3 Tier Door Locking System

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Abstract - *Security is becoming a major issue everywhere. Home Security, Security in offices, Banks, Industries, R&D is becoming necessary nowadays as the possibilities of intrusion are increasing day by day. Automated security systems are a useful addition to today's home where safety is a crucial issue. Vision-based security systems have the advantage of being easy to line up, inexpensive, and non-obtrusive. However, the GSM (global system for mobile communication) based security systems provide enhanced security as whenever a sign from the sensor occurs, a text message is shipped to the desired number to take necessary actions. The processing and administration in our security system are done using a laptop. A Facial Recognition algorithm along with a password entry has been written so that only the registered person is allowed to enter the promises and no one else does. Along with that, during the setup of the security system, details like email address and clearance level is also taken. Email address of the personnel is taken as a Two – Factor Authentication (2FA) protocol. So if a person wants to enter the premises, they have to first clear the facial recognition process. After that, an email is sent to the respective personnel on their pre-registered email address with a randomly generated security code. Thissecurity code is to be entered by the personnel to gain access to the premises. The person gets only 3 trials to enter the correct security code or else they will be locked out of the premises.*

Key Words: Facial recognition, Haar Cascade, OpenCV, CSV Files

1. INTRODUCTION

The major application of this security system is Security System, but if the Email security protocol (2FA) is neglected, it can also be used as an attendance register. The security system can be used in Commercial places, Households, Banks, Shopping centers ,and even more. After some major upgrades, it can also be used for Military Headquarters

1.1 Background

A security system is defined as to detect intrusion, unauthorized entry into a building or a protected area and deny such unauthorized access to protect personnel and property from damage or harm. Security systems are mainly utilized in residential, commercial industry, and military properties for canopy against burglary (theft) or property damage, also as personal protection against intruders. Car alarms likewise protect vehicles and their contents.

Prisons also use security systems for the control of inmates. The basic design of a security system begins with analyzing the requirements of the inhabitants, surveying existing technology and hardware, reviewing system costs, considering monitoring choices, and eventually planning theinstallation.

1.2Motivation

There are several places where there has to be security clearance based on different priorities, situations, etc. There must be a Home Security System to keep the home appliances and the people safe from intruders. There must also be a security system inside offices so that no unauthorized personnel can enter the premises. Banks require the highest level of security to protect the infrastructure from any sort of robbery.

This was one of the major reasons for selecting this topic for this project. There has to be a security system that uses both Facial as well as a 2FA based security protocol. It ensures that if an intruder somehow even tricks the Facial Recognition and obtains the password, they cannot gain access without the security code that the personnel can receive only via email.

1.3 Brief Description of the Project

The system will provide a 3 level (or tier) access control security.

1. Facial recognition.

2. Password entry (provision to set password is also present).

3. A randomly generated OTP will be sent to the email of the user. If correctly inputted by the user, then only access will be provided.

Also implemented is an algorithm for Entry logs in CSV which will note down the individual's name, date, time of entry, and the same for the exit as well

