AUTOMATIC ATTENDANCE SYSTEM USING FACE RECOGNITION

MAJOR PROJECT REPORT

Submitted by

RAVINDER (1619066)

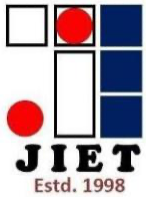
in partial fulfillment of the requirements for the award of the degree

of

BACHELOR OF TECHNOLOGY

in

COMPUTER SCIENCE AND ENGINEERING



JIND INSTITUTE OF ENGINEERING AND TECHNOLOGY - JIND

KURUKSHETRA UNIVERSITY

(2022-2023)

CERTIFICATE

This is to certify that Major project entitled "**AUTOMATIC ATTENDANCE SYSTEM USING FACE RECOGNITION**" is a bonafide work carried out by "**RAVINDER (1619066)"** under my guidance and supervision and submitted in partial fulfillment of the award of B. Tech degree in Computer science and Engineering. The work embodied in the Major Project has not been submitted for the award of other degree or diploma to the best of my knowledge

Ms. Neeraj Mor
(Project Supervision)

Ms. Neeraj Mor
(Head of the Department)

STUDENT'S DECLARATION

I hereby certify that the work which is being presented in the major project report entitled "AUTOMATIC ATTENDANCE SYSTEM USING FACE RECOGNITION" in fulfillment of the requirement for the award of the Degree of Bachelor of Technology in Department of Computer Science & Engineering of Jind Institute of Engineering and Technology, Jind, Kurukshetra University, Kurukshetra, Haryana is an authentic record of my own work carried out during 8^{th} semester.

Ravinder
(1619066)

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Finally, the authors are indebted to all whosoever have contributed in this report work.

ABSTRACT

Smart 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 taking attendance by using face biometrics based on high - definition monitor video and other information technology. In my face recognition project, a computer system will be able to find and recognize human faces fast and precisely in images or videos that are being captured through a surveillance camera. Face recognition-based attendance system is a process of recognizing the students face for taking monitor video and other information technology. In my face recognition project, a computer system will be able to find and recognize human faces fast and precisely in images or videos that are being captured through a surveillance camera. Numerous algorithms and techniques have been developed for improving the performance of face recognition but the concept to be implemented here is LBPH. It helps in conversion of the frames of the video into images so that the face of the student can Feature-based approach be easily recognized for their attendance so that the attendance database can be easily reflected automatically.

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List of Abbreviations

LBPH:	Local Binary Pattern Histogram
SDLC:	Software Development Life Cycle
SQL:	Structured Query Language
CSS:	Cascading Style Sheets
HTML:	Hypertext Markup Language
UI:	User Interface
FERET:	Face Recognition Technology
DARPA:	Defence Advanced Research Projects Agency
NIST:	National Institute of Standards and Technology
FRVTs:	Face Recognition Vendor Tests
ORM:	Object -relational Mapping

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 it is 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 arrival time of the students. It is also very easy to use and manage. Like every application, there are some setbacks to this application. The application is not one hundred percent accurate. Different factors such as image quality and lack of data sets can decrease the efficiency of the application. Administrators must add user

information manually and with data sets stored associate with the risk of being lost or stolen. The fundamental introduction of our project is given in section 1. It includes a background study of the project, the objectives set to meet, scope and limitations of our final product. The history of facial recognition and its introduction is provided in Section 2. The advantages and drawbacks of the facial recognition system are discussed in this section. Section 3 summarized the functional and non-functional requirements of the project and the feasibility of the project. Section 4 includes the development method we adopted to build the application and tools and technologies used to build the application are discussed. Section 4 discusses the structural designs of our application and how the application functions in various layers. Through various diagrams and figures, it explains step by step how the entire application works.

Chapter 2
Introduction to Facial Recognition

A person's face has distinctive physical shape and characteristics that are used to identify or verify an individual. Facial recognition records this biometrics of the face. Different face recognition methods measure the biometric of the face.

Facial recognition has become a very important topic in recent years. Facial recognition is effectively applied in various applications like security systems, authentication, entrance control, surveillance system, unlocking of smartphones and social networking systems, etc. Most of the practices do not use facial recognition as the main form of conceding entry. However, with advancement in technology and algorithm, facial recognition system has the potential to replace the standard passwords and fingerprint scanners.

This project was carried out to show how a Local Binary Pattern Histogram (LBPH) face recognizer could be used for taking attendance of students. LBPH facial recognizer is a pre-trained facial recognition classifier. If enough data set are available on the face that is needed to be identified, LBPH can perform facial recognition with high accuracy. Face Recognition Student Attendance System is a desktop application that identifies and verifies student's identities with the help of a digital image. Once the recognized face matches with the stored image, the attendance is completed and marked in the database for the student. This system will provide an alternative and easier way of taking attendance.

The facial recognition system has three main phases, which are described below:

Face Detection

Face detection is the ability to identify the person's faces within the digital images. This system identifies the human face present in an image or video. We need to define a general structure of a face to determine certain picture or

video contains a face (or several). Human faces have the same features such as eyes, nose, forehead, mouth, and chin. Therefore, the objective of face detection is to find the location and size of the face in an image. The located face is then used by the facial recognition algorithm.

Feature Extraction

In this phase, we are extracting the features from the detected face. In LBPH, the first local binary pattern images are computed, and a histogram is created for facial recognition. This generates a template. A template is a set of data that represents the unique and distinctive features of the detected face.

Face Recognition

Face Recognition is being able to uniquely identify and verify a person's face by comparing and analyzing a biometrics person's face. A face recognition system is an application that is used for identifying or verifying a person from a digital image.

2.1 History of Facial Recognition

Woody Bledsoe, Helen Chan Wolf, and Charles Bisson were the earliest pioneers of facial recognition. They began working to recognize the human face using a computer in 1964 and 1965. They marked various landmarks on the face such as eye centers, nose, mouth manually. They later used the computer to mathematically rotate to compensate for pose variation. The distances between the facial landmarks were computed automatically and compared with the image to match the identity. This was the dawn of facial recognition.

Sirovich and Kirby applied linear algebra to facial recognition and made it a viable biometric for business. They developed a system called "Eigenface"

where less than one hundred values were required to code the facial image accurately. In 1991, the discovery of face detection within an image by Turk and Pentland led to the beginning of automated facial recognition. This paved the way for the advancement and development of facial recognition technology. FERET program was rolled out in the early 1990s by the DARPA and NIST for commercial facial recognition. They created a database for facial images, which included 2413 facial images that represented 856 people. In the early 2000s, to provide independent government evaluations of facial recognition system and its prototype technologies, FRVTs was designed. These evaluations provided the necessary information to deploy the facial recognition technology in the best way to the law enforcement agencies and government. Face Recognition Grand Challenge was launched in 2006 to evaluate the face recognition algorithms available. It used high-resolution images, 3D face scans, and iris images for the test. The test concluded that the new algorithm was 10 times more accurate than the algorithms of 2002 and more than 100 times more accurate than the algorithm of 1995. In recent years, Facebook has implemented facial recognition functionality to identify people featured in the user's daily updates. In 2017, Apple launched the iPhone-X, which was the first iPhone to implement facial recognition to unlock the phone.

