HOME AUTOMATION AND SECURITY SYSTEM

BY

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This Report Presented in Partial Fulfillment of the Requirements for the Degree of Bachelor of Science in Computer Science and Engineering

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APPROVAL

This Project/Internship titled **"HOME AUTOMATION AND SECURITY SYSTEM"**, submitted by Mohammad Jahangir Alam to the Department of Computer Science and Engineering, Daffodil International University, has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of B.Sc. in Computer Science and Engineering and approved as to its style and contents.

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DECLARATION

We hereby declare that, this project has been done by us under the supervision of **Dr. Sheak Rashed Haider Noori, Associate Professor, Department of Computer Science and Engineering** Daffodil International University. We also declare that neither this project nor any part of this project has been submitted elsewhere for award of any degree or diploma.

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ABSTRACT

With the advancement in technology, the number of electronic devices in our day-to-day Life has increased to make life simpler. So there is necessity to construct a trustable Remote System that will easily control all these devices from a distance will not only reduce the complexity of handling the number of devices simultaneously, but also save power. This report presents overall design of **Home Automation and Security System**. This is an IoT based project. After research, we make a successful prototype. Using the Ethernet and microcontroller technology we design a Home Automation System where the entire electrical item will be controlled. Using the internet people can also monitor room temperature, Gas occurrence in kitchen, detect human in room through the user friendly Web Application and also makes a sms notification system. Comparing to others this system is low cost, attractive user friendly interface which is platform independent and it's very easy to install. After implementation of all functions, the system is tested in different stages and it works successfully as a prototype.

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CHAPTER ONE

INTRODUCTION

1.1: Introduction

21st century is the era of science and technology. In keeping with the change of time with the technology of the Home has been modernized a lot. Now maximum home appliances are automated. The concept of Home Automation is first introduced in water heater at 1889.After that, the uses of Home Automation increase day by day. According to API research in 2012, more than 1.5 million Home Automation systems are installed in USA [1].Now-a-days Home Automation is more popular and quickly makes a better position in market and gives a greater field to work and research for the engineers. It is predicted that within 2020 the market value of Home Automation become more than 10 billion US $.

Using the concept of IoT, it becomes very much flexible and user interactive. Different types of wireless network technology such as an internet, WIFI, GSM makes the Home Automation system more effective. Using these technology home appliances are easy to control from far distance through the android or web based application. To build a smart and intelligence home is now very possible by combining IoT and Home automation system

Here we design n Home Automation project based on IoT using the Arduino Mega and Ethernet shield to control electronics appliances and devices and make a security alarm. The Arduino is connected to internet using Ethernet cable and the mobile device or pc is connected to internet. Using any web browser the user puts a specific IP address to access the web application. User has to enter password to control the home appliance. After buying real IP Web Application are directly accessible and user can control the electrical devices from any-where in the world. But now for demonstration lacking of real IP we have to connect the mobile devices or pc and Arduino within the same network. User also watches the present condition of electrical devices through this web application. A fire-smoke alarm, LPG gas leak alarm and a thief alarm also added in this project. Sms alert system that can send sms to user if anyone trying to enter room or fire occurred. An automatic night light is also the part of this project, which is automatically off and On according to light.

1.2 Related work

Home Automation is a very common topic around the world. Now-a-days Home Automation and IoT integrated together. Lots of real life project and research is developed or currently developing based on IoT based Home Automation system. The Internet of Things (IoT), also sometimes referred to as the Internet of Everything (IoE), consists of all the web-enabled devices that collect, send and act on data they acquire from their surrounding environments using embedded sensors, processors and communication hardware. These devices, often called "connected" or "smart" devices, can sometimes talk to other related devices, a process called machine-to-machine (M2M) communication, and act on the information they get from one another. HomeSeer, Control4, Crestron, Vera, Staples Connect, Iris, Savant, SmartThings are the world best companies in field of Home Automation [2]. The main advantage of IoT based Home Automation is user can remotely control or integrated with the electric appliance and devices. Most of the Home Automation Systems are relatively high cost comparing to Bangladesh. Most of the home automation is android or IOS based, not platform independent. The security is a great concern for IoT based home automation system.[6] If it's works with Ethernet then the security is a massive term. So the IoT based Home Automation system is a great field to develop and work. Still here is a great opportunity to enhancement quality and improve security of IoT based Home Automation.

1.3 Objective of the project

The main objective of this project is remote controlling of any household device and ensuring security.

- User can remotely switch off or on the any appliance through a web based application.
- Save the waste of electricity by automatic controlling night light.
- Detect thief in night and create siren.
- Detect LPG gas leak and makes emergency sound which can prevent massive fire accident.
- User also sees the room temperature through the web application.
- SMS alert system that can send sms to enter if any security attack found.

- Makes system interface is so much interactive so that it can help to control electronics devices of elder people.
- Makes the web application is secured so that everyone cannot allow controlling devices

1.4 Scope of the project

This project is completely control all home appliance remotely and some devices are controlled automatically .It can also work on office and large shopping mall. It's remotely accessible from intranet. If we buy real IP then it can accessible using internet from anywhere in the world.
The project interface is very user friendly. It's a web application which is platform independent. That's why this application runs on any browser in any smart phone or PCs

CHAPTER THREE

REQUIREMENTS ANALYSIS

3.1 Software Requirements Specification

A software requirements specification (SRS) is a complete description of the behavior of the system to be developed. It includes a set of use cases that describe all of the interactions that the users will have with the software. SRS also contains nonfunctional (or supplementary) requirements. Non-functional requirements are requirements which impose constraints on the design or implementation (such as performance requirements, quality standards, or design constraints). [3]

The details of software requirements specification of our project given below

3.1.1 Hardware Requirement

- RAM: 256 MB
- Hard drive space: 200 MB (For executing any internet browser)
- Internet Connection

3.1.2 Software Requirement

- Any kinds of internet browser

.

3.1.3 Functional Requirement

- Controlling all electrical appliance
- Increase the home security
- Decrease the waste of electricity

3.1.4 Non Functional Requirement

- Secured system
- Better design and less complexity
- Available on android. Mac or windows

3.2 Use Case model

The Following use case diagram shows that the task which is controlled by user. In this use case user send the information to the server and then server takes the next step according to user signal. Server also sends the information through the application. Other task like SMS alerts system or night light work automatically.

