FACIAL RECOGNITION BASED ATTENDANCE SYSTEM

Major Project submitted in partial fulfillment of the requirement for the award of the degree of

BACHELOR OF TECHNOLOGY

IN

COMPUTER SCIENCE AND ENGINEERING

Under the esteemed guidance of

Mr. E. Mahender
Assistant Professor

By

Panyam Badrinath Reddy (19R11A05C9)
Vanamala Nithin (20R15A0516)
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Department of Computer Science and Engineering
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Geethanjali College of Engineering and Technology
(UGC Autonomous)
(Affiliated to J.N.T.U.H, Approved by AICTE, New Delhi)
Cheeryal (V), Keesara (M), Medchal.Dist.-501 301.

April -2023

Geethanjali College of Engineering & Technology

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CERTIFICATE

This is to certify that the B. Tech Major Project report entitled **"FACIAL RECOGNITION BASED ATTENDANCE SYSTEM"** is a bonafide work done by **Panyam Badrinath Reddy(19R11A05C9), Vanamala Nithin (20R15A0516), T.N.D.S Snigdha (19R11A05D8)**, in partial fulfillment of the requirement of the award for the degree of Bachelor of Technology in "**Computer Science and Engineering**" from Jawaharlal Nehru Technological University, Hyderabad during the year 2022-2023.

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DECLARATION BY THE CANDIDATE

We, **Panyam Badrinath Reddy, Vanamala Nithin, T.N.D.S Snigdha**, bearing Roll Nos. **19R11A05C9**, **20R15A0516, 19R11A05D8** hereby declare that the project report entitled **"Facial Recognition Based Attendance System"** is done under the guidance of **Mr. E. Mahender**, **Assistant Professor** Department of Computer Science and Engineering, Geethanjali College of Engineering and Technology, is submitted in partial fulfillment of the requirements for the award of the degree of **Bachelor of Technology in Computer Science and Engineering**.

This is a record of bonafide work carried out by us in **Geethanjali College of Engineering and Technology** and the results embodied in this project have not been reproduced or copied from any source. The results embodied in this project report have not been submitted to any other University or Institute for the award of any other degree or diploma.

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Above all, we are very much thankful to the management of **Geethanjali College of Engineering and Technology** which was established by the **high-profile intellectuals** for the cause of Technical Education in modern era. We wish that **GCET** sooner should become a deemed to be university and produce uncountable young engineers and present them to the modern world.

<div align="right">

With regards,

PANYAM BADRINATH REDDY - 19R11A05C9

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ABSTRACT

The current scenario in our college is that the attendance is taken by the faculty manually which requires time and efforts. To make the process easier, we are here with the innovative idea of making this automated. The main objective of our Project is that to Identify the Individual in the photo, based on the features given in the training data and to mark the attendance for the same person and to generate an excel report which contains the attendance details of the total class with time stamps. We have thought of this making in the two scenarios. The first one is by placing the live camera at the entrance of the class, such that it can record all the students faces who enters the class with the timestamp. It then processes the information to recognize them and then generate the attendance report of the class. The second scenario requires the minimal human efforts, where the teacher clicks a Photo of the entire class and uploads/submit to the system which recognizes each and every student in the photograph based on the training data provided before and marks the attendance of each and every student. It also marks absent if the student is not found in the Photograph and generates attendance report for the class. We will be working to make this system more efficient, such that the error percentage is minimal.

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List Of Abbreviations

S.NO.	Abbreviation	Full Form
1.	KNN	K-nearest neighbors
2.	OpenCv	Open Source Computer Vision
3.	HTML	Hypertext Markup Language
4.	CSS	Cascading Style Sheets
5.	AJAX	Asynchronous JavaScript and XML
6.	UML	Unified Modeling Language
7.	FAT	File Allocation Table
8.	MySQL	My Structured Query Language
9.	SDLC	Software development lifecycle

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1. Introduction

1.1 About the project

The current scenario in our college is such that attendance is taken manually by the faculty. This is a time-taking process and requires a lot of efforts. Keeping the above issues in mind, we have come up with this innovative idea of making the process of attendance automated. The main objective of our Project is that to Identify the Individual in the photo, based on the features given in the training data and to mark the attendance for the same person and to generate an excel report which contains the attendance details of the total class with time stamps.

We have thought of this making in the two scenarios. The first one is by placing the live camera at the entrance of the class, such that it can record all the students faces who enters the class with the timestamp. It then processes the information to recognize them and then generate the attendance report of the class.

The second scenario requires the minimal human efforts, where the teacher clicks a Photo of the entire class and uploads/submit to the system which recognizes each and every student in the photograph based on the training data provided before and marks the attendance of each and every student. It also marks absent if the student is not found in the Photograph and generates attendance report for the class. We will be working to make this system more efficient, such that the error percentage is minimal.

We used an algorithm similar to KNN for comparing the faces to recognize them. In mathematics, the Euclidean distance between two points in **Euclidean space is the length of a line segment between the two points**.The Euclidean distance formula says:

$d = \sqrt{[\ (x22 - x11)^2 + (y22 - y11)^2]}$ where,

- $(x11, y11)$ are the coordinates of one point.

- $(x22, y22)$ are the coordinates of the other point.

- d is the distance between $(x11, y11)$ and $(x22, y22)$.

1.2 Objectives

The main objective of this project is to make the process of attendance easier by making it automated. The main objective of our Project is that to Identify the Individual in the photo, based on the features given in the training data and to mark the attendance for the same person and to generate a report which contains the attendance details of the total class with time stamps.

We have thought of making this in two scenarios. The first one is by placing a live camera at the entrance of the class, such that it can record all the students faces who enters the class with the timestamp. It then processes the information to recognize them and then generates the attendance report of the class.

The second scenario requires the minimal human efforts, where the teacher clicks a Photo of the entire class and uploads/submit to the system which recognizes each and every student in the photograph based on the training data provided before and marks the attendance of each and every student. It also marks absent if the student is not found in the Photograph and generates attendance report for the class. We will be working to make this system more efficient, such that the error percentage is minimal.

The main objectives of the project are

- This project aims at making the process of attendance automated.
- It stores the facial features of students in database.
- It scans the students faces and recognizes the students.
- It marks the attendance of recognized student along with time stamps.
- It replaces the manual method of attendance system.

2. SYSTEM ANALYSIS

2.1 Existing System

1. The current scenario in our college is such that attendance is taken manually by the faculty.
2. This is a time taking process and requires a lot of efforts.
3. Since this is done manually it is also bound to a lot of errors.
4. The current process is not automated.

2.2 Proposed System

- We have created a data base that stores the facial features of students.
- Based on the training data provided, this project using a live camera detects and recognizes the students faces.
- It marks the attendance for every student.
- It generates attendance report of the entire class.
- The error percentage is minimal in our project.
- In the proposed system we are using an algorithm similar to KNN.

In mathematics, the Euclidean distance between two points in **Euclidean space is the length of a line segment between the two points**.

The Euclidean distance formula says:

$$d = \sqrt{[(x22 - x11)^2 + (y22 - y11)^2]}$$

where,

- (x11, y11) are the coordinates of one point.

- (x22, y22) are the coordinates of the other point.

- d is the distance between (x11, y11) and (x22, y22).

This project makes the process of attendance easier.

2.2.1 Details

This project is used for attendance purpose. This project is used to make the process of attendance easier. This can be done in two scenarios.

Scenario 1: The first one is done by placing a live camera at the entrance of the classroom

Scenario 2: This requires minimal efforts. The faculty clicks the photograph of the entire classroom.

Database creation: The first step in our project is to create a database which contains the images of students along with their details.

Face detection: By using the live camera our project detects the faces of students.

Feature Extraction: After the face is detected the facial features of the students are extracted.

Face recognition: An individual is identified based on the training data. It uses an algorithm similar to KNN for comparing the students faces and for giving out the similarity percentage. In mathematics, the Euclidean distance between two points in **Euclidean space is the length of a line segment between the two points**.

The Euclidean distance formula says:

$$d = \sqrt{[\ (x22 - x11)^2 + (y22 - y11)^2]}$$

where,

- (x11, y11) are the coordinates of one point.

- (x22, y22) are the coordinates of the other point.

- d is the distance between (x11, y11) and (x22, y22).

The individual in the photo is identified based on the training data provided. The students faces are recognized.

Generation of attendance report: The attendance report of the entire class is generated along with timestamps.

2.2.2 Impact on Environment

It is very useful to the environment. It avoids wastage of paper. It saves paper. It saves time and makes the process of attendance easier.

2.2.3 Safety

This project provides complete safety. It provides utmost accuracy. The results are accurate with zero errors. It ensures privacy. The data that we provide, is safely secured. The data is confidential.

2.2.4 Ethics

The project is used for taking attendance based on facial recognition. The information stored in the database is confidential. The information of every student is safely stored in database without breaching of privacy.

2.2.5 Cost

This project does not require developmental costs as it is software based. This project only requires installation of open-source and easily available modules. Hence, this project does not lead to financial constraints and is ideal from financial point of view.

2.2.6 Type

This is a web application which does not require any hardware requirements. It can run on any electronic device.

2.2.7 Standards

This project gives minimal error with minimal false positives.

2.3 Scope of the project

This project can be used by different colleges and in different departments. This project is developed to make the process of attendance automated and easier.

2.4 Modules description

User Module

Here the user is referred to the faculty, that is who uses the application. The user uses the application to record the attendance of the students. User uses their mobile phone or laptop to capture the live feed.

Camera Module

The camera module is responsible for capturing video of the students in the class.It can use a standard webcam or smart phone camera to capture video, which is processed by the detection module. The captured feed is sent to detection mode in the form of frames.

Detection Module

Detection module is responsible for analyzing the video feed from camera module and recognizing the student and marking attendance. The detection module uses face recognition module to recognize the students.

Attendance Tracking Module

Attendance of the student is stored in the Database. Also, it filters the attendance as per the user requirements.

2.5 System Configuration

Software Requirements:

Front end tools:

- **HTML :** It is the HyperText Markup Language which is used to make the user interface attractive.

- **JavaScript :** It is a scripting language that allows you to create dynamically updating content, control multimedia and animate images.

- **CSS :** It is used to make user interface attractive.

Back end tools framework :

- **Django** : Django is a high-level python web framework that enables rapid development of secure and maintainable websites. Django's primary goal is to ease the creation of complex, database-driven websites. The framework emphasizes reusability and rapid development.

- **AJAX**- stands for Asynchronous JavaScript And XML. In a nutshell, it is the use of the XMLHttpRequest object to communicate with servers. It can send and receive information in various formats, including JSON, XML, HTML, and text files.

Programming Language :

- **Python :** Python is a high-level, general-purpose programming language. Its design philosophy emphasizes code readability with the use of significant indentation via the off-side rule. Python is a multi-paradigm programming language. Object-oriented and structured programming are fully supported. Many

of their features support functional programming and aspect-oriented programming.

Python Libraries :

- **Open CV2 :** It is a python library that allows you to perform image processing and for solving computer vision problems. It provides a wide range of features including object detection, face recognition, etc.

- **Dlb dependencies :** They are required for working of facial recognition modules.

- **XlsxWriter -** XlsxWriter is a Python module that provides various methods to work with Excel using Python. It can be used to read, write, applying formulas. Also, it supports features such as formatting, images, charts, page setup, auto filters, conditional formatting, and many others.

