

# *Smart Door Opening System*

## *Smart Door Opening System using face detection*

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**Abstract**—*This is a paper for smart door opening system. We propose a system that can handle door opening system smartly. First the system learn image that given in algorithm then match the image with video frame by frame. After matching the face hardware system open the door.*

**Keywords**—*Face Recognition; Smart Door; Arduino;*

### I. INTRODUCTION

Privacy and Security are two universal rights and, to ensure that in our daily life we are secure, a lot of research is going on in the field of home security, and IoT is the turning point for the industry, where we connect everyday objects to share data for our betterment. Facial recognition is a well-established process in which the face is detected and identified out of the image. We aim to create a smart door, which secures the gateway on the basis of who we are.

Face detection is a great feature for cameras. There will be many things in the frame of the picture. Making faces apart is the real problem. Another problem finding the correct known and unknown face.

### II. RELATED WORK

#### *A. Smart Door Lock Opening in Cars Using Face Recognition*

This paper explains the use of Biometric such as face recognition in automobiles such as cars. Nowadays the door lock in cars is released using keys, and then they can also be accessed using fingerprint, RFID etc. The use of keys to unlock the doors in cars is not efficient sometimes. Because the keys may be sometimes used by the wrong person. Hence this proposed system uses the face recognition for unlocking the doors in cars. This system is an efficient method to unlock the cars and at the same time provides security for the cars. Here raspberry pi is used for storing and processing. [4]

#### *B. Facial Recognition Enabled Smart Door Using Microsoft Face API*

In this work, automatic door access system by using face recognition and detected is presented. Automatic face recognition is done by Neural Networks. Raspberry Pi controller controls the door access after successful output from the PC. Immediate responses from the door and monitor are observed.

The door remains open for indefinite time and this is not suitable for real time. [5]

#### *C. Automatic Door Access System Using Face Recognition*

There are two parts in this implementation step. The first is the implementation of face detection and face recognition system by using MATLAB. And the second is the implementation of PIC16F887 program for door access system. [6]

#### *D. Security and Usability Improvement on a Digital Door Lock System Based on Internet of Things*

The designed digital door lock senses the physical impact of an invalid visitor and notifies the user's mobile device. If an incorrect pass-code is repeated more than a certain number of times, the lock captures an image of the invalid user and transfers it to the mobile device, thus, strengthening the security function. [8]

#### *E. Implementing of Door Lock Access by using Face Recognition*

This project work proposes an idea of for face reorganisation concept for accessing the door lock system and it implemented with the help of OpenCV [2] and D-lib [3] which is a popular computer vision library. Face recognition is an important application of image processing owing to its use in many fields. An effective face recognition system based on OpenCV and D-lib is developed in the project. Face recognition has been a best choice after problem of biometrics and it has a various type of applications in our present life. An efficient face recognition system can be of great help in forensic sciences, identification for law enforcement, authentication for banking and security system, and giving preferential access to authorized users i.e. access control for secured areas etc.

A real-time door lock access system by face recognition system based on PCA is presented in the project. The technique used here involves generating the 'Eigen faces' then projecting training data into face space and evaluation of a projected test element by projecting it into face space and comparing to training data. The face recognition systems presented here can extract the features of face and compare this with the existing facial images of database. The faces considered here for comparison are still faces.

### III. HARDWARE CONNECTION SETUP

#### A. Setup

The most important part of the project is the hardware implementation in accurate manner. The electronics components of the project are very easily understood and it includes connection of various hardware devices to the Arduino UNO, Servo Motor, Web-came, PC/Raspberry Pi and various other available ports and wires for connection. The following Wiring Diagram Fig -1, shows how to connect and integration of the required hardware components of the proposed system.

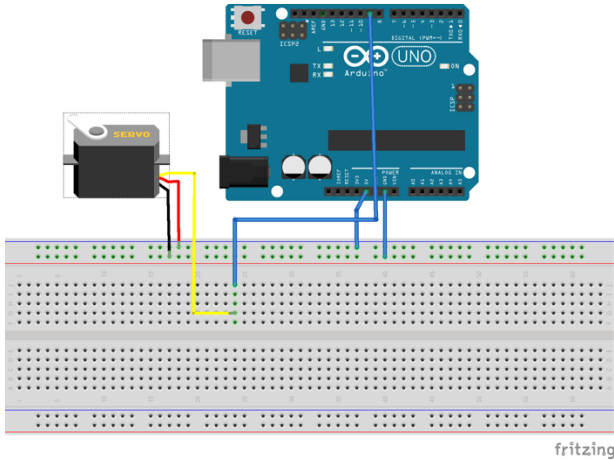


Fig -1

#### B. Training and Result

- First input the image file as input. Fig-2 is the input image for our test case. The Face Recognition module input those image file and make the face encoding from those images. Image label need to be provided for detecting the person. By webcam every frame will be captured and then the face recognition module look for face in those frame and encode them. If the encoded frame is equal as input image face encoding then it will response that known face is found. If face found it will observe the face for 5-6 seconds to verify it more accurately then open the door. After opening the door the program will wait for 5 seconds then door will be closed by this time no face recognition occur.

