ABSTRACT

Face recognition is the part of the body that uniquely identifies a person. Using the face recognition characteristics as biometric, the face recognition system can be implemented.

The most demanding job in any organization is attendance marking. In attendance system, the students are called out by the teachers and their present or absence is marked.

However, these l techniques are time consuming and tedious. In face recognition project, the based on Open CV face recognition approach has been proposed. This model integrates a camera that captures an image, an algorithm for detecting face from an input image, encoding and identifying the face, marking the attendance in a csv file and converting it into the PDF file. The training database is created by the system with the faces of the authorized students. The cropped images are stored as a database with labels. The features are feature extracted using LBPH algorithm.

Face recognition technologies have made many improvements in the changing world. Attendance using real-time face Recognition is a real-world solution which comes with day to day activities of handling student attendance system. Face recognition-based attendance system is a process of recognizing the students face for attendance by using face biometrics based on high IP camera and other information technology.

In my face recognition project, a computer system will be able to find and recognize faces fast in images or videos that are being captured through an IP camera. Numerous algorithms and techniques have been developed for improving the performance of face recognition but the concept is to be implemented here is DL (Deep Learning). This helps in conversion of the frames of the video into images so that the face of the student can be easily recognized for their attendance so that the student attendance database can be easily reflected automatically.

1.   INTRODUCTION

1.1.   PROJECT DESCRIPTION:

Face recognition is old as computer vision, because of the practical importance of the topic and theoretical interest from intelligent scientists. Face recognition technology is evolving to a universal biometric solution since it requires virtually zero effort from the user end.

Biometric face recognition is basically used in three main domains: time attendance and employee management; visitor management and last one is authorization systems and access control systems. Face recognition involves two steps, first it involves in detection of faces and second in consist of identification of those detected face images with the existing database.

There are number of face detections and recognition methods introduced, Face recognition works either in form of appearance which covers the features of entire face or feature based which covers the geometric feature like eyes, nose, etc. to recognize the face.

Our system uses face recognition approach to reduce the flaws of existing system with the help of machine learning(ML), it requires a good quality IP camera to capture the images of students, the detection process is done by histogram of oriented gradient.

And recognizing perform through deep learning. The frontend side means client side, which consist of GUI, which is based on electron JavaScript and backend side consist of logics and python, an IPC (Inter Personal Communication) is developed to communicate these two stacks. The images capture by the IP camera is sent to the system for further analysis, the input image is compared with a set of images of each of the student and mark their attendance.

1.2. COMPANY PROFILE:

Infynow head office is located in Belagavi, Karnataka and we support remote sites across multiple cities. We place our focus on leveraging our infrastructure and footprint to support a broad spectrum of organizations with rapid deployment and emerging technologies.

Over the years, Infynow has evolved into an advanced solutions provider, focused on servicing customers and creating value through long term relationships that we build. We have established and fixed costs, based on our customer needs and budget.

Infynow Business Solutions LLP is a leading IT service providing company based in Belagavi India. We offer a complete range of services that incorporates Website design and Development, Software Solutions, Application development, Digital Marketing, Video Production, and Internship and Project Training.

We help businesses overcome their challenges and stay ahead of the competition by strengthening with the latest technologies. For local businesses, we are dedicated to finding creative and affordable premium solutions to build their presence and expand their business.

We strive to deliver more efficient, effective and relevant quality services and solutions tailored to the increasingly complex demands of organizations, in order to boost productivity of operations and to maximize value for our customers.

Infynow also strives towards technology that provides a real advantage to a business. The most Powerful connection that a business can make is through all its stakeholders. Infynow binds together business and technology.

Infynow is dedicated to doing business in an ethical and sustainable manner to meet the needs of a vast range of businesses and industries. We combine our industry knowledge, expertise and best practice with our clients' needs to design and develop tailor-made solutions dependent on your requirements. We recognize that people are part of IT and that the effective combination of these two, contributes to the success of any business.

2. LITERATURE SURVEY

2.1. EXISTING AND PROPOSED SYSTEM:

2.1.1. EXISTING SYSTEM:

- **Fingerprint Based recognition system:** In Fingerprint based existing attendance system, a portable fingerprint device need to be configured with the students fingerprint either during the lecture hours or before, the student needs to be record the fingerprint on the device to ensure their attendance of the day

- **RFID (Radio Frequency Identification) Based recognition system:** In 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 appearance for the day. The system is able to connect to RS232 and record the attendance from the saved database. There are chances for the fraudulent access may occur. Some of the students may make use of other students ID to ensure their appearance when the particular student is absent.

- **Iris Based Recognition System**: In Iris based attendance system, the students needs to stand in front of a camera, so that the IP camera will scan the Iris of the student. The scanned iris is matched with data of student stored in the database and the attendance on their appearance needs be updated. This reduces the paper and pen workload of the faculty member of the institute. This also reduces the possibilities of proxies in the class, and helps in maintaining the student records. It is a wired or wireless biometric technique that solves the problem of attendance and the trouble of assigning the corresponding network.

2.1.2. Face Based Recognition System:
The facial recognition technology can be used in recording the attendance through a IP camera that detects and recognizes the faces of the students and the machine compares the recognized face with students' face stored in the database. Once the face t is matched with the stored image, then attendance is marked in attendance database. If the seize (Captured) image doesn't match with the students' face present in the database then this image is stored as a new image into the database. In this system, there are chances for the IP camera to not to capture the image appropriately.

2.1.3. PROPOSED SYSTEM:

- ➢ The job of the proposed system is to seize (capture) the face of each student and to store it in the database for attendance. The face of the student needs to be seized (captured) in such a manner that all the feature of the student's face needs to be detected. There is no need to the instructor to manually take the attendance in the class because the system records a video and through further processing steps the face is recognized and the attendance database is fully updated. This system is developed using python open source computer vision library.