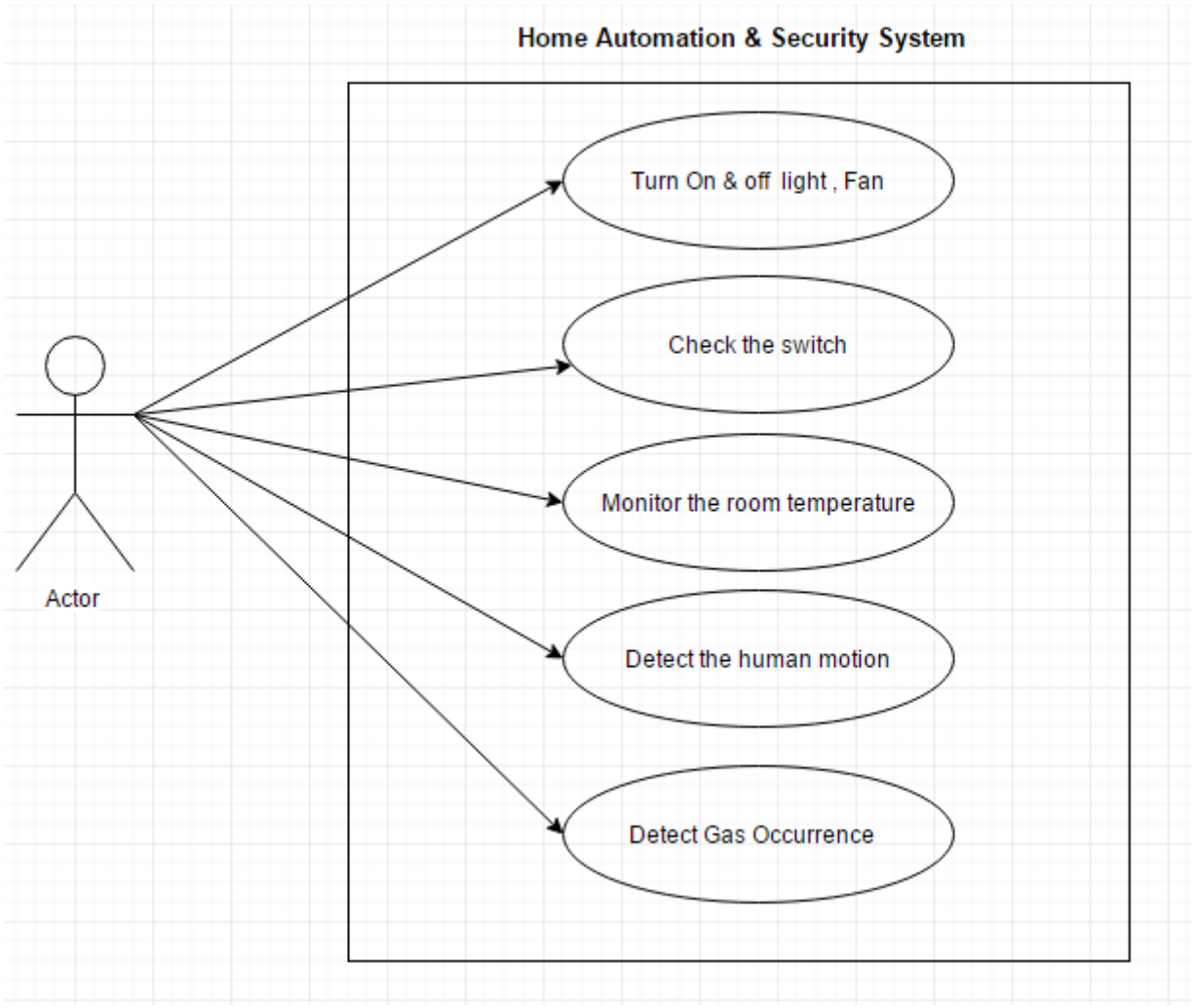

Figure 3.2: User case for user control panel

3.3 Stakeholder of the Application

Stakeholder means any person or group that has a stake or an interest in the system. It may be internal, external, technical or nontechnical .Thus our system also has stakeholders of different types. Here we will show some technical and nontechnical stake holders of our proposed application.

3.3.1 Technical

- Mobile/Computer
- Internet browser
- Internet Connection

3.3.2 Non-Technical

- Users

3.8 Implementation Requirement

Hardware:

- Arduino Mega (ATmega2560 microcontroller)
- Arduino Uno (Atmega32 microcontroller)
- Ethernet Shield for Ethernet technology.
- GSM Shield for SMS technology.
- Motion sensor(PIR sensor)
- MQ-2 sensor(GAS/LPG/Smoke Sensor)
- Light Dependent Resistors(LDR) for detecting light
- Interfacing relays with ac and dc power sources.

Developing Tools:

- Arduino IDE
- Breadboard
- wire

Language:

- Embedded programming.
- HTML and CSS (For designing web application)

CHAPTER FOUR

DESIGN AND IMPLEMENTATION

4.1 Design & Implementation

This home automation and Security system functioning based on web based application. Users have to open any browser using mobile or computer. Users have to insert specific ip address as URL address. After that user show a password box. Putting password user can see full web application and control home appliance. The following figure shows the overall design of this project.

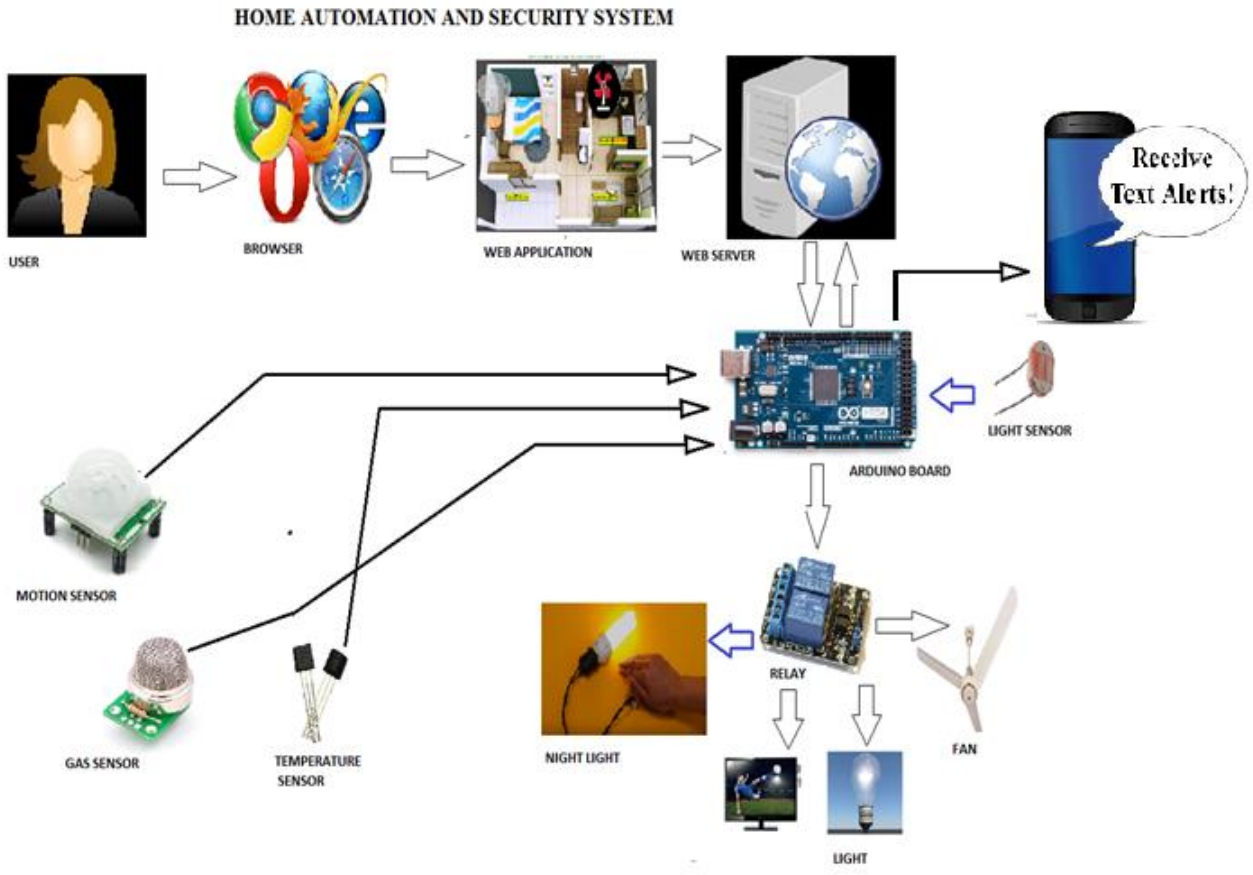

Figure 4.1: Home Automation and Security System.

To maintain all home appliances user using mobile phone or pc browsing specific IP as URL he can access the dashboard. After completing log in authentication user can access the control panel and control the light fan. When user click on light button to turn on light then a signal pass to web server. This web server actually is Ethernet web server. The web server gets the signal and passes it to Arduino board. Then the Arduino check the switch current status. If light is already on it shows that light is ON as yellow bulb or find that light is off then it turn on the light. Gas, motion and temperature sensor frequently pass information to Arduino board. If gas or motion detects then a signal pass to web server through Arduino board. The web server gives the notification in web application. And a notification sms send to user mobile with the help of gsm module .