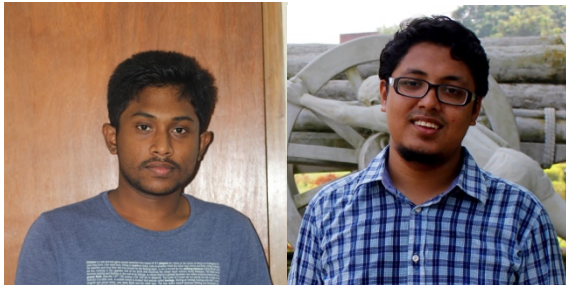


Fig -2: Input Image

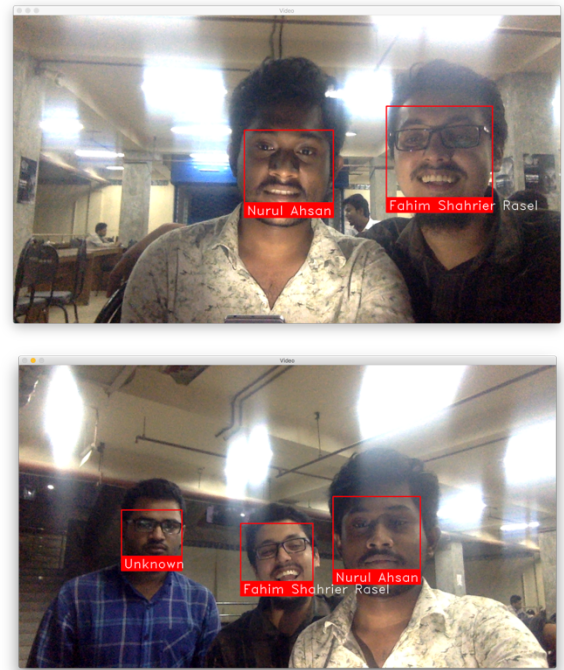


Fig -3: Recognized Image

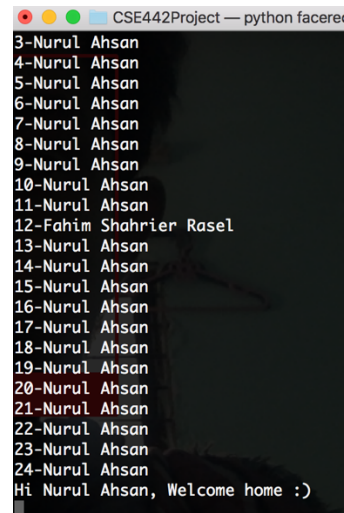


Fig -4: 24 times observe

#### C. Face recognition process and Program

- First, look at a picture and find all the faces in it.
- Second, focus on each face and be able to understand that even if a face is turned in a weird direction or in bad lighting, it is still the same person
- Third, be able to pick out unique features of the face that you can use to tell it apart from other people—like how big the eyes are, how long the face is, etc.
- Finally, compare the unique features of that face to all the people you already know to determine the person's name

```
[code]
import face_recognition
import serial
import time
import cv2

serial_comm =
serial.Serial('/dev/tty.usbmodem1421', 9600)

toggle = '0'

counter = 0

# Open Door
def open_door(name):
    print("Hi {}, Welcome home :)".format(name))
    serial_comm.write(toggle.encode())
    counter = 0
    time.sleep(5)
    serial_comm.write(toggle.encode())

# Get a reference to webcam #0 (the default one)
video_capture = cv2.VideoCapture(0)

# Load a sample picture and learn how to recognize
it.
fahim_image =
face_recognition.load_image_file("Fahim.jpg")
fahim_face_encoding =
face_recognition.face_encodings(fahim_image)[0]

# Load a second sample picture and learn how to
recognize it.
ahsan_image =
face_recognition.load_image_file("ahsan.jpg")
ahsan_face_encoding =
face_recognition.face_encodings(ahsan_image)[0]

# Create arrays of known face encodings and their
names
known_face_encodings = [
    fahim_face_encoding,
    ahsan_face_encoding
]
known_face_names = [
    "Fahim Shahrier Rasel",
    "Nurul Ahsan"
]

# Initialize some variables
face_locations = []
face_encodings = []
face_names = []
process_this_frame = True

while True:
    # Grab a single frame of video
```

```
ret, frame = video_capture.read()

# Resize frame of video to 1/4 size for faster face
recognition processing
small_frame = cv2.resize(frame, (0, 0), fx=0.25,
fy=0.25)

# Convert the image from BGR color (which
OpenCV uses) to RGB color (which face_recognition
uses)
rgb_small_frame = small_frame[:, :, :-1]

# Only process every other frame of video to save
time
if process_this_frame:
    # Find all the faces and face encodings in the
current frame of video
    face_locations =
face_recognition.face_locations(rgb_small_frame)
    face_encodings =
face_recognition.face_encodings(rgb_small_frame,
face_locations)

    face_names = []
    for face_encoding in face_encodings:
        # See if the face is a match for the known
face(s)
        matches =
face_recognition.compare_faces(known_face_encodi
ngs, face_encoding)
        name = "Unknown"

        # If a match was found in
known_face_encodings, just use the first one.
        if True in matches:
            first_match_index = matches.index(True)
            name =
known_face_names[first_match_index]
            counter = counter + 1

        if counter >= 25:
            open_door(name)
            counter = 0

    print("{}-{}".format(counter, name))
    face_names.append(name)