2.2 Importance of Facial Recognition System

Applications using facial recognition systems are widespread. They are applied in security systems, authentication systems, verification systems, surveillance systems, etc. We are interacting with face recognition systems without even realizing it. Many Businesses are using facial recognition systems for authentication, verification, and security. There are diverse applications of this system. Countries such as United States, United Kingdom, and Australia are now installing facial recognition technologies in different public spaces such as airports, cafes, shopping areas, factory areas, and government buildings. A large retail company like Alibaba is working on the development of pay-by-face technology. Workspaces are using this technology to record the clock in and

clock out tine of the employees. Law enforcement agencies are installing cameras with facial recognition systems to identify criminals and search for missing persons. As facial recognition technology and algorithms advance, we would see it being implemented more and more in our society.

2.3 Challenges of Facial Recognition System

A facial recognition system can revolutionize how businesses and governments interact with people. However, if not used properly, there are potential pitfalls with this technology. Potential misuse of personal and sensitive information is very real. Businesses and Organizations need to make sure that there are proper checks and balances and proper security before implementing this technology. Every time this technology scans someone's face, the distinct biometrics of the person is stored in a database. Depending on who owns the database and security in place to protect the database, the information can be leaked, stolen, or misused without the consent of the person. Facial recognition systems are not perfect. Data collected by humans are used to train the algorithms. If there are a lack of data and a diverse array of data to train the algorithms, the system can misidentify the person. There have been many instances where the system incorrectly identified the gender or identity of people with darker skin tones. This happened because of a lack of data representing a diverse array of people.

With the advancement of new technology comes a new type of crime. Criminals could access the facial recognition data by hacking the database and track people's movement, location, and information without their consent. Criminals can cause significant damage with the aid of a facial recognition system. They can steal sensitive personal information or the identity of a person to commit a crime.

The application of facial recognition technology holds many promise. However, it needs to be handled carefully. Businesses that want to implement this technology need to implement the proper framework and facial data protection

measures. If successfully managed to implement this technology, they can reap the benefits of this technology.

Chapter 3
Requirement Analysis and Feasibility Study

This section of the thesis describes the requirements necessary for the project and its feasibility.

3.1 Literature Review

Viola-Jones algorithm is used to detect the face. A camera is set up in the classroom that scans the facial structure of the students. The detected face is extracted for further processing. 20 images of students are stored in the database as the dataset. These datasets are used to compare the biometrics with the detected face for facial recognition. Facial recognition is done using LBPH. LBPH extracts the histogram of the image and concatenates it to form the face descriptor by segmenting the image into the local region. The distance between the biometrics of the probe image and the trained image is calculated. If the calculated distance is less than the threshold, then the probe image is recognized. Once recognized, the name is updated into an excel sheet.

3.2 Requirement Analysis

In this section, the functionalities need to run the system are described.

3.2.1 Functional Requirements

The system has different functionalities for an admin and teachers. Admin has higher privileges than teachers. Their functionalities are described below.

Admin Module

Admin has the highest privileges among all as admin is responsible to design the system. Admin register teacher and provide unique id to the teacher. They are responsible to take images of the students and add them to the database. Admin can view and update the details of both students and teachers. They can also view the attendance report. Figure 1 shows the use case for admin,

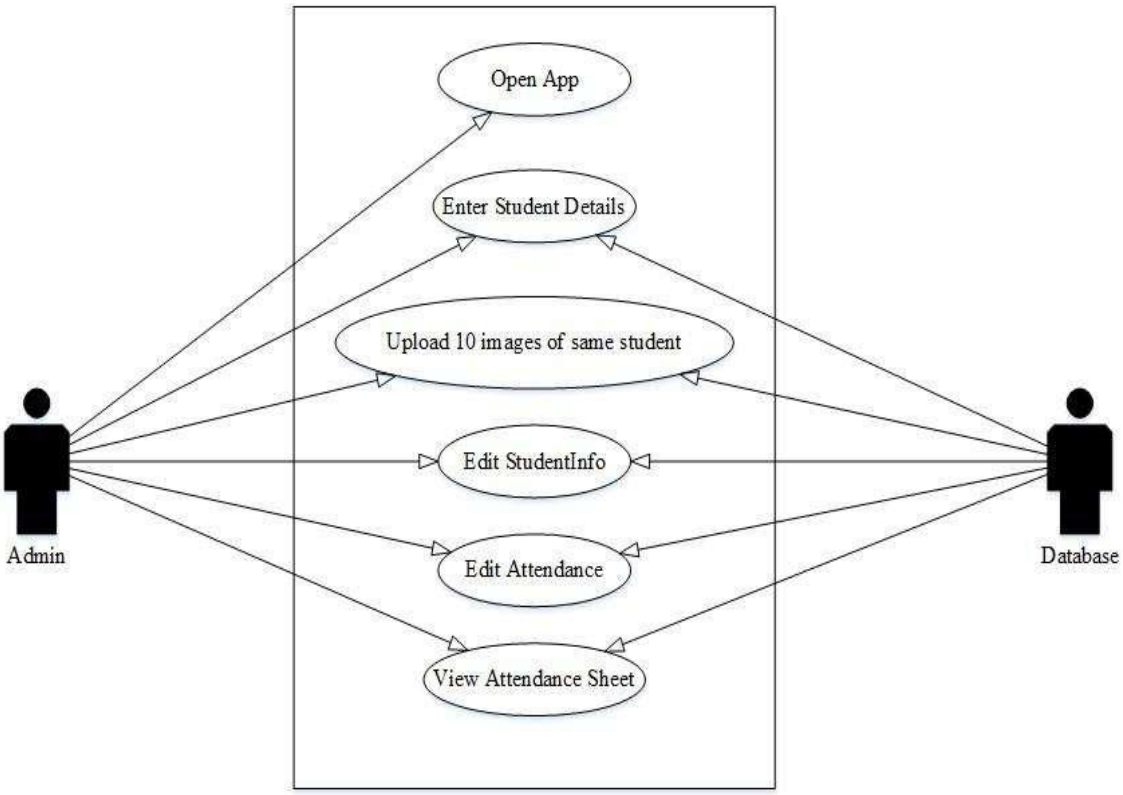


Figure 1 Use Case Admin Module

Teacher Module

Teachers can log in to the system. They can open the application and the images of the students for attendance. They can also view the attendance report. Figure 2 shows the use case for the teacher.

