



## A DESIGN OF IDENTITY (FACIAL) RECOGNITION SYSTEM FOR SMART HOME BASED ON INTERNET OF THINGS

K. PHANI BABU, G. SIVA NAGESWARA RAO  
and RENUKA KONDABALA

Department of CSE  
GMRIT, Rajam, A.P., India

Department of CSE  
KL University  
Guntur, A.P., India

Department of IT  
VNRVJIET, Telangana, India

### Abstract

Development of “Internet of Things” is growing our reality and permitting individuals to develop new items. One of the major challenging issues in our society is security. In this perspective IOT is the defining moment on the grounds that IoT has contrived it conceivable to install an “Identity (Facial) recognition system for smart home based on IoT based” which will give the security to the home. This framework is reasonable and easy to screen your home from whenever and anyplace. In this we used set of sensors and devices by which we will monitor the visitors of the house and provided timely information to the owner through email or message. The owner can forward this information to anyone in case of any emergency. This system is attached to the main door of the home with the help of PIR sensor it detect the moment near the doors by this Raspberry pi triggers and capture the image by using pi camera and compare that picture with the already stored picture in the database if both are same then only it will open the door else it will send the mail or SMS to the owner and inform about the intruder at his/her home. The system doesn't allow unauthenticated visitors to unlock the door. The owner can give authentication to anyone by adding their image to the database. Through this model we can avoid intruders and achieve the strongest security system.

---

2010 Mathematics Subject Classification: 68.

Keywords: IoT (Internet of Things), Raspberry Pi 3, Identity Recognition, email, SMS, Pi Camera.

Received November 20, 2020; Accepted December 15, 2020

## Introduction

The unstable development of the “Internet of Things” is changing our reality and permitting individuals to advance new structures and items. The new age is presently loaded with brilliant individuals utilizing savvy innovation. Brilliant gadgets make life of an individual simple and refreshed. There are several products accessible today that permit us to have control over the gadgets without human mediation. One of the major challenging issues in our society is security. In this viewpoint computer vision introducing greater security framework using IoT concept for making houses smarter. This design has scope to identify an individual in the inaccurate region and at an inappropriate time on account of this individual authority may be a noxious one for quality. Facial confirmation structure advances to be one of effective greater influential research region exceptionally as of late. It admits an agreement of enormous functions in the reaches like surveillance in public places, access control, credit card verification, criminal identification and so on.

So, here we are discussing a paper to create a security system for homes using IoT. Using set of sensors and devices we monitor the visitors of the house and provided timely information to the owner through email. The owner can forward this information to anyone in case of any emergency. We also used some algorithms to train the machine to detect the faces of the visitors and unlock the door for authenticated visitors. The system doesn't allow unauthenticated visitors to unlock the door. The owner can give authentication to anyone by adding their image to the database. In present scheme Raspberry Pi camera is attached to Raspberry Pi 3 board. The scheme will take a picture if PIR sensor perceives either improvent. At that point, camera catches a picture and calculation is applied on the caught pictures. Hence, the pictures caught will be sent to a mobile device by the scheme via gmail. By that we can evade gatecrashers and accomplish the most grounded security framework and you can ensure your home and guard significant things, and furthermore keep your house sheltered from potential robbery by criminals and cheat.

### Literature Review

[1] In this paper the author's main aim is to detect the person near the door and capturing the image of him/her and store it in the scheme. In this a raspberry pi is used which acts like a Computer and it is programmed well for image capturing and face recognition. Python is used to program the Raspberry Pi. The cost of raspberry pi is less compared to other hardware's like MYRIO is the major advantage. For image capturing module it uses pi camera which is integrated with raspberry pi and its resolution is of 5MP and for the detection of person motion near door It uses PIR (Passive InfraRed) sensor for detection. If the motion is detected near the door then automatically pi camera trigger and capture an image and that image will be stored in the memory of the raspberry pi.

[2], [8] In this paper authors main aim is to notify when any unauthenticated person detected near the door through mail .Here we will install the softwares on the raspberry pi for sending mail. For this module it uses ssmtp libraries after the installation ssmtp configuration file is edited according to your from and to address and the domain name here it mainly uses gmail only. To address here is the house owners gmail. When intruder tries to enter into the house, then it will send a image of the intruder as an attachment to the owners gmail account. Here disadvantage is if owner is in offline then what the situation is.

