A2: Project Report

Facial Recognition Based Attendance System

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Date of submission: April 27th, 2022

Declaration Sheet

Award Title: ***BSc(Hons) Computer Science***

(Award Title for your project, if in doubt refer to your course/Module Registration)

Declaration Sheet

(Presented in partial fulfillment of the assessment requirements for the above award.)

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Date: 28th March. 2022

Abstract

This project comprises constructing an attendance system that employs facial recognition to track attendees' presence. It covers face detection, alignment, and identification, as well as the creation and implementation of a web application to support the many use cases of the system, such as new attendees' registration, photo addition to the training dataset, viewing attendance records, and so on. This study highlights the libraries and machine learning based models and algorithms that have been deployed for facial detection and recognition. The report also includes chapters discussing project planning, methodology adapted and constraints. This project intends to give a cost-effective alternative to existing manual attendance methods. It may be applied in areas like corporate offices, schools, and companies where security and privacy are a necessary.

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1. Introduction

1.1 Project Briefing

Face hold significant importance in representing identity of a person. Every individual's face has a particular physical form and traits that can be used to identify them. Human recognition and communication rely greatly on facial appearance. The face is crucial for a person's identity.

I have proposed and developed a Facial Recognition based Attendance System. A facial recognition-based attendance system is a system that can match a human face and its features from a digital image or a frame of a video comparing it with a database of faces. (Team YoungWonks, 2021) It works by locating and measuring face features from a given image, such as eyes, to uniquely identify individuals. Face recognition can be quite effective in terms of real-life applications.

1.1.1 Initial Research into sources of information

History of Face Recognition System

The work on Face recognition was first done in the 1960s. Some developers built a computing device that could detect faces of a human. The facial traits in the image had to be manually selected by a human beforehand they were processed by the device for successful recognition. The ratio of distance between located features were calculated and compared. (Nilsson, 2009)

The experiments moved on to be complex and other traits such as hair color, moustache or lip thickness were utilized as a reference to recognize faces during 1970s. In 1988, Kirby and Sirovich made use of linear algebra and presented Principal Component Analysis for face recognition. In 1990s, the automatic facial recognition was slowly on the increase towards business sector. Early 2000s gave rise to government and law enforcement departments adopting facial recognition for official and investigation responsibilities. In 2006, Face Recognition Grand Challenge was held to test the available algorithms for face recognition. The event determined that the current algorithms were up to 10 times accurate than the algorithms used during 2002 and 100 times more accurate than methods that prevailed in 1995. (Duval, 2012)

Importance

Applications that utilize facial recognition technologies can be found everywhere today. They are present in security, authentication, verification and surveillance systems. We are dealing with face recognition technologies throughout our daily life. Many workspaces are utilizing facial recognition systems for security and keeping track of attendances. In today's world there are uncountable uses of this system. Many countries have deployed facial recognition systems in diverse public venues such as hotels, restaurants, cafes, shopping malls, industrial areas, and factories. Globally renowned company, Alibaba is working towards the development of technology which involves payment by the buyer's face. Industries and academic institutions are successfully implemented biometric technology to capture worktime and keep track of the

employees and students. Police and peace keeping organizations have installed cameras with facial recognition systems in sensitive or heavily crowded areas to identify criminals and seek for missing belongings or a person. As the modern technology and algorithms keeps developing at a very fast pace, it is very much certain that we will be able to observe it being utilized more and more soon.

Challenges

A facial recognition technology has the capability to alter the way governments and large corporations engage with their populations. However, there are possible difficulties with this technology if it is not handled appropriately. The potential of personal and sensitive data being exploited is significant. Before using this technology, businesses and organizations must ensure that proper checks and balances are in place, as well as adequate security. When this technology scan and detect a person's face, his/her unique biometrics are encrypted and stored. The sensitive Information can be breached, hacked, and misused without the approval of the person, depending on database owners and the security mechanisms which are present to preserve it. Facial recognition software is not without problems. The algorithms are taught using data obtained by people. The system may misidentify the individual if there is a shortage of data and a large amount of data to train the algorithms. Many times, the system has misinterpreted the gender or failed to identify of people with darker skins, which has raised many ethical concerns as the machine is not doing it intentionally and it can only detect faces based on dataset it has been fed. This occurred owing to lack of data that represented a wide range of people. (Andrejevic & Selwyn, 2020)

With the emergence of newer and modern technologies, a new form of crime has evolved. By breaching into the database, hackers can gain unauthorized access to the sensitive facial data and track the victim's activities, info, and location without their consent. If this technology falls into wrong hands, it may result in devastating nature of crimes. To commit a crime, they might replicate and misuse essential personal information or a person's identity like using fake facial data to carry out bank transactions. The application of the face recognition technology has a lot of potential. However, it must be handled very carefully. Businesses who intend to deploy this technology should build up the right framework and take proper procedures to secure their consumers data. (Andrejevic & Selwyn, 2020)

1.2 Overall working, problem domain and system as a solution

1.2.1 Problem Domain

Maintaining attendance is very essential in every institute and organization. Most of the organization utilizes traditional method of paper based or semi-automatic approach. The traditional approach of student is manual and time consuming. It might be effective for attendance of limited/small number of attendees. But handling and tracking attendance of large mass of people is very tedious and prone to manual errors.

Comparison of biometric technologies

Biometric Technology	Accuracy	Cost	Tools Required	Disadvantages
Facial recognition	Moderate	Moderate	Camera/ Image Capture device	Privacy invasion
Voice recognition	Moderate	Moderate	Mic/Audio Capture device	Less accurate than another tech
Fingerprint scanning	High	Moderate	Biometric Scanner	Time consuming
RFID Card System	High	Minimal	Card Scanner	Fraudulent usage/ Time consuming

1.2.2 System as a solution

The developed system is an automatic and dependable system that utilizes facial recognition technology in real time while considering different factors such as time consumed, background, illumination, poses, and expressions with fast computation and high accuracy. The system will also be secure and is able to effectively maintain users' privacy and it involves their sensitive (personal and facial) data.

The primary goal of the facial recognition-based attendance system is to biometrically identify all the attendees present in the designated location with the help of camera or similar optical device by detecting and recognizing the faces and store the attendance record updating the corresponding data in the database. The proposed automated system will be very much dependable and secure the old attendance methods or systems.

1.3 AI

1.3.1 Computer Vision

Every image contains a set amount of pixels. Pixels are of an image, what cells are of the living organism. There is no smaller entity than pixel in digital image. An image with a resolution of 1080 × 1080 (1080 rows and columns) comprises 1166400 pixels. Grayscale images contain pixel with value between 0 (stands for black) to 255(stands for white), whereas colored images are represented with RGB color space with one value for every red, green, and blue component respectively. To conduct out calculations among these pixels is the basis of digital picture processing.

So, to properly process and compute vast number of image-based calculations, OpenCV (Open-Source Computer Vision Library) is applied. OpenCV is a library of programming functions particularly geared towards real-time computer vision. The library contains 2500+ optimized algorithms, that includes a complete set of both traditional and modern computer vision & machine learning techniques. OpenCV has greater than 47 thousand developers in their user community and estimated number of downloads exceeds 18 million.

1.3.2 Based on supervised learning

The AI model we are using for facial recognition and detection is based on supervised learning method. Basically, huge number of facial images datasets are fed to the machine learning model to properly detect facial landmarks and features.

1.3.3. Mathematics behind AI and description of AI models

- Viola Jones Algorithm

Viola Jones Algorithm was developed by Paul Viola and Michael Jones in 2001.It is the very widely used algorithm that can be utilized to extract facial landmarks and features from static video/image files. Viola-Jones Algorithm consist of four processes.

1) Selection of Haar Features
2) Creation of integral image
3) Implementation of Adaboost
4) Cascaded Classifiers

Initially, the algorithm will require a lot of images with and without human faces to train the model. Then, the facial features are separated from it with the help of Haar feature selection. Each feature will result in a single value by subtracting total white pixels from total black pixels.

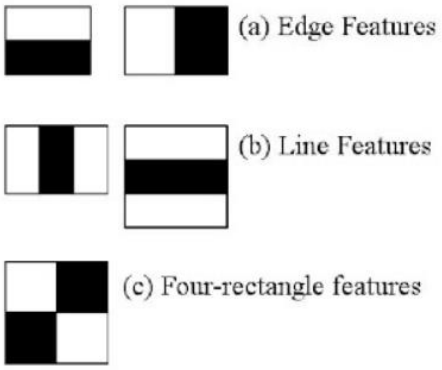
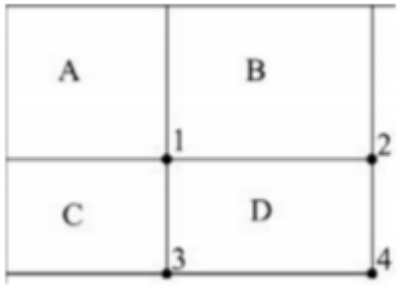


Figure 1: Haar Feature Selection (doxygen, 2021)

Very large number of computations is required as for calculating each features, we need to calculate sum of pixels with black and white rectangles. For solving this problem of huge computation, integral image is used. Even if the operation involves very large the number of pixels, the integral images simplify operation by just involving four pixels.



In the above given image, the integral image's value at location 1 is sum of pixels in rectangle A. Value of image at point 2 is sum of pixels in (A+B). Similarly, location 3 pixel is sum of (A+C) and location 4 is (A+B+C+D). Therefore, pixels in region D can be estimated by: - 4 + 1 – (2 + 3).

Most of the features extracted till now, will be irrelevant. Adaboost or Adaptive boosting is used which combines numerous weak classifiers into a strong single classifier. Every feature is tested on training images. After each classification, weight is distributed among each classifier based on previous results until significant result is achieved.

Cascade of Classifiers, utilizes, the features divided into numerous classifiers and is applied one by one. If the classifier fails, it is ignored and if it succeeds, second cascade of features is tested on it. The window which successfully goes through all the stages results in detection of a face region. (OpenCV, 2014)

- Preprocessing

Preprocessing improves the system's performance. It assists in helping the accuracy of face recognition. Scaling is an integral part of preprocessing. It increases the processing speed by reducing the number of pixels involved resulting in reduced computations required. Colored images are converted into grayscale during preprocessing. Grayscale images are less prone to error during low lighting conditions and take very less computation period, Grayscale images are 8-bit images with pixel of values 0 to 255. Colored images require 24-bit image with 16777216 values. Contrast of images also can be improved using histogram equalization during preprocessing. It enables us to uniformly distribute light intensities.\

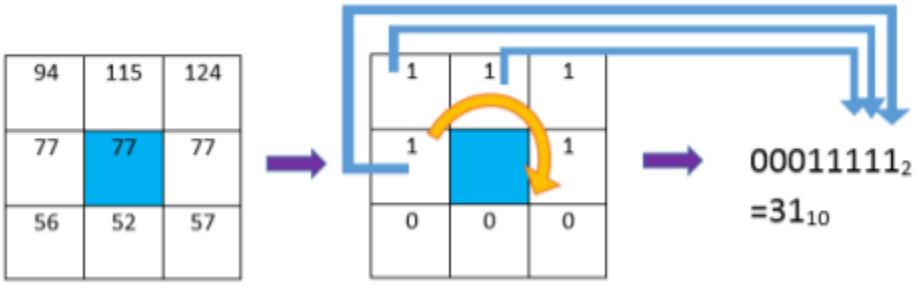
- Feature Extraction

  Working Principle of LBP:

LBP is a visual/texture descriptor. LBP operates on a 3*3 matrix. The matrix contains 9 pixels. Center pixel is utilized as a reference to covert the neighboring pixels into bytes. If the neighbor pixel's value is greater than the value of central pixel, its value is kept as 1. Else, it is assigned 0. Then, the neighboring pixel bits are concatenated to form a byte value which is a representation of Central pixel.

$$LBP = \sum_{0}^{7} f(Pn - Pc).2^n$$

where Pc is the central pixel and Pn (n = 0,1, 2...7) are its neighboring pixels.



The block values so obtained are converted to a histogram. Finally, these block histograms are \concatenated to form one feature vector for one image.

(HOG) Histogram of Oriented Gradients detector

HOG is a descriptor utilized in computer vision for the detection of objects. It works on the concept of finding gradients along the x and y-axis. These gradients are added vectorially and information such as gradients' direction, magnitude. extracted forming edges in the image. Now the whole gradient image is divided into 8*8- dimension matrix i.e., carrying 64 gradient vectors. Each matrix contains 9 bins, and each bin has a range of 40 degrees to allocate the gradient vector lying in that range. After each gradient vector has been allocated a bin, a histogram of this matrix is formed which determines the overall direction and magnitude of the gradient.

Luminosity plays a great role in the proper detection of gradients. To overcome this failure the value of the histogram is obtained in the red, green, and blue frame and then normalized making it lighting invariant. Finally, the normalized histogram is compared with its default histogram for faces to identify a face in an image.

1.4 Aims

- Deliver a beneficial attendance system
- Deliver an automated and dependable attendance system that employs face recognition to reduce manual errors.
- Reduce the time wasting during traditional attendance methods

1.5 Objectives

- Make use of most recent advances in computer vision to provide a feasible solution as an simple and effective automated attendance system
- Automate the entire attendance process to create a digital environment
- Promote the use of modern day computer technology in our real world day-to-day life.

Artefact

1.5.1 FDD

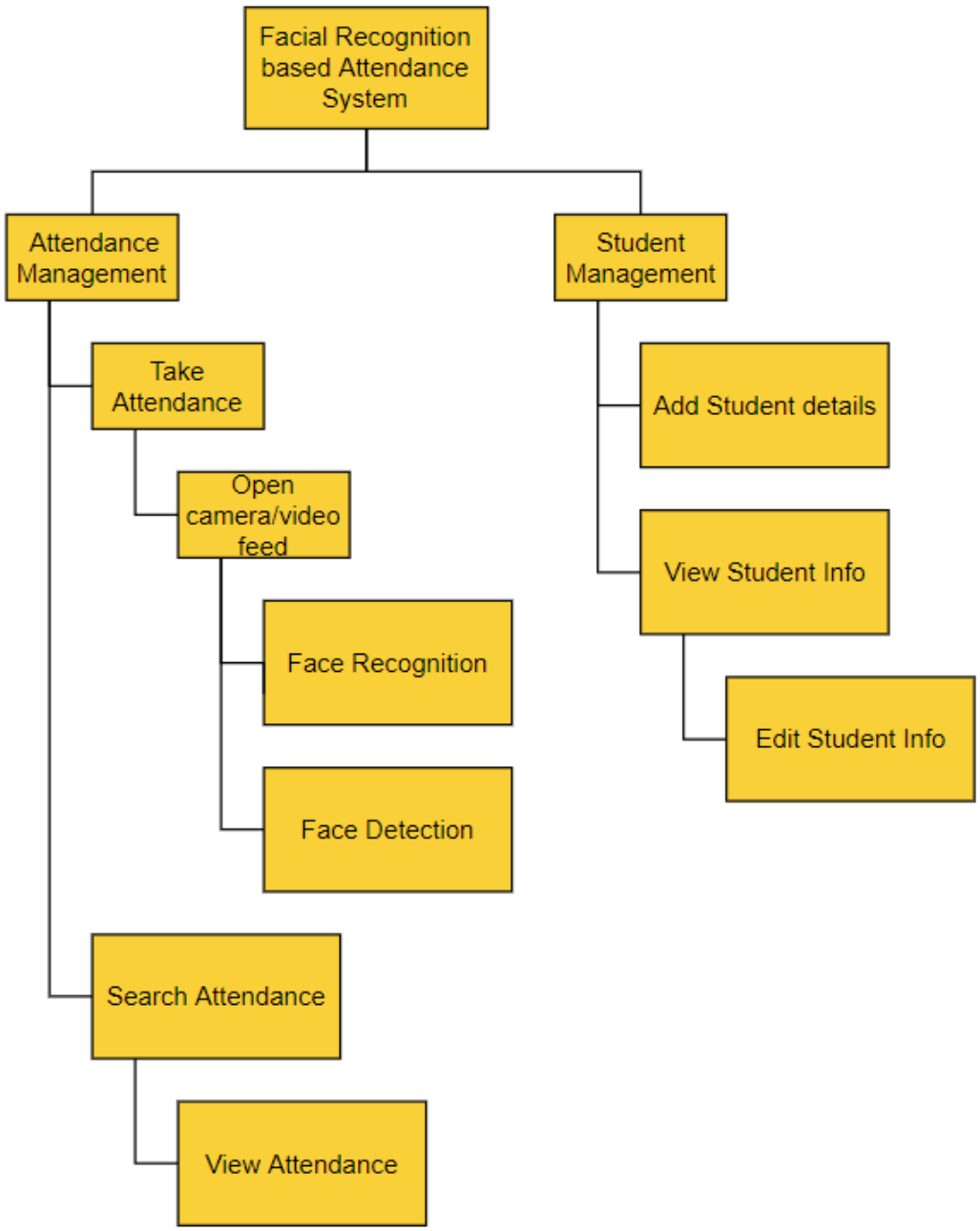


Figure 2: Functional Decomposition Diagram

1.5.2 Explain system as a whole

Facial Recognition Based Attendance System is a web application which is capable of carrying out automated attendance tasks based on trained images. The system is able to detect and recognize faces from a live video feed and track attendance of students/attendees.

1.5.3 Explain each sub systems

a) Attendance Management System

This system involves keeping track of attendance as well as searching and viewing the attendance records. Taking attendances utilizes the facial detection and recognition module. These modules detect faces from the trained database and carry out the attendance process automatically.

b) Student Management System

This subsystem keeps track of student's info. Admin/Faculty Member should be able to add students' details such as their name, course and facial data. The subsystem also enables faculty to view and edit student data.

