

# **AUTOMATE THE ATTENDANCE SYSTEM WITH DEEP FACIAL RECOGNITION USING PYTHON TOOLS**

**Major Project Report(Stage 1)**

*Submitted in partial fulfillment of  
the requirements for the award of the degree of*

**Bachelor of Technology in  
Computer Science and Engineering**

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Department of Computer Science and Engineering

***Certificate***

This is to certify that the Project Stage-I report work entitled “AUTOMATE THE ATTENDANCE SYSTEM WITH DEEP FACIAL RECOGNITION USING PYTHON TOOLS.” is a bona-fide work carried out by a team consisting of B.SAI CHARAN TEJA bearing Roll no. 19SS1A0507, S. PRAGNA SRI bearing Roll no. 19SS1A0542, V. NAGAMALLESWARI bearing Roll no. 19SS1A0548, K. PRANAY KUMAR bearing Roll no. 20SS5A0508 in partial fulfillment of the requirements for the degree of BACHELOR OF TECHNOLOGY in COMPUTER SCIENCE AND ENGINEERING discipline to Jawaharlal Nehru Technological University Hyderabad College of Engineering Sultanpur, during the academic year 2022- 2023.

The results embodied in this report have not been submitted to any other University or Institution for the award of any degree or diploma.

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## ***Declaration***

We hereby declare that the Project Stage-I entitled “**AUTOMATE THE ATTENDANCE SYSTEM WITH DEEP FACIAL RECOGNITION USING PYTHON TOOLS.**” is a bona-fide work carried out by a team consisting of B.SAI CHARAN TEJA bearing Roll no. 19SS1A0507, S. PRAGNA SRI bearing Roll no. 19SS1A0542, V. NAGAMALLESWARI bearing Roll no. 19SS1A0548, K. PRANAY KUMAR bearing Roll no. 20SS5A0508 in partial fulfillment of the requirements for the degree of Bachelor of Technology in Computer Science and Engineering discipline to Jawaharlal Nehru Technological University Hyderabad University College of Engineering Sultanpur during the academic year 2022- 2023. The results embodied in this report have not been submitted to any other University or Institution for the award of any degree or diploma.

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# Contents

<b>Certificate</b>	<b>i</b>
<b>Declaration</b>	<b>ii</b>
<b>Acknowledgement</b>	<b>iii</b>
<b>Abstract</b>	<b>viii</b>
<b>INTRODUCTION</b>	<b>1</b>
1.1 Project Overview	2
1.2 Problem Statement	2
1.3 Purpose	3
1.4 Existing System	3
1.5 Proposed System	4
<b>2 LITERATURE SURVEY</b>	<b>9</b>

2.1	Introduction	9
2.2	Conclusion	10
<b>3</b>	<b>REQUIREMENT SPECIFICATION</b>	<b>11</b>
3.1	Software Requirements	11
3.2	Hardware Requirements	11
3.3	Conclusion	11
<b>4</b>	<b>WORKING OF SYSTEM</b>	<b>12</b>
4.1	SYSTEM ARCHITECTURE	13
4.2	MACHINE LEARNING	14
4.3	Conclusion	15
<b>5</b>	<b>SYSTEM DESIGN</b>	<b>16</b>
5.1	UML DIAGRAMS	16
5.1.1	USE CASE DIAGRAMS	16
5.1.2	SEQUENCE DIAGRAMS	17
5.1.3	DATA FLOW DIAGRAMS	18
5.1.4	ACTIVITY DIAGRAM	21
5.2	Conclusion	22

<b>6 CONCLUSION</b>	<b>23</b>
<b>REFERENCES</b>	<b>24</b>



# *Abstract*

Identifying a person with an image has been popularized through the mass media. It reduces the sense of touch with conventional systems. This project mainly competes with the biometrics method (which is a very time-consuming and also sequential process) however with our project, we make the process so quick in a parallel fashion by detecting groups of faces at a time. The current method that institutions use is the faculty passes an attendance sheet or make. Roll calls and mark the attendance of the students, which sometimes disturbs the discipline of the class and this sheet further goes to the admin department, which is then updated to an excel-sheet. This process is quite hectic and time-consuming. Also, for professors or employees at institutes or organizations, the biometric system serves one at a time. As we can see, the student's classroom behavior has been washed out. The majority of students only showed up in class because of attendance-based detention. We created this project to prevent the student's conduct from being unpredictable. The project is revolutionized to overcome the problems of the conventional system. Our project will ensure more precision and negligible manual work. In our project, face recognition (Machine Learning) technology is used. It reports the technologies available in the Open-Computer-Vision (Open CV) library, existing libraries (like pandas, NumPy, Matplotlib, etc) and the methodology to implement using Python. The model has an accuracy of 99.38% on the Labeled Faces in the Wild benchmark

# List of Figures

- 1.1 Capture video
- 1.2 Multi Face Detection
- 1.3 Face Recognition
- 3.1 Feature Extraction
- 3.2 Attendance marking system
- 5.1 Use Case Diagram
- 5.2 Sequence Diagram
- 5.3 Data flow Diagram Notation
- 5.4 Data flow Diagram
- 5.5 Activity Diagram

# Chapter 1

## INTRODUCTION

The success of an educational institute begins by engaging students and having regular attendance of students. Having a higher attendance score results in higher marks, higher retention rates, and a better educational experience. It is difficult for teachers and students to build a strong relationship if students are frequently absent. This hampers teachers and students to develop their skills and make progression. In many schools, the school budgets are based on the average daily attendance of the school. If the attendance rates are low, then school budgets suffer. Hence, schools have less money to get essential classroom needs for students and eventually end up with less quality education. Therefore, the educational institute needs to have high-quality attendance data. These data provide essential information for the institute to formulate policies, programs, and practices to improve attendance rates. To increase the attendance of students, many teachers give better grades to the students with higher attendance scores.