Database requirements :

Mysql is an open-source relational database management system (RDBMS). Its name is a combination of "My", the name of co-founder Michael Widenius's daughter My, and "SQL", the acronym for Structured Query Language. A relational database organizes data into one or more data tables in which data may be related to each other; these relations help structure the data. SQL is a language programmers use to create, modify and extract data from the relational database, as well as control user access to the database. In addition to relational databases and SQL, an RDBMS like MySQL works with an operating system to implement a relational database in a computer's storage system, manages users, allows for network access and facilitates testing database integrity and creation of backups.

IDE requirements :

PyCharm is an integrated development environment (IDE) used for programming in Python. It provides code analysis, a graphical debugger, an integrated unit tester, integration with version control systems, and supports web development with Django. PyCharm is developed by the Czech company JetBrains. It is cross-platform, working on Microsoft Windows, macOS and Linux. PyCharm has a Professional Edition, released under a proprietary license and a Community Edition released under the Apache License. PyCharm Community Edition is less extensive than the Professional Edition.

Hardware Requirements

1   Ram 8GB
2   64-bit architecture
3   Processor : 2.16 GHz

3. Literature Overview

3.1 Feasibility Study

A feasibility study evaluates the project's potential for success; therefore, perceived objectivity is an important factor in the credibility of the study for potential investors and lending institutions. It must therefore, be conducted with an objective, unbiased approach to provide information upon which decisions can be based.

3.1.1 Operational Feasibility

Operational feasibility is the measure of how well a proposed system solves the problems with the users. Operational feasibility is dependent on human resources available for the project and involves projecting whether the system will be used if it is developed and implemented. The project is operationally feasible for the users as nowadays almost all the teachers/staffs are familiar with digital technology.

3.1.2 Economic Feasibility

Economic feasibility defines whether the expected benefit equals or exceeds the expected costs. It is also commonly referred to as cost/benefit analysis. The procedure is to determine the benefits and the savings expected from the system and compare them with the costs. A proposed system is expected to outweigh the costs. This is a small project with no cost for development. The system is easy to understand and use. Therefore, there is no need to spend on training to use the system. This system has the potential to grow by adding functionalities for students as well as teachers. This can Hence, the project could have economic benefits in the future.

3.1.3 Technical Feasibility

Technical feasibility is carried out to determine whether the project is feasible in terms of software, hardware, personnel, and expertise, to handle the completion of the project. It considers determining resources for the proposed system. As the system is developed using python, it is platform independent. Therefore, the users of the system can have

average processing capabilities, running on any platform. The technology is one of the latest hence the system is also technically feasible.

3.2 Literature Survey

- A literature survey on facial recognition based attendance would involve researching and reviewing past studies and articles that have explored the use of facial recognition to make the process of attendance automated by using facial recognition for taking attendance.

- **An Automated Classroom Attendance System Using Video Based Face Recognition by Anshun Raghuwanshi, and Dr. Preeti D (2017)** - This paper proposes and compares the methodologies for an automated attendance system using video-based face recognition. Here input to the system is a video and output is an excel sheet with attendance of the students in the video. Automated attendance system can be implemented using various techniques of biometrics. Face recognition is one of them which does not involve human intervention. In this paper, attendance is registered from a video of students of a class by first performing Face Detection which separates faces from non- faces, and then Face Recognition is carried out which finds the match of the detected face from the face database (collection of student's name and images). If it is a valid match then attendance is registered to an excel sheet. Face recognition is performed and compared on the basis of the accuracy of recognition using Principle Component Analysis (PCA) and Linear Discriminant Analysis (LDA) algorithms.
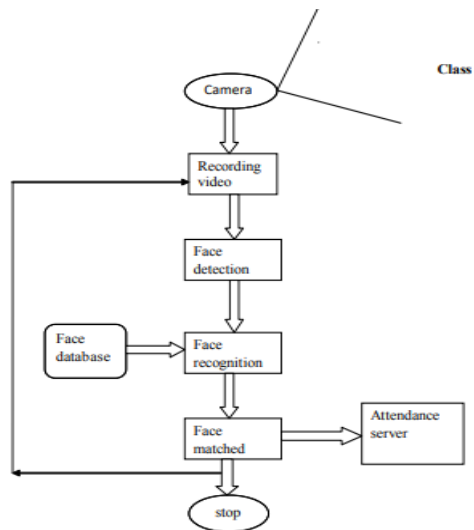
Figure 3.2.1 Block diagram of an Automated Attendance System
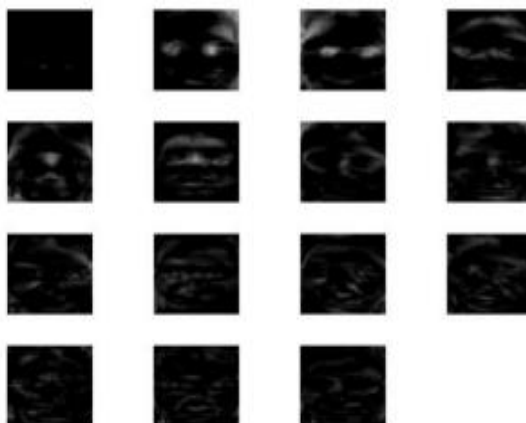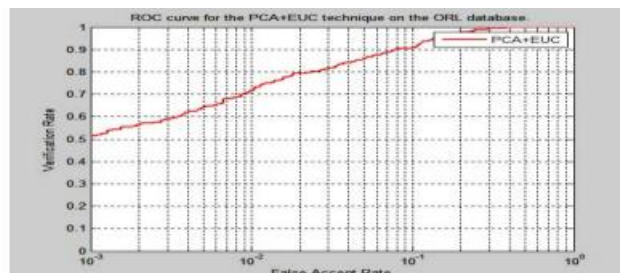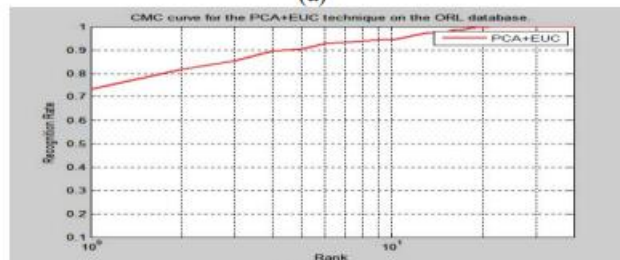

Figure 3.2.2 Detected Faces

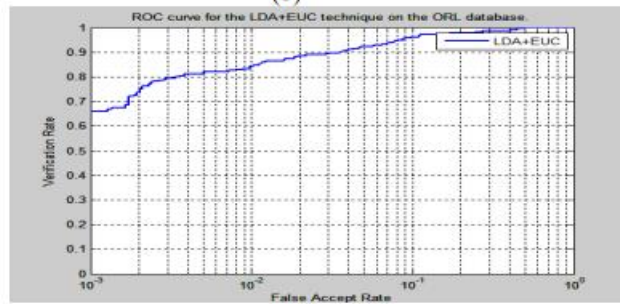Figure 3.2.3 Eigen Face Images of Normal Face Images
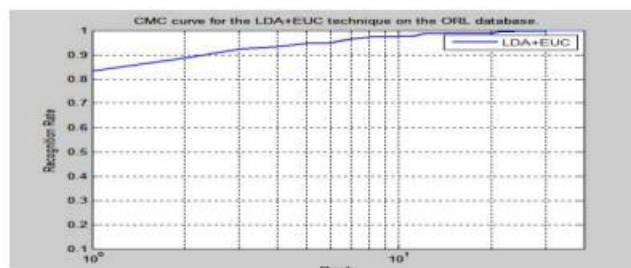
Figure 3.2.4 Matched faces

(a)

(b)

(c)

(d)

Figure 3.2.5 ROC and CMC curve for PCA and LDA on the ORL database

- **Face Recognition based Attendance Management System by Smitha, Pavithra S Hegde, Afshin (2020)** - In this digital era, face recognition system plays a vital role in almost every sector. Face recognition is one of the mostly used biometrics. It can used for security, authentication, identification, and has got many more advantages. Despite of having low accuracy when compared to iris recognition and fingerprint recognition, it is being widely used due to its contactless and non-invasive process. Furthermore, face recognition system can also be used for attendance marking in schools, colleges, offices, etc. This system aims to build a class attendance system which uses the concept of face recognition as existing manual attendance system is time consuming and cumbersome to maintain. And there may be chances of proxy attendance. Thus, the need for this system increases. This system consists of four phases- database creation, face detection, face recognition, attendance updation. Database is created by the images of the students in class. Face detection and recognition is performed using Haar-Cascade classifier and Local Binary Pattern Histogram algorithm respectively. Faces are detected and recognized from live streaming video of the classroom. Attendance will be mailed to the respective faculty at the end of the session.
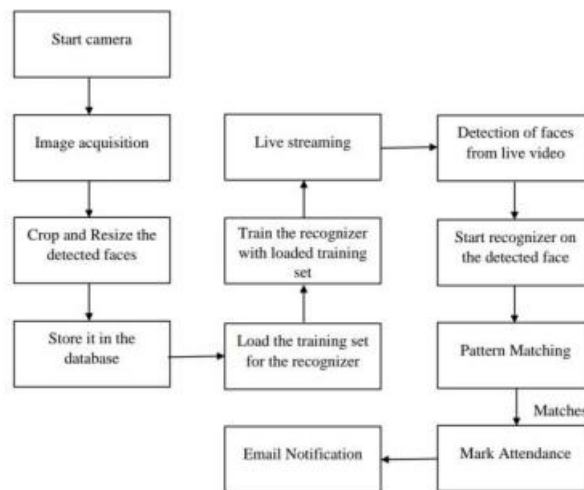
Figure 3.2.6 System Architecture
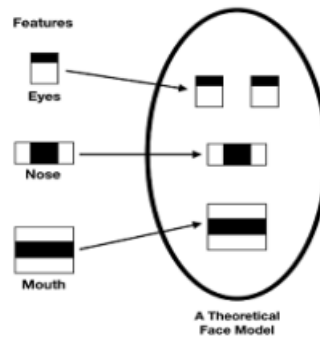
Figure 3.2.7 Haar features
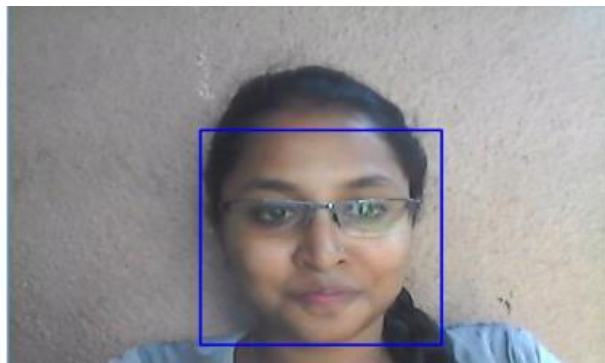
Figure 3.2.8 Face Detection
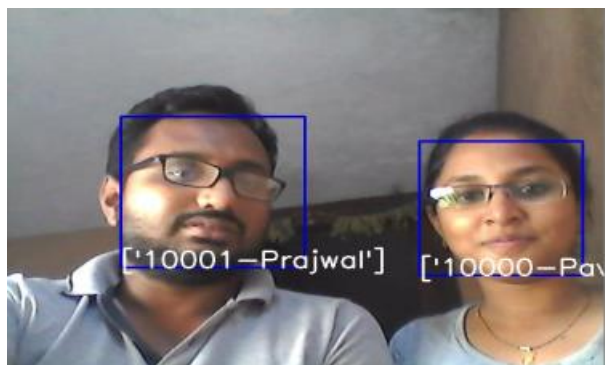
Figure 3.2.9 Face Recognition

	Name	Email	Contact No.	09-04-2020	
2	afshin	afshin@gmail.com	8353323222	0	
3	vishnu	vishnu@gmail.com	7444436614	0	
4	Pranamya	pranamya@gmail.com	8522266321	0	
5	ashwini	ash@gmail.com	6154545585	0	
6	Prajwal	hegdeprajwal@gmail.com	9856222114	1	
7	pavithra	hegdepavithra13@gmail.com	8073668261	1	
8					
9					

Figure 3.2.10 Attendance Sheet

- **Face Recognition System by Shivam Singh , Prof. S. Graceline Jasmine (2019) -** In present times, face recognition has become one of the best technologies for computer vision. Face recognition is always a very difficult task in computer vision, illumination, pose, facial expression. Face recognition tracks target objects in live video images taken with a video camera. In simple words, it is a system application for automatically identifying a person from a still image or video frame. In this paper we proposed an automated face recognition system.

