

Chapter 1

Introduction

1.1 Background

Attendance systems are used by all companies to track when a student or employee starts and stops working. Some organisations keep meticulous records of attendance difficulties, such as who is absent or arrives late. It is vital to keep track of the students' attendance in a class. The attendance tracking system was developed, which revolutionised the way attendance was recorded. Teachers and students have found that the attendance monitoring technology has made their lives easier. When it comes to schools and universities, an attendance monitoring system can be quite beneficial to both parents and professors. If the institution uses an automatic attendance tracking system, parents will never be unaware of their children's attendance in class. Students could readily exploit the registers, and if information was addressed to parents, there was a good probability that the mails would vanish before they arrived parents even saw them. The information can easily be printed or a soft copy can be delivered directly to parents in their own email accounts or by sms as part of the monitoring system.

1.2 Problem Definition

Maintaining attendance is critical for all institutions. The traditional method involves the use of sheets of paper or books when taking attendance. This system can easily be man-made and the attendance paper can be stolen or lost. Taking in the number of attendees is time-consuming and difficult to convince a small number of students to pass a test. Attending attendees by calling every student's name or wrap often takes about 10 to 15 minutes of time. Also, calling attendees in general has many other issues that also make a false presence, losing attendance.

If some automation system will successfully do the job of maintaining attendance of the students, then this saved time can be utilized for other important work. The method is using old paper or the used file method .

1.3 Existing Attendance System

Attendance is important for both the teacher and student of an educational system and it is equally important to keep the record of the attendance. In today's world there are various attendance management systems vary in complexity.[7]

1.3.1 Basic Attendance Management System

1.3.2 Manual Attendance System

This system involves the teacher calling out names and taking the roll calls. If the student is present in the class, the student physically responds to it. In other cases, the teacher marks the student absent.

1.3.3 Paper Based Attendance System

This system is taken in any form and its recorded on a paper by writing either the absentees or the presentes only.

1.4 Advanced Attendance System

1.4.1 Facial Recognition Attendance System

This system makes use of facial features such as distance between the eyes, width of the nose, depth of the eye sockets, the shape of the cheekbones, the length of the jaw line, etc to recognise and mark attendance.

1.4.2 Section Detection Attendance System

The sensor uses RFID (Radio Frequency Identification) to identify individuals. A radio frequency identification reader is a device used to gather information from an RFID tag, which is used to track individual objects.

1.5 Drawbacks of Existing System

1.5.1 Accuracy

When we manually track students attendance the students might report their working hours after they have worked. The student may forget what his actual in and out times were.[7]

1.5.2 Savings

With an automated system, we will be able to save roll call processing hours and eliminate time theft.

Chapter 2

Proposed Architecture

2.1 Overview

Our overall design architecture consists of:

