# SMART ATTENDANCE SYSTEM

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## Internship on Machine Learning/Artificial Intelligence

submitted by

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## ICT ACADEMY OF KERALA

**THIRUVANANTHAPURAM, KERALA, INDIA**

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# List of Abbreviations

AI - Artificial Intelligence

ML – Machine Learning

RGB - Red, Green, Blue (color channels)

KNN - K-Nearest Neighbors

CV – Computer Vision

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# Abstract

## Smart Attendance System

The Face Recognition Smart Attendance System is an innovative and efficient solution designed to automate and streamline the process of attendance tracking in various settings such as educational institutions, corporate offices, and events. Traditional attendance methods, which rely on manual input or RFID cards, are often time-consuming, prone to errors, and susceptible to manipulation. This system leverages advanced computer vision techniques and machine learning algorithms to offer a more secure, accurate, and convenient alternative . At the core of the system is a facial recognition technology, which employs the K-Nearest Neighbors (KNN) algorithm to identify and verify individuals in real-time. The system captureslive video feed from a camera, detects faces using the Haar Cascade classifier, and preprocessesthe images to extract relevant features. These features are then matched against a pre-traineddataset of known faces using the KNN classifier, which has been trained on a labeled dataset of facial images. Once a face is recognized, the system logs the attendance information, including the individual's name and the timestamp, into a centralized database. This data can be easily accessed and analyzedfor attendance reports, ensuring transparency and ease of management. Additionally, the systemcan provide auditory feedback to confirm successful attendance recording, enhancing user experience.

In summary, the Face Recognition Smart Attendance System is a robust and reliable solution that enhances the accuracy and efficiency of attendance management. It leverages state-of-the-art facial recognition technology to provide a seamless and user-friendly experience, making it an ideal choice for modern institutions seeking to adopt smart solutions.

# Problem Definition

## 1.1 Overview

The main goal of the Face Recognition Smart Attendance System is to automate the process of taking attendance using face recognition technology. This system ensures an efficient, accurate, and user-friendly way to manage attendance records.

## 1.2 Problem Statement

Attendance is an important part of daily classroom evaluation. At the beginning and ending of class, it is usually checked by the teacher, but it may appear that a teacher may miss someone or some students answer multiple times. Face recognition-based attendance system is a problem of recognizing face for taking attendance by using face recognition technology based on highdefinition monitor video and other information technology. The concept of face recognition is to give a computer system the ability of finding and recognizing human faces fast and precisely in images or videos. Numerous algorithms and techniques have been developed for improving the performance of face recognition. Recently Deep learning has been highly explored for computer vision applications. Human brain can automatically and instantly detect and recognize multiple faces. But when it comes to computer, it is very difficult to do all the challenging tasks on the level of human brain. The face recognition is an integral part of biometrics. In biometrics, basic traits of human are matched to the existing data. Facial features are extracted and implemented through algorithms, which are efficient and some modifications are done to improve the existing algorithm models. Computers that detect and recognize faces could be applied to a wide variety of practical applications including criminal identification, security systems, identity verification etc. The face recognition system generally involves two stages face detection and face recognition.

# Introduction

Medical imaging is a cornerstone of modern healthcare, providing critical insights into a wide range of medical conditions. Recent advancements in artificial intelligence (AI) have revolutionized medical imaging, enabling the development of sophisticated algorithms that can analyze images with high precision. AI techniques, particularly Convolutional Neural Networks (CNNs), have shown great promise in detecting abnormalities that may not be easily discernible by human eyes, leading to more accurate diagnoses and improved patient outcomes.

Despite these advancements, brain tumor detection remains a challenging task due to the complex and subtle nature of tumors in MRI images. Traditional diagnostic methods are often time-consuming and reliant on the expertise of radiologists, which can result in variability and potential delays in diagnosis. The integration of AI in this domain has the potential to significantly enhance diagnostic accuracy and efficiency, thereby improving clinical decision-making and patient care.

The primary objective of this project is to develop and evaluate CNN and Transfer Learning models for the accurate detection of brain tumors in MRI images. By employing data augmentation techniques and leveraging advanced CNN architectures such as VGG, ResNet, DenseNet and MobileNet, we aim to overcome the limitations posed by the limited size of available datasets and improve the performance of our models. Additionally, we will perform hyperparameter tuning to optimize the models and conduct a comparative analysis to determine the most effective approach for brain tumor detection.

This project report is organized as follows: Section 3 provides a literature survey, discussing key studies and findings in this area. Section 4 presents the experimental results of our study. Finally, Section 5 concludes the report and suggests directions for future research.

