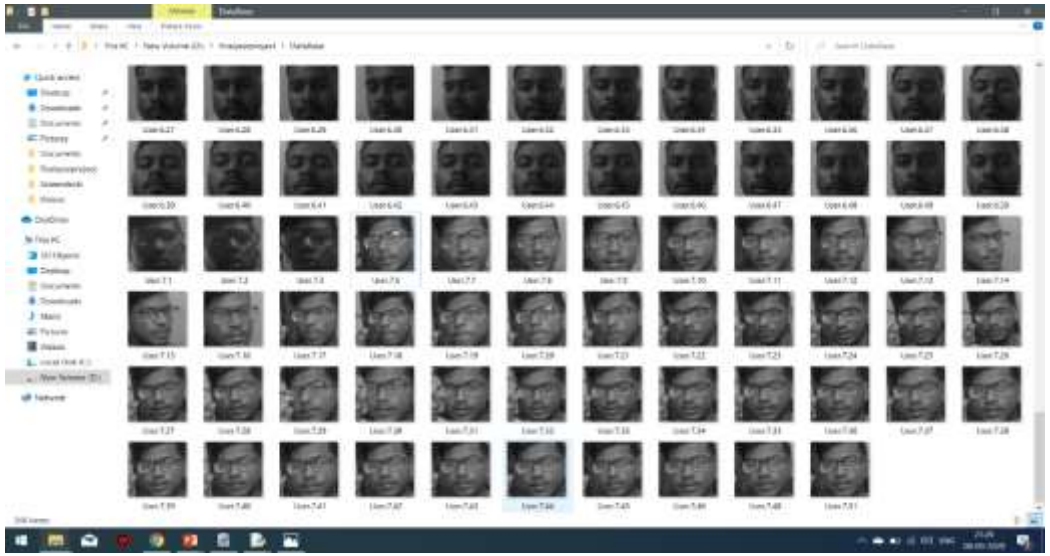
TRAINING :

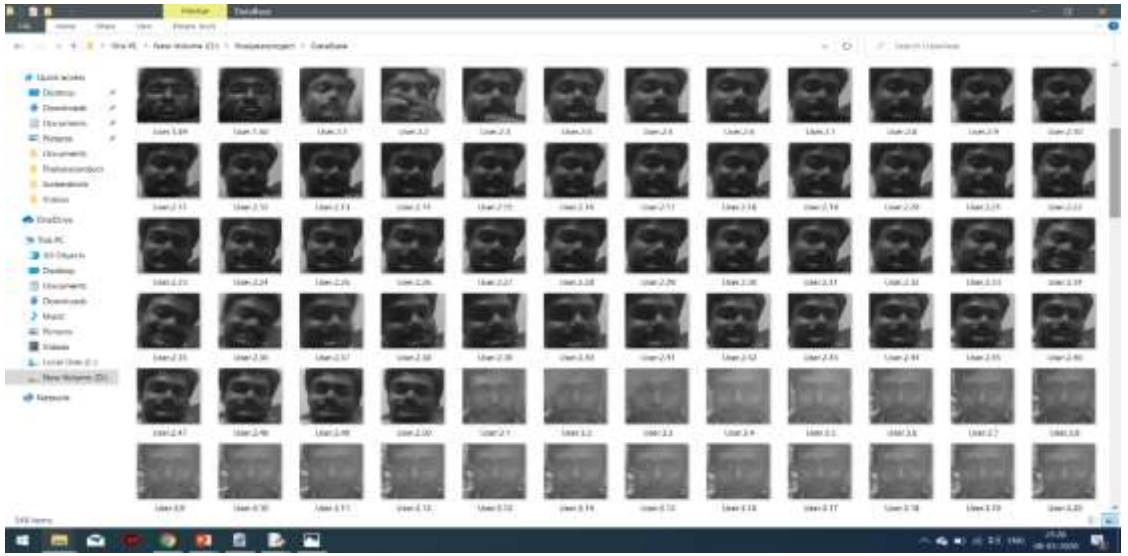
- Stored images are trained using LBPH algorithm.
- Images are trained one by one for each individuals.
- YML file can be generated.