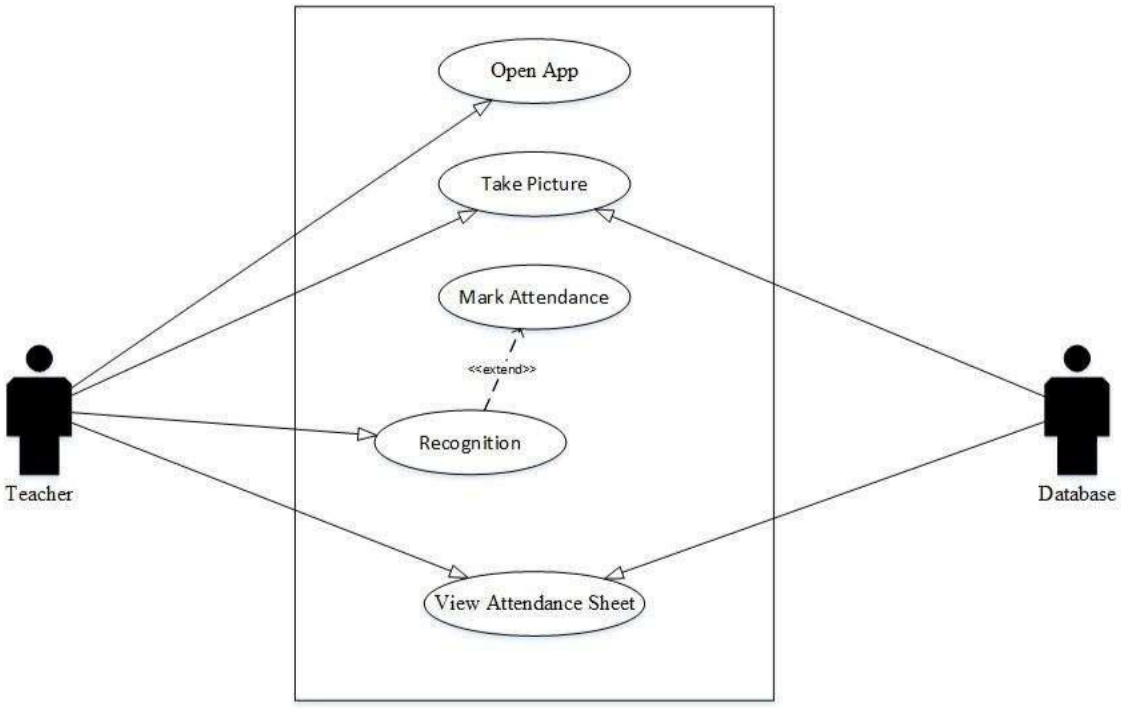


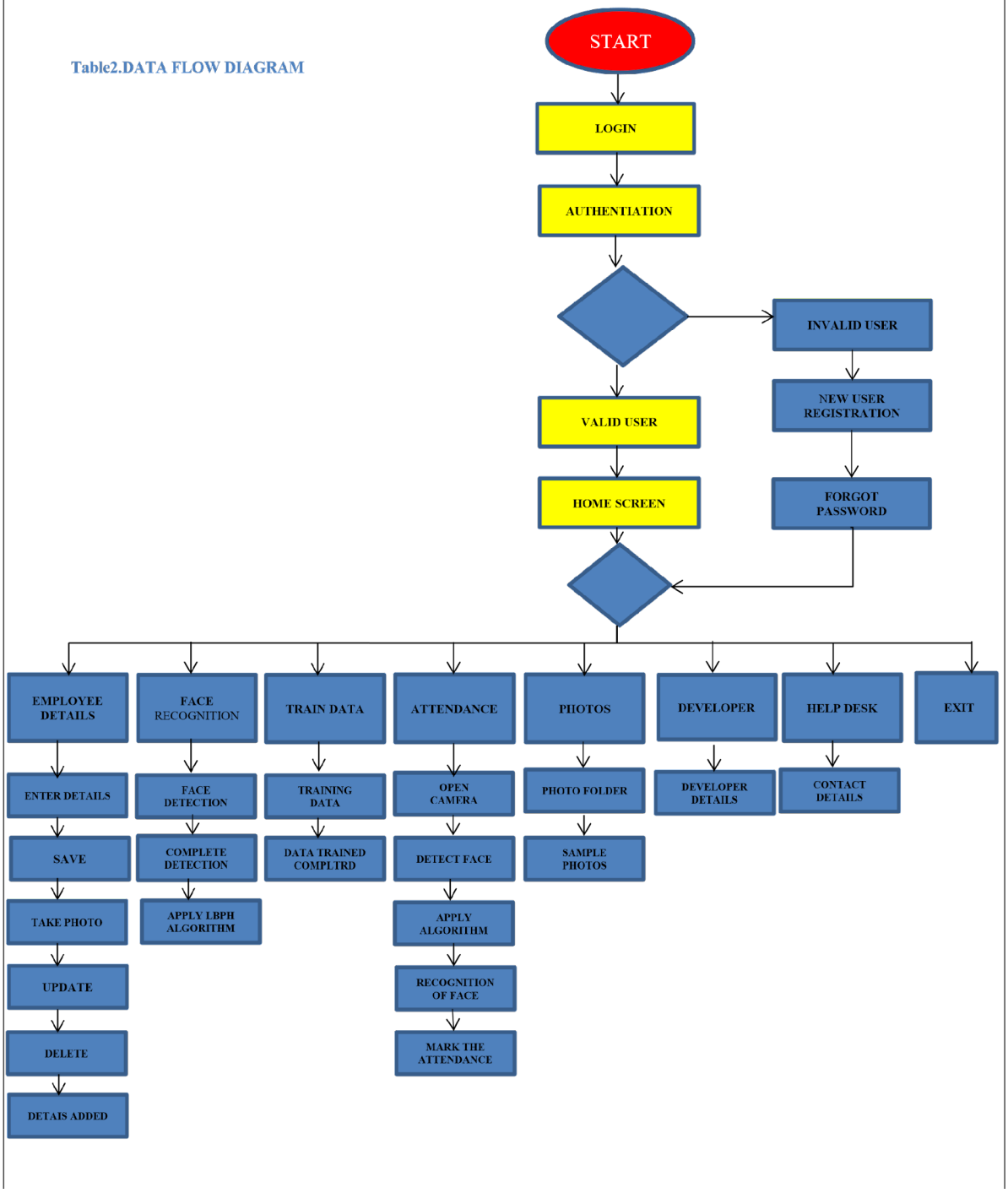
Figure 2 Use Case Teacher Module

3.2.2 Non-Functional Requirements

Non-Functional Requirements are the characteristics or attributes of the system that are necessary for the smooth operation of the system. Those requirements are listed below.

