Birla Vishvakarma Mahavidyalaya Engineering College

[An Autonomous Institution]

A
Project Report
On

Attendance Management System using Face recognition

Under the course of

DESIGN ENGINEERING -3CP08

B. E. Semester – IV

(Computer Engineering)

Submitted by:

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Guided by
kirtikumar sharma

Academic year
(2021-2022)

CERTIFICATE

This is to certify that the students namely, **Ms. Krupa Patel(20CP301), Ms. Prachi Vasava(20CP302)** of ***B. E. (Computer Engineering) Semester VI*** have successfully completed the course work and related tasks for the course of **Design Engineering 3CP08** during the academic term ending in the month of May 2022.

Date: _____

Place: _____

(Faculty Guide) Head of the Department

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1. INTRODUCTION

1.1 Definition

Attendance Management System is software development for daily student attendance in schools, colleges and institutes. It facilities to access the attendance information of a particular student in a particular class. The Information is sorted by the operators, which will be provides by the teacher for a particular class.

1.2 Purpose

The purpose of developing attendance management system is to computerized the tradition way of taking attendance. Another Purpose for developing this software is to save time by manually doing ayttendance.

1.3 Scope

The scope of the project is the system on which the software is installed. i.e. the project is developed as a desktop application, and it will work for a particular institute. but later on the project can be modified , later on the project can be modified to operate it online.

1.4 Overview

Attendance Management System basically has one main modules for proper functioning:- All module is handled by the user which can be a faulty or an operator. User has a right of making daily attendance, and register student to the system.

2. LITERATURE REVIEW

Project Background

In the face detection and recognition system, the process flow is initiated by being able to detect the facial features from a camera or a picture store in a memory. The algorithm processes the image captured and identifies the number of faces in the image by analyzing from the learned pattern and compare them to filter out the rest. This image processing uses multiple algorithm that takes facial features and compare them with known database.

The motivation behind this project is to simplify the means by which attendance is taken during lectures and how much time it takes. The use of ID cards or manually calling out attendance and writing it down on sheets is not productive and efficient. This system will detect the number of faces on the class and will also identify them from the store database. 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.

CASE STUDY

PROJECT # 1

This is a project done by students as a final year project at Kingston University London in 2018. The system will be presented an image either via camera or from memory and it must detect the number of faces on it automatically. After identifying faces, the system should crop the faces from the image and store them in memory for image recognition which will be done in the second step. The system should be able to automatically count the number of faces detected on the image. The second step will be the recognition part where the system will be able to match faces from the stored dataset and compare it to the input data from the first step. A software will be used for this system which automatically sorts out the faces. The software will be inter-active so to facilitate interaction between multiple tasks as required. Because the system has two steps, the second phase of the system will involve the training of images on a dataset that are to be used for recognition.

Technology Used

The key algorithms are Viola-Jones for face detection and Hidden Markov Model with SVD.

- The implementation of The Viola-Jones algorithm is available on softwares like MATLAB, OpenCV and Web Browsers (using adobe flash).
- The existing implementation of the Hidden Markov Model with SVD for face recognition are available on MATLAB, C++ and OpenCV libraries.

PROJECT # 2

This is a project done by students as a final year project at University of Nairobi in 2012. The system will comprise of two modules. The first module a.k.a face detector is a mobile component, which is basically a camera that captures student faces and stores them in a file using computer vision face detection algorithms and face extraction techniques. The second module is a desktop application that does face recognition of the captured images (faces) in the file, marks the students register and then stores the results in a database for future analysis.

Technology Used

The following tools will be used in the implementation of the designed system.

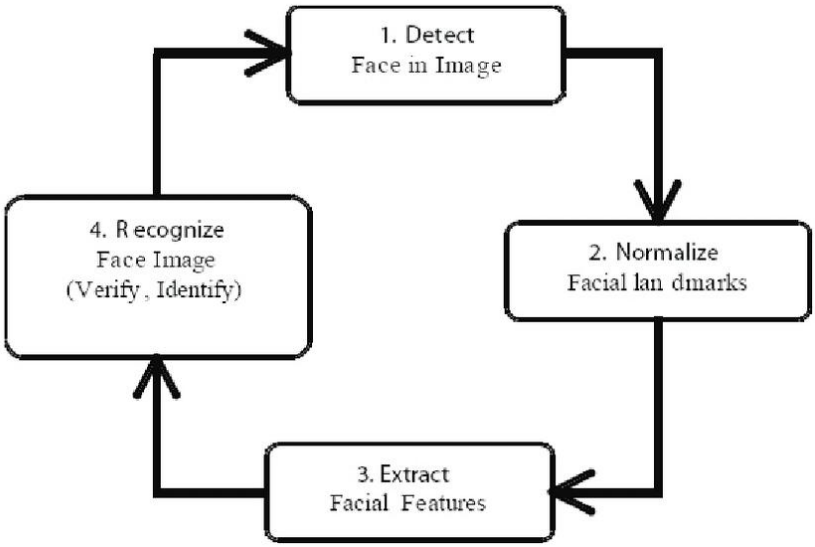
They've been divided in to two categories; Mobile and Desktop tools.

- Mobile Tools The face detection module will use OpenCV library for implementation by use of the frontal Haar Cascade face detector in either Android studio. OpenCV for Android Library - (Open Source Computer Vision) is a library of programming functions mainly aimed at real-time computer vision. Android Studio/ Eclipse IDE - Android Studio is the official IDE for Android application development, based on IntelliJ IDEA.
- Desktop Tools EmguCV Library - EmguCV is a cross platform .Net wrapper to the OpenCV image processing library. OpenCV/EmguCV uses a type of face detector called a Haar Cascade. The Haar Cascade is a classifier (detector) trained on thousands of human faces. Visual Studio - Visual Studio is able to build and run the solution examples after a proper configuration of EmguCV. The desktop software will implement the two sub-systems (Training set manager and Face recognizer) together with face detector in windows form.

PROJECT # 3

- It is a simple python script that recognizes faces and mark attendance for the recognized faces in an excel sheet. This face recognition attendance system is made by Shubham Sonkesriya. This program is made in Python language.

FLOWCHART



DATASET

- We have to take Datasets from Kaggle or we can take manually images from google.