Even though keeping attendance data is an essential part of educational institutes, there has been little advancement in the attendance system. Still, many institutes use traditional handwritten attendance or use some spreadsheet on the computer. This makes it hard for teachers to track the students' attendance data and their progress. Chances of attendance fraud in this system are relatively higher than in automated attendance system. Unless the attendance data is correct, schools cannot formulate proper policies and practices to improve the quality of education.

This project will help eliminate the traditional attendance system, minimize manipulation during attendance and record the attendance of the students based on their attention. It is also very easy to use and manage.

## **1.1 Project Overview**

Our project working mechanism is quite different from others. The other system uses recorded class sessions to take attendance, but our system randomly selects pictures from those sessions to gauge student concentration in class. We record the attendance after taking into account the students' behavior and attention. Let's say we took 100 pictures in a one-hour session. The student must appear focused in at least 40 photos before only that student qualifies for attendance; else, not. Sending an email with the students' attendance data to the administrative department as well.

Our project will ensure more precision and negligible manual work. In our project, face recognition (Machine Learning) technology is used. Administrators must add user information manually and with data sets stored associated with the risk of being lost or stolen.

## **1.2 Problem Statement**

Attendance is an important part of daily classroom evaluation. At the beginning and ending of class, it is usually checked by the teacher, but it may appear that a teacher may miss someone or some students answer multiple times. Face recognition-based attendance system is a problem of recognizing face for taking attendance by using face recognition technology based on high definition monitor video and other information technology.

The concept of face recognition is to give a computer system the ability of finding and recognizing human faces fast and precisely in images or videos. Numerous algorithms and techniques have been developed for improving the performance of face recognition. Recently Deep learning has been highly explored for computer vision applications. Human brain can automatically and instantly detect and recognize multiple faces. But when it comes to computer, it is very difficult to do all the challenging tasks on the level of human brain. The face recognition is an integral part of biometrics. In biometrics, basic traits of human are matched to the existing data. Facial features are extracted and implemented through algorithms, which are efficient and some modifications are done to improve the existing algorithm models.

## **1.3 Purpose**

As we can see, the student's classroom behavior has been washed out. We created this project to prevent the student's conduct from being unpredictable. This hampers teachers and students to develop their skills and make progression.

Computers that detect and recognize faces could be applied to a wide variety of practical applications including criminal identification, security systems, identity verification etc. to patients and avoid severe consequences.

## **1.4 Existing System**

### **1.4.1 Fingerprint Based recognition system:**

In the Fingerprint based existing attendance system, a portable fingerprint device needs to be configured with the student's fingerprint earlier. Later either during the lecture hours or before, the student needs to record the fingerprint on the configured device to ensure their attendance for the day. The problem with this approach is that during the lecture time it may distract the attention of the students.

### **1.4.2 RFID (Radio Frequency Identification) Based recognition system:**

In the RFID based existing system, the student needs to carry a Radio Frequency Identity Card with them and place the ID on the card reader to record their presence for the day. The system is capable of connecting to RS232 and recording the attendance to the saved database. There are possibilities for fraudulent access may occur. Some students may make use of other students' ID to ensure their presence when the particular student is absent or they even try to misuse it sometimes.

### **1.4.3 Iris Based Recognition System:**

In the Iris based student attendance system, the student needs to stand in front of a camera, so that the camera will scan the Iris of the student. The scanned iris is matched

with data of students stored in the database and the attendance on their attendance needs to be updated. This reduces the paper and pen workload of the faculty members of the institute. This also reduces the chances of proxies in the class, and helps in maintaining the student records safe. It is a wireless biometric technique that solves the problem of spurious attendance and the trouble of laying the corresponding network.

#### **1.4.4 Face Based Recognition System:**

The facial recognition technology can be used in recording the attendance through a high-resolution digital camera that detects and recognizes the faces of the students and the machine compares the recognized face with students' face images stored in the database. Once the face of the student is matched with the stored image, then the attendance is marked in the attendance database for further calculation. If the captured image doesn't match with the students' face present in the database then this image is stored as a new image onto the database. In this system, there are possibilities for the camera to not to capture the image properly or it may miss some of the students from capturing

### **1.5 Proposed System**

The task of the proposed system is to capture the face of each student and to store it in the database for their attendance. The face of the student needs to be captured in such a manner that all the features of the students' face needs to be detected, even the seating and the posture of the student need to be recognized. There is no need for the teacher to manually take attendance in the class because the system records a video and through further processing steps the face is being recognized and the attendance database is updated

The algorithms are applied and the model is trained using the training data. The accuracy of the system is obtained by testing the system using the captured images during the class session. This system is implemented using the following modules.

1. Capture video
2. Randomly collect the frames from the video
3. Multi face detection
4. Face Recognition
5. Post-Processing

### 1.5.1 Capture video:

The Camera is fixed at a specific distance inside a classroom to capture videos of the frontal images of the entire students of the class.