# Literature Survey

The primary purpose of this paper review is to find the solutions provided by others author and consider the imperfection of the system proposed by them, give the best solutions. In [18] Kawaguchi introduced a lecture attendance system with a new method called continuous monitoring, and the student's attendance marked automatically by the camera which captures the photo of a student in the class. The architecture of the system is simple since two cameras equipped with the wall of the class. The first one is a capturing camera used to capture the image student in the class and the second camera is sensor camera is used to getting the seat of a student inside the class and the camera capturing will snap the image of the student. The system compares the picture taking from a camera capturing images and faces in the database done much time to perfect the attendance. Other paper proposed by [2] introduced a real-time computer vision algorithm in automatic attendance management system. The system installed the camera with non-intrusive, which can snap images in the classroom and compared the extracted face from the image of the camera capturing with faces inside the system. This system also used machine learning algorithm which are usually used in computer vision. Also, HAAR CLASSIFIERS used to train the images from the camera capturing. The face snap by the camera capturing will convert to grayscale and do subtraction on the images; then the image is transferred to store on the server and processing later. In 2012 N. Kar [19] introduced an automated attendance management system using face recognition technique which used the Principal Component Analysis To implementation the system, use two libraries such OpenCV is a computer vision library and FLTK(Light Tool Kit. Both of this libraries helped the development such as OpenCV support algorithm[20] and FLTK [21] used to design the interface. In the system, there are Request Matching and Adding New fact to Database. In Request Matching, the first step is open the camera and snap the photo after the extraction the frontal face. The next step is recognizing the face with the training data and project the extracted face onto the Principal Component Analysis. The final step displays the nearest face with the acquired images. Apart from that, adding a new face into the database is snap the photo after that extract the frontal face images and then perform the Haar cascade Method to find the perform the Principal Component Analysis Algorithm. The final step is storing the information inside the face XML file. The system is focused on the algorithm to improve the face detection

from acquired images or videos. In [3] the author also proposed a system which implements automatic attendance using face recognition. The system which can extract the object in the face such nose, mouth by using MATLAB with Principal Component Analysis (PCA). The system [7] designed to resolve the issues of attendance marking system such as timeconsuming. As the result of the experiment show that this paper, the system can recognize in case the dark background or difference view of the face in the classroom. Jyotshana Kanti [4] proposed a smart attendance marking system which combines two differencing algorithms such Principal Component Analysis and Artificial Neural Network. The purpose of the author is to solve the traditional attendance marking system and to resolve the time-consuming. In the system implement with Principal Component Analysis, it does an extraction and identify the similarities of the face database and acquire images. Artificial Neural Network is used to solve the problem of the input data or learn from the input data, and the expect value. In the system implemented by the author using back propagation algorithm and combines with mathematical function to perform in that system. As a result, written by the author research, it shows that the system can use to recognize in a different environment. In [22] Priyanka Thakare proposed a method using Eigenface and Principal Component Analysis which has the architecture as the following step. The camera needs to install in the front which can capture an entire face of the student inside the class. The first phase after the camera has been captured; the captured image was transferred into the system as an input. The image capture from the camera sometimes come with the darkness or brightness which need to do an enhancement on it such as convert to gray image. The next step, Histogram Normalization is used in this system remove the contrast of the image. It is easy to recognize when has the student sit in the back row. The Median filter is used to remove noise from the image in case the camera is high definition camera, but sometimes it still contains the noise. The author also implements with skin classification which changes all the pixel to black except the pixel are close to the skin [1] Student Attendance System using Face Recognition: Samridhi Dev, Tushar Patnaikb(2020) In this paper the system was tested on three different algorithms out of which the KNN algorithm proved to be better with the accuracy of 99.27 %. The system was tested on various conditions which include illumination, head movements, expressions, the distance of students from the camera. The system stands up to the expectations even when the image contains faces with beards and spectacles and without beard and spectacles. proposed system evinced to be magnificent to recognize faces having two years of difference. [2] AUTOMATED SMART ATTENDANCE

SYSTEM USING FACE RECOGNITION: Kolipaka Preethi,swathy vodithala (2021) The proposed method consists of different stages to mark the attendance live A. Face Detection B. DataSet Creation and Training C. Face Recognition and Updating attendance [3] FAREC - CNN Based Efficient Face Recognition Technique using Dlib: Sharma S, Karthikeyan Shanmugasundaram, Sathees Kumar Ramasamy(2016) The paper used trained feature models from Convolutional Neural Network; model has the features of the entire labels of the face recognition systems. The test images are validated against these models and provide the maximum probability value among the labels and claims that to be the person. FAREC takes 20 epoch for converging learning rate from 0.01 and produce 96% accuracy for FRGC and False acceptance rate of 0.1% (1 in 100). The training losses are drastically reduced to 0 very soon as before 5th epoch. The following figure 9 and figure 10 showing the learning rate convergence and accuracy of FAREC. [4] FaceTime – Deep Learning Based Face Recognition Attendance System: Marko Arsenovic, Srdjan Sladojevic, Andras Anderla, Darko Stefanovic (2017) The model was trained based on a small number of images per employee and using the proposed method of augmentation. This led to the enlargement of the initial dataset and the improvement of the overall accuracy. By analyzing the images stored in the database during the acquisition period, it could be seen that the light conditions influenced the recognition process. The results of our initial experiment performed better in performance assessment than traditional black and white display systems. This system is mainly developed for face recognition from images or video frames.

# Methodology

3.1 Dataset  - The dataset used for this work contains students images,

3.2. Data Preprocessing

3.2.1 Cropping Images:

The crop_img function detects the extreme points of the largest contour in an image and crops the image to that rectangular region3.3 example images as students