1.5.4 Artefact Design

SRS

Sub-systems

1. AMS: Attendance Management System
   a) FDM: Face Detection Module
   b) FRM: Face Recognition Module
2. SMS: Student Management System

Types of Requirements

1. F: Functional
2. NF: Non-Functional
3. UR: Usability requirements

Attendance Management System (AMS)

Req. Code	Req. Description	MoSCoW prioritization
AMS-F-1.0	The system must be able to take attendance of the attendees.	Must Have
AMS-F-1.1	The system must enable faculty to view or alter the attendance record.	Must Have
AMS-F-1.2	The system should allow to search attendance records according to provided criteria.	Must Have
AMS-UR.1.3	The search functionalities like Date and Time picker should be user friendly.	Should Have

Face Detection Module (FDM)

Req. Code	Req. Description	MoSCoW prioritization
FDM-F-1.0	The module must be able to detect the facial features and landmarks present in the input images accurately.	Must Have
FDM-NF-1.1	Input images must be of required resolution.	Should Have
FDM-NF-1.2	Input images must be encoded/named properly in order to ensure successful recognition.	Must Have
FDM-UR.1.3	User should have easy access to insert their facial image as input in the system	Should Have

Face Recognition Module (FRM)

Req. Code	Req. Description	MoSCoW prioritization
FRM-F-1.0	The module must be able to access camera/webcam.	Must Have
FRM-F-1.1	The module must be able to detect faces from the live video feed by using Haar classifiers.	Must Have
FRM-F-1.2	The module must be able to recognize the faces and match them with data available in the database.	Must Have
FRM-UR-1.3	If the face/s is recognized, Attendees' Id no. is displayed in the live feed.	Should Have
FRM-NF-1.4	Proper conditions and lighting will help the face recognition process.	Should Have

Student Management System (SMS)

Req. Code	Req. Description	MoSCoW prioritization
SMS-F-1.0	The system must allow faculty to add new student records.	Must Have
SMS-F-1.1	The system must allow faculty member to upload student images.	Must Have
SMS-F-1.2	The system must allow to view student's academic and facial data.	Must Have
SMS-F-1.3	The system must allow to edit student's academic and facial data.	Must Have
SMS-NF-1.3	The system should protect the student's privacy who are being monitored with encryption to prevent data breach,	Must Have

Data Dictionary

Faculty

No	Field name	Data type	Required	Unique	PK / FK	Ref. Table
1	user	OnetoOne	true	true	PK	-
2	firstname	string	true	false	-	-
3	lastname	string	true	false	-	-
4	phone	string	true	false	-	-
5	email	string	true	false	-	-
6	profile_pic	Image	true	false	-	-

Student

No	Field name	Data type	Required	Unique	PK / FK	Ref. Table
1	reg_id	string	true	true	PK	-
2	firstname	string	true	false	-	-
3	lastname	string	true	false	-	-
4	branch	string	true	false	-	-
5	year	string	true	false	-	-
6	section	string	True	false		
7	profile_pic	Image	true	false	-	-

Attendance

No	Field name	Data type	Required	Unique	PK / FK	Ref. Table
1	Faculty_Name	string	true	true	-	-

2	Student_ID	string	true	false	FK	-
3	date	Date	true	false	-	-
4	time	Time	true	false	-	-
5	branch	string	true	false	-	-
6	year					
7	section	string	True	false		
8	period	Image	true	false	-	-
9	status					

1.5.5 Design Diagrams

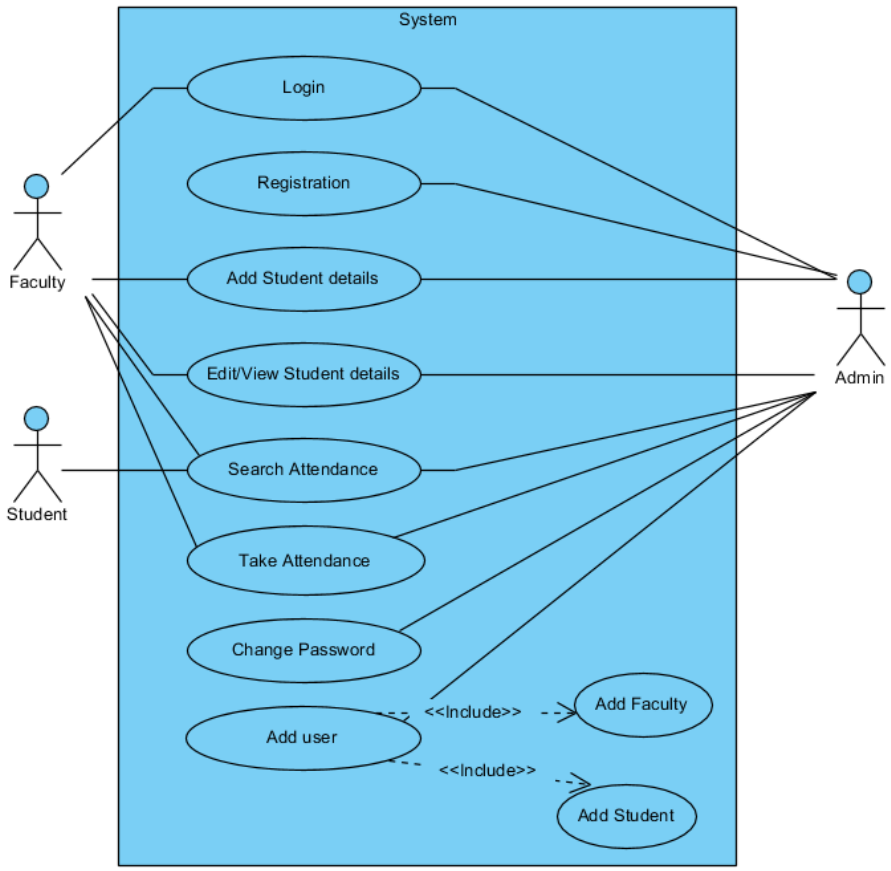


Figure 3: Use Case Diagram

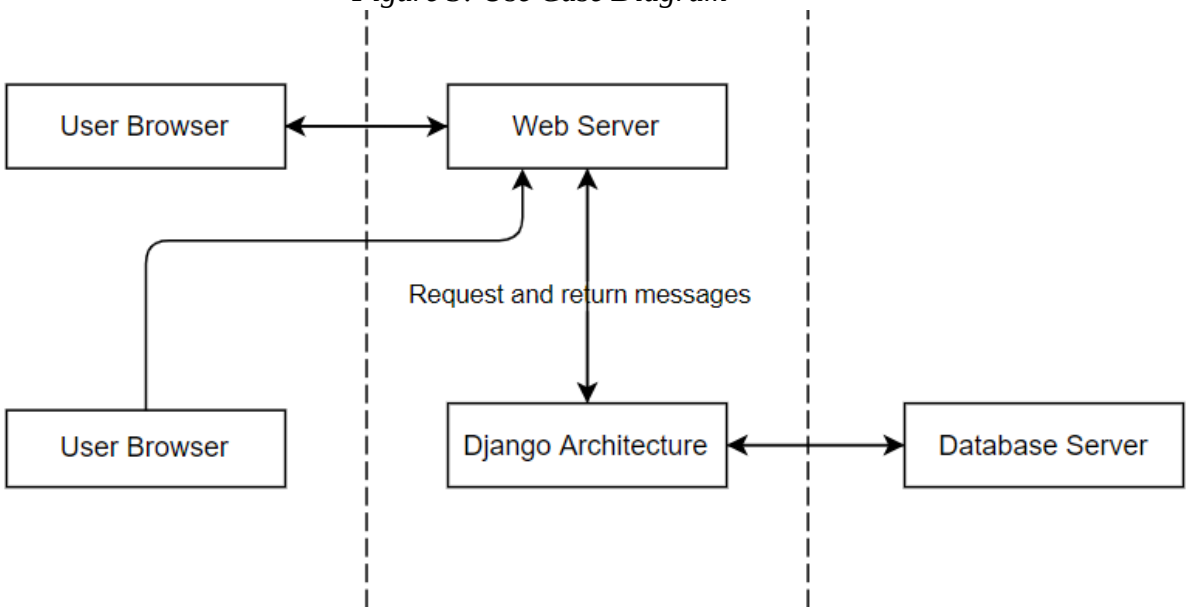


Figure 4:- Flowchart of Functional Structure of the System

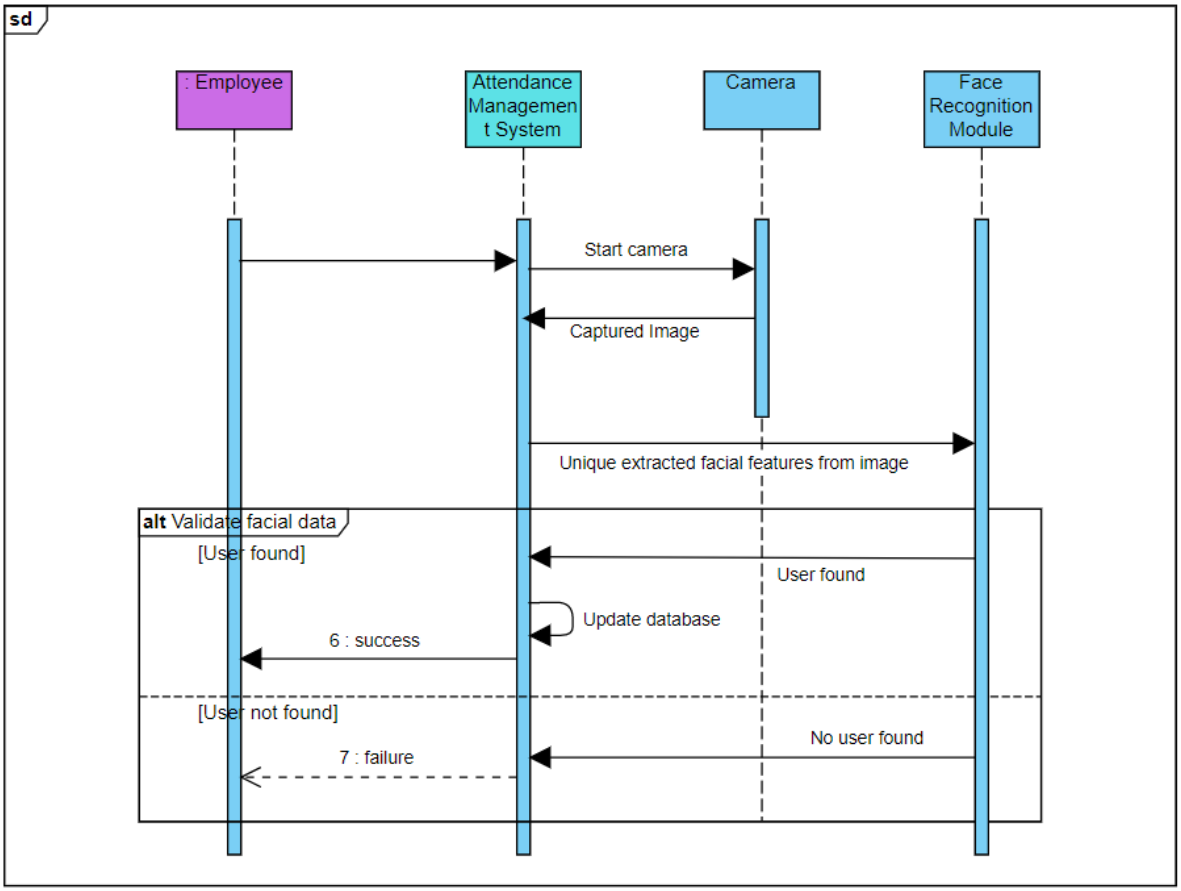


Figure 5: Sequence Diagram

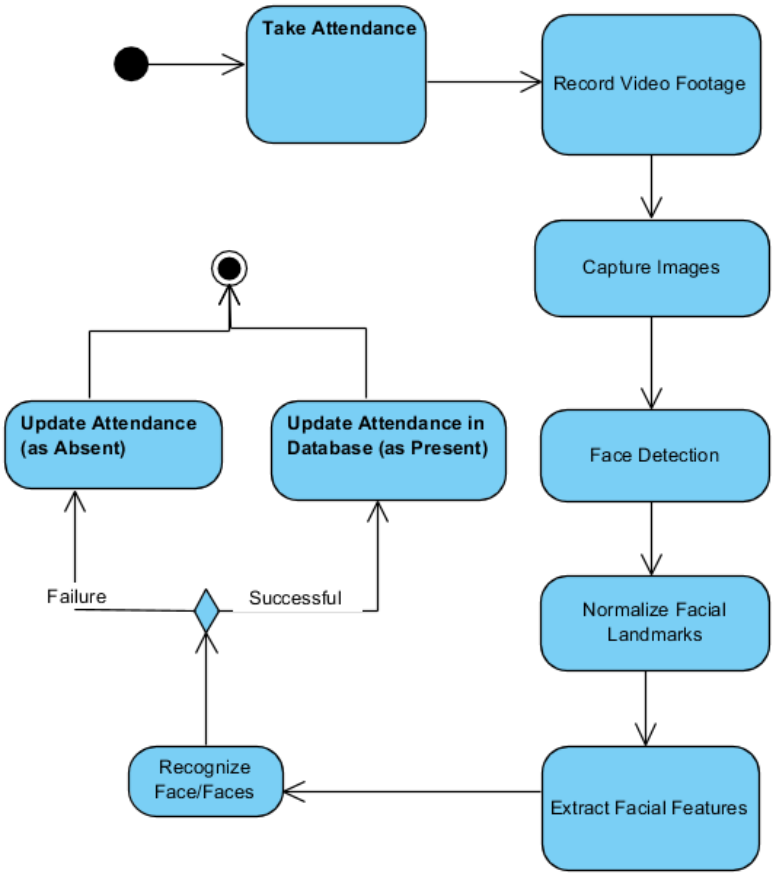


Figure 6: Attendance Activity Diagram

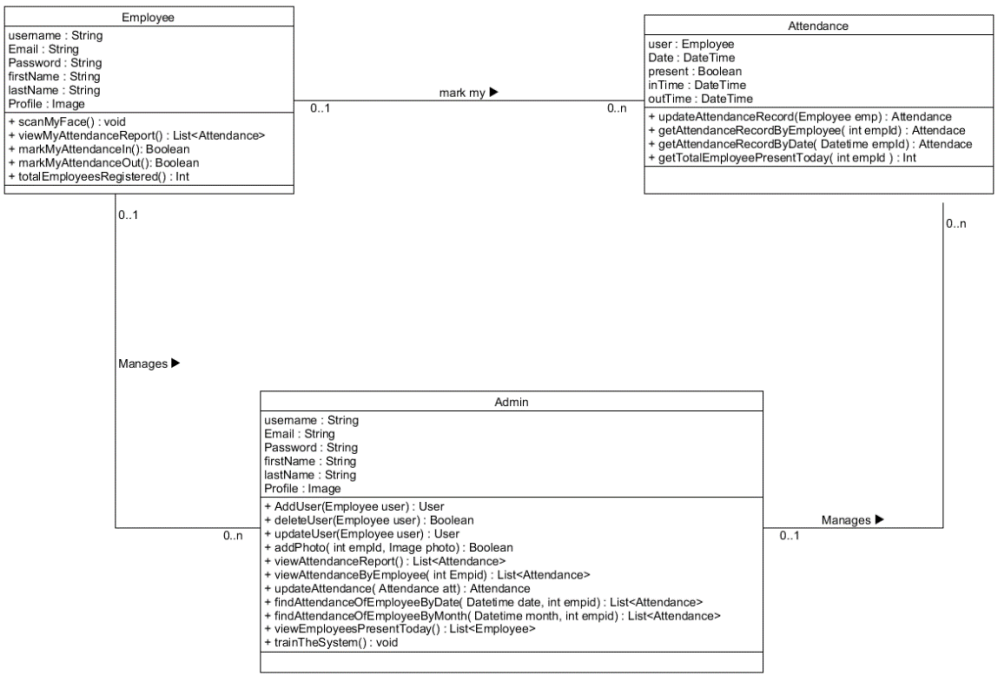


Figure 7: Class Diagram

Purpose

It is meant for possible future developers and testers that might work on the project. This plan document will summarize:

• how the system will function

• scope of the project from developer's standpoint

• the technologies utilized to build the project, and

• the methods and methodologies used to keep track of progress of the project

Intended audience

The targeted readers of this document are prospective developers working on the project and testers who need to evaluate whether the product satisfies the user's requirements and is bug-free.

Development Responsibility

I, Ankit Tamrakar, would be developing the software and I will be responsible for all the coding for the application, database development, and management of deployment and releases

Overall Description

Maintaining and tracking attendance is required task in every institute and organization. Most of the organization utilizes traditional method of paper based or semi-automatic approach. The traditional approach of student is manual and time consuming. It might be effective for attendance of limited/small number of attendees. But handling and tracking attendance of large mass of people is very tedious and prone to manual errors.

Traditional methods of attendance that requires manual labor and has high chance of error are not very reliable and time consuming. This project aims to deliver an automatic attendance system that uses face detection and recognition to swiftly carry out the attendance process.

End User

The target of the system will be organizations involving large number of peoples whose attendance need to be kept. Target end users include offices, companies, factories and educational institutions like schools, colleges, and universities.

System Features and Requirements

Functional requirements

- Must use facial recognition to take and track attendance in real time.
- Must allow authorized users to login to view/modify the attendance data.

System Features

The proposed system will consist of Face detection and recognition algorithms which integrates into an automated attendance system. A camera will capture image or video, which will be stored in the database. Proposed Viola Jones Algorithm will be implemented, and the feature extraction is done in the image. The extracted cropped faces are then differentiated to the saved facial images present in the database, and if the face is matched and successfully recognized, the database is updated with attendance record, a web page is generated, and the files and the process will be visible in the GUI.

This process will involve 5 different steps which are as follows: -

1) Gathering of training data

System is first trained, cropped, and preprocessed photos are saved to a database and they are then identified and recognized. The data will also be utilized to compare the known facial features inside images across all uploaded files and attendance will be monitored accordingly.

2) Capturing of live video/ image

The video or picture is recorded with the help of a camera device, and the captured frame will be saved to the image database.

3) Face Detection

Face detection is conducted on the image file saved to the database utilizing the Haar cascade classifier. The frames will be screened for detection of faces, and the detected frames will be cropped and will undergo recognition process.

4) Face Recognition
The faces discovered are then matched with the database's trained images as per given threshold. This enables the discovered photographs to be identified.

5) Tracking Attendance
After the completion the Recognition process, the attendees that are recognized are searched up in the database and present status of the attendees is recorded.

Non-Functional requirements

- Precision/Accuracy: The system must be able to execute its operation precisely and accurately, without any errors or issues
- Security: The system must be secure and must encrypt the data to protect the privacy of the attendees involved.
- Usability: The system should be simple to operate and understand.
- Flexibility: The system should be easily adjustable, to easily remove any possible occurring bugs and errors.
- Maintainability: The debugging or maintenance person should be able to quickly solve any problems that might come up.
- Speed and Responsiveness: The system must be able to execute the process quickly.