1. Camera- as an input device
2. Face Detection
3. Database

The end to end working of all the components may be seen in figure 2.1

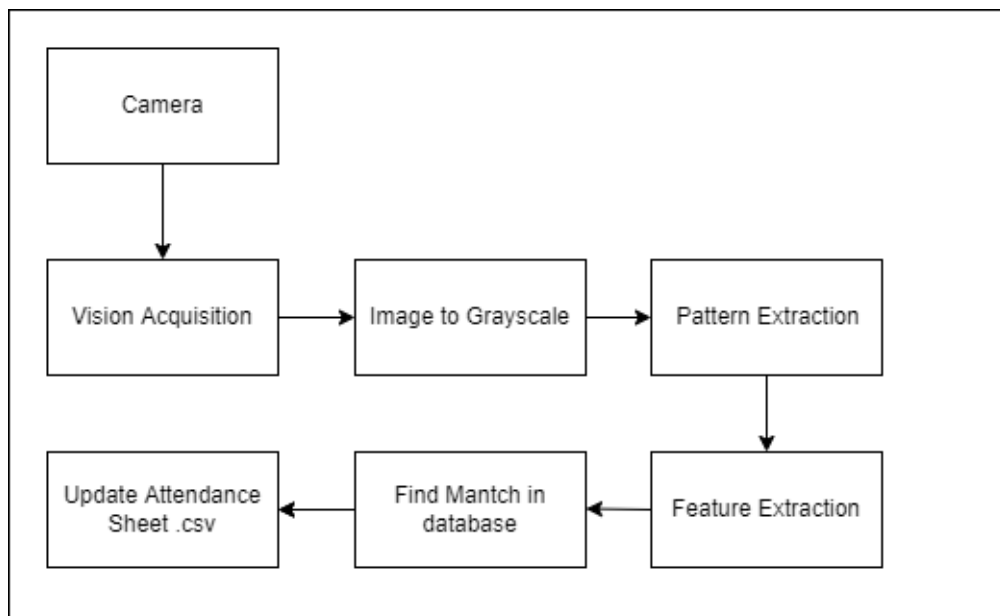


Figure 2.1: Block Diagram

2.2 Use Case Model

List of Use Cases

1. Attendee - Someone who is registering for attendance and gives attendance.
 - New Registration.
 - Give Attendance
2. Admin(Teacher) - Someone who take attendance of students.
 - Take Attendance.

2.2.1 Use Case Description(brief)

1. New Registration - This use case is started by attendee. It provides capability to newly registration on Automatic Attendance Recording System. Attendee have to provide their roll number as ID.
2. Give Attendance - This use case is started by students. It allows students to give their attendance for a particular class. Attendee have to show their face in front of system camera.
3. Take Attendance - This use case is started by the admin or teacher. It allows the teacher to take the attendance of a particular class. Admin needs to enter password during new registration of a student.

2.3 Non-functional Requirements

1. Response time must me less that 0.5 sec per action.
2. In order to satisfy security requirements, we cannot let everyone access the system.
3. Password shall never be visible at the time of entry or any other time.

2.4 System Requirements

2.4.1 Hardware Requirements

1. Minimum RAM:- 500MB

2. Hard Disk:- 1GB
3. Processor:- 1.50GHZ or above

2.4.2 Software Requirements

1. Operating System:- Windows
2. Front end:- Tkinter
3. Back end:- Python
4. Application :- Visual Studio

2.4.3 Developer Requirements

1. Operating System:- Windows Environemnt
2. Language:- Python 3
3. Package Installer:- tk-tools, OpenCV 3.0, NumPy, python-csv, pillow, pandas, pytest-shutil.

2.5 Layers

2.5.1 Input layer

The input layer is first layer of the system and is used to get the raw image data from the user.

1. Camera-We use camera as an input device for capturing images of students.

2.5.2 Processing Layer

This layer mainly focuses on image processing i.e. converting the image to machine understandable form and extracting the features. [7]

1. Image to Grayscale- This process is performed for image conversion of a 32/16 bit image to 8bit image.This is an essential for pattern matching algorithm.[9]
2. Pattern Extraction- Pattern extraction is the process of extracting patterns by using a machine learning algorithm. A pattern can be identifoed physci-cally or observed by applying mathematical algorithms such as ANN, GNN,

KNN. Pattern Extraction is a feature in which the input images are compared using pattern matching algorithms.[8]

3. Feature Extraction- Feature Extraction refers to extracting of face component features like eyes,nose,mouth, etc from an human face.Among all facial features,the location of eye and detection is essential from which locations of all other facial features are identified.[1]
4. Find match in database In our database we have stored images of students which is going to be recognised and attendance will be marked. As someone registers, the database gets updated accordingly.This database is used for comparing the extracted feature of the image to confirm the identity.

2.5.3 Database Layer

1. Update Attendance Sheet- If a match is found on our algorithm, it gets updated on the attendance of the student in his name in the excel sheet with date and time.