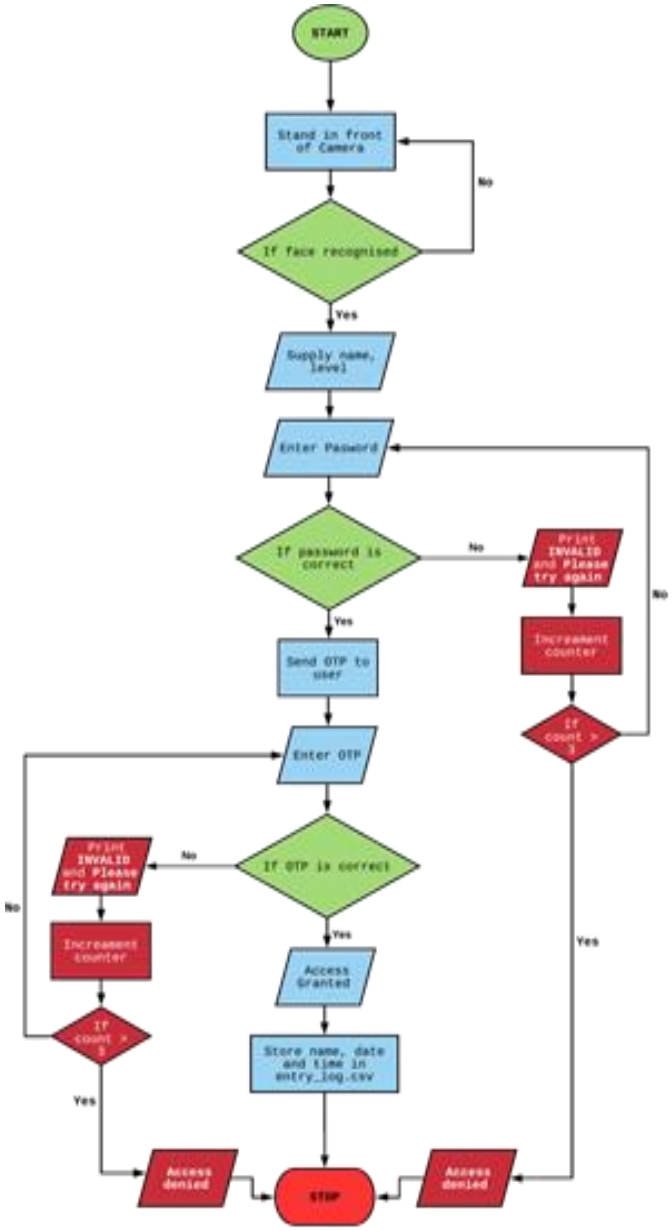
2 LITERATURE REVIEW

Face detection is one among the present research topics within the computer vision field. It is very easy for human beings to detect faces on the other hand it is difficult for computers to detect faces. The difficulties associated with face detection are variations in scale, pose, orientation, lighting condition, facial expression etc. Many approaches have been implemented but each has its advantages and limitations. The proposed system relies on the appearance based approach. Here the face detection is completed by extracting countenance like eye feature, bridge of the nose feature, mouth feature, etc. which are present in a grayscale image. These features are proportional to the change in contrast values between adjacent groups of pixels but to not the intensity values of a pixel. The features used in this system are named rectangular features and are reminiscent of the Haar basis functions. The suggested face detection system detects faces with a low false-positive rate. Initially, the face detection is done with a 10 and 12 stage detector but it gives poor detection accuracy and a high false-positive rate. e. The 14- stage detector gives good accuracy in face detection and very low false-positive rates. The detector works well on Raspberry Pi with a 5MP camera and detects the faces of the captured image with the lowest resolution of 640x480 and the highest resolution of 2560 x 1920 pixels with acceptable detection speed. Patel and Shah introduced research on facial feature extraction techniques for automatic face annotation. A vital role is being played by automatic face annotation roles in multimedia information. In face annotation, face detection and face recognition are the two most vital virtues. An author also discusses the phases of the automated face annotation and surveys various techniques of facial feature extraction. Raspberry pi is being used for the implementation of this system with the extended capabilities of Computer Vision (OpenCV) software which is used for Image processing operations. One time password technique is used in this system which increases the security of the system. In an unauthorized condition the ATM door has been locked and it's only when the OTP password is entered by my watchman. Heshmat et al. introduced Face Identification system in Video. An author proposed CIE-Luv color space, facial feature extraction and variance estimation. In surveillance, human machine interfacing, Database management system can be implemented and is of great use as it is creating a proper visual interface here. The experimental results show the efficiency and the usefulness of the system where the system can recognize different faces and work accordingly and this one is highly advantageous due to its high security advantages [20]. Intensive research work and detailed study on implementation of smart door lock system using GSM network by Jie-Ci Yang. Pi Camera Module is an add on with Raspberry Pi which acts as a visual interface in case of face detection or recognition. This interface uses the dedicated CSI interface, which was designed especially for interfacing to cameras. An algorithm known as Haar Cascade classifier is used for detection of the object which it has been trained for, from the source. This proposed system uses Haar Cascades classifier as a face detection algorithm. Face preprocessing is the module which lessens the issues that make the image vague to perceive the face. for example, less brightness and complexity issues and noise in the picture and ensure the facial highlights dependably be in a consistent position. In this task we use histogram leveling for face preprocessing. For proficiency we utilize separate preprocessing which is histogram evening out for left and right face. So, histogram leveling is completed multiple times, right off the bat for the entire face and the other two for side appearances. For more efficient working, each stage of the cascade must have a low false negative rate, because if the actual object is assessed as a nonobject, then the classification of that branch stops, with no way to correct the mistake made. However, each stage can have a comparatively high false positive rate, because albeit the n-th stage classifies the non-object as actually being the object, then this mistake can be fixed in n+1-the and subsequent stages of the classifier. The purpose or