Development of AI

Data collection

The facial data was taken from Labeled Faces in the Wild. URL: http://vis-www.cs.umass.edu/lfw/
It is an archived file containing folders of Images for each personality in the dataset.
Total of 5749 folders are present in the dataset.
It contains 100 images for each available sample. e.g., George W Bush: 100 images

Model development

Development of face detection model.

jupyter 1_object_detection_cascade_classifier Last Checkpoint: 03/27/2022 (unsaved changes) Logout

File Edit View Insert Cell Kernel Widgets Help Trusted Python 3 (ipykernel)

Run Code

```
In [4]: import numpy as np
        import cv2
```

Face Detection

```
In [5]: img = cv2.imread('./images.v1/0021.jpg')

        cv2.imshow('image',img)
        cv2.waitKey(0)
        cv2.destroyAllWindows()

In [6]: # load cascasde classifier - frontalface
        face_cascade = cv2.CascadeClassifier('./cascade_classifier/haarcasc

In [7]: # apply cascade classfier to an image
        faces, num_detection = face_cascade.detectMultiScale2(img)

In [8]: print(faces)
        [[114  40 196 196]]

In [9]: print(num_detection)
        [89]

In [*]: pt1 = (114,40)
        pt2 = (114+196, 40+196)
        # draw the rectangle
        cv2.rectangle(img,pt1,pt2,(0,255,0))
```

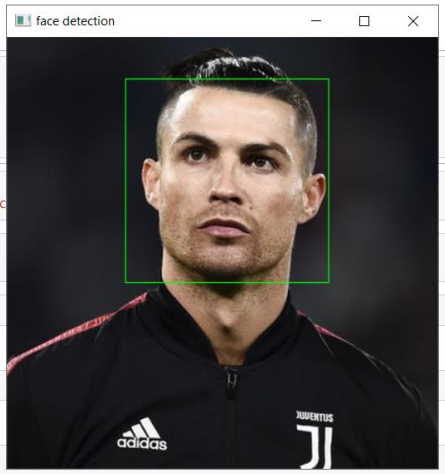


Figure 8: Multiple faces detection.

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Run Markdown

```
        cv2.waitKey(0)
        cv2.destroyAllWindows()
```

Multiple Face Detection

```
In [13]: img = cv2.imread('./images.v1/group_smile.jpg')

         cv2.imshow('image',img)
         cv2.waitKey(0)
         cv2.destroyAllWindows()

In [*]: face_cascade = cv2.CascadeClassifier('./cascade_class

        # step-1: apply cascade classifier to an image
        faces,num_detection = face_cascade.detectMultiScale2(
        # step-2: run a loop
        for x,y,w,h in faces:
            cv2.rectangle(img,(x,y),(x+w,y+h),(0,255,0))

        # step-3: display the image
        cv2.imshow('face detection',img)
        cv2.waitKey(0)
        cv2.destroyAllWindows()
```

Faces & Eyes Detection

```
In [18]: img = cv2.imread('./images/group_smile.jpg')

         cv2.imshow('image',img)
         cv2.waitKey(0)
```

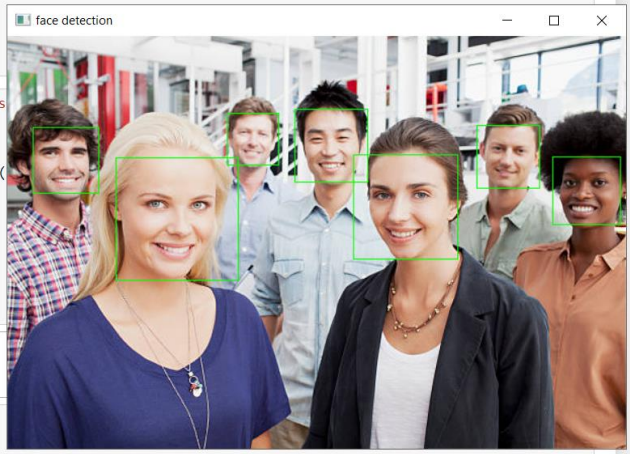


Figure 9: Facial features Detection

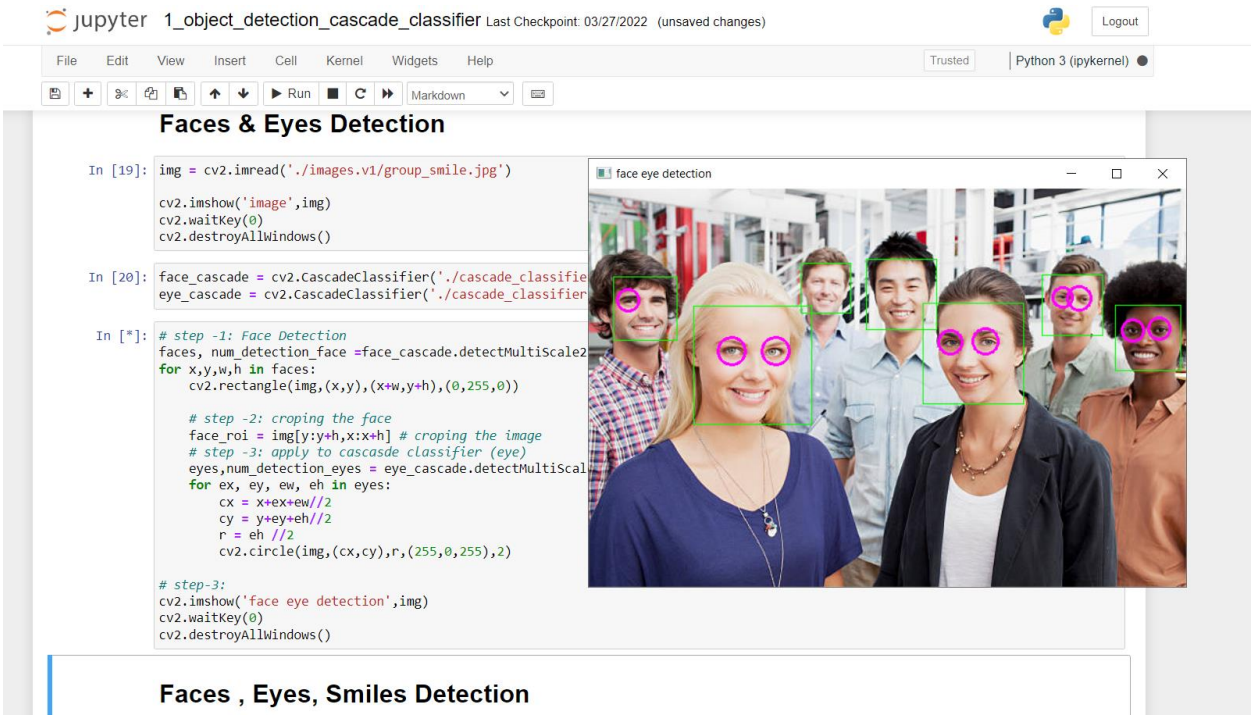
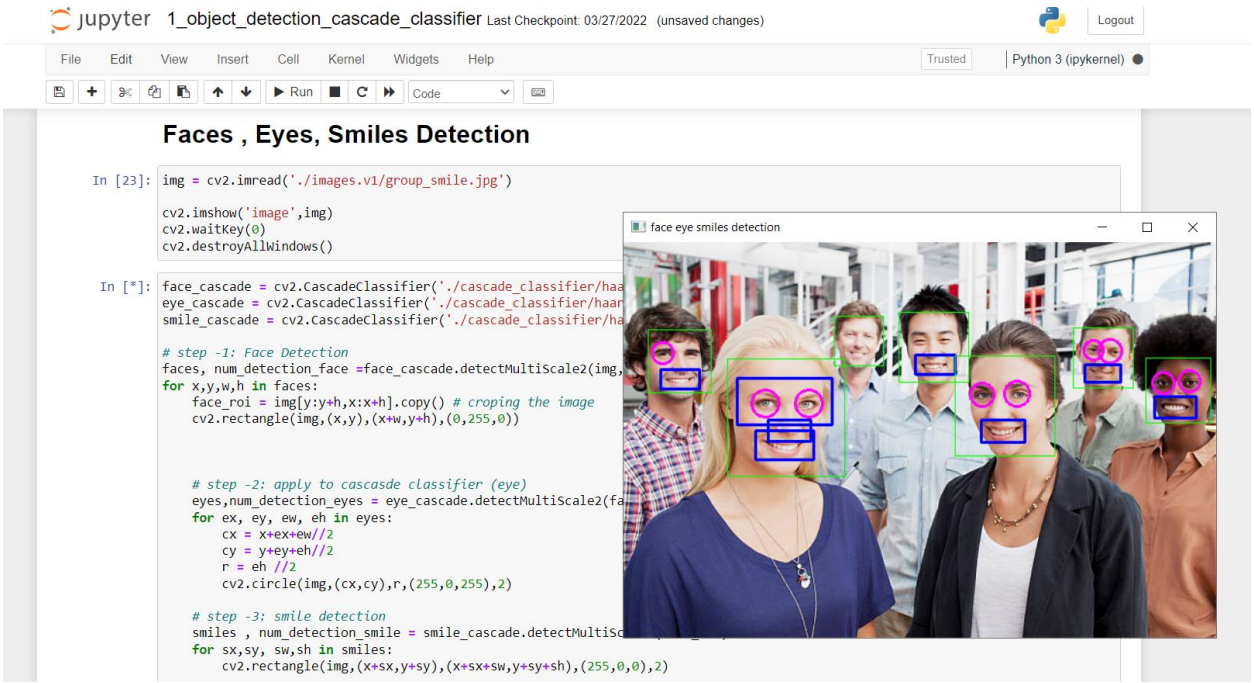


Figure 10: Facial Features Detection Part 2



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Logout

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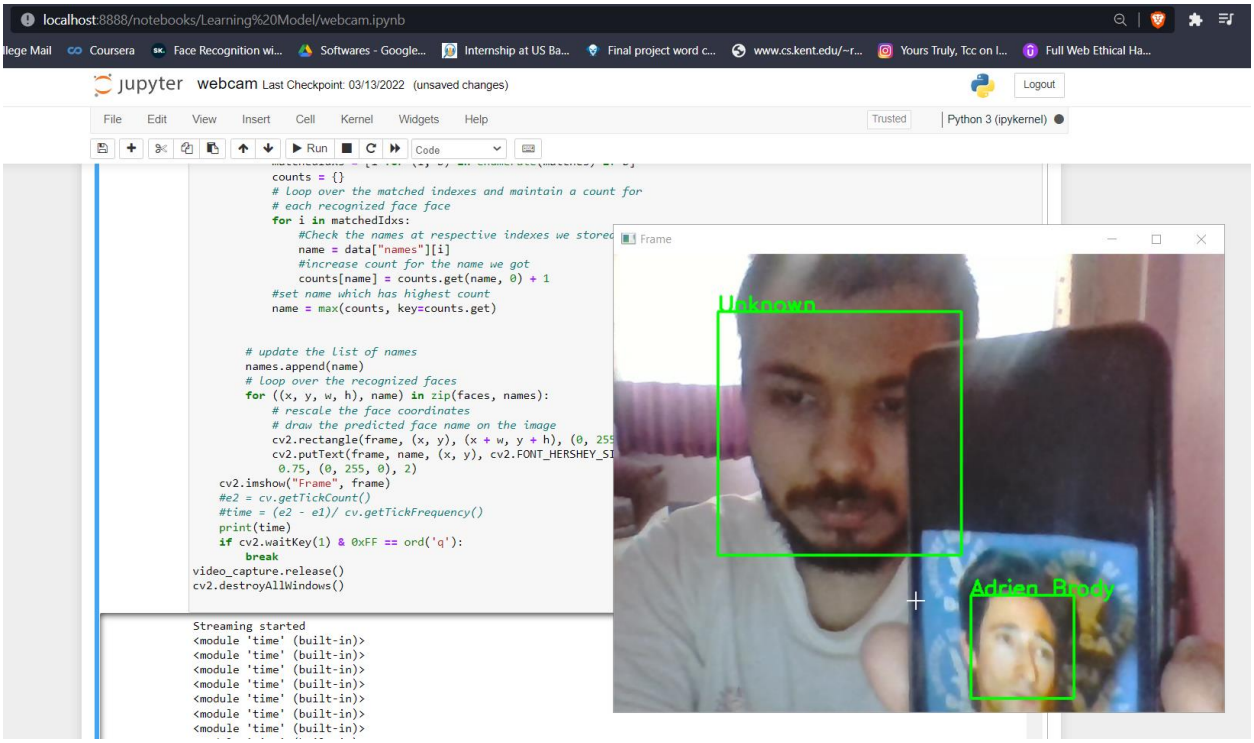
Not Trusted | Python 3 (ipykernel)

Run Code

In [1]:
```
import face_recognition
from imutils import paths
import pickle
import time
import cv2
import os

#get paths of each file in folder named Images
#Images here contains my data(folders of various persons)
imagePaths = list(paths.list_images('Images'))
knownEncodings = []
knownNames = []
# loop over the image paths
for (i, imagePath) in enumerate(imagePaths):
    # extract the person name from the image path
    name = imagePath.split(os.path.sep)[-2]
    # load the input image and convert it from BGR (OpenCV ordering)
    # to dlib ordering (RGB)
    image = cv2.imread(imagePath)
    rgb = cv2.cvtColor(image, cv2.COLOR_BGR2RGB)
    #Use Face_recognition to locate faces
    boxes = face_recognition.face_locations(rgb,model='hog')
    # compute the facial embedding for the face
    encodings = face_recognition.face_encodings(rgb, boxes)
    # loop over the encodings
    for encoding in encodings:
        knownEncodings.append(encoding)
        knownNames.append(name)
#save emcodings along with their names in dictionary data
data = {"encodings": knownEncodings, "names": knownNames}
#use pickle to save data into a file for later use
f = open("face_enc", "wb")
f.write(pickle.dumps(data))
f.close()
```

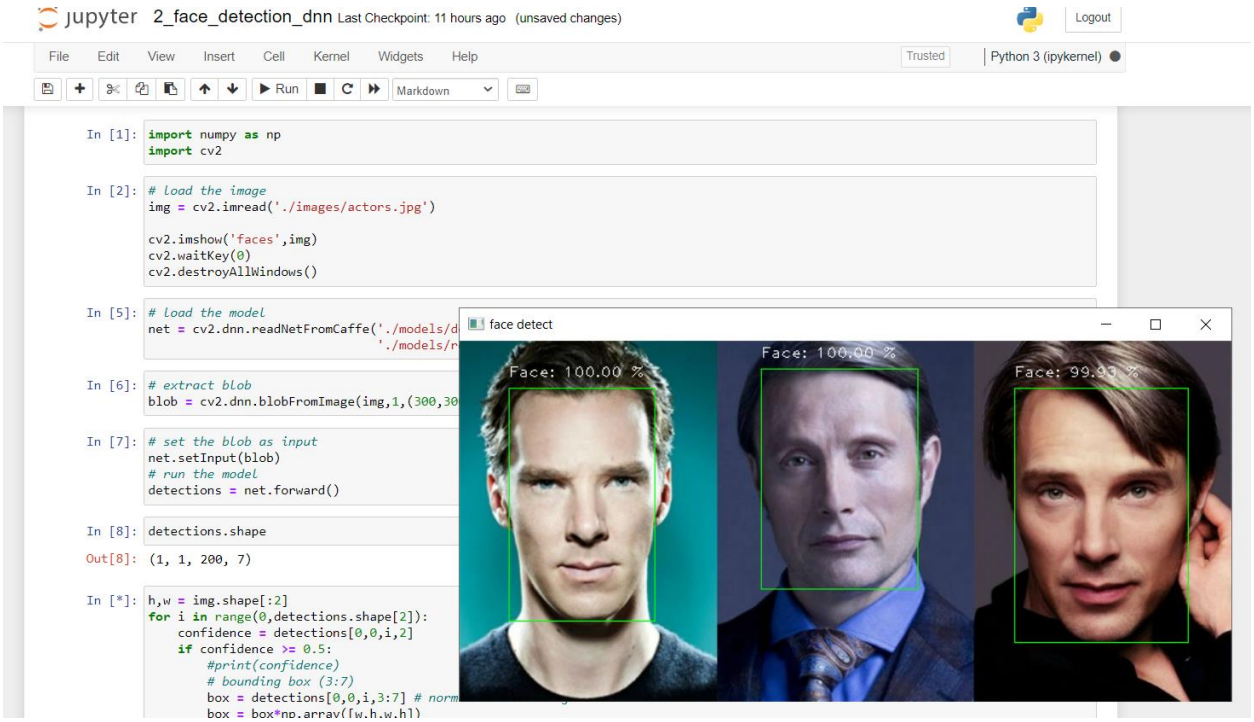


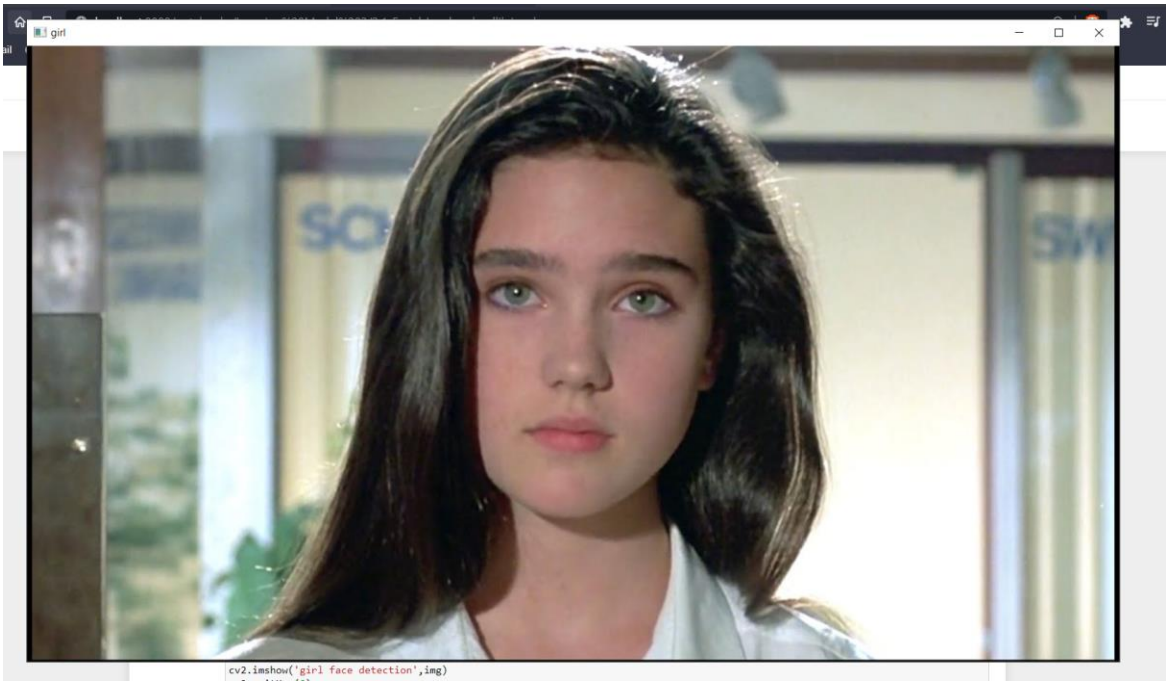
During the initial phase of model development, face recognition library was used which was dependent on dlib library. While later integrating the model with Django, it was discovered that dlib library was not compatible with Python versions and the author got multiple compiling errors. So, as an alternative to dlib, OpenCV DNN was utilized to build the face recognition model.