3.3 Example images  students

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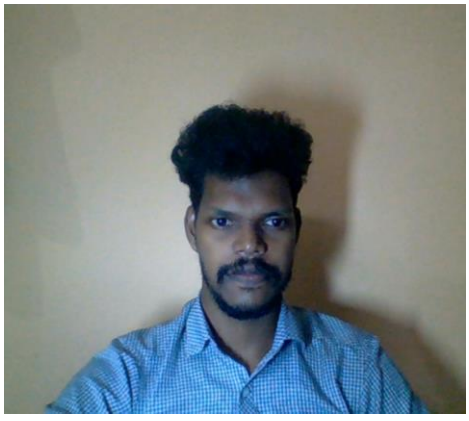
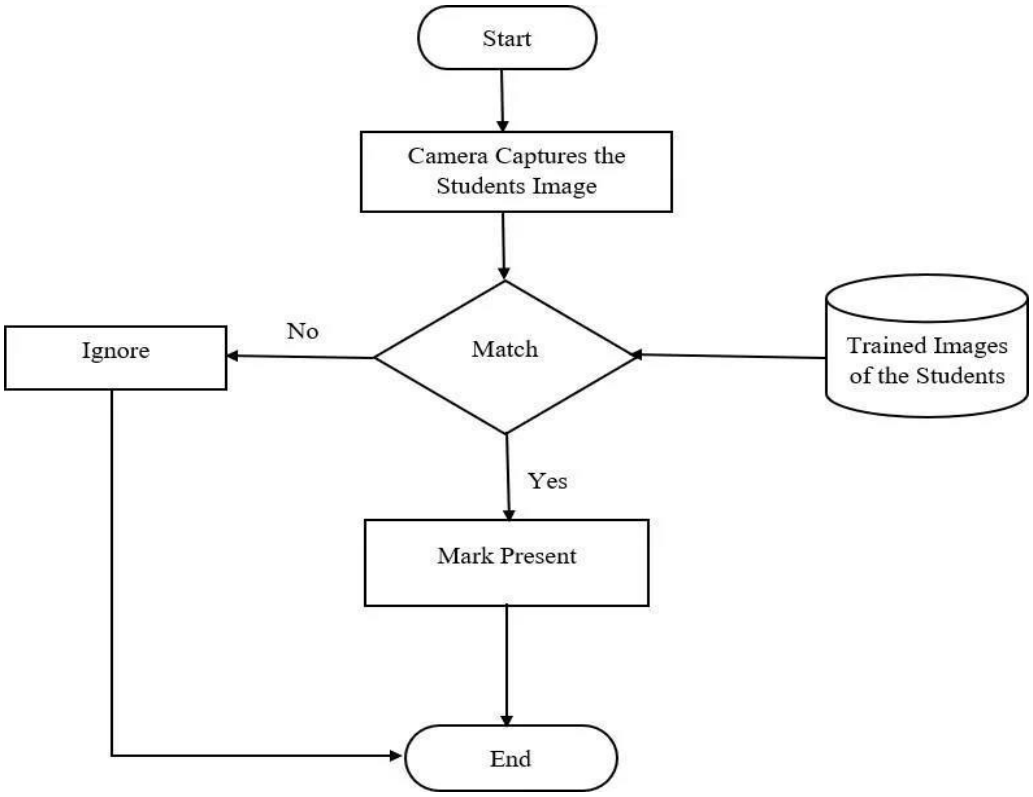


# Flowchart


Start
Camera Captures the Students Image
Match
No
Ignore
Trained Images of the Students
Yes
Mark Present
End

# Implementation

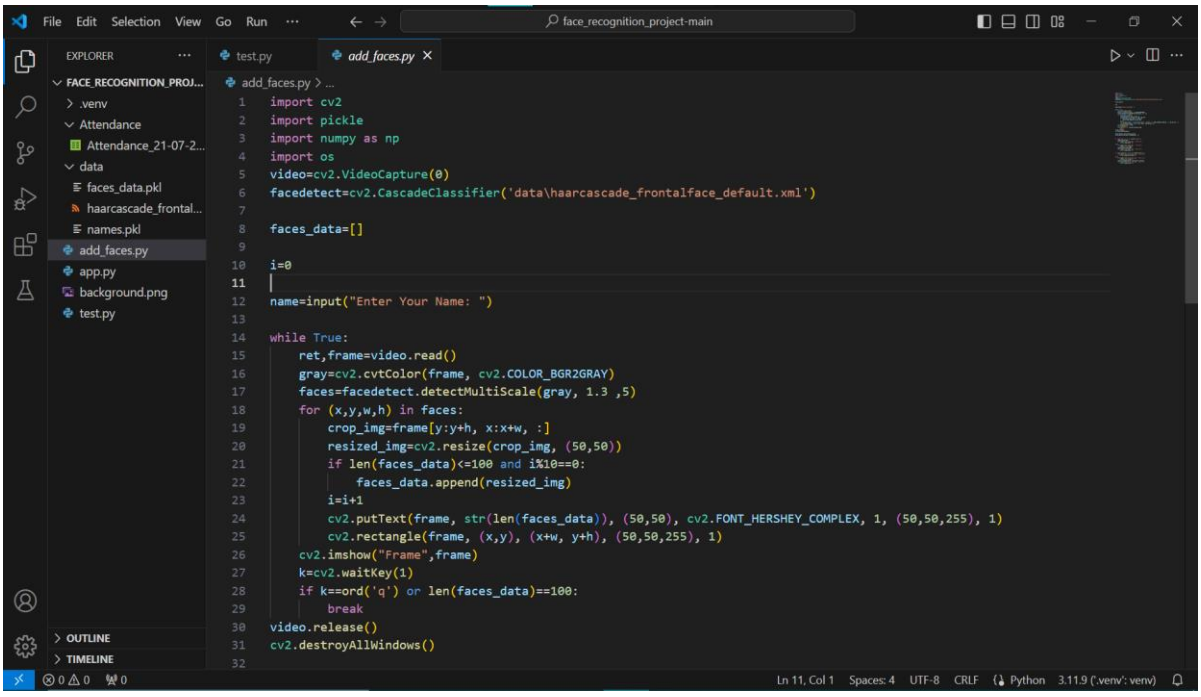
4.1 registering name – registering names of students