COST ANALYSIS

- This is fully program-based system so it doesn't need any cost analysis.

HARDWARE/ SOFTWARE DETAILS

- Any Python Compiler

LIBRARIES

- face_recognition
- Opencv
- openpyxl
- Datetime

PROJECT # 4

After you run the project you have to register your face so that system can identify you, so click on register new student

After you click a small window will pop up in that you have to enter you ID and name and then click on Take Image button

After clicking Take Image button A camera window will pop up and it will detect your Face and take upto 50 Images(you can change the number of Image it can take) and stored in the folder named TrainingImage. more you give the image to system, the better it will perform while recognising the face. Then you have to click on Train Image button, It will train the model and convert all the Image into numeric format so that computer can understand. we are training the image so that next time when we will show the same face to the computer it will easily identify the face. It will take some time(depends on you system). After training model click on Automatic Attendance ,you have to enter the subject name and then it can fill attendace by your face using our trained model it will create .csv file for every subject you enter and seperate every .csv file accoriding the subject.You can view the attendance after clicking View Attendance button. It will show record in tabular format.

DATASET

- Train and tested on few samples

COST ANALYSIS

- This is fully program-based system so it doesn’t need any cost analysis.

HARDWARE/ SOFTWARE DETAILS

- Any Python Compiler

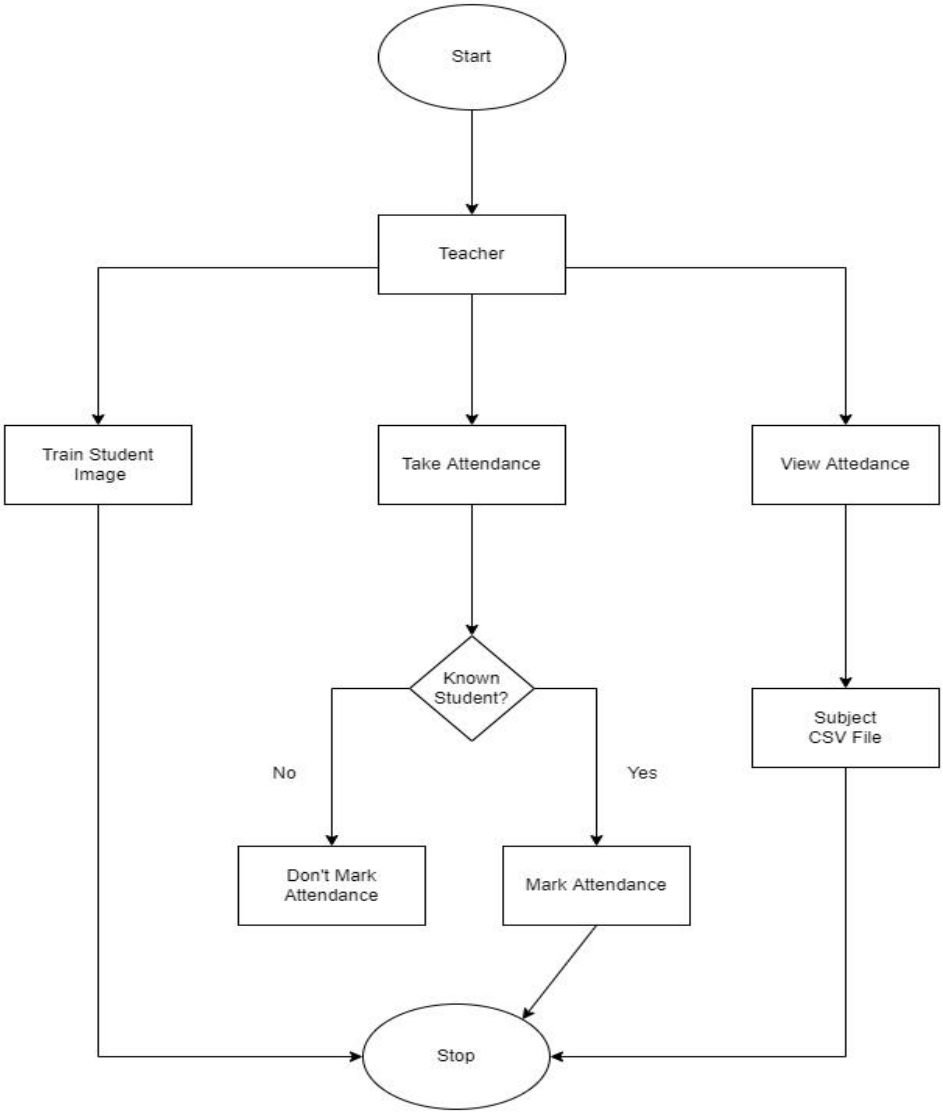
LIBRARIES

- Tkinter
- Opencv
- faceRecognition

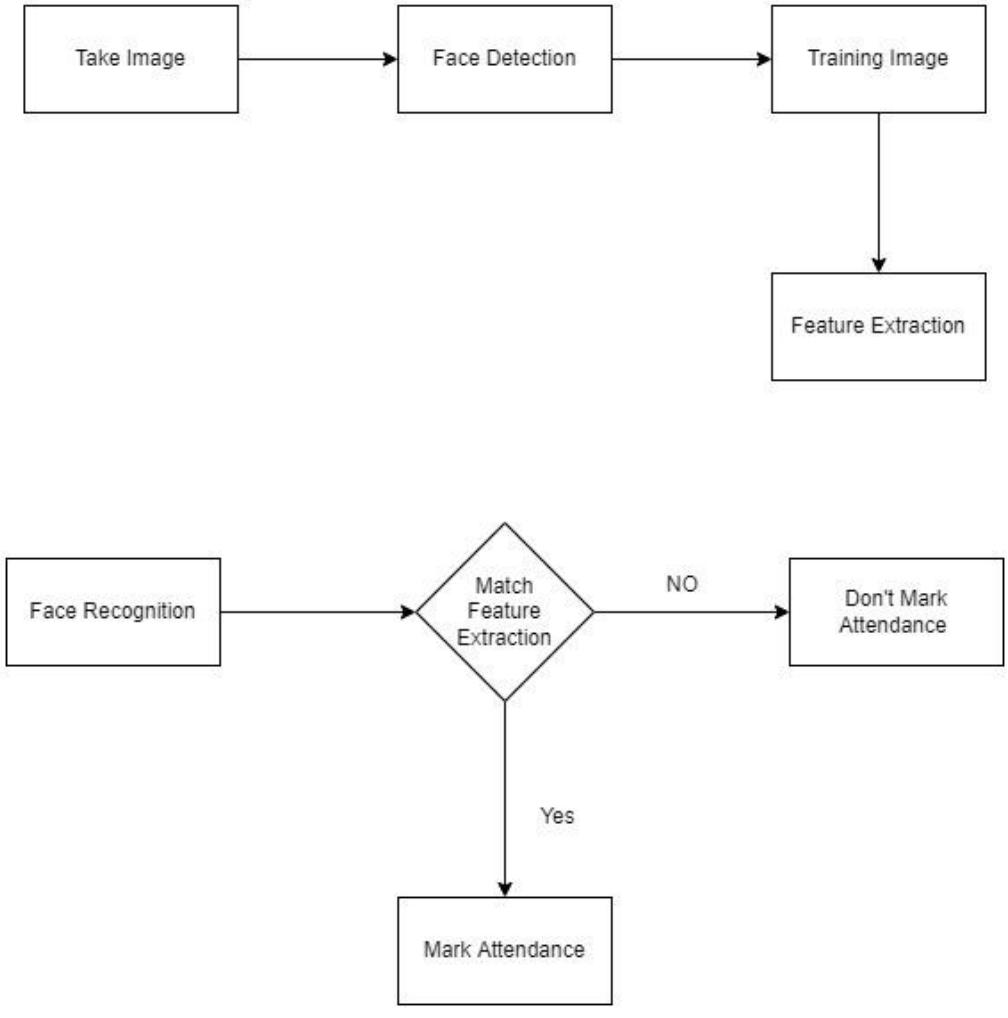
3. DESIGN CONSIDERATIONS FOR DETAIL DESIGN

Design Constraints The constraints which were considered while designing on project are following.

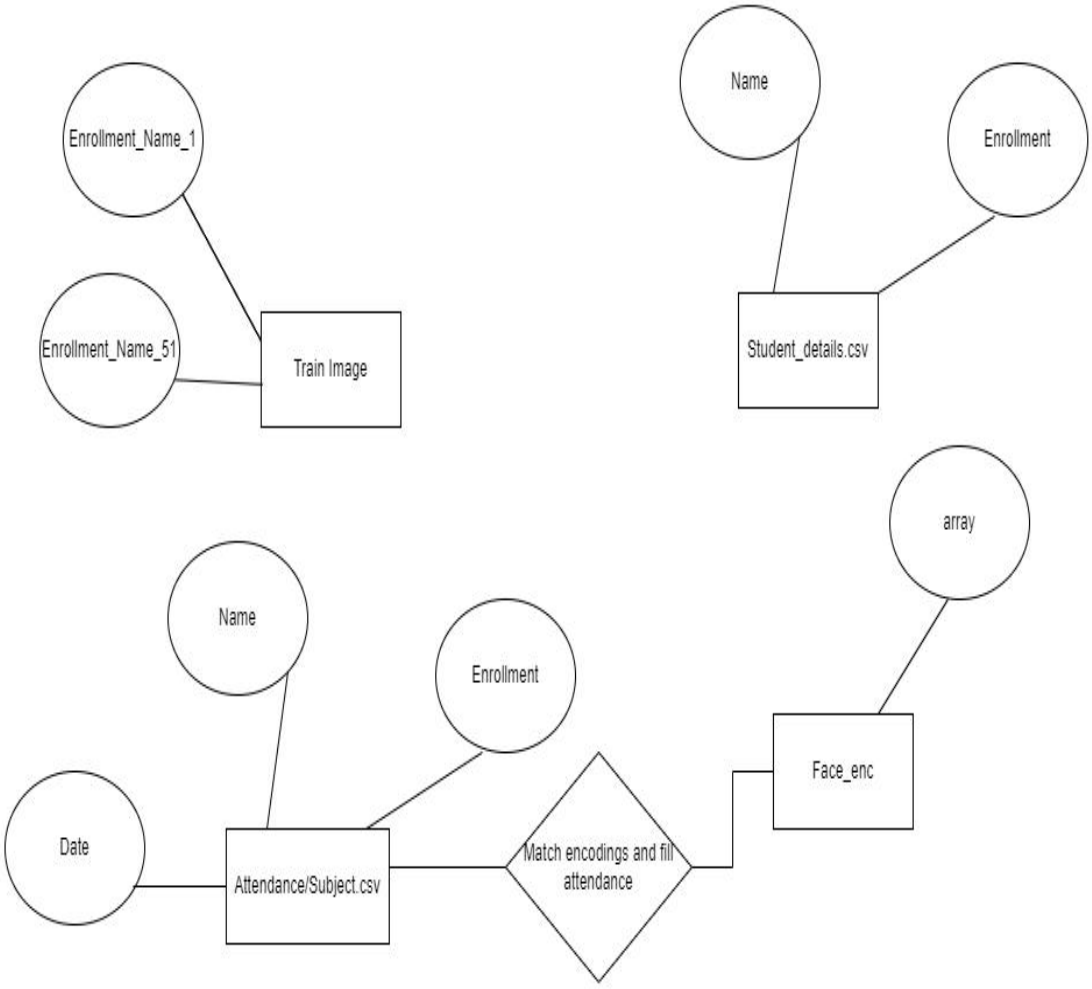
DATA FLOW DIAGRAM



PROTOTYPE


Take Image
Face Detection
Training Image
Feature Extraction
Face Recognition
Match Feature Extraction
NO
Don't Mark Attendance
Yes
Mark Attendance

E-R Diagram


Enrollment_Name_1
Enrollment_Name_51
Train Image
Name
Enrollment
Student_details.csv
array
Name
Enrollment
Face_enc
Date
Attendance/Subject.csv
Match encodings and fill attendance