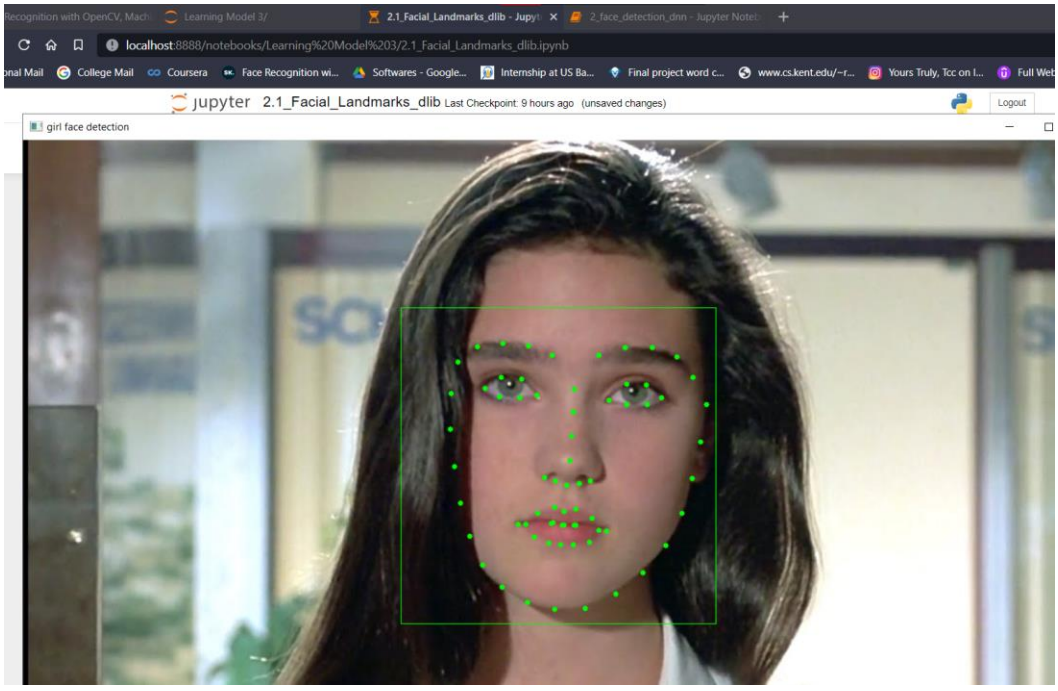
deploy.prototxt.txt	5/17/2021 3:10 PM	Text Document	28 KB
dlib_face_recognition_resnet_model_v1.dat	3/4/2018 10:44 PM	DAT File	21,940 KB
openface.nn4.small2.v1.t7	5/2/2021 8:25 PM	T7 File	30,773 KB
res10_300x300_ssd_iter_140000_fp16.caffemodel	5/17/2021 3:09 PM	CAFFEMODEL File	5,226 KB
shape_predictor_68_face_landmarks.dat	3/4/2018 10:48 PM	DAT File	97,358 KB
urls.txt	5/17/2021 3:13 PM	Text Document	1 KB

Single Shot MultiBox Detector (SSD) framework using a ResNet-10 network.
OpenCV DNN module:

- Caffe
- TensorFlow
- Torch
- Darknet




girl
cv2.imshow('girl face detection',img)


2.1_Facial_Landmarks_dlib - Jupyt
2_face_detection_dnn - Jupyter Noteb
localhost:8888/notebooks/Learning%20Model%203/2.1_Facial_Landmarks_dlib.ipynb
College Mail
Coursera
Face Recognition wi...
Softwares - Google...
Internship at US Ba...
Final project word c...
www.cs.kent.edu/~r...
Yours Truly, Tcc on l...
jupyter 2.1_Facial_Landmarks_dlib Last Checkpoint: 9 hours ago (unsaved changes)
Logout
girl face detection

Optimization Evaluation & Comparing algorithm performance

jupyter 3_data_preprocessing Last Checkpoint: 4 minutes ago (autosaved)

File Edit View Insert Cell Kernel Widgets Help

Run Code

apply helper function to all images and get face descriptors

In [8]:
```
data = dict(data=[],label=[])
```

In [12]:
```
folders = os.listdir('images')
for folder in folders:
    filenames = os.listdir('images/{}'.format(folder))
    for filename in filenames:
        try:

            vector = helper('./images/{}/{}'.format(folder,filename))
            if vector is not None:
                data['data'].append(vector)
                data['label'].append(folder)
                print('Feature Extracted Sucessfully')

        except:
            pass
```

```
Feature Extracted Sucessfully
Feature Extracted Sucessfully
Feature Extracted Sucessfully
Feature Extracted Sucessfully
Feature Extracted Sucessfully
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Feature Extracted Sucessfully
```

In [13]:
```
data.keys()
```

Out[13]:
```
dict_keys(['data', 'label'])
```

In [14]:
```
pd.Series(data['label']).value_counts()
```

Out[14]:
```
Robert Downey Jr      125
Barack Obama          122
Donald Trump          122
Scarlett Johansson    119
Elon Musk             117
Lionel Messi          114
Roger Federer         111
Cristiano Ronaldo     109
Leonardo DiCaprio     106
Angelina Jolie         99
Joe Biden              98
Tom Curise             96
dtype: int64
```

In [15]:
```
# save the data
pickle.dump(data,open('data_face_features.pickle',mode='wb'))
```

Figure 11: PreProcessing of the Available Data

1. Data

- Load data from pickle file
- split the data into independent and dependent
- split to train and test set

```
In [2]: data = pickle.load(open('data_face_features.pickle',mode='rb'))
```

```
In [4]: X = np.array(data['data']) # indendepent variable
        y = np.array(data['label']) # dependent variable
```

```
In [5]: X.shape , y.shape
Out[5]: ((1652, 1, 128), (1652,))
```

```
In [6]: X = X.reshape(-1,128)
        X.shape
Out[6]: (1652, 128)
```

```
In [7]: # split the data into train and test
        from sklearn.model_selection import train_test_split
```

```
In [8]: x_train,x_test,y_train,y_test = train_test_split(X,y,train_size=0.8,random_state=0)
```

```
In [9]: x_train.shape, x_test.shape, y_train.shape, y_test.shape
Out[9]: ((1321, 128), (331, 128), (1321,), (331,))
```

2. Train Machine Learning

```
In [10]: from sklearn.linear_model import LogisticRegression
         from sklearn.svm import SVC
         from sklearn.ensemble import RandomForestClassifier
         from sklearn.ensemble import VotingClassifier
         from sklearn.metrics import classification_report, accuracy_score, f1_score
```

Logistic Regression

```
In [11]: model_logistic = LogisticRegression()
```

Logistic Regression

```
In [11]: model_logistic = LogisticRegression()
         model_logistic.fit(x_train,y_train) # training logistic regression
Out[11]: LogisticRegression()
```

```
In [17]: def get_report(model, x_train,y_train,x_test,y_test):
             y_pred_train = model.predict(x_train)
             y_pred_test = model.predict(x_test)

             # accuracy score
             acc_train = accuracy_score(y_train,y_pred_train)
             acc_test = accuracy_score(y_test,y_pred_test)

             # f1 score
             f1_score_train = f1_score(y_train,y_pred_train,average='macro')
             f1_score_test = f1_score(y_test,y_pred_test,average='macro')


             print('Accuracy Train = %0.2f'%acc_train)
             print('Accuracy Test = %0.2f'%acc_test)
             print('F1 Score Train = %0.2f'%f1_score_train)
             print('F1 Score Test = %0.2f'%f1_score_test)
```

```
In [19]: get_report(model_logistic,x_train,y_train,x_test,y_test)

         Accuracy Train = 0.74
         Accuracy Test = 0.69
         F1 Score Train = 0.74
         F1 Score Test = 0.69
```

Support Vector Machines

```
In [20]: model_svc = SVC(probability=True)
         model_svc.fit(x_train,y_train)
Out[20]: SVC(probability=True)
```

```
In [21]: get_report(model_svc,x_train,y_train,x_test,y_test)

         Accuracy Train = 0.84
         Accuracy Test = 0.71
         F1 Score Train = 0.84
         F1 Score Test = 0.72
```

Random Forest

```
In [24]: model_rf = RandomForestClassifier(n_estimators=10,)
         model_rf.fit(x_train,y_train)

Out[24]: RandomForestClassifier(n_estimators=10)

In [25]: get_report(model_rf,x_train,y_train,x_test,y_test)

         Accuracy Train = 0.99
         Accuracy Test = 0.56
         F1 Score Train = 0.99
         F1 Score Test = 0.54
```

Voting Classifier

```
In [29]: model_voting = VotingClassifier(estimators=[
             ('logistic',LogisticRegression()),
             ('svm',SVC(probability=True)),
             ('rf',RandomForestClassifier())
         ], voting='soft',weights=[2,3,1])

In [30]: model_voting.fit(x_train,y_train)

Out[30]: VotingClassifier(estimators=[('logistic', LogisticRegression()),
                                      ('svm', SVC(probability=True)),
                                      ('rf', RandomForestClassifier())],
                          voting='soft', weights=[2, 3, 1])

In [31]: get_report(model_voting,x_train,y_train,x_test,y_test)

         Accuracy Train = 0.88
         Accuracy Test = 0.70
         F1 Score Train = 0.87
         F1 Score Test = 0.70
```

3. Parameter Tuning

```
In [32]: from sklearn.model_selection import GridSearchCV

In [35]: model_grid = GridSearchCV(model_voting,
                                   param_grid={
                                       'svm__C':[3,5,7,10],
                                       'svm__gamma':[0.1,0.3,0.5],
                                       'rf__n_estimators':[5,10,20],
                                       'rf__max_depth':[3,5,7],
                                       'voting':['soft','hard']
                                   },scoring='accuracy',cv=3,n_jobs=1,verbose=2)

In [36]: model_grid.fit(x_train,y_train)
         [CV] END rf__max_depth=3, rf__n_estimators=5, svm__C=5, svm__gamma=0.3, voting=hard; total time=   0.3s
         [CV] END rf__max_depth=3, rf__n_estimators=5, svm__C=5, svm__gamma=0.3, voting=hard; total time=   0.3s
         [CV] END rf__max_depth=3, rf__n_estimators=5, svm__C=5, svm__gamma=0.3, voting=hard; total time=   0.3s
         [CV] END rf__max_depth=3, rf__n_estimators=5, svm__C=5, svm__gamma=0.5, voting=soft; total time=   0.4s
         [CV] END rf__max_depth=3, rf__n_estimators=5, svm__C=5, svm__gamma=0.5, voting=soft; total time=   0.3s
         [CV] END rf__max_depth=3, rf__n_estimators=5, svm__C=5, svm__gamma=0.5, voting=soft; total time=   0.3s
         [CV] END rf__max_depth=3, rf__n_estimators=5, svm__C=5, svm__gamma=0.5, voting=hard; total time=   0.3s
         [CV] END rf__max_depth=3, rf__n_estimators=5, svm__C=5, svm__gamma=0.5, voting=hard; total time=   0.4s
         [CV] END rf__max_depth=3, rf__n_estimators=5, svm__C=5, svm__gamma=0.5, voting=hard; total time=   0.4s
         [CV] END rf__max_depth=3, rf__n_estimators=5, svm__C=7, svm__gamma=0.1, voting=soft; total time=   0.3s
         [CV] END rf__max_depth=3, rf__n_estimators=5, svm__C=7, svm__gamma=0.1, voting=soft; total time=   0.4s
         [CV] END rf__max_depth=3, rf__n_estimators=5, svm__C=7, svm__gamma=0.1, voting=soft; total time=   0.4s
         [CV] END rf__max_depth=3, rf__n_estimators=5, svm__C=7, svm__gamma=0.1, voting=hard; total time=   0.3s
         [CV] END rf__max_depth=3, rf__n_estimators=5, svm__C=7, svm__gamma=0.1, voting=hard; total time=   0.3s
         [CV] END rf__max_depth=3, rf__n_estimators=5, svm__C=7, svm__gamma=0.1, voting=hard; total time=   0.4s
         [CV] END rf__max_depth=3, rf__n_estimators=5, svm__C=7, svm__gamma=0.3, voting=soft; total time=   0.3s
         [CV] END rf__max_depth=3, rf__n_estimators=5, svm__C=7, svm__gamma=0.3, voting=soft; total time=   0.4s
         [CV] END rf__max_depth=3, rf__n_estimators=5, svm__C=7, svm__gamma=0.3, voting=soft; total time=   0.3s
         [CV] END rf__max_depth=3, rf__n_estimators=5, svm__C=7, svm__gamma=0.3, voting=hard; total time=   0.3s
         [CV] END rf__max_depth=3, rf__n_estimators=5, svm__C=7, svm__gamma=0.3, voting=hard; total time=   0.3s

In [42]: model_best_estimator = model_grid.best_estimator_

In [43]: model_grid.best_score_

Out[43]: 0.7100683707826566
```

4. Save Model

```
In [45]: pickle.dump(model_best_estimator,open('./models/machinelearning_face_person_identity.pkl',mode='wb'))
```

Final model after optimization and comparison of different algorithms

1.6 Academic Question

1) Can traditional method of student attendance be replaced with an automated and dependable system that utilizes facial recognition technology in real time?

   Yes, Traditional, and manual methods of taking student attendances can easily be replaced with an automated and dependable system just like the developed prototype. Digital technology has developed, and innovations have been made in such way that facial recognition technology can be successfully utilized to detect faces along with facial landmarks and features in real time. This technology can be used in various sectors and activities for real time applications like attendance, monitoring, law enforcement and verification-based payments.

2) Is there a more effective approach to implement a facial recognition-based attendance system considering factors such as time consumed, background, illumination, poses expression with high accuracy and fast computation?

   Yes, by utilizing different modern machine learning algorithms and learning models and various preprocessing techniques, we can overcome different external environmental factors to develop a real time detection system that has high accuracy and fast computation.

3) How can I make the system secure in order to maintain attendee's privacy (as it involves sensitive data)?
   Facial data concerns privacy and security of the attendees involved. The data can be very sensitive and can be misused/ abused to do heinous activities. So, Django has been utilized because it provides protections against a number of threats, like cross site scripting attacks. Superuser privilege is restricted to a single person and only they can register the faculty members. The sensitive data are restricted and are available to view edit by only the faculty members.

1.7 Scope and Limitation of the project

Attendance on workshop and tutorial can be done. The system might not be viable in lecture as it requires corresponding type of video capturing hardware to detect facial images at a distance. Further development can be done.

Search functionalities can be further improved.

A feature which can alert about intruder in class can be included in system. Images of unknown people can be captured and saved in the database for security reasons.

Feature can be included where students are automatically warned if his attendance records are below the required threshold.

2. Literature Review

2.1 Similar Works

"Face Recognition based Attendance System" proposes an automated attendance management system that deals with the problem of face identification in biometric frameworks under varying constant conditions such as light, revolution, and scaling. The model combines a camera that captures an input image, a computation to recognize a face from the input picture, encode and perceive the face, and stamp the participation in a spreadsheet before converting it to a PDF file. An android phone's camera captures the image and sends it to a server, where faces are recognized from the data set and attendance is recorded. (Dhanush Gowda H.L, 2020)

"An improved face recognition algorithm and its application in attendance management system" suggests a system that employs a different technique that combines the calculation of Local Binary Patterns (LBPs) with advanced image processing, such as contrast, image Blending, bilateral Filter, adjustment, and equalization of histograms to alleviate some of the concerns reducing the precision of facial recognition in order to improve the LBPAs a result, the overall face's accuracy is improved framework for acknowledgment The outcomes of the examination demonstrate that the approach is extremely precise, reliable, and strong face recognition system that can be basically carried out in a real-life setting as an Attendance management system that has been programmed. (Serign Modou Bah, 2020)

"Automated Attendance Management System Based on Face Recognition Algorithms" utilizes the Viola Jones Face Detection Algorithm. This algorithm provides superior outcomes in a variety of illumination settings and utilizes several Haar classifiers to obtain higher output rates up to 30 degrees. The histogram equalization of the facial picture acquired when it is scaled down to 100x100 is part of the preprocessing phase. Photos are converted to grayscale, histograms are equalized, and images are resized to 100x100 pixels. The LBPH technique was used to extract the attributes, and the SVM classifier was used to classify them. This publication made use of an 80-person database (NITW database) that included around 20 photos of each person. The false positive rate is 25%, the object distance for correct recognition must be 4 feet, the training time is 563 milliseconds, 95 percent recognition percentage for static images, 78 percent recognition percentage (real-time video), and the occluded faces are 2.3 percent, according to this document. (Shireesha Chintalapati, 2013)

2.2 Findings of research from similar works

Based on research papers reviewed, the conclusion is reached that the accuracy of the face detection and recognition is exponentially related to the number of datasets that are trained to develop the face recognition model.