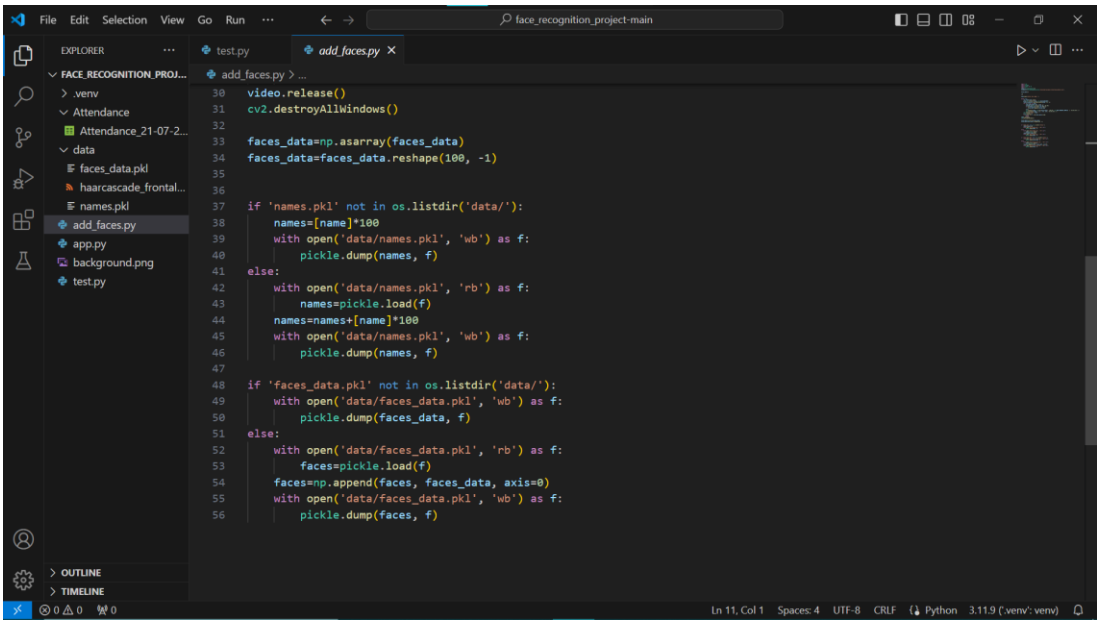
3.2 capturing face – capture face details of students

3.3 face detection – face detection of students and press o button to take attendance. The attendance will mark automatically to a csv files.

