SMART SECURITY SYSTEM USING IMAGE RECOGNITION

Using Computer Vision

Developed by : Arpita Prakash Hegde, Neha Pawar K R, Nidhi S Jain, Nikita B N, Yashaswini Bandloor. V

Smart Bridge-Remote Summer Internship Program

1. INTRODUCTION

The growing interest in computer vision of the past decade, fueled by the steady doubling rate of computing power every 13 months, face detection and recognition has transcended from an esoteric to a popular area of research in computer vision and one of the better and successful applications of image analysis and algorithm based understanding. With the aid of a regular web camera, a machine is able to detect and recognize a person's face; a custom login screen with the ability to filter user access based on the users' facial features will be developed.A general statement of the face recognition problem (in computer vision) can be formulated as follows: given still or video images of a scene, identify or verify one or more persons in the scene using a stored database of faces. Facial recognition generally involves two stages: 'Face Detection' where a photo is searched to find a face, then the image is processed to crop and extract the person's face for easier recognition. 'Face Recognition' where that detected and processed face is compared to a database of known faces, to decide who that person is. Face detection can be performed fairly easily and reliably with Intel's open source framework called OpenCV. This framework has an inbuilt Face Detector that works in roughly 90-95% of clear photos of a person looking forward at the camera. OpenCV has the advantage of being a multi-platform framework; it supports both Windows and Linux, and more recently, Mac OS X. OpenCV has so many capabilities it can seem overwhelming at first. A good understanding of how these methods work is the key to getting good results when using OpenCV.

1.1 Overview

The Smart Security System using Image Recognition service in real time helps the home based security system to track the persons coming into the house and unlocking the door, hereby the system would be accessed by image recognition service using opencv in which the images are trained in different classes labeled with the names of the family members with which we can give the access to unlock their door.

1.2 Purpose

By using Smart Security System Using Image Recognition we can secure home premises from the invaders and also capture the suspected people who are not authorized to move inside the house. And also for example, if a person is not at home and forgot keeping the keys for the housemates, they can give their facial image standing in front of camera in which the model would process the image, tally it with the reference images and then give the access to the housemates which could not make them wait in front of the door.

2. LITERATURE SURVEY

A literature review on Smart security system using image recognition talks about building a door locking system that can recognize the face of the owner of the house and family members who will have access to pass through the door in the house. It can be done by using face recognition algorithms which are gaining much importance in this era. The advantage of using face recognition over other identification features like RFID or Passcode is because it is less intrusive. There are plenty of methods for face detection and recognition, in this system face detection is done based on Haar features and face recognition is done based on local binary pattern using OpenCV library. Haar Cascade Classifier is used to detect the face that it's been trained for, from the source. The classifier, detects a single face and crops the face out of the scene.

2.1 Proposed System

Computer Vision :