- The system should perform the process accurately and precisely to avoid problems.
- The system should be easy to modify for any updates. Any errors or bugs that are identified should be easy to mend.
- The system should be secure and maintain the privacy of the students.
- The system should be easy to understand and use.
- Execution of the operation should be fast.

Table2.DATA FLOW DIAGRAM



3.3 Feasibility Analysis

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. Here, we discuss 3 major feasibility studies required for our project.

3.3.1 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.

3.3.2 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.

3.3.3 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.

Chapter 4
Method and Materials

This is the most important section of the thesis. This section describes the detailed workflow of the project and the necessary theoretical background.
Tools and Technologies

4.1 Tools and Technologies

Tools and techniques used in the project are described in this section of the thesis. This project focused was mainly focused on Python Programming and its libraries.

4.1.1 Python

Python is a high-level object-oriented programming language. It was created by Guido van Rossum in 1991 as Python 0.9.0. It was created as the successor of the ABC programming language. Python 2.0 was released on 16 October 2000 and added many features like list comprehension and garbage collecting system. On 3 December 2008, Python 3.0 was released. Python is a very popular programming language and can be used for various purposes. It is widely used for web development, software development, mathematics and data analysis, system scripting, etc. Python is a multi-purpose programming language that works on different platforms like Windows, Linux, Mac, Raspberry Pie, etc. Python is popular than other programming languages because it has a simple syntax than other programming languages. Its syntax allows the programs to write code that is easier to understand and in fewer lines. It runs in an interpreter system. Hence, the code can be executed as soon as it is written.

In this thesis, we use Python for web development. This project demonstrated how Python is used for an effective and reliable web application. Various Python frameworks, libraries are used in this project.

4.1.2 Tkinter

Tkinter is the standard GUI library for Python. Python when combined with Tkinter provides a fast and easy way to create GUI applications. Tkinter provides a powerful object-oriented interface to the Tk GUI toolkit. Creating a GUI application using Tkinter is an easy task.

4.1.3 OpenCV

OpenCV is an open-source machine learning and computer vision library. OpenCV is a cross-platform library and is free to use. It was launched in 1999. Intel launched OpenCV to advance CPU-intensive applications. It was developed in C++. It provides bindings for Java and Python programming languages. It runs in different operating systems such as Linux, Windows, OSx, etc. It focuses mainly on video capturing, image processing, and analysis. It has face detection

and objects detection features. OpenCV can be used to read and write images and capture and save videos. It can perform feature detection like faces, cars, images, etc. Many established companies like Yahoo, Google, Microsoft, Intel, and many others use the library.

4.2 Methodology

This section describes how LBPH is used for face recognition. First, a dataset is collected for images and each image is labeled with a unique id. The images are divided into an 8X8 grid and converted into grayscale. A 3X3 matrix of each pixel containing its intensity (0~255) is extracted from the image. The threshold of the central value of this matrix is taken which is used to determine the neighboring value of the matrix. Each neighboring value is compared with the central value. If the neighboring value is greater or equal to the threshold value, it is set to 1. If the neighboring value is less than the threshold value, it is set to 0. Then, the matrix value will contain binary values only. The decimal value is calculated using the given formula:

$$LBP\ (x_c,y_c) = \sum^{7}_{n=S}(i_c - i_n)2^n$$

In the above formula, 'n' is the 8 neighbors of the central pixel, i_c, and i_n are the grey level value of the central pixel and the surrounding pixel, respectively. S(x) is 1 if x is greater than or equal to the threshold. S(x) is 0 if x is less than the threshold.

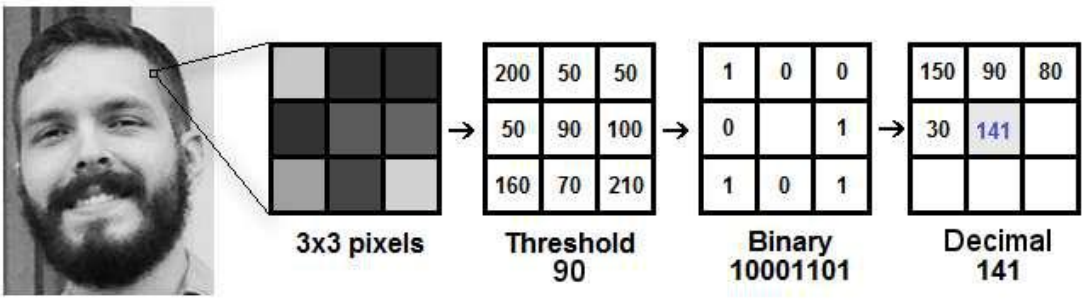


Figure 3 Extracting 3X3 matrix of a pixel.

The calculated decimal value is replaced with the central value. Hence, we obtain the characteristics of the original image in a new image. Once all the processes are complete, a histogram is extracted from each grid and are concatenated. This process is repeated for all the images and a histogram is generated. To compare two images, histograms are compared at a time. The comparison is done by Histogram Intersection. Its formula is given below:

$$\sum_{j=1} \min(Ij, Mj)$$

Here, j is the bin number and I and M are histogram 1 and histogram 2. If the intersection value is greater than 80% then, the image is successfully recognized.

4.3 Implementation

This section describes how the algorithm was implemented to design the system and the testing of the system. The application was created using Python's Tkinter package. The front-end of the project were done using Tkinter. This project implements the tools and technologies mentioned in section 4.1.

4.3.1 System Design

The project follows three-layered architecture, which is described below.

Presentation Layer

This layer is responsible for the user interface. All the components that users see and interact with within the application are in this layer.

Application Layer

Application layer controls the overall functionality of the system. Functionality such as logging into the system, facial detection, and recognition is all done in this layer.

Data Layer

In this layer, Data and Information are stored and retrieved in the database. The names, images of students as datasets, teaches are stored in the database. Once the face is matched, marking of attendance in the database. See figure 4.

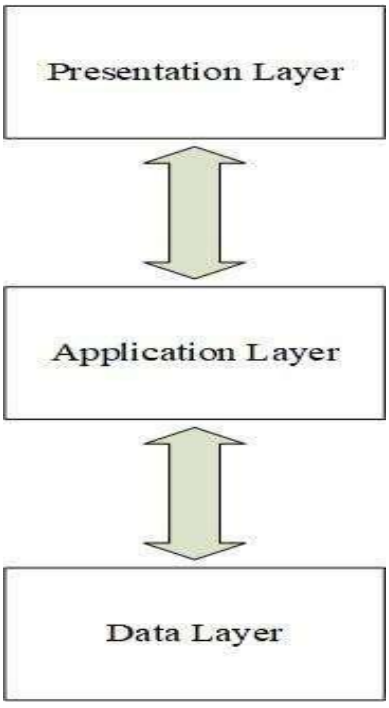


Figure 4 System Design

4.3.2 Database Design

For this project, the default Django SQLite was used to create the database. The tables are created by Django's model. It provides an ORM to the underlying database. ORM makes it easy to work with relational databases. The models in Django are Object, which is mapped to the database. When a model is created, Django creates the corresponding table without having to write any SQL code.

