A Major Project final Report on

Facial Attendance System

Submitted in Partial Fulfillment of the Requirements for

The Degree of **Software Engineering**

Under Pokhara University

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ABSTRACT

Attendance management system using facial recognition is the system where we do attendance using facial Recognition. It helps to record attendance of students one by one for each and every subject without any hassle. Furthermore, attendance reports can be generated in .csv formats for easier evaluation. This provides a completely paperless route for recording the attendance of students using facial recognition system. The main idea behind this project is to remedy the time-consuming attendance taking process and make it as seamless as possible.

Keywords: Python, PyQT5, Eigen faces, PCA , MySQL, LBPH, Fisher face

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LIST OF ABBREVIATIONS

Fig **Figure**

DFD **Dataflow Diagram**

RDBMS **Relational Database Management**

GUI **Graphical User Interface**

1. Introduction

This attendance system uses the mapping of the images with the database and compares with the currently given feed of video to match the id of the student. A **facial recognition system** is a computer application capable of identifying a person from a digital image or a video frame from a video source. The current method that institutes uses is the faculty passes an attendance sheet or make calls and mark the attendance of the student, which sometime disturbs the discipline of the class and this sheet further goes to the admin department which is then updated to an excel sheet.

Attendance of students in a large classroom is hard to be handled by the traditional system, as it is time-consuming and has a high probability of error during the process of inputting data into the computer. This project purposes automated attendance marking system using face recognition technique. The system deployed for face recognition uses python programming and the Eigenfaces.

In our approach, approach to face recognition called **eigenfaces**. The essence of eigenfaces is an unsupervised dimensionality reduction algorithm called **Principal Components Analysis (PCA)** that we use to reduce the dimensionality of images into something smaller. Now that we have a smaller representation of our faces. These eigenfaces are essentially the basis for each of our training and testing images. There are ghostly images which can be combined together to produce other images.

If we provide images of face each of resolution 100*100. Each image is converted to a feature vector i.e, flattened to size 1*10000. But using Neural networks or SVM on a data with a feature vector of that size will increase the computational a lot. So, dimension reduction techniques like PCA are used to reduce the dimensions or bring latent factors from large data.

We can also call them Eigen faces as a mean profile for all the images is constructed first and then we take the top k faces that can identify the uniqueness of all images.

LBPH recognized both front end image and side image. It labels pixels of an image by thresholding of neighborhood of each pixel and produce the result in Binary number. That it show result in histogram.

The use of Fisher face goal is to make the face image to be uniform in terms of size and format so that the image is ready to be used by the system

Each image can now be represented as a combination of these Eigen faces with some error, but that is minimal that we cannot observe much difference between the two.

1.2 Problem Statement

The existing system is the system currently in use. At present attendance making involve manual attendance on the paper sheet by professors and teachers, but it is a very time-consuming process and chance of proxy are also an issue that arises in such type attendance marking. Also, there is an attendance marking system such as RFID, Biometric but this system is not currently not that popular in schools and classroom for students.

- Time Consuming.
- These attendance systems are manual.
- There is always chance of forgery since these are manually so there is great risk of error.
- More manpower required
- Calculations related to attendance are done manually which is prone to error. It is difficult to maintain database manually.
- It is difficult to search for a particular data from this System
- The ability to compute the attendance percentage becomes a major task as manual computation procedures errors, and also wastes of a lot of time.
- Attendance sheet could be stolen and forged.

- The existing systems are using recognition by considering whole face features with high dimensionality. It may increase the number of error rate and lot of computation work. The process requires extended time to make comparison for entire training images with image input. The extracted image which contained noise is affected to recognition result.

1.3 Project Objectives

- Detection of unique face image amidst the other natural component such as walls and other backgrounds.
- Detection of faces amongst other face characters such as beard, spectacles etc.
- Extraction of unique characteristics features of a face useful in face recognition.
- Effective recognition of unique faces in a class.
- Automated Update in the attendance sheet without human intervention
- To help the lecturers improve and organize the process of tracking and managing student Attendance.
- Provides a valuable attentive serviced for both teachers and students.
- Reduce manual process errors by providing automated and a reliable attendance system.
- Increase privacy and security which, student can't present him or her his friend while they aren't.
- Reduced time spend when taking attendance as time is very valuable resource.

1.3 Significance of the Study

This system will drastically improve the attendance taking process which will in turn save both time and resources. Currently lecturers have to take attendance by either shouting names and keeping track of present and absentees or giving it to a student to fill themselves. This can be a problem as it takes more time and can lead to foul play. And even then, the data has to be manually written into an excel sheet as a digital copy.

This system will also help to automate attendance recording by exporting the data in a csv format which can be imported directly into most spreadsheet programs and analyzed.

1. Scope and Limitations

2.1 Scope

- Provide facility for the automated attendance of students.
- Uses live face recognition to recognize each individual and mark their attendance automatically.
- Utilize video and image processing to provide inputs to the system.
- Facility of marking manual attendance

2.2 Limitations

- Accuracy is not 100%.
- Cannot be used in extreme dark environments.

3. Literature Study

We have done a detailed survey of a number of face recognition algorithms along with their advantages and limitations. Some of the important methods studied will be described in this section. Face recognition systems architecture broadly consists of the three following tasks:

1. Acquisition (Detection, Tracking of face-like images)
2. Feature extraction (Segmentation, alignment & normalization of the face image)
3. Recognition

3.1. Face Detection Approaches

Some of the main face detection methods are discussed here.

