© 2018 IJSRST | Volume 5 | Issue 3 | Print ISSN: 2395-6011 | Online ISSN: 2395-602X
Themed Section: Science and Technology

Smart Home Security -Intrusion Detection System" Security for Home

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ABSTRACT

The "Internet of things" (IOT), is a system of interconnected, interrelated computing devices, digital and mechanical machines, physical objects, moving objects, with each object having unique IP address assigned to it, it plays an influential role in almost all the fields one of them is security, an important prospect of security is providing a security for home. Home Intrusion Detection [10] is IOT conceptualization which provides a security for home. The paper entitled "Smart Home Security-intrusion detection system" is a IOT based concept by the name itself witnesses that it is providing a security for home using the sensors and actuators. Passive Infrared Sensor (PIR) sensors are used to detect the motion of moving objects and magnetic door sensors are used to detect the state of door, Raspberry PI 3 model B is used as an interfacing, computing device, buzzer and Light Emitting Diode (Led) is used as actuators. The proposed intrusion detection system sends a Text SMS to owner and activates the Buzzer, Led at home.

Keywords: Raspberry Pi, twilio Api, sensors, actutatos, pir sensor.

I. INTRODUCTION

IoT is an emerging concept it has a simmering effect in most of the fields such as home automation, smart city, smart manufacturing, Health care, Automotive, wearables and one of the most important fields is security. An important prospect of security is providing a security for home. Security is degree of opposition, protection from harmful activity, or a state of feeling stable. From earlier to till now the security is important aspect in almost all the fields few of them are communication security, computer security, application security, information security, home security, physical security. Our intrusion detection system plays a valuable role in protection of home from the third person or the intruder. Our proposed system provides a security for the home without always keeping eye on home all the time.

The security plays an important role in layman's life. Providing a security for the homes is the major concern now-a-days. Keeping an eye on the home all the time is impossible and it may sometime be more expensive. In case of big Buildings and bungalow it becomes difficult to keep an eye on every area of the property to have a look at it physically by a single person. it easy to fool the person keeping an eye on home easily.

The proposed system provides a security for the home with a less expenses using the Raspberry PI as the main component, which acts as a physical interface between the physical environment and the computer.

II. REVIEW OF LITERATURE

In the field of IOT [10] many proficient has contributed their knowledge, mainly in the field of home introduction detection. Many have worked and explored about the providing a security for the home using the concept of IOT. The many sensors can be used to provide a protection for the home from the intruder some of them are PIR sensor [1] which senses

the motion of the moving object, Magnetic door sensor [2] senses the door state, Raspberry PI camera module [3] which captures the image of intruder.

HIVE: Home Automation System for Intrusion Detection [4] which uses the ZigBee sensors and actuators and also used Firebase for services such as a cloud database and user authentication. This system can enhance security and safety for home. Smart home automation system for intrusion detection [5] provides an implementation of smart home automation system along with the intrusion detection to minimize the damages for the home. Home Monitoring and Security system [6] which gives the implementation of PIR sensor, temperature sensor, humidity sensor to measure and detect the motion of the intruder which helps in making home secure with less expensive sensors.

PIR-sensor based human motion event classification [7], the modified passive infrared radiation sensor is used to detect the motion and based on motion detected the classification is done. Active Compressive Sensing via Pyroelectric Infrared Sensor for Human Situation Recognition [8], the design and implementation of the PIR sensor is demonstrated in this paper

III. PROPOSED SYSTEM

A. System Architecture:

The architecture shown in figure 1 is the architecture of the proposed intrusion detection system.