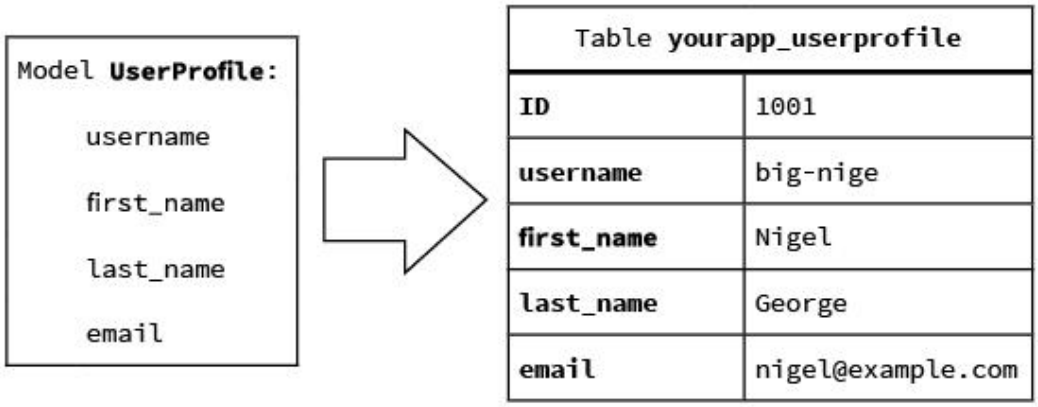


Figure 5 Model and its corresponding table in the database

Creating a model in Tkinter is easy. It contains essential fields needed for our data and specifies the behavior of the data. Each model is mapped to a single table in the database.

fname	lname	cnum	email	ssq	sa	pwd
Ravinder	Verma	9729391948	rvindr2001@gmail.com	Your Date of Birth	20/10/2001	vrma@2001
Sapna	Aggarwal	987654321	sapnaaggarwal@gmail.com	Your Nick Name	sapna	sapna@jiet

Figure 6 Teacher Database Table

The teacher table contains columns like a first name, last name contact number, email and password. The user field has a one-to-one relation with the User class, which is imported from the Django library as shown in figure 6.

Student_ID	N...	Department	Course	Year	Semester	Division	Gender	DOB	Mobile_No	Address	Roll_No	Email	Teacher_Name	PhotoSample
1	...	CSE	TE	2019-23	Semester-8	Morning	Male	20/10/2001	9729391948	Sirsa	1619066	rvindr2001@gmail.com	sapna	Yes
NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL

Figure 7 Student table

This is a table to record the student information. The student model contains fields such as Student ID, name, department roll no., email etc. as shown in figure 7. In the image_path field, images of a particular student are stored as the dataset. These images are used to compare the detected face during facial recognition.

std_id	std_roll_no	std_name	std_time	std_date	std_attendan...
1	1619066	ravi	07:45:08	03/05/2023	Present

Figure 8 Attendance table

The attendance table keeps the attendance record. It has student and teacher field, which has a foreign key attribute with the Student model and Teacher model, respectively. It has a date, time, and attended fields to keep the date and time record of the attendance.

4.3.3 Interface Design

The user interface is created by implementing Tkinter package. It is the standard tool to create a user interface in Python. Tkinter templates create interface, which is rendered by Python view. In Tkinter, views can be created as a class and a function. View created by function is called function-based view and view created by class is called a class-based view.

```
class Login:
    def __init__(self,root):
        self.root=root
        self.root.title("Login")
        self.root.geometry("1366x768+0+0")

        # variables
        self.var_ssq=StringVar()
        self.var_sa=StringVar()
        self.var_pwd=StringVar()

        self.bg=ImageTk.PhotoImage(file="Images_GUI/loginBg1.jpg")

        lb1_bg=Label(self.root,image=self.bg)
        lb1_bg.place(x=0,y=0, relwidth=1,relheight=1)

        frame1= Frame(self.root,bg="#002B53")
        frame1.place(x=560,y=170,width=340,height=450)

        img1=Image.open("Images_GUI/log1.png")
        img1=img1.resize((100,100),Image.ANTIALIAS)
        self.photoimage1=ImageTk.PhotoImage(img1)
        lb1img1 = Label(image=self.photoimage1,bg="#002B53")
        lb1img1.place(x=690,y=175, width=100,height=100)

        get_str = Label(frame1,text="Login",font=("times new roman",20,"bold"),fg="white",bg="#002B53")
        get_str.place(x=140,y=100)

        #label1
        username =lb1= Label(frame1,text="Email:",font=("times new roman",15,"bold"),fg="white",bg="#002B53")
        username.place(x=30,y=160)

        #entry1
        self.txtuser=ttk.Entry(frame1,font=("times new roman",15,"bold"))
        self.txtuser.place(x=33,y=190,width=270)


        #label2
        pwd =lb1= Label(frame1,text="Password:",font=("times new roman",15,"bold"),fg="white",bg="#002B53")
        pwd.place(x=30,y=230)

        #entry2
        self.txtpwd=ttk.Entry(frame1,font=("times new roman",15,"bold"))
        self.txtpwd.place(x=33,y=260,width=270)


        # Creating Button Login
        loginbtn=Button(frame1,command=self.login,text="Login",font=("times new roman",15,"bold"),bd=0,relief=RIDGE,fg="#002B53",bg="white",activeforeground="white",activebackground="#007ACC")
        loginbtn.place(x=33,y=320,width=270,height=35)
```

Figure 8 Function-based view for Login and Logout.

Figure 8 shows an example of function-based views. It has two functions login and register view. In login_view, if the user is an admin and authenticated then, it redirects the user to the admin's home page. If the user is a teacher and authenticated then, the user is redirected to the teacher's home page. The user is redirected to the application's home page when signed out.

```python
def student_pannels(self):
    self.new_window=Toplevel(self.root)
    self.app=Student(self.new_window)

def train_pannels(self):
    self.new_window=Toplevel(self.root)
    self.app=Train(self.new_window)

def face_rec(self):
    self.new_window=Toplevel(self.root)
    self.app=Face_Recognition(self.new_window)

def attendance_pannel(self):
    self.new_window=Toplevel(self.root)
    self.app=Attendance(self.new_window)

def developr(self):
    self.new_window=Toplevel(self.root)
    self.app=Developer(self.new_window)

def regteach(self):
    self.new_window=Toplevel(self.root)
    self.app=Register(self.new_window)

def Close(self):
    root.destroy()
```

Figure 9 Main file functions

Figure 9 shows main python file functions for main panel view.