The successful working of the model is observed under the available conditions that includes:

Background	The model's efficiency is affected by the background and environment of the attendees. Because it is difficult to recognize faces in a dynamic background, static backgrounds are ideal.
Illumination/Lighting	In comparison to dimly lit areas, situations with enough illumination produce accurate results when using the model. The recognition of face features is particularly hampered by a dimly illuminated setting.
Pose	Variation in body or facial positions means capturing image from a difficult angle, which can cause distortion in the recognition process, particularly for Fisher and Eigen face recognition techniques.
Expression	Humans use a variety of facial expressions to express themselves. The shape and size of facial features vary as a result of changes in facial emotion.
Occlusion	The performance of the face recognition model will be diminished by parts of the human face that are not visible.
Rotation, scaling and translation	The image has a chance of being distorted during scaling and preprocessing, which could impact the original information in the image.
Facial features / Accessories	During the face recognition process, a variety of facial expressions/poses may cause inaccuracies. Similarly, facial traits and accessories such as glasses, veils, caps, moustaches, beards, and other facial features and accessories may make it difficult to recognize the face of attendees.

Advantages and Disadvantages of Facial Detection Methods (Varsha Gupta, 2014)

Face Detection Method	Pros	Cons
Viola Jones	Higher accuracy Higher detection speed	Greater training time Limited facial pose Cannot detect poorly/dimly lit faces
Local Binary Pattern	Simple and quick computation Greater tolerance against monotonic change in lighting.	Utilized only for monotonic images Overall performance is not very accurate
AdaBoost algorithm	Works without any prior facial datasets. (unsupervised).	Result depends on the provided training dataset. Weak classifiers might affect the result.
SMQT Features & SNOW Classifier	Able to tackle with illumination problems. Efficient computation	Grey value regions might be misinterpreted as part of the face.
Neural Network	Results in High accuracy only when large number of image datasets are trained.	Detection time is very slow Complex computation is involved Overall performance is very weak.

Methods of Contrast Improvement

Histogram equalization

Contrast enhancement is carried out by transforming intensity values resulting in uniformly distributed histogram.

Pros - Less sensitive to noisy, grainy images

Cons – Depends on global statistic of the image, causes over enhancement to some part of the image whereas some peripheral part might need more enhancement.

Adaptive Histogram Equalization Contrast Limited

Unlike Histogram Equalization, it works on small data regions. Each tiles contrast is exchanged to ensure uniformly distributed histogram. Bilinear interpolation is then used to merge the neighboring tiles.

Pros – It prevents noise amplification and over enhancement

Cons – More sensitive to noisy and grainy images.

Comparison of Algorithms

Method	Pros	Cons	Accuracy
Eigen face or kernel PCA	Very fast speed in training and recognition	Recognition depends on training database	77.97%
Fisher face or LDA	Facial images with varied lighting and expressions can be recognized if more samples are trained	Bigger database is required because multiple expressions of individual have to be trained	82.45%
LBP	Can overcome variety of facial expressions, lighting, angles and age of the individual	Training time is significantly longer	90.93%
Neural network	High accuracy only if training database is large	Requires very long time to train Database is extremely large	N.A.

2.3 Conclusion

The idea of developing a automated facial recognition-based attendance system is thoroughly reviewed. The proposed approach describes a method to identify attendees by comparing input image obtained from real time video to get the training set. After the initial review, Viola Jones Algorithm will be used along with Eigenfaces (PCA), Fisher face (LDA) and LBP and OpenCV. All the available methods will be evaluated, and the most efficient and accurate approach will be utilized to develop the proposed system.

3. Project Methodology

Agile Scrum Methodology was utilized to develop the system. Weekly Meetings and supervision from Supervisor Mr. Ganesh Kuikel assisted a lot while developing the project.

3.1 Why?

Agile scrum approach offers various advantages. First, it pushes products to be produced quicker, as each set of objectives must be fulfilled inside each sprint's time constraint. It also demands regular planning and goal setting, which helps the scrum team concentrate on the current sprint's goals and enhance productivity.

3.2 How does it suit?

The methodology suited my final year project because it helped me break down and carry out the development, research, and testing process in short sprints. So, during the whole development cycle, I was able to focus on a single task every week and carry out and complete the project with ease. Supervisor Mr. Ganesh Kuikel acted as my Product Owner and Weekly Meeting Minutes were produced and kept which can be seen at 7. Evidence of Project Management.

3.3 Gantt chart

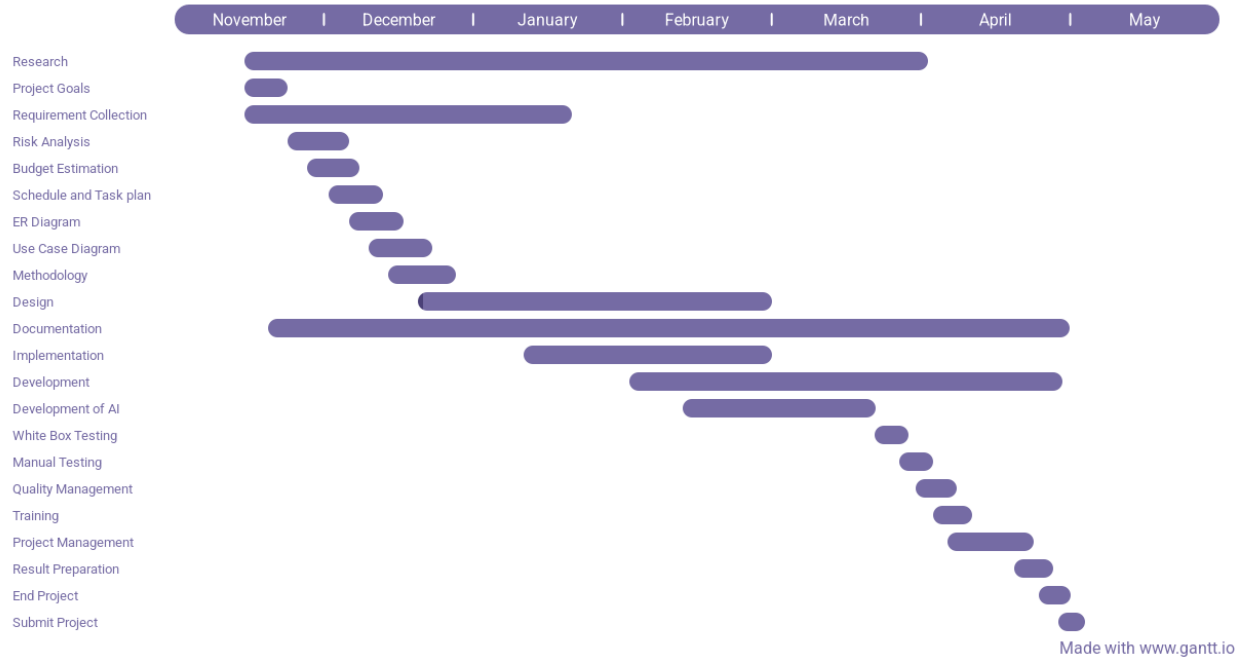


Figure 12: Gantt Chart

4. Different Technologies and Tools used

Web based application

The system will be a web-based application. It can be accessed easily from any device through the internet instead of having to be individually installed. It will work on most browsers and operating system, regardless of their version or update. This will give the users with accessibility and flexibility while increasing their overall productivity. All the security, uptime, backups, and upgrades can be handled through a central point and the users do not have to worry about it and focus on what's important. Using of web-based apps also enables sensitive user data to be secure and backed up.

To develop the web app, I'll be utilizing Python, Django and OpenCV. Python supports artificial intelligence programming, as well as OOP, System Programming, GUI, Component Integration, Database Programming, Numeric Programming, Image Processing Tools built-in, a library, and

third-party apps. Django is a python-based framework, which is highly secure and scalable and comes fully loaded with wide range of packages.

Python

Python was selected as the programming language for constructing the system because of its interoperability with OpenCV and machine learning models. It also connects quite effectively with Django which was also employed.

Python is a programming language that's widely used for scripting. Commonly referred to as an object-oriented scripting language, a phrase that combines OOP support with an emphasis on scripting roles. Python has a huge active userbase and a thriving development community. Python is reasonably robust and sturdy since it has been around for over two decades and is extensively used. Python is generally utilized in actual softwares by real comapnies, in addition to being utilized by individual users. (Python Software Foundation., 2021)

Its all-purpose aspect permits it to be employed in nearly any area, not just one. It's reasonable to assume that Python is utilized by practically every large organization that creates software, whether for short-term logical jobs like testing and administration or long-term strategic product creation. OOP, System Programming, GUI, Component Integration, Database Programming, Numeric Programming, Image Processing Tools built-in, a library, and third-party applications are available in Python which is why the language is preferred to develop the proposed system. (Lutz, 2009)

Django

Django was picked because of its maintainability and ability to aid in quick development.

Django is a high-level globally renowned python-based web framework. Django was established by a team of individuals who worked on developing and maintaining newspaper websites between 2003 and 2005. Django 1.0 was launched in 2008, and the most current version is Django 3.1, which was released in 2020. It allows individuals to construct websites rapidly and securely. It is free, open-sourced and provides well documented manuals, as well as a active usrebase. Django may be used to develop any sort of website. (Django Software Foundation, 2021)

OpenCV

OpenCV was applied due of its broad usage and several efficient techniques. The key reason was its ability at identifying faces in realtime.

In 2000, the first alpha version of OpenCV was published for public use at the IEEE Conference held on topic of Computer Vision and Pattern Recognition, and five beta versions were released between 2001 and 2005. In 2006, the original 1.0 version was introduced. In October 2009, the second version of OpenCV was released, with considerable improvements. The second version contains a considerable modification to the C++ interface, with the purpose of making implementations simpler, more type-safe, and better. Currently, an independent Russian team monitors development, and a new version is issued every six months.

OpenCV has a modular structure, i.e., the library package comprises multiple static or shared libraries. Modules such as Object Detection ,High-level GUI , Video Analysis, Image Processing, and Camera Calibration, are all included in the same package which would aid enormously in creating my suggested system. (doxygen, 2021)

Jupyter notebook

Jupyter notebook was utilized because it provides interactive environment where you can immediately make a single change, execute a small chunk of code and see the effect makes it perfect for experimentation and prototyping. I also personally find it quite user-friendly and like that the interface is simple and not overwhelmed with options no one ever uses.

Dlib

Dlib is a contemporary C++ toolkit providing machine learning algorithms and tools for constructing complex software's in C++ to tackle everyday world issues. It is utilized in both business and academics in a wide variety of areas like mobile phones, computer systems, robots, and embedded devices. It was used since the facial recognition model was reliant on the dlib library.

Visual Studio Code

Visual Studio Code was employed as an IDE because of its compatibility with Python, Django and the simple and accessible workflow it offered.

Visual Studio Code is a simplified code editor that offers functionality as well as usability for development tasks including and version control, execution and version control. It offers only the required tools and extensions a developer needs for a fast code and debug cycle with high personalization and customizable features.

5. Testing / User Manual

In general, testing means figuring out how well something works. In computer hardware and software development, testing is done at important checkpoints in the entire process to determine whether goals are being fulfilled. Software testing is the process of assessment a software item to find differences \between supplied input and anticipated result.

The testing document below can also serve as a user manual if prompted.

5.1 Login

Case 1: Valid Credentials

Test Id:	TC1
Tester:	Admin
Date:	15-04-2022
Purpose:	Login to the System
Pre-requisites	Must fill Login form
Test Data	Username, Password
Steps	1) Start the system i.e., go to http://127.0.0.1:8000/login/ in any web browser. 2) Login page will be displayed 3) Enter the correct credentials 4) Click on “Login” button. 5) Will be redirected to the homepage.
Status	Pass

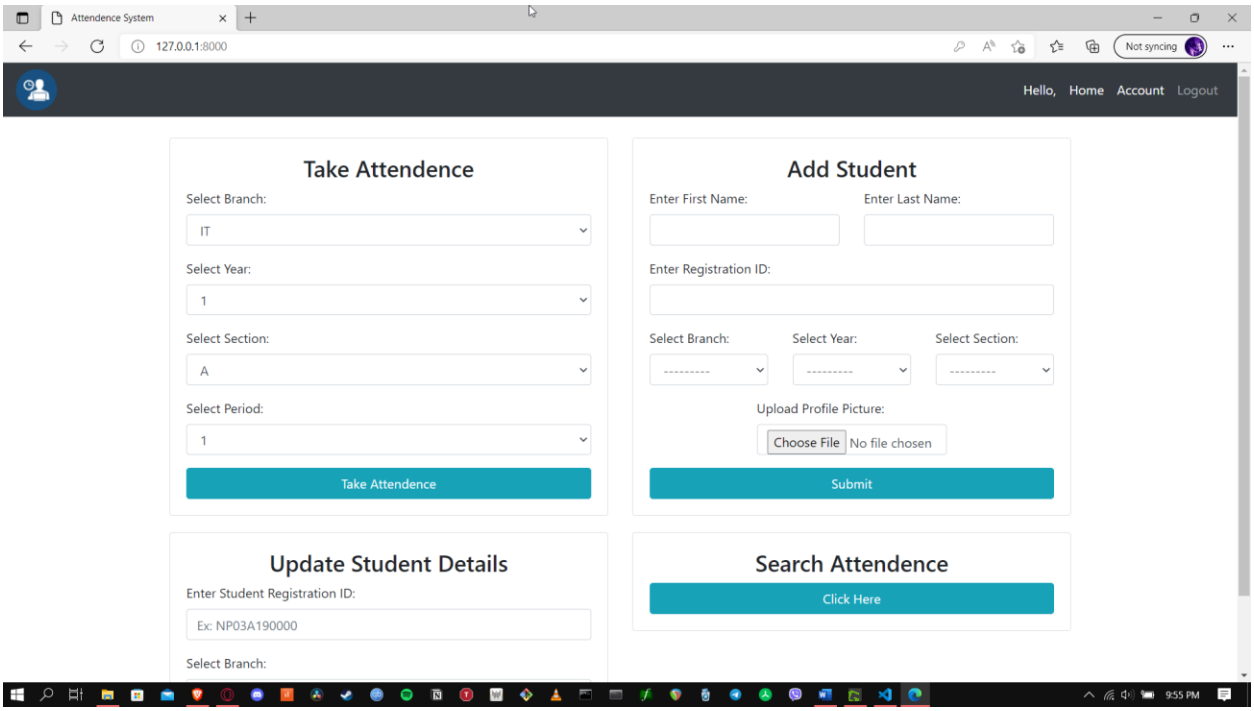


Figure 13: Test Case 1

Case 2: Invalid Username or Password

Test Id:	TC2
Tester:	Admin
Date:	15-04-2022
Purpose:	Invalid Login to the System
Pre-requisites	Must fill Login form
Test Data	Username, Password
Steps	1) Start the system i.e., go to http://127.0.0.1:8000/login/ in any web browser. 2) Login page will be displayed 3) Enter the invalid credentials 4) Click on "Login" button. 5) Will be redirected to the login page along with the message "Username or Password is incorrect"
Status	Pass

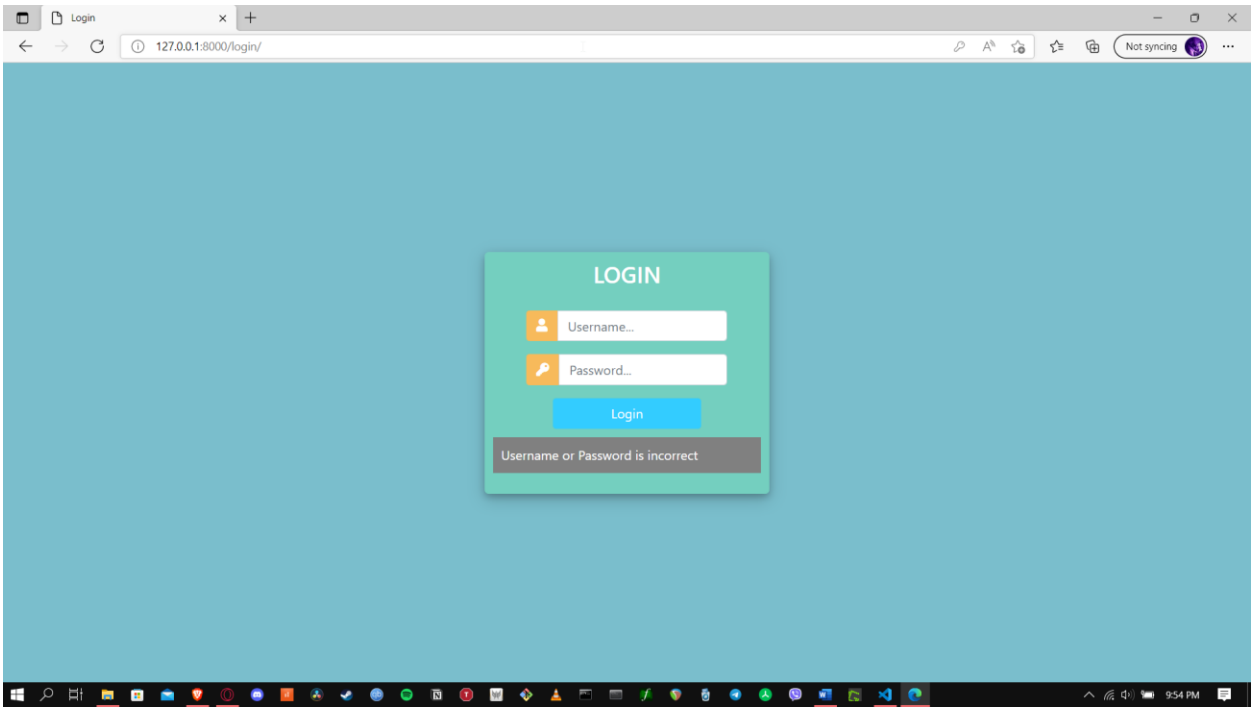


Figure 14: Test Case 2

5.2 View Student Details

Case 1: Valid Student Details

Test Id:	TC3
Tester:	Admin
Date:	15-04-2022
Purpose:	View student details
Pre-requisites	Must fill update student form
Test Data	Student ID, Branch
Steps	1) In the main page, head towards Update Student Details section 2) Enter Student ID of the student's info you want to view 3) Enter their respective branch 4) Click on "Submit" button. 5) The student's info will be displayed along with their profile picture.
Status	Pass