- This application based on face detection, feature extraction and recognition algorithms, which automatically detects the human face when the person in front of the camera recognizing him. We used KLT Algorithm, Viola-Jones Algorithm face detection which detect human face using Haar cascade classifier, however camera is continuously detecting the face every frame, PCA algorithm for feature selection. We apply a model combining to match the geometric characteristics of the human face.
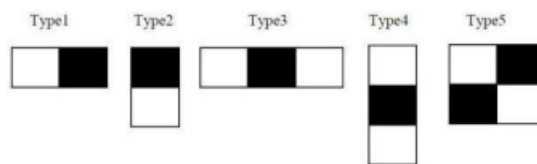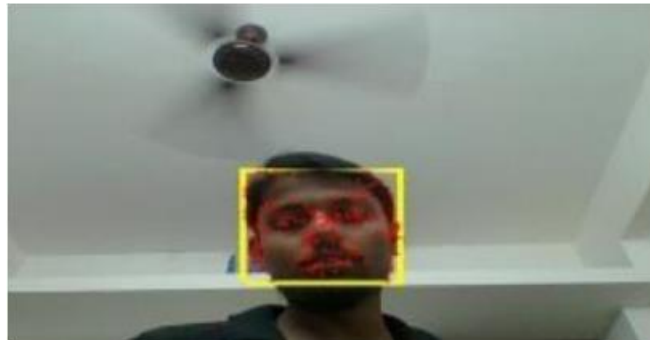

Figure 3.2.11 Haar Cascade classifier

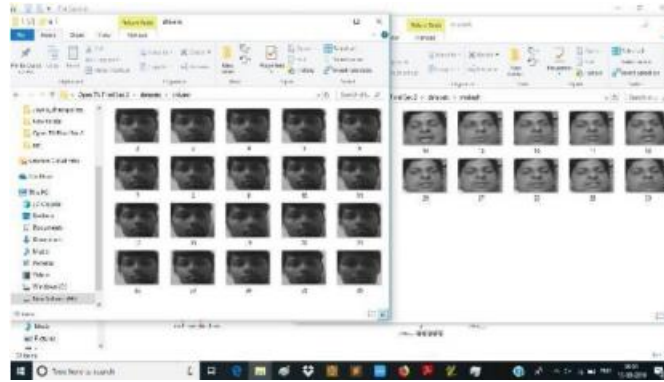Figure 3.2.12 Extracting the face features

Figure 3.2.13 Training Database

- **Facial Feature Detection Algorithms by Nikolaos Nikolaidis (2010) -** Facial feature localization has been a very active research field for many years and a multitude of methods appear in the literature. Depending on their applicability, existing methods have been developed and tested on various databases, ranging from high resolution color face databases of neutral faces to lower resolution grayscale images depicting even more than one face. Also, the metrics used for the evaluation of each method varies depending on the number of points in search, the resolution of the test database and, generally, is usually based on subjective criteria. For these reasons, an objective comparison of the existing methods would fail in the sense that, most of the times, they are developed for specific reasons (e.g expression recognition, gaze detection, driver's alertness estimation, etc.) and a method of general applicability seems to be away from the current state of research. This paper intends to offer an up-to-date literature review of the latest methods on facial feature detection, showing different approaches in the field. A critical evaluation of these techniques highlights their advantages and disadvantages commenting on issues such as computational complexity and accuracy.
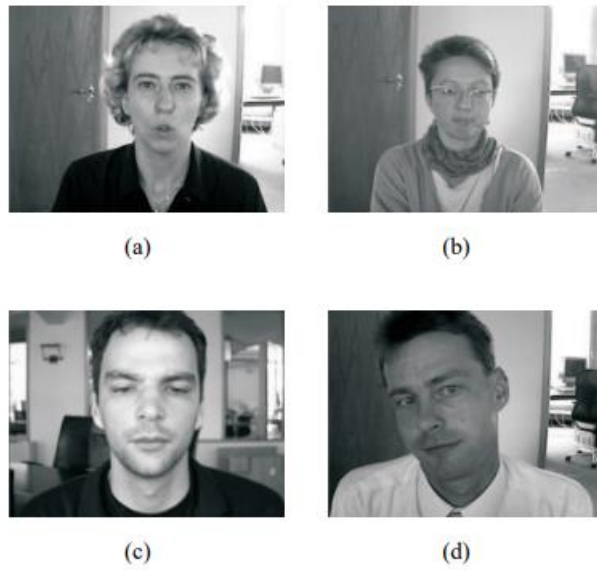
Figure 3.2.14 Examples from database
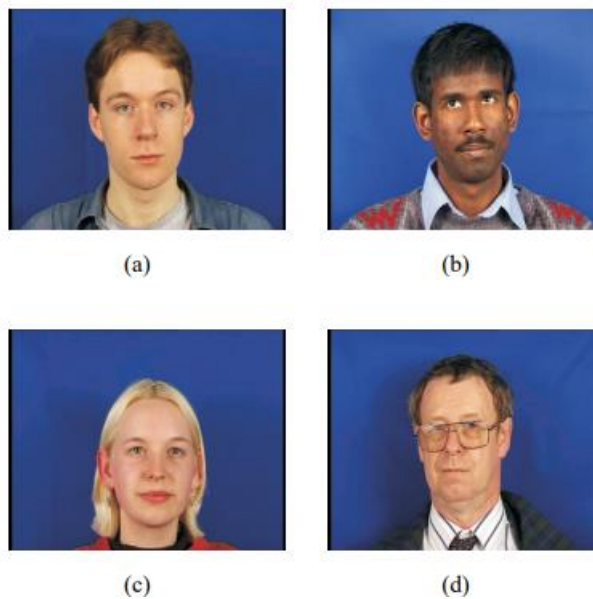
Figure 3.2.15 Examples from database

- **Facial Recognition Attendance System Using Python and OpenCv by Dr. V Suresh, Srinivasa Chakravarthi Dumpa, Chiranjeevi Deepak Vankayala, HaneeshaAduri, Jayasree Rapa (2020)** - The main purpose of this project is to build a face recognition-based attendance monitoring system for educational institution to enhance and upgrade the current attendance system into more efficient and effective as compared to before. The current old system has a lot of ambiguity that caused inaccurate and inefficient of attendance taking. Many

problems arise when the authority is unable to enforce the regulation that exist in the old system. The technology working behind will be the face recognition system. The human face is one of the natural traits that can uniquely identify an individual. Therefore, it is used to trace identity as the possibilities for a face to deviate or being duplicated is low. In this project, face databases will be created to pump data into the recognizer algorithm. Then, during the attendance taking session, faces will be compared against the database to seek for identity. When an individual is identified, its attendance will be taken down automatically saving necessary information into a excel sheet. At the end of the day, the excel sheet containing attendance information regarding all individuals are mailed to the respective faculty
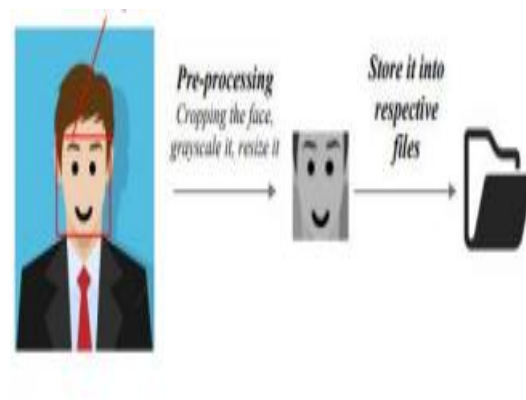
Figure 3.2.16 Image Acquisition and Pre-processing procedures
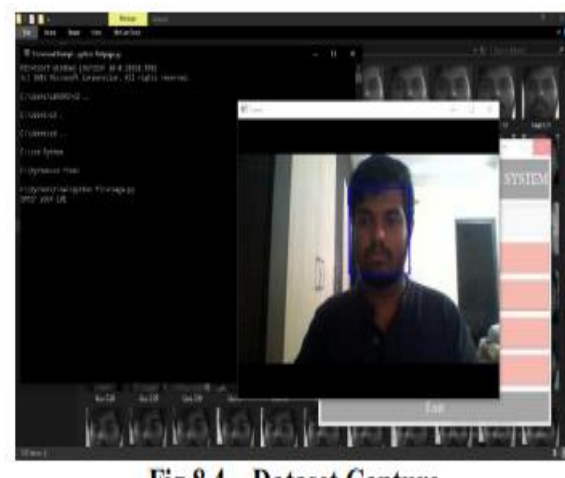
Figure 3.2.17 Dataset capture
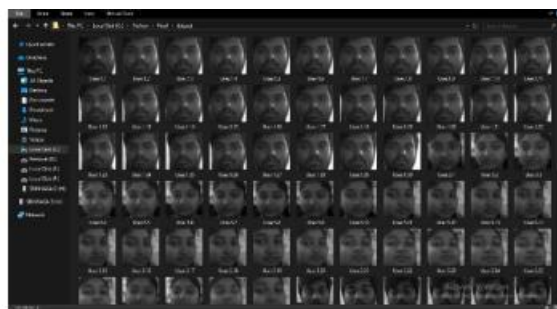
Figure 3.2.18 Database
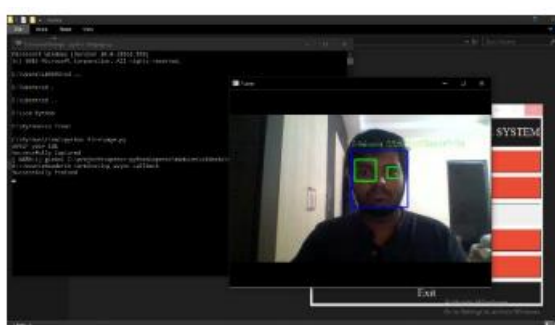
Figure 3.2.19 recognizer