- ➢ **OpenCV:** The Open source computer vision (OpenCV) is a library of programming language mostly focused at real time computer vision. Originally developed by Intel, it was supported by Willow Garage then It seize. The library is cross platform. Python is energetically typed and garbage collected. It supports multiple programming patterns, including structured, object-oriented, and functional programming. Python is described as a case sensitive programming language due to its comprehensive standard library.

- ➢ **Image Capture:** We need some HD IP camera in order to get results. We can seize (capture) the images from the video or by capturing each and every image from the IP Camera Manually. Doing the frame capture from the video will give us results in less time but we will not be able to capture the face properly in case we lose light or something and if the face is not captured appropriately..

- ➢ **Image Processing:** Digital image processing (DIP) is the use of integral (digital) computer to process digital images through an algorithm. As a field of integral (digital) signal processing, integral (digital) image processing has so many benefits over image processing. This allows so much wide range of algorithms to be applied to the data and can avoid problems such as the build-up of noise and distortion during processing. Ever since images are defined over two dimensions digital image processing may be

modeled in the form of multidimensional systems. The generation of integral (digital) image processing are mostly affected by 3 factors: 1: the development of computers; 2: the development of mathematics. 3: the demand for a wider range of applications in environment, agriculture, military, industry etc. has increased.

➢ **Convolution Neural Network:** In this DL (deep learning), a CNN (convolutional neural network) is a class of deep neural networks(DNN), most commonly applied to analyzing visual imagery. They also known as shift invariant artificial neural networks, based on their shared weights architecture and translation invariance features. They have applications in image and video recognition, recommender systems, image classification etc. CNNs are regularized versions of multilayer perceptron's. Multilayer perceptron's usually means fully connected networks, that is, each neuron in one layer is connected to all neurons in the next layer. The fully-connectedness of these networks makes them liable to overfitting data.

2.2. TOOLS AND TECHNOLOGIES USED:

➢ **TOOLS:**

- **Software Components:**
  - Sublime Text Editor
  - Microsoft Excel

- **Hardware Components:**
  - IP Camera
  - Computer/Laptop

➢ **TECHNOLOGIES:**

- Python
- Tkinter
- Pycharm Libraries:
  - Pandas: A python package which provides fast and flexible structure and data analysis tools.
  - Sklearn: Sklearn is powerful python libraries for ML.
  - Numpy: Numpy is a python library which is used for scientific calculations.
  - Matplotlib: Matplotlib is a library which is used for plotting a diagram
  - Scipi: It is a python library which is used for scientific mathematical calculations.
  - Tensorflow: It is a python library for fast numerical or mathematical computing
  - Keras: Keras is an open source neural network library.
  - Dlib: It contains a wide range of ML Algorithm..
  - OpenCV: OpenCV makes use of numpy which is a optimized library for numerical operations.

2.3. HARDWARE AND SOFTWARE REQUIREMENTS:

2.3.1. HARDWARE:

- A Computer(i3 4gb or 8gb or higher).
- Highquality camera to capture images.
- Memory to store images and databases.

2.3.2. SOFTWARE:

- Sublime Text Editor
- Python 9 or higher
- Window 10 or higher
- Newest version of all libraries.

3. SOFTWARE REQUIREMENT SPECIFICATION

3.1. FUNCTIONAL REQUIREMENTS:

- ➢ System functional requirements describes activities and services that must provide:
- ➢ A user must be able to manage records.
- ➢ An only authorized user must be able to use the machine.
- ➢ A system must be attached to wired/wireless IP camera and face recognition should be smooth.
- ➢ The admin or the person who will be given the access to the system must login into the system before using it.
- ➢ The information must be managed and maintain properly.

3.2. NON-FUNCTIONAL REQUIREMENT:

a. Non-Functional Requirements are characteristic or the attribute of the system that can judge its operation. The following points clarify them:

b. Accuracy and Precision: The system should perform its process with accuracy and precision to ignore/avoid problems.

c. Flexibility: The system should be easy to modify, any incorrect should be correct.

d. Security: The system should be secure and saving information privacy.

e. Usability: The system should be easy to deal and simple to understand.

f. Maintainability: The maintains group should be able to cope up with any problem when occurs suddenly.

- Speed and Responsiveness: Execution of operation should be fast.
- The GUI (Graphical user interface) of the system will be user-friendly.
- The data that will be shown to the user will be made sure that it is correct and is available for is time being.
- The system will be extended for corrections and to the latest technologies.
- Efficiency and Effectiveness of the machine (system) will be made sure.

4.   SYSTEM DESIGN

4.1. SYSTEM PERSPECTIVE:

Assistencia is facial recognition attendance system which consist of a various phases throughout the completion of the process and is accessed by the administrator. The admin must be signed up before accessing the system. Login permission is required for the system.

For the person to be recognized they need to be registered. For registration a form must be filled up with the basic detail of the person. Once the form is filled up 100 images of persons are captured automatically after face being detected as a part of the registration process and are stored in a training set within the particular student folder.

Encoding of the images take place. Followed by training of the images inside the training set which creates csv file for images that are encode..

During attendance, webcam/camera is connected and as students enter in the class their faces are detected and recognized with an id along with name after which an entry is marked in csv file as a present and other as absent. Unknown faces are shown Unknown.