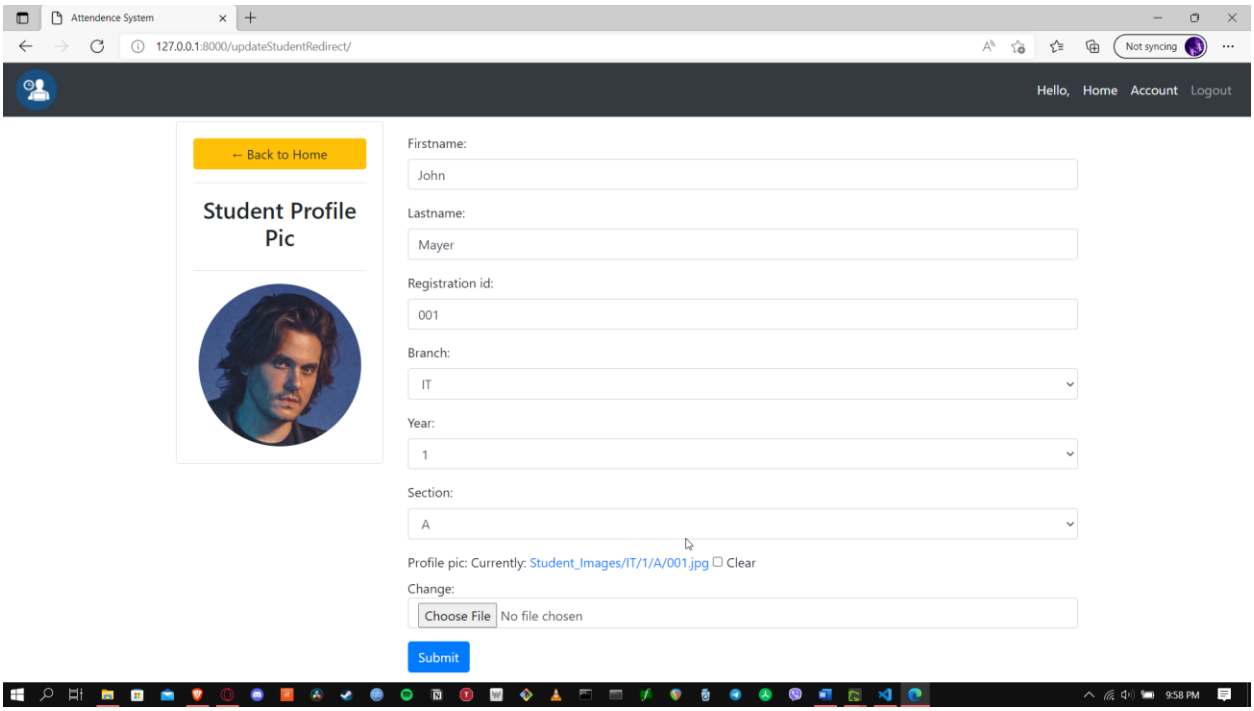


Figure 15: Test Case 3

Case 2: Invalid Student Details

Test Id:	TC4
Tester:	Admin
Date:	15-04-2022
Purpose:	Check how system responds to invalid student details
Pre-requisites	Must fill update student form
Test Data	Student ID, Branch
Steps	1) In the main page, head towards Update Student Details section 2) Enter invalid Student ID of the student's info you want to view 3) Enter invalid info in the branch section 4) Error message "Student Not Found" is displayed.
Status	Pass

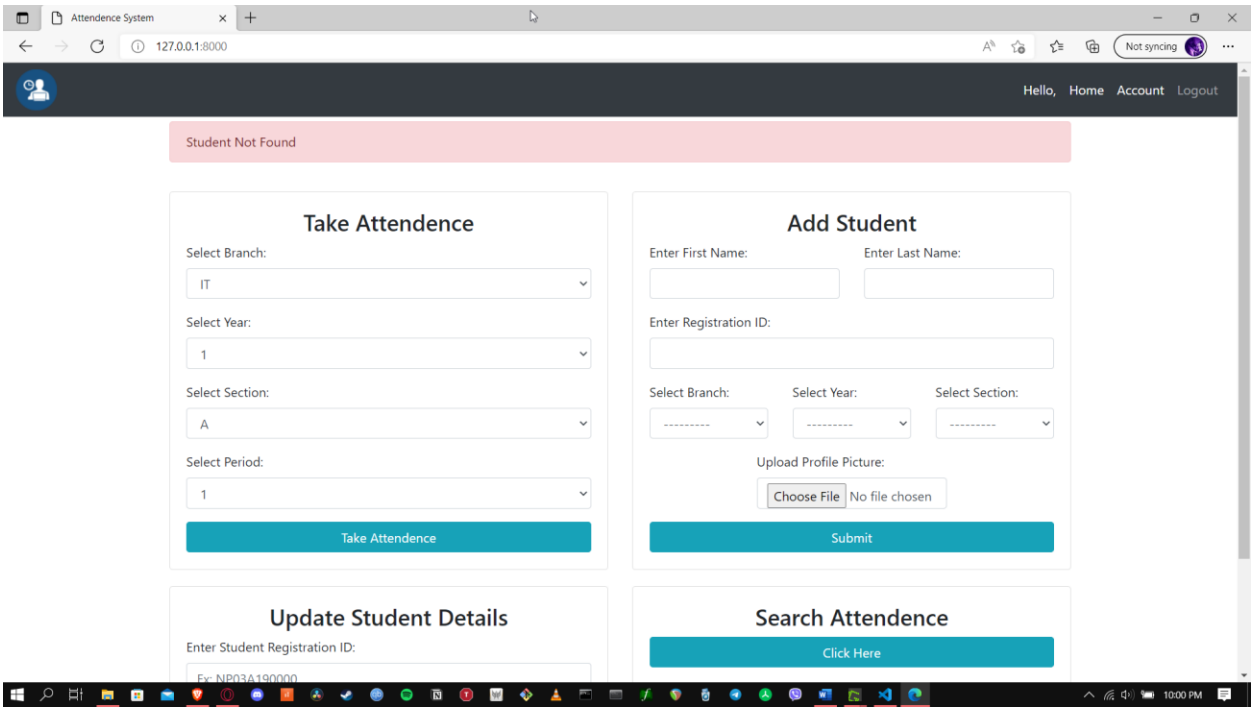


Figure 16: Test Case 4

5.3 Edit Student Details

Test Id:	TC5
Tester:	Admin
Date:	15-04-2022
Purpose:	Edit student details
Pre-requisites	Must fill update student form
Test Data	Firstname, lastname, reg id, branch, year, section, profile pic
Steps	1) In the Student Details page 2) Enter the Student student's info you want to change in the respective field 3) Upload updated photo of the student by clicking "Choose File" button 4) "Updation Success" Message is received.

Status	Pass

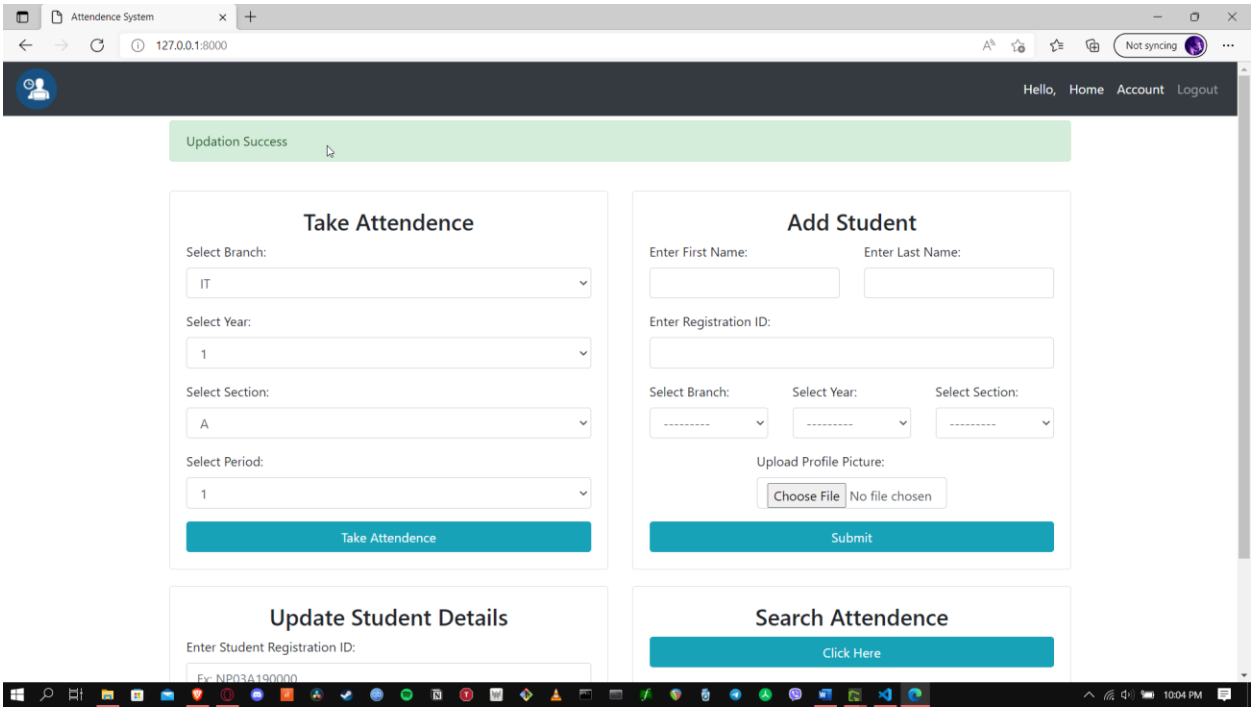


Figure 17: Test Case 5

5,4 Add Student

Case 1: Complete Student Details

Test Id:	TC6
Tester:	Admin
Date:	15-04-2022
Purpose:	Add student details
Pre-requisites	Must fill add student form
Test Data	Firstname, lastname, reg id, branch, year, section, profile pic
Steps	1) In the main page 2) Enter the Student student's info you want to add to the database in the respective field 3) Upload student's photo by clicking "Choose File" button 4) Click on "Submit" button.

	5) “Student Successfully Added” Message Displayed.
Status	Pass

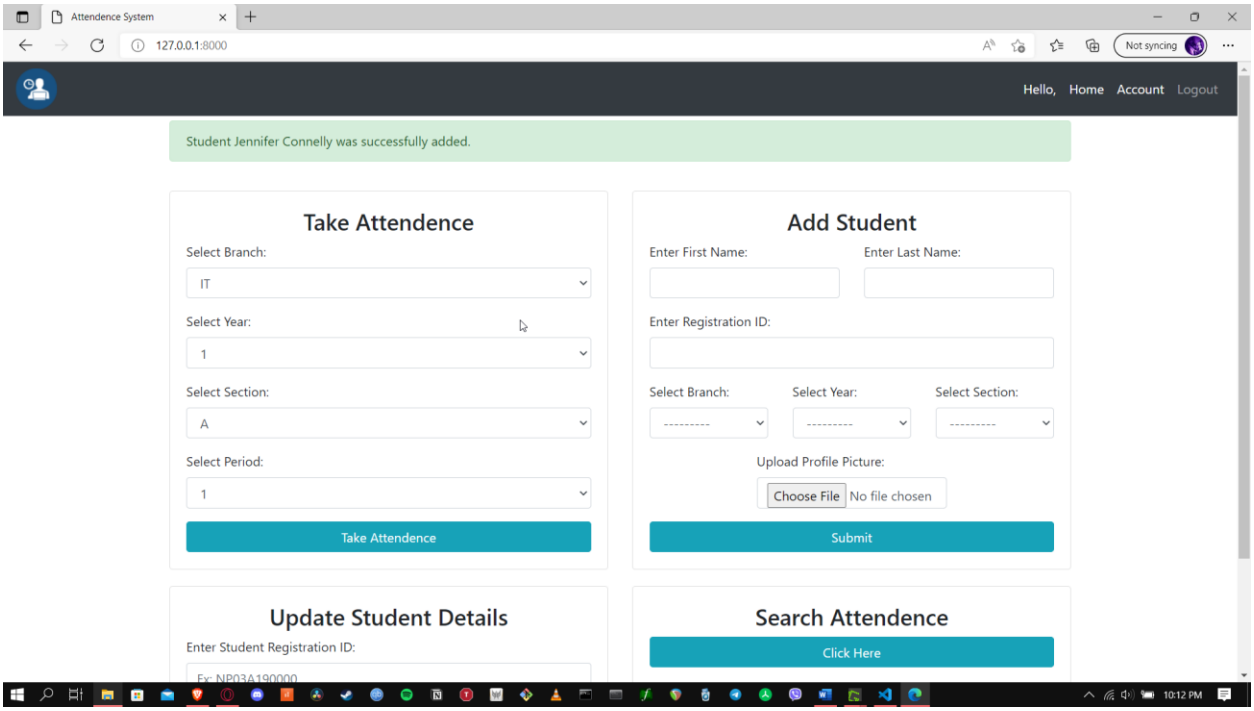


Figure 18: Test Case 6

Case 2: Incomplete Student Details

Test Id:	TC7
Tester:	Admin
Date:	15-04-2022
Purpose:	Incomplete student details
Pre-requisites	Must fill add student form
Test Data	Firstname, lastname, reg id, branch, year, section, profile pic
Steps	1) In the main page 2) Enter the incomplete Student student’s info you want to add to the database in the respective field 3) Upload student’s photo by clicking “Choose File” button 4) Click on “Submit” button. 5) “Please fill out this field” Message Displayed in empty fields.

Status	Pass

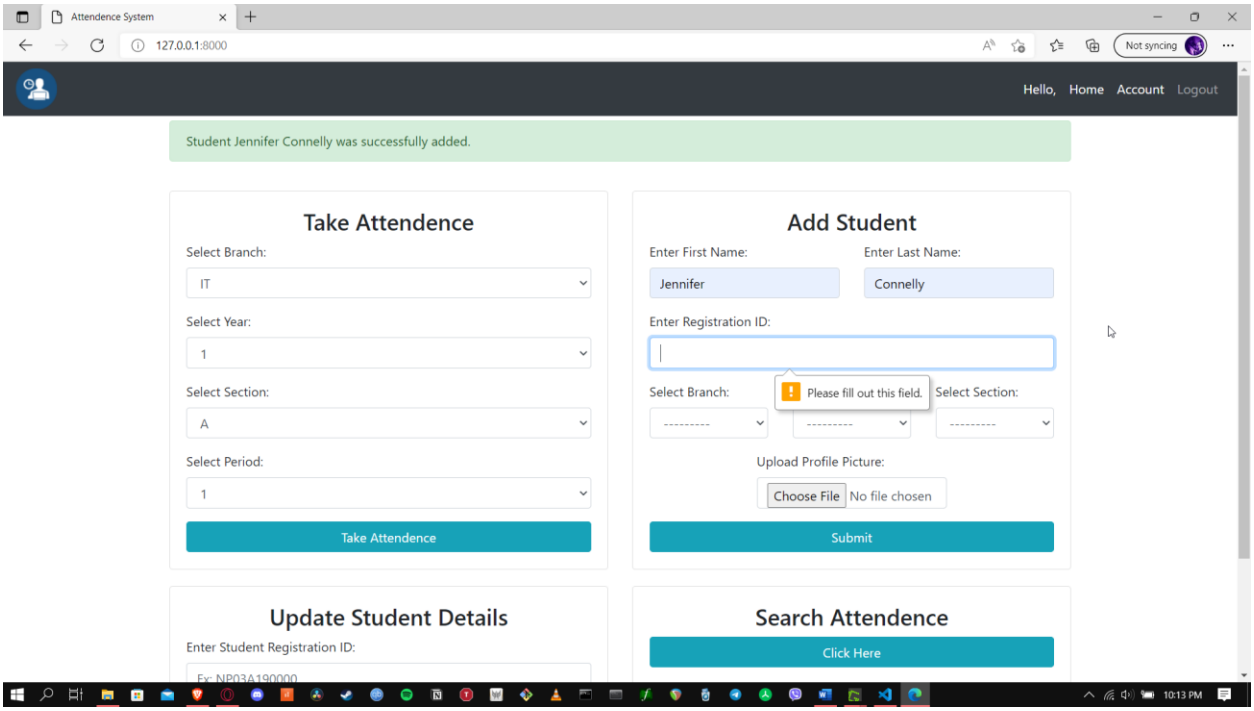


Figure 19: Test Case 7

5.5 Take Attendance

Test Id:	TC8
Tester:	Admin
Date:	15-04-2022
Purpose:	Take attendance of the current period
Pre-requisites	Must fill take attendance form
Test Data	branch, year, section, period
Steps	1) In the main page 2) Enter the take attendance form of the respective branch year section and period

	3) Click on “Take Attendance” button 4) Camera / Live Video Feed will pop up. 5) Detected Student’s Id no will be displayed, and attendance will be recorded. 6) Press “S” to stop the camera. 7) “Attendance Taking Success” Message displayed.
Status	Pass