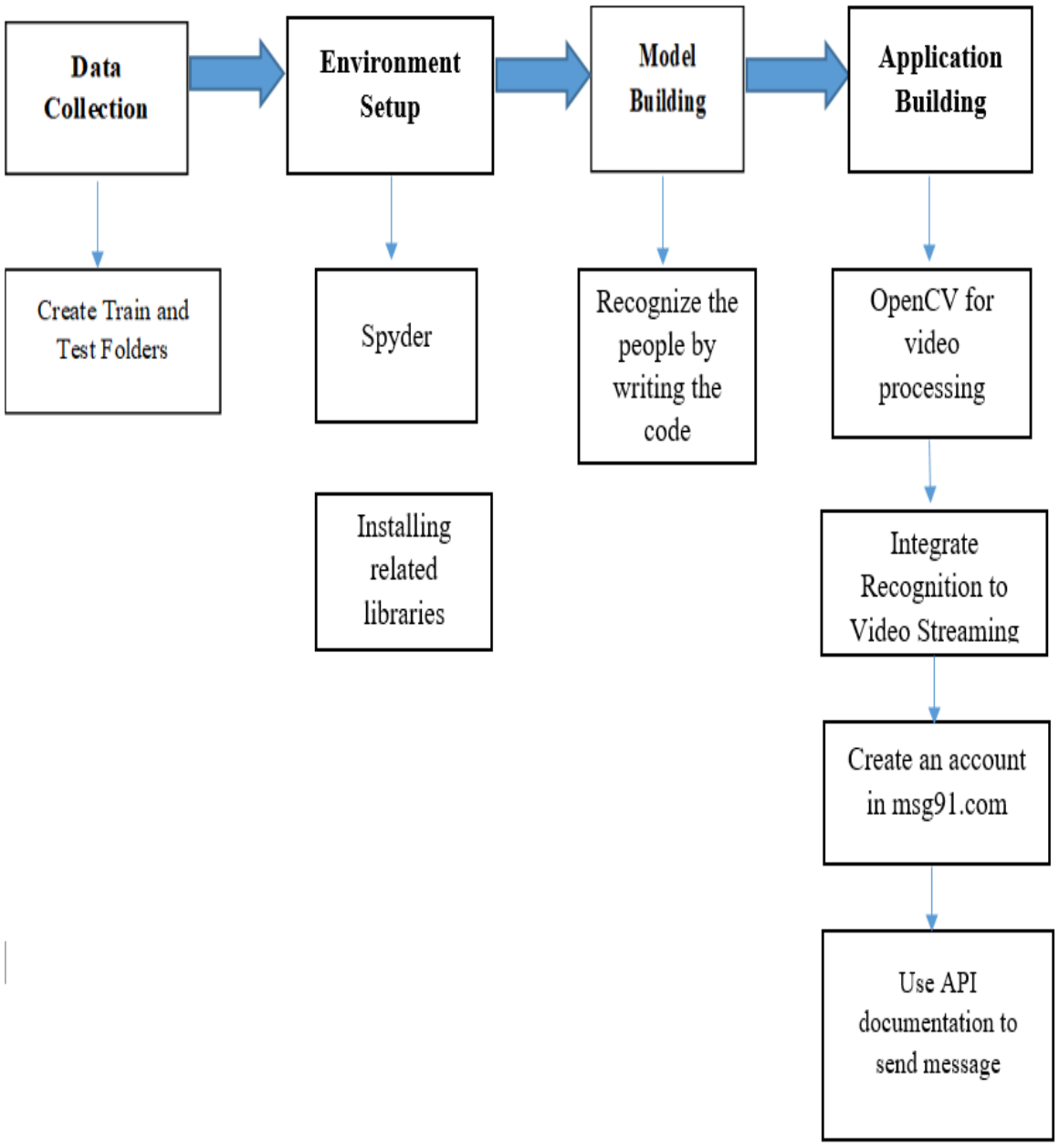
The Smart Security System using Image Recognition uses Computer Vision (OpenCV). OpenCV uses a type of face detector called a Haar Cascade classifier. Given an image, which can come from a file or from live video, the face detector examines each image location and classifies it as "Face" or "Not Face." Classification assumes a fixed scale for the face, say 50x50 pixels. Since faces in an image might be smaller or larger than this, the classifier runs over the image several times, to search for faces across a range of scales. A standard camera captures the image to spot the person. It's a prototype that identifies the visitor. If the door recognizes the visitor, the door is going to be unlocked. If they are not identified the door will remain firmly locked. This system talks about four features: security, safety, control and monitoring to home automation. Thus, when an unauthenticated user tries to log in, a message is sent to the authorized person.

3. THEORETICAL ANALYSIS

A number of methods are available for detecting and recognizing faces with various levels of complexities. The human brain makes vision seem very easy. It does not take any difficulty to tell apart a cheetah and a tiger, read a sign or recognizes a human face. But these are really difficult problems to solve with a computer. They only seem easy because human brains are fabulously good at understanding images. In recent years, machine learning has made marvelous progress in solving these difficult problems. In particular, the model called a deep convolutional neural network can achieve reasonable performance on difficult visual recognition tasks which are matching or exceeding human performance in some domains.