IMPLEMENTATION OF MODULE 2

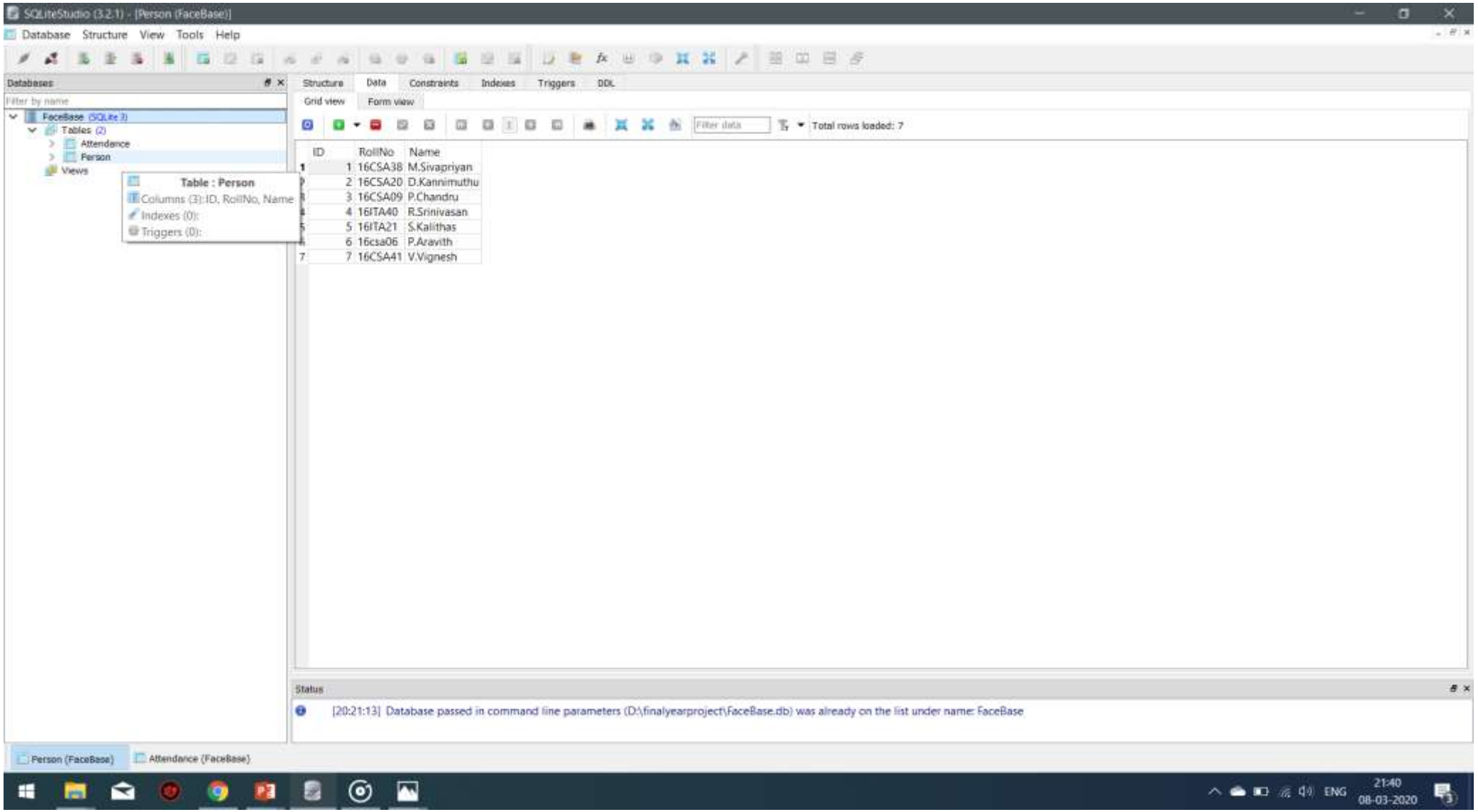
DATASET :