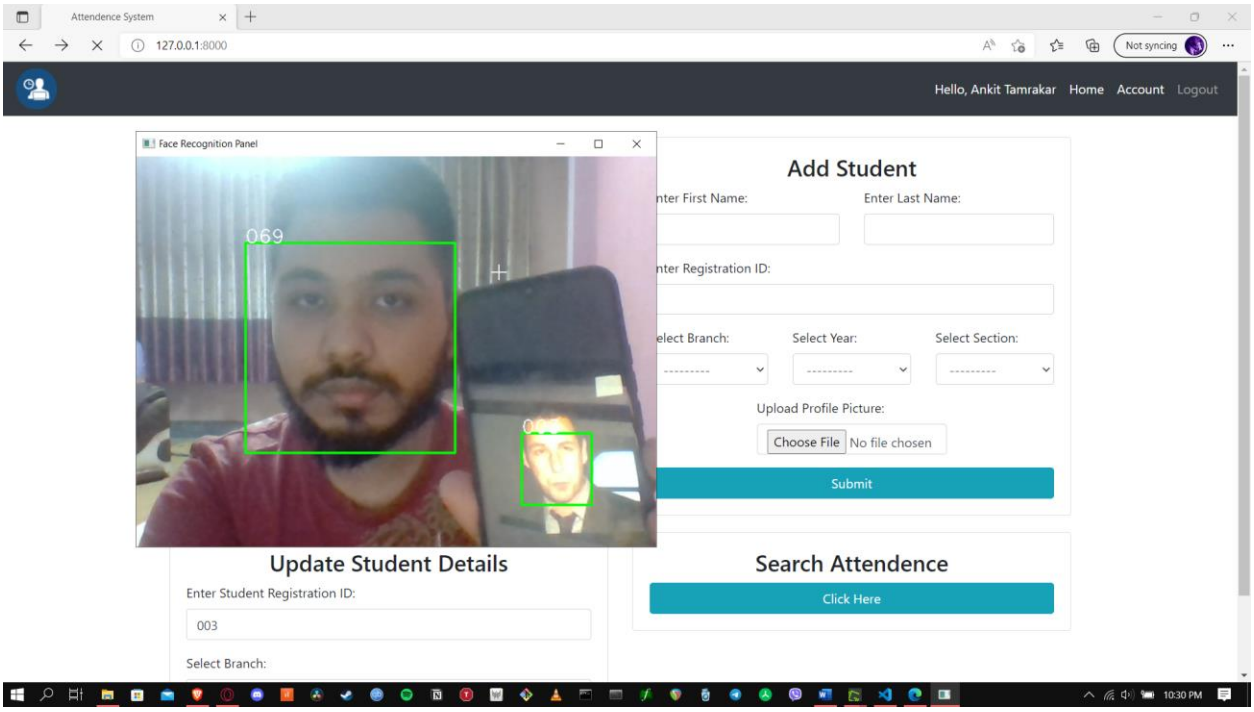


Figure 20: Test Case 8

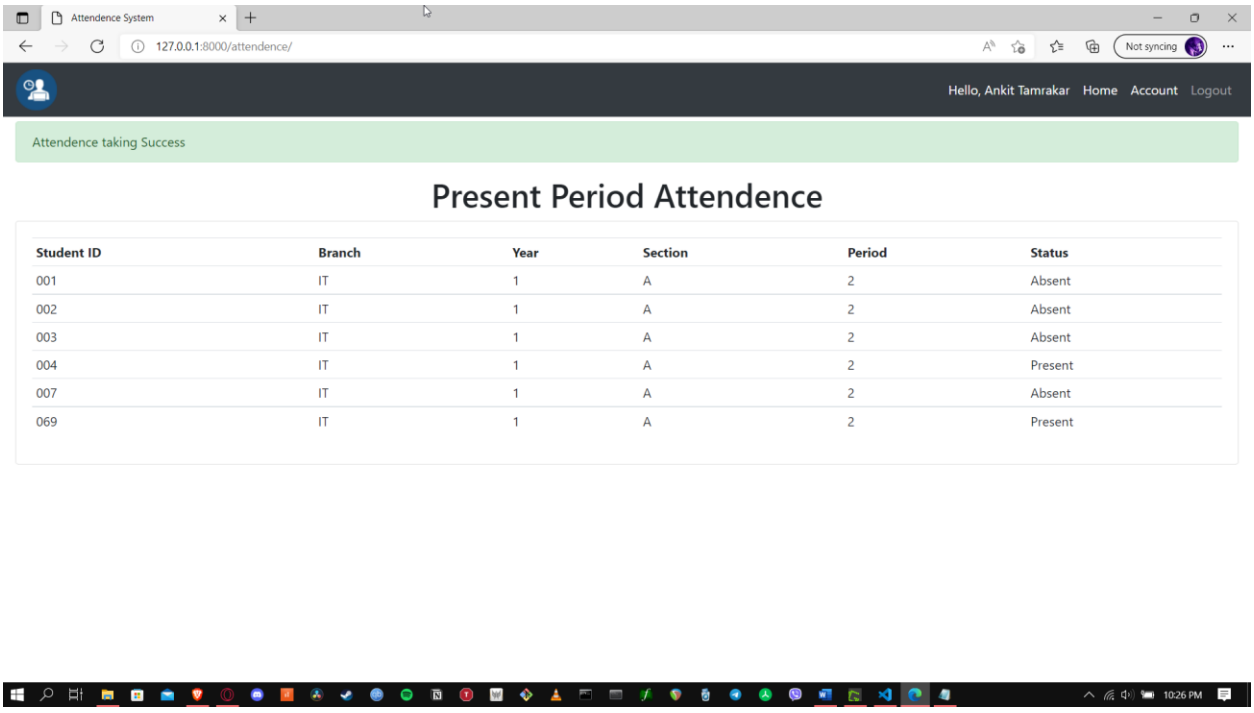


Figure 21: Test Case 8 Part 2

5.6 Search Attendance

Test Id:	TC9
Tester:	Admin
Date:	15-04-2022
Purpose:	Search attendance record
Pre-requisites	Must fill search attendance form
Test Data	Student ID, Date, Year Period
Steps	1) In the main page 2) Click on “Search Attendance” button 3) Fill up the required field 4) Detected Student’s attendance record will be displayed. 5) If Date or not valid “Enter Valid Date” message is shown. 6) Invalid search will result in empty results.
Status	Pass

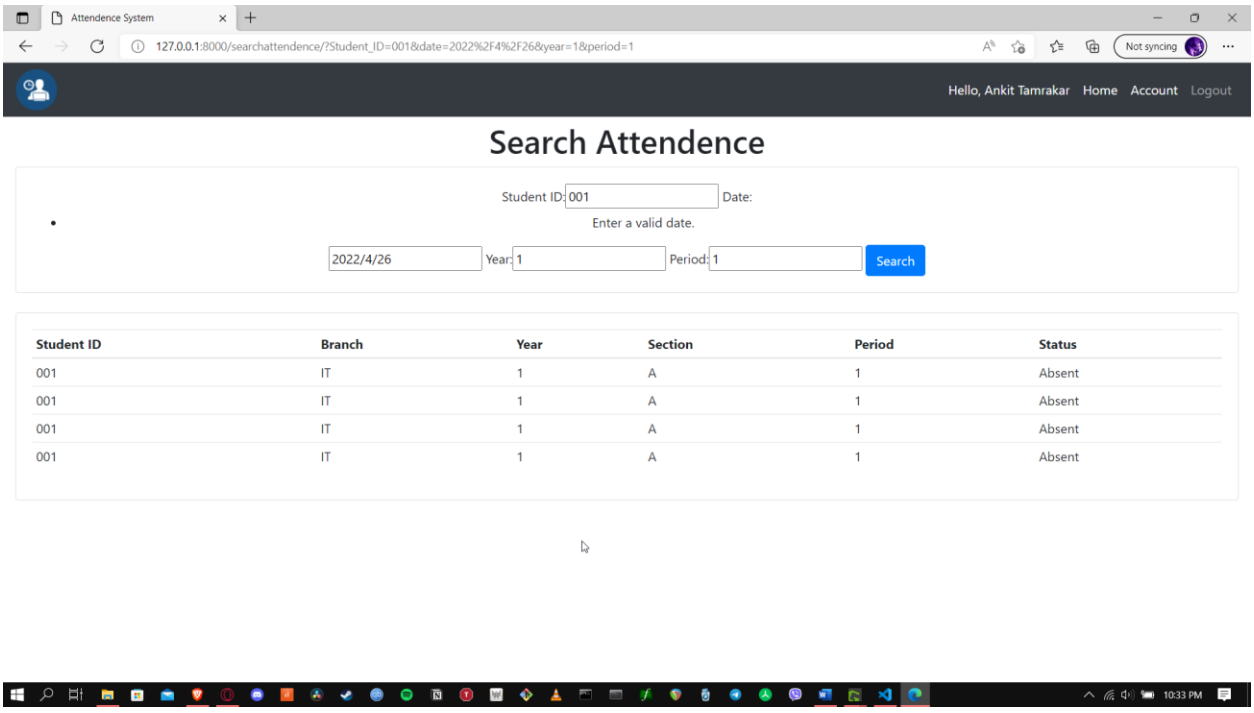


Figure 22: Test Case 9

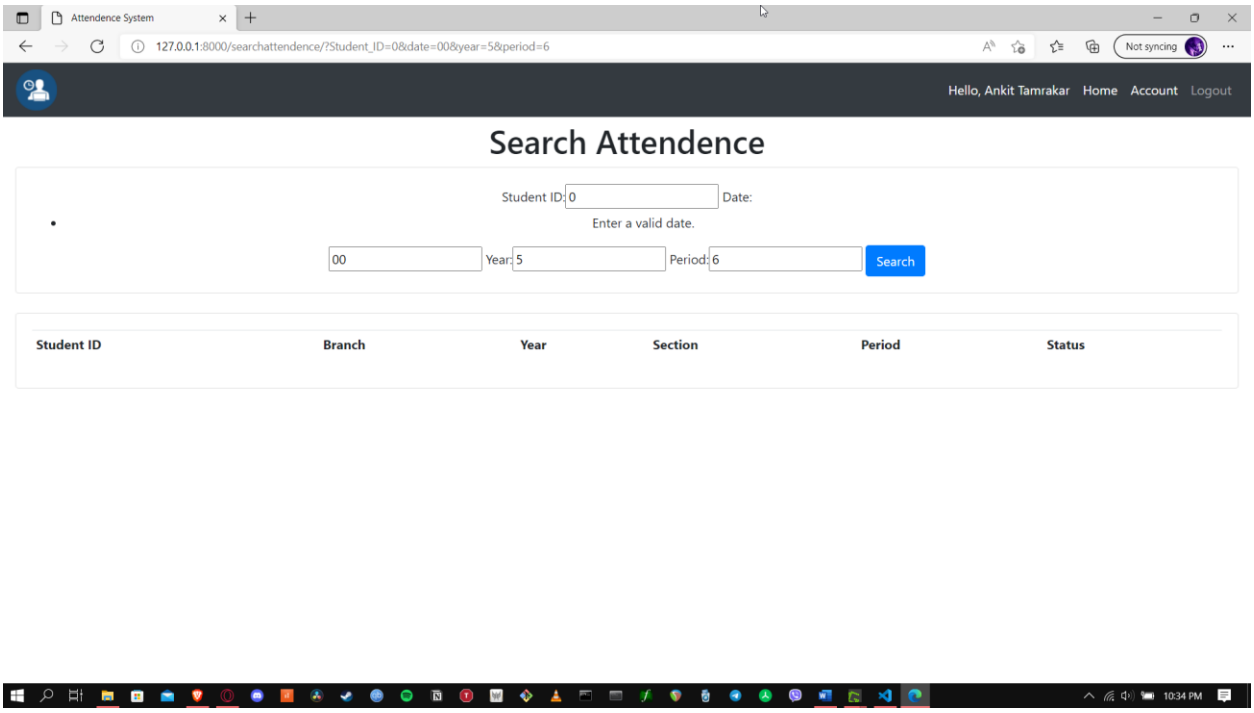


Figure 23: Test Case 9 Part 2

5.7 View Faculty Info

Test Id:	TC10
Tester:	Admin
Date:	15-04-2022
Purpose:	View and edit faculty member details
Pre-requisites	Must be logged in and be a faculty member
Test Data	First name, last name, phone email, photo
Steps	1) In the main page 2) Click on “Account” button 3) You can view Faculty member’s details 4) If you wish to update it, fill the form accordingly.
Status	Pass

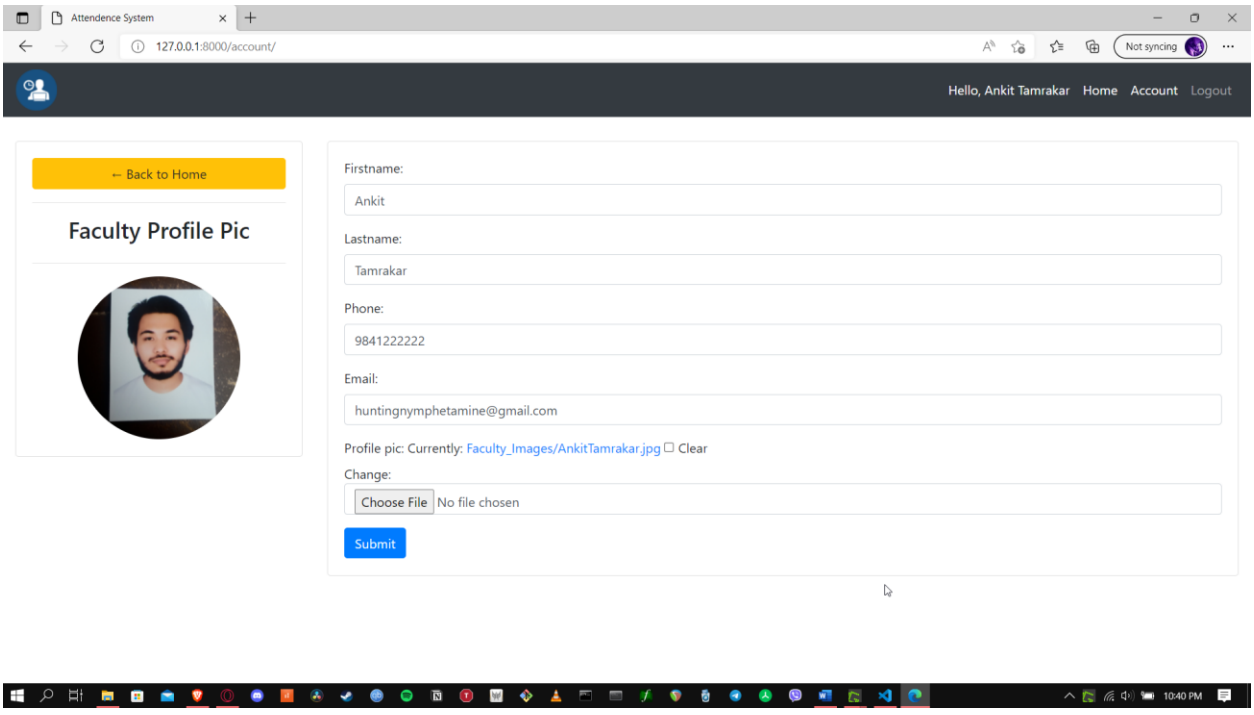


Figure 24: Test Case 10

5 Conclusion

In this way, the system was developed and completed. The system can take automated attendance and keep track of the record successfully. Although the project is still in the initial stages of the development, its limitations and weaknesses can surely be overcome in the future.

The machine learning model can be successfully integrated into any other system to successfully detect and recognize faces with great accuracy. The possibilities are endless due to convenience and simplicity. The author has successfully developed and delivered a simple yet useful working system that can be deployed and make use of in real world.

6 Critical Evaluation

6.4 Self-evaluation of report

The process of writing this report was very fruitful to the author. The author got to do a lot of research on published papers related to face recognition while doing literature review portion. The author was very unaware about the Professionalism part and the ethical and privacy concerns and issues that are raised while dealing with sensitive facial data. The author was totally unaware about the ethical issues that are involved with faces. The author got to reflect on it and think based on different laws and rules. The author was able to develop the system accordingly. The hardest part for the author to do was the Artefact Design and Diagrams portion as the author was very new to the subject. Based on this report, the author would give himself a 8 out of 10.

6.5 Findings and process

Different machine learning models, algorithms and approaches related to detection of facial landmarks and recognition based on them were successfully researched, evaluated, and implemented. Different libraries like dlib, face_recognition, OpenCV's DNN, Google's FaceNet. OpenFace were explored which was anew to the author. The author had keen interest in Machine Learning and Artificial Intelligence and this development process helped him to gather even more knowledge in the field.

6.6 System

While developing the system and generating the report, the author was able to participate actively in solely developing the web application. The author got to know about the development and deployment of Django apps. The author also got to learn and develop simultaneously. With guidance from the supervisor, the author considered different development approaches. Numerous libraries were considered while creating the face recognition model. Flask, Django Rest API, and Django celery were researched for their potential usability while developing the system.

6.7 Planning management, quality of sources found

The author was new to planning the software development cycle. The module helped author to plan and develop the system. Agile Scrum Methodology and Software such as Notion were utilized

to keep track of work that were done and work that need to be completed. While researching the facial datasets, the author came across numerous facial datasets present in the World Wide Web. Similarly, During the development and testing phase, assistance was taken from various sources such as Stack Overflow and YouTube to successfully tackle library errors and debugging.

6.8 Self-reflection

The author found the whole development of Final Year Project very prolific and rewarding. The author had very thoughtfully chosen the topic Facial Recognition Based Attendance as his Final Year Project as it was challenging; it involved development of artificially intelligent model as well as a fully functional web application. This was totally a new and genuine experience for the author to explore and enter the world of software development. The author very much enjoyed the process and appreciates every wonderful insight and feedback he got from his friends, family and supervisors while developing the project.

7 Evidence of Project Management

Faculty of Science and Engineering
School of Mathematics and Computer Science

PROJECT MANAGEMENT LOG

First Name: Ankit	Surname: Tamrakar
Student Number: 2058058	Supervisor: Ganesh Kunkel
Project Title: -Not decided-	Month: November

What have you done since the last meeting

- Researched and discussed FYP topic

What do you aim to complete before the next meeting

- PRF and Proposal
- Finalize the FYP topic

Supervisor comments

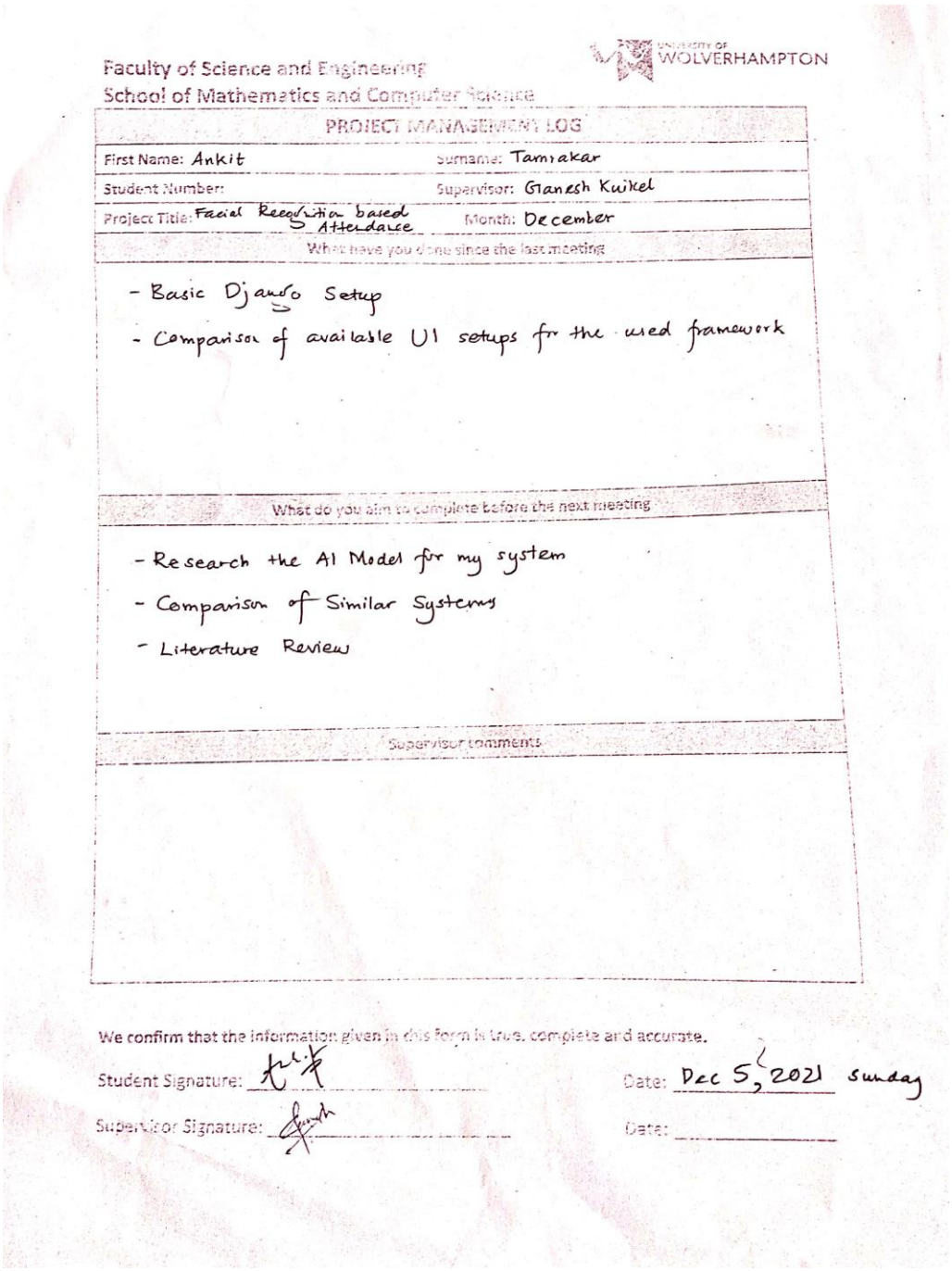
- Complete PRF and proposal
- Bug tracker is not feasible
- Research on sentiment analysis, computer vision and NLP

We confirm that the information given in this form is true, complete and accurate.