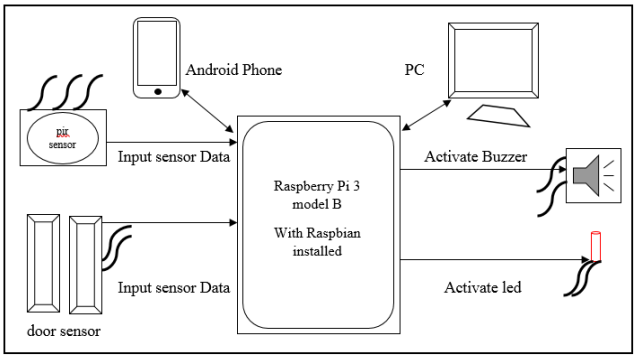

Figure 1. Architecture of Intrusion detection system

The main component in the proposed system is the Raspberry PI which is the interface between the physical environment and the computing environment. Here in this paper we are using Raspberry PI 3 model B along with the SD card containing the installed RaspbianOs it contains inbuild python packages which provides a basics for writing code to control the sensors and actuators.

The Android phone can be used to login to Raspberry PI using Raspberry PI's dynamic IP address and control the Raspberry PI using Android phone. The commands are given from phone which is in the same network as the Raspberry PI.

The PIR sensors are used to detect the motion of the object moving in front of it and a pair of door sensors is used which detects the state of door and both these sensors send the input information to the Raspberry PI to which they are connected. The Raspberry PI activates the Buzzer and a led based on the input given by the input sensors. If motion is detected then it turns on led and buzzer indicating that someone is moving around home. If the one magnet is moved away from the other then the Raspberry PI activates the led and buzzer indicating that door is open.

The Raspberry PI uses twilio API to send the alert text SMS to the owner person. When the motion is detected the it sends the alert message to owner. When door is left open then the door sensor senses it and sends the signals to the Raspberry PI which in turn sends the text message to authorized remote owner.

IV. IMPLEMENTATION DETAILS

The following are the components used in this implementation of the Home intrusion detection system, Hardware Components are Raspberry PI 3 model B, PIR sensor, T-SEN-DR-003-N/C Magnetic Door sensor, 5mm Red Led, HXD Buzzer Software components are NOOBS (Raspbian), VNC viewer,

Advanced IP Scanner, Android Application such as Network Scanner and Mobile SSH. Twilio API for text messages, Programming language used is Python

A. Raspberry PI 3 model B: Raspberry PI 3 [8] is the third-generation Raspberry PI. It has many features such as A1.2GHz CPU, 64-bit quad-core ARMv8 processor, 802.11n wireless LAN, Bluetooth of version 4.1 and has BLE (Bluetooth Low Energy). The Raspberry PI 3 model B has 4 USB ports for connecting external devices such as keyboard, mouse etc, and one full HDMI port for connecting monitor to Raspberry PI, RAM is 1GB, it has one ethernet RJ45 port for network connectivity, it has a 1 camera interface and a display interface, it also has a 40 GPIO Pins (General Purpose Input Output Pins) for connecting various sensors and actuators. it provides a slot for placing a SD card in which the Raspbian OS is been installed.

Figure 2. Raspberry PI 3 model B outlook

The figure 3 is the Pin diagram of Raspberry PI 40 GPIO Pins.

The Pins are normally grouped as:

- ✓ GND-for ground connection.
- ✓ GPIO-General Purpose input output Pin.
- ✓ 3.3V- 3.3 volts power supply
- ✓ 5V- 5 Volts power supply
- ✓ DNC- ID_SD (I2C EEPROM)

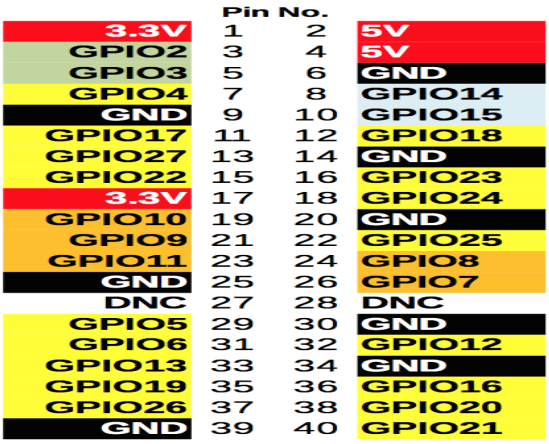

Figure 3. Raspberry PI 3 model B Pin Diagram

B. PIR Sensor: PIR is used to detect the motion of the human moment in and out of sensor range. PIR sensor is small and less expensive, it consumes less power. The figure 3.4 shows the outlook of Pir sensor and figure 3.5 shows the inside view of the Pir sensor. It is made up of pyroelectric sensor which can detect the levels of infrared radiation. Figure 3.7 shows the working of Pir sensor, everything emits a radiation which above the room temperature those radiations are in infrared range, the PIR sensors reads the infrared radiation and detects the moment of object in its range.