To implement this project there is two major works

- Control and monitor Electrical appliance
- Control sensor

4.2 Control Electrical appliance:

The following figure easily describes how the electrical home appliances are controlled and monitor.

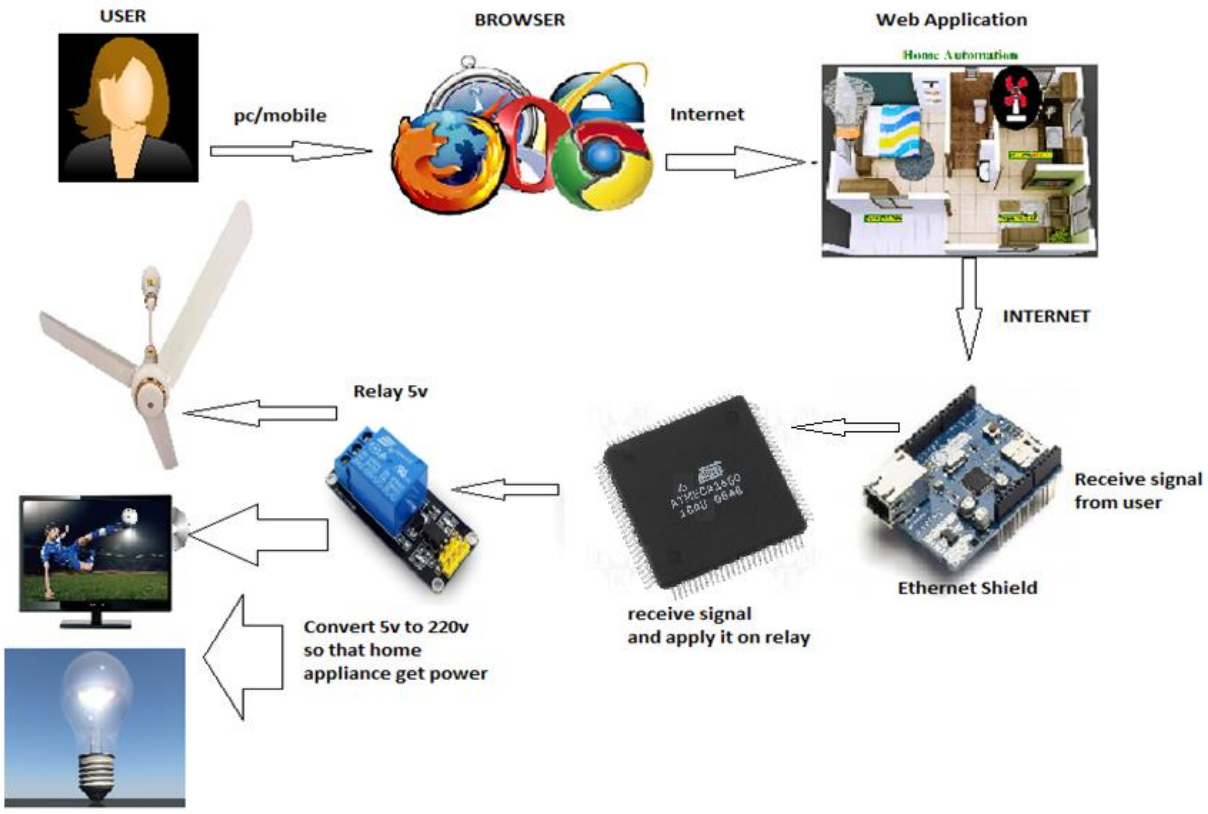

Figure 4.2: How the electrical home appliance are controlled

Using any browser from mobile or computer user access to web application through a specific ip address . After log in he can see the application. User can see the current status of electrical appliance. Either it's on or off. When user click on fan to turn on the signal passing to Arduino Mega microcontroller using Ethernet shield. According to signal, the microcontroller turn off or turn on the relay connection. If relay need much voltage it takes from external source. Such this way the electrical appliance are controlled and monitored.

4.3 Controlling sensor:

Sensor work divided in two parts.

- PIR and MQ-2 sensor control
- TLM-35 and LDR control

4.3.1 PIR and MQ-2 sensor control:

The following figure helps you to understand easily how the Motion sensor and gas sensor works. First we try to know about PIR sensor working methodology.

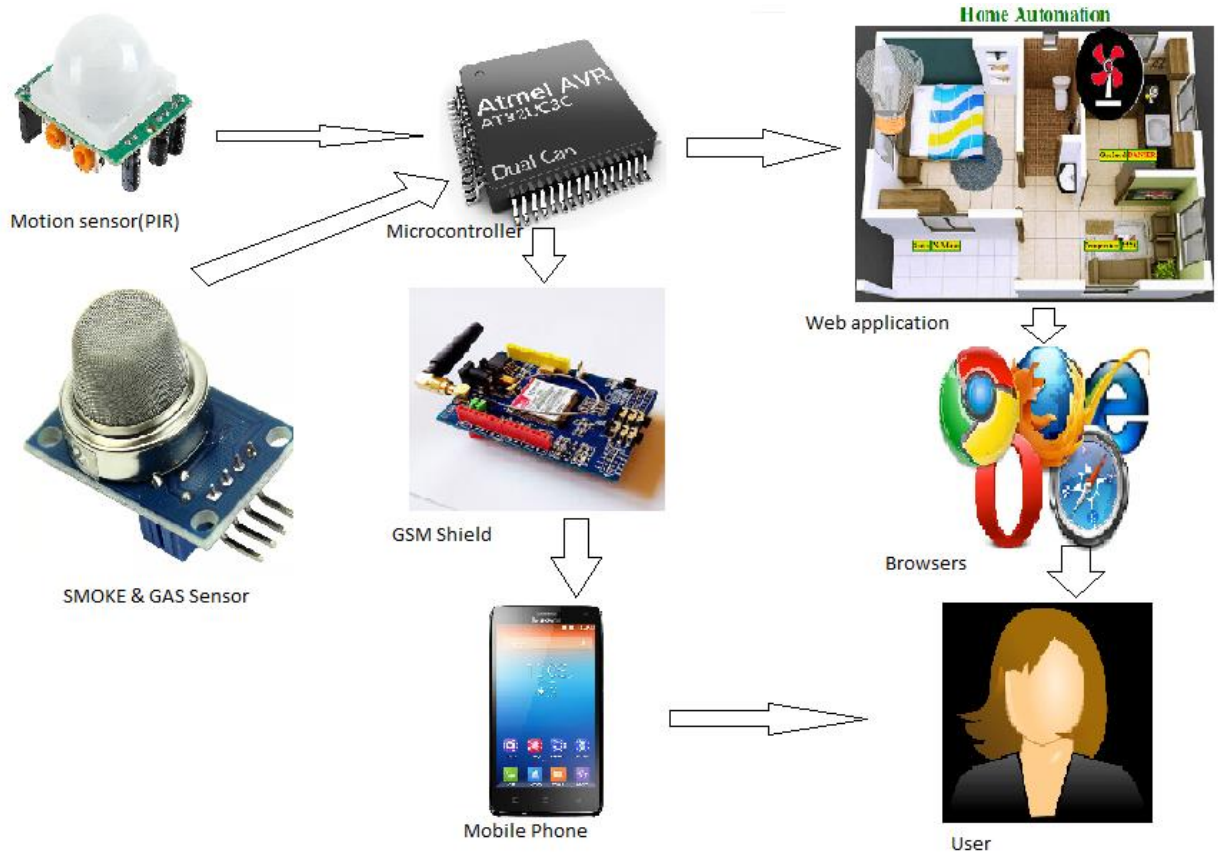

Figure 4.3.1: How the PIR+MQ-2 sensor works.

When a warm body like a human or animal passes by, it first intercepts one half of the PIR sensor,which causes a positive differential change between the two halves. When the warm body leaves the sensing area, the reverse happens, whereby the sensor generates a negative differential change. If any object detect then the PIR sensor send HIGH signal microcontroller.