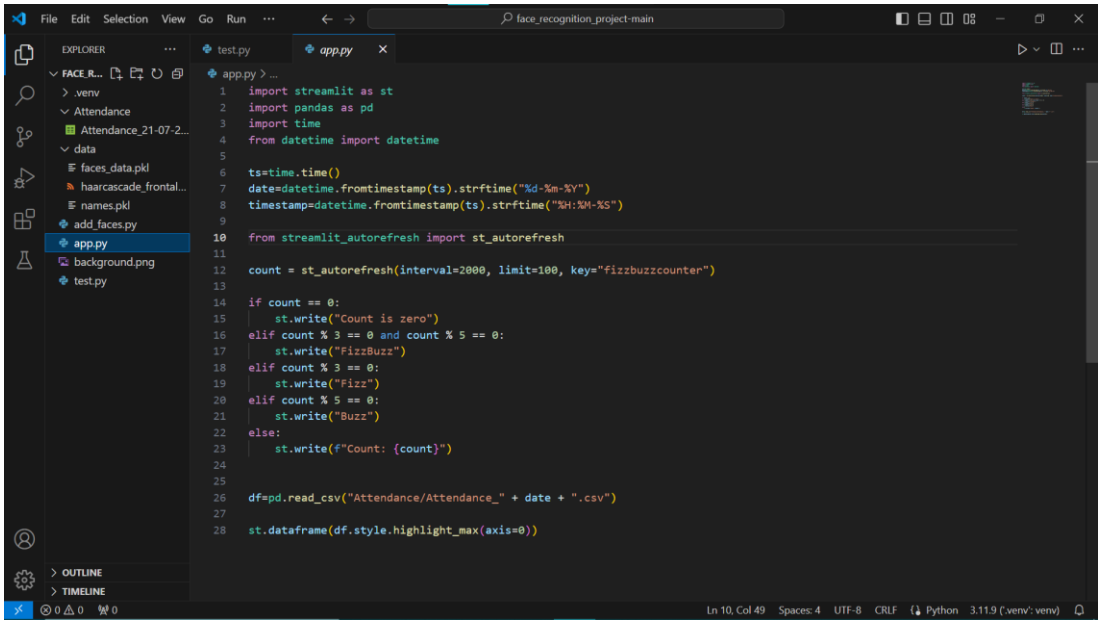
# Code

### 5.1 add_faces.py

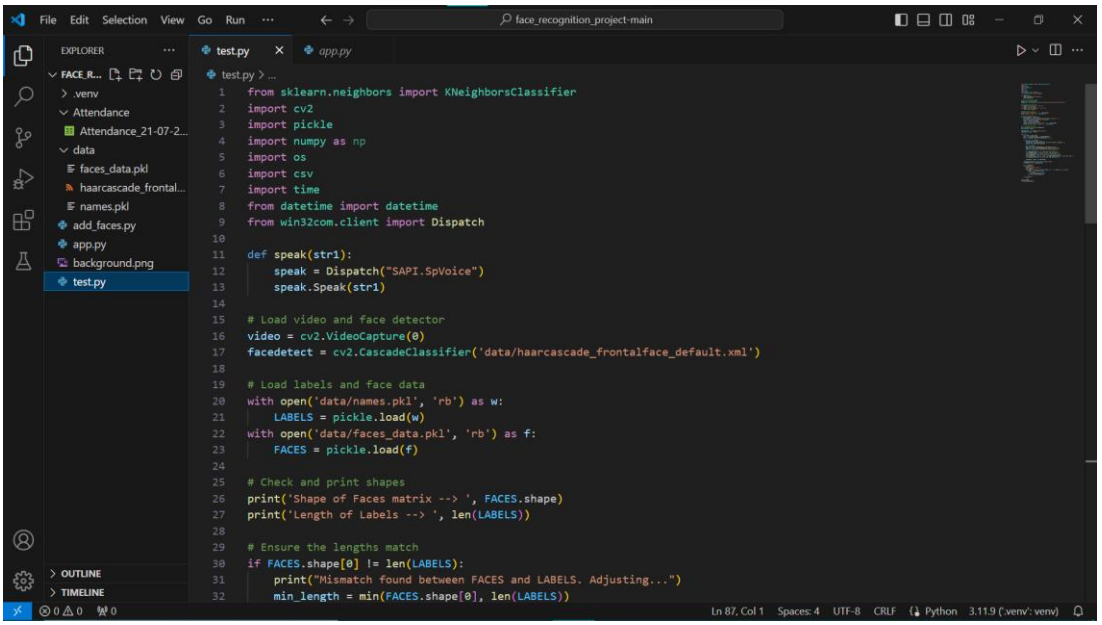



File Edit Selection View Go Run
face_recognition_project-main
EXPLORER
test.py
add_faces.py
add_faces.py > ...
FACE_RECOGNITION_PROJ...
.venv
Attendance
Attendance_21-07-2...
data
faces_data.pkl
haarcascade_frontal...
names.pkl
add_faces.py
app.py
background.png
test.py
video.release()
cv2.destroyAllWindows()
faces_data=np.asarray(faces_data)
faces_data=faces_data.reshape(100, -1)
if 'names.pkl' not in os.listdir('data/'):
names=[name]*100
with open('data/names.pkl', 'wb') as f:
pickle.dump(names, f)
else:
with open('data/names.pkl', 'rb') as f:
names=pickle.load(f)
names=names+[name]*100
with open('data/names.pkl', 'wb') as f:
pickle.dump(names, f)
if 'faces_data.pkl' not in os.listdir('data/'):
with open('data/faces_data.pkl', 'wb') as f:
pickle.dump(faces_data, f)
else:
with open('data/faces_data.pkl', 'rb') as f:
faces=pickle.load(f)
faces=np.append(faces, faces_data, axis=0)
with open('data/faces_data.pkl', 'wb') as f:
pickle.dump(faces, f)
OUTLINE
TIMELINE
Ln 11, Col 1 Spaces: 4 UTF-8 CRLF Python 3.11.9 ('.venv': venv)