1. Knowledge based methods:

These are developed on the rules derived from the researcher's knowledge of human faces. Problem in this approach is the difficulty in translating human knowledge into well-defined rules.

2. Featured-based methods:

Invariant features of faces are used for detecting texture, skin color. But features from such algorithm can be severely corrupted due to illumination, noise and occlusion.

3. Template matching:

Input image is compared with predefined face template. But the performance here suffers due to variations in scale, pose and shape.

4. Appearance-based method:

In template matching methods, the templates are predefined by experts. Whereas, the templates in appearance-based methods are learned from examples in images. Statistical analysis and machine learning techniques can be used to find the relevant characteristics of face and non-face images.

3.2. Face Recognition Approaches

Some of the main face recognition methods are discussed here

1.**Holistic approaches**:

In this category, every pixel of the face region is fed into the recognition system. Two widely used and most successful face recognition algorithms, Eigenfaces and Fisher face , belong to this category.

2.**Feature-based approaches**:

In this category, the features or the landmarks on the face such as eyes, nose, and mouth are detected first. Their locations and neighborhood are fed into a classifier
or matched against a pretrained dataset for recognition.

3.**Hybrid approaches**:

Approaches that combine the ideas from the two previous categories and potentially offer the best of both. Over the past few decades, much progress has been made toward the detection of faces in still images and the extraction of the face features. At the same time, significant advances have also been made in the area of face recognition. Researchers have shown that holistic approaches are effective on large datasets

4. Technical Description of Project

A brief explanation of the methodology is :

- Applying Viola Jones algorithm for face detection.
- To capture image via web camera and save as dataset.
- To detect the face of the static image.
- Save only the face in box and remove unnecessary part of the image.
- Set the saved image with grayscale format.
- Convert the images into eigenfaces, fisher faces and LBPH
- Compare the weight of the unknown image with the weight of training images. i.e Measure Euclidian distance.
- If the value is within a threshold then it is the face.

These eigenfaces can now be used to represent both existing and new faces

E.g. a face can be 40%of 1 EF1 -10%of EF2+……..x% of EF(N)

Eigen face

Eigenface is a practical approach for face recognition. Due to the simplicity of its algorithm.we could implement an Eigenface recognition system easily. Besides, it is efficient in processing time and storage.
PCA reduces the dimension size of an image greatly in a short period of time. The accuracy of Eigenface is also satisfactory (over 90 %) with frontal faces.

Fisher face

Fisherface is similar to Eigenface but with improvement in better classification of different classes image. With FLD, we could classify the training set to deal with different people and different facial expression. We could have better accuracy in facial expression than Eigen face approach.
Besides, Fisherface removes the first three principal components which is responsible for light intensity changes, it is more invariant to light intensity. Fisherface is more complex than Eigenface in finding the projection of face space.
Calculation of ratio of between-class scatter to within-class scatter requires a lot of processing time.
Besides, due to the need of better classification, the dimension of projection in face space is not as compact as Eigenface, results in larger storage of the face and more processing time in recognition.

LBPH

It is a simple solution for the face recognition problem, which can be recognizing both the front face and side face.
LBP is a simple and efficient text description operator which labels the pixels of an image by thresholds the neighborhood of each pixel and which produce the result as a binary number.
Then the LBP combined with histogram, we can represent the face images with a simple data vector.