[3] [9] In This paper author told in detail about process and use of LBP (Local Binary Patterns) in facial recognition. In this Face recognition takes place in 3 modules. First module is Face Representation in this hear like feature classifiers used and face detection done in this module. Second module is feature extraction which is done using LBP (local binary pattern) This will calculate LBP value for each pixel of image and also calculate binary relationship among the pixels. Then creates a feature vector with that pixels. Then it will compare the feature vector of the input image with each and every image in the training set. But there are so many algorithms are there which are accurate than this LBP and process occur in less time.

[4] [7] In this paper author main aim is to unlock the door when the person near the door is authenticated. Here door unlocking mechanism is done by using stepper motor. Stepper engine is an electrical engine which can

change up computerized beats into mechanical pivots. When the engine spins, its revolutions are separated into specific propositions. These mechanisms are distinct and for each evolution the engine is sent a pulse. The speed of motor depends on the regularity of digital pulse i.e. frequency directly proportional to the motor speed. In this door unlocking mechanism when the person is a authenticated person then digital pulse frequency will be high and motor speed is also high then the motor rotates in the direction in such a way that the door lock will open. If person is not a authenticated one then digital pulse remains low so stepper motor remains constant and does not make any rotations.

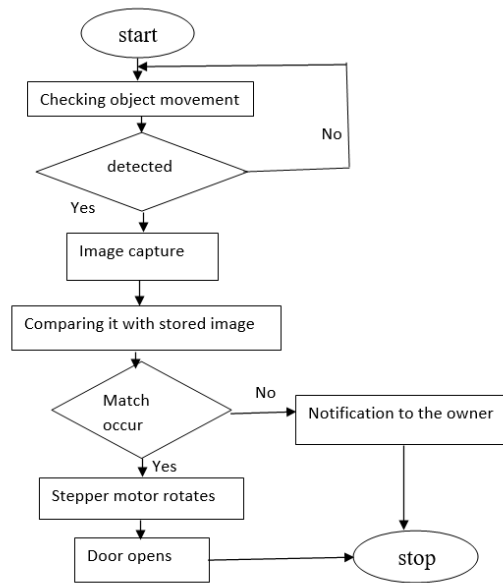
[5] [6] In this author primary point is to inform the proprietor about the gatecrasher by utilizing GSM module. By this module we can make the proprietor by sending a SMS aware of his/her versatile number. Here GSM module is utilized for sending instant message or a call to the proprietor about the interloper close to the entryway. Over the off incidental that the output is sure for example pictures coordinated at that point of connection conceded message will be sent to the proprietor, if there should be an existence of illegitimate pulse, will send an Access reject, some dim personal is attempting to open the portal. This do profitable in light of the fact that when proprietor telephone is in the disconnected mode and if any gatecrasher attempting to go into the home in that crisis case proprietor will get an instant message or a call so he can make any move.

### **System Architecture:**

The proposed system flow of execution is shown below

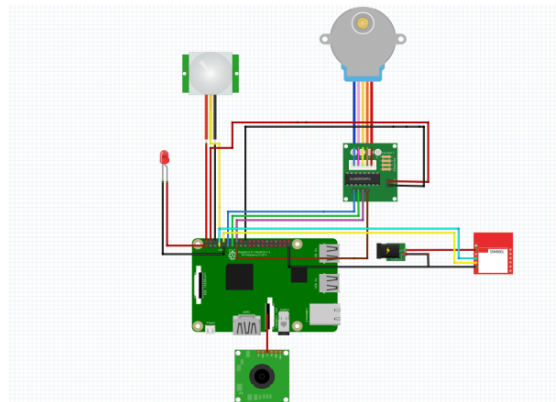
- **Step 1.** Connect the PIR sensor , Pi camera and stepper motor to the Raspberry pi
- **Step 2.** After the circuit connection dump the code and execute it.
- **Step 3.** First It will check for the person near door. If the person is there then the motion will be detected by PIR sensor.
- **Step 4.** If the motion is there then pi camera automatically switches on, captures the image of body near the door.
- **Step 5.** Then that captured image is compared with the already stored owner image.

- **Step 6.** If both images are matched then stepper motor will rotate it means door will unlock.
- **Step 7.** If images are not matched then it will notify the owner through mail and SMS with the intruder image as an attachment and door will remain locked only.