Then the microcontroller send request to web application through internet and send a alert sms to user mobile phone. Using Browser the user can see the status of motion. To detect LPG or smoke MQ-2 sensor continuously sends the air gas level to microcontroller. The microcontroller checks this value with the threshold value. The threshold value is predefined by programmer. If the input value is greater than threshold value, then microcontroller send information to web application and also send a alert sms to use mobile phone.

4.3.2 LM-35 and LDR control: LM-35 receives temperature from the environment and send it web application using internet. The light sensor (LDR) continuously sends the brightness value to microcontroller from the environment. The microcontroller checks this value with the threshold value. The threshold value is predefined by programmer. If the input value is greater than threshold value, then the light is off. Here the threshold value considers that night value.

4.4 Parts list with cost estimation

Name	Quantity	Price
Arduino Mega 2560	1	800tk
Arduino Uno	1	400tk
Ethernet Shield	1	1250tk
GSA Shield	1	3200tk
Relay	1	350tk
Jumper wires	1pkt	30tk
Resistors	1pkt	40tk
Ethernet cable	1	50tk
Adapter	1	200tk

Table 4.4: Parts list with price

CHAPTER FIVE

APPLICATION TESTING

After completing this project we are completing some testing. We are completing unit testing, component testing and integrated testing.[4] To do unit test our code we check all the functions and class. Completing units testing there to no bug found. In component testing we particularly test one by one task electrical appliance, motion, Gas, Temperature, and night light test individually and Finds that all the task perfectly working.

5.1 System Testing: System testing, or end-to-end testing a completely integrated system to verify that it meets its requirements. The System testing result show as a table below:

Test Case	Expected Result	Observed Result	Test Result
User should have successful login this system	Successful login	Successfully login	Pass
User can easily access the home appliance switch	Accessible every menu	Easily accessible	Pass
User can control the electrical appliance	Easily controllable	User controlled	Pass
User can see the temperate motion and gas status	Can see the current home status	Easily visible home status	Pass
User Can control sms service	User can control sms service	User can control sms service	Pass

Table 5.1: Table of System Testing

5.2 Component Testing: All the hardware and software component testing screen shot and camera photograph attached below.

5.2.1 Password authentication check:

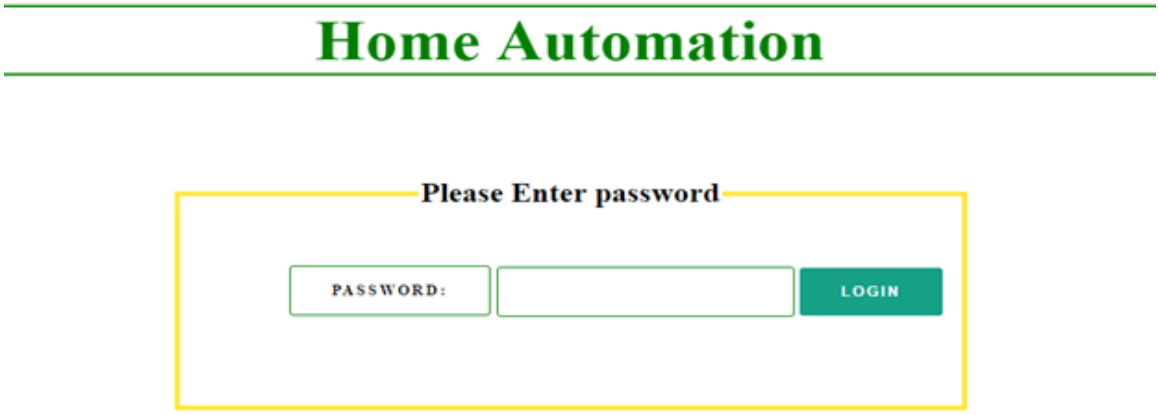

Figure 5.2.1: password Authentication

If we insert wrong password it will not open the web application just open this page again.

5.2.2 Light and fan control and check current status:

We turn on the light and fan after we can see the status of light and fan. Here we see that light and fan is turn on that why light is yellow and fan if green.

5.2.2.1: Light and fan is turn on: The following figure shows that light and fan are already turn on.

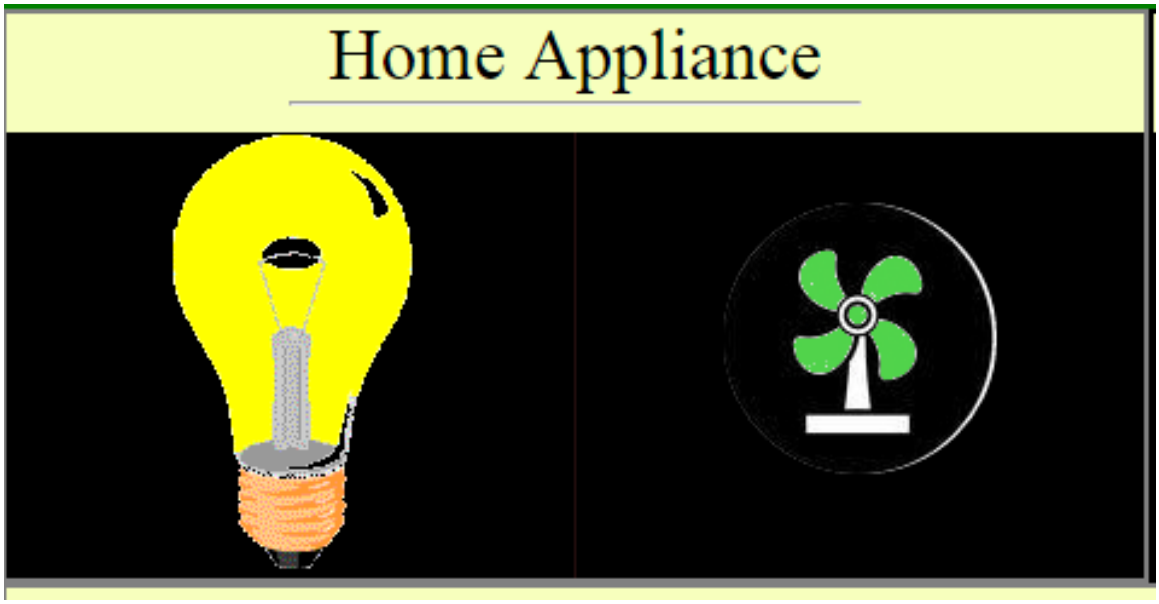

Figure 5.2.2.1: light and fan turn On

5.2.2.2: Light off fan turn on: Above figure shows that two for appliances are turn on. If users try to turn off the light then the application shows the following interface