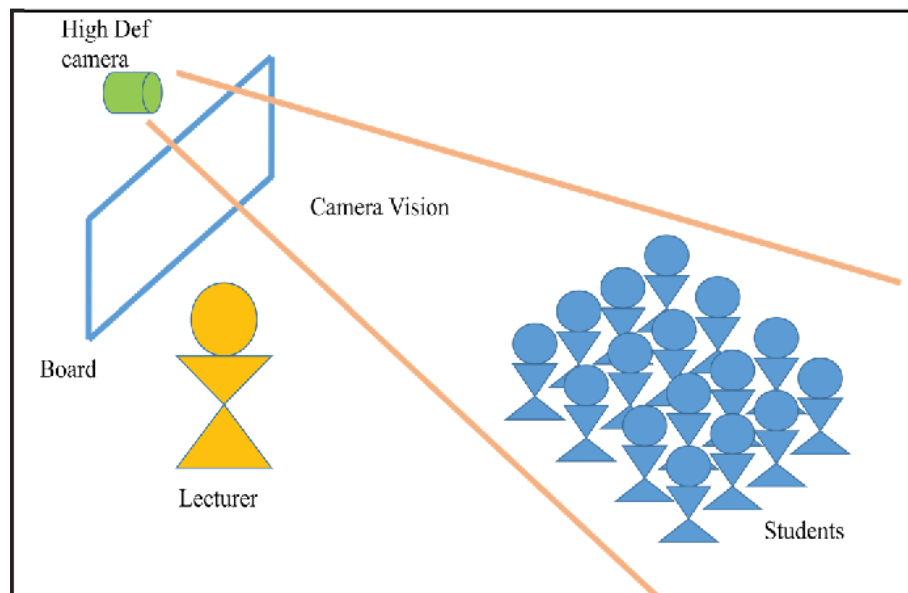


Figure 1.1: Capture video

### 1.5.2 Randomly collect the frames from the captured video:

The captured video needs to be converted into frames per second for easier detection and recognition of the students

### 1.5.3 Multi-Face Detection:

Face Detection is the process where the image, given as an input (picture) is searched to find any face, after finding the face the image processing cleans up the facial image for easier recognition of the face.

Detecting facial landmarks is a subset of the shape prediction problem. Facial landmarks such as eyes, eyebrows, nose, mouth, jawline were used to localize and represent salient regions of the face. In the context of facial landmarks, our goal was to detect important facial structures on the face using shape prediction methods. Dlib and OpenCV were used to detect facial landmarks in an image. Face detection has been achieved by us using a model for predicting facial landmarks.

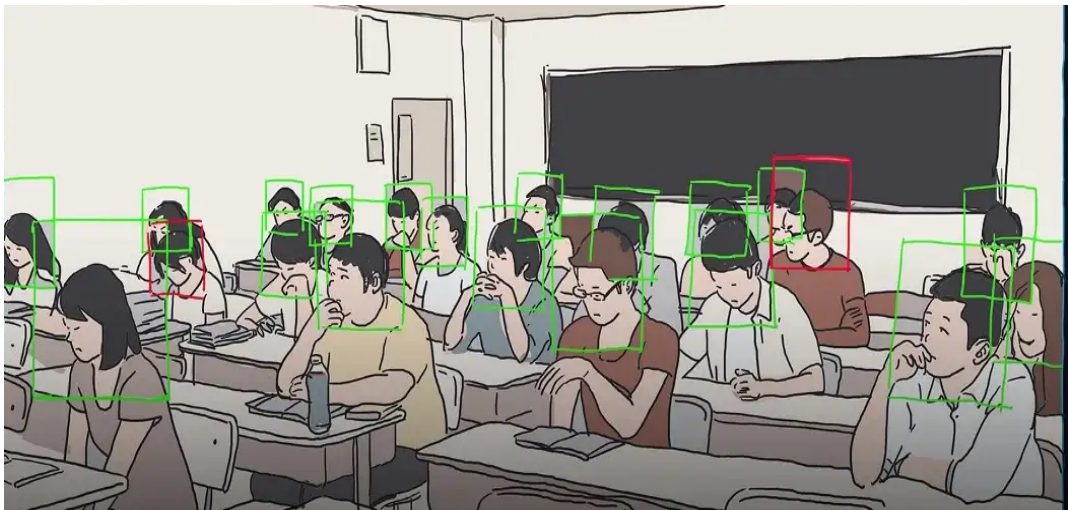


Figure 1.2: Multi Face Detection



### 1.5.4 Face Recognition :

After the completion of detecting and processing the face, it is compared to the faces present in the students' database to update the attendance of the students. Using the concept of Convolutional Neural Network, the appropriate face will be recognised as in the database. CNN is a class of deep, feed-forward artificial neural networks that has successfully been applied to analysing visual imagery. CNNs have wide applications in image and video recognition, recommender systems and natural language.



Figure 1.3: Face Recognition

### **1.5.5 Post processing and mailing:**

The post-processing mechanism involves the process of updating the names of the students into an excel sheet. The excel sheet can be maintained on a weekly basis or monthly basis to record the students' attendance. This attendance record can be sent to parents or guardians of students to report the performance of the student. Based on the attendance marking the total attendance list of students is sent to the Administrative department and also to the student's mail id so that they can keep track of their attendance. We have used the mailing capabilities of Python using the SMTP library.

## **1.6 Conclusion**

This paper viewed the existing system and the pros of it. There are different systems for attendance marking but each system contains a disadvantage that makes it not to use. To make the present attendance system automated we are here to propose facial recognition using python tools which helps in the attendance system with less effort and more accuracy than the existing system.