Reports are generated on the basis of attendance sheet monthly and email notification is sent to the student who are absent.
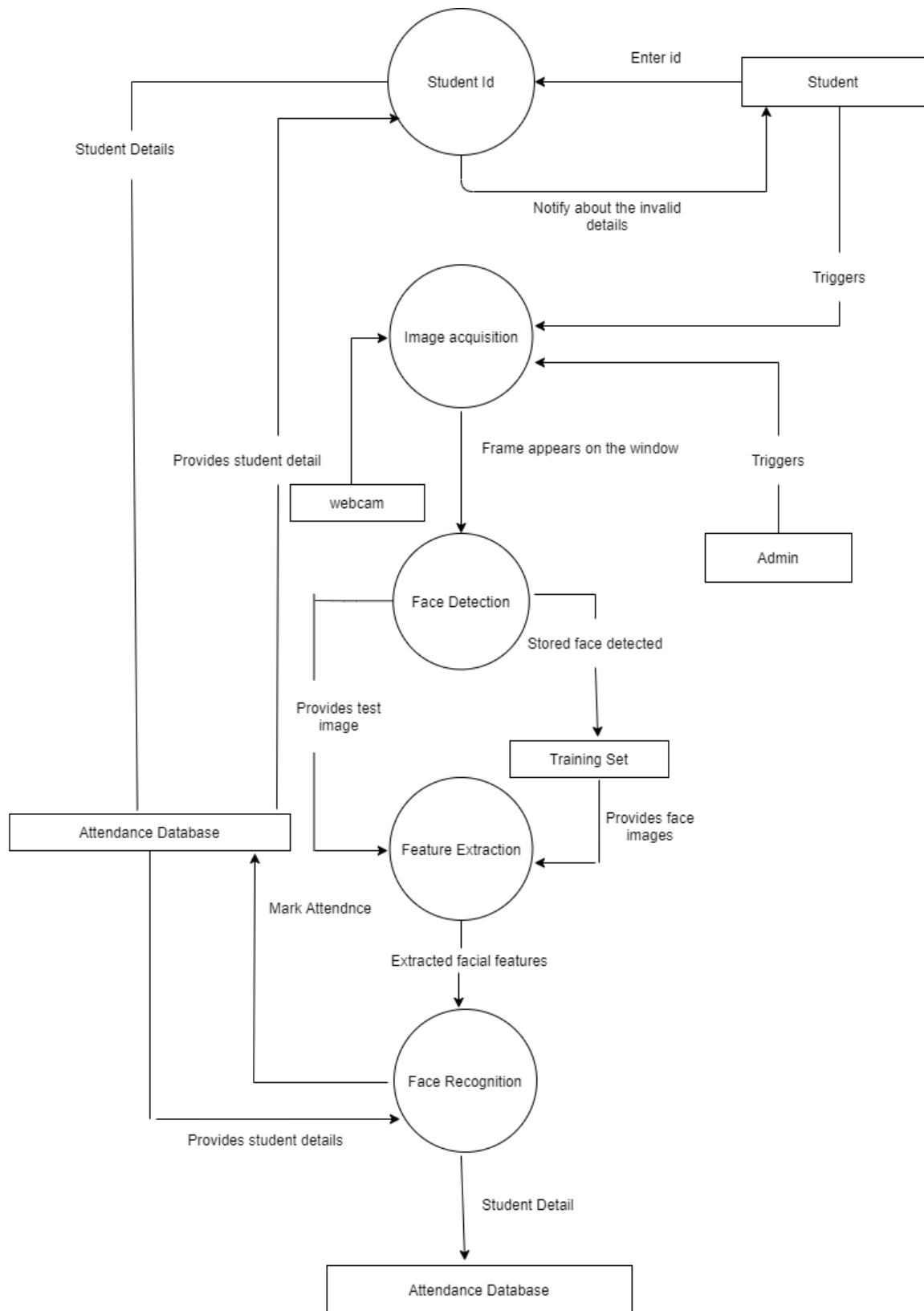
4.2. CONTEXT DIAGRAM:

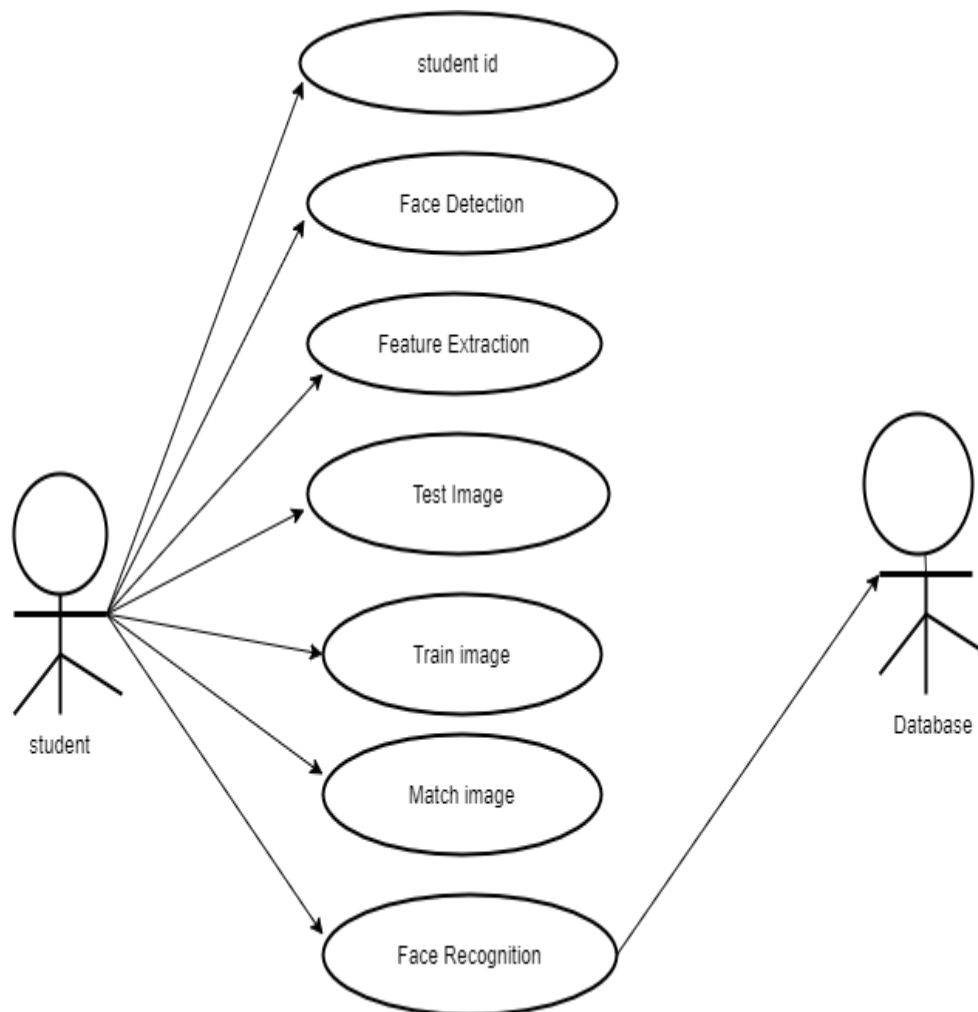Fig. Context Diagram

5. DETAILED DESIGN

5.1. USE CASE DIAGRAM:
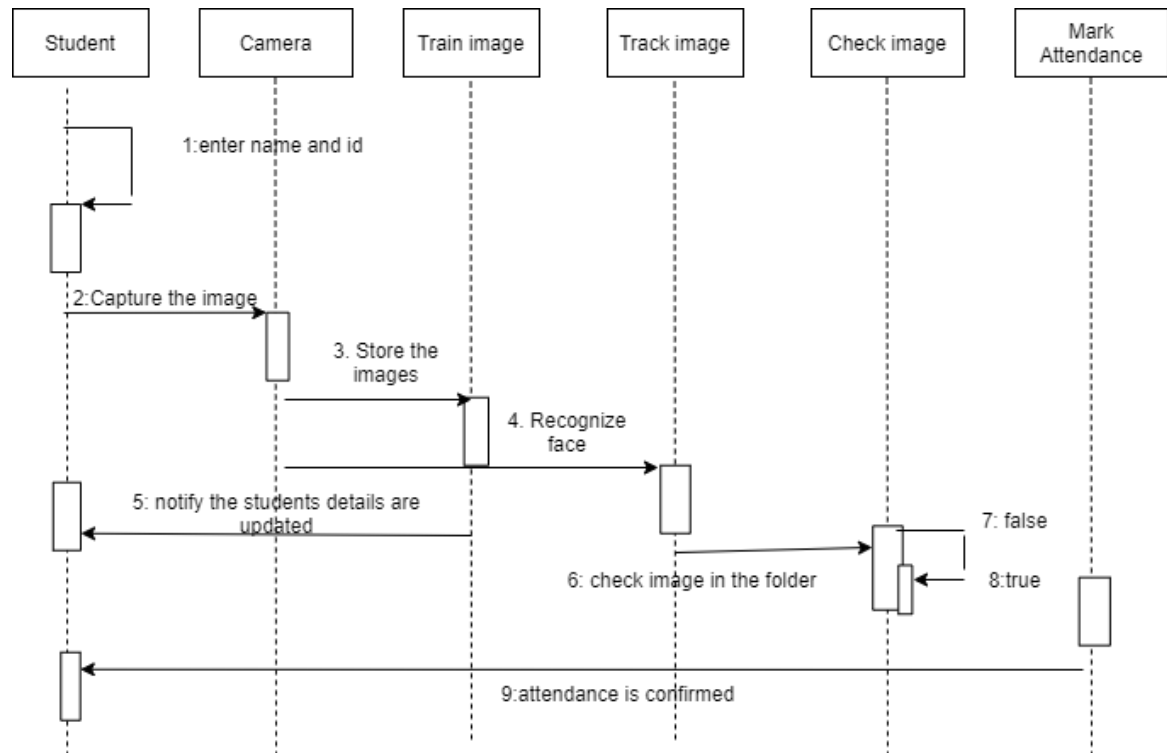

Fig: USECASE Diagram

5.2.   SEQUENCE DIAGRAM:
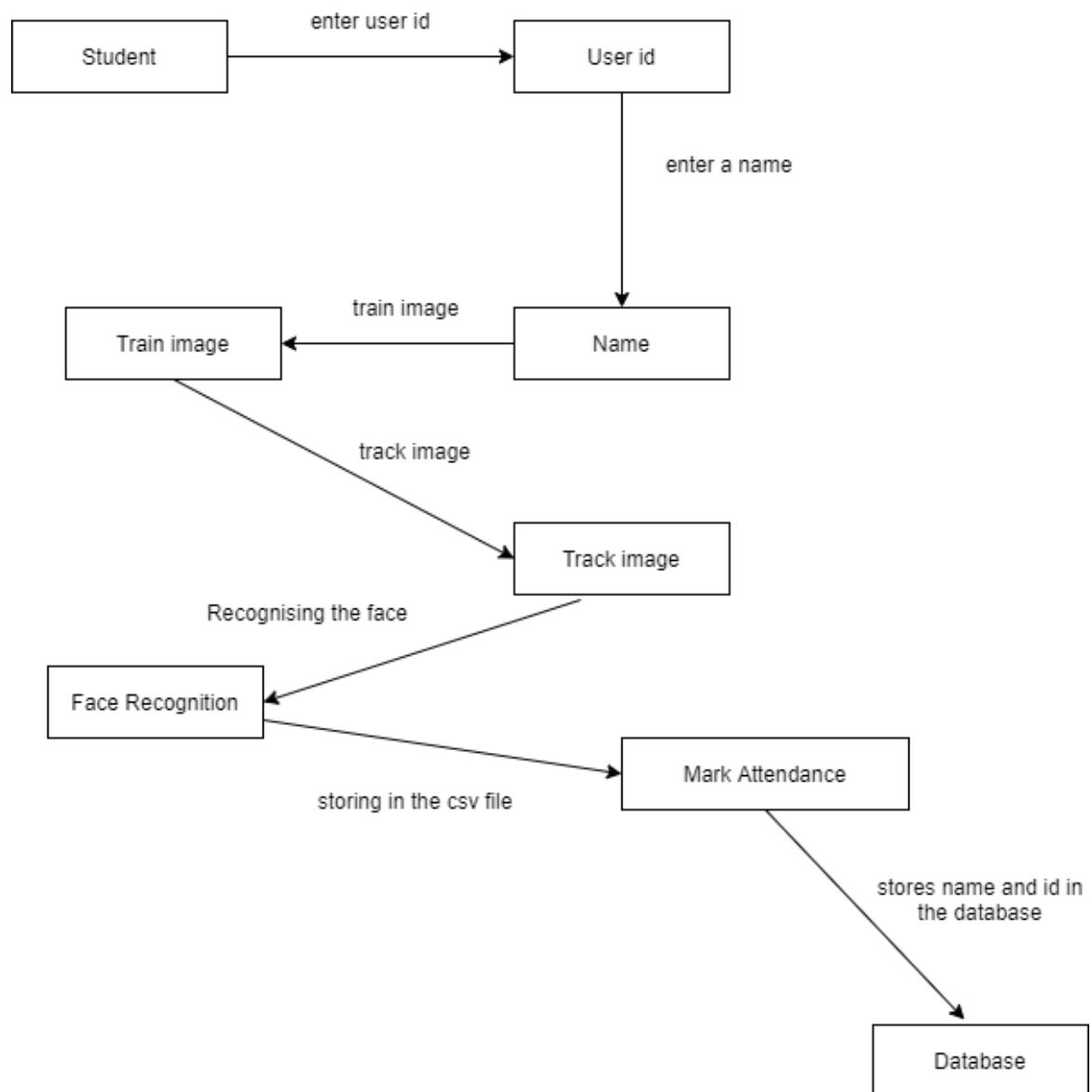