**Figure 1.** System architecture.

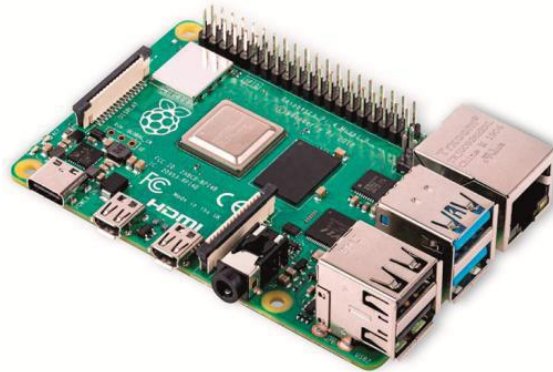
**Circuit Connection:**



**Figure 2.** Circuit Connection.

**Components Required:**

**i. Raspberry pi:** a new form of PC is Raspberry Pi 3 Model B. Raspberry Pi with nominal intension; charge card is used to connect to a PC screen or TV, and utilizes a standard console and mouse. This will do the work of a PC like scan the web, playing a top quality video, preparing workbooks, word, and messing around .It is integrated with Bluetooth, and Quad Core Broadcom BCM2837 64bit ARMv8 processor is attached. The Pi 3 runs at 1.2 GHz. This device connects over world, and hold wide variety of advanced digital maker projects.



**ii. PIR Sensor:** An electronic sensor named as Passive Infrared Sensor, estimates infrared emanating from objects. These are very small and low expensive devices used to capture the movements of the body by sensing. PIR sensors are customarily used in security vigilance and programmed lighting applications. PIR sensor has 3 pins namely Vcc, information and GND.



**iii. Pi Camera:** The Pi camera module is a light weight capturing functional device that underpins Raspberry Pi, communicates with Pi

utilizing the MIPI camera sequential interface convention. It is regularly applied in picture preparing, AI or in observation ventures. Payload of camera is very less. 5MP shading camera module. Supports both Raspberry Pi Model A and Model B. Light weight and compact.



**iv. Stepper Motor:** A stepping motor is an electromechanical gadget, changes an electrical force into mechanical force. Additionally it is a brushless, simultaneous electric engine that can separate a full pivot into a broad number of steps.



**v. LED:** A light-emitting diode, a semiconductor device that discharges noticeable light when an electric flow goes through it. It consists of two leads, one lead longer which is positive and than the other is negative.



**vi. GSM Module:** To establish a communication among a cell phone or a processing machine and a GSM framework, A GSM module will be utilized. It digitizes the signal and then transmits on a channel. A GSM modem is frequently an obsessive modem gadget with abilities like sequential, USB or

Bluetooth, or a versatile that gives reduced digital data signals.



### Circuit Description:

The circuit above, PIR sensor is connected to raspberry pi from which VCC is connected to GPIO pin 4, GND to GPIO pin 6 and input to GPIO pin 7. LED cathode is connected to GPIO pin no.1 and anode pin Connected to GPIO pin 9. Pi Camera is connected to Raspberry Pi camera slot. Stepper motor VCC and GND connected to GPIO pin 3 and 20 and remaining four pins of stepper motor IN1, IN2, IN3, IN4 are connected to GPIO pins 11,13,15,16 respectively. Now GSM module is connected to raspberry pi in which VCC i.e. pin 2 and GND i.e. pin 6 connected to the external power supply and pin 4 and 5 of GSM connected to GPIO pins 8 and 10. But these all connections should be made on single raspberry pi so the pin number may vary based on your requirement.

### Methodology and Implementation:

This Proposed system working is divided into different modules those are explained below. First of all raspberry pi is loaded with Debian based Linux Operating system called Raspbian buster.

- **Motion Detection:** This is the initial module or step in this system. First of all PIR check for the person near the door. If PIR detects the heat emitted by the person body in its range then person near the door is detected.
- **Image Capturing:** If any object is standing near to the door is detected, then camera which is connected to the pi automatically triggers and takes the image.



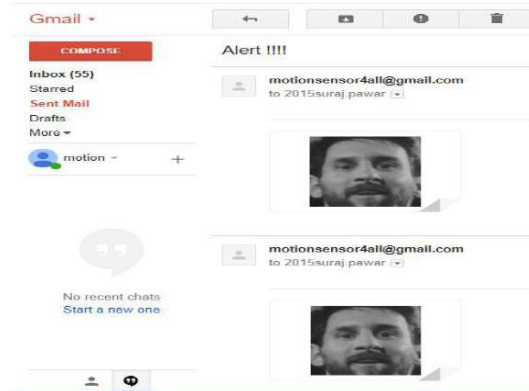
- **Face Recognition and Comparison:** image captured by the pi camera will undergo for processing. First it will check for the faces in that image using CNN and then it will extract feature vectors from the face and compare that captured image feature vector with the already stored image feature vector. This all process is done by importing single package in your python code i.e. face\_recognition package.