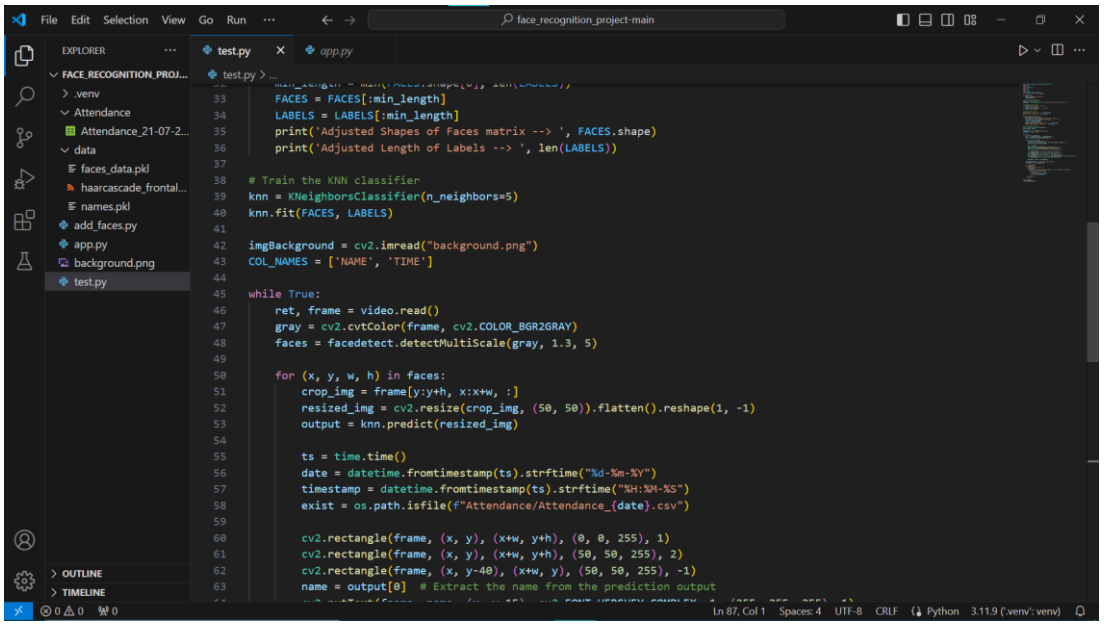
## 5.2 app.py


File Edit Selection View Go Run
face_recognition_project-main
EXPLORER
test.py
app.py
app.py > ...
FACE_R...
.venv
Attendance
Attendance_21-07-2...
data
faces_data.pkl
haarcascade_frontal...
names.pkl
add_faces.py
app.py
background.png
test.py
import streamlit as st
import pandas as pd
import time
from datetime import datetime
ts=time.time()
date=datetime.fromtimestamp(ts).strftime("%d-%m-%Y")
timestamp=datetime.fromtimestamp(ts).strftime("%H:%M-%S")
from streamlit_autorefresh import st_autorefresh
count = st_autorefresh(interval=2000, limit=100, key="fizzbuzzcounter")
if count == 0:
st.write("Count is zero")
elif count % 3 == 0 and count % 5 == 0:
st.write("FizzBuzz")
elif count % 3 == 0:
st.write("Fizz")
elif count % 5 == 0:
st.write("Buzz")
else:
st.write(f"Count: {count}")
df=pd.read_csv("Attendance/Attendance_" + date + ".csv")
st.dataframe(df.style.highlight_max(axis=0))
OUTLINE
TIMELINE
Ln 10, Col 49 Spaces: 4 UTF-8 CRLF Python 3.11.9 ('.venv': venv)

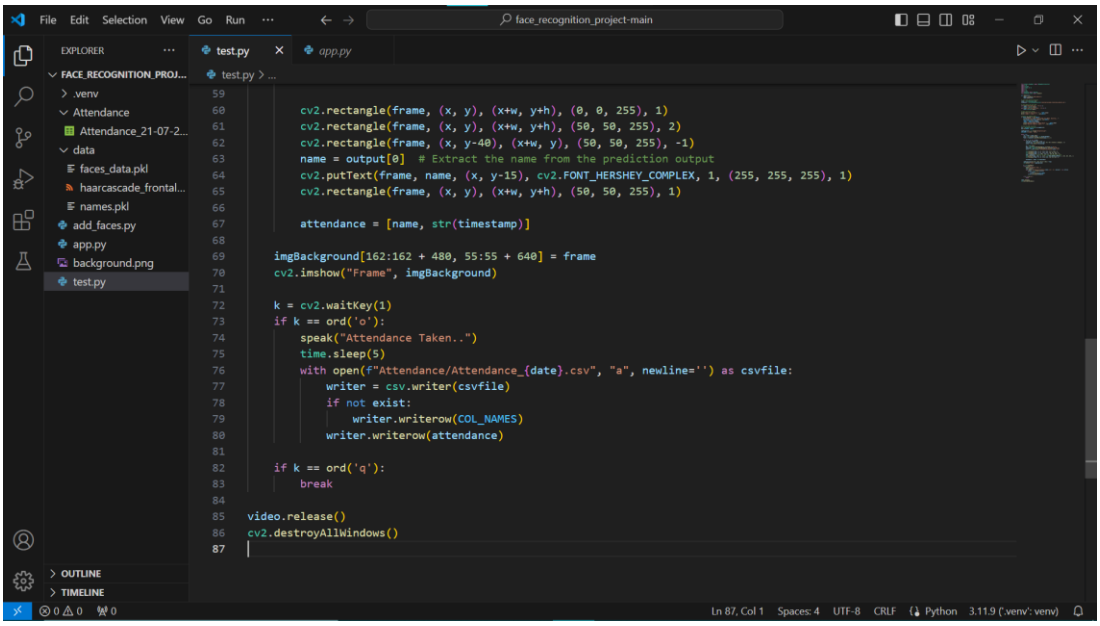
## 5.3 test.py



```python
from sklearn.neighbors import KNeighborsClassifier
import cv2
import pickle
import numpy as np
import os
import csv
import time
from datetime import datetime
from win32com.client import Dispatch

def speak(str1):
    speak = Dispatch("SAPI.SpVoice")
    speak.Speak(str1)

# Load video and face detector
video = cv2.VideoCapture(0)
facedetect = cv2.CascadeClassifier('data/haarcascade_frontalface_default.xml')

# Load labels and face data
with open('data/names.pkl', 'rb') as w:
    LABELS = pickle.load(w)
with open('data/faces_data.pkl', 'rb') as f:
    FACES = pickle.load(f)

# Check and print shapes
print('Shape of Faces matrix --> ', FACES.shape)
print('Length of Labels --> ', len(LABELS))

# Ensure the lengths match
if FACES.shape[0] != len(LABELS):
    print("Mismatch found between FACES and LABELS. Adjusting...")
    min_length = min(FACES.shape[0], len(LABELS))
```



```python
    FACES = FACES[:min_length]
    LABELS = LABELS[:min_length]
    print('Adjusted Shapes of Faces matrix --> ', FACES.shape)
    print('Adjusted Length of Labels --> ', len(LABELS))

# Train the KNN classifier
knn = KNeighborsClassifier(n_neighbors=5)
knn.fit(FACES, LABELS)

imgBackground = cv2.imread("background.png")
COL_NAMES = ['NAME', 'TIME']

while True:
    ret, frame = video.read()
    gray = cv2.cvtColor(frame, cv2.COLOR_BGR2GRAY)
    faces = facedetect.detectMultiScale(gray, 1.3, 5)

    for (x, y, w, h) in faces:
        crop_img = frame[y:y+h, x:x+w, :]
        resized_img = cv2.resize(crop_img, (50, 50)).flatten().reshape(1, -1)
        output = knn.predict(resized_img)

        ts = time.time()
        date = datetime.fromtimestamp(ts).strftime("%d-%m-%Y")
        timestamp = datetime.fromtimestamp(ts).strftime("%H:%M-%S")
        exist = os.path.isfile(f"Attendance/Attendance_{date}.csv")

        cv2.rectangle(frame, (x, y), (x+w, y+h), (0, 0, 255), 1)
        cv2.rectangle(frame, (x, y), (x+w, y+h), (50, 50, 255), 2)
        cv2.rectangle(frame, (x, y-40), (x+w, y), (50, 50, 255), -1)
        name = output[0]  # Extract the name from the prediction output
```