- **Face Recognition based Attendance System Dhanush Gowda by H.L 1 , K Vishal , Keertiraj B. R , Neha Kumari Dubey, Pooja M. R. (2020)** – The management of the attendance can be a great burden on the teachers if it is done by hand. To resolve this problem, smart and auto attendance management system is being utilized. By utilizing this framework, the problem of proxies and students being marked present even though they are not physically present can easily be solved. This system marks the attendance using live video stream. The frames are extracted from video using OpenCV. The main implementation steps used in this type of system are face detection and recognizing the detected face, for which dlib is used. After these, the connection of recognized faces ought to be conceivable by comparing with the database containing student's faces. This model will be a successful technique to manage the attendance of students.
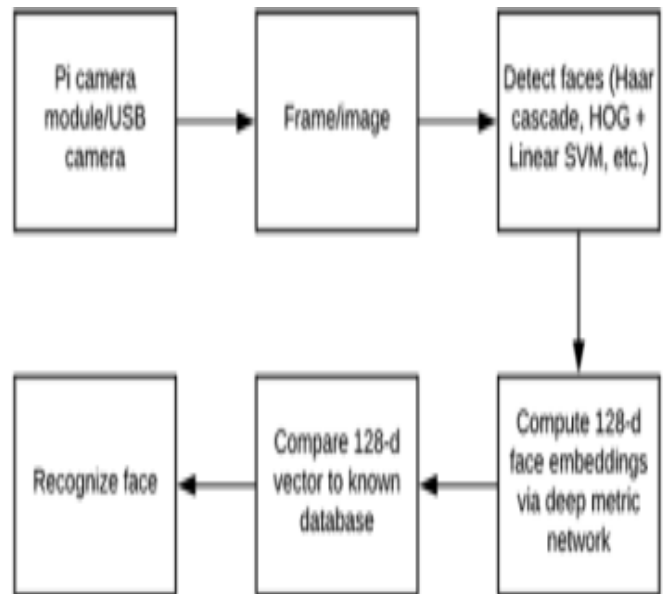
Fig 3.2.20 Facial recognition model
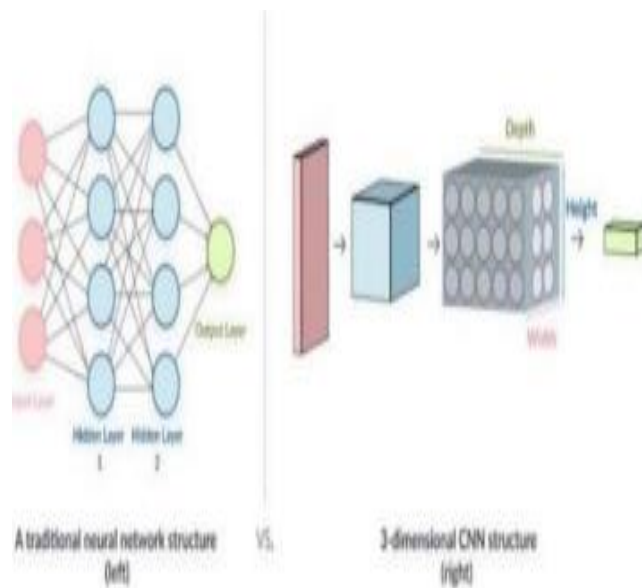
Fig 3.2.21 Traditional neural network vs CNN

4.System Design

4.1. System Architecture
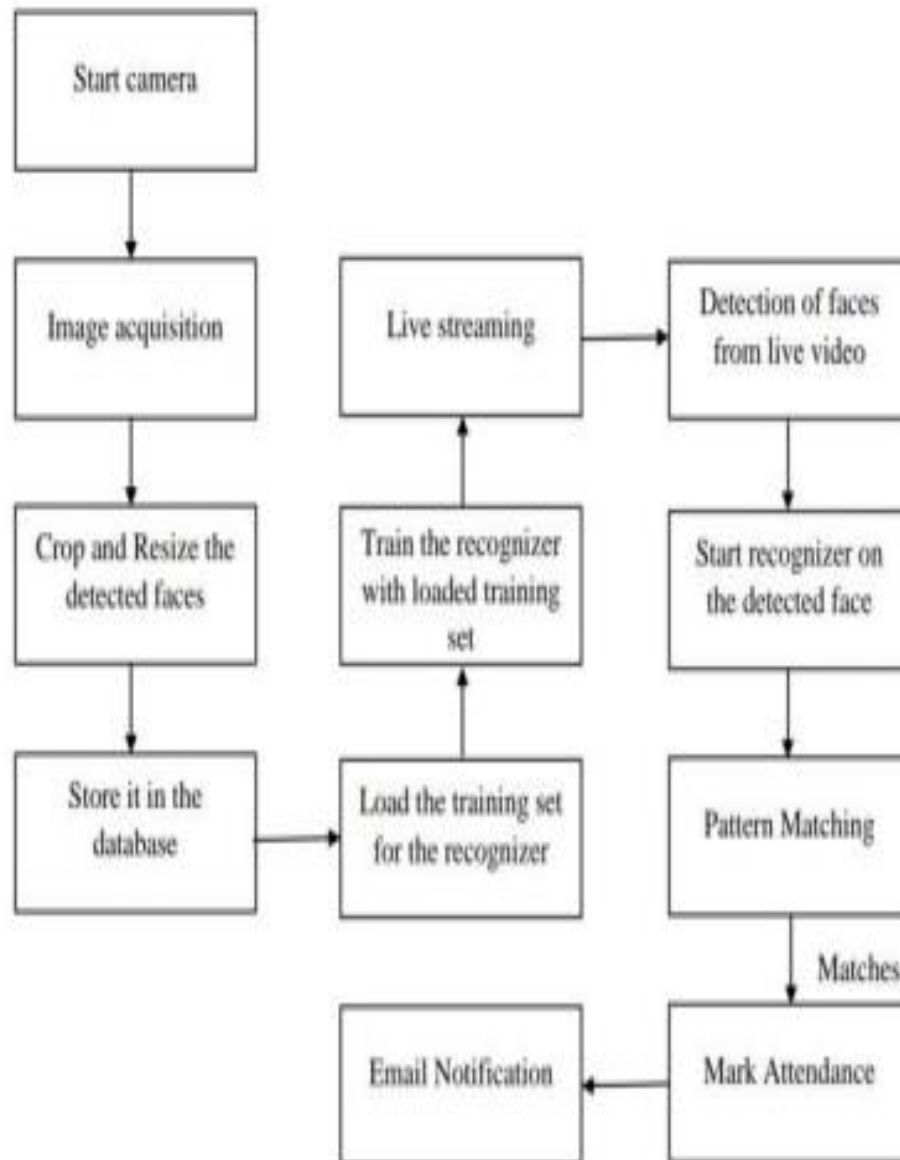
Fig 4.1.1: System design

4.1.1 Modules description

User Module

   Here the user is referred to the faculty, that is who uses the application. The user uses the application to record the attendance of the students. User uses their mobile phone or laptop to capture the live feed.

Camera Module

   The camera module is responsible for capturing video of the students in the class. It can use a standard webcam or smart phone camera to capture video, which is processed by the detection module. The captured feed is sent to detection mode in the form of frames.

Detection Module

   Detection module is responsible for analyzing the video feed from camera module and recognizing the student and marking attendance. The detection module uses face recognition module to recognize the students.

Attendance Tracking Module

   Attendance of the student is stored in the Database. Also, it filters the attendance as per the user requirements.

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4.2.1 UML Diagrams

Design is a multi-step process that focuses on software architecture, procedural details, (algorithms etc.) and interface between modules. The design process also translates the requirements into the presentation of software before coding begins. Computer software design changes continuously as new methods, better analysis and broader understanding evolved.

Software Design is at relatively early stage in its revolution. Therefore, compare Software Design methodology lacks the depth, flexibility and quantitative nature that are normally associated with more classical engineering disciplines. However, techniques for software designs do exist, criteria for design qualities are available and design notation can be applied. UML is a modelling language mostly used by developers for system design. It can be used to develop diagrams and provide users with ready-to-use, expressive modelling examples.

Types of UML Diagrams:

1.Use Case Diagram

2.Class Diagram

3.Activity Diagram

4.Sequence Diagram

4.2.2 Use Case Diagram

Use cases describe the system from the user's point of view. Use cases describe the interaction between a primary actor and the system itself, represented as a sequence of simple steps. Actors are something or someone which exists outside the system under study, and that take part in a sequence of activities in a dialogue with the system to achieve some goal. Actors may be end users, other systems or hardware devices. Each use case is a complete series of events described from the point of view of the actor.
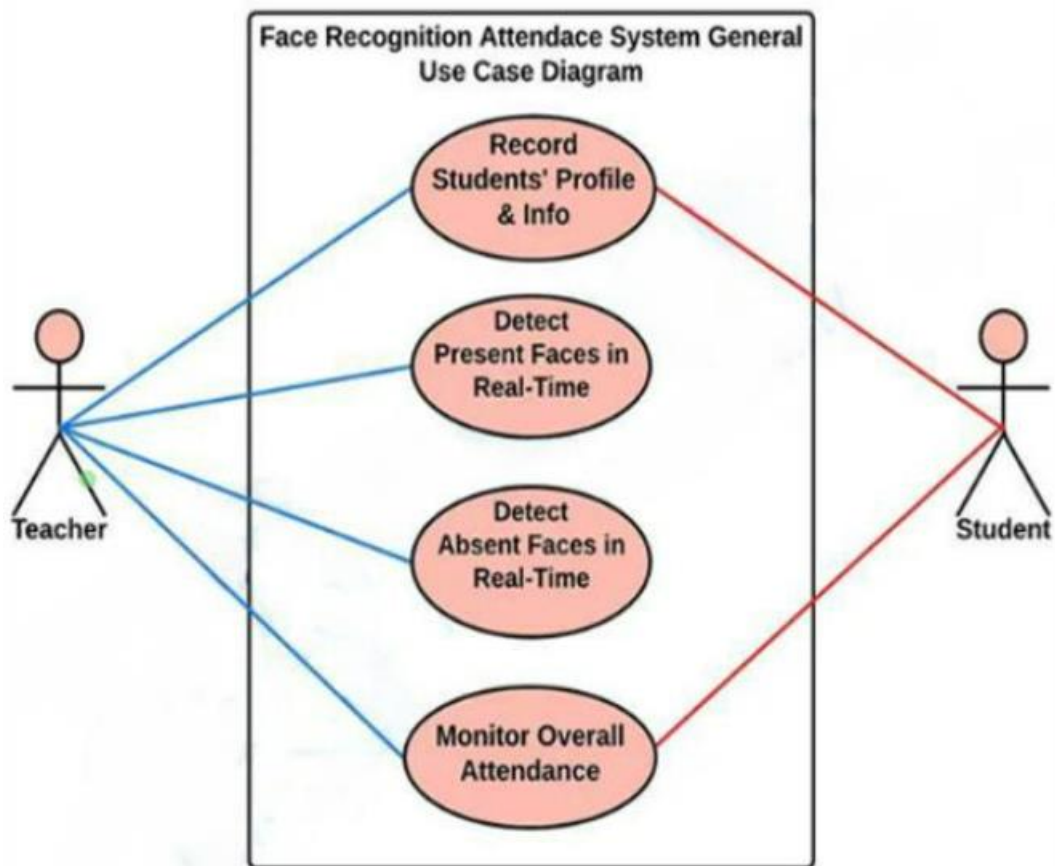
4..2.2 Use Case Diagram