PIR sensor is made up of little circuitry, capacitors and the resistors, it has a Micro power PIR Motion Detector IC BISS0001, this chip is used for processing of sensor output before sending out of sensor and emit the output in digital form. PIR sensor is in Rectangular in shape, it outputs Digital pulse high (3V) when it detects the motion and digital low when no motion is detected. The range to which it is capable of sensing is up to 6 meters. The PIR sensor has 3 Pins one is VCC for connecting a power supply to PIR, one for Ground connection GND and the other is the OUT which is the output Pin of PIR sensor as shown in figure 3.6.

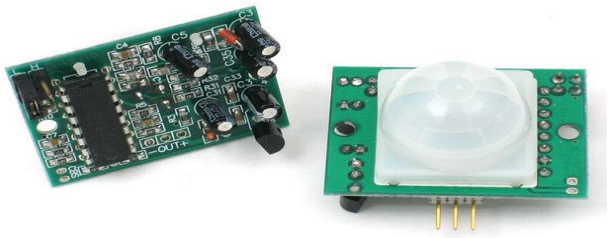

Figure 4. PIR sensor Outlook

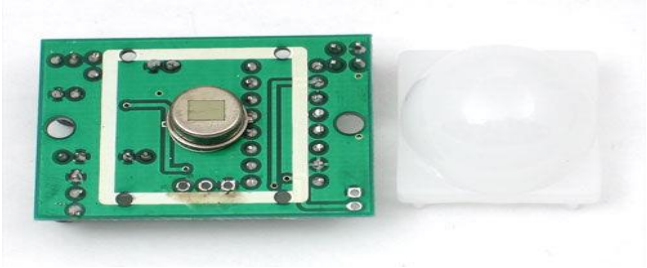

Figure 5. PIR Sensor inside view

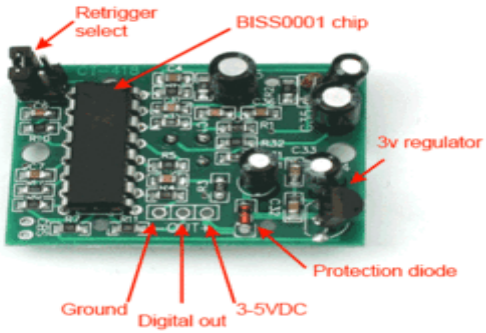

Figure 6. PIR sensor Pin Diagram

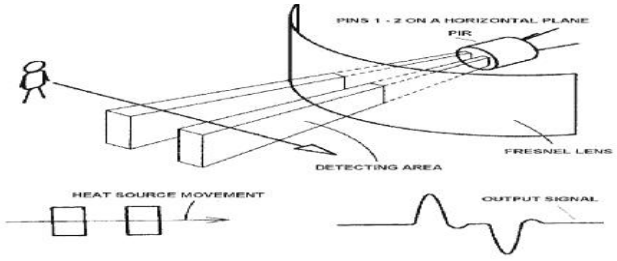

Figure 7.working of PIR sensor

C. BT-SEN-DR-003-N/C Magnetic Door sensor: is a Reed switch, which is enclosed in an ABS plastic shell as shown in figure 3.8. When it is open—no connection between the two wires. The other half is a magnet. when this magnet is away from other with a 5" then the door is said to be open else it is in a closed state. These sensors are commonly used to detect the state of door is it closed or open. Maximum rated current is 100mA and maximum distance is 15mm.