objective of the suggested work is to implement a working model of a smart door and to give solutions to the problem faced by people in day-to-day incidents of burglary or losing the key and also to market and ignite the work being done on IOT systems and implementing it with the help of key research areas of Neural Networks and IoT APIs and protocols.

3. PROJECT DESIGN

3.1 Flow chart



If the password is correct, go to step 8.

If it is not a match, increment the counter c by 1 and let the user try again.

If c2 = 3, then print access denied and go to step 10.

Ask the user for the updated password.

Replace the old password with the updated one in the excel file, save it and close it.

3.2 Algorithm for creating datasets

Start.

Import all the required libraries like cv2, os, andopenpyxl.

Take name, password email and clearance level from the user and storeit in n, p, e, m respectively.

If m = 1, open directory level_1 and if m = 2 thendirectory level_2 is opened.

Open the camera.

Choose the desired dimensions of the dataset images.

Using the haar cascade, the face of the user would be detected and 100 pictures would be stored in a new directory with the user's name to be used as the dataset.

Open the excel file personal data and store the user's password andemail in the bottom-most row.

Save and close the excel file.

Keep the provision to close the camera by pressingthe ESC key.

Stop.

3.3 Algorithm for changing password

Start.

Create a variable c and store the value 0 in it.Load

the excel file personal data.

Take the name and the current password from theuser.

Compare the entered password to the one entered inthe excel file.

Stop.

3.4 Algorithm for access control

Start.

Import all the required libraries like smtplib, random, datetime, cv2, numpy,os, pytz, and openpyxl.

Create two variables c1 and c2 and store the number0 in

both of them.

Load the excel files personal_data and entry_log.Open the camera.

Detect any face using the haar cascade.

Compare the detected face from thedatasets available in the directorieslevel_1 and level_2.

If the faces are similar, then it is a match.

Find the name and level of the dataset directorysimilar to the detected face.

Using the now function of the datetime library, getthe current time.

Request the user to provide their password.

Compare the entered password to the one in the excelfile.

If it is a match then go to step 16.

If it is not a match, increment the counter c1 by 1 andlet the user try again.

If c1 = 3, then print access denied and go to step 25.

Then generate a random 4-digit OTP using the randint function of the randomlibrary and send it to the user via email.

After that request the user to provide their OTP.Compare the entered OTP to the one sent.

If it is a match then go to step 22.

If it is not a match, increment the counter c2 by 1 andlet the user try again.

If c2 = 3, then print access denied and go to step 25Print access granted.

Enter the name, date, and time ofthe user's entry to the bottom-most row of the entry_logexcel file.

Save and close the entry_log file.Stop.

Fig 3.1-Code for creating Data set

```
data_create.py
import cv2, os
from openpyxl import load_workbook

haar = 'haarcascade_frontalface_default.xml'

n = input('Enter your name: ')
p = input('Enter your password: ')
e = input('Enter your email: ')

while 1:
    m = input('Enter your clearance level: ')
    if m == '1':
        d = 'level_1'
        break
    elif m == '2':
        d = 'level_2'
        break
    else:
        print('Invalid')

path = os.path.join(d, n)
if not os.path.isdir(path):
    os.mkdir(path)

(width, height) = (130, 100)

face_cascade = cv2.CascadeClassifier(haar)
webcam = cv2.VideoCapture(0)

count = 1
while count < 100:
    (_, im) = webcam.read()
    gray = cv2.cvtColor(im, cv2.COLOR_BGR2GRAY)
    faces = face_cascade.detectMultiScale(gray, 1.3, 4)
    for (x, y, w, h) in faces:
```