2.5.4 Architecture Design

The systematic architecture with all the components is shown below.2.2

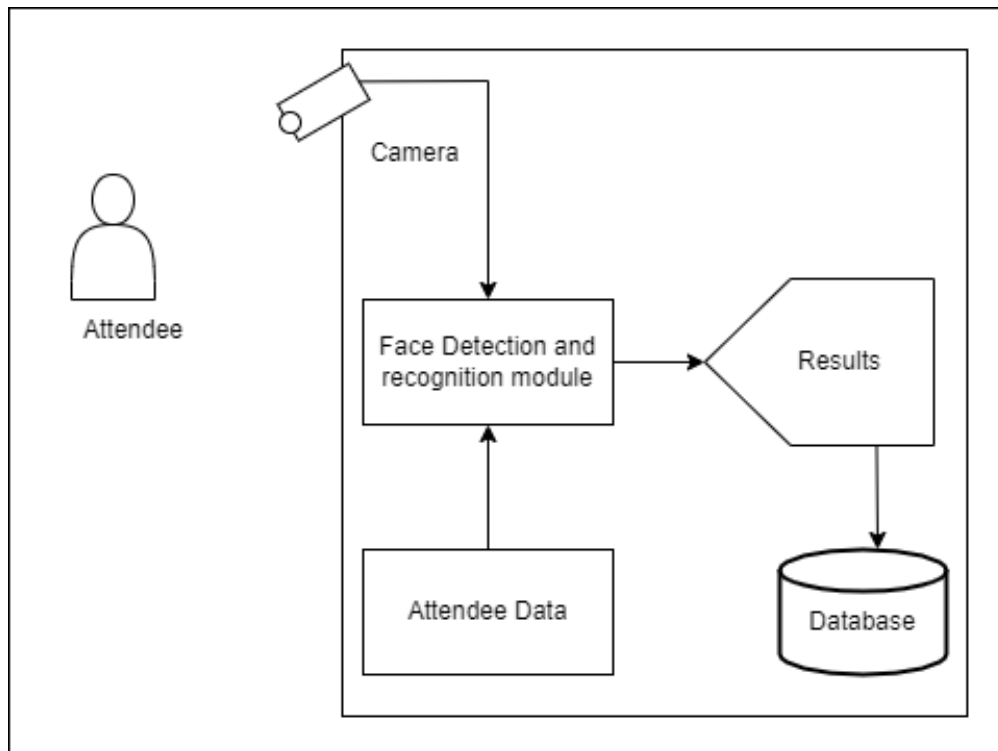


Figure 2.2: Architecture Design

Chapter 3

Literature Review and Related Works

3.1 Student Attendance System

Because of its simplicity, the RFID card system has been implemented. However, as long as they have their friend's ID card, the user tends to assist their pals in checking in. The fingerprint technology is effective, but it is inefficient because the verification procedure takes time, and the user must line up and execute the verification step by step.[5]

3.2 Face Detection

Facial detection and face recognition are not the same thing. Face detection is used to extract only the face segment from a picture, whereas face recognition is used to identify the person who owns the facial image. The psychological process through which people find and attention to faces in a visual context is known as face detection. [2]

3.3 Pre-processing

The goal of pre-processing is to improve picture data by suppressing unwanted distortions or enhancing particular visual properties that are important for further processing and analysis. Scaling is one of the most important pre-processing procedures for manipulating the image's size. Because the number of pixels in an image is reduced, scaling it down boosts processing speed by lowering system computations.[4]