4.2.3 Class Diagram

Classes are the most important building block of any object-oriented system. A class is a description of set of objects that share the same attributes, operations, relationships and semantics. A class implements one or more interfaces.
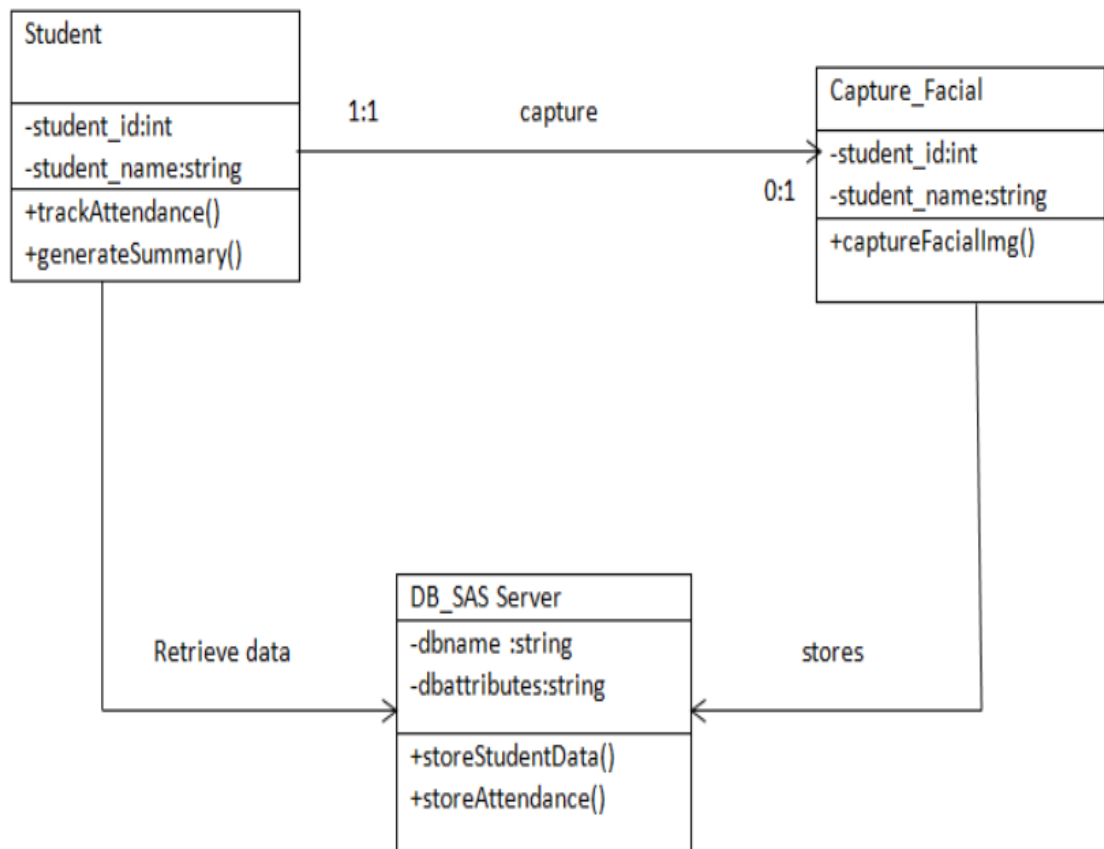
Fig 4.2.3: Class Diagram

4.2.4 Activity Diagram

Activity diagrams are graphical representations of workflows of stepwise activities and actions with support for choice, iteration and concurrency. In the Unified Modelling Language, activity diagrams are intended to model both computational and organizational processes. Activity diagrams show the overall flow of control.
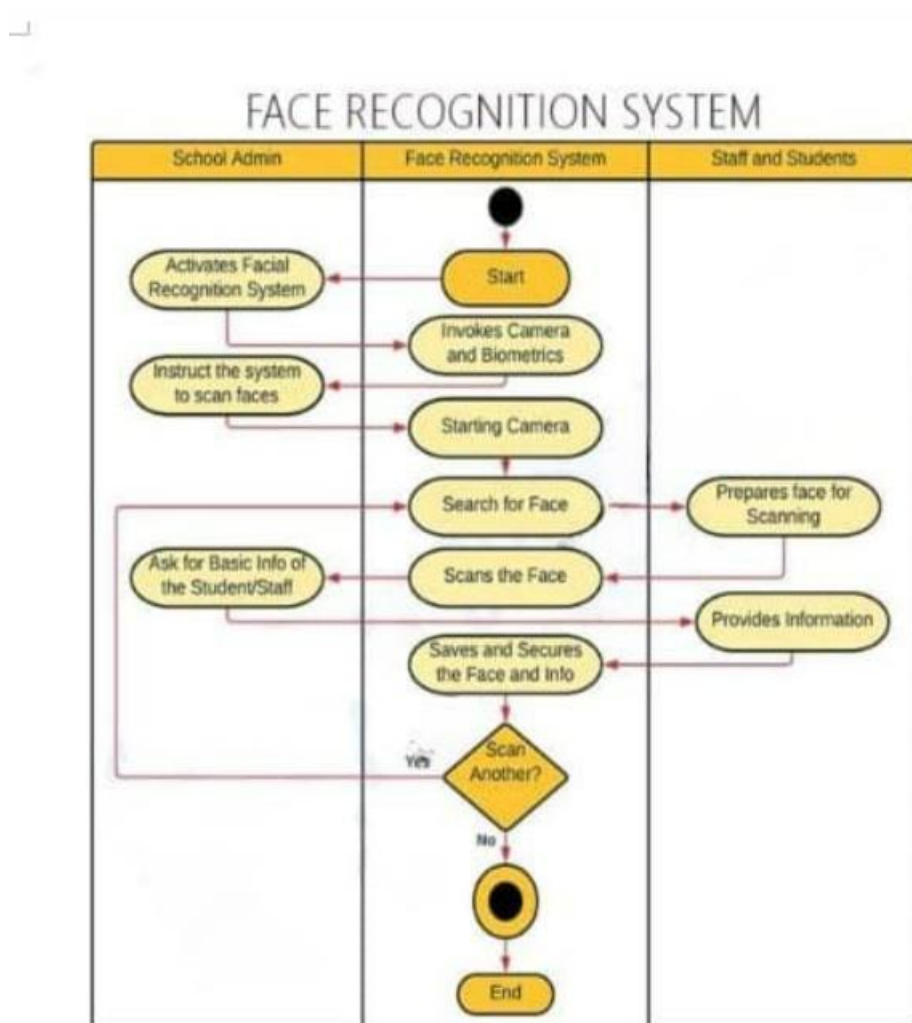
Fig 4.2.4: Activity Diagram

4.2.5 Sequence Diagram

Sequence diagrams, commonly used by developers, model the interactions between objects in a single use case. They illustrate how the different parts of a system interact with each other to carry out a function, and the order in which the interactions occur when a particular use case is executed.

In simpler words, a sequence diagram shows different parts of a system work in a 'sequence' to get something done.
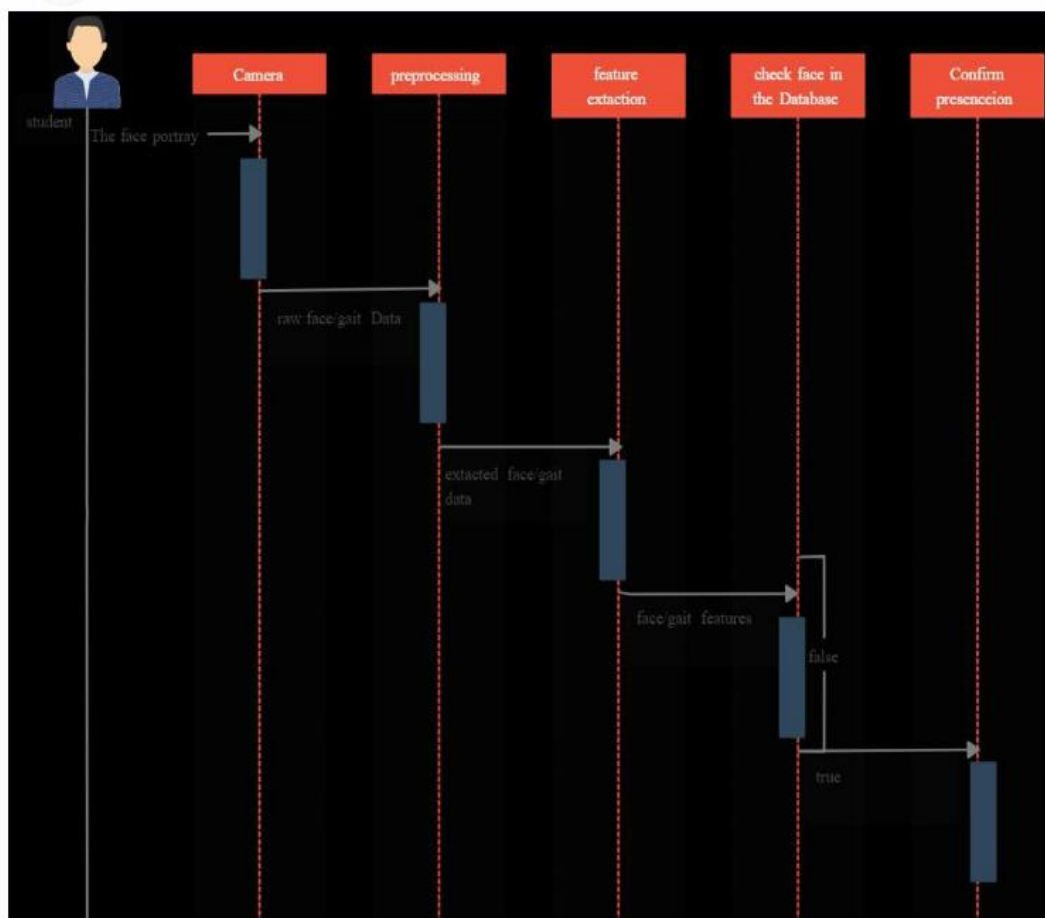
Fig 4.2.5: Sequence Diagram

4.2 System Design

Starting with the live camera which is connected to either mobile phone or web camera captures the live video of the classroom and convert this video in to frames (i.e images).These images are then preprocessed and are sent for face detection.

During this Face_recognition module is used to detect the faces in each image. After this, facial features are extracted from each face and are converted into numpy array.

The detected face numpy arrays are compared with the student faces present in database. Here, the numpy arrays are compared, and a dis-similarity percentage is generated. Then the least dis-similarity percentage is compared with the threshold value and output face is recognised.

After recognising the face, attendance is marked for that recognised student and is stored in database. Finally the attendance in the database is filtered based on the requirements of faculty and faculty can download the attendance.