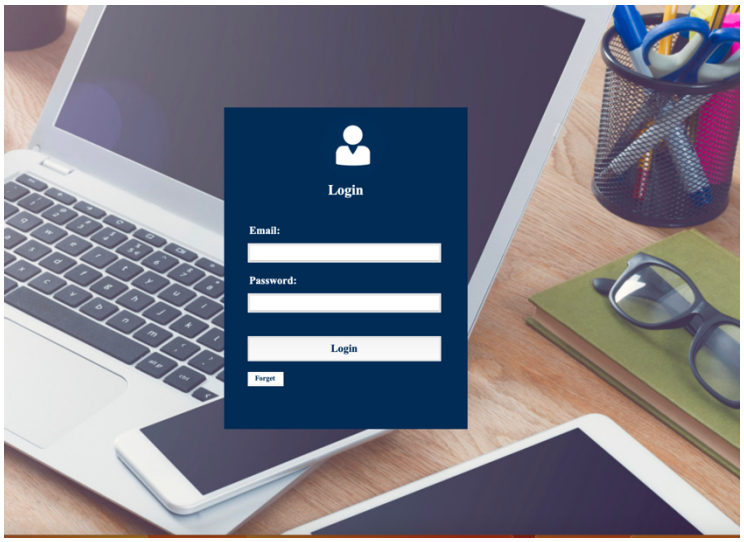


Figure 10 Login Interface

Figure 10 shows the login page of the website. Here the admin and the teachers can log in to the system. Admin had provided teachers with the username that they could use to log in to the system.

Figure 11 Admin Interface

Figure 11 shows what the admin sees after the admin has logged in to the system. Here, the admin can see the teachers and students that have been added to the system. The teacher's information can be seen from here by the admin. Admin can also add teachers to the system and delete teachers from the system.

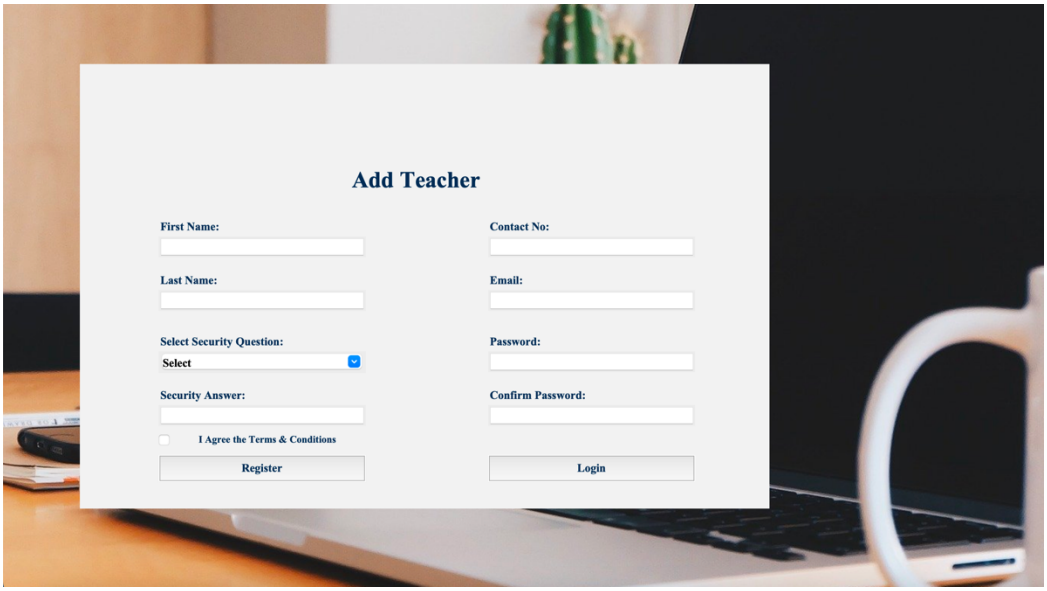


Figure 12 Add teacher by the admin.

In figure 12, we can see the form that the admin needs to fill to add a teacher to the system. Teacher information like their first name, last name, email, security question, and password should be filled in.

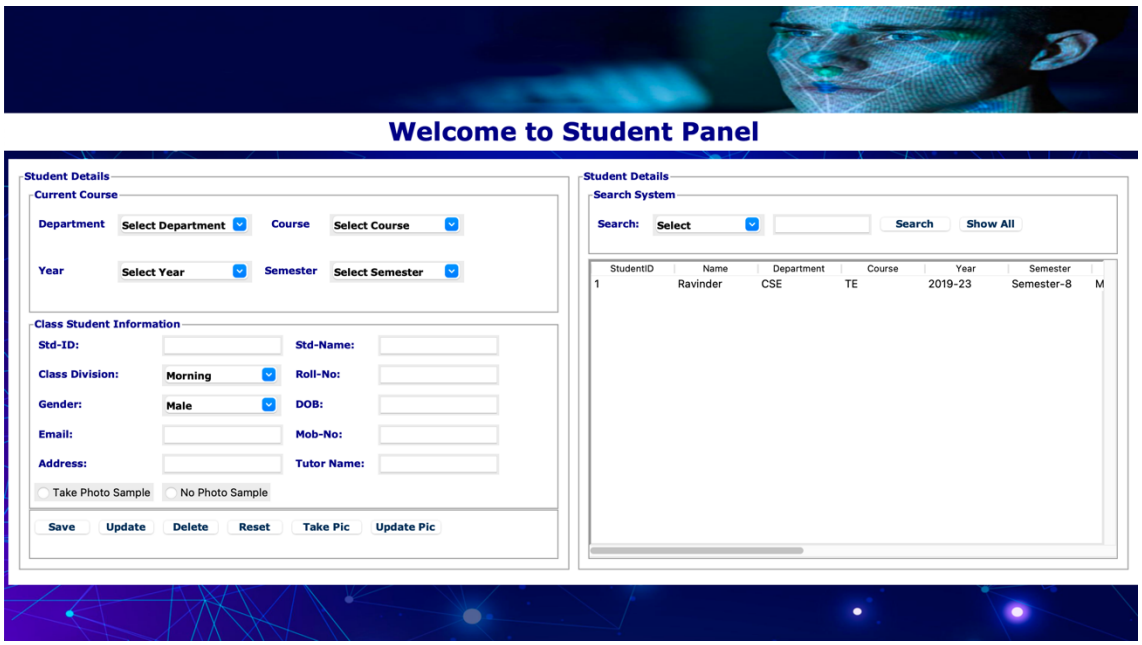


Figure 13 Add student by admin.

Similarly, as shown in figure 12, the admin can also add students to the system. The admin needs to provide student's information that is shown in figure 13. In the image path of the data set images of a student is provided. The scanned image is compared with the images stored in the data set from this path.