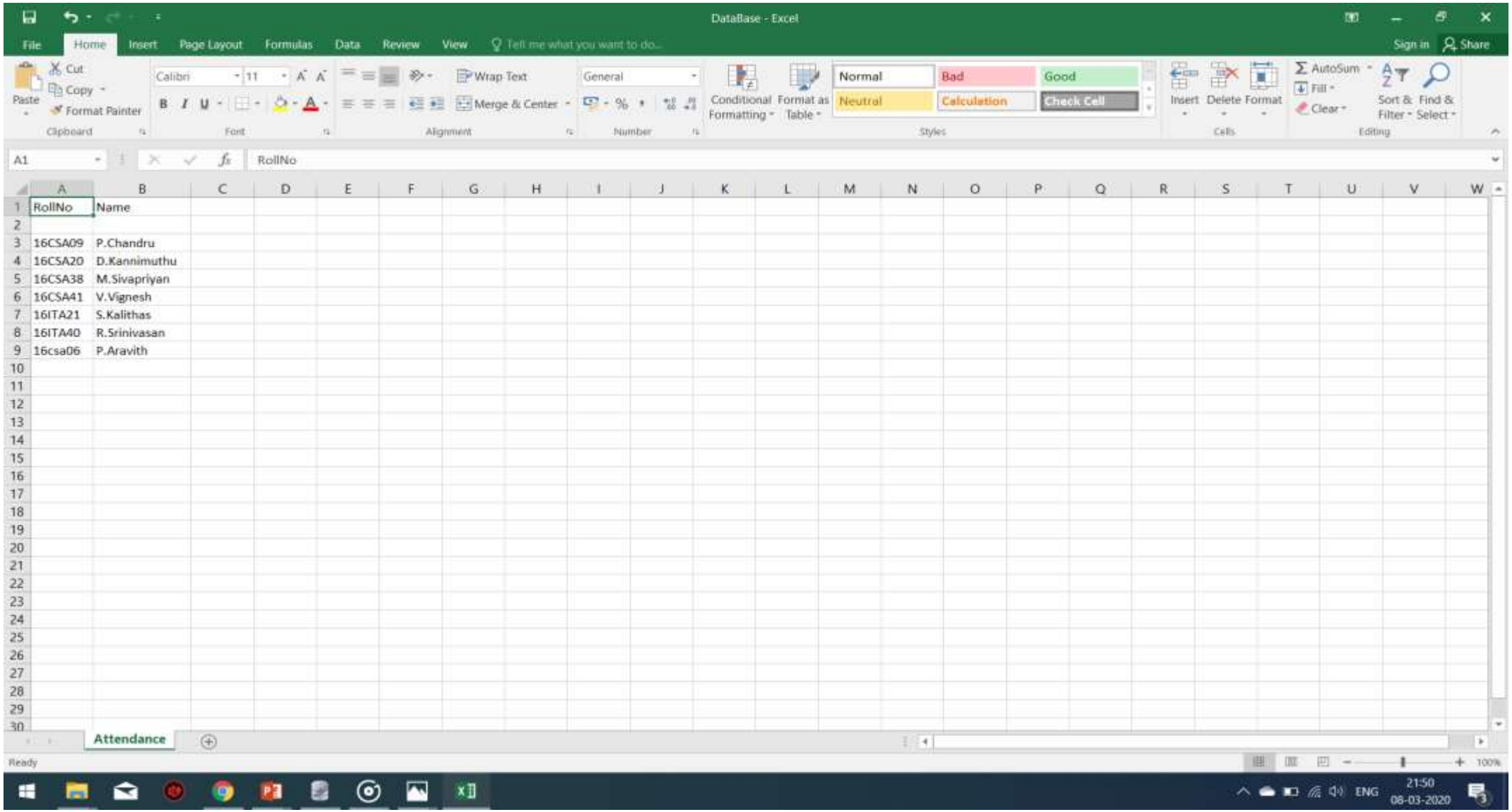




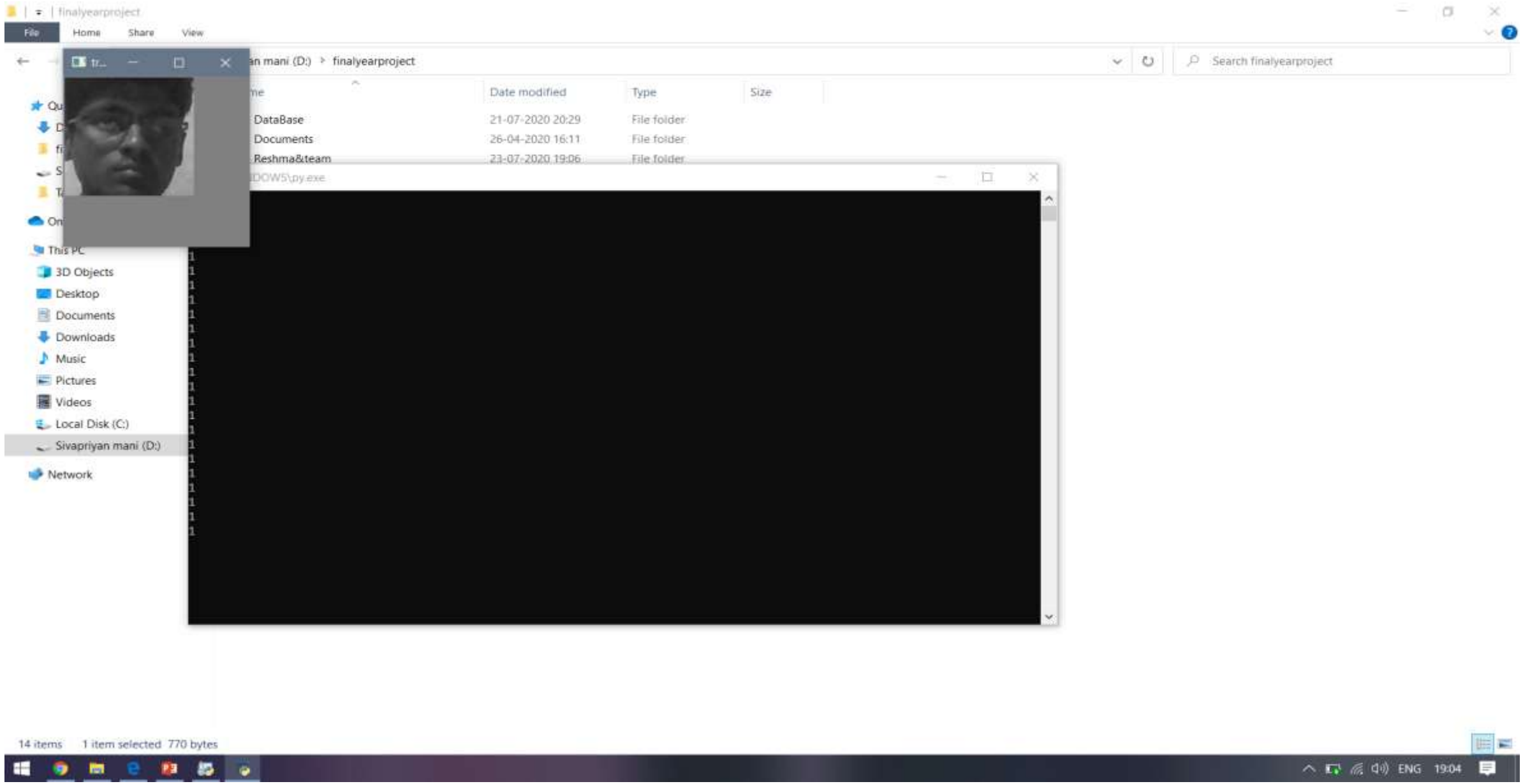
DATABASE:


SQLiteStudio (3.2.1) - [Person (FaceBase)]
Database Structure View Tools Help
Databases
FaceBase (SQLite 3)
Tables (2)
Attendance
Person
Views
Table : Person
Columns (3): ID, RollNo, Name
Indexes (0):
Triggers (0):
Structure Data Constraints Indexes Triggers DDL
Grid view Form view
Total rows loaded: 7
ID RollNo Name
1 16CSA38 M.Sivapriyan
2 16CSA20 D.Kannimuthu
3 16CSA09 P.Chandru
4 16ITA40 R.Srinivasan
5 16ITA21 S.Kalithas
6 16csa06 P.Aravith
7 16CSA41 V.Vignesh
Status
[20:21:13] Database passed in command line parameters (D:\finalyearproject\FaceBase.db) was already on the list under name: FaceBase
Person (FaceBase)
Attendance (FaceBase)
ENG
21:40
08-03-2020

SPREADSHEET(DATABASE):



Training:

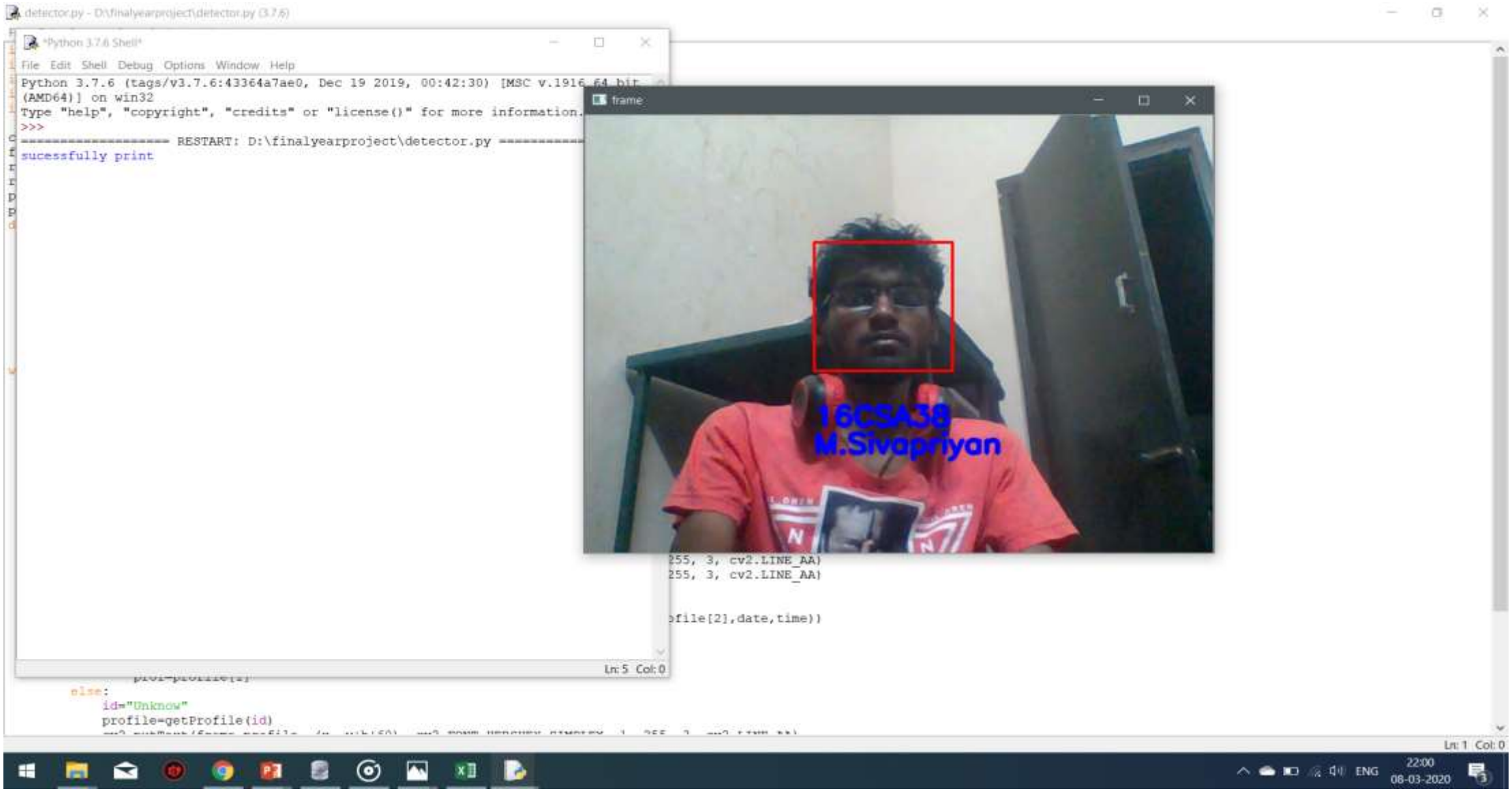

finalyearproject
File
Home
Share
View
Search finalyearproject
Date modified
Type
Size
DataBase
21-07-2020 20:29
File folder
Documents
26-04-2020 16:11
File folder
Reshma&team
23-07-2020 19:06
File folder
This PC
3D Objects
Desktop
Documents
Downloads
Music
Pictures
Videos
Local Disk (C:)
Sivapriyan mani (D:)
Network
14 items
1 item selected 770 bytes
ENG
19:04

MODULE 3:

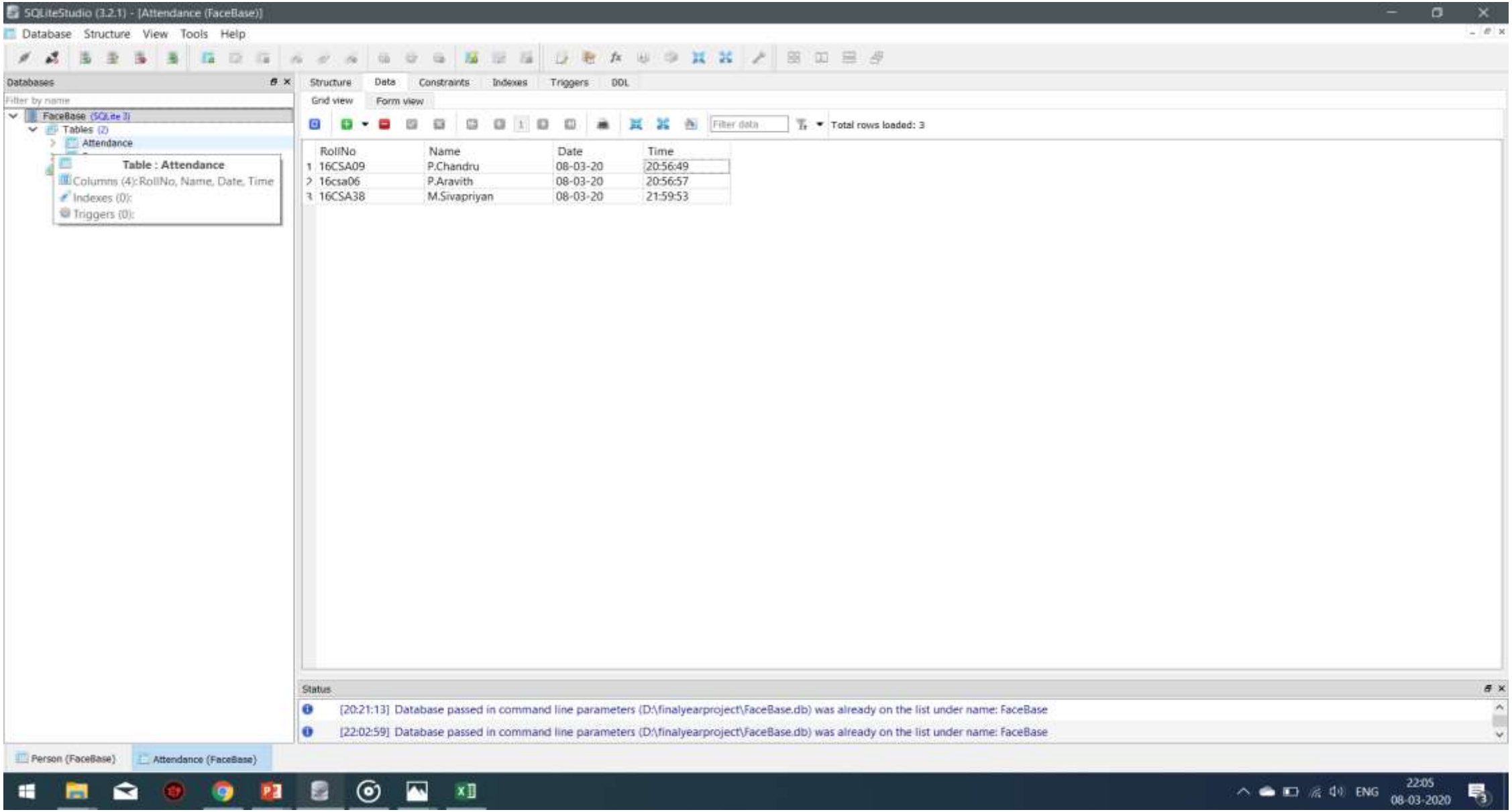
- Face recognition is a process as well as the Face detection process with small changes.
- Initially camera is opened and the faces can be detected using Haar cascade file and LBPH algorithm.
- Detected faces are compared with trained YML file and predict the faces of the individuals.
- The data of the predicted faces can be fetched from the person’s database and marked as attendance in attendance database with date and time.
- The name and roll number of the individual is shown under the rectangular detection box.
- The attendance database can be fetched to Excel Sheet if needed.