5. System Implementation

5.1 Source Code

5.1.1 main.py

```python
import numpy as np
import face_recognition


import cv2
import os

def findEncodings(images):
  encodeList = []
  for img in images:
    img = cv2.cvtColor(img, cv2.COLOR_BGR2RGB)
    encode = face_recognition.face_encodings(img)[0]
    encodeList.append(encode)
  return encodeList

def markAttendance(name):
  with open('Attendance.csv','r+') as f:
    myDataList = f.readlines()
    nameList = []
    for line in myDataList:
      entry = line.split(',')
      nameList.append(entry[0])
    if name not in nameList:
      now = datetime.now()
      #dtString = now.strftime('%H:%M:%S')
      f.writelines(f'n{name},{dtString}')

import xlsxwriter as xl
name = "attendance4c"
outsheet = xl.Workbook(name + ".xlsx")
sheet = outsheet.add_worksheet()
names = {"Vinay": [2, "5B7"], "Mahesh": [3, "5B7"],"badri": [4, "5C9"],"sujith": [5,
"5B8"],"sandeep": [6, "513"],"Nomitha": [7, "088"]}

sheet.write("A1", "ROLLNUMBER")
sheet.write("B1", "NAME")
sheet.write("C1", "9.40AM to 10.40AM")
for a in names:
    abc=names[a]
    sheet.write("A" + str(abc[0]), abc[1])
    sheet.write("B" + str(abc[0]), a)
    sheet.write("C" + str(abc[0]), "absent")
```

```python
from datetime import datetime
path = 'Student_image'

images = []
classNames = []
myList = os.listdir(path)
print(myList)
#myList=myList[1:]
print(myList)

for cl in myList:
    curImg = cv2.imread(f'{path}/{cl}')
    images.append(curImg)
    classNames.append(os.path.splitext(cl)[0])
print(classNames)

encodeListKnown = findEncodings(images)
print('Encoding Complete')

cap = cv2.VideoCapture(0)
# print(encodeListKnown)


ccc = 0
while ccc <50:
    success, img = cap.read()
    #img = cv2.captureScreen()
    # print("img is",type(img),img)
   # img = cv2.imread("ctest.jpg")

    imgS = cv2.resize(img, (0, 0), None, 0.25, 0.25)
    imgS = cv2.cvtColor(imgS, cv2.COLOR_BGR2RGB)

    facesCurFrame = face_recognition.face_locations(imgS)
    #print(facesCurFrame, "len is ")
    if(len(facesCurFrame)>0):
        encodesCurFrame = face_recognition.face_encodings(imgS, facesCurFrame)

        for encodeFace, faceLoc in zip(encodesCurFrame, facesCurFrame):
            matches = face_recognition.compare_faces(encodeListKnown, encodeFace)
            faceDis = face_recognition.face_distance(encodeListKnown, encodeFace)

            matchIndex = np.argmin(faceDis)

            if faceDis[matchIndex]<0.5 and matches[matchIndex]:
                name = classNames[matchIndex]
```

```python
        print(name,faceDis,matchIndex)

        y1, x2, y2, x1 = faceLoc
        y1, x2, y2, x1 = y1 * 4, x2 * 4, y2 * 4, x1 * 4
        cv2.rectangle(img, (x1, y1), (x2, y2), (0, 255, 0), 2)
        cv2.rectangle(img, (x1, y2 - 35), (x2, y2), (0, 255, 0), cv2.FILLED)
        cv2.putText(img, name, (x1 + 6, y2 - 6), cv2.FONT_HERSHEY_COMPLEX, 1,
(255, 255, 255), 2)
        # markAttendance(name)

        out = names[name]
        # print("out is ",out)
        abc = out[0]
        sheet.write("C" + str(abc), "present")



  cv2.imshow("img is", img)
  cv2.waitKey(1)


  ccc += 1
outsheet.close()
```

5.2 Function Description

Django - Django is a high-level Python web framework that enables rapid development of secure and maintainable websites. Built by experienced developers, Django takes care of much of the hassle of web development, so you can focus on writing your app without needing to reinvent the wheel.

OpenCV2 - Python is a library of Python bindings designed to solve computer vision problems.

cv2.imread() - cv2.imread() method loads an image from the specified file. If the image cannot be read (because of missing file, improper permissions, unsupported or invalid format) then this method returns an empty matrix.

XlsxWriter - XlsxWriter is a Python module that provides various methods to work with Excel using Python. It can be used to read, write, applying formulas. Also, it supports features such as formatting, images, charts, page setup, auto filters, conditional formatting, and many others.

NumPy -NumPy is a Python library used for working with arrays. It also has functions for working in domain of linear algebra, fourier transform, and matrices.

Driver class - The driver class for the mysql database is com.mysql.jdbc.Driver. Connection URL: The connection URL for the mysql database is jdbc:mysql://localhost:3306/sonoo where jdbc is the API, mysql is the database, localhost is the server name on which mysql is running, we may also use IP address, 3306 is the port number and sonoo is the database name.

AJAX- stands for Asynchronous JavaScript And XML. In a nutshell, it is the use of the XMLHttpRequest object to communicate with servers. It can send and receive information in various formats, including JSON, XML, HTML, and text files.

5.3 Project Structure
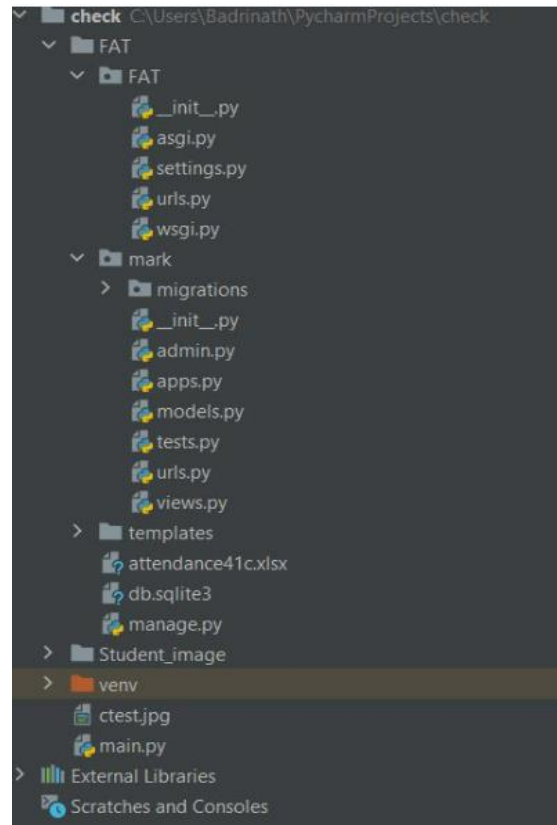
5.2.1 Project structure

FAT-It is the main folder which is the root implementation for entire project. FAT uses a 32 byte structure.

MARK-It is the extended folder for FAT, where user writes the logic, makes connections and sets up the project implementation.

Templates-It contains all the HTML CSS, JS codes which is used by web-app.

Student Image-It is the folder which contains images of the students.

Libraries- It contains the libraries which are externally downloaded.

5.4 Methodology
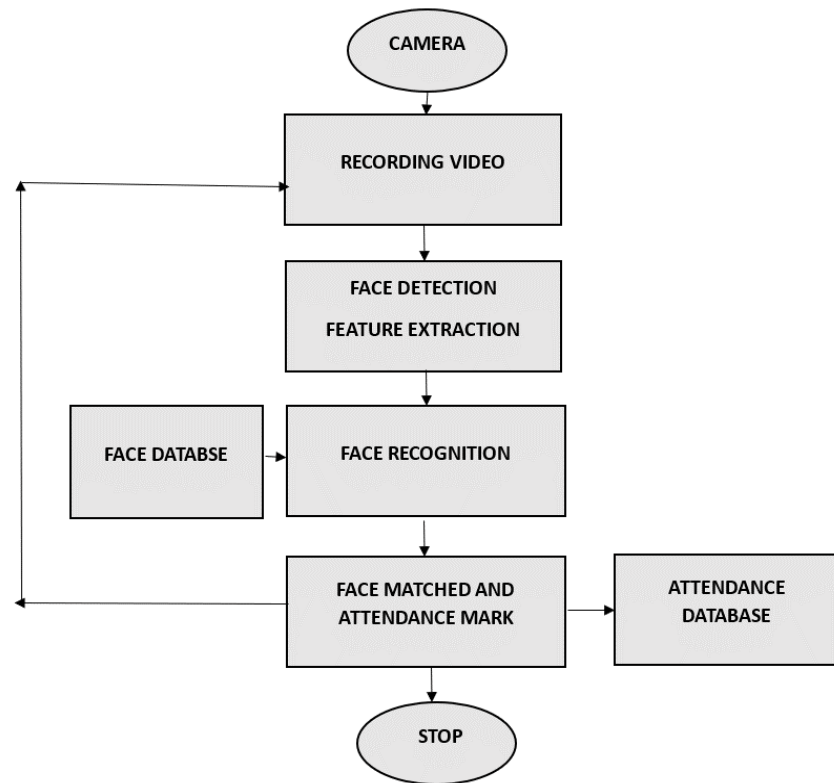
Fig 5.4.1 Flow chart of Methodology

Camera

The project starts with capturing the live class room using camera. The camera captures the feed in the form of frames (i.e images). These images are captured by the hardware device and are sent to back-end using AJAX. The images are binded with headers and are sent backend in the form of requests. These images are sent at a faster rate to the back-end.

Recording Video

The frames received at the back-end are preprocessed using CV2.Then these images are sent for face detection face one by one.

Face Detection

In the Face Detection phase, python module known as Face_Recognition module. Is used to detect the faces in image. The detected faces are stored in a list. After detecting all the faces they are sent of feature extraction.

Feature Extraction

In the Feature Extraction phase, using the face_recognition module unique facial features are extracted from each image and are converted into numpy array. After completion of feature extraction we get list of numpy arrays of unknown faces. Now the same process is done on the images of students present in the database.

Face Recognition

Now we to recognize the face, we compare the unknown face numpy arrays with known face numpy arrays. Using the face_comapre method in the Face_Recognition module we compare the numpy array and the method returns the dis-similarity percentage for each (known face and unknown face) pair. Now we consider the least dis-similarity percentage. Now the least dis-similarity percentage is compared with the threshold value which is used for improving the accuracy. Upon satisfying the threshold value, face is recognised and is given as output.

Attendance Marking

After getting the roll numbers of the presentee students. we create a object of the database table and make the presentees roll number as present, where the default status of roll numbers is absent and saved in the database.

Attendance Filtering

To access the data from the database, we first take year, branch, section and two dates as input from user. Based on the these parameters ,we filter the data in the database and print in the form of table in html page. We added external javascript links to the table using the table ID , with these table data can be downloaded or saved in any format like csv, excel, pdf.

| Copy | CSV | Excel | PDF | Print | | | | | | Search: | | |

id ▲	year	branch	section	date	period	R19R11A05B0	R19R11A05B1	R19R11A05B2	R19R11A05B3	R19R11A05B4	R19R11A05B5
4	first	cse	a	March 16, 2023	1	absent	absent	absent	absent	absent	absent
6	first	cse	a	March 17, 2023	1	absent	absent	absent	absent	absent	present
8	first	cse	a	March 25, 2023	1	absent	absent	absent	absent	absent	absent
9	fourth	cse	c	March 15, 2023	3	absent	absent	absent	absent	absent	present
10	fourth	cse	c	March 19, 2023	1	absent	absent	absent	absent	absent	absent
11	first	cse	c	March 22, 2023	1	absent	absent	absent	absent	absent	absent
12	fourth	cse	c	March 24, 2023	1	absent	absent	absent	absent	absent	absent
13	fourth	cse	a	March 24, 2023	1	absent	absent	absent	absent	absent	absent
14	fourth	cse	c	March 26, 2023	1	absent	absent	absent	absent	absent	absent

Showing 1 to 9 of 9 entries

Previous 1 Next

Fig 5.4.2 Output

6. Testing

Regression Testing

Regression testing covers already tested software to ensure it doesn't suddenly break, even after a change of component or module. For example, retesting a dialer after making a feature upgrade. If the software didn't work after several modifications, then it would be called a regression.

Unit Testing

Here, the program is split into blocks, or units, and each section is tested separately. Each unit is called and validated to ensure the individual components of the model meet the user requirements.

Beta Testing

Beta testing, or usability testing, gives selected target users an almost finished version of the program. It helps finding bugs and is carried out to match and validate the program with the user's requirements.

