

Door Unlock using Face Recognition

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Abstract— In light of current circumstances entryways (Doors) are controlled and opened using keys, Passcodes, Patterns, Keycards and Fingerprints. These systems can be cracked at some extent but using Face recognition system in which whole Face is used as access. Face is a complex multidimensional structure and needs great registering procedures for location and acknowledgment it is difficult to split. Face recognition systems have upgraded individual recognizing evidence and affirmation, expecting a basic part in individual, national, and overall security. 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.

Index Terms— Viola-jones, LBPH, Raspberry Pi.

I. INTRODUCTION

Nowadays security is required due to the top of the line resources individuals obtain. Because of the improvement in splitting security frameworks there is a high need in growing top of the line security frameworks which are difficult to hack. So when we plan a security framework which utilizes confront as a get to key it is hard to break these. This will upgrade the security of every one of our homes/workplaces/any.

Face Recognition System will identify or verifies the identity of a person from digital images captured from a

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camera source. We utilize OPEN CV library which is a famous PC vision library began by Intel. The cross-stage library sets its emphasis on constant picture handling and incorporates sans patent executions of the most recent PC vision calculations. The basic flow of the face recognition system is the image is captured by camera. The Viola jones method will identify the face in the picture utilizing Haar cascade classifiers and features are extricated from the face. After the extraction, system matches the captured images with data base images.

The Matching of the captured images and data base images is done using LBPH algorithm. The thought is to not take a gander at the entire picture as a high-dimensional vector like in Eigen Faces and the Fisher Face Recognizer algorithms however it is to depict just neighborhood components of a question. The LBPH algorithm is more accurate than the Eigen Faces. The complexity in huge calculation in Eigen Faces or PCA is reduced by the LBPH algorithm. The components you extricate along these lines will have a low-dimensionality verifiably. In the event that a face is remembered, it is known, else it is obscure. The entryway will open consequently for the approved individual because of the charge of the Raspberry Pi to the entryway Motor. Then again, alarm will ring for the obscure individual.

II. OBJECTIVE

The point of our venture is to give a high security framework utilizing face acknowledgment on Raspberry Pi board and give get to just to the approved individual, this will expand the security of our venture. The proposed work is as per the following:

- 1) Interfacing of camera module to catch live Face picture.
- 2) Create a database of approved people.
- 3) Capture the Image just when the Outside Sensors are enacted by the nearness of a question.
- 4) Capture current face, spare it and contrast and information base picture.
- 5) For Authorized individual open the entryway naturally by turning the Motor.
- 6) When the individual crosses the second sensors i.e., inside sensors are initiated the entryway closes by turning the engine in switch heading.
- 7) For an unapproved individual the Alarm will ring

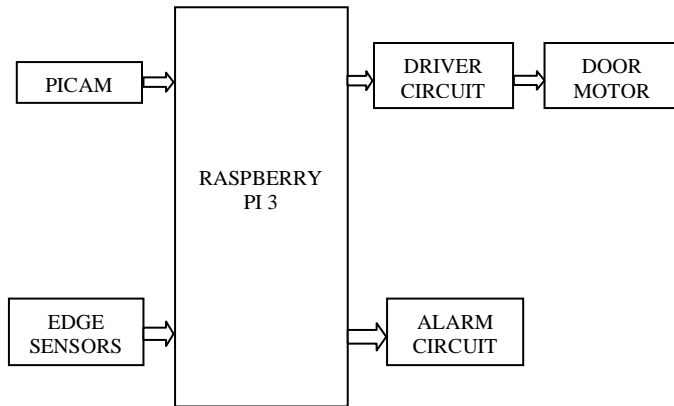


Fig. 1. Fundamental Block Diagram of the Face Recognition System

III. METHODOLOGY

Face Recognition System have three steps in which the first step is Face Detection using Viola Jones Algorithm and the second step is Face Recognition using LBPH Algorithm. Final step is Door Unlocking i.e., opening and closing of the Door using a Motor based on the Sensor operations.

A. Viola Jones Face Detection

The fundamental standard of the Viola-Jones calculation is to check a sub-window equipped for distinguishing faces over a given information picture. There are three steps required in this Face Detection.

The initial step is to transform the information picture into another picture portrayal called a necessary picture that permits a quick element assessment in Haar Cascade.

The second step is building a classifier with a specific end goal to choose few critical components utilizing AdaBoost learning calculation.

