

Door Unlock Using Face Recognition

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Abstract

In today's era of automation and smart devices, there is a crucial need to alter the security measures of the system as privacy and security are notable issues in the information system. It is difficult to trust blindly on traditional and simple security measures of the system. In traditional systems many of the doors have mechanical locks which are restricted on the number of keys. Door Unlock using Face Recognition proposes to enhance the security.

In this system a Raspberry PI infrared night vision camera is used to capture the face and an image matching algorithm will be used to detect the authenticated faces. Only the person whose face is matched can be able to unlock the door. So, hassle of managing keys and remembering passwords will be resolved. The security system is also made by means of maintaining the eye of old age humans for whom it is hard to open the door manually. This system will not only enhance the security but also make the system keyless. The project will be robust from hacking attacks as we are proposing a machine learning based approach.

This project can also be implemented on a large scale by industries with enhanced equipment and algorithms to achieve greater accuracy with respect to security.

1.Introduction

Nowadays there is an extreme use of smart devices to automate many of the processes. Home automation is one of the aggressively developed technologies used by high end society. It's far tougher to consider blindly traditional and simple security features of the device. In conventional gadgets many of the doors are having mechanical locks which have been constrained on the number of keys. So, to overcome the aforementioned issues and traditional locking system one has to modify them and make them smart and automated.

It works well but when we wish for a more secure environment and accountability of who locked and unlocked when the major part was missing in the traditional system it has been included in this new system where we use the face recognition feature to unlock the door.

In this project we have implemented the face recognition algorithm using opencv and combined it with Raspberry pi to unlock the door. We have also added eye blinking detection for more security, so that anyone trying to unlock the door by malpractices will be caught.

2. Literature Survey

1. Face Recognition Implementation on Raspberry pi Using Opencv and Python, "International Journal of Computer Engineering and Technology" 10(3), 2019.--

Distinguishing an individual with a picture has been advanced through broad communications. Be that as it may, it is less powerful than a unique finger impression or retina examination.

This report depicts the face detection and recognition smaller than normal task attempted for the visual observation and self-governance module at Plymouth college.

It reports the innovations accessible in the Open-Computer-Vision (OpenCV) library and techniques to execute them utilizing Python. For face identification, Haar-Cascades were utilized and for face recognition Eigenfaces, Fisher faces and Local double example histograms were utilized.

2.Door Unlock using Face Recognition: International Journal of Advanced Research in Electronics and Communication Engineering (IJARECE) Volume 6, Issue 4, April 2017.--

The face is detected by using the viola jones method and face recognition is implemented by using the Local Binary Patterns Histograms. Face Recognition based on LBPH is to abridge the nearby structure in a picture by contrasting every pixel and its neighborhood. Initially the authorized Faces are trained into a local database. These Database faces are compared with the captured test image. In the event that a face is perceived, it is known, else it is obscure.

The door will open automatically for the authorized person due to the command of the Raspberry Pi to the door motor. Then again, Alarm will ring for the obscure individual.

3. Face Recognition Using OpenCv Based On IoT for Smart Door Conference: International Conference on Sustainable Computing in Science, Technology and Management.--

The paper intends to provide the information to the user using open source technology which comprises OpenCV2, LBPH algorithm, SMTP, raspberry pi3,pi camera. The implementation area is categorized more on a local level like home, offices and campus. The system provides real time face detection and recognition once the bell is triggered. The captured image is analyzed with the available database and if it is a match, the access is granted and the door will open. On the contrary if the face did not match the captured image is then sent to the user mail using SMTP.

4.Face Recognition for Smart Door Lock System using Hierarchical Network ,Publisher: IEEE--

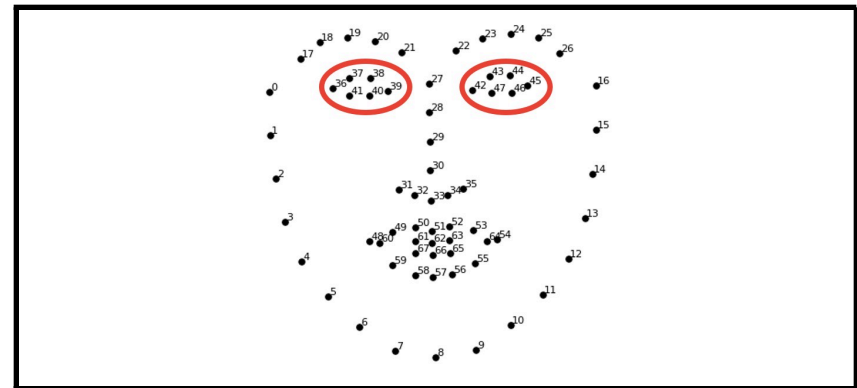
In this paper, we propose a hierarchical network (HN) framework which uses pre-trained architecture for recognizing faces followed by the validation from face embeddings using FaceNet. We also designed a real-time face recognition security door lock system connected with raspberry pi as an implication of the proposed method.