When processing an image, face detection is done by finding a square around faces. We have also used reshape function to get the proper square around the face. In our project, once we run the code in the prompt, we get the output as “allowed” or “not allowed” on the person’s image. This is done by running the “tester.py” file in the prompt. If we run the “videoTester.py” file, webcam gets on (activated) and recognizes the face and gives the output around the square.

3.1 Block Diagram



3.2 Software Designing

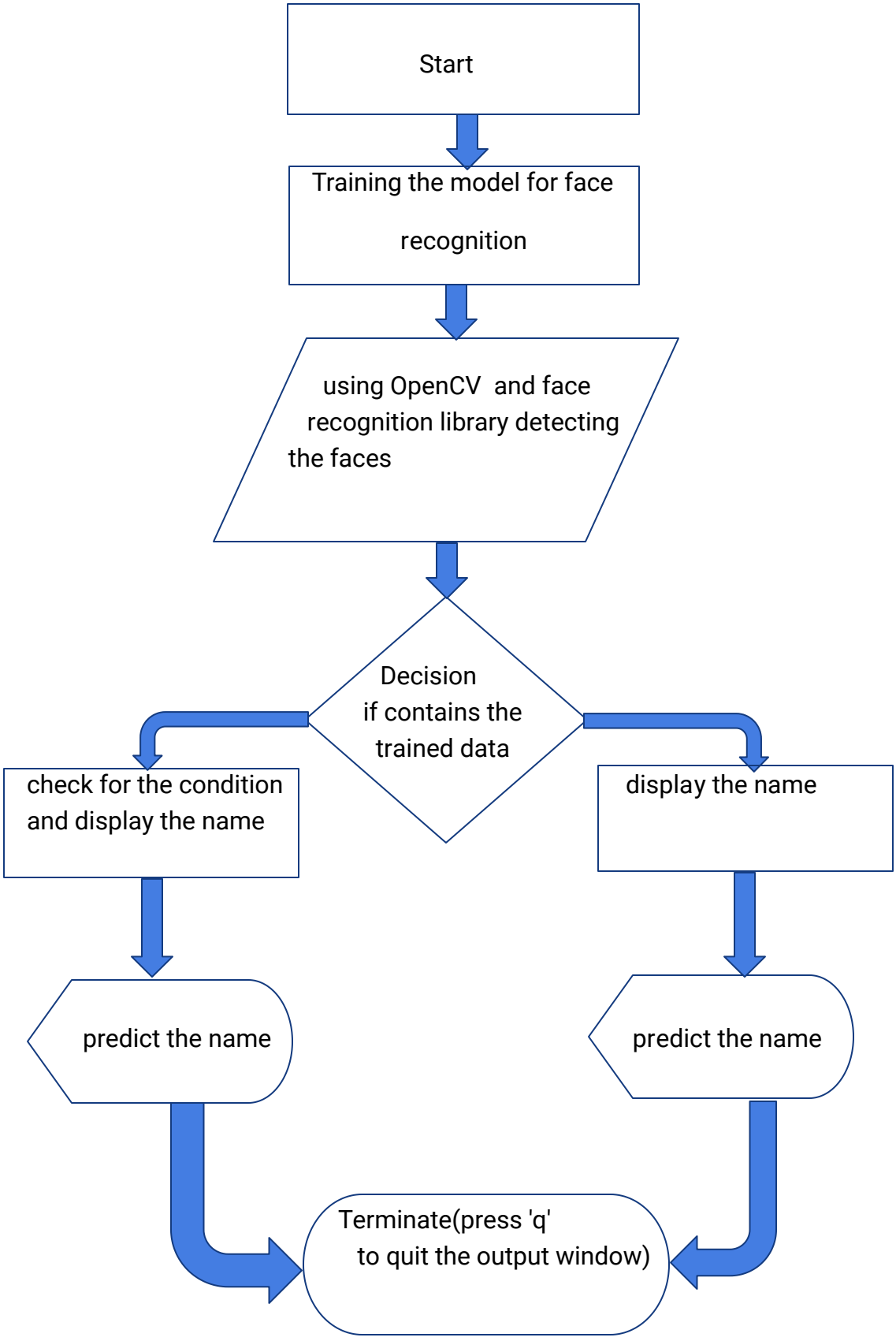
- Python
- Spyder
- OpenCV
- Msg91.com
- API