if len(face_encodings) <= 0:
    print("No Face Found")
    counter = 0

process_this_frame = not process_this_frame

# Display the results
for (top, right, bottom, left), name in
zip(face_locations, face_names):
```

```

# Scale back up face locations since the frame
we detected in was scaled to 1/4 size
top *= 4
right *= 4
bottom *= 4
left *= 4

# Draw a box around the face
cv2.rectangle(frame, (left, top), (right, bottom),
(0, 0, 255), 2)

# Draw a label with a name below the face
cv2.rectangle(frame, (left, bottom - 35), (right,
bottom), (0, 0, 255), cv2.FILLED)
font = cv2.FONT_HERSHEY_DUPLEX
cv2.putText(frame, name, (left + 6, bottom - 6),
font, 1.0, (255, 255, 255), 1)

# Display the resulting image
cv2.imshow('Video', frame)

# Hit 'q' on the keyboard to quit!
if cv2.waitKey(1) & 0xFF == ord('q'):
    break

# Release handle to the webcam
video_capture.release()
cv2.destroyAllWindows(). [1]

```

#### D. Future work

- If a blacklisted person attempted to open a smart door lock, the system will send an emergency alert to home or business owner.[7]
- Eventually the facial recognition technology would be able to differentiate between friends and strangers. Alerts can be sent directly to the account owner to let them know someone they don't know is at the door.
- A voice assistant can be added to smart door lock as a way to improve user experience.[7]
- A cloud-based database can be utilized to store the comings and goings of those who are at the door.[7]

#### IV. WEKNESSES

A few problems can occur with smart door locks that include facial recognition. For one, accuracy has yet to be 100 percent.

Due to this issue, there absolutely needs to be a backup method to enter the home. There's also the issue of hacker spoofing facial recognition technology for a smart door lock. With the popularity of social media, your picture is likely to appear easily in an online search. With 3D printing technology, a model could even be used to create a replica of your face. If criminals are capable of achieving this, you run into a big issue. Passwords can be changed, your face can't. If you do decide to use a door lock down the road with face recognition, find out how secure the lock is for protecting your home and what type of backup method is available to get into the home. [7]

#### CONCLUSION

In this work, automatic door access system by using face recognition and detected is presented. Automatic face recognition is done by deep learning. Servo motor controls the door access after successful output from the PC. Immediate responses from the door and monitor are observed. The door remains open for indefinite time and this is not suitable for real time so appropriate time should be set in real time environment. This system can be used in many places where need of security is maximum and security cannot be compromised.

#### REFERENCES

- [1] [https://github.com/ageitgey/face\\_recognition](https://github.com/ageitgey/face_recognition)
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- [8] [http://www.sersc.org/journals/IJSIA/vol9\\_no8\\_2015/5.pdf](http://www.sersc.org/journals/IJSIA/vol9_no8_2015/5.pdf)