Block diagram of the system

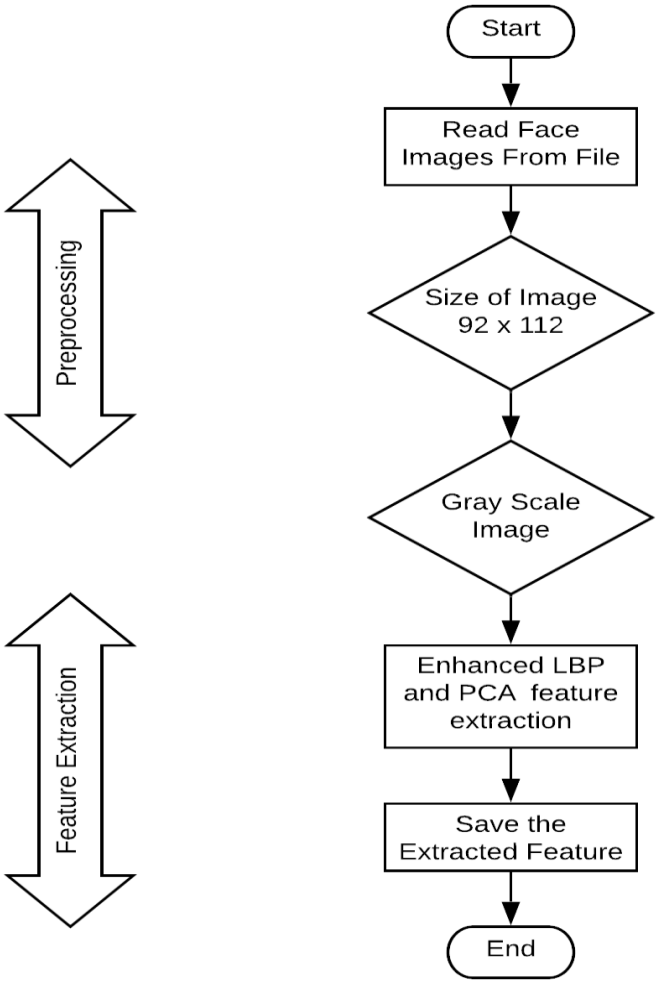

Figure 4.1 : Training Part

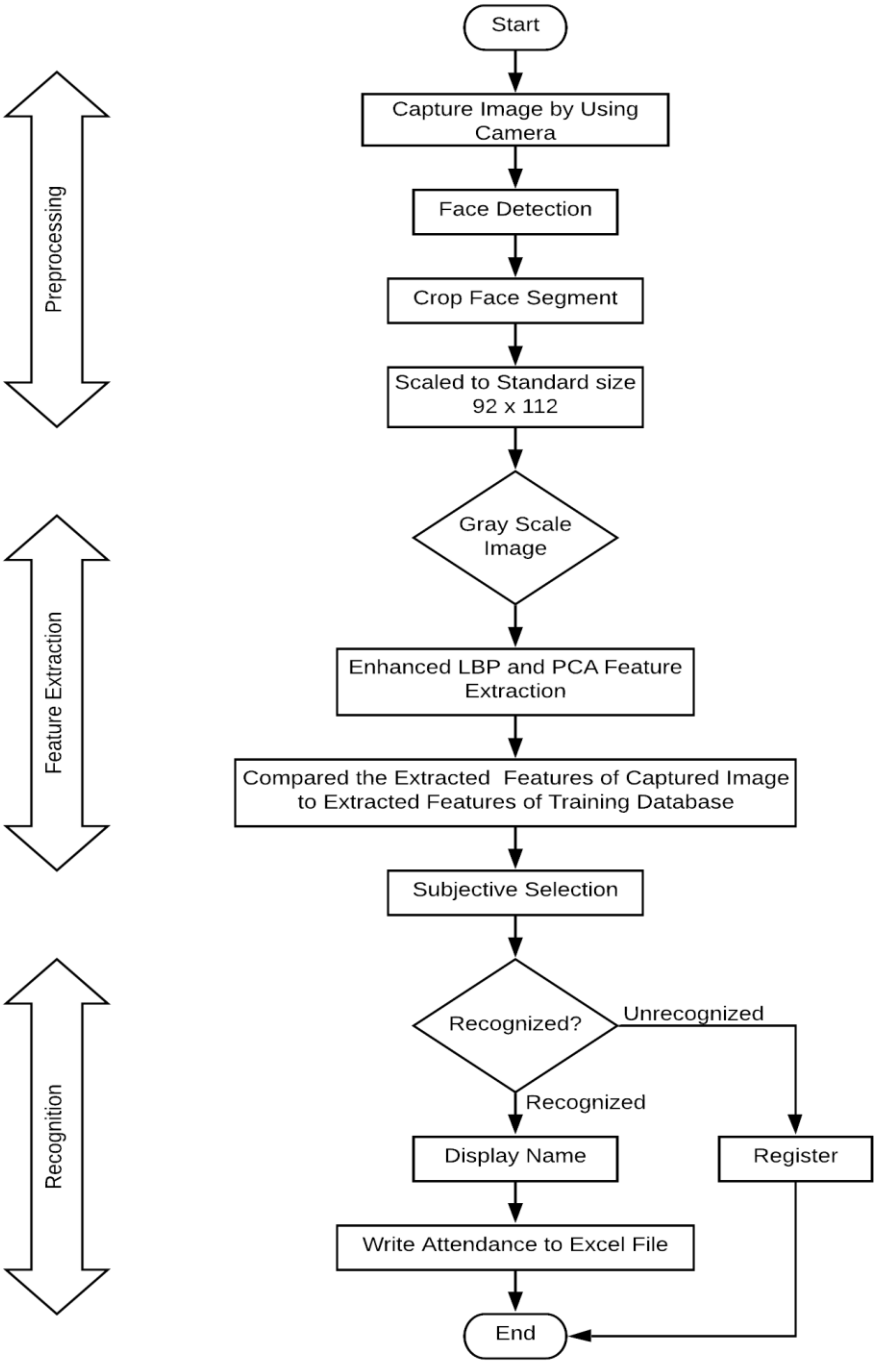

Figure 4.2: Recognition Part

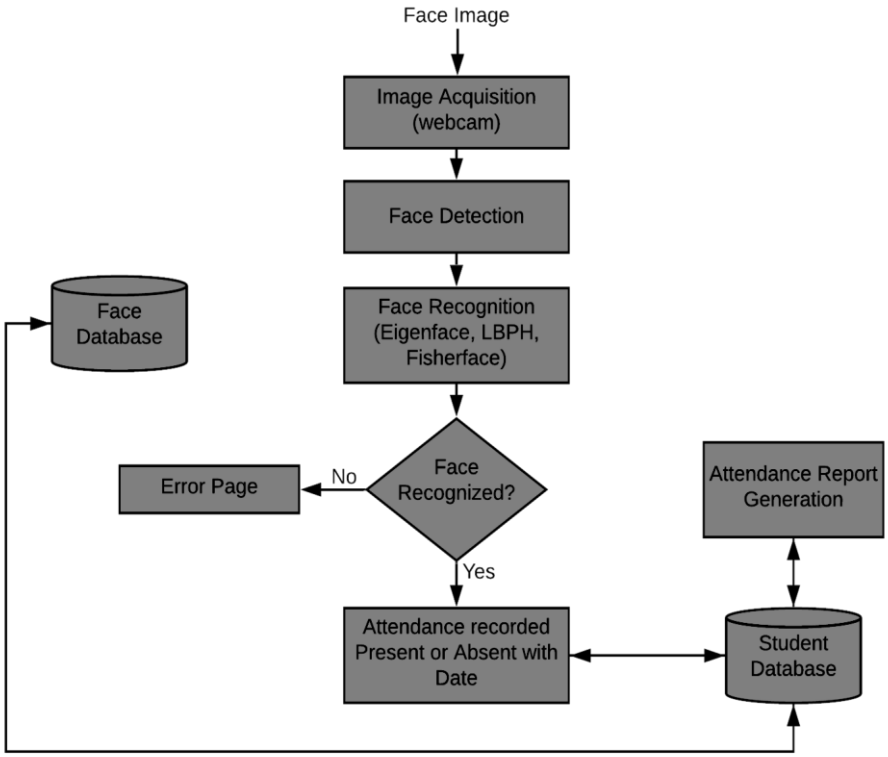

Figure 4.3: Block diagram of the system

5. Requirement Analysis

Requirement analysis is the requirement engineering task that bridges the gap between system level software engineering designs. This also encompasses the analyzing, documenting, validating and managing system requirements.

SYSTEM REQUIREMENTS SPECIFICTAIONS

5.1 Functional Requirements

This requirements states the functional of the system. What it should do or what it should not. This will includes the most common requirements of the student in addition to some additional feature like adding student in list.

Following are Functional requirements of our project:

- Create User Datasets
- Train the datasets according to different algorithms such as Eigen, Fisher and LBPH methods
- View attendance.

5.2 Non Functional Requirements

This requirement will describe how a system should behave and what limits there are on it's functionality. Non-functional requirements generally specify the system's quality attributes or characteristics

Following re Non-Functional requirements of our project:

- .csv file generated automatically.
- Student can easily do attendance

5.1.3 Input Requirements

Data is required

The data to be input are :

- Student Details

Input	Data type	Description
s_key	char	It is primary key given to the student.
s_name	Varchar(32)	It is the unique key given to the student.

5.1.4 Output Requirements

Output objective:

The system given the following output

1. Present Details of Student
2. Generate a csv file with all those present according to the timestamp.
3. Training files in form of .yml format.

6. System Design

System design is the process of defining the components, modules ,interface and data for the system to satisfy specified requirements. So, while designing according to the requirements specification, we have tried to fulfill the staff and student requirements.

The diagram helps in representing the overall description of the system that is “Facial attendance system”. The diagrammatic representation of the system is shown below.

6.1 Use case Diagram

The purpose of use case diagram is to capture the dynamic aspect of a system. Usecase diagram are used to gather the requirements of a system including internal and external influences. These requirements are mostly design requirements.Hence,When a system is analysed to gather it’s functionalities, Use cases are prepared and actors are identified