# Chapter 2

## 2.1 LITERATURE SURVEY

1. Tripathi claimed a real time system which can follow through the presence of the students in a classroom. The necessary supported images for this model was bought at a constant rate through a webcam until the system is turned off. The author scanned through several techniques in order for face detection and encourage them in recognition. Pupils are distinguished with the help of the Ada boost and Haar cascade classifier. Although for face exposure and recollection, the author made use of OpenCV libraries but still for in depth insight he made a quick use of PCA and LDA. The document also emphasized about the difference between LDA and PCA. In the end author confidently inclined towards the system's accuracy and noted that identification rate is entirely dependent on the database and the size of the used image.
2. Ms. Pooja Humbe made use of 360-degree rotating camera for building the model which detects the pupils in the class. This system without the software such as XAMPP controller, NetBeans, Java Advance for the frontend and back-end with MySQL could have been impossible as stated by author. The characteristics of face are being brought by principal component analysis (PCA). Once registered, the record containing the names of students attended will be sent through email to parents and teachers.
3. Firoz Mahmud approbated use of 2 database types including UMIST database and ORL database. PCA and LDA both are used for face knowing purposes. The accuracy of the face recognition is determined using the above listed algorithms, depending on the face alignment. It is observed that front aligned faces have a much better accuracy of recognition than those of face side alignment
4. E. Varadharajan explained the automatic Attendance Management system based on Face Detection. The author describes how faces are sensed and then cut, before which background subtraction is performed on the image in order to improve system performance efficacy. The erudite authors recommend the use of Eigen face for its simplicity and quality of performance in facial recognition. The document also concluded with the observation that in the case of women,detection and recognition rate of the face with a veil was 45% and 10%, while in the case of women it was 93% and 87% without the veil.The identification and recognition levels, on the other hand, were 79% and 65% for bearded men.
5. Akshara Jadhav prompted face encounter algorithm Viola Jones and face recognition PCA algorithm with support for machine learning and SVM for extraction functionality. The author also incorporated reprocessing which includes

the histogram equalization of the facial image extracted and is scaled to 100x100. The use of neural networks for facial recognition has been shown, and we can see the possibility of a semi-supervised learning approach that uses facial recognition support vector machines for satisfactory results. The process followed after the face is recognized is the subsequent processing in which attendance is generated weekly or monthly and can be sent to parents or guardians.

6. Nirmalya Kar used Haar cascade front XML file for pinpointing a face and confirmation of faces using Eigen face. It was created using Open-CV Libraries. On the end of facial orientation, the test was prepared. Both detection and recognition levels were high when facial orientation was approximately 0 degrees with 98.7% and 95% respectively. The frequency decreased slowly as facial orientation rose from 0 degrees to 90 degrees. In the end, the identification and recognition levels ranged from 0 to 90 degrees.
7. Smit Hapani has magnified the system which approbated the model which contributes face distinguishing. Haar classifiers which use a cascade approach and followed by recognition which uses Fisher face. The system optimally offers efficacy up to 50% within 15 pupils when modeling with more than one face with respect to variations such as cap, spectacles. The proposed system makes use of the classroom through video source, and these resulting frames are used to identify the faces. Thus, by following the procedures thereby increasing the rate and accuracy of the overall model.

## **2.2 Conclusion**

This paper reviewed vivid ways in which one can consider to improve the detection and recognition rate. The results show that Viola Jones which uses Haar Cascade is consistent in all the papers studied and gives a good detection rate whereas the LDA algorithm which is used by Fisher face has a better performance and gives faster results. Albeit with the tedious efforts of authors to adjust those above-mentioned algorithms with a model which deals with multiple faces, but it still lacks in both detection and as well as recognition thus reaching out for Deep Learning with the help of convolutional neural networks to engage and satisfy the need for the application.

# Chapter 3

## REQUIREMENT SPECIFICATION

### 3.1 Software Requirements

Software Requirements for the project are:

- **Python** - If possible we could use the latest version of python i.e Python 3.9.0.  
Or you can use any version of python that comes after python 3.6
- **IDE** – Anaconda.
- **Operating System** - Linux/Windows 8 (or) Higher.

### 3.2 Hardware Requirements

Hardware Requirements for the project are:

- **Processor** : Intel i3 (or) Higher.
- **RAM** : 4GB (or) Higher.
- **Hard disk** : 80GB (or) Higher.

### 3.3 Conclusion

Hardware and Software are required to make a computer system to operate effectively. Hardware is the physical components while the software forms the

interface between the hardware and software.

# **Chapter 4**

## **WORKING OF SYSTEM**

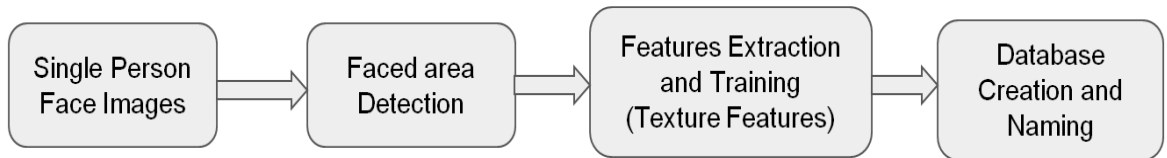
### **4.1 SYSTEM ARCHITECTURE**

The system architecture gives an overview of the system.

