

## Smart Door Lock/Unlock Using Raspberry Pi

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### ABSTRACT

This paper deals with the proposed system for smart and savvy door lock recognition system which is essentially for identification of human faces and mainly for home security. This is divided into two sub systems. First is image capturing, then comes face detection and recognition and finally automatic door access management. Open CV is mainly used for Face Recognition because it uses Eigen faces which compares the face images and produces it without losing vital face features, facial images of various persons are going to be stored in database. The purpose of the paper is to take face recognition to height which can replace the use of standard passwords, pins and patterns, adding more security to our life. The process carried out by raspberry pi is fast and makes the system work smoother.

**Keywords :** Face recognition, Face detection, Raspberry pi, OpenCv, Eigen faces.

### I. INTRODUCTION

Now each day accurate and faster user identification and authentication method is required. As of facial recognition approach, the detected face will be compared with the faces stored in the database, in this way we can identify the given face. If the face matches with database, without any restrictions the door will be opened. Epigram here is that the software should find the faces in the database by highest similarity. Face recognition technology mainly runs on identifying or recognizing the human faces. So that is what is been used here. The process of detection of certain face features and usage of these features are called as templates. So these templates will be compared in order to detect a face. For this project we extrapolate Raspberry pi, Solenoid lock, External dc power source, Relay module, Raspberry pi camera.

Face recognition has been a decisive element for researchers due to various human activities found in applications of security like criminal detection, forensic, face tracking, airport etc. Compared to other biometric traits like finger print, Iris, finger, palm etc., face bio metrics can be non-intrusive. They can be taken even without user's knowledge and further can be used for many security applications. Also Face authentication has fascinating approach that other approaches lack: facial images can be captured from a distance, any special actions are not always required for authentication, and crimes can be reduced because the captured images can be recorded and shown as proof.

### II. LITERATURE SURVEY

In the paper, a "Smart Door Access Using Facial Recognition" as Face recognition technology emulates the capabilities of human eyes to detect. So

this is been carried out by smart computing which creates 'face bunch'. The extracted face feature is been saved as templates. The templates are being compared to the face detected and the name of the person is being displayed and the machine will rotate as it functions in opening and closing the gate. For a process of extraction of images, a simple way is to capture the variations in the collection of images, encode them and compare them [1].

Telegram Application is used in paper it is important to own a reliable security system that can secure our assets as well as to protect our privacy. In the old system, the security is provided by card or password. Most of the doors are secured by people with some keys or security cards or some kind of pattern for opening the door. But here, the door lock can also be accessed remotely from any part of the world by using Telegram android application. The image of the person who accesses the door will be sent through email [2].

This explains about the technique of remotely controlling the door by using the network and passes the messages between owner and the door works according to owner's command. The unlocking system works based on the owner's command. The system at the door can be controlled by any type of small single board computers. IoT is a technology which is growing fast and has many applications. So we use IoT as the security mechanism for door lock system [3].

The paper "Pose and illumination Invariant Face Recognition for Automation of Door Lock System" proposes a door lock system which is based on face recognition. The system proposed here will only work if the door is accessed by known users. For an unauthorized person the door will remain closed. The

algorithm used for proposed system is Local Binary Pattern Histogram (LBPH) [4].

In the study, the proposed system for automobile security is a face detection and recognition application that control the automobile to be operated or restricted. This system is mainly applicable for automobiles. By the proposed methodology, the result of this becomes better quality by product and maintainable. The main aim of this project is to provide safety for automobiles and to avoid any theft [5].

The paper which is "Survey On Various Door Lock Access Control Mechanism" gives a survey on various automatic identification and access control mechanisms that have been used over the years to prevent unauthorized access. In traditional method, for high security areas like locker rooms for banks, military sites etc., and passwords were used. Due to the advancements in technology RFID cards were used, but this was not useful for the user due to the chance of getting lost, forgotten or stolen. Later various door lock security systems based on biometrics, OTP, cryptography etc. were developed and also lot of research is going on various automatic door lock systems [6].

### III.METHODOLOGY

The working of door lock/ unlock system is done using open source hardware components and software tools, which is available in the open market.