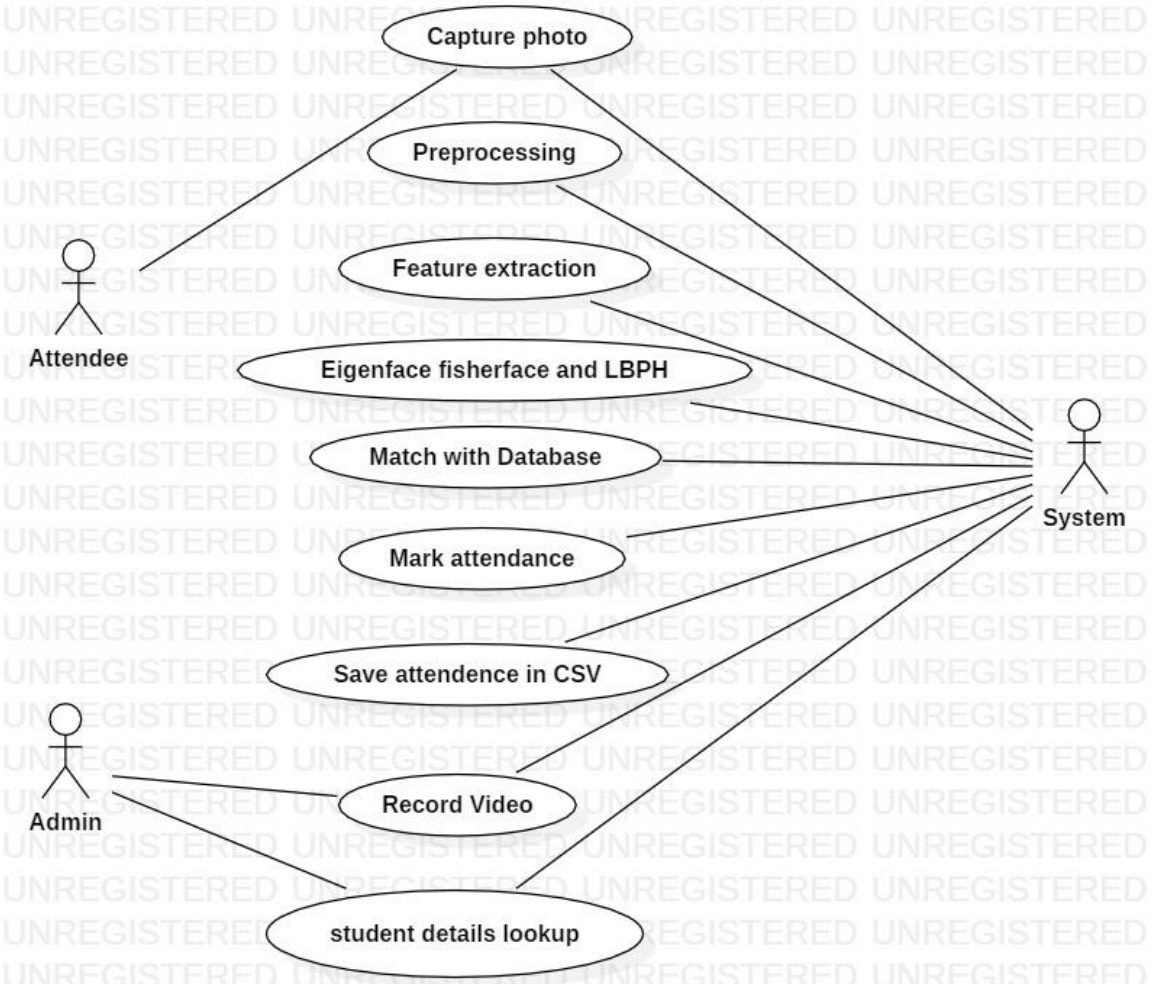

Figure 6.1 : Use case Diagram

6.2 Data flow Diagram

Data Flow Diagram helps in representing flow of the data throughout the system. A Data Flow Diagram (DFD) is traditional visual representation of the information flows within a system. A neat and clear DFD can depict a good amount of the system requirements graphically.

6.3.1 Context Diagram

DFD Level 0 is also called a Context Diagram. It's a basic overview of the whole system or process being analyzed or modeled. It's designed to be an at-a-glance view, showing the system as a single high-level process, with its relationship to external entities. It should be easily understood by a wide audience, including stakeholders, business analysts, data analysts and developers.

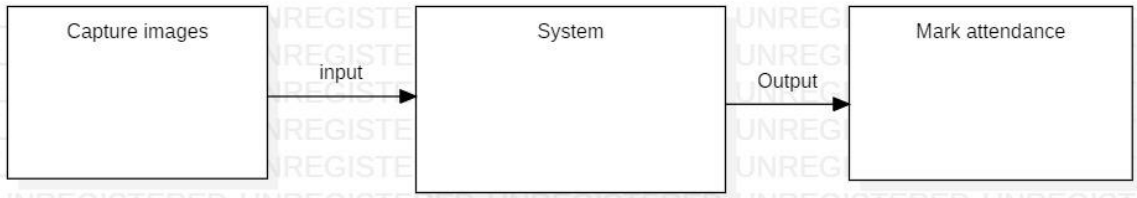

Figure 6.3.1: DFD Level 0

6.3.2 Level 1 DFD

DFD Level 1 provides a more detailed breakout of pieces of the Context Level Diagram. You will highlight the main functions carried out by the system, as you break down the high-level process of the Context Diagram into its sub processes.