We developed this “Smart Security System Using Image Recognition” by using Python language, which is a high level programming language. For the coding part, we used Spyder, which is an integrated scientific programming in python language. We used OpenCV to perform face recognition, extract face embedding from each face using deep learning, train a face recognition model on the embedding, and then finally recognize faces in both images and video streams with OpenCV. We have used msg91.com to send the notifications to people.We haveintegrated our video streaming with face recognition and SMS API. If person is recognised then give door access is given to person otherwise a notification is send to authorised people.

4. EXPERIMENTAL INVESTIGATION

In our project, we have used Image dataset. This dataset contains two folder: Test_images and Training_images. In Test_images, we have almost 148 images, in which we placed images of 3 different persons namely, MS Dhoni, Virat Kholi and PV Sindhu. Similarly, in the Training_images, we have 2 folders 0 and 1, where 0 is for not allowed and 1 for allowed. In 0 folder we have 150 images of PV Sindhu and in 1 folder we have 150 images of both MS Dhoni and Virat Kholi.

5. FLOWCHART


Start
Training the model for face recognition
using OpenCV and face recognition library detecting the faces
Decision if contains the trained data
check for the condition and display the name
display the name
predict the name
predict the name
Terminate(press 'q' to quit the output window)

6. RESULT

Our home Security model will predict whether the person is allowed or not allowed to the home.We trained our model with M S Dhoni and Virat Kholi's pictures. So if we show any other person it will not allow.If any person there in front of webcam it will send the alert message to the specified owner's mobile phone.