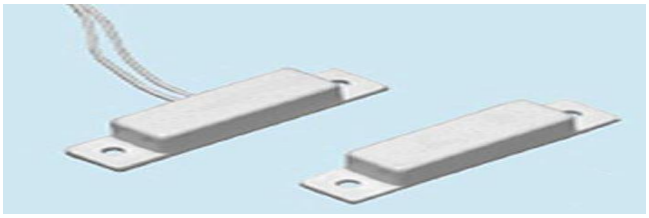

Figure 8. Magnetic Door sensor

D. HXD Buzzer: HXD buzzer is long working buzzer which beeps when it is triggered by an action. Its rated voltage is in the range of 1.5~12 VDC and a operation voltage is 1.2~16VDC and the sound output is greater than 85DB.

E. NOOBS: NOOBS are also known as Net Out of Box Software. The NOOBS are an easy OS (operating system) installer for Raspberry PI It contains Raspbian OS which is installed in Raspberry PI using SD card. It provides an option for user to select the alternative OS which can be downloaded and installed.

F. VNC Viewer: VNCis the Virtual Network Computing which is a graphical desktop system that uses the RFB (known as Remote Frame Buffer) protocol for controlling the computer remotely. In this proposed system, we use VNC viewer for controlling the Raspberry PI which is connected by an ethernet cable to the computer. Figure 9 shows the login screen to pi using VNC viewer.

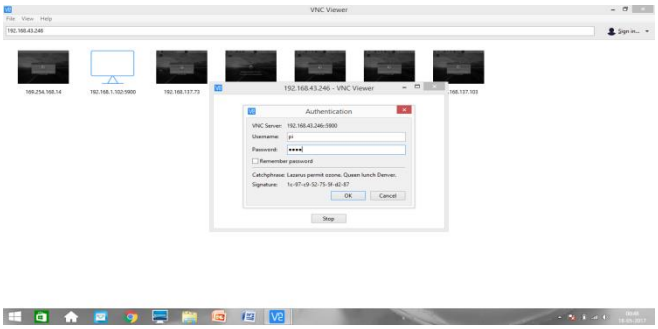

Figure 9. Login screen of Raspberry PI into Raspberry PI

G. Advanced IP Scanner: The Raspberry PI is assigned a unique dynamic address whenever it is connected to the computer and joined to the Network. To know the Raspberry PI Dynamic, address the Advanced IP

scanner is used which shows the connected live and dead Devices within the network. The below is the Fig 3.10 showing the Advanced IP Scanner with Raspberry PI dynamic IP address, the Blue node indicate that the System is alive and running state.

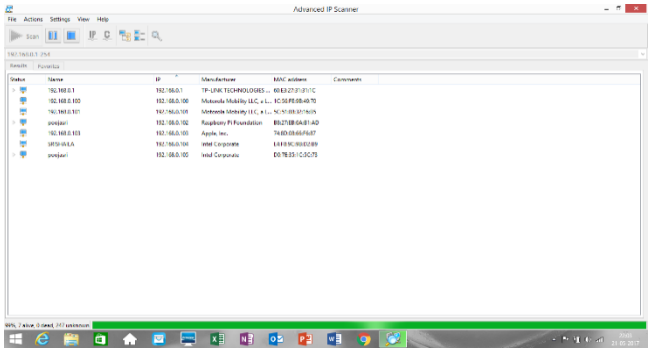

Figure 10. Advanced IP scanner showing the status of Raspberry PI within the network.

H. Twilio API: Twilio API allows Messaging. This API allows user to send messages using twilio Rest API and Receive SMS from the twilio Number, in this each user is given a public and private key and a unique twilio assigned phone number using which the messages are sent to mobile numbers of user. Twilio API supports python programming language.

I Android Apps: **Network Scanner** is an Android App used in Smartphone to detect the devices connected within that network and their IP address. Which is used to connect the Raspberry PI from the android Phone.

Mobile SSH is an Android App based on putty SSH library which is used to control the Raspberry PI remotely and give commands from the Android phone to Raspberry. The Username and password is entered from Mobile SSH android App to get connected to the Raspberry PI wirelessly.