4. CANVASES

1. AEIOU CANVAS

<table>
<tr><td rowspan="2">AEIOU CANVAS</td><td colspan="2">Group – 1
20CP301, 20CP302 VERSION - 1.0</td></tr>
<tr><td colspan="2">Domain Name - Attendence based on Face Recognition</td></tr>
<tr><td>ACTIVITIES

Face Detection

Face Recognition

Attendance Marking

Student Record</td><td>ENVIRONMENT

User Friendly

Secure

Use less Man power

Searching data is easy</td><td>INTERACTION

Teacher to System

Principal to System

Staff to System</td></tr>
<tr><td>OBJECTS

WebCam

CCTV</td><td colspan="2">USERS

Students

Professors/Teachers

Principal

Staff</td></tr>
</table>

2. EMPATHY CANVAS

Design for: Attendence based on Face Recognition **Date:**	**Design By: Group – 1** **20CP301, 20CP302** **Version: 1.0**
USER Professor Staff Principle Student	**STACKHOLDER** Principle Developers Professor
ACTIVITIES Face Detection Face Recognition Attendance Marking Student Record	**STORY BOARDING** Happy Time Saving Happy Paper Saving Sad Datalost Sad Webcam Required

3. IDEATION CANVAS

Project: Attendence based on Face Recognition	**Team**: Group 1 20CP301,20CP302
PEOPLE Student Staff	
ACTIVITIES Face Detection Face Reorganization Student Record Attendance Marking	**CONTEXT/LOCATION** Attend Study Home
POSSIBLE SOLUTIONS Use of Database and make a device	

4. PRODUCT DEVELOPMENT CANVAS

PURPOSE

- Time Saving
- No Proxy Attendance
- Digitalization

PRODUCT FUNCTION

- Easiness to Professors

PRODUCT FUNCTION

- Detect face
- Recognize face
- Mark Attendance

CUSTOMER REVALDATION

- User Friendly
- Marking Attendance is Easy

PEOPLE

- Professor
- Staff
- Principle
- Student

PRODUCT FEATURES

- Add Student
- Take Attendance
- View Attendance

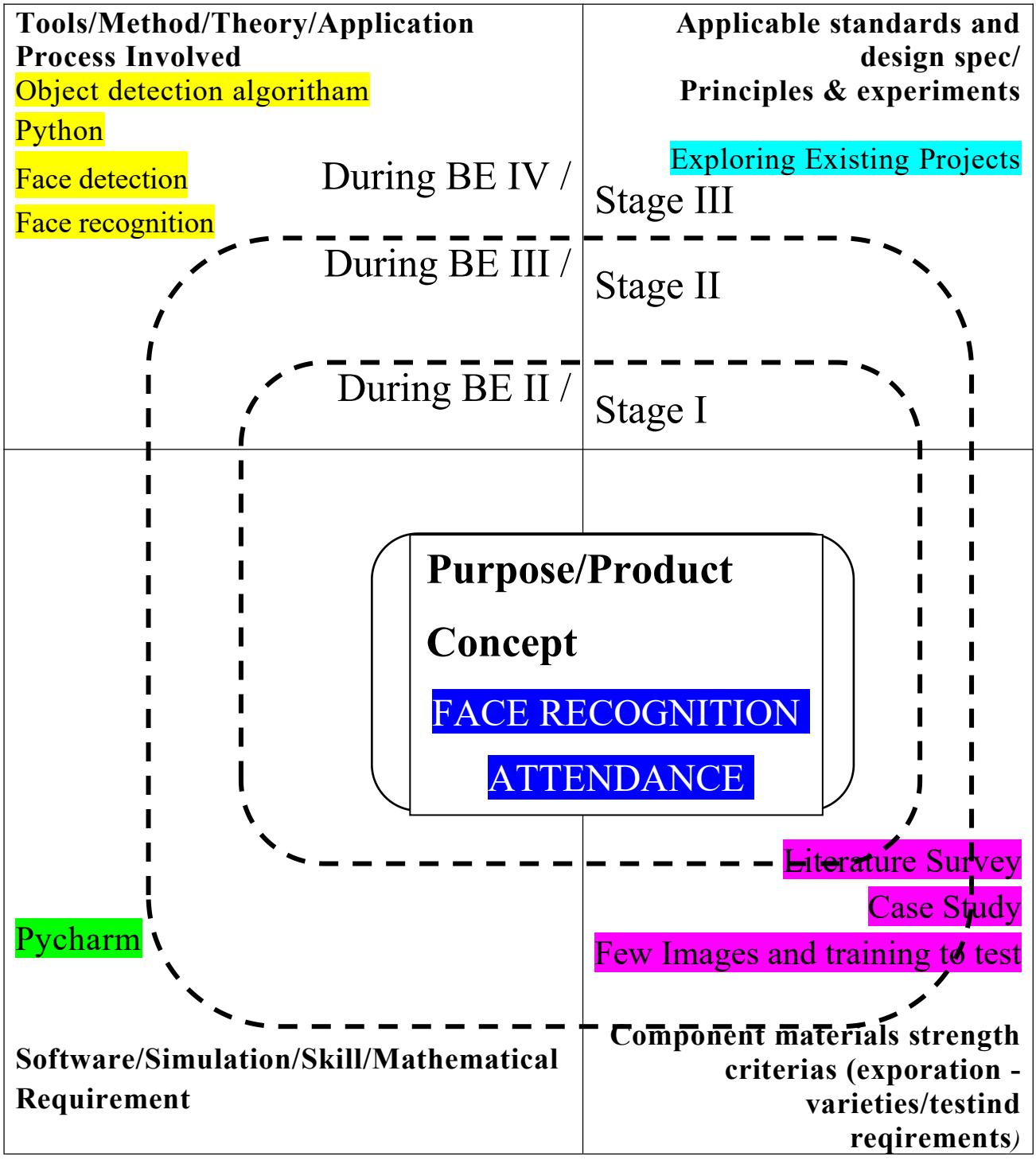
COMPONENTS

- Webcam
- Algorithams

REJECT, REDESIGN, RETAIN

- Appliable to all system in colleges and schools

5.LEARNING NEED MATRIX



5. PROTOTYPE, IMPLEMENTATION/ SIMULATION

METHODOLOGY

The proposed methodology starts with the registration of students into the system. Following methodology has few main stages such as capturing images, pre-processing of the images, Haar Cascade classifier is used for face detection, developing a dataset of images, the further process of face recognition is done with the help of LBPH algorithm as shown in fig 1.