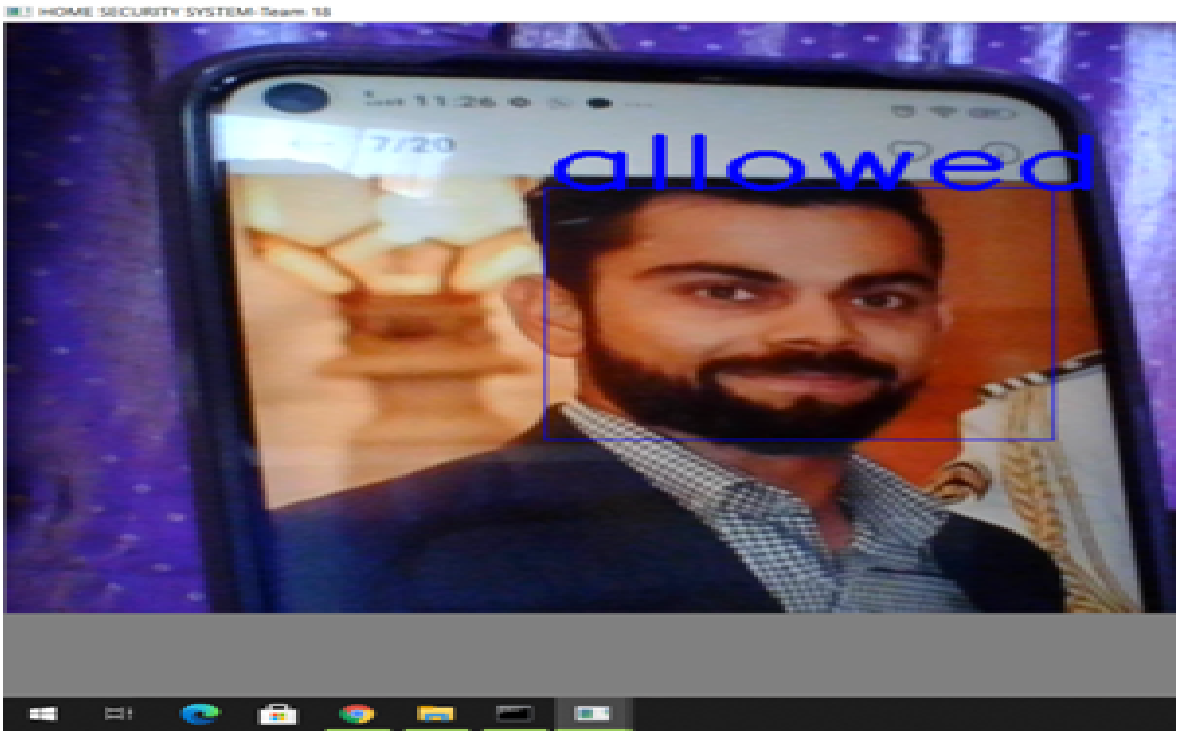


Fig 1: model found Virat Kholi's picture so it will allow him.

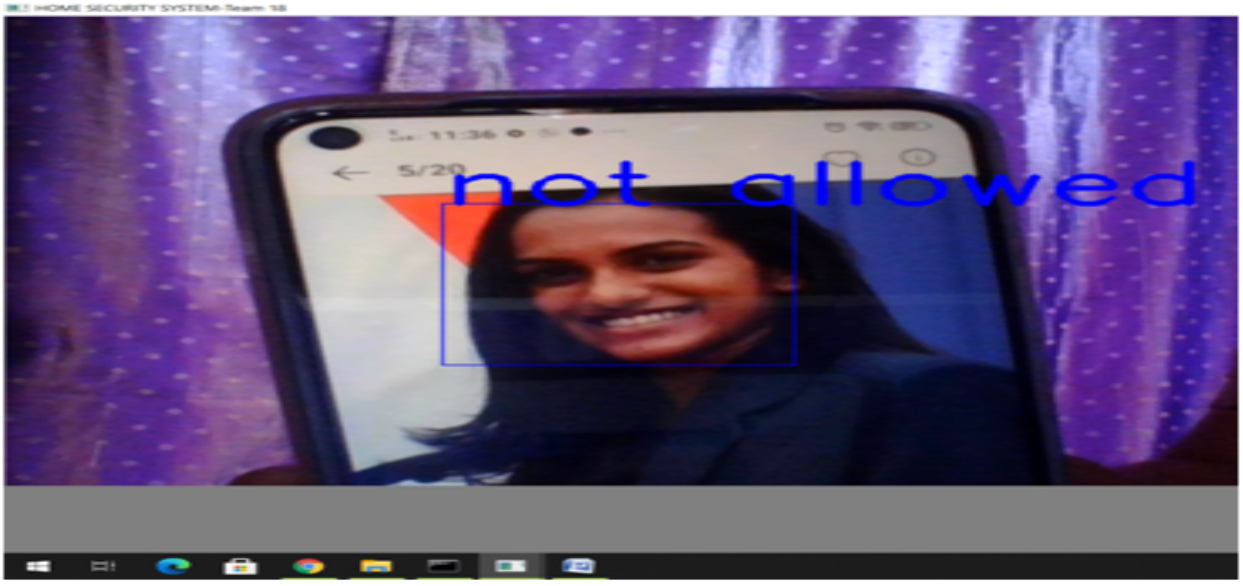


Fig 2: model found P V Sindhu's picture and it will not allow

Fig 3: model found M S Dhoni's picture so it will allow him.