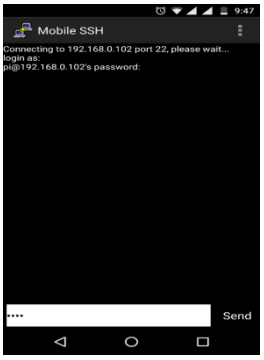

Figure 11. Mobile SSH connecting to Raspberry PI using PI id and password

J. Programming language: Python, Raspbian comes with ainbuild packages for python the Raspbian contains both python 2.7 as well as python 3 but for this paper we are using python 2.7. [9] Python is a High-level programming language commonly used because of its simplicity and ease of learning. Python interpreters are available for many operating system. Python supports the object oriented and structured programming language.

K. Connections

The fig 3.17 shows the Pin connection of the Raspberry PI to Bread board and to the Sensors.

The Raspberry PI 3 model B has 40 GPIO Pins to connect the sensors and actuators. The +ve Pin of PIR sensor is connected to 5v Pin of Raspberry PI, -ve Pin is connected to common ground, the out Pin of PIR sensor is connected to Pin 11 and 15. One Pin of door sensor is connected to 16 as +ve , other to ground Pin 20.Led +ve Pin is connected to 13 and other Pin to the ground. HXD Buzzer One Pin is connected to Pin 12 and other to ground.

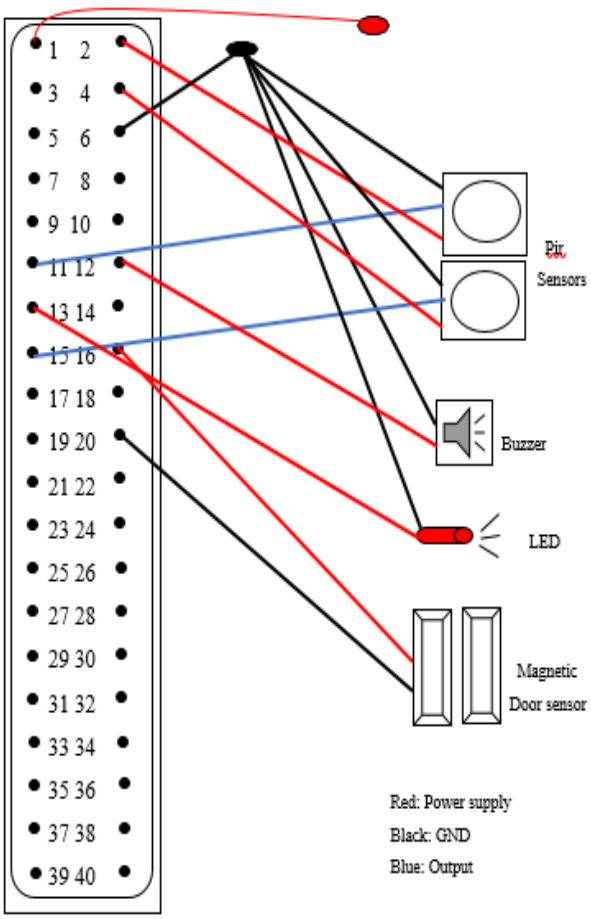

Figure 12. Pin connections

V Experimental Results

The following figures shows the result of the proposed system. When no objects move around the home then led and buzzer remains off which is shown in figure13.1, figure 13.2 is Raspberry PI screen and figure13.3 is mobile ssh screen in normal screen.

Figure13.1.when sensors are in normal state.