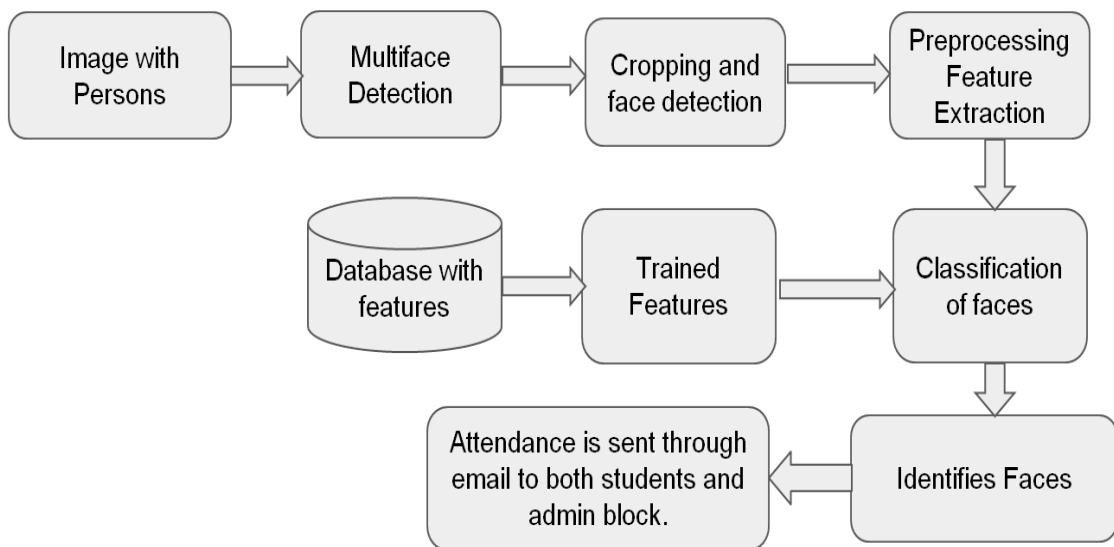
The working of this system is described as follows:

Feature Extraction is carried out as initially collecting the faces of each and every single person. Then detect the face area .After extracting the features and train the system according to our need. Subsequently, create the database and name it.

In the attendance marking system, take a picture of people. Detect the faces in the picture. Then crop the image of the particular face. Preprocess the features of the image. From the database extract the trained features and classify the faces. Identify the face and if it is recognized then attendance is sent through the email to the student as well as for admin also.



**Figure 4.1: Feature Extraction**



**Figure 4.2: Attendance marking system**



## **4.2 MACHINE LEARNING**

Facial recognition software relies on machine learning technology, which requires massive data sets to learn to deliver accurate results.

### **4.2.1 Facial Detection**

Detecting facial landmarks is a subset of the shape prediction problem. Facial landmarks such as eyes, eyebrows, nose, mouth, jaw line were used to localize and represent salient regions of the face. In the context of facial landmarks, our goal was to detect important facial structures on the face using shape prediction methods. Dlib and OpenCV were used to detect facial landmarks in an image. Face detection has been achieved by us Using a model for predicting facial landmarks.

### **4.2.2 Facial Detection using a model for predicting Facial Landmarks**

The algorithm used to detect the face in the image matter less, instead what matters is given the face region where we can apply facial landmark detection. For detecting key facial structures in the face region we have used a pre-trained facial landmark detector which estimates the location of 68 (x, y)-coordinates that map to facial structures on the face. There are other facial landmark detectors, but all of them try to localize and label the following facial regions: Mouth, Right eyebrow, Left eyebrow, Right eye, Left eye, Nose, Jaw, etc.

### **4.2.3 Face Recognition**

Using the concept of Convolutional Neural Network, the appropriate face will be recognized as in the database. CNN is a class of deep, feed-forward artificial neural networks that has successfully been applied to analyzing visual imagery. CNNs have

wide application in image and video recognition, recommender systems and natural language processing.

#### **4.2.4 Mailing**

Based on the attendance marking the total attendance list of students is sent to the Administrative department and also to the student's mail id so that they can keep track of their attendance. We have used the mailing capabilities of Python using the SMTP library.

### **4.3 Conclusion**

System architecture provides us how the features are extracted and trained by the system. Then the attendance marking system illustrates how the system recognizes the student and mark attendance for them along with informing it to the student and admin by sending email. In this machine learning can be used for our accurate results. It has a data set and the system trained according to our feature extraction and then the detection of landmarks, recognition and mailing the attendance.