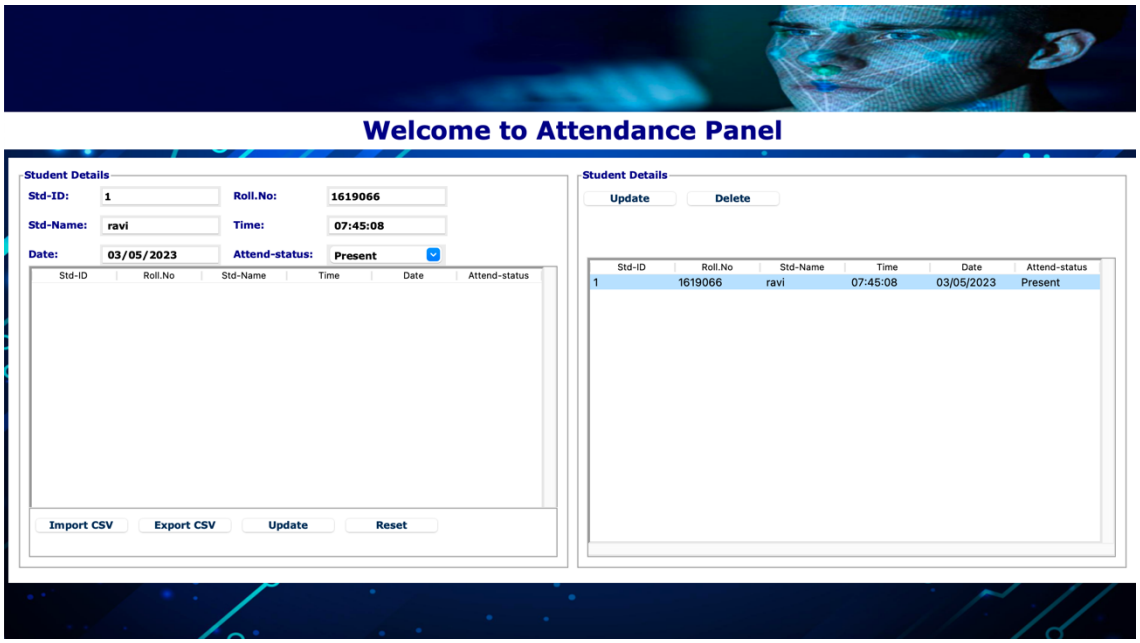


Figure 14 Teacher Interface

Figure 14 shows the teacher interface after the teacher has logged into the system. Here teacher can see the previous attendance record of the students. The teacher can also take new attendance of the students. The teacher can see the student information and their attendance report.

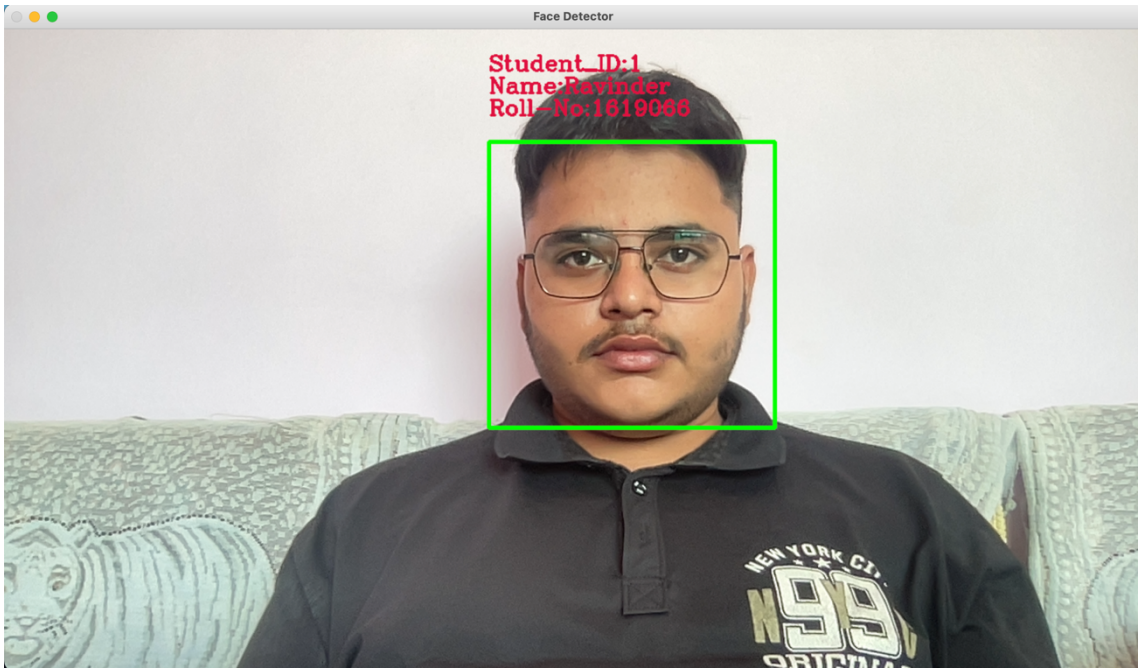
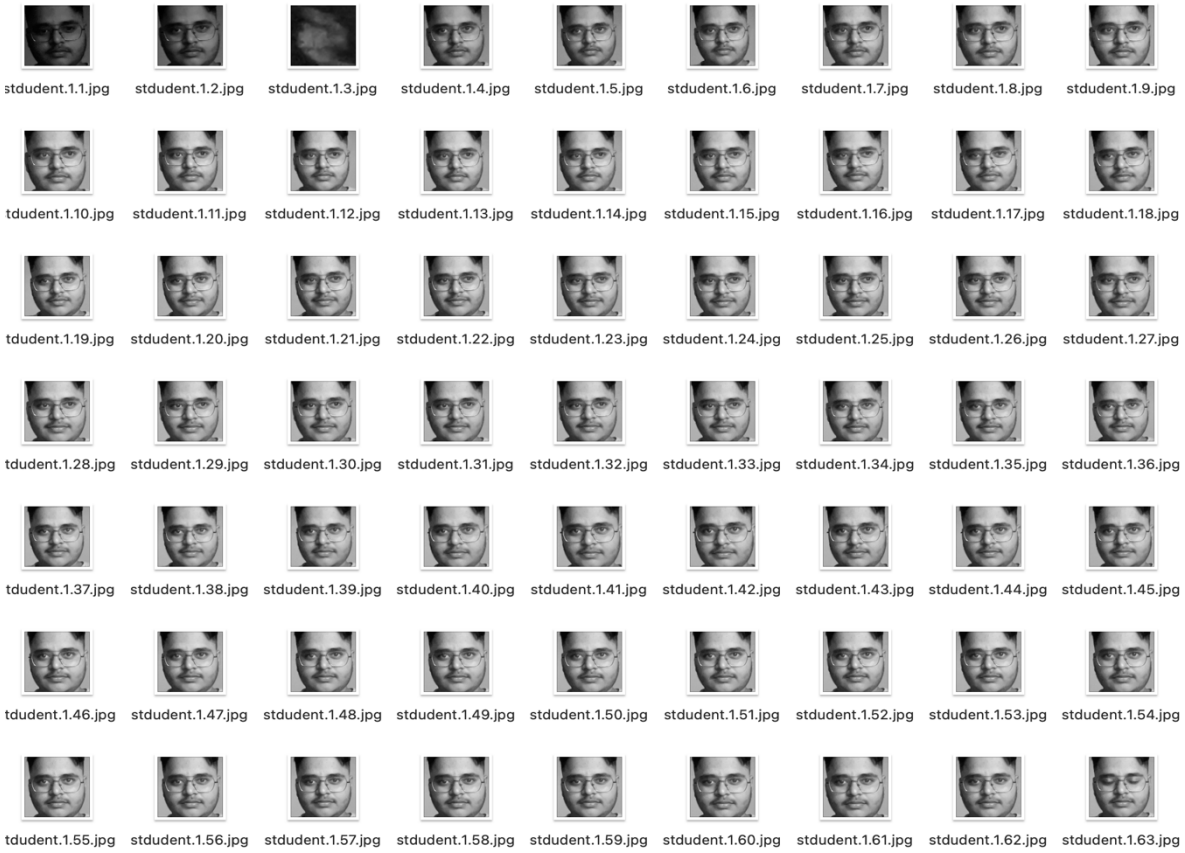