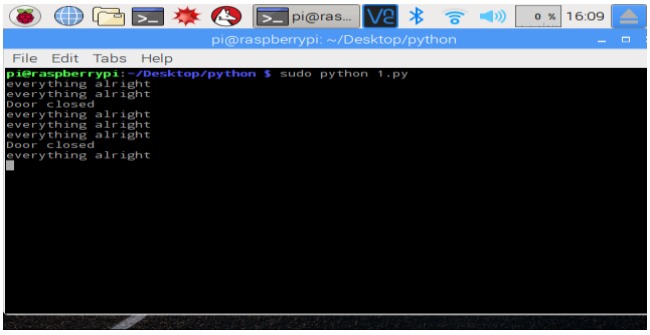

Figure 13.2. PC Screen shot showing that everything is alright

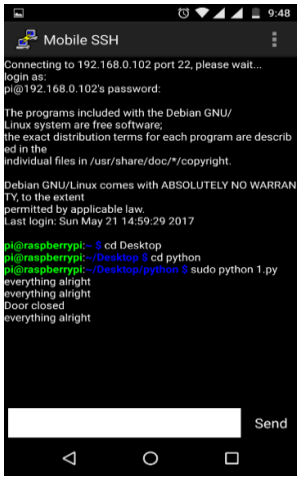

Figure 13.3.showing the snapshot of mobile when all sensors are in normal state

When objects or person moves right side of the home then the Led glows along with the buzzer beep as shown in fig 4.4. The text SMS is sent to authorized person's phone number fig 4.6 shows the screen shot of the text SMS.

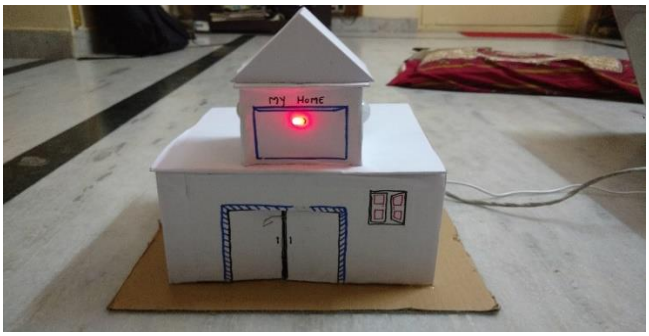

Figure 13.4.the blinking of Led and Buzzer is on when someone moves right side of home

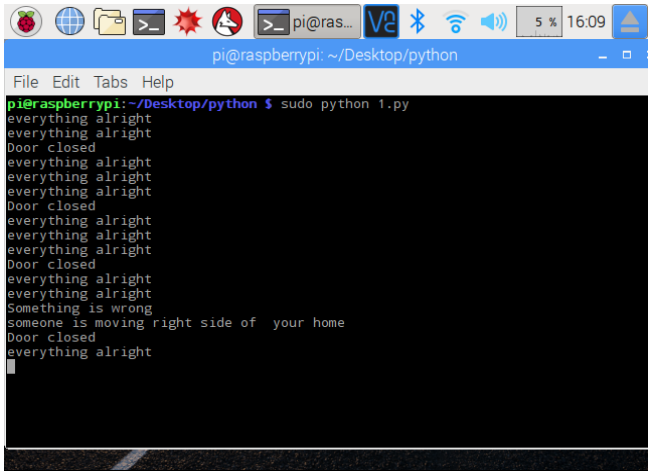

Figure 13.5. When person moves right side of the house

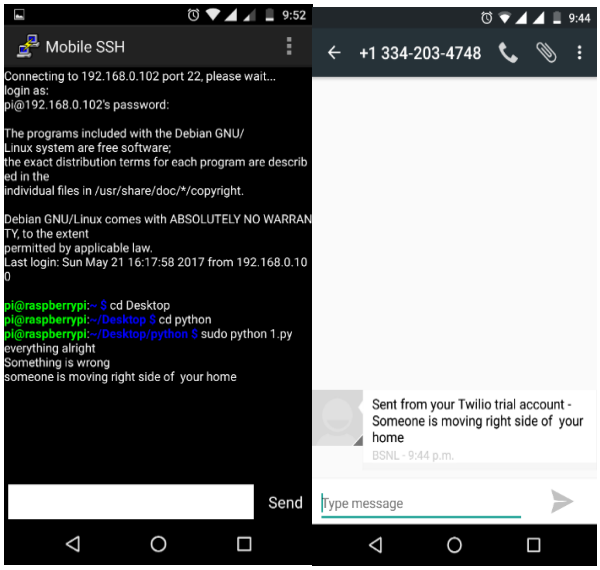

Figure 13.6.mobile snapshot showing the Someone is moving right side of the home in Mobile SSH and also the text message received by the owner

When objects or person moves left side of the home then the Led glows along with the buzzer beep as shown in figure13.7. The text SMS is sent to authorized person's phone number figure13.9 shows the screen shot of the text SMS.