Beta tests are typically deployed several times to achieve this. For example, giving select users access to new versions of video conferencing platforms, like Jitsi or an alternative to Zoom.

Alpha Testing

This type of testing is done just before the product launches. It's similar to beta testing, where users test the program. But this time it's done in-house with the testing team. Alpha testing aims to find and fix bugs that weren't discovered through previous tests.

Integration Testing

In integration testing, the result set is taken from unit testing and groups of modules combined to see how they work together. The main purpose of integration testing is to ensure that modules interact correctly when combined and that the standards of the system and model are met.

Phase 1

Phase 1 testing involves comparing the unknown faces with known faces. This phase has resulted in more numbers of false positives which is a bad sign. To enhance the accuracy the methodology is change, i.e recognising the faces and extracting the facial features with face_recognition module.

After changing the methodology the number of false positives has been minimised.

Phase 2

This phase involves the testing the integration of live camera with backend code. This includes transferring the frames captured by live camera to back-end code. This transfer of frames was taking a long time to process the frames because the number of frames generated by live camera is more than 70 frames per second, this is causing the delay. To improve the processing speed, we have reduced number of frames to 10 per second, which worked effectively without changing the accuracy of prediction.

Phase 3

This process involves the testing of Database management, where the attendance is stored in a object and is saved in the MySQL. Initially the fault has been found while saving the attendance of a particular period.

When user wants to update the previous attendance of that period, it is creating a duplicate record of that period, which is causing redundancy. We have removed this bug, by overriding the previous record based on the id of that period.

6.1 Test cases

TEST CASE ID	TEST CASE OBJECTIVE	EXPECTED OUTPUT	ACTUAL OUTPUT	STATUS
TC_01	If the face is being detected from image	An output FACE DETECTED must be printed	FACE DETECTED	PASS
TC_02	If the face is recognised	Roll number of the student must be printed	Roll number is printed	PASS
TC_03	Integration of camera with website	Camera must be integrated with website and must capture the file	Camera is successfully integrated and working	PASS
TC_04	Transfer of frames to backend	The Frames captured by camera must be transferred to backend safely	Frames are sent to Backend successfully	PASS
TC_05	Storing the attendance into database	A new record must be saved in database	A new record is stored	PASS
TC_06	Fetching of data from database	Attendance records must be accessed from database	Attendance records are accessed from database	PASS

7. Output Screens
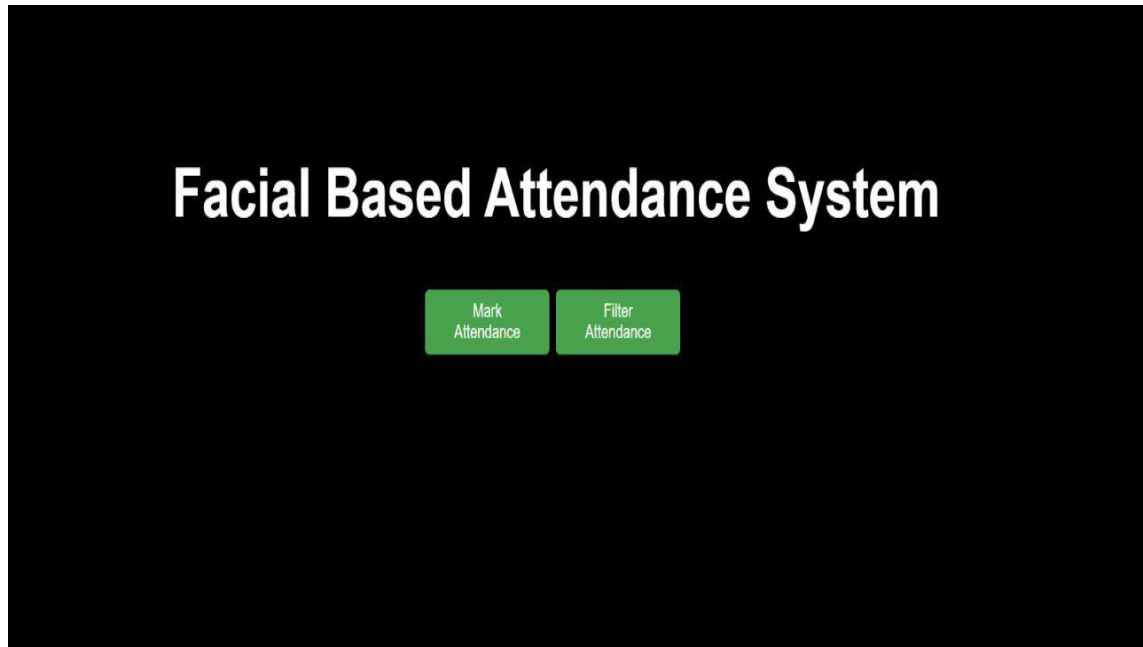
Figure 7.1 Facial Based Attendance System
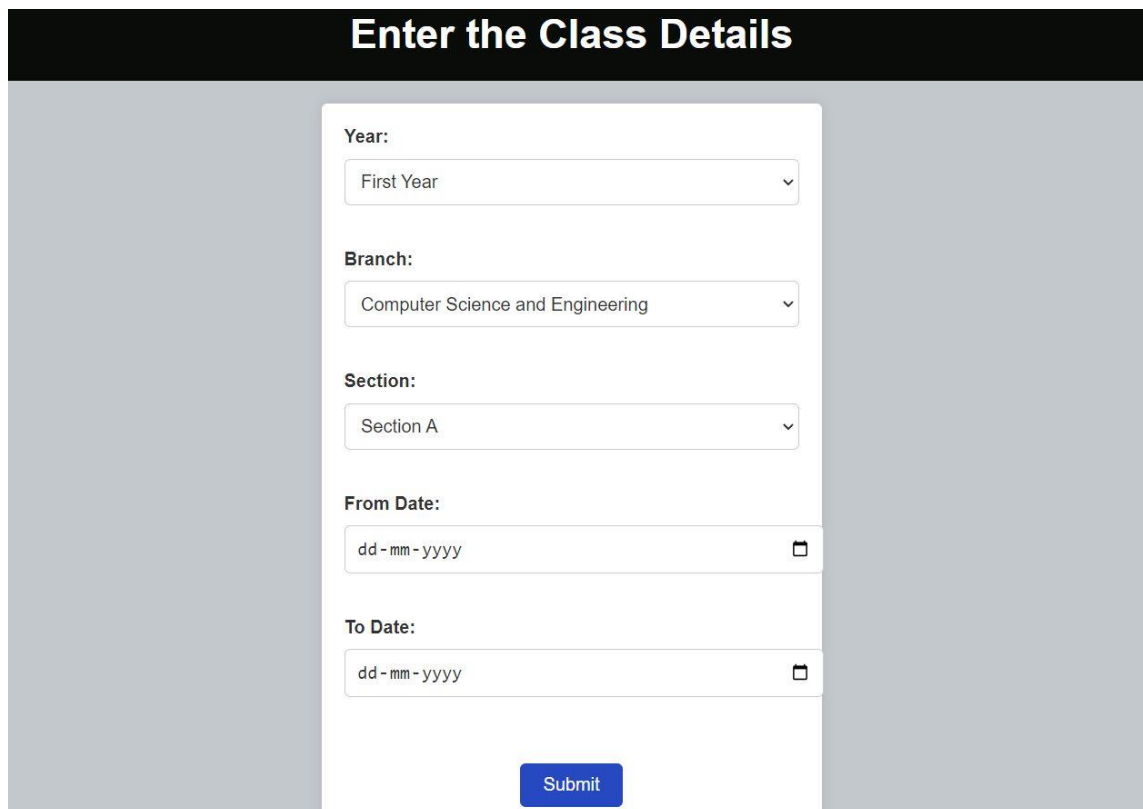
Figure 7.2 Class details
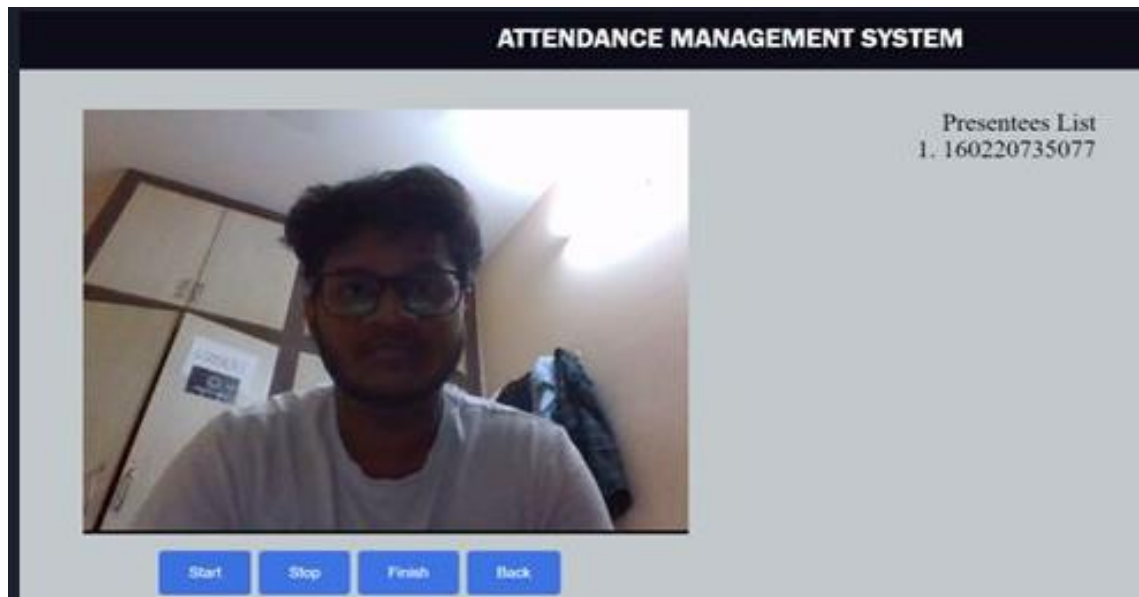
Figure 7.3 Attendance Management System

Figure 7.4 Enter the class details

Figure 7.5 Database creation

id ▲	year	branch	section	date	period	R19R11A05B0	R19R11A05B1	R19R11A05B2	R19R11A05B3	R19R11A05B4	R19R11A05B5
4	first	cse	a	March 16, 2023	1	absent	absent	absent	absent	absent	absent
6	first	cse	a	March 17, 2023	1	absent	absent	absent	absent	absent	present
8	first	cse	a	March 25, 2023	1	absent	absent	absent	absent	absent	absent
9	fourth	cse	c	March 15, 2023	3	absent	absent	absent	absent	absent	present
10	fourth	cse	c	March 19, 2023	1	absent	absent	absent	absent	absent	absent
11	first	cse	c	March 22, 2023	1	absent	absent	absent	absent	absent	absent
12	fourth	cse	c	March 24, 2023	1	absent	absent	absent	absent	absent	absent
13	fourth	cse	a	March 24, 2023	1	absent	absent	absent	absent	absent	absent
14	fourth	cse	c	March 26, 2023	1	absent	absent	absent	absent	absent	absent

Showing 1 to 9 of 9 entries

Figure 7.6 Attendance report

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8. Conclusion

8.1 Conclusion

This project entitled Facial Recognition based Attendance System is very useful. It makes the process of attendance easier. It reduces time and efforts. This project makes the process of attendance automated. A database is created which contains the students details. With the help of the live camera, faces are detected. The detected faces are then matched with the faces in the database and a similarity meter is given. Based on the training data provided, the students faces are recognized and attendance is marked for each and every student. After the marking of the attendance, an attendance report of the entire class along with timestamps is generated. This project can be used in many colleges and in many departments. This project provides attendance report of the entire class and of each and every period. The facial features of each and every student is stored in a database. The first step in our project is to detect the students faces. The next step is to extract the facial features. After the facial features are extracted, the faces are compared with the faces present in the database and are classified and faces are recorded. Then the attendance report of the entire class along with timestamps is generated. This project aims at replacing the manual way of taking attendance with facial recognition based attendance system. Our project provides 94% accuracy with minimal false positives. It provides minimum errors. It is an accurate method of taking attendance.