In the third step, the fell classifier is utilized to figure out if a given sub-window classifier is certainly not a face or possibly a face.

1) Haar Features:

These are utilized to recognize the nearness of that element in the given picture. Each element brings about a solitary esteem which is computed by subtracting the aggregate of pixels under white rectangle from the total of pixels under dark rectangle.



Fig. 2. Different Haar features.

2) AdaBoost Algorithm:

On the off chance that we consider every single conceivable parameter of the haar features like position, scale and sort we wind up ascertaining around 160,000+ elements in this window. As expressed beforehand there can be roughly 160,000+ component values inside a locator at 24x24 base resolutions which should be computed. Yet, it is to be comprehended that lone few arrangements of components will

be helpful among every one of these elements to recognize a face.

AdaBoost is a machine learning boosting calculation equipped for building a solid classifier through a weighted blend of frail classifiers. A powerless classifier is figured by the accompanying condition.

$$h(x,f,p,\theta) = \begin{cases} 1 & \text{if } pf x < p\theta \\ 0 & \text{otherwise} \end{cases}$$

Where x is a 24*24 pixel sub-window of a picture, f is the connected element, p shows the course of the disparity, and θ is a limit that chooses whether x ought to be delegated a positive (a face) or a negative (a non-face).The last solid classifier is acquired subsequent to applying the adaboost calculation.

3) Haar Cascade:

The cascaded classifier is utilized to figure out if a given sub-window classifier is unquestionably not a face or perhaps a face. The cascaded classifier is made out of stages in which each comprises of a solid classifier. The idea is outlined with two phases in figure 3.

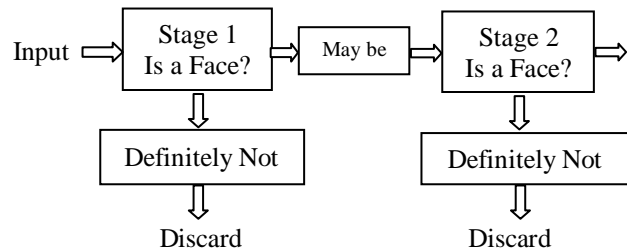


Fig. 3. Cascade Classifiers.

B. LBPH Algorithm

The Local Binary examples Histogram philosophy has its underlying foundations in 2D surface investigation. The essential thought of LBPH is to outline the nearby structure in a picture by contrasting every pixel and its neighborhood.

Take a pixel as focus and limit its neighbors against. In the event that the force of the middle pixel is more prominent or equivalent its neighbor, then signify it with 1 and 0 if not. You will wind up with twofold number for every pixel. So with 8 encompassing pixels you will wind up with 2^8 conceivable blends, called Local double examples or here and there alluded to as LBP codes. The principal LBP administrator portrayed in writing really utilized as a settled 3 x 3 neighborhood.

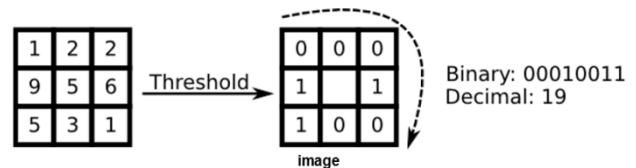


Fig. 4. LBPH operation.

C. Door Unlocking

The Door opening is done utilizing a Motor revolution. At first one arrangement of Edge sensors are kept outside to catch the Image just when a protest comes before the camera. The caught picture is handled and the Door is opened if the

face in the caught Image is a known Face and at whatever point the individual crosses the Inside Edge sensors the Motor will begin pivoting in inverse bearing. On the off chance that the individual before the camera is Unauthorized the Alarm will ring.

IV. HARDWARE DESIGN

A. Raspberry Pi 3

The Raspberry Pi 3 Model B highlights a quad-center 64-bit ARM Cortex A53 timed at 1.2 GHz. This puts the Pi 3 around half speedier than the Pi 2. Contrasted with the Pi 2, the RAM continues as before – 1GB of LPDDR2-900 SDRAM, and the representation capacities, gave by the Video Core IV GPU, are the same as they ever were. As the spilled FCC docs will let you know, the Pi 3 now incorporates on-board 802.11n Wi-Fi and Bluetooth 4.0. Wi-Fi, remote consoles, and remote mice now work out of the case.