Student Signature: _____ Date: Nov 14th

Supervisor Signature: _____ Date: _____

Figure 25: Log sheet 1



Faculty of Science and Engineering
School of Mathematics and Computer Science

UNIVERSITY OF WOLVERHAMPTON

PROJECT MANAGEMENT LOG

First Name: Ankit | Surname: Tamrakar

Student Number: | Supervisor: Ganesh Kukkel

Project Title: Facial Recognition based Attendance | Month: December

What have you done since the last meeting

- Basic Django Setup
- Comparison of available UI setups for the used framework

What do you aim to complete before the next meeting

- Research the AI Model for my system
- Comparison of Similar Systems
- Literature Review

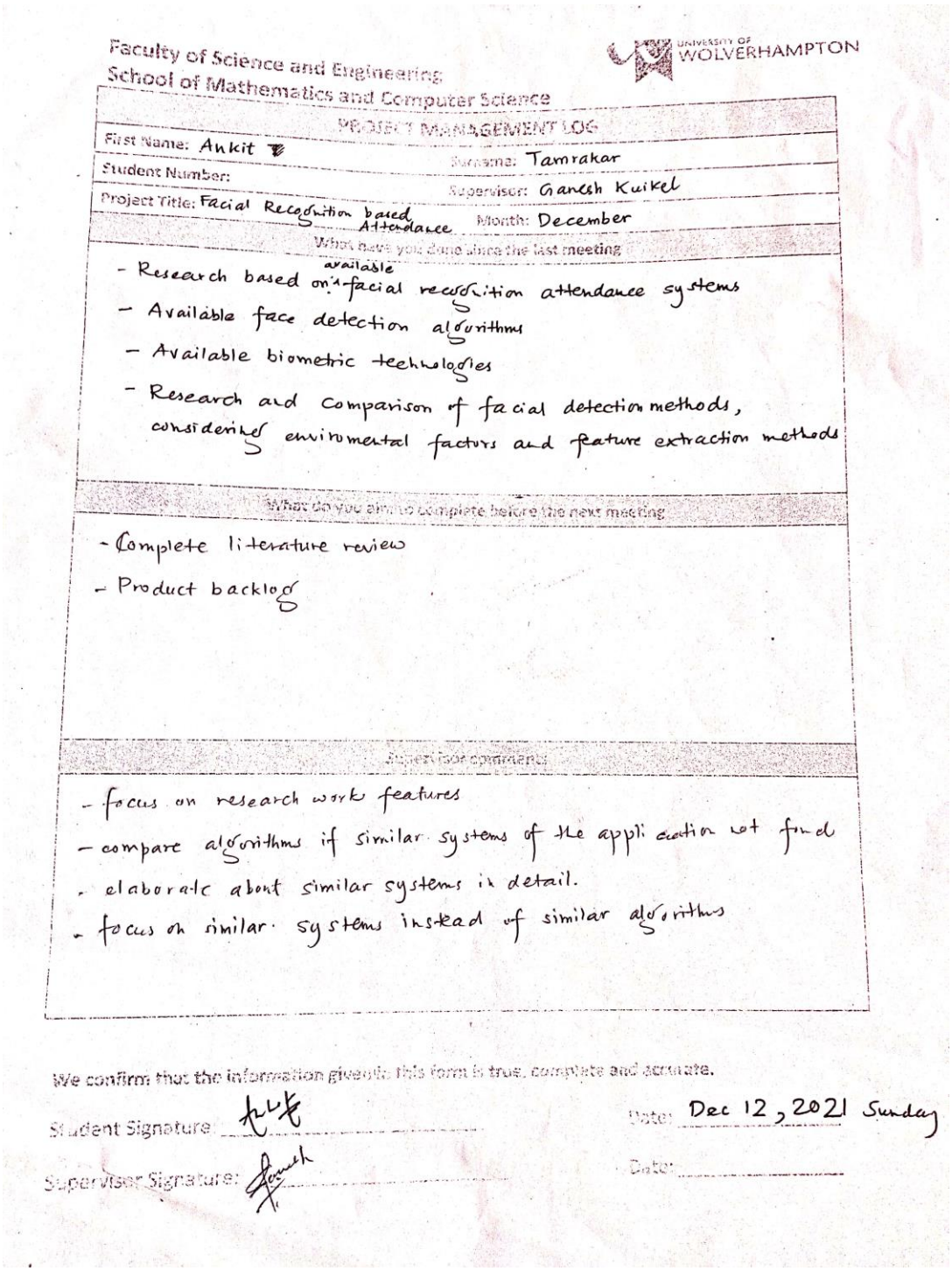
Supervisor comments

We confirm that the information given in this form is true, complete and accurate.

Student Signature: Ankit | Date: Dec 5, 2021 sunday

Supervisor Signature: | Date:

Figure 26:Log Sheet 2



Faculty of Science and Engineering
School of Mathematics and Computer Science

UNIVERSITY OF WOLVERHAMPTON

PROJECT MANAGEMENT LOG

First Name: Ankit — Surname: Tamrakar

Student Number: — Supervisor: Ganesh Kuikel

Project Title: Facial Recognition based Attendance — Month: December

What have you done since the last meeting

- Research based on available facial recognition attendance systems
- Available face detection algorithms
- Available biometric technologies
- Research and comparison of facial detection methods, considering environmental factors and feature extraction methods

What do you aim to complete before the next meeting

- Complete literature review
- Product backlog

Supervisor comments

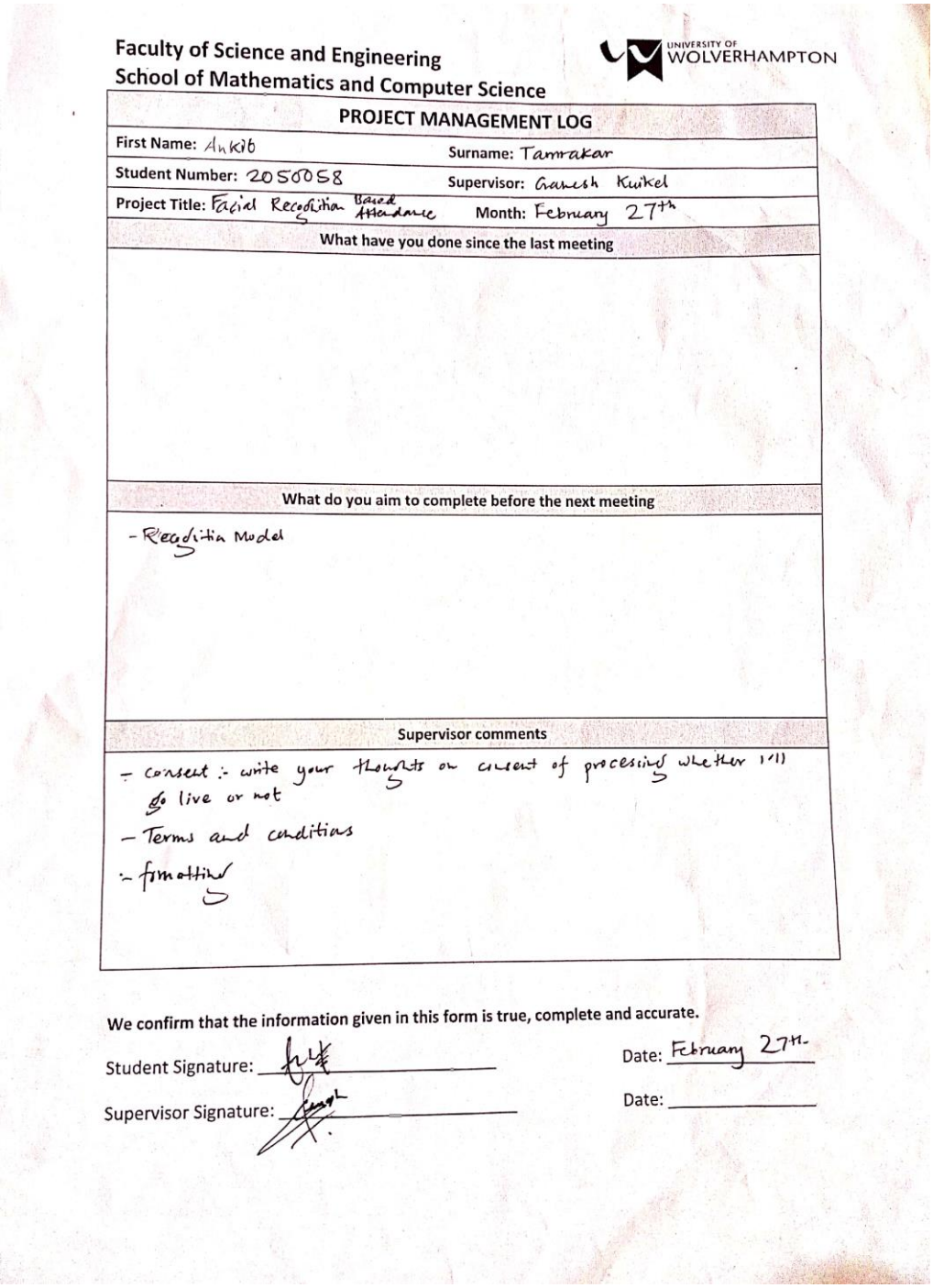
- focus on research work features
- compare algorithms if similar systems of the application not found
- elaborate about similar systems in detail.
- focus on similar systems instead of similar algorithms

We confirm that the information given in this form is true, complete and accurate.

Student Signature: Ankit — Date: Dec 12, 2021 Sunday

Supervisor Signature: Ganesh — Date:

Figure 27:Log Sheet 3



Faculty of Science and Engineering
School of Mathematics and Computer Science

UNIVERSITY OF WOLVERHAMPTON

PROJECT MANAGEMENT LOG

First Name: Ankit Surname: Tamrakar

Student Number: 2050058 Supervisor: Ganesh Kunkel

Project Title: Facial Recognition Based Attendance Month: February 27th

What have you done since the last meeting

What do you aim to complete before the next meeting

- Recognition Model

Supervisor comments

- consent :- write your thoughts on consent of processing whether it'll go live or not
- Terms and conditions
- formatting

We confirm that the information given in this form is true, complete and accurate.

Student Signature: _____ Date: February 27th.

Supervisor Signature: _____ Date: _____

Figure 28: Log Sheet 4

Faculty of Science and Engineering
School of Mathematics and Computer Science

WOLVERHAMPTON

PROJECT MANAGEMENT LOG

First Name: Ankit	Surname: Tamrakar
Student Number: 2050058	Supervisor: Ganesh Kaikel
Project Title: Facial Recognition based Attendance	Month: March

What have you done since the last meeting

- Development of face recognition model using OpenCV

What do you aim to complete before the next meeting

- Rest API must be implemented (Django or Flask)

Supervisor comments

- try to optimize the model
- multiple users must be detected

We confirm that the information given in this form is true, complete and accurate.

Student Signature: Ankit Date: March 6th

Supervisor Signature: Ganesh Date: _____

Figure 29: Log Sheet 5

Faculty of Science and Engineering
School of Mathematics and Computer Science

UNIVERSITY OF WOLVERHAMPTON

PROJECT MANAGEMENT LOG

First Name: Ankit	Surname: Tamrakar
Student Number: 2050058	Supervisor: Ganesh Kuikel
Project Title: Facial Recognition Based Attendance	Month: March

What have you done since the last meeting

- tried integration of face recognition model into Rest API / flask
- optimized the model for better performance

What do you aim to complete before the next meeting

- Research on Django celery if it is feasible for face recognition project
- implement anaconda / jupyternotebook codebase in django

Supervisor comments

- 1

We confirm that the information given in this form is true, complete and accurate.

Student Signature: _____ Date: March 13th

Supervisor Signature: _____ Date: _____

Figure 30: Log Sheet 6

Faculty of Science and Engineering
School of Mathematics and Computer Science

WOLVERHAMPTON

PROJECT MANAGEMENT LOG

First Name: Ankit	Surname: Tamrakar
Student Number: 2050058	Supervisor: Ganesh Kunkel
Project Title: Facial Attendance	Month: March

What have you done since the last meeting

- faced dlib and library error

What do you aim to complete before the next meeting

- resolve the library error

Supervisor comments

- utilize visual studio and cmake versions to resolve the library error

We confirm that the information given in this form is true, complete and accurate.

Student Signature: Ankit Date: March 20th

Supervisor Signature: Ganesh Date: _____

Figure 31: Log Sheet 7

Faculty of Science and Engineering
School of Mathematics and Computer Science

UNIVERSITY OF WOLVERHAMPTON

PROJECT MANAGEMENT LOG

First Name: Ankit	Surname: Tamrakar
Student Number: 2050058	Supervisor: Mr. Ganesh Kuikel
Project Title: Facial Recognition based attendance	Month: March

What have you done since the last meeting

- created alternate model that is independent of dlib library
- preprocessing

What do you aim to complete before the next meeting

Supervisor comments

- No comments —
Presentation based on how much work is done in the presence of reader

We confirm that the information given in this form is true, complete and accurate.

Student Signature: _____ Date: 27th March

Supervisor Signature: _____ Date: _____

Figure 32: Log Sheet 8

Faculty of Science and Engineering
School of Mathematics and Computer Science

UNIVERSITY OF WOLVERHAMPTON

PROJECT MANAGEMENT LOG

First Name: Aadit Surname: Tamrakar

Student Number: ~~Tamrakar~~ 2050058 Supervisor: Ganesh Kwikel

Project Title: Facial Recognition based attendance Month: April

What have you done since the last meeting

- Design diagrams
- Optimization Evaluation and Comparison of algorithm performances
- Draft Report - created pipeline models

(FDD, sprint planning, conclusion needs to be discussed)

What do you aim to complete before the next meeting

- front end, back end implementation
- work on admin dashboard
- test cases

Supervisor comments

- improve FDD
-

We confirm that the information given in this form is true, complete and accurate.

Student Signature: _____ Date: 3rd April

Supervisor Signature: _____ Date: _____

Figure 33: Log Sheet 9

Faculty of Science and Engineering
School of Mathematics and Computer Science

UNIVERSITY OF WOLVERHAMPTON

PROJECT MANAGEMENT LOG	
First Name: Akhil	Surname: Tammineni
Student Number: 2054058	Supervisor: Ganesh Kurikal
Project Title: Facial Recognition based Attendance	Month: April

What have you done since the last meeting

- developed frontend design
- integrated facial recognition model

What do you aim to complete before the next meeting

- backend portion of the system
- work on UI/UX.

Supervisor comments

We confirm that the information given in this form is true, complete and accurate.

Student Signature: _____ Date: April 10th

Supervisor Signature: _____ Date: _____

Figure 34: Log Sheet 10

Faculty of Science and Engineering
School of Mathematics and Computer Science

WOLVERHAMPTON

PROJECT MANAGEMENT LOG	
First Name: Ankit	Surname: Tamrakar
Student Number: 2050058	Supervisor: Ganesh Kwikel
Project Title: Facial Recgnition based Attendance	Month: April

What have you done since the last meeting

- FDD diagrams
- UML diagrams

What do you aim to complete before the next meeting

- Optimization and Evaluation
- Diagram Correction
- SRS & Methodology

Supervisor comments

- FDD and UML needs to be updated
- Explain Academic Questin in Detail
- SRS & Project Methodologies

We confirm that the information given in this form is true, complete and accurate.

Student Signature: _____ Date: April 17th

Supervisor Signature: _____ Date: _____

Figure 35: Log Sheet 11

Faculty of Science and Engineering
School of Mathematics and Computer Science

UNIVERSITY OF WOLVERHAMPTON

PROJECT MANAGEMENT LOG	
First Name: Ankit	Surname: Tamrakar
Student Number: 2050058	Supervisor: Ganesh Kenkel
Project Title: Facial Recognition based Attendance	Month: April

What have you done since the last meeting

- backend django models
- debugged frontend and backend errors
-

What do you aim to complete before the next meeting

- successful use of decorators
- create web app logos

Supervisor comments

- logos improve
- use decorator (login)
- search functionalities

We confirm that the information given in this form is true, complete and accurate.

Student Signature: _____ Date: Apr 24th

Supervisor Signature: _____ Date: _____

Figure 36: Log Sheet 12

8 References and Bibliography

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