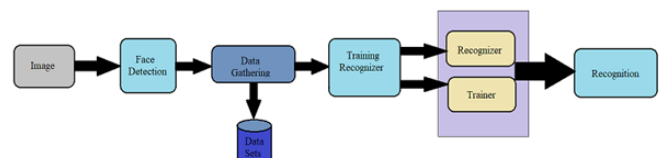


Fig 1. System Architecture

Face detection and Data gathering is actually a process where in the face of a person is captured first

before doing anything, that is face detection of the person is done first which is the most basic step in this process. Object detection using Haar cascade classifier is an effective method for object detection. The next task is to gather the data for which the training will be done on the classifier provided. The required data will be gathered to detect the face which will match the data that is stored in the database

Training recognizer consists of a recognizer and a trainer where in the process of training the new face with their respective identities, which is basically feeds the face with their ID's to the recognizer so that it can learn and the data which is sent can be effectively trained by the trainer. Thus by this process the data which is sent to the recognizer will learn effectively and efficiently.

Initially, the algorithm needs a lot of positive images (images of faces) and negative images (images without faces) to train the classifier. Then the extraction of the features will be done from it. One good feature is that OpenCV comes with a trainer as well as a detector.

Once the training recognition process is done it comes to the final stage of face recognition. Here, a fresh face on the camera will be captured and if this person had his face captured and trained before, the recognizer will make a "prediction" returning its id and an index, shown how confident the recognizer is with this match. In next step the cycle is repeated like detect a face, same as its done before with the Haar Cascade classifier.

The system will capture the image by raspberry pi cam and if it recognises the face as an authorized person, then the door unlocks. In case it is some unauthorized person, the system will alert by alarming and the image will be captured and sent to the admin by email. If the admin feels he is threatless, the door will unlock else access is denied.

This way the project is worked and carried out by the system.

#### IV.COMPONENTS REQUIRED

- Raspberry Pi board

Raspberry pi is a single computer board which is in credit card size. This can perform many tasks as the typical computer does. The main aim of using this raspberry pi is to make the work easier and to help in the innovation. It is also portable and costs less. The raspberry pi has two models; one is model A and other model B. The main variation between model A and model B is the USB port. Model A does not have Ethernet port and it also consumes less power. Where as in Model B it has Ethernet port. The central



Fig 1. Raspberry pi board

Processing unit of raspberry pi is the brain, where it carries out the instructions and logical process as required.

- Raspberry Pi camera

Raspberry Pi Camera consists of a 5MP CMOS camera with a fixed focus lens. That is capable enough to capture all the images in still as well as HD videos. Stills are captured at a resolution of 2592 x 1944, while video is supported at 1080p at 30 FPS, 720p at 60 FPS and 640x480 at 60 or 90 FPS.



Fig 2. Raspberry pi camera

The pi camera also has some features such as its automatic control functions, automatic exposure control (AEC), automatic white balance (AWB), automatic band filter (ABF), automatic black level calibration (ABLC), digital video port (DVP) and so on.

- Servo motor

A servomotor basically is like a rotary actuator or linear actuator. This allows for accurate control of angular and linear position, velocity and acceleration. A servo motor has a closed loop mechanism which is used to position feedback to control its motion and final position. The input is taken in as a signal (either analogue or digital) which controls the input and represents the position commanded for the output shaft.

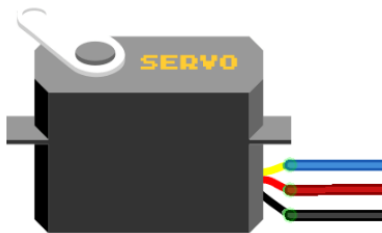


Fig 3. Servo motor

The basic and simple servomotors use position- only sensing via a potentiometer and bang-bang control of their motor. The motor always rotates in full speed or is stopped. This type is not mostly used in industrial motion control. But it is used for radio controlled models.

## V. FLOWCHART & BLOCK DIAGRAM

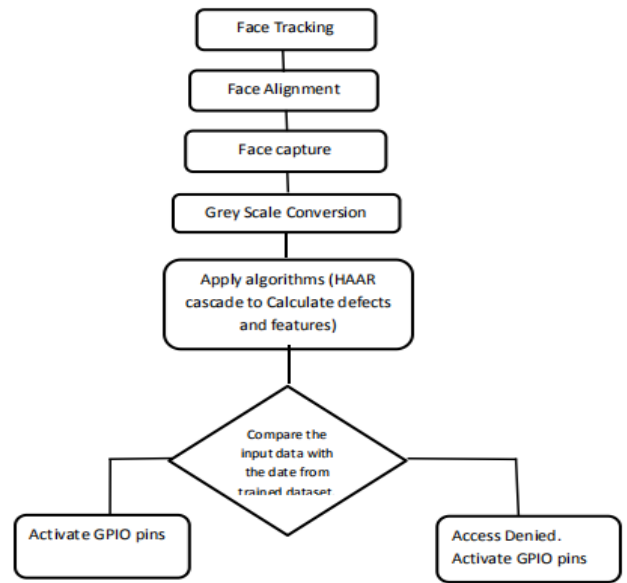


Fig 3. Sequence of working

In this work, a user defined algorithm has been implemented, and the flow has been represented here.