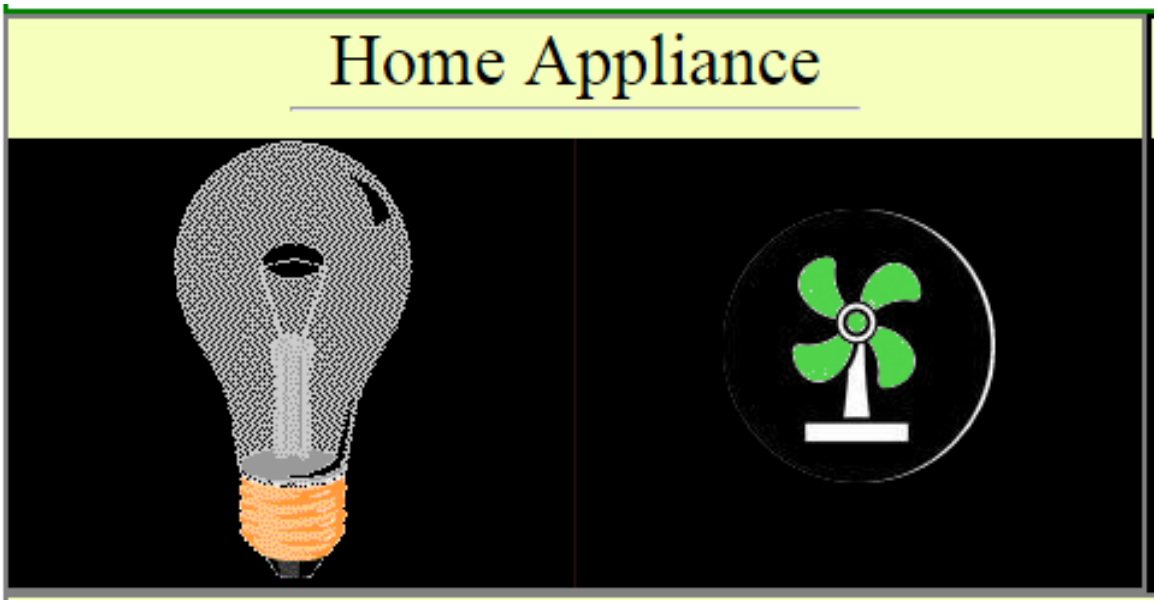

Figure: 5.2.2.2: Light turns off and Fan turn on

5.2.2.3 Light turn on and Fan Turn off: If users try to turn off the light then the application shows the following interface. The red fan indicates that fan is turn off

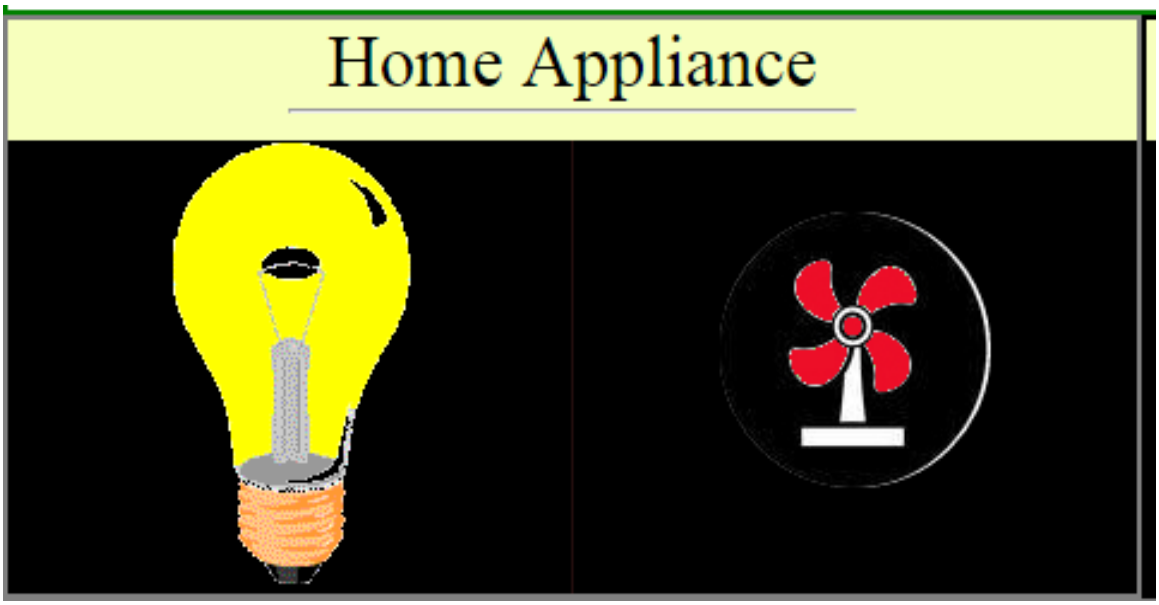

Figure: 5.2.2.3 Light turn on and fan turn off

5.2.3 Check the motion sensor

When motion sensors find that anyone try to enter your room then it show that motion detected and send sms to mobile phone. In figure 5.2.3.1 shows no indicator and figure 5.2.3.2 shows the red light indicator for motion