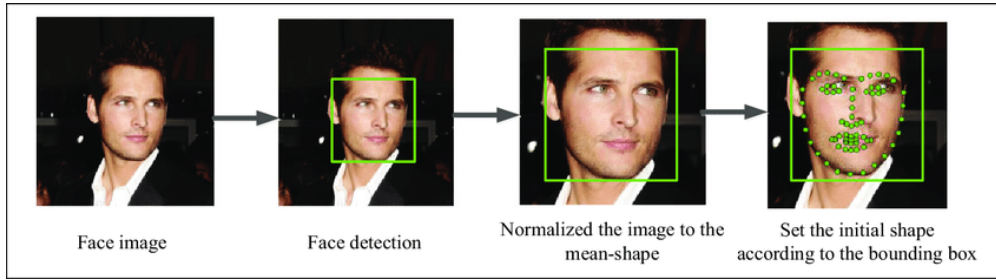


Figure 3.1: Pre-processing of an image

3.3.1 Scaling of image

Scaling of image is to and fro tasks in image processing. The size of the images has to be carefully manipulated to prevent loss of spatial information. As in order to perform face recognition, the image has to be equalized.

3.4 Feature Extraction

Variables that are continuous or discrete can be used to represent the feature. To achieve high accuracy, the feature extraction method must be reliable and robust throughout a wide range of changes. The extraction of the image's characteristics is the initial phase, followed by pattern classification. In face recognition, feature extraction is a crucial stage. The system's recognition rate is determined by the useful data collected from the facial image. When characteristics belong to distinct classes and the distance between them is greater, these traits become more essential for picture identification.[6]

Chapter 4

Implementation and Results

4.1 Implementation

4.1.1 Overview

This project is developed using python for various stage of face recognition shown in the figure 2.1 such as image to grayscale, pattern extraction, feature extraction, face recognition and finally record the attendance of the attendees whose face matches with one of the faces in the database. At first we take real time image by using system camera, then we process that image into grayscale to make it more efficient for pattern extraction and make the image more enhance. Then comes pattern extraction, it is used to gather patterns of a face such that a face consists of an eye, mouth, nose and ears and a nose must be below the face and the mouth after the nose and the ears on the sides. Then comes feature extraction which is used to find patterns of a face like determining the distance between the eyes and the nose, forehead and eye brows, cheeks and eyes etc. After the features are extracted from the object the data is compared with the stored data in the database and if a match is found on the existing database then the database gets updated and the attendee is marked present.

4.1.2 Registration Process

We have implemented the following processes at the time of registration of an attendee. During registration process the system will capture about 20 images of a particular attendee.

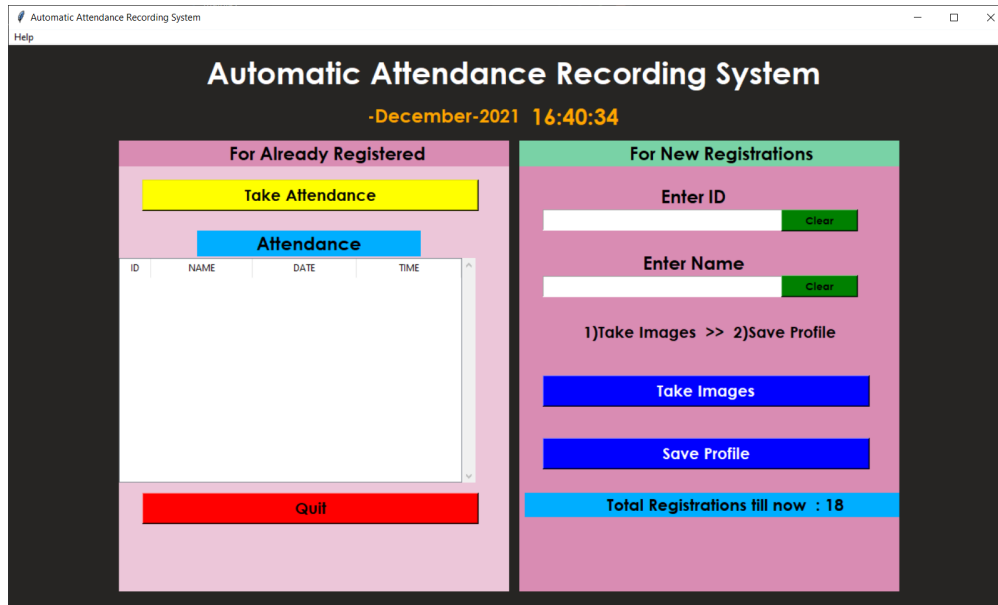


Figure 4.1: User Interface

4.1.3 GUI

We have used tkinter library to make the Graphical User Interface(GUI) for designing the front end part of our system.By using we divided the system into two frames as one for taking attendance and the other for showing the recently taken attendance .The system GUI shown in figure 4.1