# **Chapter 5**

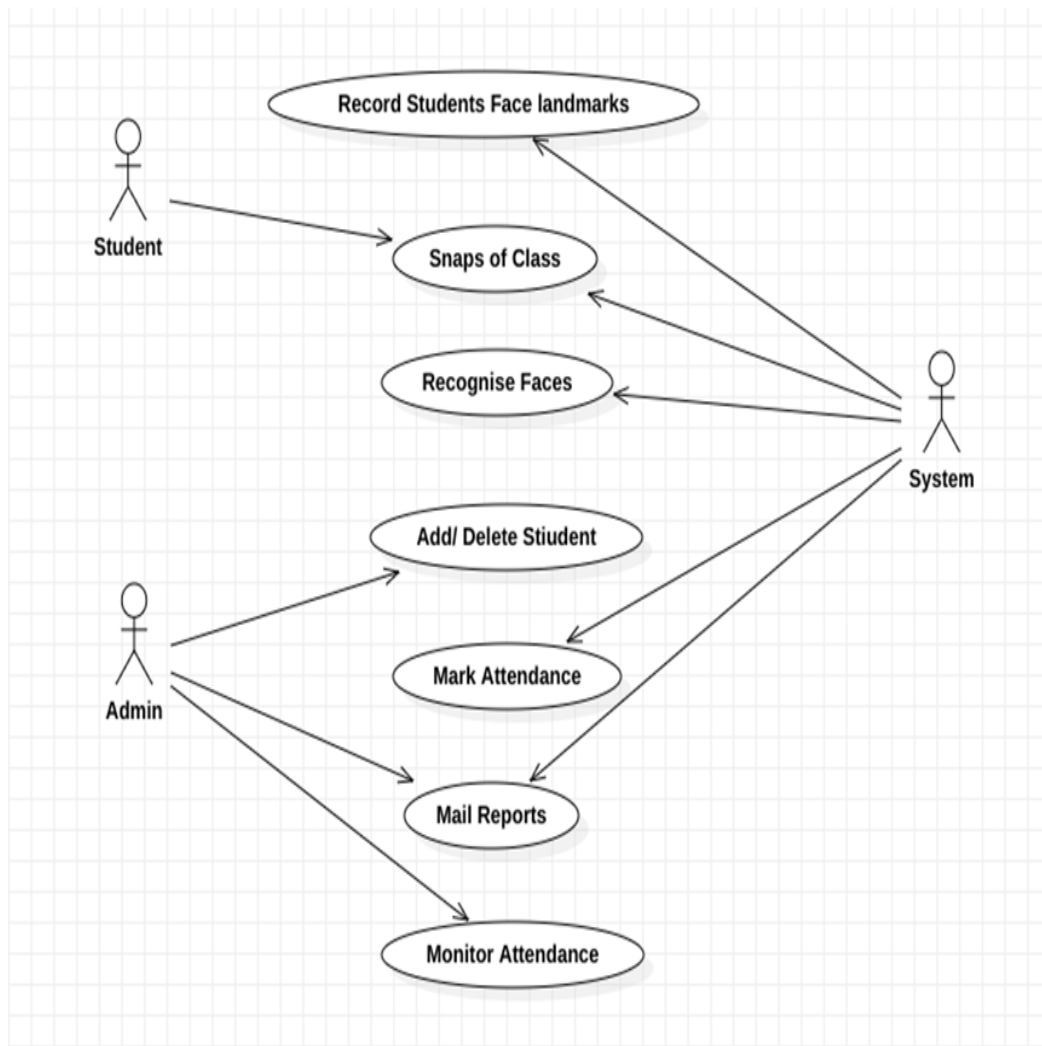
## **SYSTEM DESIGN**

### **5.1 UML DIAGRAMS**

UML, which stands for Unified Modeling Language, is a way to visually represent the architecture, design, and implementation of complex software systems. UML is a standardized modeling language that can be used across different programming languages and development processes, so the majority of software developers will understand it and be able to apply it to their work.

#### **5.1.1 USE CASE DIAGRAMS**

A use case diagram is used to represent the dynamic behavior of a system. It models the tasks, services, and functions required by a system /subsystem of an application. It depicts the high-level functionality of a system and also tells how the user handles a system.



**Figure 5.1: Use Case Diagram**

### **5.1.2 SEQUENCE DIAGRAMS**

Sequence Diagrams are interaction diagrams that detail how operations are carried out. They capture the interaction between objects in the context of a collaboration. Sequence Diagrams are time focus and they show the order of the interaction visually by using the vertical axis of the diagram to represent time what messages are sent and when.