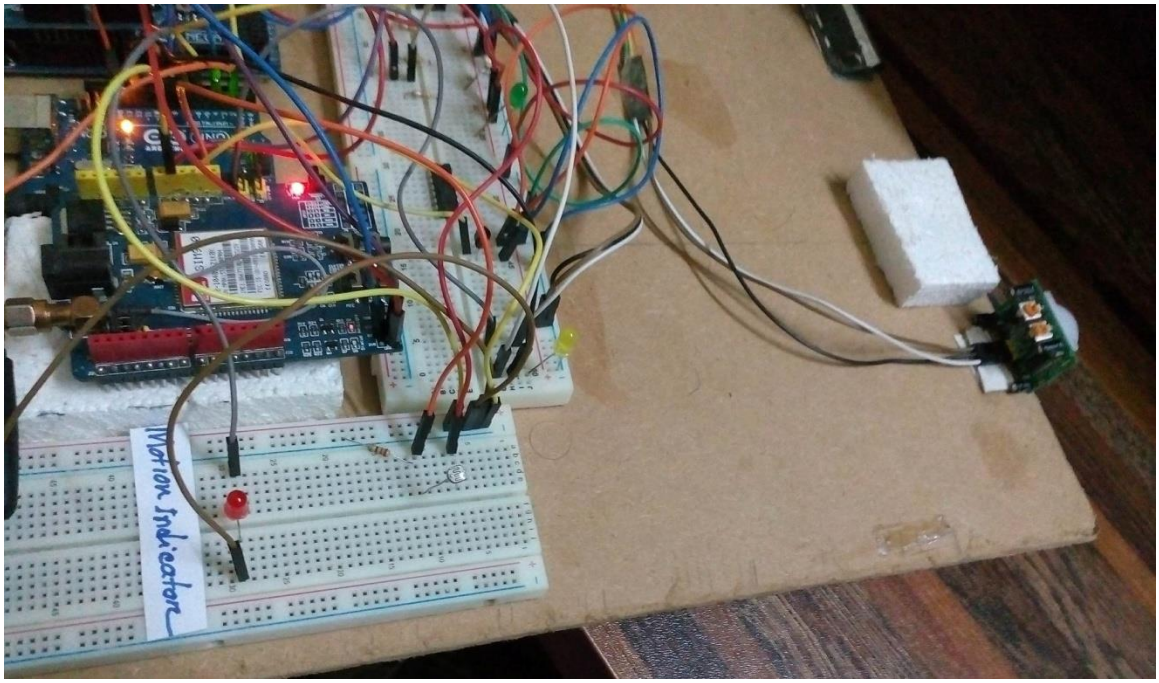

Figure 5.2.3.1: No motion so no indication

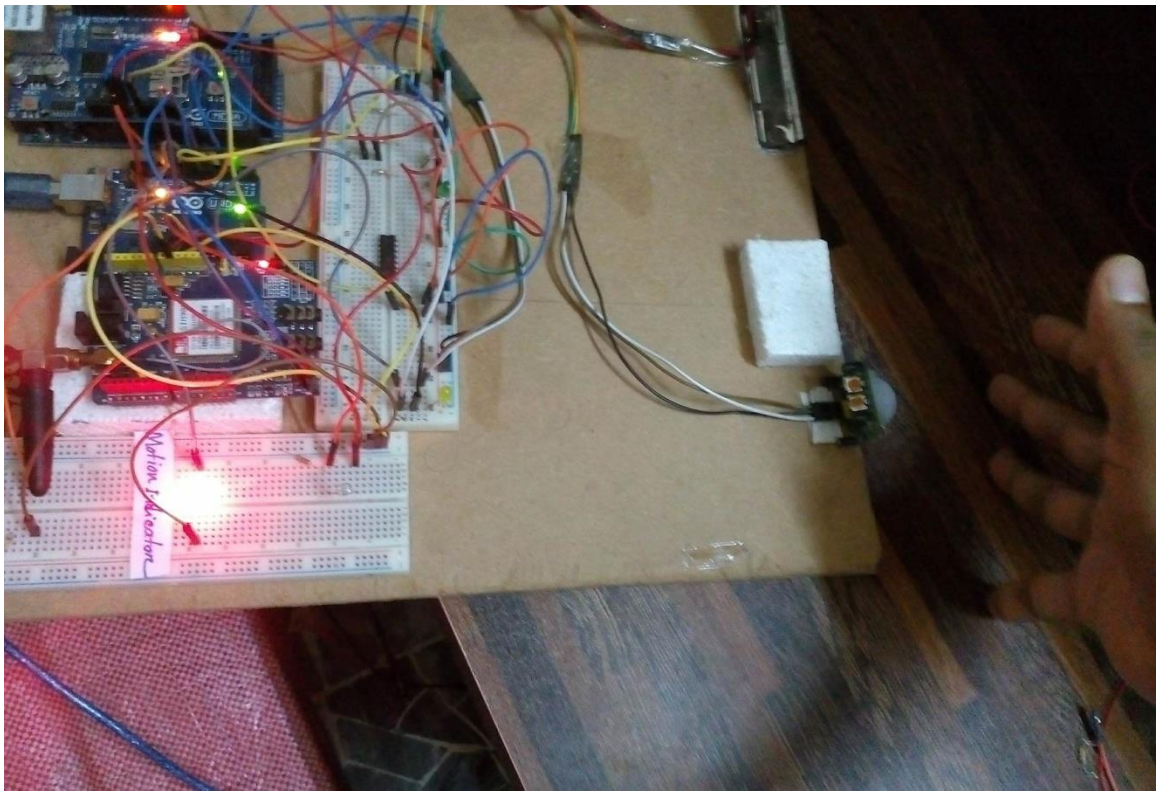

Figure 5.2.3.2: Motion detect and Red night indicator turn on

5.1.3.1: Motion Sms alert: After Finding anyone in entering your room along with the indicators is also send the sms notification to user mobile phone.

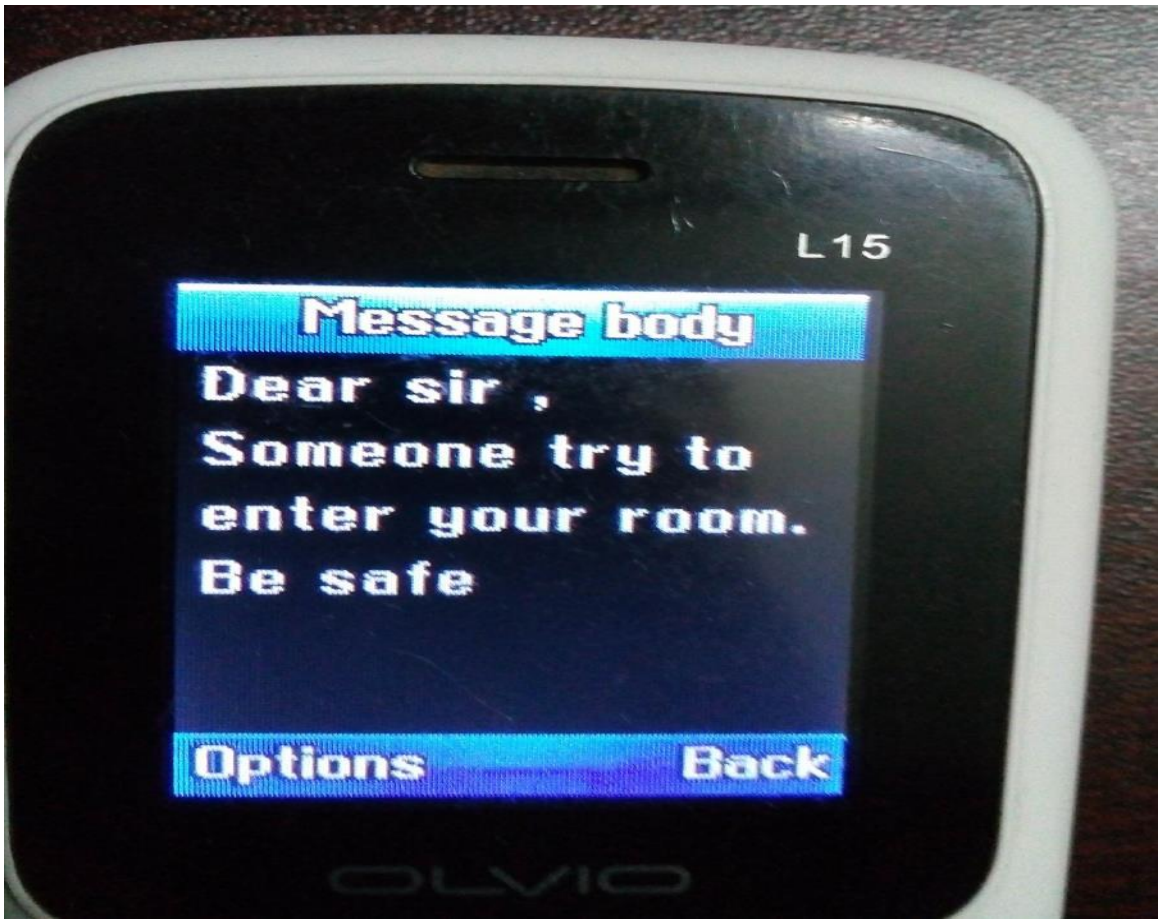

Figure 5.2.3.1: SMS alert for Motion detection

5.2.3.2 Motion detection notification in web application: After finding motion it also send show in web application

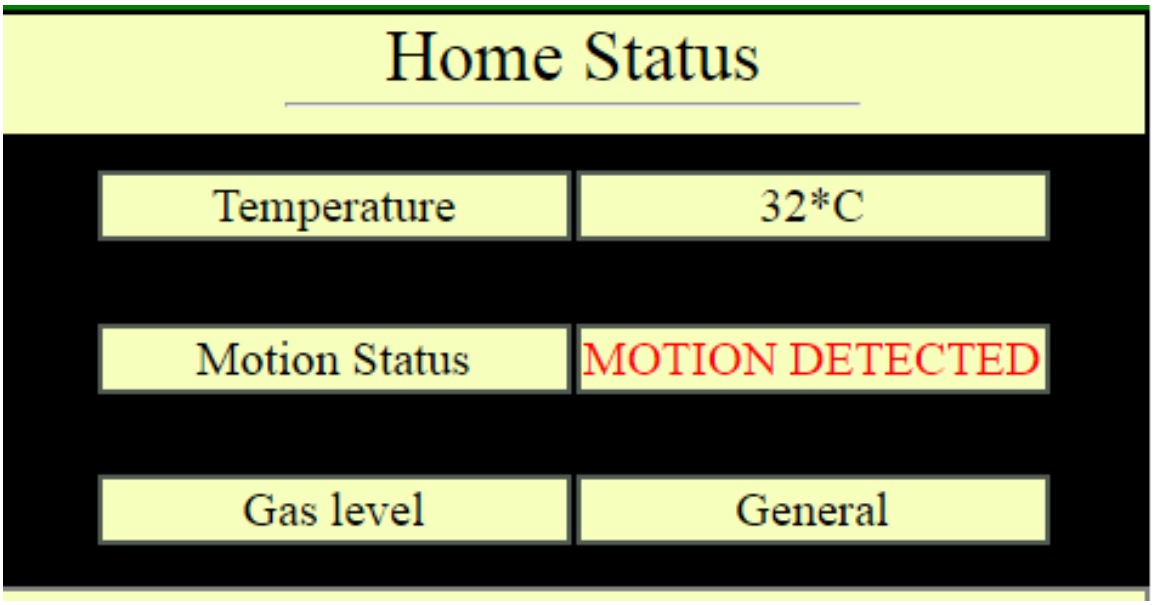

Figure 5.2.3.2: Web application says motion is detected.

5.2.4 Check smoke /gas:

Detect the gas level and show "DANGER"(Figure 5.1.4.2) in gas level. In normal it says Gas Level is "GENERAL" (Figure5.1.4.1).

