Course*:* Computer Networks Laboratory (D)

Course code*:* CSE 324

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Project name: Home Automation & security System

Home Automation & security system 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 & security 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. The main advantage of IoT based Home Automation & security system 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 & security system is android or IOS based, not platform independent. The security is a great concern for IoT based home automation system. 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.

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

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

Hardware Requirement

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

Software Requirement

- Any kinds of internet browser

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Functional Requirement

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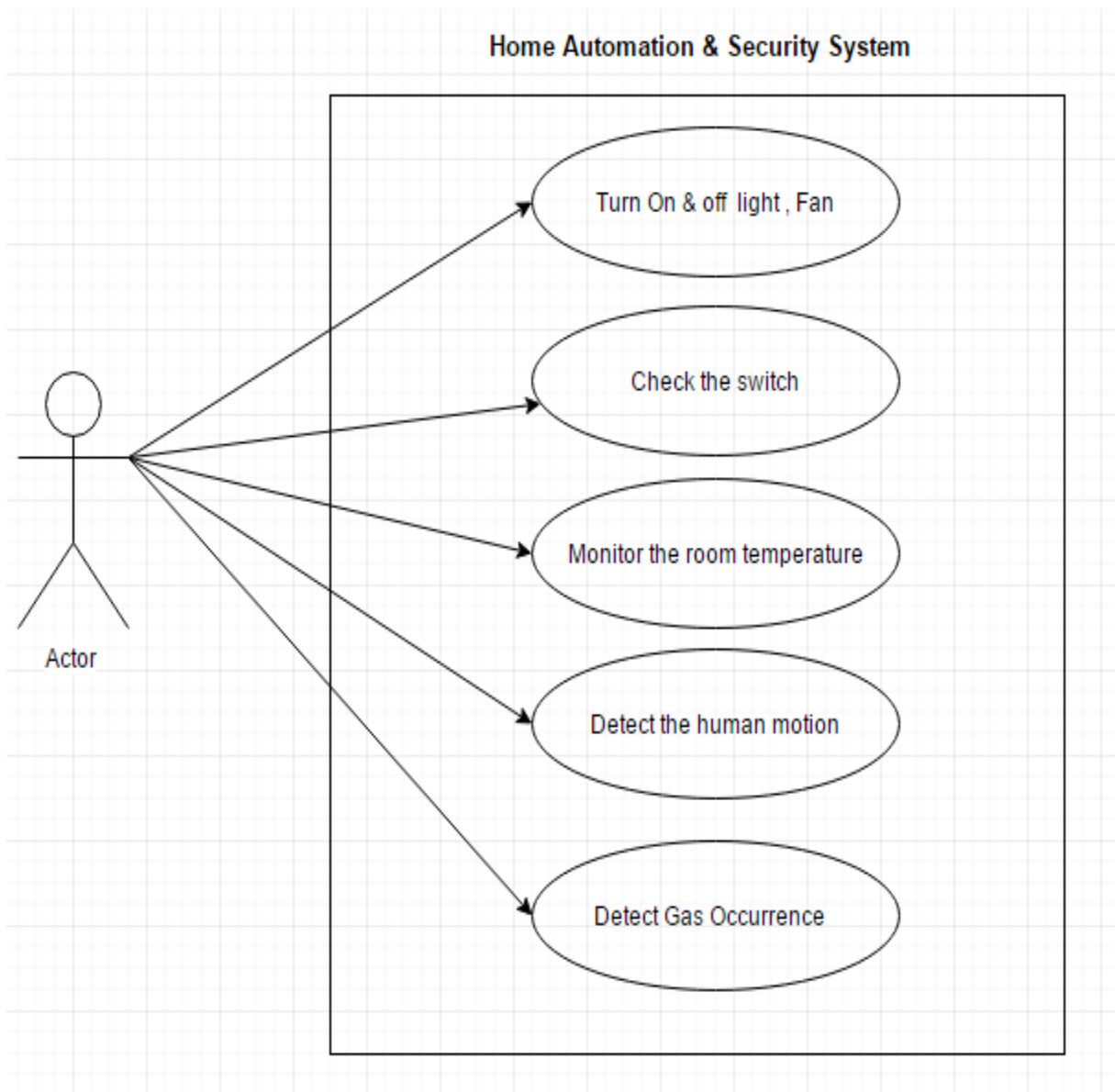- Decrease the waste of electricity

Non Functional Requirement

- Secured system
- Better design and less complexity

- Available on android. Mac or windows

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.