Fig: Sequence Diagram

5.3. COLLABARATION DIAGRAMS:

Fig: Collaboration Diagram

5.4.   ACTIVITY DIAGRAM:
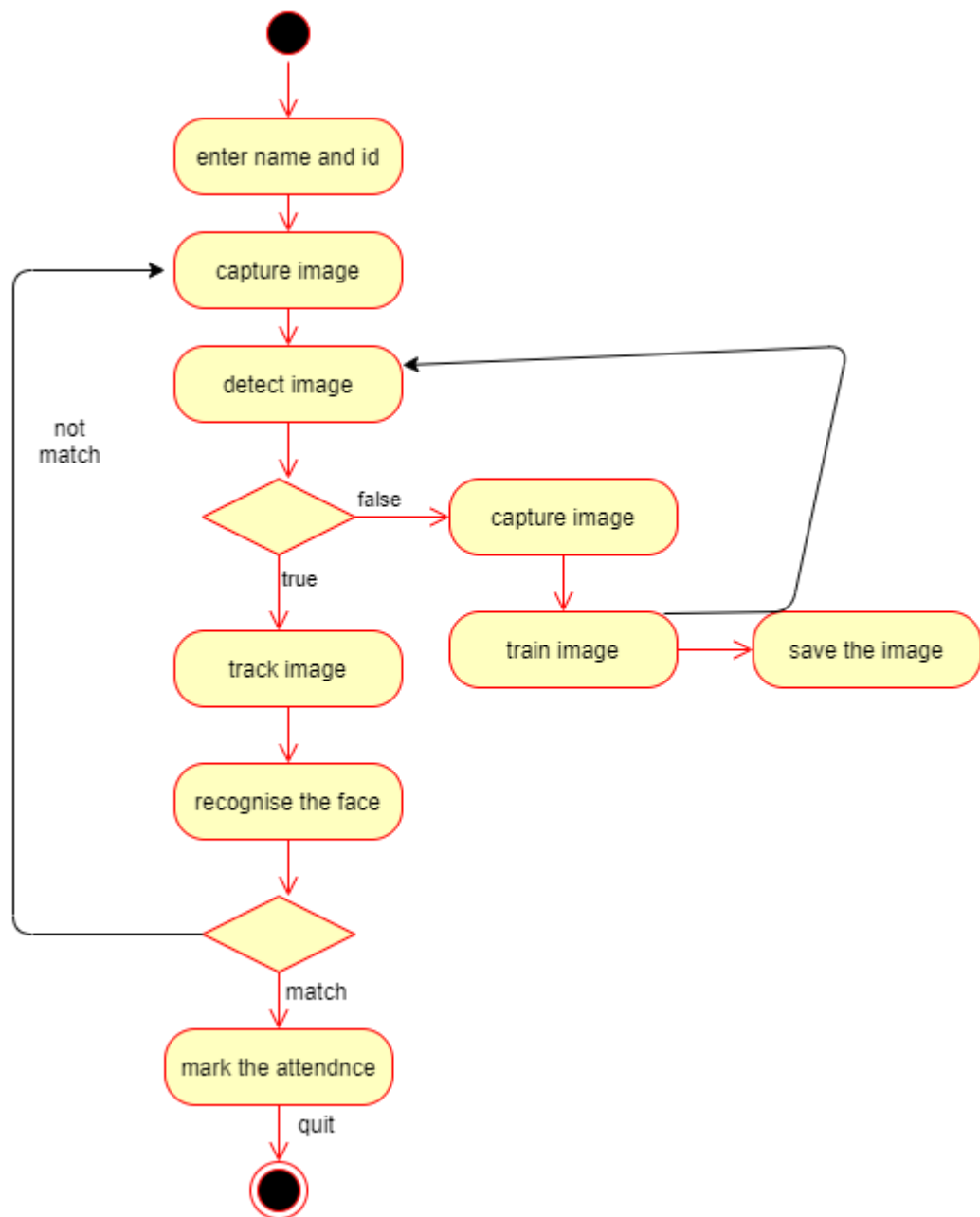
enter name and id

capture image

detect image

not match

false

capture image

true

train image