Fig3.2-Code for creating Data set

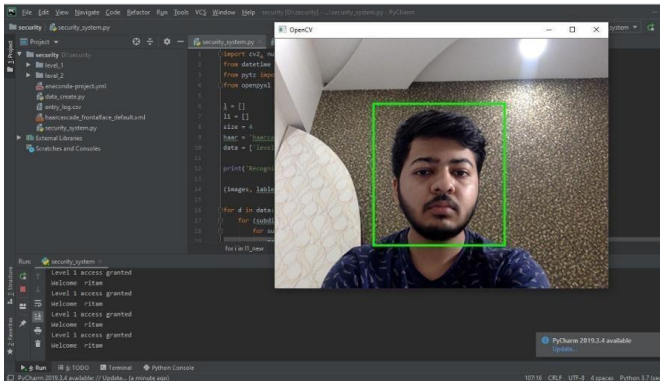
```
    for (x, y, w, h) in faces:
        cv2.rectangle(im, (x, y), (x + w, y + h), (255, 0, 0), 2)
        face = gray[y:y + h, x:x + w]
        face_resize = cv2.resize(face, (width, height))
        cv2.imwrite('% s/% s.png' % (path, count), face_resize)
    count += 1

    cv2.imshow('OpenCV', im)
    key = cv2.waitKey(10)
    if key == 27:
        break

wb = load_workbook('personal_data.xlsx')
ws = wb.active

r = ws.max_row + 1
ws.cell(column=1, row=r, value=n)
ws.cell(column=2, row=r, value=p)
ws.cell(column=3, row=r, value=e)

wb.save(filename='personal_data.xlsx')
wb.close()
```

Fig 3.3- Code for changing password

```
from openpyxl import load_workbook

i = 0

wb2 = load_workbook('personal_data.xlsx')
ws2 = wb2.active

n = input('Enter your name: ')

for cell in ws2['A']:
    if cell.value is not None:
        if n in cell.value:
            r = cell.row

r1 = 'B' + str(r)

while i < 3:
    p = input('Enter your current password: ')
    if p == ws2[r1].value:
        p1 = input('Enter your new password: ')
        ws2[r1] = p1
        break

    else:
        print('Incorrect password')
        i += 1

wb2.save(filename='personal_data.xlsx')
wb2.close()
```

4. SIMULATION

1. The Facial Recognition Algorithm has been implemented successfully with an accuracy of70%.
2. The Raspberry Pi will stream the video feed from the camera to the laptop.
3. The laptop will run the Facial Recognition Algorithm on the video stream and create a CSV file of the personnel.
4. The CSV file will be updated every time there is an entry.
5. The Numerical keypad has also been programmed and implemented for the personnel to enter the password.



5. SUMMARY

The aim of this research, Design and Implementation of a Microcontroller Based Three Tier Security is to develop a security system that is reliable, economical and affordable, to perform a specific task to provide protection for life and properties. A security system that is applicable in places where security is essential, such as offices, homes, school, industries, etc. The security system is cost effective, that is, affordable, reliable, economical and easy to operate, easy to install and maintain and also make power consumption less. The system is fully and properly constructed to perform a specific task for security purposes. The system is designed to have an operating time of 24/7as long as there is power to the system. Also, a backup battery is provided in case of power failure.

5.1 Advantages of Password Based Door LockSystem

1. This project provides security
2. Power consumption is less
3. Project is simple and easy
4. Used commonly available components

5.2 Applications of Password Based Door Lock System

1. This simple circuit can be used at residential places to ensure better safety.
2. With a slight modification this project can be used to control the switching of loads through password.
3. It can be used at organizations to ensure authorized access to highly secured places.

5.3 Limitations of Password Based Door LockSystem

1. It is a low range circuit i.e. it is not possible tooperate the circuit remotely.
2. If you forget the password, it is not possibleto open the door

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