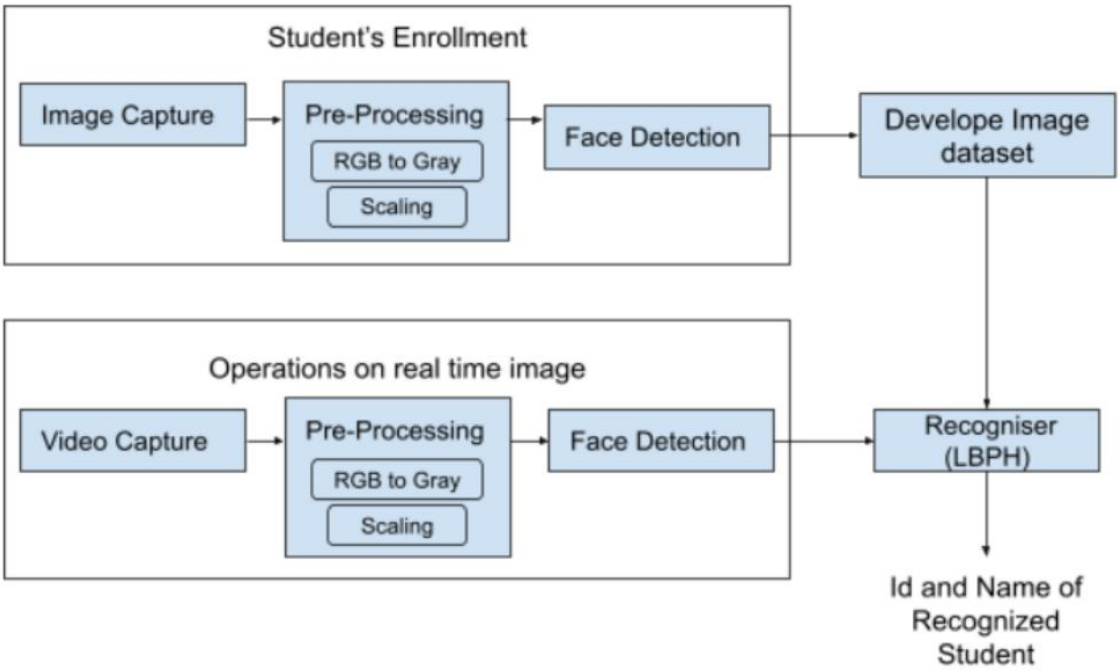


Fig 1: Proposed Methodology for Attendance monitoring.

1. Image Capture:

The high-resolution camera which is used for capturing video is used to take frontal images of the students.

2. Pre-processing

The images are converted from RGB to Grayscale and are scaled down by a factor of 1.2.

3. Face Detection

Face Detection is composed of three stages.

1. Haar Cascade Classifier
2. Integral Image

1. Haar Features

Haar features are the same as convolutional kernels and are used to detect the features in a given image. There are different kinds of Haar features such as line feature, edge feature, four – rectangle feature etc. A single value is used to represent each feature which i calculated by subtracting the sum of pixels under the white rectangle from the sum of pixels under the black rectangle as shown in fig 2. Haar cascade algorithm makes use of 24*24 windows which ends up calculating 160000+ features in a window.They are sensitive to different scale to detect face of different size. To simplify the work of calculating the feature values, an Integral image algorithm is introduced.

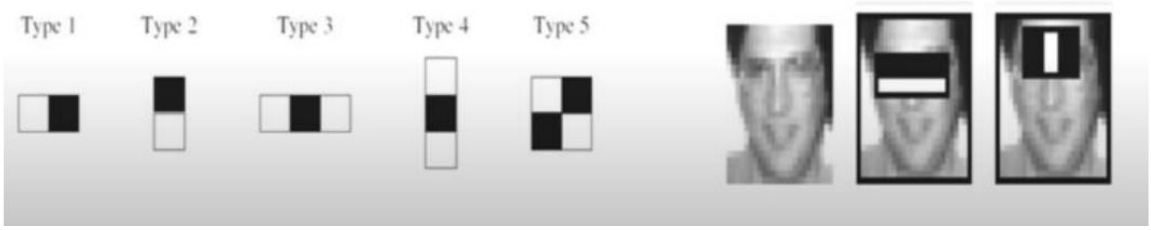


Fig 2: Haar Feature Selection.

2. Integral Image

To reduce the computation of the pixels to find the feature values, Viola Jones introduced a technique called Integral Image. As shown in fig 3, the value of the pixel at (x, y) in an Integral image is calculated by adding the values of pixels above and to the left of (x, y) pixel.

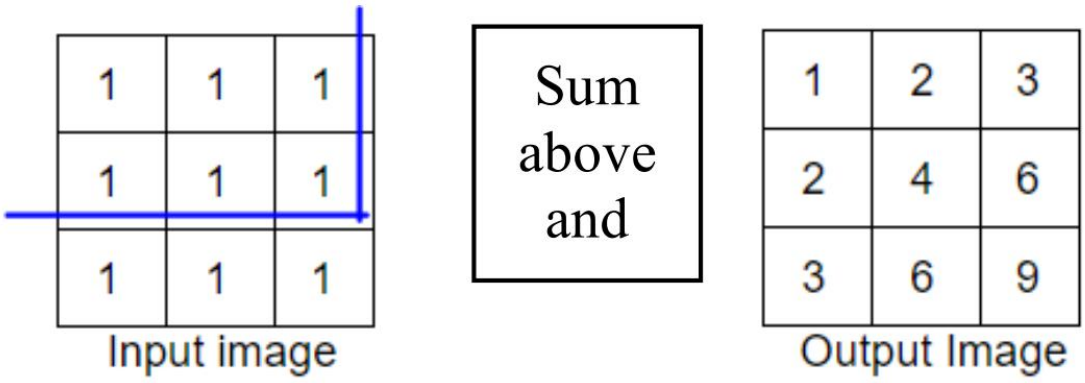


Fig 3: Integral Image.