File Edit Selection View Go Run
face_recognition_project-main
EXPLORER
test.py
app.py
FACE_RECOGNITION_PROJ...
.venv
Attendance
Attendance_21-07-2...
data
faces_data.pkl
haarcascade_frontal...
names.pkl
add_faces.py
app.py
background.png
test.py
OUTLINE
TIMELINE
cv2.rectangle(frame, (x, y), (x+w, y+h), (0, 0, 255), 1)
cv2.rectangle(frame, (x, y), (x+w, y+h), (50, 50, 255), 2)
cv2.rectangle(frame, (x, y-40), (x+w, y), (50, 50, 255), -1)
name = output[0] # Extract the name from the prediction output
cv2.putText(frame, name, (x, y-15), cv2.FONT_HERSHEY_COMPLEX, 1, (255, 255, 255), 1)
cv2.rectangle(frame, (x, y), (x+w, y+h), (50, 50, 255), 1)
attendance = [name, str(timestamp)]
imgBackground[162:162 + 480, 55:55 + 640] = frame
cv2.imshow("Frame", imgBackground)
k = cv2.waitKey(1)
if k == ord('o'):
speak("Attendance Taken..")
time.sleep(5)
with open(f"Attendance/Attendance_{date}.csv", "a", newline='') as csvfile:
writer = csv.writer(csvfile)
if not exist:
writer.writerow(COL_NAMES)
writer.writerow(attendance)
if k == ord('q'):
break
video.release()
cv2.destroyAllWindows()
Ln 87, Col 1 Spaces: 4 UTF-8 CRLF Python 3.11.9 ('.venv': venv)