save the image

track image

recognise the face

match

mark the attendnce
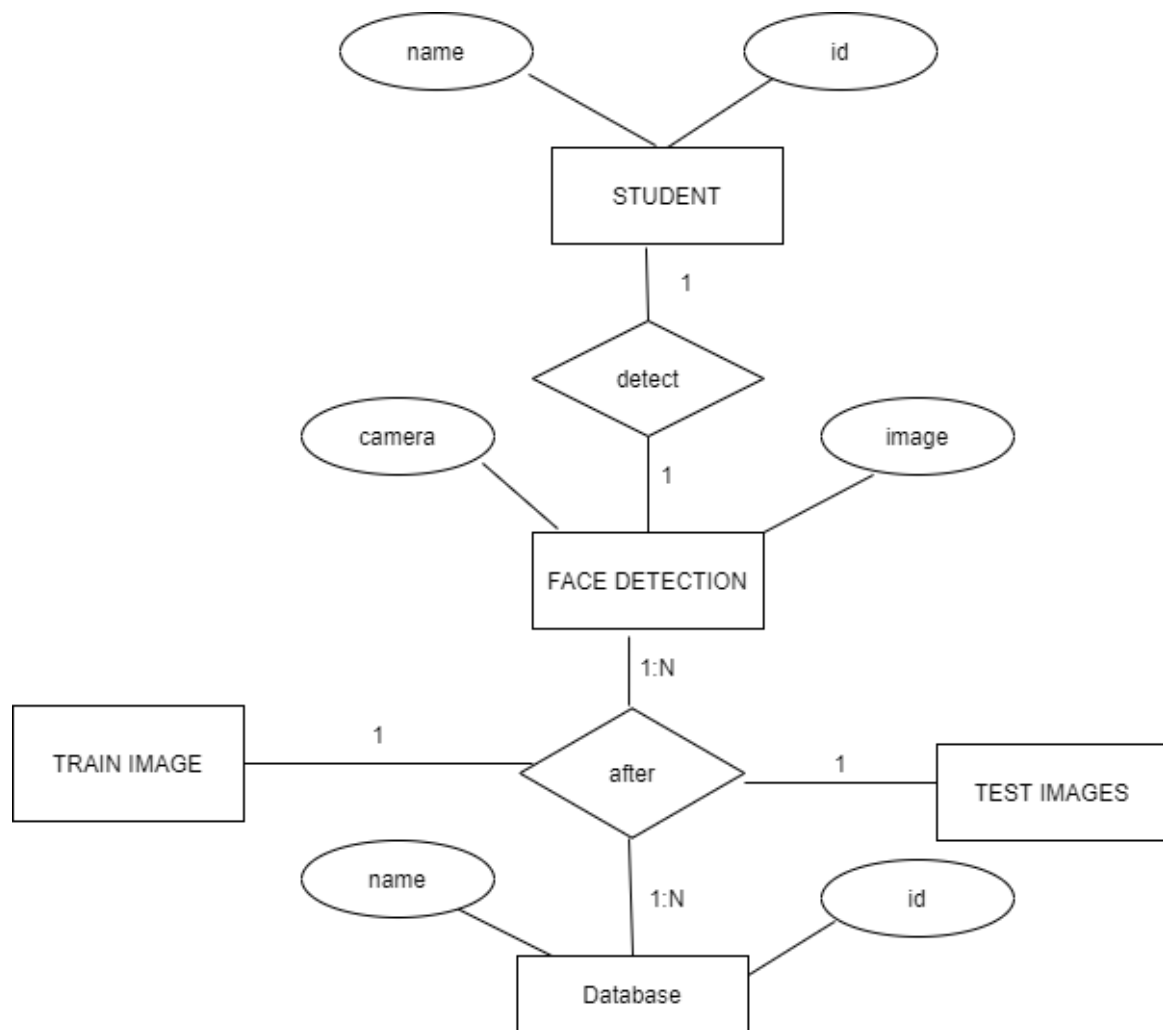
quit

Fig: Activity Diagram

5.5. ER DIAGRAM:

Fig: ER Diagram

6. IMPLEMENTATION

6.1. SCREENSHOTS:

Fig 5. The interface for the Face Recognition Based Attendance System i
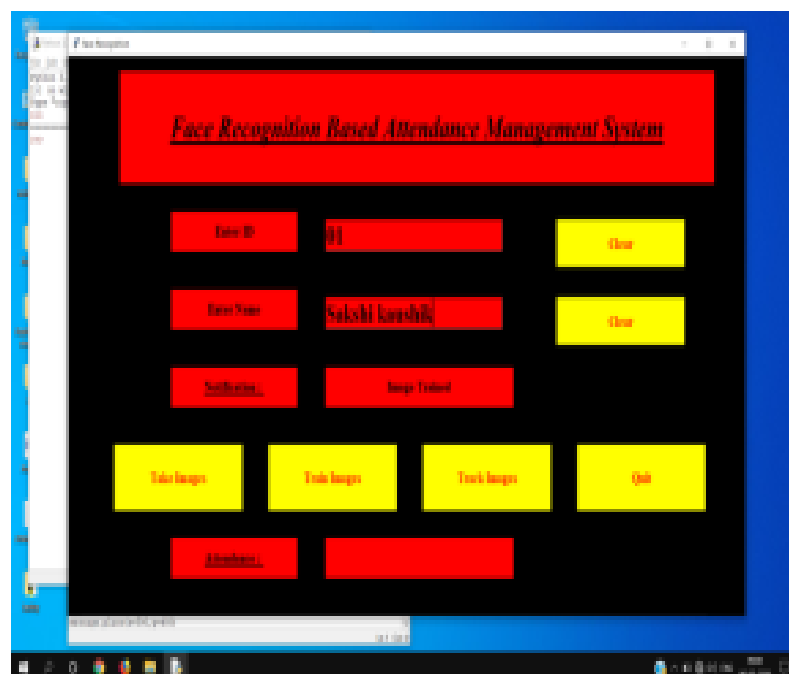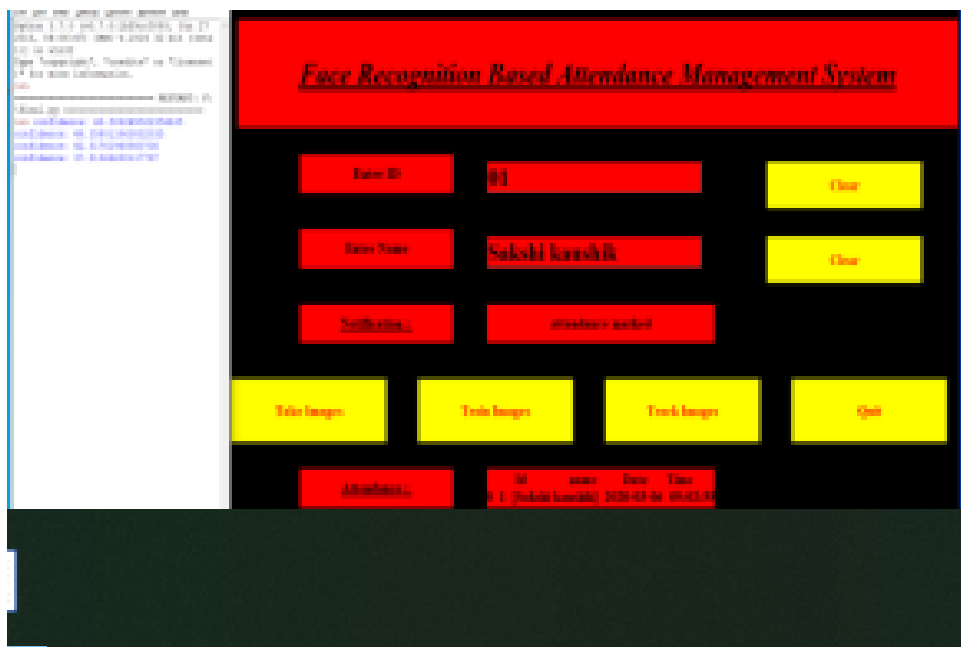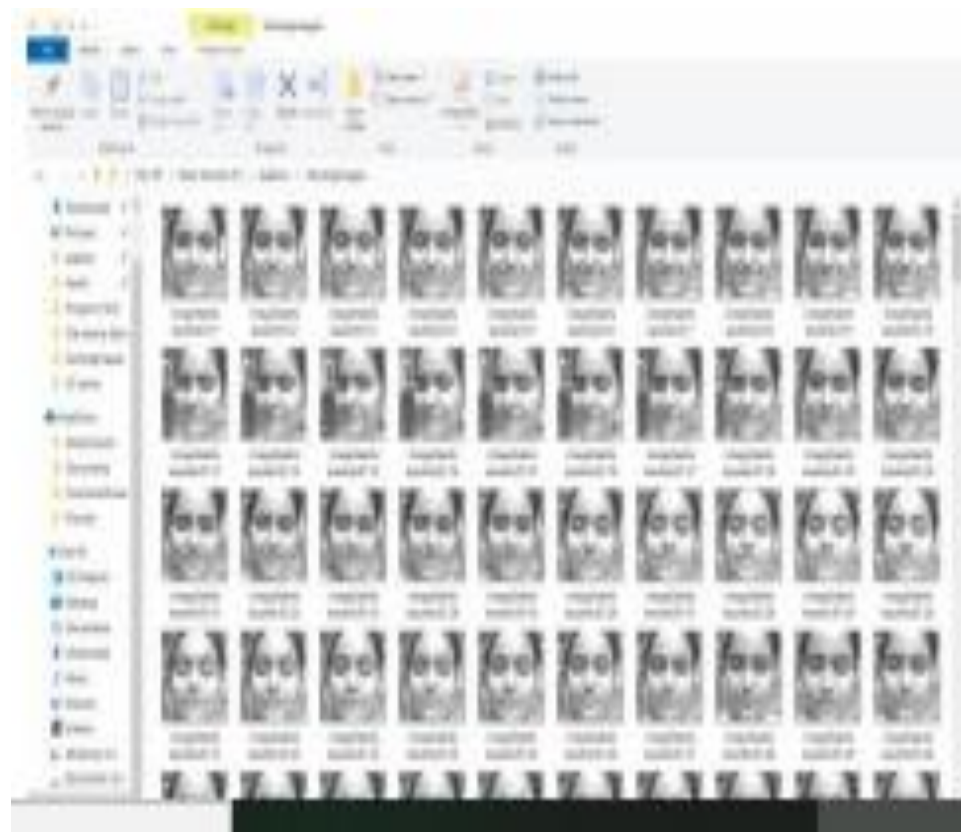which the Id and Name of the respective students are stored.