Calculation of the sum of all pixels inside any given rectangle can be done by using only four values at the corner of that rectangle with the help of Integral image as shown in fig 4.

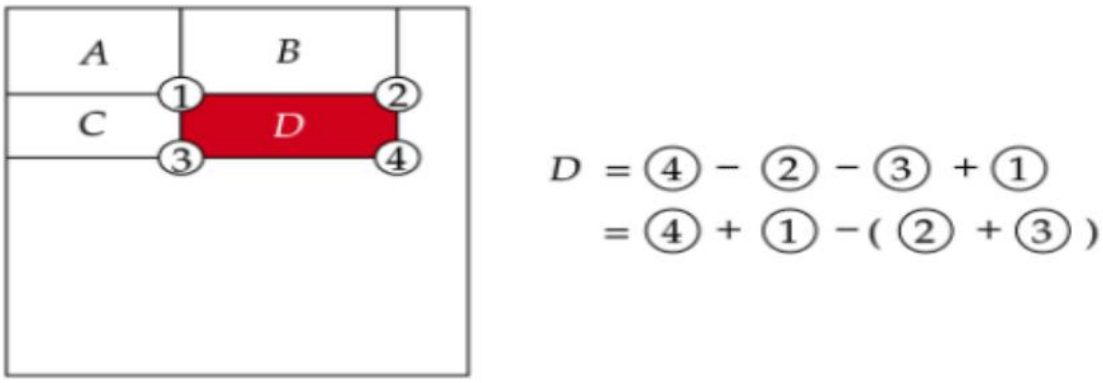


Fig 4: Calculation of sum of pixels using Integral Image.

In Paul Viola and Michael Jones detection algorithm, one single image is scanned many times by the detector with a new size every time. When multiple faces appear in

an image the algorithm concentrates on removal of non-faces and brings out the most feasible face area. Since the computation cost is very high for each window when a particular strong classifier is a linear combination of all the best features and is not so appropriate for evaluation. Hence a cascade classifier is used.

Cascade classifiers comprise various stages. All the features are grouped into different stages and each stage contains a strong classifier and a feature. To design these stages, AdaBoost is used. In, each stage decides whether a sub- window is a face or not. The window is discarded if it does not contain a face. While training a classifier the number of features, stages and thresholds are taken into account.

4. Developing a dataset

The faces detected in images are stored in the database after pre-processing and detection. A minimum of 51images are captured per individual student along with a unique ID. The dimensions of these stored images are 212x212 pixels. These images are later used to train the recognizer.

5. Face Recognition

Local Binary Pattern (LBPH) is a smooth & adequate operator, which operates by setting the pixels of an image by thresholding the neighborhood of each pixel and examines the outcome as a binary number. Histogram of Oriented Gradients (HOG) descriptor increases the detection performance when combined with LBP. Therefore, a combination of LBP & HOG which gives LBPH algorithm is used for face recognition. Steps involved in LBPH are as follows.

1. LBPH considers four parameters for face recognition which are as follows

- Radius: To set up a circular local binary pattern radius is used. Generally, it is set to 1.
- Neighbors: To set the circular local binary pattern neighbors are used. Normally, set to 8.
- Grid X: Gives cells count which are in horizontal direction. Normally, it is set to 8.
- Grid Y: Gives cells count which are in vertical direction. Normally, it is set to 8.

2. Training the Algorithm:

A database of the face images of students which are to be recognized is used to train the algorithm. The unique ID which is set while developing a dataset is useful for recognizing the student.

3. Applying the LBP operation:

By intensifying facial characteristics, create an intermediate image that describes the original image. Based on the parameters like radius and neighbors, the algorithm uses a sliding window concept. Fig 5 describes this operation.

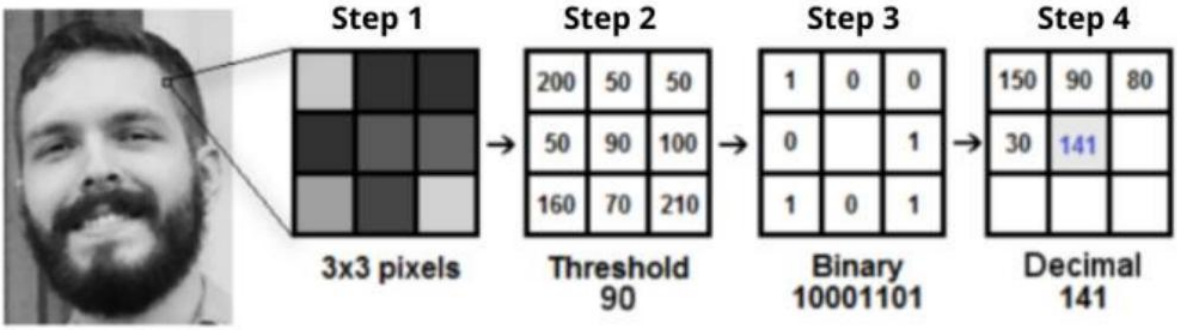


fig 5. LBP Operation

● Assume that we have a grayscale facial image, take a part of images as a 3 x 3 matrix containing pixel intensities in the range (0 – 255), as shown in step1 and 2 in fig 6.

● In step 3, consider central pixel intensity as threshold and change the values of 8 neighbors with respect to the threshold value. (Set it to 1 if neighboring pixel intensity is greater than or equal to the threshold value, otherwise set to 0.)

● In step 4, convert the binary value into decimal value. The central pixel value of the image matrix is replaced by a decimal value. This central pixel is actually a pixel of a primary image.

● Applying these steps to all the parts of the image, we get a new image (result of LBP operation) that describes the features of the primary image.

4. Extracting the Histograms: Grid X and Grid Y parameters are used to divide images into multiple grids. Each histogram holds only 256 positions (0-255) that shows the existence of each pixel intensity as the image is in grayscale. Histogram of each cell is to be concatenated to generate a bigger and new histogram. The final histogram shows the characteristics of the primary image as shown in fig 6.