4.1.4 Image to grayscale

We have used pillow library to convert the colored image into grayscale because coloured image contains more information per pixel i.e. RGB values and processing those values become much more computational.Grayscale simplifies the algorithm and reduces computational requirements.The image to grayscale of database faces is shown in figure.Pillow library uses LBPH to extract the grayscale features from the contrast improved images as 8 bit texture descriptor4.2

LBP is basically a texture based descriptor which it encoded local primitive into binary string.The original LBP operator works on a 3*3 mask size, that contains 9 pixels.The center pixel will be used as a threshold to cover the neighbouring pixels into binary format.If the neighbouring pixel value is larger than the center pixel value, then it is assigned to 1, otherwise it is assigned to 0.After that, the neighbouring pixel bits are concatenated to a binary code to form a byte value representing the center pixel.



Figure 4.2: Gray Image

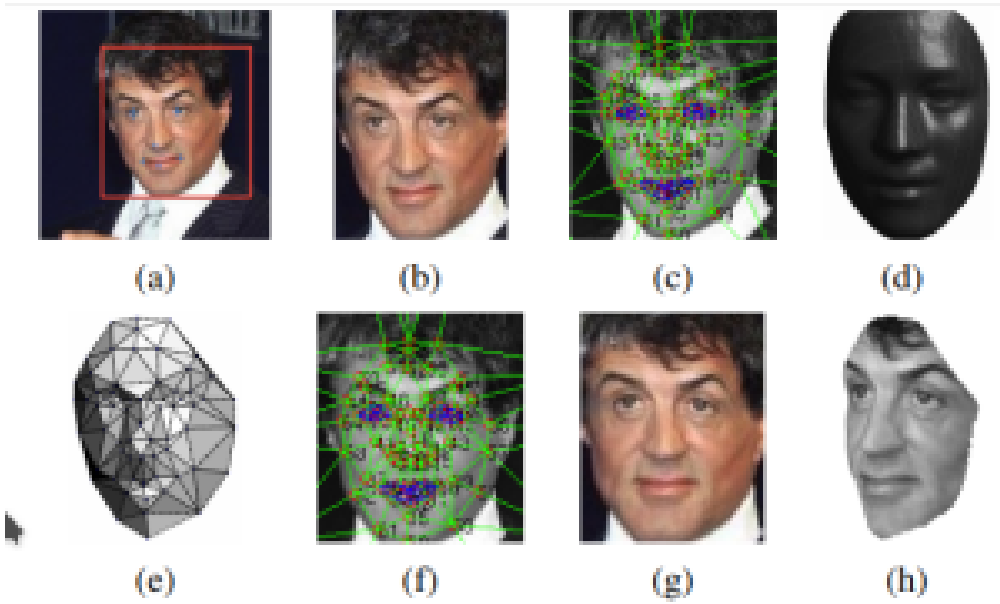


Figure 4.3: Patten Extraction

4.1.5 Pattern Extraction

We have used OpenCV libraries to recognise the pattern of the face. OpenCV is used for detecting face if there is any face or not. If a face is found then it is sent for feature extraction in the next process. The process of pattern extraction is shown in figure 4.3

4.1.6 Feature Extraction

We have used Times Series library to extract the features of the the face like the mouth, eyes, nose etc. Facial feature extraction is very much important for the initialization of processing techniques like face tracking, facial expression recognition or face recognition. The process of extracting the features is shown in figure