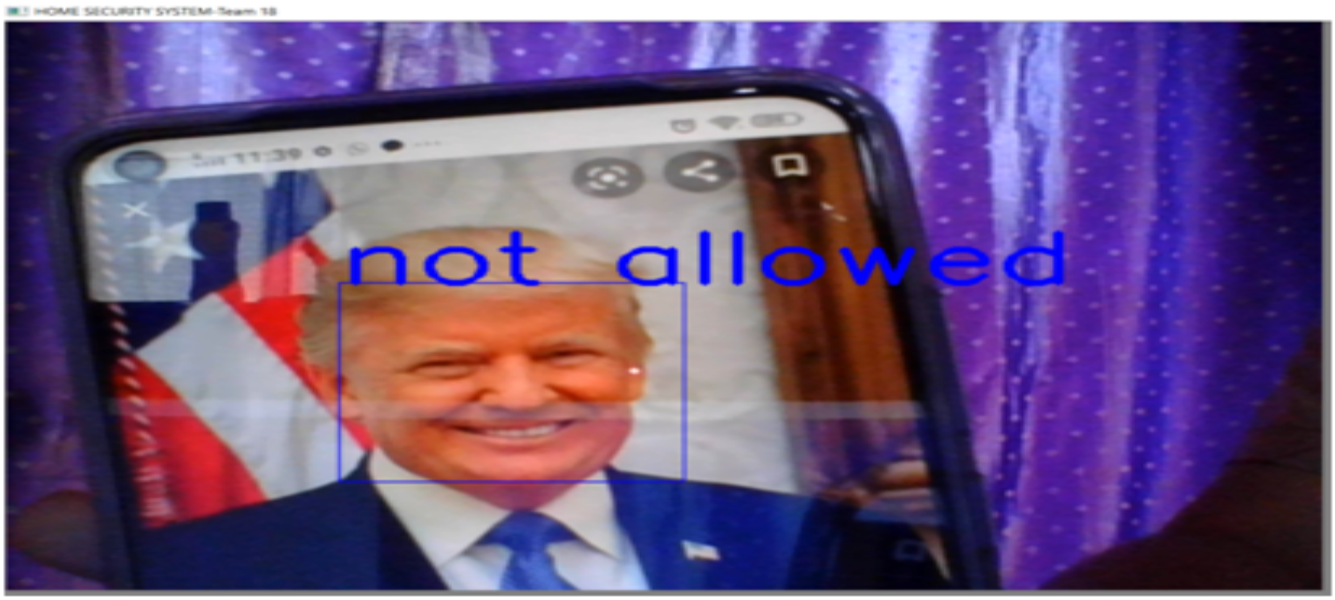


Fig 4: model found trump's picture so it will not allow him.

Fig 5:model will found both Virat Kholi and Anushka's pictures it will allow only virat to enter home as we not trained anushka's picture to our model it will not allow her to enter home.

Fig 6:The alert message received by the owner of the home.

7. ADVANTAGES AND DISADVANTAGES

ADVANTAGES

Central to the advantage of facial recognition is that it enables the computerized and automated processing of biometric data based on the digital image or live video feed of a person for a variety of purposes or applications. Some of the advantages are :

• **Security Through Biometric Authentication:** One of the benefits of facial recognition system centers on its application in biometrics. It can be used as a part of identification and access control systems in organizations, as well as personal devices, such as in the case of smartphones.

• **Automated Image Recognition:** The system can also be used to enable automated image recognition capabilities. Consider Facebook as an example. Through machine learning and Big Data analytics, the social networking site can recognize photos of its users and allow automated linking or tagging to individual user profiles.

• **Deployment in Security Measures:** Similar to biometric application and automated image recognition, another advantage of facial recognition system involves its application in law enforcement and security systems. Automated biometric identity allows less intrusive monitoring and mass identification.

• **Human-Computer Interaction:** The system also supports virtual reality and augmented reality applications. Filters in Snapchat and Instagram use both AR and facial recognition. In both VR and AR applications, the system facilitates further human-computer interaction.

• **Equips Devices with Added Functionalities:** It is also worth noting that equipping devices with facial recognition capabilities means expanding their capabilities. For example, iPhone devices from Apple use Face ID for biometric identification and supporting its AR capabilities.