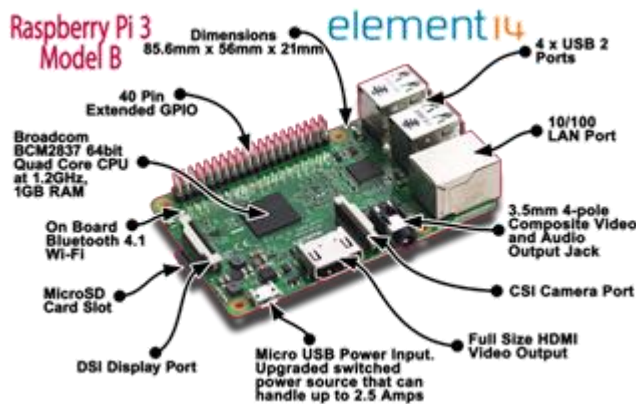


Fig. 5. Raspberry Pi 3.

B. Power Supply

The contribution to the circuit is connected from the managed control supply. The microcontroller voltage is of 5V. The A.C. input i.e., 230V from the mains supply is venture around the transformer to 12V and is nourished to a rectifier. The yield acquired from the rectifier is a throbbing D.C voltage. So with a specific end goal to get an immaculate D.C voltage, the yield voltage from the rectifier is nourished to a channel to expel any A.C segments introduce even after correction. Presently, this voltage is given to a voltage controller to get an unadulterated consistent dc voltage. We are utilizing an IC 7805 as voltage controller to get a 5V yield Voltage.

C. Edge Sensors

Here we use Two sets of Edge Sensors i.e., two IR sensors which are placed at the Edges of the Door. The IR sensor consists of IR LED and IR Receiver.

In IR sensor an IR beam is consistently falling on a photodiode, and at whatever point this Infrared beam breaks, by any sort of development, the sensors are initiated. IR sensors comprise an IR LED and photodiode, in which IR LED discharges IR radiation and photodiode distinguishes the radiation. Photodiode conducts current in reverse direction, at

whatever point light falls on it, and voltage crosswise over it changes and produces output accordingly.

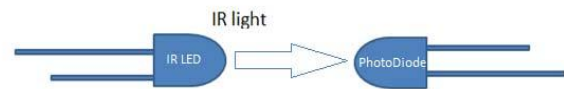


Fig. 6. IR Sensor

V. RESULTS

The Complete Hardware design of the Project is shown below,

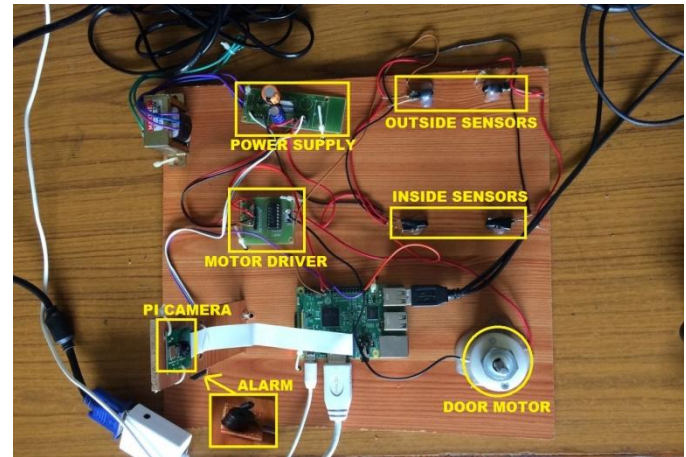


Fig. 7. Complete Hardware.

As shown in Fig. 7, the outside edge sensors are put in front of entryway for object detection. These sensors will be actuated at whatever point a protest goes between. The Inside Edge sensors are set at the inverse corners of the Architrave and these sensors will be actuated when the individual goes between. The Motor will be connected to the entryway for opening and shutting the entryway. The Alarm is for the caution for unapproved people.

At first the database is prepared with the approved people faces when the framework is installed. For every individual two learner countenances will be put away in the database keeping in mind the end goal to give additional productivity to the framework. The Database is made locally and the picture stockpiling limit in the Database depends on the memory card introduced in the Raspberry pi.

At whatever point the object is distinguished by outside sensors then camera will capture the image and checks whether a face is available in captured image or not. on the off chance that face is available in the image utilizing LBPH algorithm the face is contrasted with the faces in database. The motor turns in clockwise bearing to open the entryway as appeared in Fig. 8.