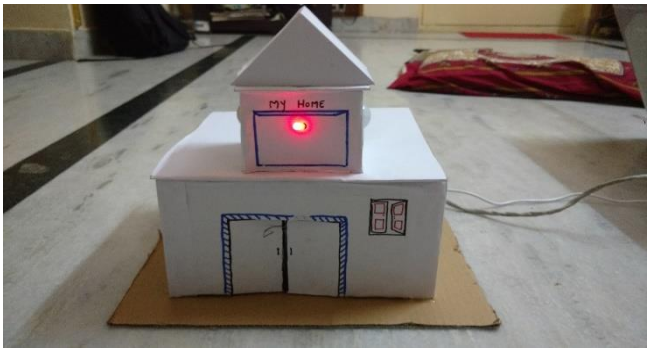

Figure 13.7.showing when the person moves left side of the home then led and buzzer activates.

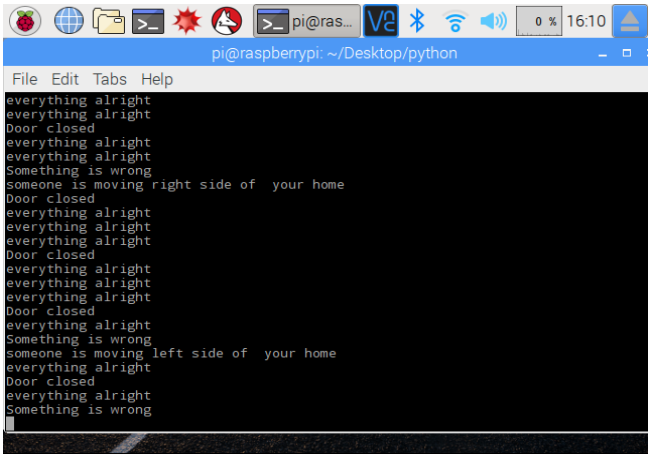

Figure13.8.when someone moves left side of the home

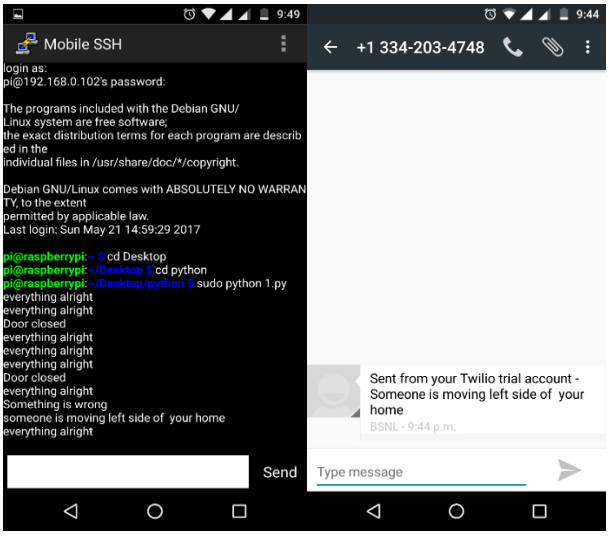

Figure 13.9.mobile snapshot showing the Someone is moving right side of the home in Mobile SSH and also the text message received by the owner.

When the door of the home is left open then the led and buzzer activates as shown in figure13.10 along with these the Alert text SMS is sent to the authorized

owner's phone number, the mobile phone screen shot is shown in figure13.12.