IMPLEMENTATION OF MODULE 3:

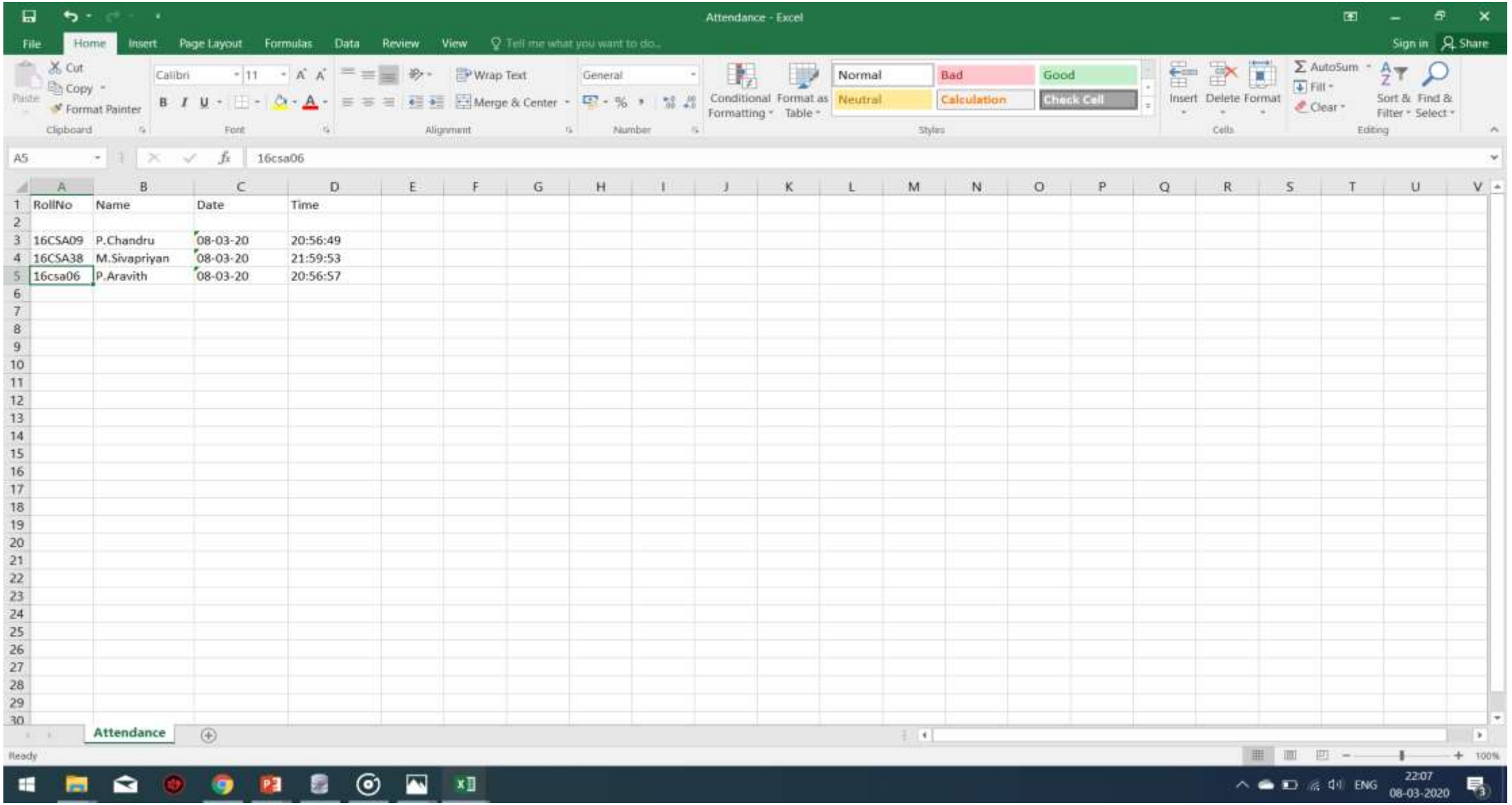
FACE RECOGNITION:



ATTENDANCE(DATABASE):



SPREADSHEET(ATTENDANCE):



ADVANTAGES

- The system reduces the human and paper work.
- The system is user friendly.
- Retrieval of data can be easy at any time.
- Calculations can be done easily.
- There is no chances of data loss.

LITERATURE REVIEW

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- http://www.scholarpedia.org/article/Fisherfaces

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