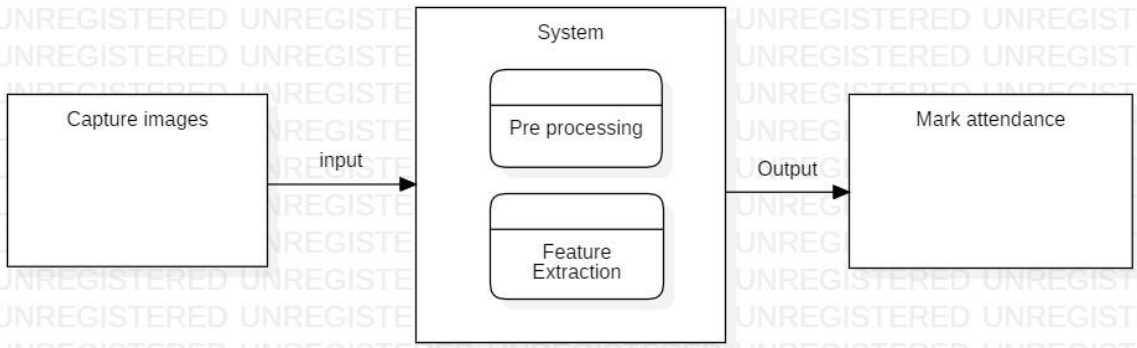

Figure 6.3.2: DFD Level 1

6.3.3 Level 2 DFD

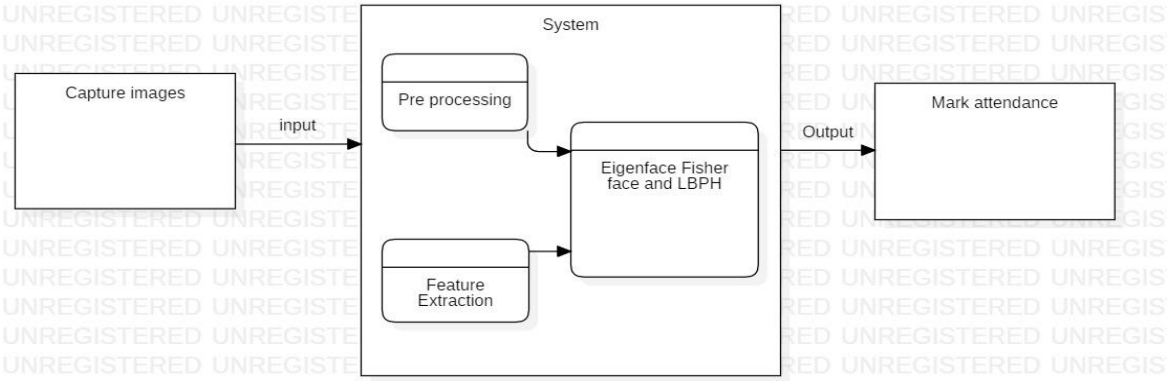

Figure 6.3.3: Level 2 DFD

6.3.4 Activity Diagram

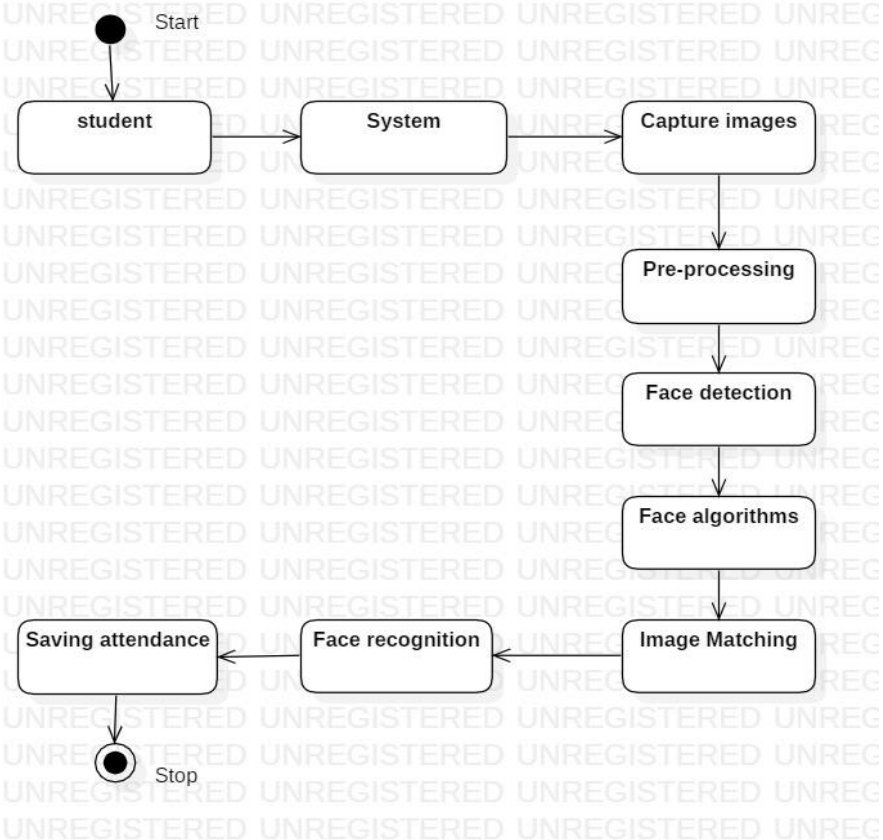

Figure 6.3.4 : Activity diagram

6.3.5 Sequence Diagram

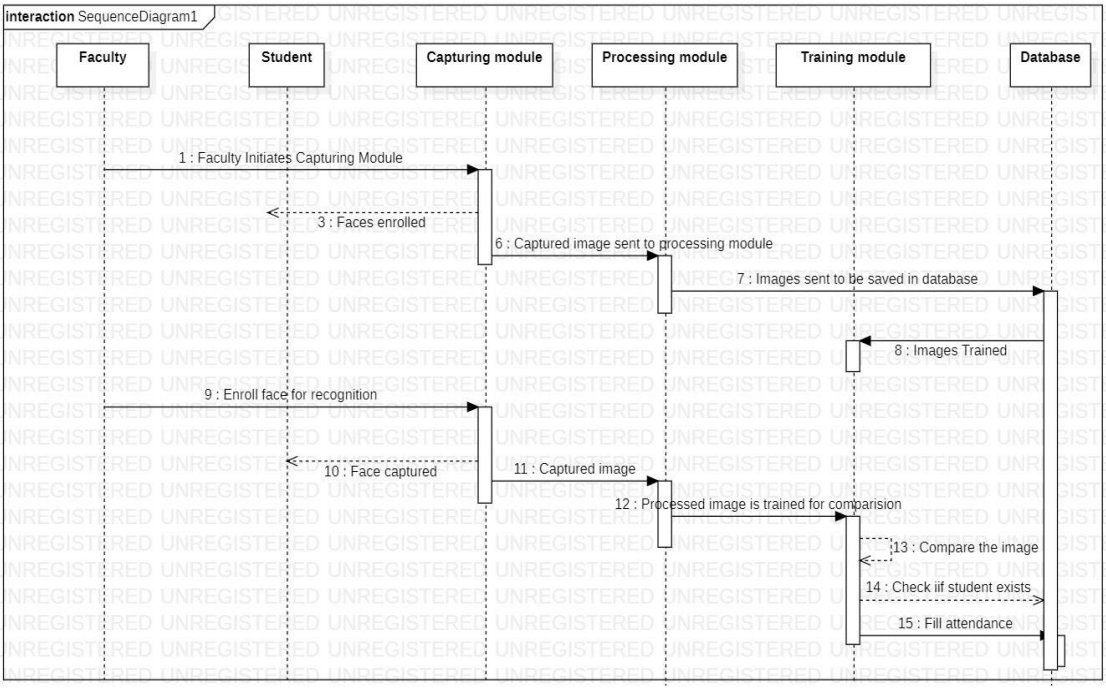

Figure 6.3.5: System sequence diagram student attendee system

7. Task Done so Far

- Creation of datasets and storage
- Training the datasets using LBPH, Eigen and Fisherface methods and storing
- Recognition using said methods.
- Creation of Gui using PyQT5.
- Daily attendance report generation on csv files.
- Video can be recorded while attendance for future purposes.