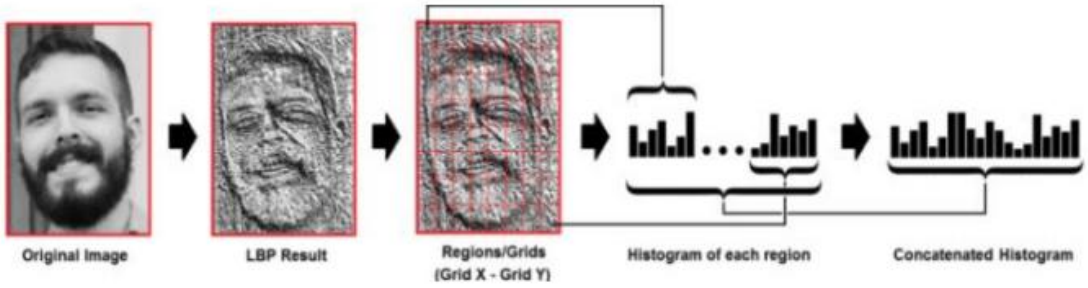


fig 6. Extracting Histogram of image

Performing the face recognition: The algorithm for creating histogram is initially trained. Each image from the training dataset is represented by each histogram. To generate a histogram for the input image the above steps are performed again on that image. The histogram of input image is compared with the histograms of dataset images, selecting the closest histogram gives the matching image from the dataset. Various methods like Absolute value, Euclidean distance, etc can be used to compare the histograms. The Euclidean distance can be calculated using equation 1 to compare the histograms

$$D = \sqrt{\sum_{1}^{n} (HistD - HistR)^2} \quad \text{-----Eq1}$$

.

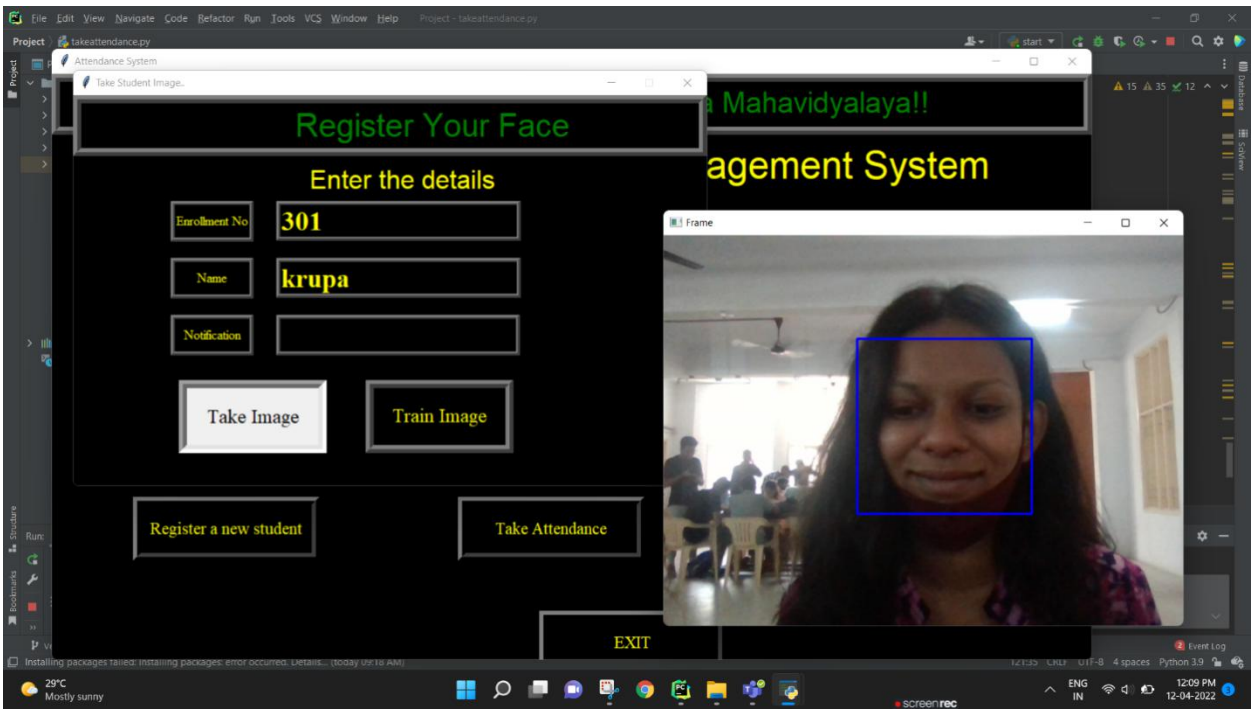
Where HistD - Histograms of dataset images

HistR - Histogram of real time image

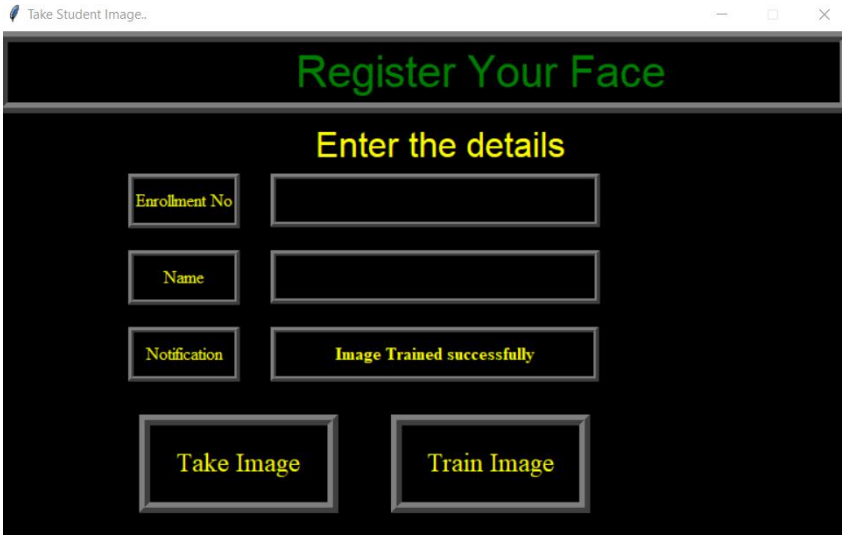
The algorithm returns a unique Id of the student with the minimum difference in the histograms of the student's image and dataset images. It also returns the calculated distance, which can be used as a ‘confidence’ measurement. Lower the confidence measurement, more is the precision of the recognizer.