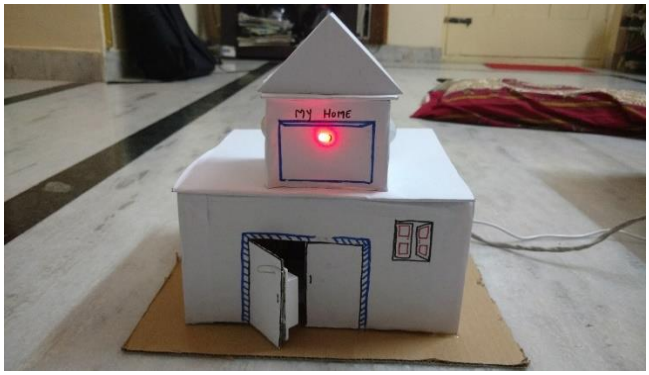

Figure 13.10.when home door is open it blinks led and buzzers

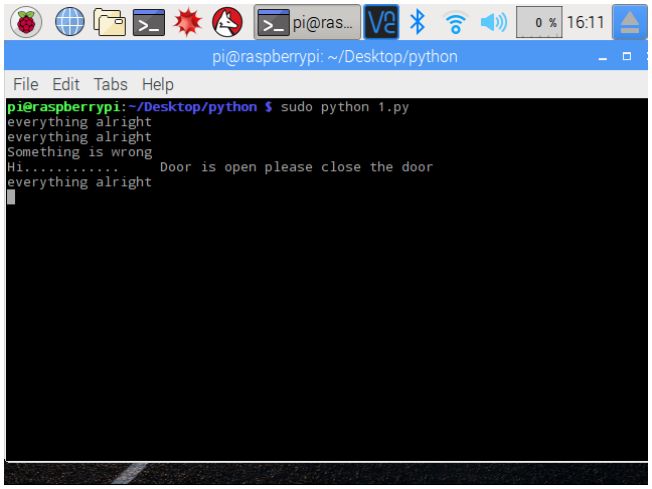

Figure 13.11. When the door is open, it gives an alert message

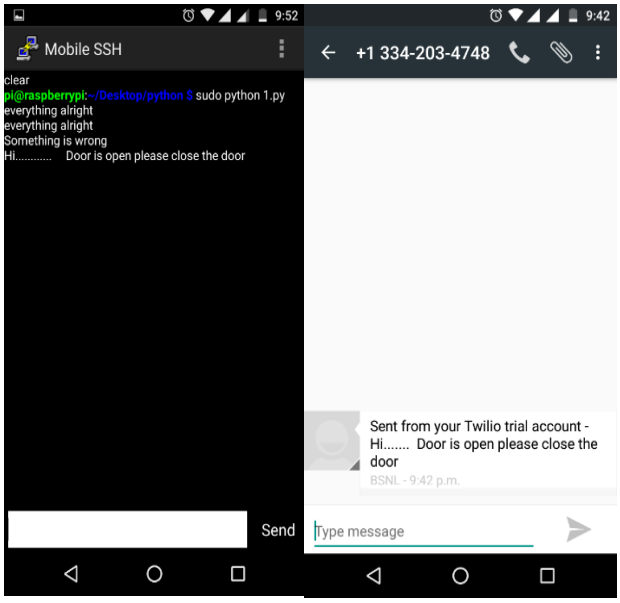

Figure 13.12.snapshot shop of mobile phone when the door is open

V. ADVANTAGES AND APPLICATIONS

- ✓ The security for the home using a low-cost sensor. It is efficient to use this concept for big bungalow.
- ✓ It can also be used to monitor particular objects in a room or a public place such as gold showrooms museums.
- ✓ It alerts immediately to user even when they are away from home, it is also possible to send messages to multiple phone numbers from using this paper.
- ✓ This can be implemented in private buildings.
- ✓ Using PIR sensor and door sensor it is possible to keep an eye on restricted places in office all the time.

VI. CONCLUSION

In this paper, the security for home is provided using the various low-cost input sensors and output actuators. The Python programming language is used for designing and controlling the sensors and triggering actuators. RaspbianOs is installed in Raspberry PI using the SD card. The text message is sent to owner's mobile phone whenever input sensor detects the changes. The PIR sensors detect the human motion and sends signals to the Raspberry PI which in turn activates the Led and the Buzzer, also sends an alert Text message to the owner's mobile phone, Similarly, when the door sensor detects that the other part of magnet is away from it, it sends signals to the Raspberry PI which in turn activates the led and Buzzer also sends alert text SMS to owner's phone. For the Future enhancement, the Raspberry PI camera model can be used with this paper to capture the image of intruder whenever PIR sensor detects the motion and send the image of the intruder to the remote person.

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