Figure 15 Face Scan.

Figure 15 shows the camera windows when taking new attendance. When the teacher takes new attendance, the camera windows open to scan the face. Once the camera detects the face, it covers the face with a blue square. Once the face has been scanned, it is compared with the images stored in the dataset. If it matches with the images in the dataset, it marks the students as present. The student report can be seen on the teacher's main page as shown in figure 14.

Dataset



Dataset Trainer

```python
def train_classifier(self):
    data_dir=("data_img")
    path=[os.path.join(data_dir,file) for file in os.listdir(data_dir)]

    faces=[]
    ids=[]

    for image in path:
        img=Image.open(image).convert('L') # conver in gray scale
        imageNp = np.array(img,'uint8')
        id=int(os.path.split(image)[1].split('.')[1])

        faces.append(imageNp)
        ids.append(id)

        cv2.imshow("Training",imageNp)
        cv2.waitKey(1)==13

    ids=np.array(ids)

    #================Train Classifier============
    clf= cv2.face.LBPHFaceRecognizer_create()
    clf.train(faces,ids)
    clf.write("clf.xml")

    cv2.destroyAllWindows()
    messagebox.showinfo("Result","Training Dataset Completed!",parent=self.root)
```

Detector

```python
#================face recognition==================
def face_recog(self):
    def draw_boundray(img,classifier,scaleFactor,minNeighbors,color,text,clf):
        gray_image=cv2.cvtColor(img,cv2.COLOR_BGR2GRAY)
        featuers=classifier.detectMultiScale(gray_image,scaleFactor,minNeighbors)

        coord=[]

        for (x,y,w,h) in featuers:
            cv2.rectangle(img,(x,y),(x+w,y+h),(0,255,0),3)
            id,predict=clf.predict(gray_image[y:y+h,x:x+w])

            confidence=int((100*(1-predict/300)))

            conn = mysql.connector.connect(username='root', password='vrma@2001',host='localhost',database='face_recognizer',port=3306)
            cursor = conn.cursor()

            cursor.execute("select Name from student where Student_ID="+str(id))
            n=cursor.fetchone()
            # print(n)
            n="+".join(n)

            cursor.execute("select Roll_No from student where Student_ID="+str(id))
            r=cursor.fetchone()
            r="+".join(r)

            cursor.execute("select Student_ID from student where Student_ID="+str(id))
            i=cursor.fetchone()
            i="+".join(i)


            if confidence > 77:
                cv2.putText(img,f"Student_ID:{i}",(x,y-80),cv2.FONT_HERSHEY_COMPLEX,0.8,(64,15,223),2)
                cv2.putText(img,f"Name:{n}",(x,y-55),cv2.FONT_HERSHEY_COMPLEX,0.8,(64,15,223),2)
                cv2.putText(img,f"Roll-No:{r}",(x,y-30),cv2.FONT_HERSHEY_COMPLEX,0.8,(64,15,223),2)
                self.mark_attendance(i,r,n)
            else:
                cv2.rectangle(img,(x,y),(x+w,y+h),(0,0,255),3)
                cv2.putText(img,"Unknown Face",(x,y-5),cv2.FONT_HERSHEY_COMPLEX,0.8,(255,255,0),3)

            coord=[x,y,w,y]

        return coord


    #==========
    def recognize(img,clf,faceCascade):
        coord=draw_boundray(img,faceCascade,1.1,10,(255,25,255),"Face",clf)
        return img

    faceCascade=cv2.CascadeClassifier("haarcascade_frontalface_default.xml")
    clf=cv2.face.LBPHFaceRecognizer_create()
    clf.read("clf.xml")

    videoCap=cv2.VideoCapture(0)

    while True:
        ret,img=videoCap.read()
        img=recognize(img,clf,faceCascade)
        cv2.imshow("Face Detector",img)

        if cv2.waitKey(1) == 13:
            break
    videoCap.release()
    cv2.destroyAllWindows()
```

Chapter 5
Result and Discussion

As this was a small-scale project, data structure and implementation did not have many problems. However, it took the author many effort with research and study with different technologies needed as these tools and technologies were new to the author. This caused a delay in the development of the project. Despite the delay and difficulties, the author was able to incorporate those tools and technologies and complete the project. However, the success rate of facial recognition was not as expected. The success rate depended upon the quality of the camera, lighting, and sufficient dataset in the database. When these factors were to be managed properly, the success rate of face recognition increased.

The effort that went to learn and research about LBPH and Django and other tools and technologies was worth it. While the process of researching and implementing was overwhelming, it started to be interesting as the project started to show some results. This project gave the author first-hand experience in working on a project using Python and found Python easier and more scalable.

Chapter 6
Conclusion

The goal of the project was to build a facial recognition system for student's attendance. Concepts of facial recognition and LBPH is heavily discussed in this thesis. Similarly, web development with Django is also discussed, followed by examples of implementation and explanations.

The result of the project was a successful prototype of a facial recognition system where the admin can create a teacher account and add students and their information to the database. Teachers then can log in to the system and take attendance of the student. The student's face is detected by a camera and attendance is recorded in the database. Teachers and admin could see the attendance report of the students.

Overall, the project was successful in its showcasing how LBPH can be implemented in Django to create a web application. Once implemented, it can be used to take attendance of students and keep track of their attendance records. This project has the potential for further development in the future by adding more features for students and teachers. More features such as assignments, results, and grades could be added.

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