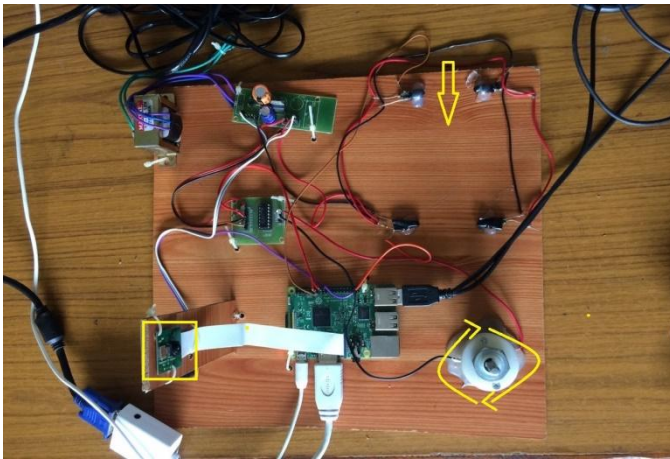


Fig. 8. Entry for Authorized persons(open).

when the individual goes into Home/office and so on., the Inside sensors are actuated and the Motor pivots in anticlockwise shutting the entryway as appeared in Fig. 9. The simulation results in Python Idle is shown in Fig. 10.

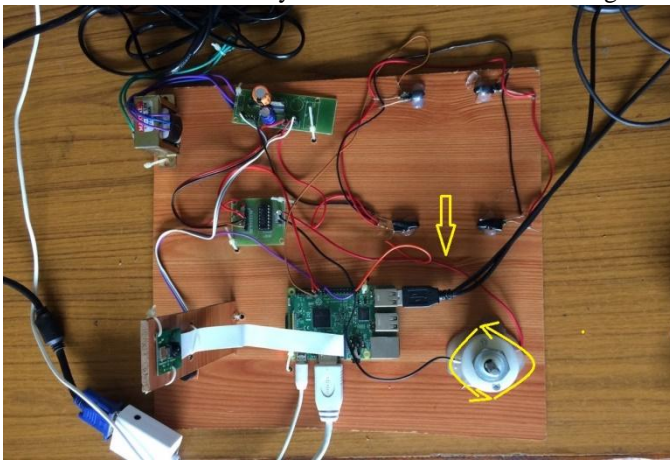


Fig. 9. Entry for Authorized persons(close).

```
Python 2.7.9 (default, Sep 17 2016, 20:26:04)
[GCC 4.9.2] on linux2
Type "copyright", "credits" or "license()" for more information.
>>> ===== RESTART =====
>>>
Do you want to train?[y=yes]: N
Waiting for EDGE Sensors
Outside EDGE sensor activated
Starting Face recognizer
Capturing image for comparison
Found 1 face(s)
Comparing this face with positives....
Running compare function.....
Hello AKBAR, Welcome Home
Waiting for inside EDGE Sensor....
Inside EDGE sensor activated....
Waiting for EDGE Sensors
```

Fig. 10. Simulation for Authorized persons.

At the point when an unapproved individual image is caught the Alarm will ring and the accompanying simulation results can be seen on python IDLE as shown in Fig. 11.

```
Python 2.7.9 (default, Sep 17 2016, 20:26:04)
[GCC 4.9.2] on linux2
Type "copyright", "credits" or "license()" for more information.
>>> ===== RESTART =====
>>>
Do you want to train?[y=yes]: N
Waiting for EDGE Sensors
Outside EDGE sensor activated
Starting Face recognizer
Capturing image for comparison
Found 1 face(s)
Comparing this face with positives....
Running compare function.....
Unauthorized Access...
Waiting for EDGE Sensors
```

Fig. 11. Simulation Results for Unauthorized persons

VI. CONCLUSION

The plan of the Face acknowledgment framework utilizing Raspberry pi can make the littler, lighter and with lower control utilization, so it is more advantageous than the PC-based face acknowledgment framework. In light of the open source code, it is more liberated to do programming advancement on Linux. The Hardware costs around \$107 and the software utilized in Pi is free of cost. We utilize Local Binary Patterns Histogram algorithm for the face recognition prepare. Additionally Alarm will ring for unauthorized access. The created plan is shoddy, quick, and profoundly dependable and gives enough adaptability to suit the prerequisites of various frameworks.

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