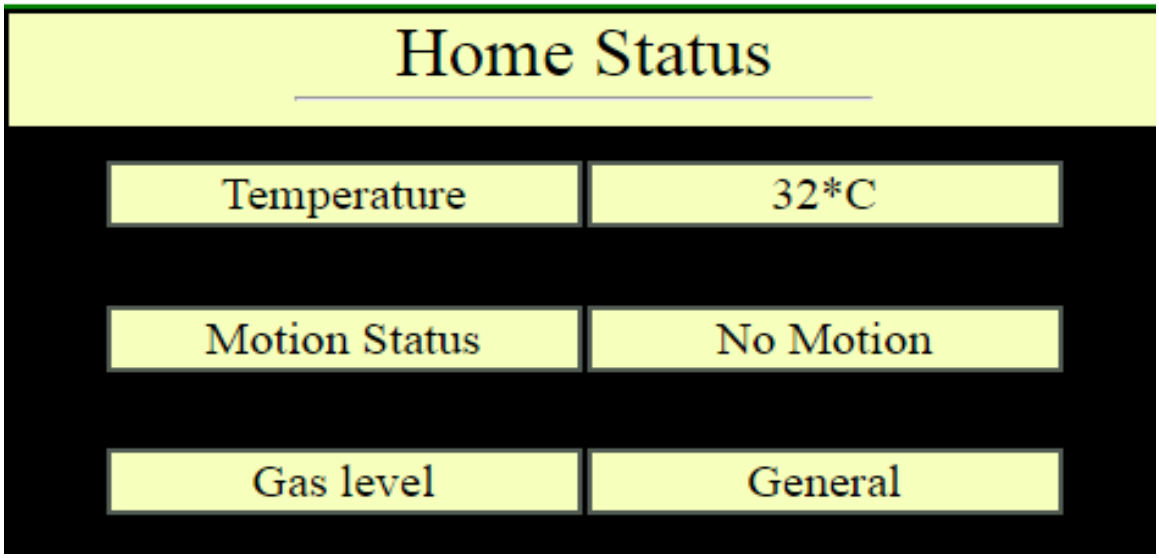

Figure 5.2.4.1: Gas level status Normal

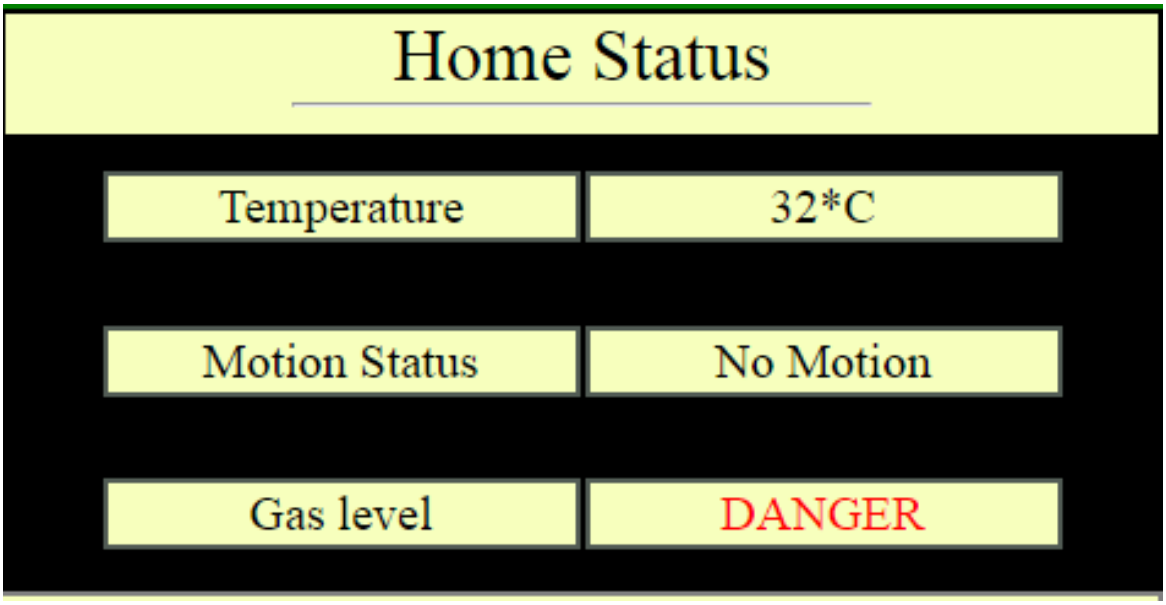

Figure 5.2.4.2 Gas level status Danger

5.2.5 Check the night light

: Here we put hand on sensor makes night and the light is on (figure5.2.5.2). other the out light in turn off (figure 5.2.5.1).