3. Methodology

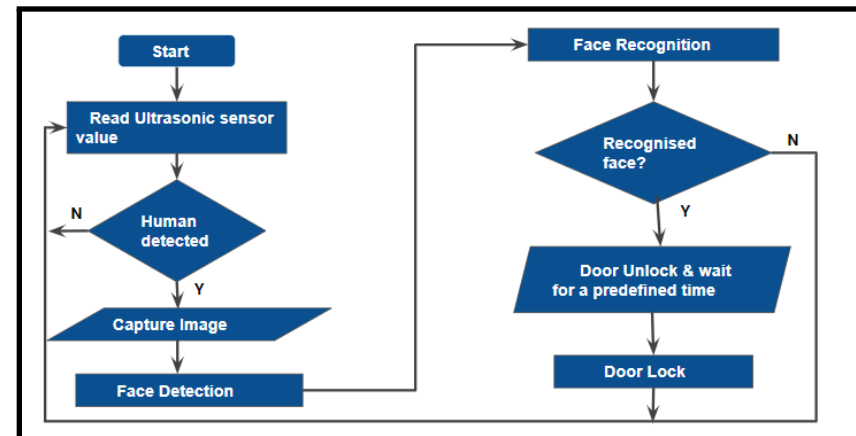
There are a few steps in face recognition, which are :
collecting images, creating databases, pre-processing images, training images and testing images.

1. First the system reads an ultrasonic sensor to detect the human presence, which could be set to check every second (configurable).
2. If the human presence is detected, then the camera will capture the face image. The face detection routine will localize and segment the face region only
3. The face image is then fed to the face recognition routine.
4. After the face recognition is done it will then check for the eye blinking of the person standing in front of the door.
- 5.. If the recognised face and blink is detected, the system will unlock the door and an audio message will be heard that the 'Door is unlocked .. welcome in' then the door will be locked again some after predefined time, and if the face is not recognised then the whatsapp message that an "intruder has entered " will be sent to the owner.
6. Also an email with the attached photo of the unknown person will be sent to the owner.
7. If the owner replies as "Allow" to the mail then the system will open the door and again an audio message will be heard that the "door is unlocked ...welcome in."

8. Else the Audio message will say "Sorry ...Access denied" and the door will remain closed and the same thing will be printed on the console.



Landmarks for face recognition



Basic Flow of the System

- ***Face_recognition Algorithm :--***

This algorithm is present in the Dlib library of open cv. In this algorithm the 68 landmarks are used to detect points(landmarks) on the face using which the module is trained to generate 128 measurements for each individual which are unique such as distance between the eyebrows, nose and eyes and 2 eyes etc. This generation of 128 measurements is known as encodings and the face is located using the landmarks. The encodings are stored in a numpy array and then the input image is compared with the images database . The image from the dataset with the same or minimum difference in these measurements is matched as the correct face. Generally the accuracy of this algorithm is 98% and is specially designed for face recognition.

- ***Blink Detection :--***

The landmarks of eyes like center top , center bottom , left and right are detected and using that vertical and horizontal distance is calculated and ratio of vertical by horizontal distance is taken. Also a threshold is set to compare, if the generated value of input image is greater than the threshold,the blink will be detected.

- ***Mail Sending and Receiving :--***

The mail can be sent using '*smtplib*' library with port 587 (smtp tls secure server). Also the MIME MULTIPART an extension for internet mail is used to attach text in a format

other than ASCII as well as audios, videos, images and runnable applications.

For retrieving the mail there are 2 protocols that act in the Application layer of osi or TCP/IP model that are IMAP(Internet Message Access Protocol) and POP3 (Post Office Protocol 3). But in POP3 the message needs to be downloaded in the local computer but this is not the case with IMAP. Imap allows the user to search the content of mail for a specific string before downloading like in our case "*Allow*".