8.2 Further Enhancement

We can add many other features to the project. As of now our project recognizes student faces and generates attendance report. We can also add a feature in such a way that the parents of the students will also be sent the attendance report of the students with timestamps to their mobile phones.

Another additional feature that can be added is that parents will also be sent a live video coverage of the classroom. They can monitor and see what their child is doing and what is going on in the classroom.

Along with these features another important feature that can be added is that subject wise attendance will be provided. Subject wise attendance report will also be generated and an overall percentage of each subject's attendance along with the overall attendance report will be sent to the parents every week. Subject wise attendance of each student will be sent to the respective faculty as well.

In future this project can be used by each and every jntuh affiliated college and by each and every department.

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10. Appendices

A. Software used

- **MySQL** is an open-source relational database management system (RDBMS). Its name is a combination of "My", the name of co-founder Michael Widenius's daughter My,[1] and "SQL", the acronym for Structured Query Language. A relational database organizes data into one or more data tables in which data may be related to each other; these relations help structure the data. SQL is a language programmers use to create, modify and extract data from the relational database, as well as control user access to the database. In addition to relational databases and SQL, an RDBMS like MySQL works with an operating system to implement a relational database in a computer's storage system, manages users, allows for network access and facilitates testing database integrity and creation of backups.

- **Python** is an interpreted, high-level, general-purpose programming language. Created by "GUIDO VAN ROSSUM" and first released in 1991. Python is a powerful general-purpose programming language. It is used in web development, data science, creating software prototypes, and so on. Fortunately for beginners, Python has simple easy-to-use syntax. This makes Python an excellent language to learn to program for beginners.
  Python is largely used for developing data science and machine learning models.

- **Pycharm** is an integrated development environment (IDE) used for programming in Python. It provides code analysis, a graphical debugger, an integrated unit tester, integration with version control systems, and supports web development with Django. PyCharm is developed by the Czech company JetBrains. It is cross-platform, working on Microsoft Windows, macOS and Linux. PyCharm has a Professional Edition, released under a proprietary license and a Community Edition released under the Apache License. PyCharm Community Edition is less extensive than the Professional Edition.

B. Methodology used

Waterfall Model

The waterfall is a universally accepted SDLC model. In this method, the whole process of software development is divided into various phases.

The waterfall model is a continuous software development model in which development is seen as flowing steadily downwards (like a waterfall) through the steps of requirements analysis, design, implementation, testing (validation), integration, and maintenance.

Linear ordering of activities has some significant consequences. First, to identify theend of a phase and the beginning of the next, some certification techniques have to be employed at the end of each step. Some verification and validation usually do this mean that will ensure that the output of the stage is consistent with its input, and that the output of the stage is consistent with the overall requirements of the system.

Waterfall approach was first SDLC Model to be used widely in Software Engineering to ensure success of the project. In "The Waterfall" approach, the whole process of software development is divided into separate phases. In this Waterfall model, typically, the outcome of one phase acts as the input for the next phase sequentially.

The following illustration is a representation of the different phases of the Waterfall Model.
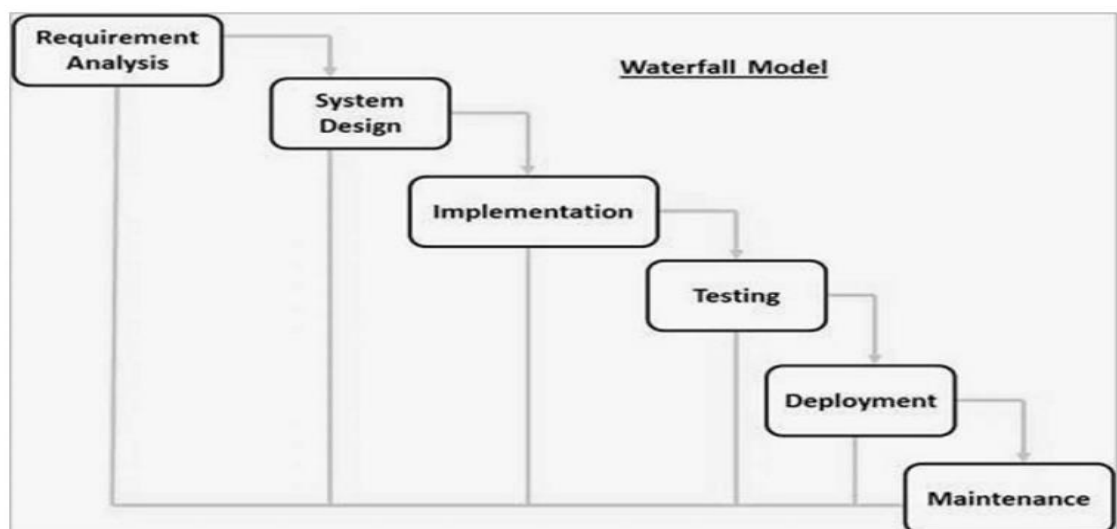
The sequential phases in Waterfall model are −

- **Requirement Gathering and analysis** − All possible requirements of the system to be developed are captured in this phase and documented in a requirement specification document.

- **System Design** − The requirement specifications from first phase are studied in this phase and the system design is prepared. This system design helps in specifying hardware and system requirements and helps in defining the overall system architecture.

- **Implementation** − With inputs from the system design, the system is first developed in small programs called units, which are integrated in the next phase. Each unit is developed and tested for its functionality, which is referred to as Unit Testing.

- **Integration and Testing** − All the units developed in the implementation phase are integrated into a system after testing of each unit. Post integration the entire system is tested for any faults and failures.

- **Deployment of system** − Once the functional and non-functional testing is done; the product is deployed in the customer environment or released into the market.

- **Maintenance** − There are some issues which come up in the client environment. To fix those issues, patches are released. Also to enhance the product some better versions are released. Maintenance is done to deliver these changes in the customer environment.

- All these phases are cascaded to each other in which progress is seen as flowing steadily downwards (like a waterfall) through the phases. The next phase is started only after the defined set of goals are achieved for previous phase and it is signed off, so the name "Waterfall Model". In this model, phases do not overlap.

C. Testing

Acceptance tests

Tests to verify that requirements have been met, usually referred to as User Acceptance Testing (UAT).

Regression Testing

Regression testing covers already tested software to ensure it doesn't suddenly break, even after a change of component or module. For example, retesting a dialer after making a feature upgrade. If the software didn't work after several modifications, then it would be called a regression.

Unit Testing

Here, the program is split into blocks, or units, and each section is tested separately. Each unit is called and validated to ensure the individual components of the model meet the user requirements.

Beta Testing

Beta testing, or usability testing, gives selected target users an almost finished version of the program. It helps finding bugs and is carried out to match and validate the program with the user's requirements.

Beta tests are typically deployed several times to achieve this. For example, giving select users access to new versions of video conferencing platforms, like Jitsi or an alternative to Zoom.

Alpha Testing

This type of testing is done just before the product launches. It's similar to beta testing, where users test the program. But this time it's done in-house with the testing team. Alpha testing aims to find and fix bugs that weren't discovered through previous tests.

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11. Plagiarism Report

0%
Plagiarized

100%
Unique

Generate Report

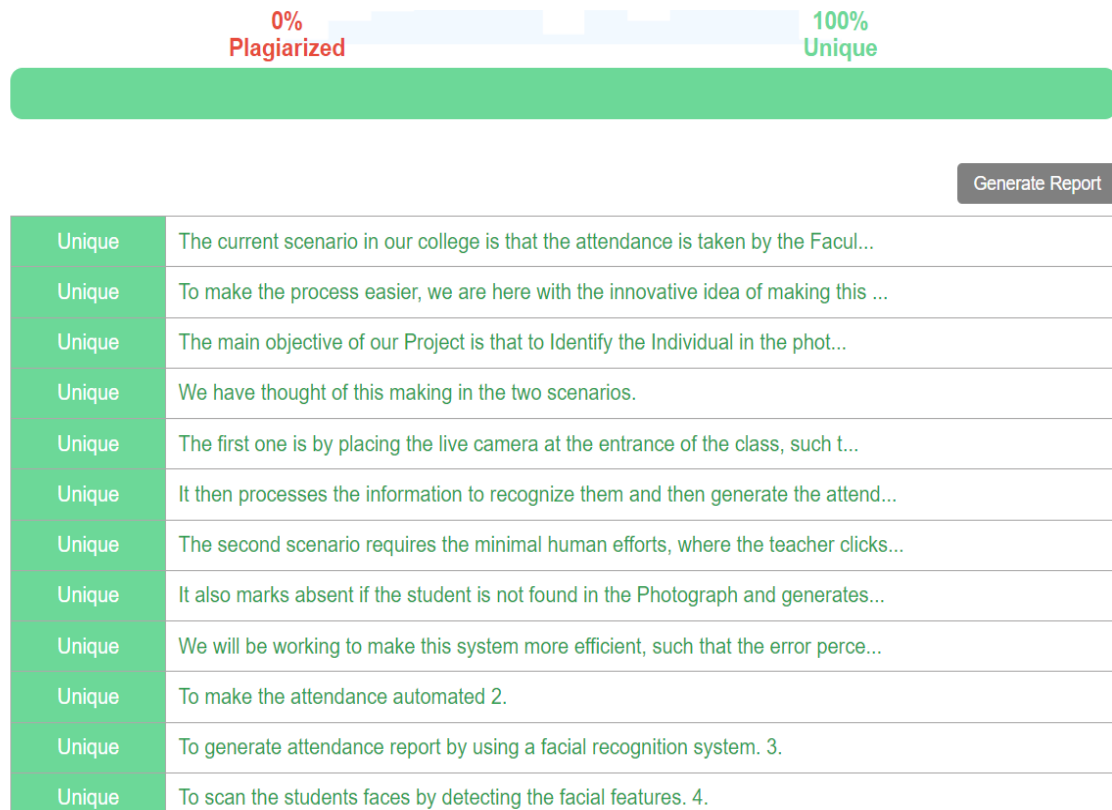|	
Unique	The current scenario in our college is that the attendance is taken by the Facul...
Unique	To make the process easier, we are here with the innovative idea of making this ...
Unique	The main objective of our Project is that to Identify the Individual in the phot...
Unique	We have thought of this making in the two scenarios.
Unique	The first one is by placing the live camera at the entrance of the class, such t...
Unique	It then processes the information to recognize them and then generate the attend...
Unique	The second scenario requires the minimal human efforts, where the teacher clicks...
Unique	It also marks absent if the student is not found in the Photograph and generates...
Unique	We will be working to make this system more efficient, such that the error perce...
Unique	To make the attendance automated 2.
Unique	To generate attendance report by using a facial recognition system. 3.
Unique	To scan the students faces by detecting the facial features. 4.

Fig 11.1: Plagiarism report