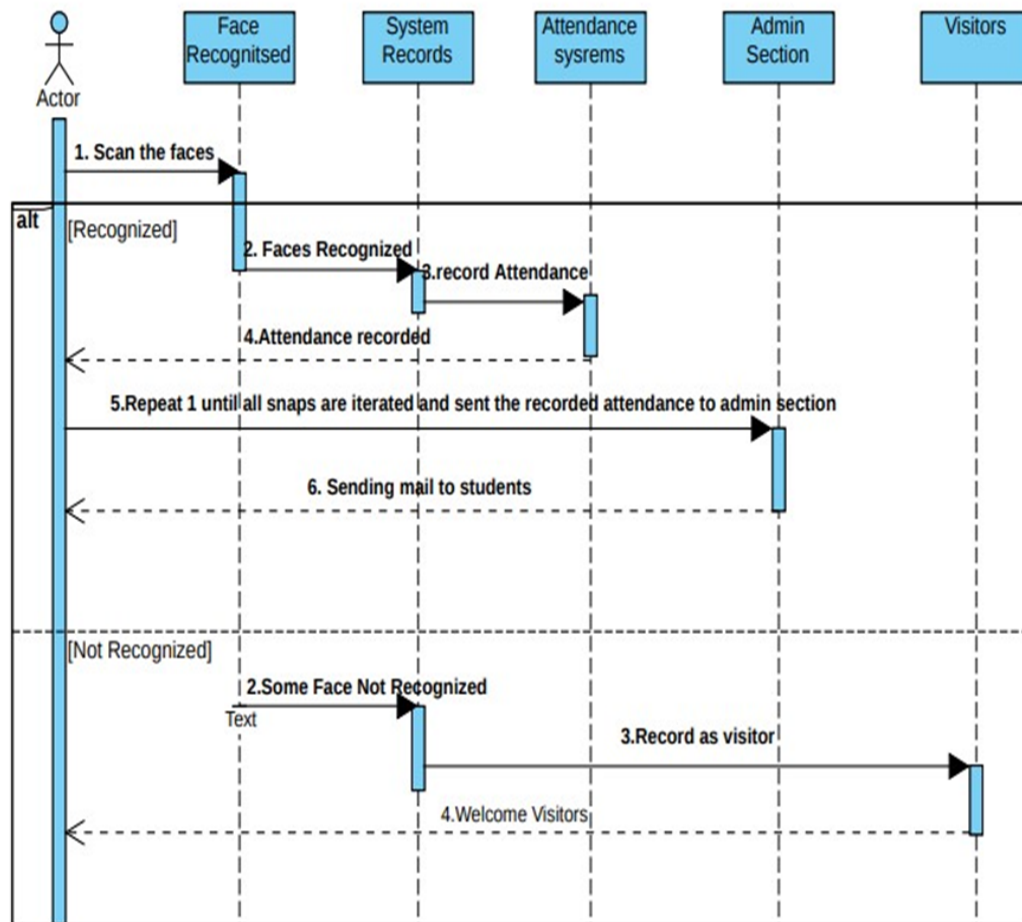


Figure 5.2: Sequence Diagram

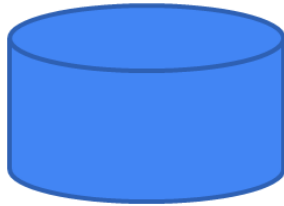
### 5.1.3 DATA FLOW DIAGRAMS

A Data Flow Diagram (DFD) is a graphical representation of the “flow” of data through an Information System. A data flow Diagram can also be used for the visualization of Data Processing .It is common practice for a designer to draw a context-level DFD first which shows the interaction between the system and outside entities. This context-level DFD is then “exploded” to show more detail of the system being modeled.

A DFD represents flow of data through a system. Data flow diagrams are commonly used during problem analysis. It views a system as a function that transforms the input into desired output. A DFD shows movement of data through the different transformations or processes in the system.



**Function**



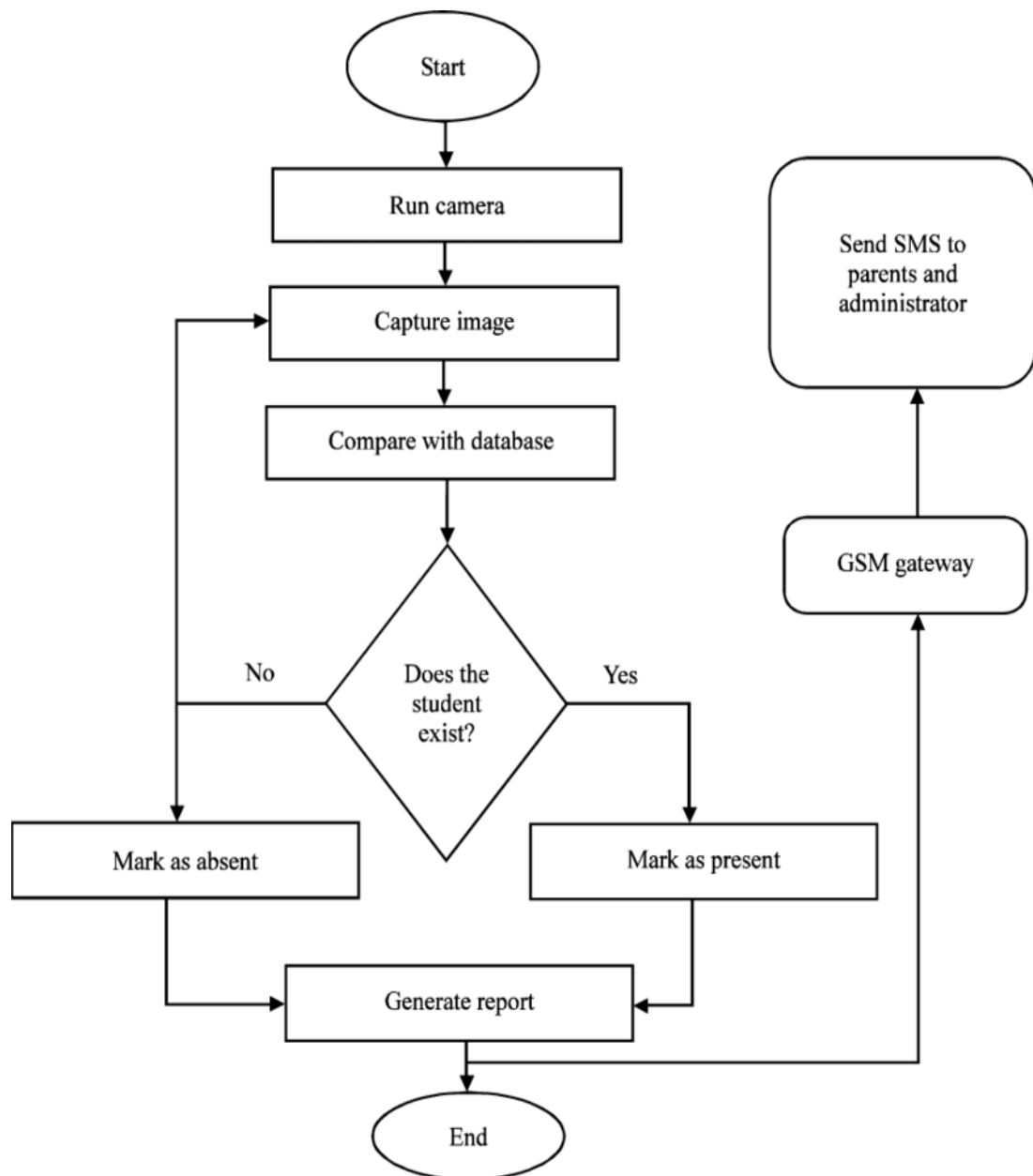
**Database**



**Input/ Output**

**Figure 5.3: Data flow Diagram Notation**

Data flow diagrams can be used to provide the end user with a physical idea of where the data they input ultimately has an effect upon the structure of the whole system from order to dispatch to restock how any system is developed can be determined through a data flow diagram. The appropriate register saved in database and maintained by appropriate authorities.



