Smart Home Security System Using IoT

P. Prathibha[1], Alok Kumar[2*], Abhay Singh[3], Kumari Parul[4], Shubham Jaiswal[5]

[1]*Assistant Professor, Department of Electronics and Communication Engineering, Sapthagiri College of Engineering, Bengaluru, India*

[2,3,4,5]*Student, Department of Electronics and Communication Engineering, Sapthagiri College of Engineering, Bengaluru, India*

*Corresponding author: alokanshu15@gmail.com

Abstract: Security has always been a major concern for the office environment and the households, and for this concern various approaches are in place to address this problem. In this paper we have proposed a low cost GSM based smart home security system along with the face recognition and detection technique. In this system, images of authorized person is stored in the database and when some intrusion occurs the camera will capture the image from the live video streaming and compare it with the database. For saving the memory and power we are using Passive Infrared (PIR) sensor which will activate the recording camera only whenever it encounters with any motion. All the sensors are well connected to a centralized Raspberry Pi 3 microcontroller section which will generate an appropriate output in case of any tragedy. Various security services contact numbers like authorized person or Police Helpline numbers can be feed into the system so that prior generated messages can be sent using GSM module in case of emergency.

Keywords: AC, ARM, AVR, CSI, DC, GSM, GPRS, IoT, IC, PIR, SIM, USB, VGA.

1. Introduction

Security is a method by which something is secured through an internetworking components and devices. The electronic security systems are widely used within government agencies, commercial places, corporate workplaces, shopping malls etc. Smart home security system is a network of electronic devices and sensors working together with a central control panel or microcontroller to protect family and households against burglars and other potential home intruders. Hence we have introduced a low cost home security system based on Internet of Things (IoT) that could protect home from unauthorized intrusion and protect home from burglaries.

The basic aim of this home security system is to secure entry points into a home with sensors that communicate with the command center or Raspberry Pi 3 microcontroller installed in a convenient location somewhere inside the home. We have also implemented face recognition system to make this system more secure and reliable. Thus, we have designed this Security system with an innovative feature of sending an alert message to the authorized person in order to grant permission or not. The alert message will be sent using GSM module installed in the system. This is a needy try just to develop a completely secured system with low cost and convenience.

2. Problem statement

Generally, people used to stay away from their home due to certain reasons, so at that time it becomes very crucial to enhance the security of their house. In order to keep an eye on the house the smart inventions with advance features has to be introduced. So this will help people to take care of their house anytime and from anywhere in the world. Therefore, we intend to design a similar type of system called Smart Home Security System based on Internet of Things (IoT) with face recognition feature.

3. Proposed System

This system is dedicated to make the working area safe and secure for the workers in industrial area and family as well as the households.

In this modern era the scenario has completely changed as all the systems are introduced with automation as well as with a lot of advanced technologies. Manual safety and human errors can be failed as it is not possible to monitor or keep track on activities each and every second. So in order to overcome this problem this and to enhance the security of home this system has been proposed.

This system consists up of a Passive Infrared (PIR) sensor (motion detection sensor) which will detect any motion around the entrance gate of the house. In case of any intrusion it will immediately detect the motion and sends the signal to the microcontroller which is Raspberry Pi 3. After receiving signal from PIR sensor the microcontroller will immediately turn ON the surveillance camera which is a Raspberry Pi v2 camera in this system situated near the entrance to detect and recognize the face of the intruder. So PIR sensor will able to help the system in saving memory as well as power by activating camera at the particular time only when the intrusion will occur. When the camera will be turned ON the system will capture the face image of the intruder and compare it with the predefined database of authorized person's face images. If the intrusion occurred by authorized person of the house the system will unlock the door automatically by recognizing the face but if the person is unauthorized then the system will use its most advanced feature which is to ask for permission from the authorized person of the house. For doing this, the system will