### Step 1: Input Face Image

In this step, the face will be captured by the pi camera.

### Step 2: Processing Face images

After the first step, the captured image will be processed using certain classifiers and compares the image with dataset.

### Step 3: If the Face detected matches with our dataset

In this step, if the comparison succeeds i.e. if the user 's data is already present in our dataset, then, entry action will be performed the system and user can unlock the door.

### Step 4: Else if Face is not detected, go to Step 1

In this step, if an unauthorized or unknown person's face is captured by the system, then user will be restricted from entering directly.

**Step 5: Unauthorized Person Verification**

Verification is required for entry of the unauthorized person. The system will capture the image of this person and sends the image to admin's personal email address. Admin can verify the person by interacting with the person through microphone feature.

**Step 6: Entry on unauthorized person**

Once the admin verifies the person, he will be able to unlock the door and enter..

**Step 7: If authorization fails**

In this step, if the admin can't verify the person or if he feels insecure on granting the entry, the admin can restrict the person by alarming the system.

**Step 8: Repeat Step 1**

**Data flow diagram:**

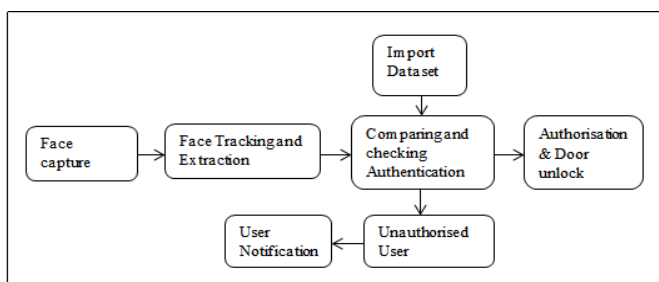


Fig 4. Block diagram

First, what we do here is first we store some set of images in data base. These images are being hold in a folder. Next what happens is we generating labels for data set and we keep multiple images in a separate folder to avoid confusion. We then train the model with the provided data set and we test the training

model on real time video.

The process starts by capturing the image and then the face is being extracted or identified. Then the system compares the extracted image from data set, if face is a match in data set door unlocks else authentication denied and notifies the user.

**VI.COMPARATIVE ANALYSIS**

In the previous survey papers or the existing system, the method they have used is complex and relatively less secured. Compared to other bio metric traits face recognition is easy and simple to carry out.

**Drawbacks:**

- Usage of passwords and pins.
- Manual door opening methods used.
- Complicated and less security measures leads to malpractices.

**Advantages of the proposed system:**

- Usage of password and pins is not considered here.
- The simple and easy way of bio metric trait is used here, i.e. face detection.
- The existing system problems have been overcome and leads to easy way to use for the users.
- This system is also time efficient.

**VII. EXPECTED RESULT**

When a person comes near the system, the camera acts first by capturing the image and sending it to the database. Algorithm compares the image with database images and ultimately if it is a known person, he will be granted entry without any restriction.

Whereas, if an unknown person comes his face will be captured and SMS alert will be sent to the owner. Then the owner will contact to that person through

micro phone and if he is some guy to trust, then the door will be opened else no. This project is basically monitoring the environment for visitor entry.

## VIII. CONCLUSION

The project is meant in such the way that has fast and efficient alert and monitoring system that may in used not just for door lock security system moreover as other applications also. This project is one of the best examples of Raspberry pi and pi camera with Open CV. The systems are programmed by Python language. We have used the technique that need very less computational time and greater accuracy in detection, recognizing of both Real times and from images, i.e. stored images. Also Eigen faces are used to represent the vector features for human faces. The features are extracted from the first image to represents unique identity used as inputs to the neural network to live similarity in classification and recognition. The Eigen faces has proven the aptitude to supply the numerous features and reduces the input size for neural network. Thus, the network speed for recognition is increased.

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