Fig 9. The images of the students is trained.

Face Recognition Based Attendance Management System

7.   SOFTWARE TESTING

7.1.   TESTING PLAN:

- The testing plan include following functions:
  - ➢ Face Detection
  - ➢ Capturing Images
  - ➢ Face Recognition
  - ➢ Unknown Face Detection
  - ➢ Attendance Entry in CSV file

7.2.   TESTING METHOD:

a. **Unit Test:** This test verifies the program logic and is based on the program structure.

b. **Integration Test:** This test verifies the entry system functionality according to the design specification.

c. **Business Requirements:** This test verifies whether specific requirements of the user.

d. **Acceptance Testing:** This test verifies that the system needs to meet the objectives and customer's expectations.

7.3. TEST CASES:

ID	023
TITLE	IP CAMERA CONFIGURATION AND INTEGRATION
PREREQUIST	IP CAMERA
TEST ACTION	1. START APPLICATION 2. ENTER ID 3. NAME 4. FACE DETECTION 5. TRAIN IMAGE 6. TRACK IMAGE 7. DATABASE
EXPECTED RESULT	IP CAMERA SHOULD BE CONNECTED AND TURNED ON.
STATUS	PASS

ID	024
TITLE	FACE DETECTION
PREREQUIST	IP CAMERA
TEST ACTION	1. START APPLICATION 2. ENTER ID 3. ENTER NAME 4. FACE DETECTION 5. TRAIN IMAGE 6. TRACK IMAGE 7. DATABASE
EXPECTED RESULT	AFTER CONNECTING IP CAMERA TO THE SYSTEM, THE FACE SHOULD BE DETECTED AND AUTOMATICALLY CAPTURE IMAGE.
STATUS	PASS

ID	025
TITLE	STORAGE OF FACES IN TRAINING SET
PREREQUIST	TRAINING SET FOLDER
TEST ACTION	1. START APPLICATION 2. ENTER ID 3. ENTER NAME 4. FACE DETECTION 5. TRAIN IMAGE 6. TRACK IMAGE 7. DATABASE
EXPECTED RESULT	CHECK IF THE TRAINING SET FOLDER IS AVAILABLE OR NOT, IF NOT CREATE A NEW ONE, IN ITS CHECK WHETHER THE NAME OF THE STUDENT FOLDER IS AVAILABLE

	INSIDE IT OR NOT, IF NOT CRETE A NEW ONE AND STORE IMAGE INTO THE STUDENT'S FOLDER.
STATUS	PASS

ID	026
TITLE	ENCODING FACES
PREREQUIST	TRAINING SET
TEST ACTION	1. START APPLICATION 2. ENCODE DATABASE
EXPECTED RESULT	GET THE FOLDER'S NAME IN TRAINING_DIR TO BE ENCODED IN NUMERICAL FORM FOR ML.
STATUS	PASS

ID	027
TITLE	TRAINING
PREREQUIST	TRAINING SET: .CSV FILE
TEST ACTION	1. START APPLICATION 2. TRAIN DATASET
EXPECTED RESULT	SAVE ENCODING FILE .CSV FORMAT.
STATUS	PASS

ID	028
TITLE	LIVE FACE RECOGNITION
PREREQUIST	ENCODING AND TRAINING SHOULD BE DONE BEFORE A LIVE PREDICTION
TEST ACTION	1. START APPLICATION 2. TAKE ATTENDANCE
EXPECTED RESULT	CAMERA SHOULD BE CONNECTED AND TURNED ON AUTOMATICALLY AND DETECTED FACE OF STUDENTS AND UNKNOWN USERS.
STATUS	PASS

ID	029
TITLE	ATTENDANCE ENTRY IN CSV FILE
PREREQUIST	LIVE PREDICTION
TEST ACTION	1. START APPLICATION 2. TAKE ATTENDANCE
EXPECTED RESULT	CHECK WHETHER TODAY'S DATE IS AVAILABLE OR NOT, IF NOT ENTER TODAY'S DATE IN COLUMN.
STATUS	PASS

8. CONCLUSION

This paper features the most productive Open CV face recognition method accessible for Attendance Management. The system has been implemented using the LBPH algorithm. LBPH excels other algorithms by confidence factor of 2-5 and has least noise interference. The implementation of the Smart Attendance System portrays the existence of an agreement between the appropriate recognition rate and the threshold value. Therefore LBPH is the most authentic and competent face recognition algorithm found in Open CV for the identification of the students in an educational institute and marking their attendance adequately by averting proxies.

9. FUTURE ENHANCEMENT

In further work, authors intend to improve face recognition effectiveness by using the interaction among our system, the users and the administrators. On the other hand, our system can be used in a completely new dimension of face recognition application, mobile based face recognition, which can be an aid for common people to know about any person being photographed by cell phone camera including proper authorization for accessing a centralized database.

BIBLIOGRAPHY:

https://www.ijert.org/smart-attendance-system-using-opencv-based-on-facial-recognition

https://www.jetir.org/papers/JETIR2010064.pdf

https://eudl.eu/pdf/10.4108/eai.13-7-2018.159713

https://www.pantechsolutions.net/open-cv-based-facial-recognition-for-automated-attendance-marking-system

http://www.ijcce.org/papers/28-N010.pdf

https://www.slideshare.net/ShreyaDandavate/face-recognition-attendance-system-96913577

https://www.sciencedirect.com/science/article/pii/S2590005619300141