DISADVANTAGES

Despite the advantages and application, facial recognition system has drawbacks and limitations revolving around concerns over its effectiveness and controversial applications. Some of the are :

• **Issues About Reliability and Efficiency:** A notable disadvantage of facial recognition system is that it is less reliable and efficient than other biometric systems such as fingerprint. Factors such as illumination, expression, and image or video quality, as well as software and hardware capabilities, can affect the performance of the system.

• **Further Reports About It Reliability:** Several reports have pointed out the ineffectiveness of some systems. For example, a report by an advocacy organization noted that the systems used by law enforcement agencies in the U.K. had an accuracy rate of only 2 percent. Applications in London and Tampa, Florida did not result in better law enforcement according to another report.
• **Concerns About Racial Bias:** A study by the American Civil Liberties Union revealed that the Rekognition technology developed by Amazon failed nearly 40 percent false matches in tests involving people of color. In general, the system has been criticized for perpetuating racial bias due to false matches.
• **Issues with Privacy Laws:** Alleged conflict with privacy rights is another disadvantage of facial recognition. In Illinois, for example, its Biometric Information Privacy Act requires affirmative consent for companies to collect biometric data. The fact that the system enables less intrusive mass identification also translates to mass surveillance, which according to groups, is a violation of privacy rights.

8. APPLICATIONS OF THE PROJECT

1.This Project model we can secure our home premises from the invaders and also capture the suspected people who are not authorised to move inside the house by taking appropriate action.
2. Admin can see live streaming of suspected people.
3. It will save computer memory.
4. It will save time during analysis of recorded video.

9. FUTURE SCOPE

The proposed system will further extended to provided the notices from long distance by providing the internet connectivity which will allow the system to update notices, anywhere in the world.

Using opencv the current project can be modified by an Infrared camera interfacing it can be used in Smart Surveillance Monitoring security system which any type of public security is using Living bobdy detection or spying .Also it can be used in Attendence System of class .Also some profound applications can be implemented using interfacing of Raspberry pi and ArduionUNO board like sensor application of smartcard swapping, finger detection ,alcohol detection, agriculture humidity sensing

Temperature sensing using web server ,and many more. Internet of households where we can attach other devices of house with internet. Industrial automation and control through internet. Automated fire exit system can be build. Improvement in the security issues in highly restricted areas.

10. BIBLIOGRAPHY

[1] A tutorial on Principal Component Analysis, Lindsay I Smith, February 26, 2002.

[2] Analysis and Recognition in Image and Videos, Face Recognition using corselet transform, Project Report, Rami COHEN, Technion - Israel Institute of Technology, arXiv:1107.2781v1 [cs.CV] 14 July 2011.

[3] I T Joliffe; Principal component analysis 1986 .

[4] R C Gonzalas, P A Wintz; Digital processing 1987.

[5] K.Karhunen;Uber Linear methoden in der wabrscheinlichkeit's Rechnug;1946 M.M .Loeve;probability theory 1955.

[6] W Zhao, R Chellappa, P J Phillips, Face recognition: A literature survey, "ACM Computing surveys (CSUR)", December 2003.

[7] Paul viola, Michaelj. Jhon, Robust Real time face detection.

[8] D.chen, and H Jiu-qiang "An FPGA-based face recognition using combined 5/3 DWT with PCA method". Journal of communication and computer, ISSN 848-7709, USA, \volume 6, no.10 (Serial No.59), oct.2009.

[9] H Moon, and P Phillps, "Computational and performance aspects of PCA based face-recognition algorithm", perception, 2001, volume 30, pp303-321.

[10] M Sharkas, "Application of DCT blocks with principal component analysis for face recognition" proceedings of the 5th WSEAS intconf. on single, speech and image processing, Corfu, Greece, (pp107-111), 2005 .

[11] M Turk, A. Pentland: Face recognition using eigen faces, conference on computer vision and pattern recognition , 3-6 June 1991,Maui, HI,USI, pp.586591.

[12] PRINCIPAL COMPONENT ANALYSIS: A BEGINNER'S GUIDE - I. Introduction and application By IAN T. JOLLIFFE Institute of Mathematics, University of Kent, Canterbury .