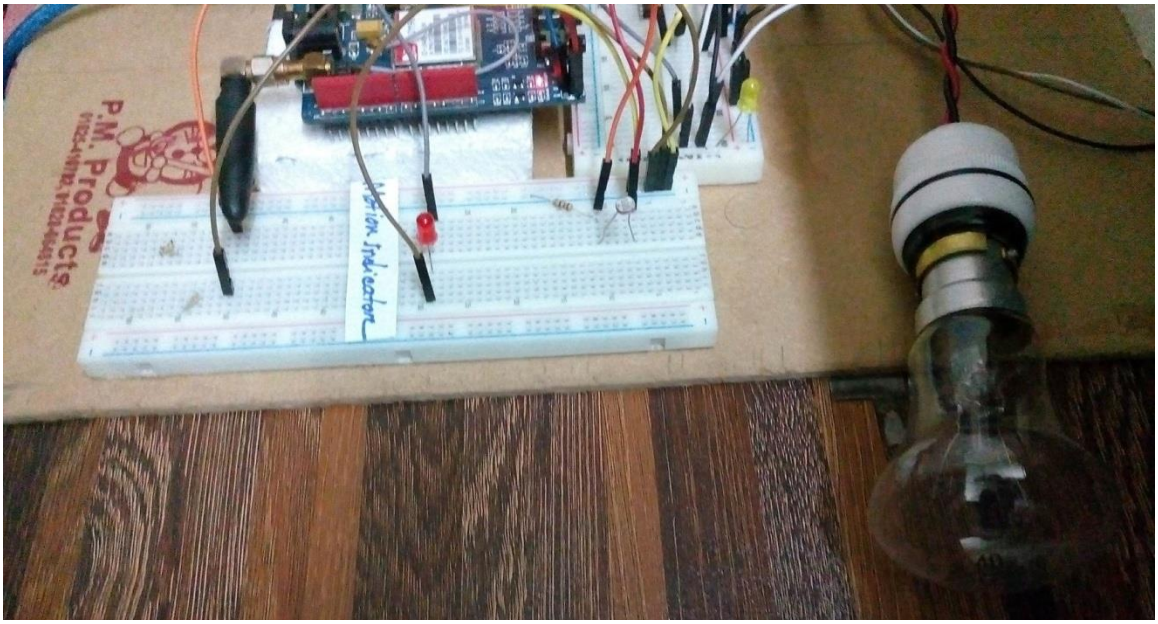

Figure 5.2.5.1 Automatic night light turn off at day

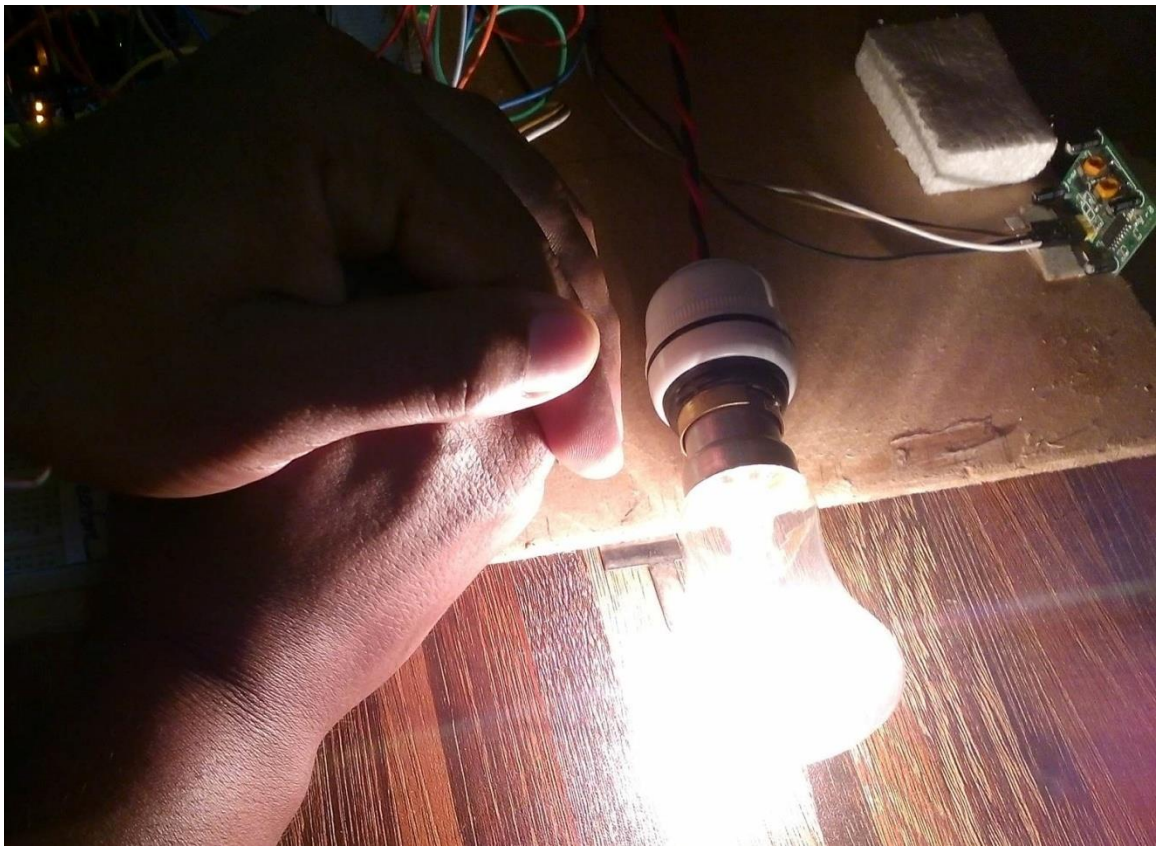

Figure 5.2.5.2 Automatic night light turn on at night

5.2.6 Check temperature:

Show the room temperature in web application.

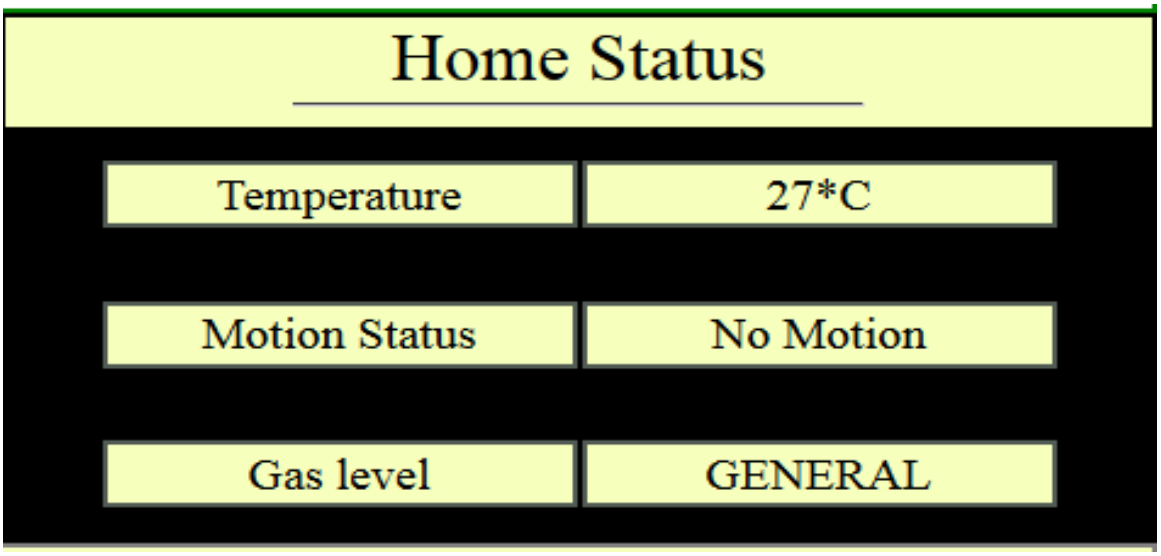

Figure5.2.6: show the temperature in web application

5.2.7: Controlling Motion sensor Audio Alarm and Sms Notification: User also controls the Motion sensor audio alarm and sms service if he desire in special case. The following figure shows that on interface of controlling Motion sensor audio alarm and sms notification. The green background shows that Button is already on and red background shows that the Alarm or service is already off.

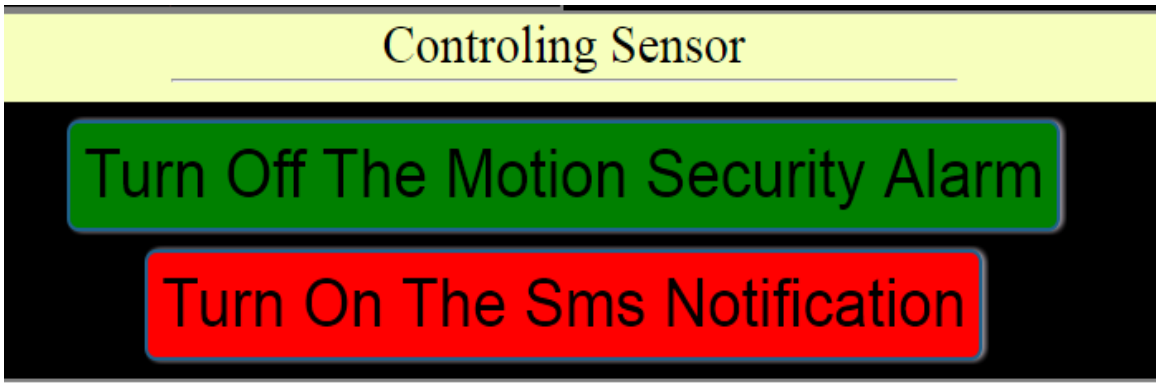

Figure5.2.7: Controlling Sensor and sms service

CHAPTER SIX

LIMITATION, CONCLUSION AND FUTURE WORK

6.1 Limitation

Through we try hard to do best but this project has some limitation. I try to list some laminations

- Before baying real IP address this project just work only intranet not over internet
- User can't get the password customization facility
- If sensors are damage or not working properly there will be occurred serious site effect

.

6.2 Conclusion

This Home automation and security System is cheaply made from low-cost available components and can be used to control more than hundred home appliances. This system is easily adjustable at any home or office space. The designed home automation system was tested a number of times and successfully control different home appliances (this is as long as the maximum power and current rating of the appliance does not exceed that of the used relay). Finally, this home automation system can be also implemented over Bluetooth, Infrared and WIFI connectivity without much change to the design and yet still be able to control a variety of home appliances. Hence, this system is scalable and flexible.

6.3 Future Work

In this project we have a large scope to develop and working with this project. We try to listed some task which would be added in future

- Add a camera and using image processing try to find out known and unknown face. If detect known face system can send sms and email with picture and information about this face which is store in previous.
- We can make the web application more users friendly. Can be added voice commands technology
- Adding some safety issues like when gas leakage or smoke found the system automatically takes necessary steps to reduce the losses.

CHAPTER SEVEN

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