**Figure 5.4: Data flow Diagram**

## 5.1.4 ACTIVITY DIAGRAM

The activity diagram is used to demonstrate the flow of control within the system rather than the implementation. The activity diagram helps in envisioning the workflow from one activity to another. It puts emphasis on the condition of flow and the order in which it occurs.

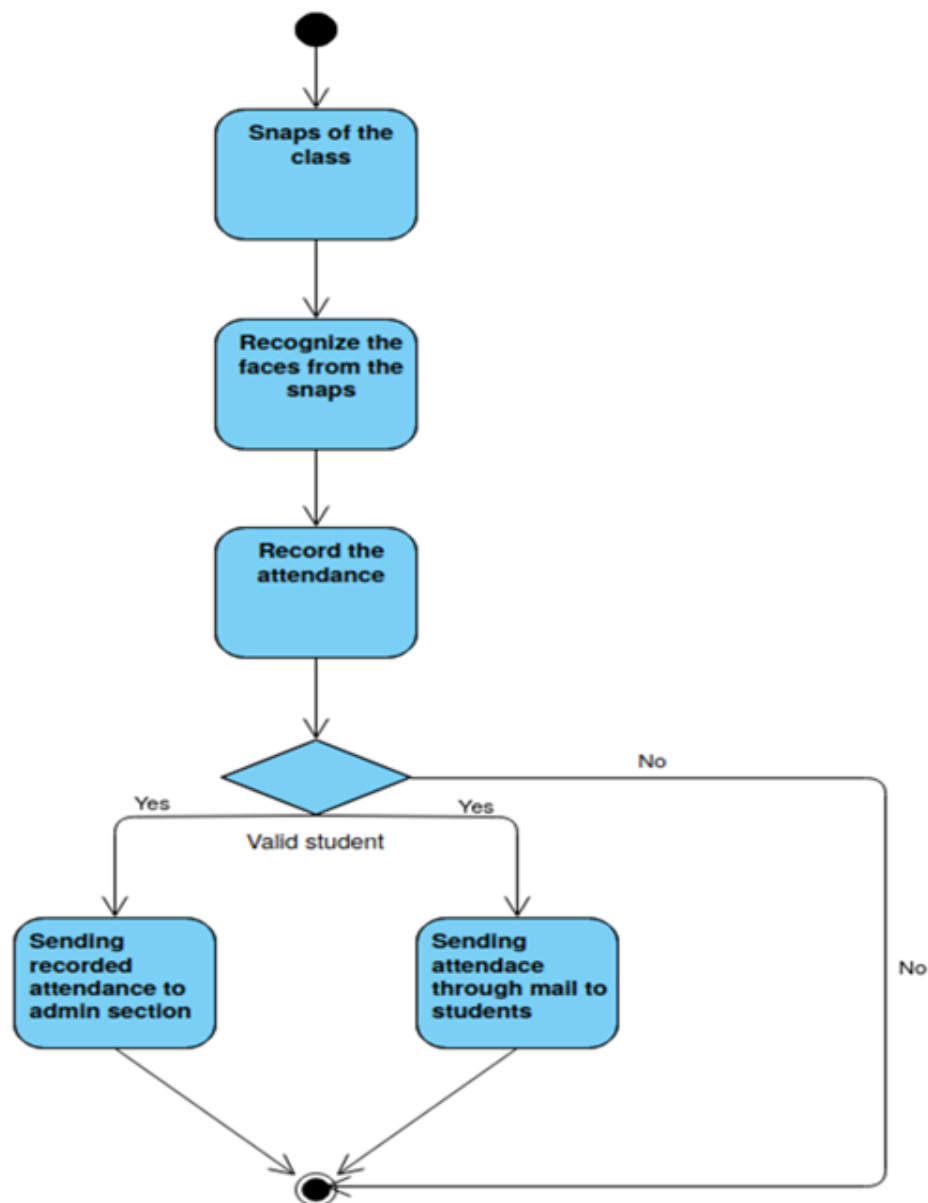


Figure 5.5: Activity Diagram



## **5.2 Conclusion**

The prevailing methodology used to specify software designs of UML. This language consists of various types of diagrams, each one dedicated to a different design aspect. This variety of views, that overlap with respect to the information depicted in each can leave the overall system design specification in an inconsistent state

## **Chapter 6**

### **6 CONCLUSION**

Thus, the aim of this project is to capture the video of the students, convert it into frames, relate it with the database to ensure their presence or absence, and mark attendance to the particular student to maintain the record. The Deep Facial Recognition Attendance System helps in increasing the accuracy and speed ultimately achieve the high-precision real-time attendance to meet the need for automatic classroom evaluation.

Face Recognition BASED Attendance System can be implemented in larger areas like in a seminar hall where it helps in sensing the presence of many people with ease.

# REFERENCES

- [https://www.researchgate.net/publication/326261079\\_Face\\_detection\\_system\\_for\\_attendance\\_of\\_class%27\\_students](https://www.researchgate.net/publication/326261079_Face_detection_system_for_attendance_of_class%27_students) Hapani, Smit, et al. \"Automate Attendance System Using Image Processing.\" 2018 Fourth International Conference on Computing Communication Control and Automation (ICCUBEA). IEEE, 2018.
- <https://opencv.org>
- <https://numpy.org>
- [https://en.wikipedia.org/wiki/Facial\\_recognition\\_system](https://en.wikipedia.org/wiki/Facial_recognition_system)
- <https://tinyurl.com/facebased>
- <https://docs.python.org/3/library/smtplib>