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send a message along with the image of the intruder and ask for the permission to access or not.
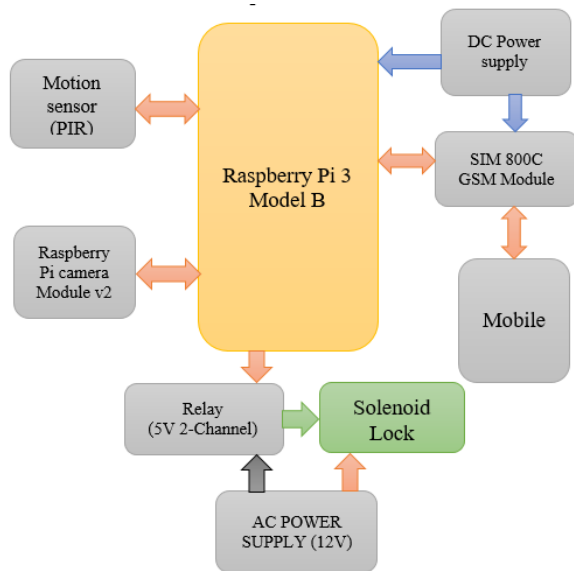

Fig. 1. Proposed system block diagram

At this stage the authorized person can control whole security system by giving commands to the system from anywhere in the world using GSM module. If it required, then they can give command to alert the Police also in case of unauthorized attempt to access.

Therefore, the purpose of this project is solved and brings a success in making the house more secure and advance.

4. Hardware Description

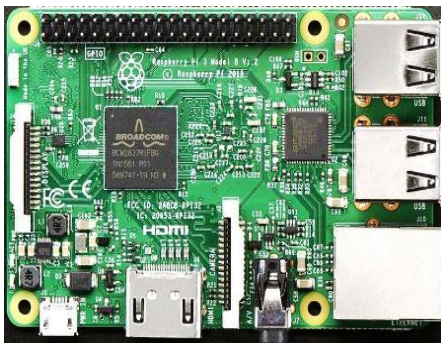### A. Raspberry Pi 3 Microprocessor

Fig. 2. Raspberry Pi 3 Model-B

Raspberry Pi 3 Model-B is a single board computer. It is a quad-core; 64-bit processor works on the impressive clock frequency of 1.2 GHz. This microcontroller is very easy to operate by just using generic USB mouse and keyboard. This processor is also equipped with 2.4GHz Wi-Fi802 and Bluetooth 4.1(244Mbps) based on Broadcom chip, which enables the processor to connect and use it into networking and hence it can be operated wirelessly from anywhere in the world.

B. GSM Module

Fig. 3. GSM Module 800C

A GSM module is an integrated circuit (IC) chip that connects the GSM network using SIM. GSM Module SIM 800C is GSM/GPRS quad-band module which works on several frequencies such as PCS 1900MHz, DCS 1800MHz, EGSM 900MHz and GSM 850MHz.

With the help of its small configuration, SIM 800C can meet all the requirements in customer's applications.

It has SMT (Surface Mount Technology) package with 42 pads and provides hardware interfaces between customer's board and the module. This module is designed very efficiently with power saving feature so that the current and power consumption is very low.

C. PIR Sensor

Fig. 4. PIR Sensor

PIR sensor or commonly known as Passive Infrared sensor is designed to sense motion in its range. They are inexpensive, small, consumes low power and very easy to use. It is sensitive up to 20 feet or 6 meters with an angular distance of 110° * 70° and consumes power supply of 5V-12V input voltage.
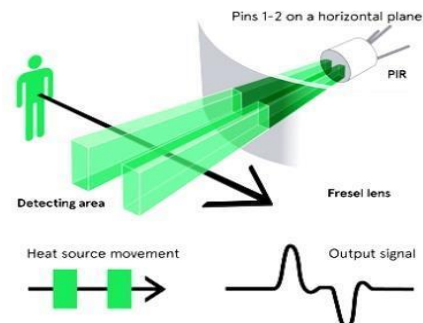

Fig. 5. Working range and output of PIR sensor

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PIR sensor gives the output in the form of digital pulse. It gives digital high pulse of 3V when it detects the motion or gets triggered and digital low pulse when idle or when no motion is detected.
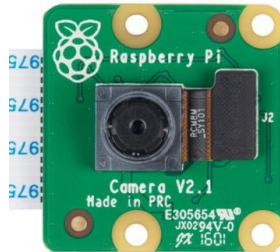
D. Raspberry Pi Camera Module v2