[13] Door Lock System through Face Recognition Using MATLAB, Ayushi Gupta*1, Ekta Sharma2, Neha Sachan3 and Neha Tiwari4 *1, 2, 3, 4 Kanpur institute of technology, Kanpur, India.

[14] MATLAB Programming for engineers, Stephen J. Chapman, BAE SYSTEM, Australia, CENGAGE Learning, third edition.

[15] Education(India)private limited.

[16] Applied Numerical Analysis using MATLAB, Second edition, Laurene V.Fausett, Texas A&M University-comme.

11. APPENDIX

TESTER.PY

```
import cv2

import os

import numpy as np

import faceRecognition as fr


#This module takes images  stored in diskand performs face recognition

test_img=cv2.imread(r'C:\Users\user\Desktop\Major
Project\Test_images\PVS164.jpg')#test_img path

faces_detected,gray_img=fr.faceDetection(test_img)

print("faces_detected:",faces_detected)


#Comment the below lines when running this program second time.Since it saves training.yml file in directory

#faces,faceID=fr.labels_for_training_data('Training_images')
```

```
#face_recognizer=fr.train_classifier(faces,faceID)
#face_recognizer.write('trainingData.yml')

#Uncomment below line for subsequent runs
face_recognizer=cv2.face.LBPHFaceRecognizer_create()
face_recognizer.read('trainingData.yml')#use this to load training data for subsequent runs

name={0:"not_allowed",1:"allowed"}#creating dictionary containing names for each label

for face in faces_detected:
    (x,y,w,h)=face
    roi_gray=gray_img[y:y+h,x:x+h]
  label,confidence=face_recognizer.predict(roi_gray) #predicting the label of given image
    print("confidence:",confidence)
    print("label:",name[label])
    fr.draw_rect(test_img,face)
    predicted_name=name[label]

    fr.put_text(test_img,predicted_name,x,y)

resized_img=cv2.resize(test_img,(1000,700))
cv2.imshow("face dtecetion",resized_img)
cv2.waitKey(0)#Waits indefinitely until a key is pressed
cv2.destroyAllWindows
```

VIDEOTESTER.PY

```
import os
import cv2
import numpy as np
import faceRecognition as fr
from twilio.rest import Client
account_sid="AC0e8aed41e0995cd500b36217b12b55d0"
auth_token="35f951c349d2f2cd24b5c9d6154f5c23"
client=Client(account_sid,auth_token)
client.messages.create(
   to="+919148354550",
   from_="+14087136444",
   body="Someone is at the door!"
   )


#This module captures images via webcam and performs face recognition
face_recognizer = cv2.face.LBPHFaceRecognizer_create()
face_recognizer.read('trainingData.yml')#Load saved training data

name = {0 : "not allowed",1 : "allowed"}

cap=cv2.VideoCapture(0)

while True:
      ret,test_img=cap.read()# captures frame and returns boolean value and captured image
      faces_detected,gray_img=fr.faceDetection(test_img)



   for (x,y,w,h) in faces_detected:
     cv2.rectangle(test_img,(x,y),(x+w,y+h),(255,0,0),thickness=1)

   resized_img = cv2.resize(test_img, (1000, 700))
   cv2.imshow('face detection',resized_img)
```

```
    cv2.waitKey(10)


    for face in faces_detected:
        (x,y,w,h)=face
        roi_gray=gray_img[y:y+w, x:x+h]
    label,confidence=face_recognizer.predict(roi_gray)#predicting the label of given image
        print("confidence:",confidence)
        print("label:",name[label])
        fr.draw_rect(test_img,face)
        predicted_name=name[label]

        fr.put_text(test_img,predicted_name,x,y)

    resized_img = cv2.resize(test_img, (1000, 700))
    cv2.imshow('face recognition tutorial ',resized_img)
    if cv2.waitKey(10) == ord('q'):#wait until 'q' key is pressed
        break


cap.release()
cv2.destroyAllWindows
```