8.Results and Discussion

The GUI is the interactive window for our system. Which is shown in figure below. The training of student face successfully done. Student and teacher's face detection work properly means eyes, nose, hair can detect by the system. Face recognition of student is done for the before trained students. After recognition result is stored is excel file.

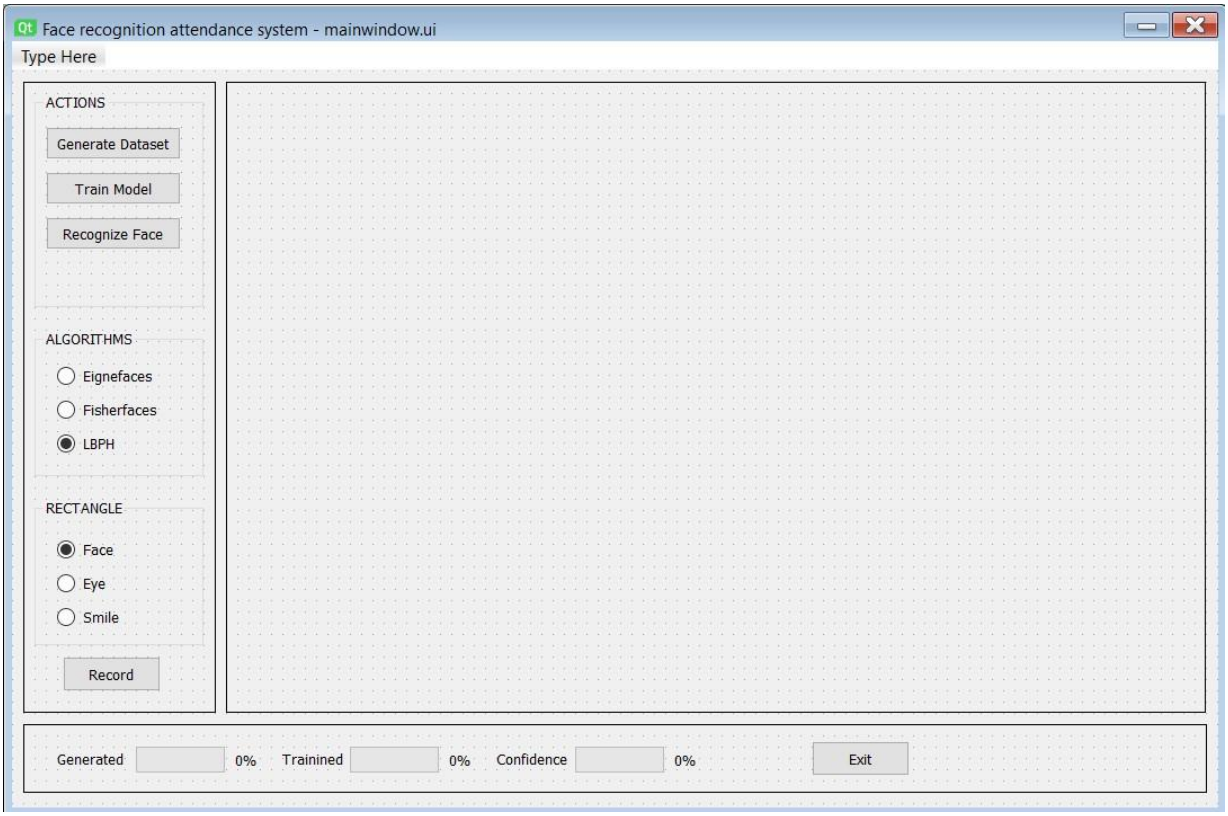

Fig 8.1: Main window of the program

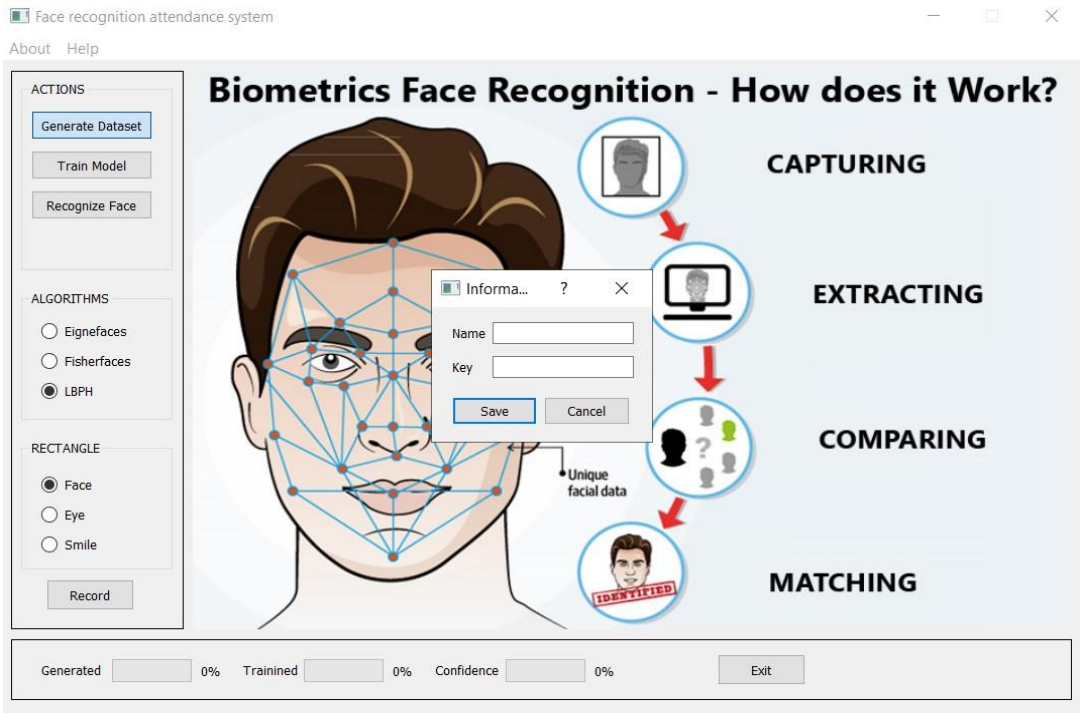

Figure 8.2: User info and dataset creation

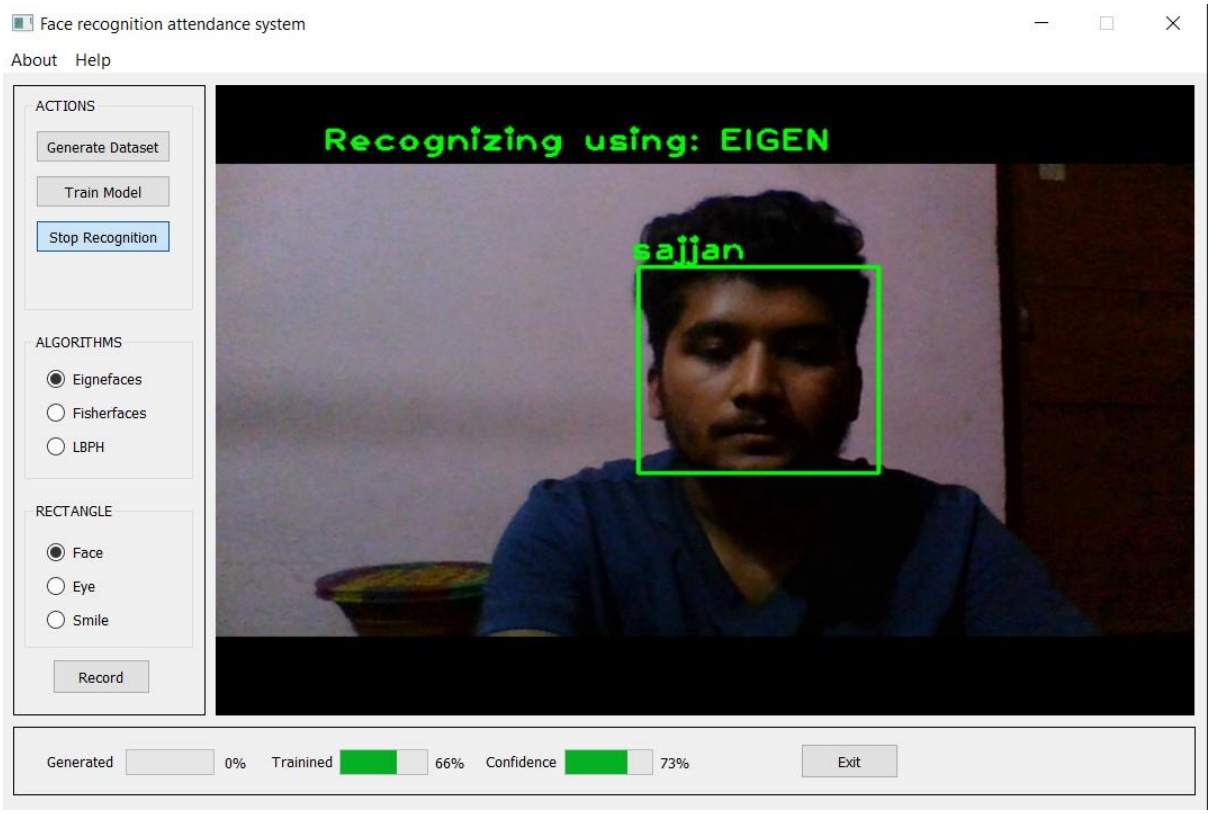

Figure 8.3: Recognizing person with Eigenface

9. Performance Analysis and Validation

We used different algorithm for the best value of accuracy and we found that :,

- The accuracy using eigen faces algorithm is 40-90%.
- The system accuracy using LBPH algorithm is 30%
- The system algorithm using fisherface is 80%

By seeing above result all algorithm gives the accurate result.

10. Proposed Deliverables:

The project delivers following features

- Facial detection.
- Analysis of facial features.
- Compare it to existing trained data to perform facial recognition.
- Plot the attendance according to the recognized face Id.
- Generate attendance report as an excel spreadsheet file.

11. Task and Time Schedule

Figure 2: Gantt chart (weekly)

We have planned to complete the project by 12 weeks. The required number of days required for different phases are:

- Requirement specification - 1.5 weeks
- Analysis - 1.5 weeks
- Designing - 3 weeks
- Coding - 6 weeks
- Testing and Maintenance - 2.4 weeks
- Documentation - 12 week

12. Conclusion and Future Extension

It’s future Extension will be implementing in student and library management system in different school, college, Restaurant in any organization where large number of staff.

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