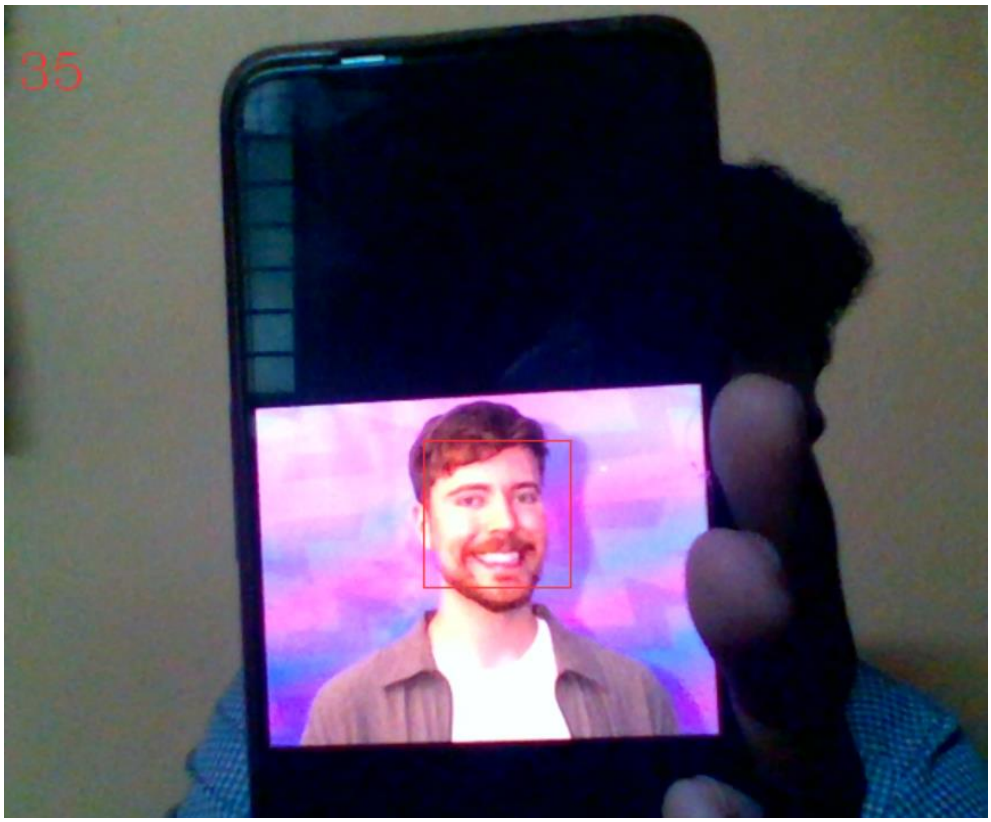
# Screenshots

### 5.4 adding name

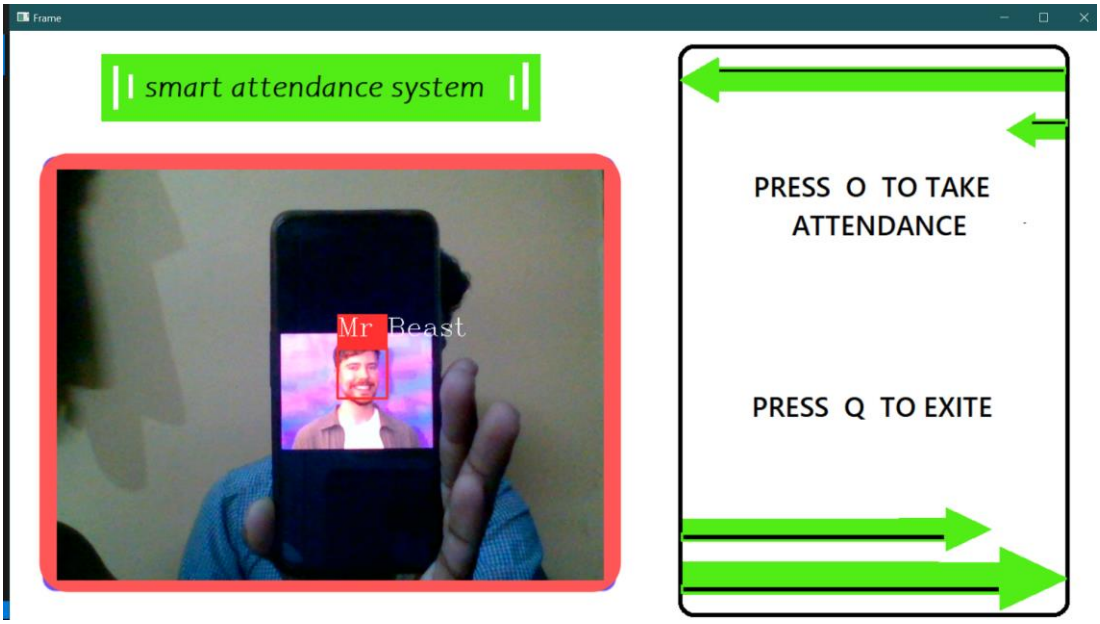
```
PS C:\Users\krish\OneDrive\Desktop\New folder\face_recognition_project-main (1)\face_recognition_project-main> & "c:/Users/
krish/OneDrive/Desktop/New folder/face_recognition_project-main (1)/face_recognition_project-main/.venv/Scripts/python.exe"
 "c:/Users/krish/OneDrive/Desktop/New folder/face_recognition_project-main (1)/face_recognition_project-main/add_faces.py"
Enter Your Name:
```

```
krish/OneDrive/Desktop/New folder/face_recognition_project-main (1)/face_recognition_project-main/.venv/Scripts/python.exe"
 "c:/Users/krish/OneDrive/Desktop/New folder/face_recognition_project-main (1)/face_recognition_project-main/add_faces.py"
Enter Your Name: Mr Beast
```

### 5.5 adding face details



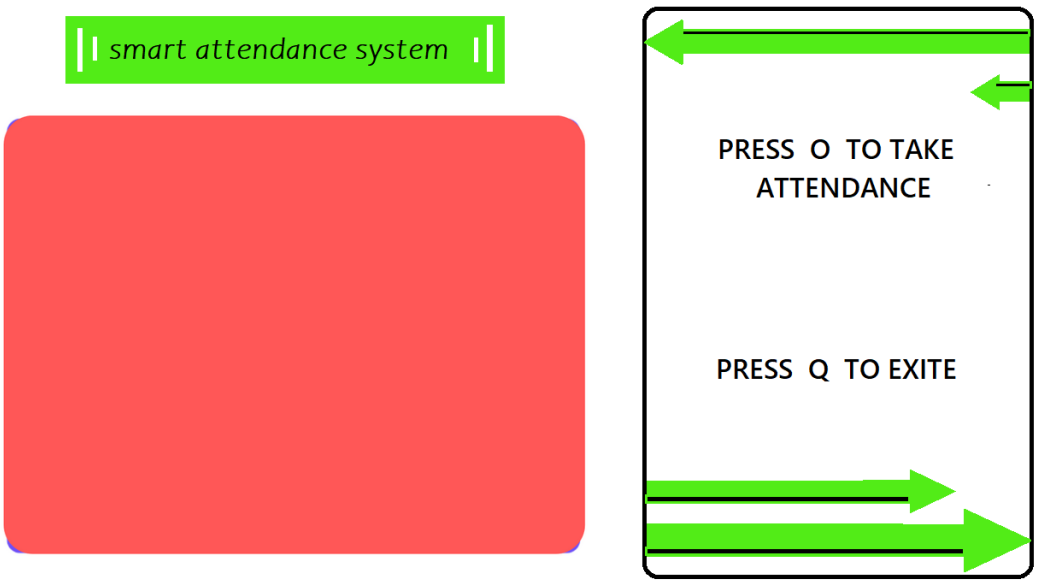
## 5.6 face recognition




## 5.7 multiple face recognition

# Attendance sheet


# Background image



# Conclusion

Face recognition systems are part of facial image processing applications and their significance as a research area are increasing recently. Implementations of system are crime prevention, video surveillance, person verification, and similar security activities. The face recognition system implementation can be part of Universities. Face Recognition Based Attendance System has been envisioned for the purpose of reducing the errors that occur in the traditional (manual) attendance taking system. The aim is to automate and make a system that is useful to the organization such as an institute. The efficient and accurate method of attendance in the office environment that can replace the old manual methods. This method is secure enough, reliable and available for use. Proposed algorithm is capable of detect multiple faces, and performance of system has acceptable good results.

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