- ***WhatsApp Message :--***

There is a platform called Twilio which enables us to send whatsapp messages with a predefined message body using some credentials like Account Sid and Authentication token and the phone number to which we want to send the message like in this case it is the owner who will receive the alert that he has an intruder at the doorstep.

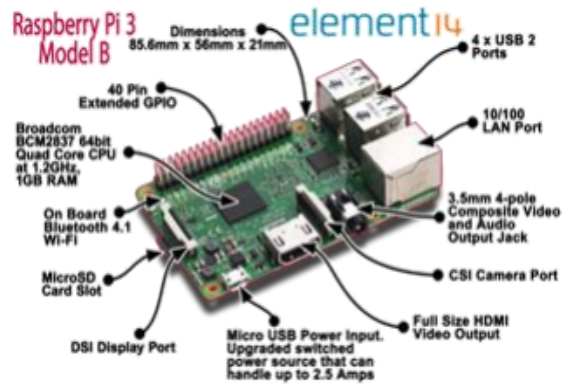
4.Hardware Design

The System has following Main components:

A. Raspberry Pi :--

It is the central core part of the whole system. Raspberry pi 3 module is a small computer board. When an image is taken by raspberry pi it is compared with the database image then further actions are taken according to the output.. It has

camera port for connecting the camera. It also has built-in Wi-Fi.



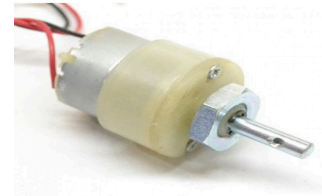
B. Infrared night Vision Camera :--

It is connected to Raspberry pi for observing the door. When there is somebody at the door, by using intelligent face recognition software, one will facilitate in providing security



to home. Its resolution is 5-megapixel and still picture resolution 2592 x 1944, Max image transfer rate 1080p: 30fps