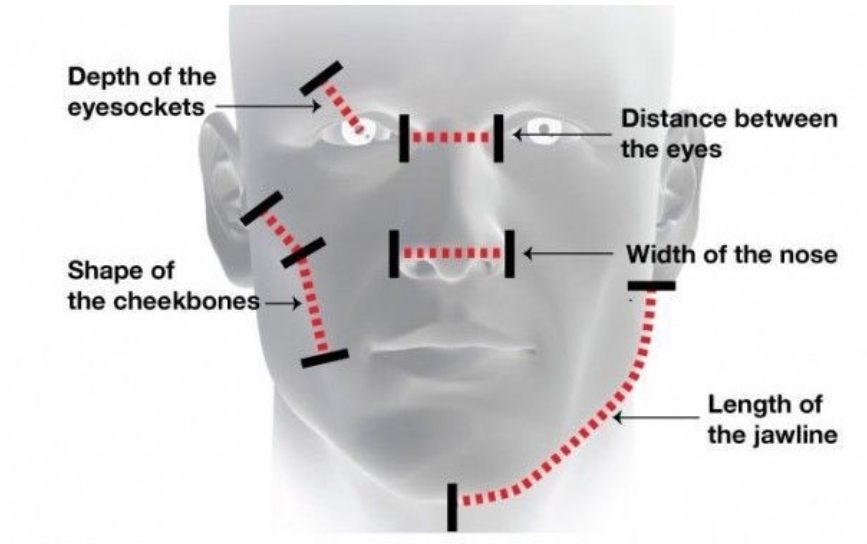


Figure 4.4: Feature Extraction

4.4

4.2 Attendance Process

The attendance is taken by capturing the image and identify if there is any face or not with the help of pattern recognition which we have mentioned above. If there is a face found then the extract the features of that face and try to match with the images on the system database. If features matches with any of the image features that are available in the system database, attendee is marked present and update the .csv file with respective date and time.

4.3 Results

In this approach, Automatic Attendance Recording System with user friendly interface is made by using Python GUI. When a face is matched with the registered face in the database the attendance sheet gets updated. In the GUI the results are shown in the space provided as the details of ID, Name, Date and Time.

Attendance			
ID	NAME	DATE	TIME
'csb19202'	Milan Mandal	26-12-2021	13:11:12
'csb19202'	Milan Mandal	26-12-2021	12:19:45
'csb19202'	Milan Mandal	26-12-2021	12:19:27
'csb19202'	Milan Mandal	26-12-2021	01:35:59
'csb19202'	Milan Mandal	26-12-2021	01:35:43
'csb19202'	Milan Mandal	26-12-2021	01:35:33
'csb19202'	Milan Mandal	26-12-2021	01:34:30

Figure 4.5: Results

ID	Name	Date	Time
'csb19202'	Milan Mandal	26-12-2021	13:11:12
'csb19202'	Milan Mandal	26-12-2021	12:19:45
'csb19202'	Milan Mandal	26-12-2021	12:19:27
'csb19202'	Milan Mandal	26-12-2021	01:35:59
'csb19202'	Milan Mandal	26-12-2021	01:35:43
'csb19202'	Milan Mandal	26-12-2021	01:35:33
'csb19202'	Milan Mandal	26-12-2021	01:34:30

Figure 4.6: Result Sheet

Chapter 5

Conclusion and Future Work

5.1 Conclusion

We can proudly acknowledge that we have been able to achieve most of the objectives set for the project in this semester.

We were able to create a working model of Automatic Attendance Recording System for recording the attendance of the students without the hassle of pen- paper method which is time taking and results in error in data storing. An advantage of this system is that the data will be stored safely in the system.

5.2 Future Work

For the future work, there is a large scope of improvement and addition of several features for our setup.

Further addition of new features:

1. Adding subject-wise attendance recording
2. Report generation at the end of every month
3. Students can be sent their attendance record to maintain their attendance criteria.