Fig. 6. Raspberry Pi Camera Module v2

Raspberry Pi Camera is used to take high definition video as well as still photographs. It consists up of Sony IMX219 8-megapixel sensor which supports 1080p@30fps, 720p@60fps and VGA@90fps video modes with still photograph capturing feature. It is attached via a 15cm ribbon cable to the Camera Serial Interface (CSI) port on Raspberry Pi. The camera module is applicable almost everywhere especially in those cases where power consumption is a major concern.
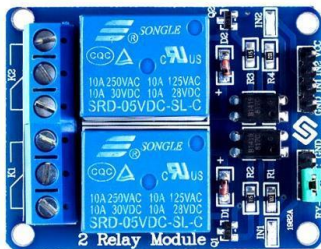
E. 2-Channel 5V Relay Module

Fig. 7. 2-Channel 5V Relay Module

It is a low level 5V 2-Channel relay board. In this board each channel requires 15-20mA driver current. This module is equipped with high-current relays that work under AC250V@10A or DC30V@10A.
It can be interfaced and controlled directly by various microcontrollers like 8051ARM cortex, AVR, ARM Raspberry Pi etc.

F. Solenoid Lock

Fig. 8. Solenoid lock

The solenoid lock is an electronic latch for unlocking and locking. As the situation demands it is available in unlocking in the power ON mode and locking and keeping in the power ON mode type. The power ON locking type will be in locking position when it is powered ON and if the power is disconnected the door is unlocked. It performs two types of operations locking and unlocking by applying a positive or negative pulse voltage to the solenoid and maintains the no power state in each position. By this power is saved because it is not necessary to always give power to solenoid lock.
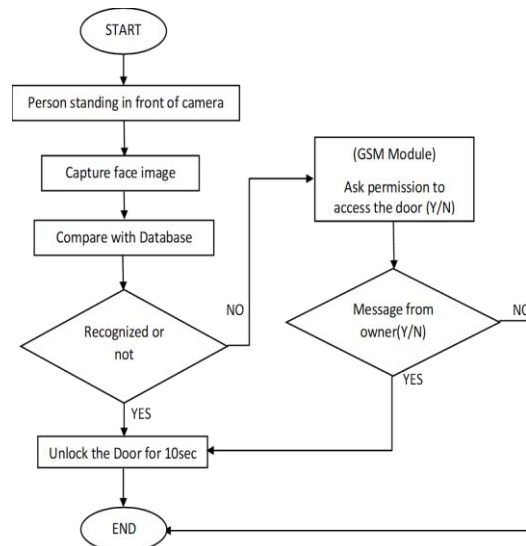
5. Flow chart

Fig. 9. Overall Flow chart

6. Advantages

Smart Home Security System using IoT is an advantageous project for enhancing the security of homes and households and for putting a check inside as well as outside the home in a cheaper or affordable budget. The main advantages of the system are:

- This security system not only allow only authorized person to enter into the house but also gives a remote access to the home security so it can be operated from anywhere from the world.
- Through its live streaming it captures the image of unauthorized intruder and sends it to the owner immediately and efficiently which makes the system more secure and accurate.
- This type of security system develops a fear to commit crimes in house.
- Makes more familiar with usage of internet.
- This system can also reduce the home insurance rate.

7. Conclusion

Smart Home Security system using IoT, no doubt will be a future sensation due to its properties of detecting and alerting the owner for unauthorized intrusion. This will ultimately protect the home from burglaries as well as unauthorized access and hence keeps the owner safe and tension free even they are not present in their house. Through live surveillance and live capturing of the images owner will get full information about

their home even when they are not physically present at their home through GSM module. Face recognition system saves the time of the owner by automatically recognizing their faces and by opening the door automatically for them. There is also a provision to alert Police in case if anyone wants to attempting to break the security system with the permission of the owner.

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