- **Door Unlocking:** By the above step if both the images are matched it means person is authenticated then stepper motor will get high frequency pulse so that stepper motor rotates and door will unlock. After some time stepper motor will rotate to the original position because after the entry of person the door should be locked.

- **Notification to Owner:** This is the last module in this system this will execute only if the intruder trying to enter into the house if the both images are not matched then it will send the mail to the owner with the image of that unknown person saying that some intruder trying to enter into your home and also led indication will be shown and text message will be send to owners phone number because if the owner is not in online then SMS notification will be useful which will be done by using GSM module. Through this model we can avoid intruders and achieve the strongest security system.

### Results and Discussion

This framework will perform four tasks, for example, movement location, picture catching, face acknowledgment and examination, entryway opening and warning to the proprietor. In the event that the movement is distinguished close to the entryway if the individual is validated for example in the event that the two pictures coordinated, at that point entryway will open naturally and the individual is not validated, at that point the entryway will remain bolted just and send the notice about the interloper through Gmail and SMS as shown in the below screenshots.



Notification Via Gmail

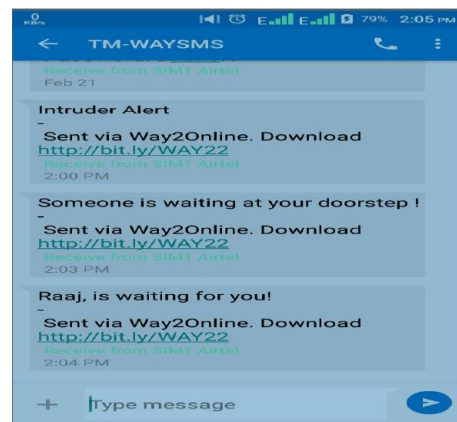


Figure 4. Notification via SMS.

### Conclusion

In this paper we have proposed, demonstrated a keen security approach for homes with low expenditure and expanded security. The plan of Identity acknowledgment framework using facial recognition by implementing raspberry pi can make the framework more diminutive, lighter and work effectively using small amount of power, Advanced degree of surveillance is furnished with assistance of IoT and Face Recognition. This system gives complete monitoring of house surroundings by face detection and Face recognition concepts for finding any stranger movements are there or not and inform same in the form warning utilizing a LED and send notification to the

house owner using either SMS or email. We are additionally giving force reinforcement to the smooth and consistent working of the framework if there should be an occurrence of power failure. To charge the Raspberry Pi a power bank might be used so there may be an opportunity to hinder the framework. This improvement conspire is modest, quick, and profoundly solid. The couple IoT and identify of face acknowledgment are developing instantaneously, in future an incremental progression in this field is conceivable. Trial outcome, in all actuality, shows that framework fulfils necessities of the present home security.

### References

- [1] Suraj Pawar, Vipul Kithani, Sagar Ahuja and Sunita Sahu, Smart Home Security using IoT and Face Recognition, 4th International Conference on Computing Communication Control and Automation, 2018.
- [2] Amritha Nag, J. N. Nikhilendra and Mrutyunjay Kalmath, IOT Based Door Access Control Using Face Recognition, 3rd International Conference for Convergence in Technology, April 2018.
- [3] Nashwan Adnan Othman and Ilhan Aydin, A Face Recognition Method in the Internet of Things for Security Applications in Smart Homes and Cities, 6th International Istanbul Smart Grids and Cities Congress and Fair (ICSG), 2018.
- [4] Sandesh Kulkarni, Minakshee Bagul, Akansha Dukare and Archana Gaikwad, Face Recognition System Using IoT, International Journal of Advanced Research in Computer Engineering and Technology (IJARCET) 6(11) (2017).
- [5] Anjali Patel and Ashok Verma, IoT based Facial Recognition Door Access Control Home Security System, International Journal of Computer Applications.2017.
- [6] Ravi Kishore Kodali, Vishal Jain, Suvadeep Bose and Lakshmi Boppana, IoT Based Smart Security and Home Automation System, IEEE 2016.
- [7] Shaik Anwar and D. Kishore, IoT based Home security system with alert and door access control using Smart Phone, December 2016, IJERT.
- [8] Hteik Htar Lwin, Aung Soe Khaing and Hla Myo Tun, Automatic Door Access System Using Face Recognition, International Journal of Scientific Technology Research 4(6) (2015).
- [9] Taewan Kim, Hyungsoo Park and Yunmo Chung, Integrated system of face recognition and sound localization for smart door, IEEE Transactions on Consumer Electronics. 59(3) (2013), 598-603.