C. DC Motor :--



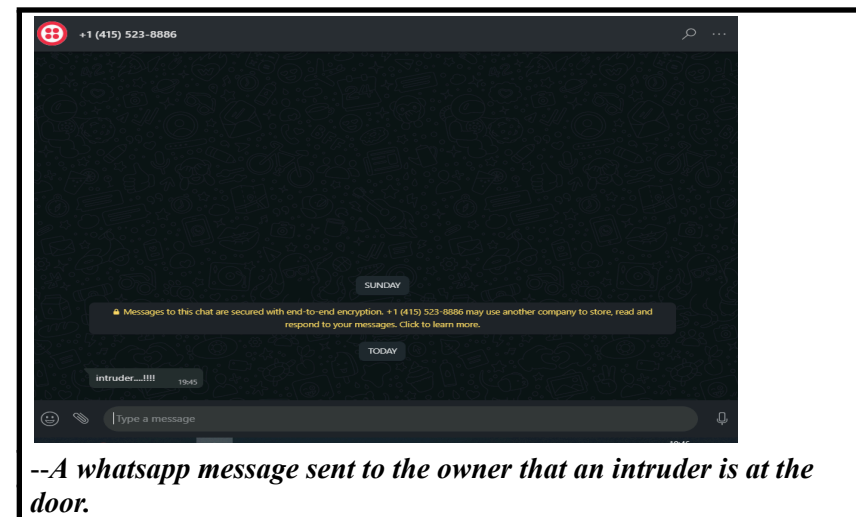
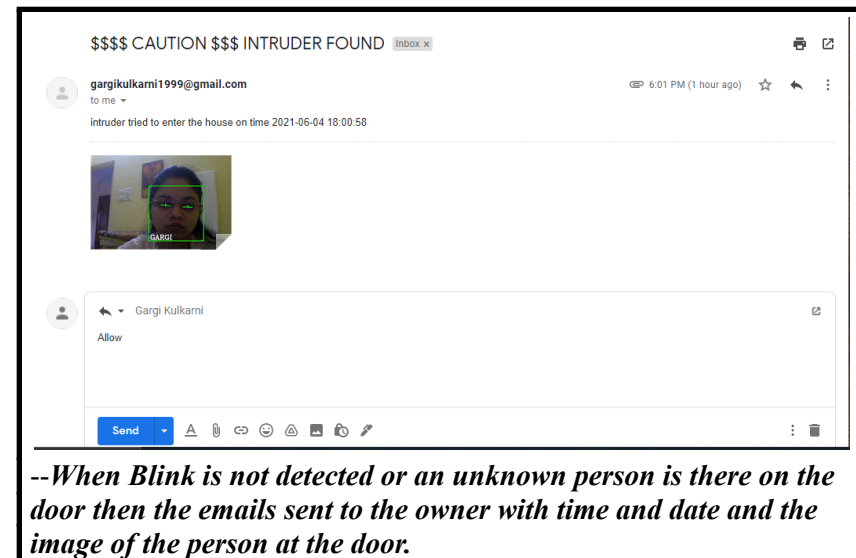
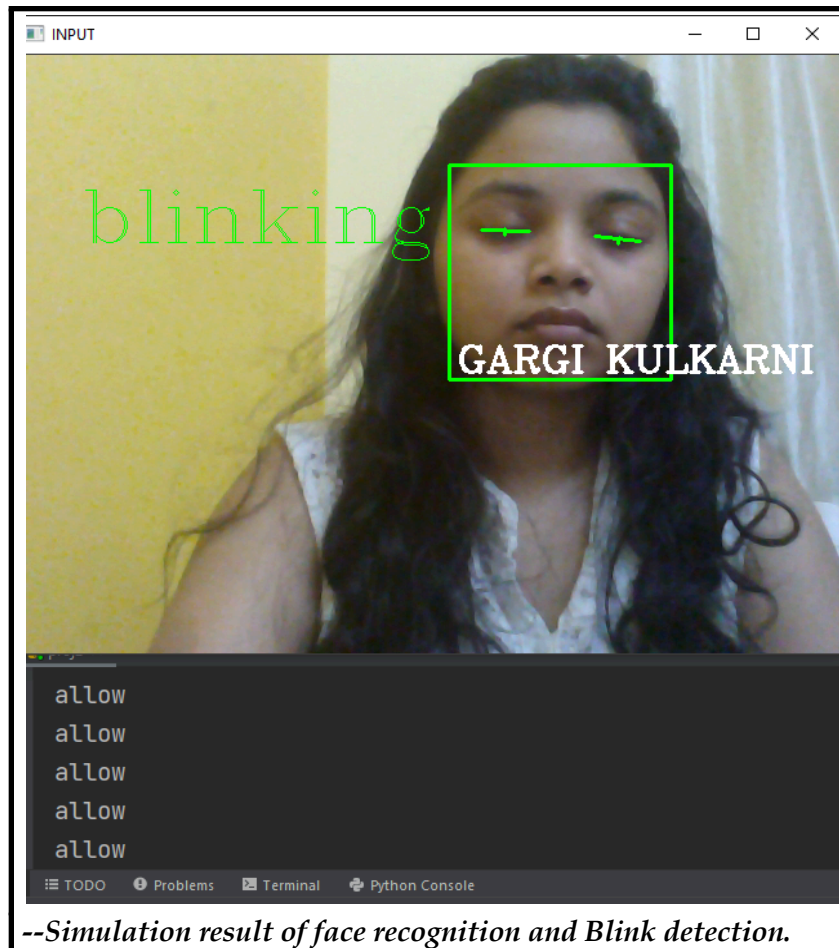
The DC Motor is connected to the entryway for opening and shutting the entryway, motor turns in clockwise bearing to open the entryway, waits for some time to let a person enter inside and then motor turns in anticlockwise direction to close the door.

D. Ultrasonic Sensor :--

This sensor is used to detect the human presence at the door. If the human presence is detected the ultrasonic waves are radiated and converted into electrical signals. This sensor has a frequency of 40 kHz and range of 3cm - 400 cm.



5.Results



6. Conclusion

- 1..Can Unlock the door if the face matches with the registered face in the database.
2. Can detect the difference between fake face (i.e, Photo of the person) and original person.
- 3.Can send a whatsapp message to the owner of the house if an unknown face is detected, and can unlock the door if the owner gives the permission for the same.

7. Limitations

- 1.The low quality of the Camera (owing to the high prices of infrared and 3D cameras)can sometimes cause a hindrance for detecting the face in a dark background, and the image can be blurry.
- 2.The time required for detecting the image and differentiating between a fake and original person can be long(depending on the speed of the CPU).

8. Future Scope

- 1.This project can be implemented on a large scale in industries by using highly efficient technologies like high quality camera sensors and more accurate face recognition algorithms.

2.This project can also be used in museums , or to open the lockers if it is combined with iris recognition for making it more secure.

9. References

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