6. ANALYSIS AND RESULT DISCUSSION

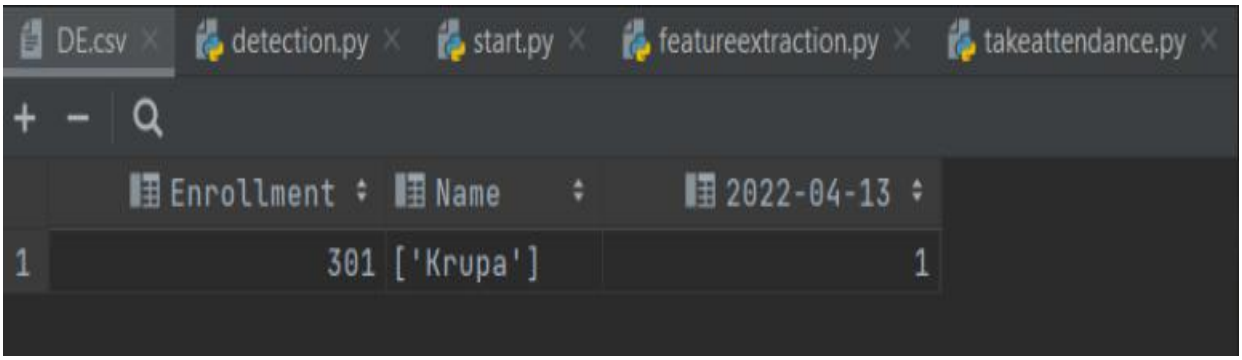
At first it will take image as input and train that image for output.



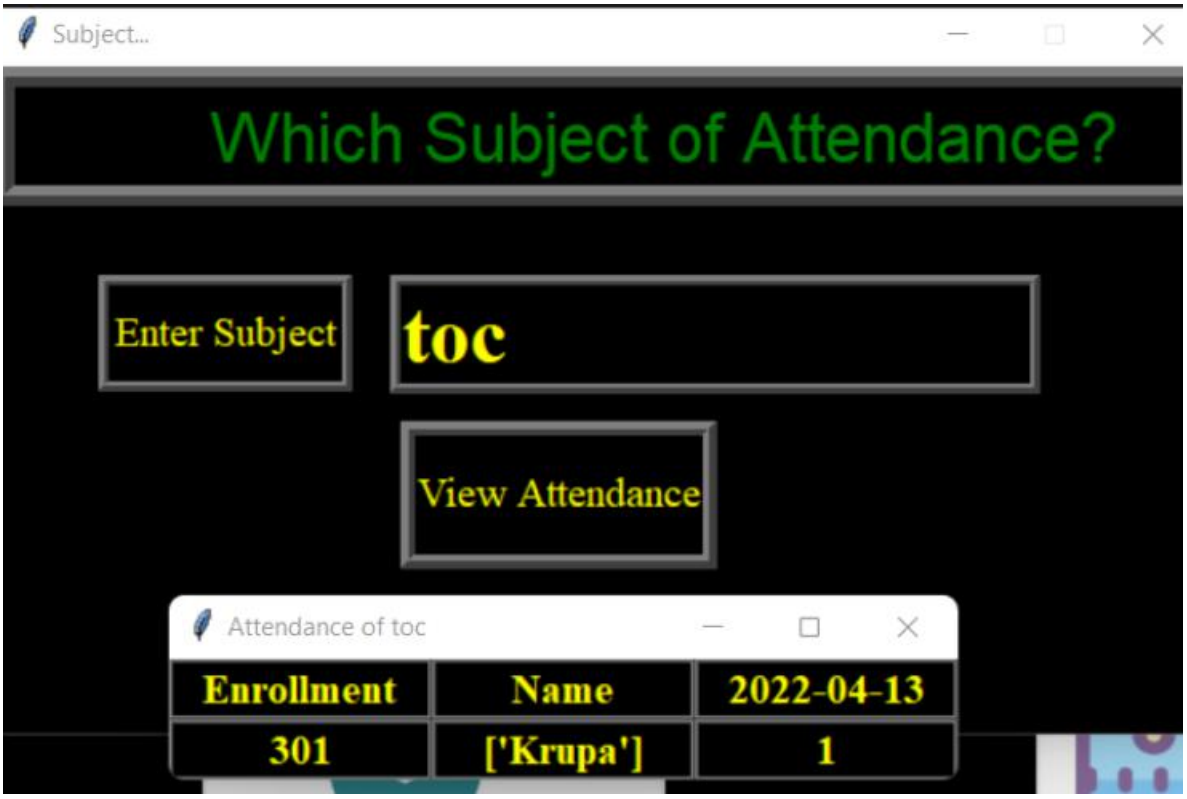
This is result of the proposed system. The unique Id and name of the students are displayed with the accurate number.



This is result of taken attendance of DE Subject.



This is result of View Attendance of TOC Subject.



7. CONCLUSION AND FUTURE SCOPE

CONCLUSION

The proposed method uses face detection and face recognition that helps to maintain the automated attendance system. For face detection, Haarcascade algorithm is used and for face recognition Linear Binary Pattern Histogram (LPBH) algorithm is applied.

In the result, the unique ID and name of the student is displayed along with the confidence percentage. Confidence percentage represents the distance between the histogram of the stored image and histogram of the real time image and is calculated by using Euclidean distance. Lower is the distance, higher is the recognition rate.

FUTURE SCOPE

The future scope of the project can be integrated with the hardware components for example GSM through which a monthly list of the defaulter students can be sent to the mentor.

Additionally, an application can be developed to help students to maintain a track of their attendance. It can also be used in offices where a large group of employees sit in a hall and their attendance will be marked automatically by capturing a video but for this the accuracy of the recognition needs to be improved.

8. REFERENCES

1. Face Detection and Recognition Student Attendance System

- https://www.pmu.edu.sa/attachments/academics/pdf/udp/coe/dept/ee/face_detection_system_report.pdf

2. Students attendance management system mini project report master of computer applications

- https://www.academia.edu/7760318/STUDENTS_ATTENDANCE_MANAGEMENT_SYSTEM_MINI_PROJECT_REPORT_MASTER_OF_COMPUTER_APPLICATIONS