Home Automation & Security System

- Turn On & off light , Fan
- Check the switch
- Monitor the room temperature
- Detect the human motion
- Detect Gas Occurrence

Actor

Technical

- Mobile/Computer
- Internet browser
- Internet Connection

Non-Technical

- Users

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
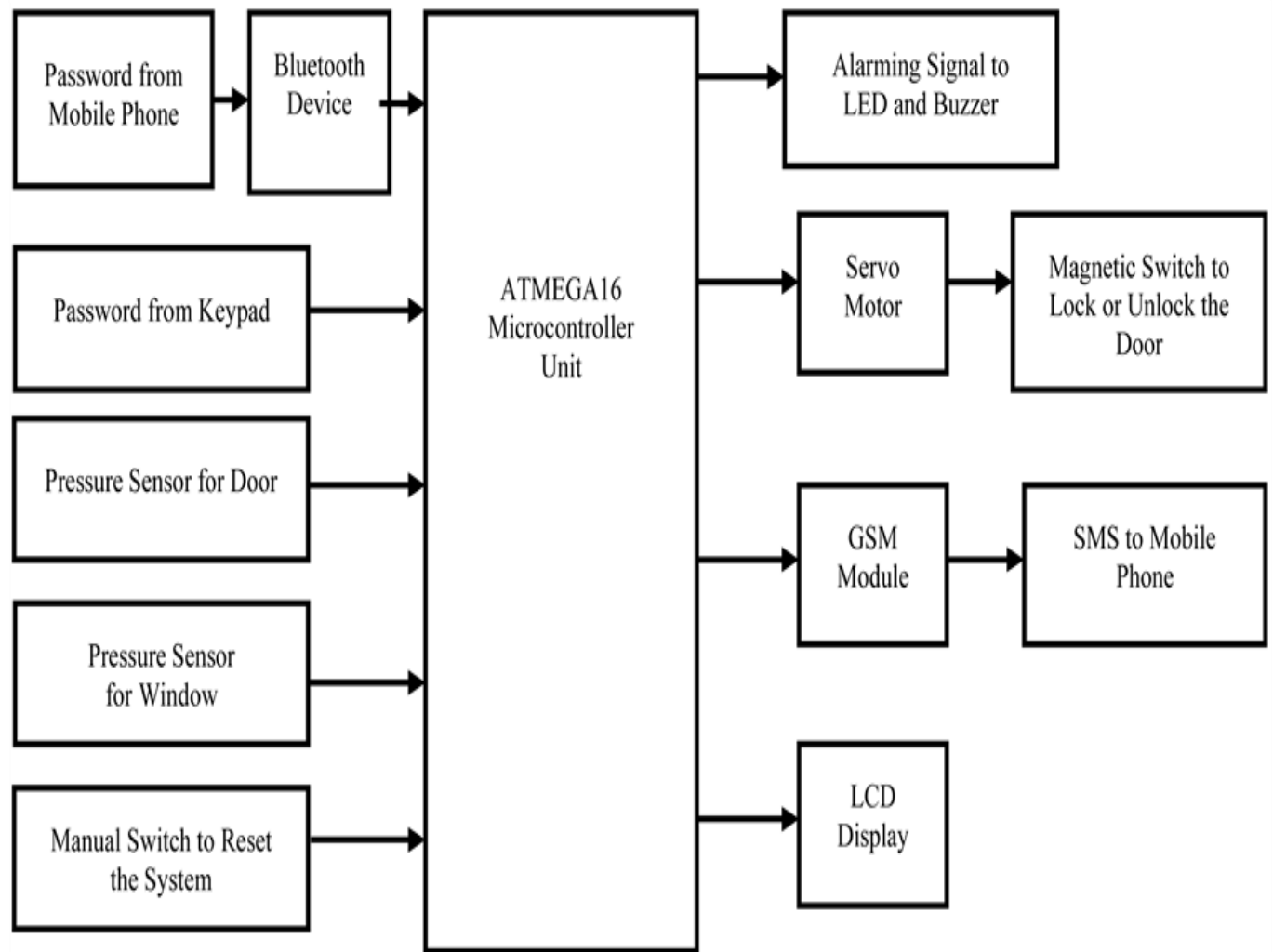- Interfacing relays with ac and dc power sources.

Developing Tools:

- Arduino IDE
- Breadboard
- wire

Language:

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

DESIGN AND IMPLEMENTATION

FLOW CHART:

Password from Mobile Phone	→	Bluetooth Device	→			Alarming Signal to LED and Buzzer

```
Password from Mobile Phone → Bluetooth Device →

Password from Keypad →

Pressure Sensor for Door →                    ATMEGA16
                                              Microcontroller
Pressure Sensor for Window →                  Unit

Manual Switch to Reset the System →

→ Alarming Signal to LED and Buzzer

→ Servo Motor → Magnetic Switch to Lock or Unlock the Door

→ GSM Module → SMS to Mobile Phone

→ LCD Display
```

BLOCK DIAGRAM OF THE PROPOSED SYSTEM
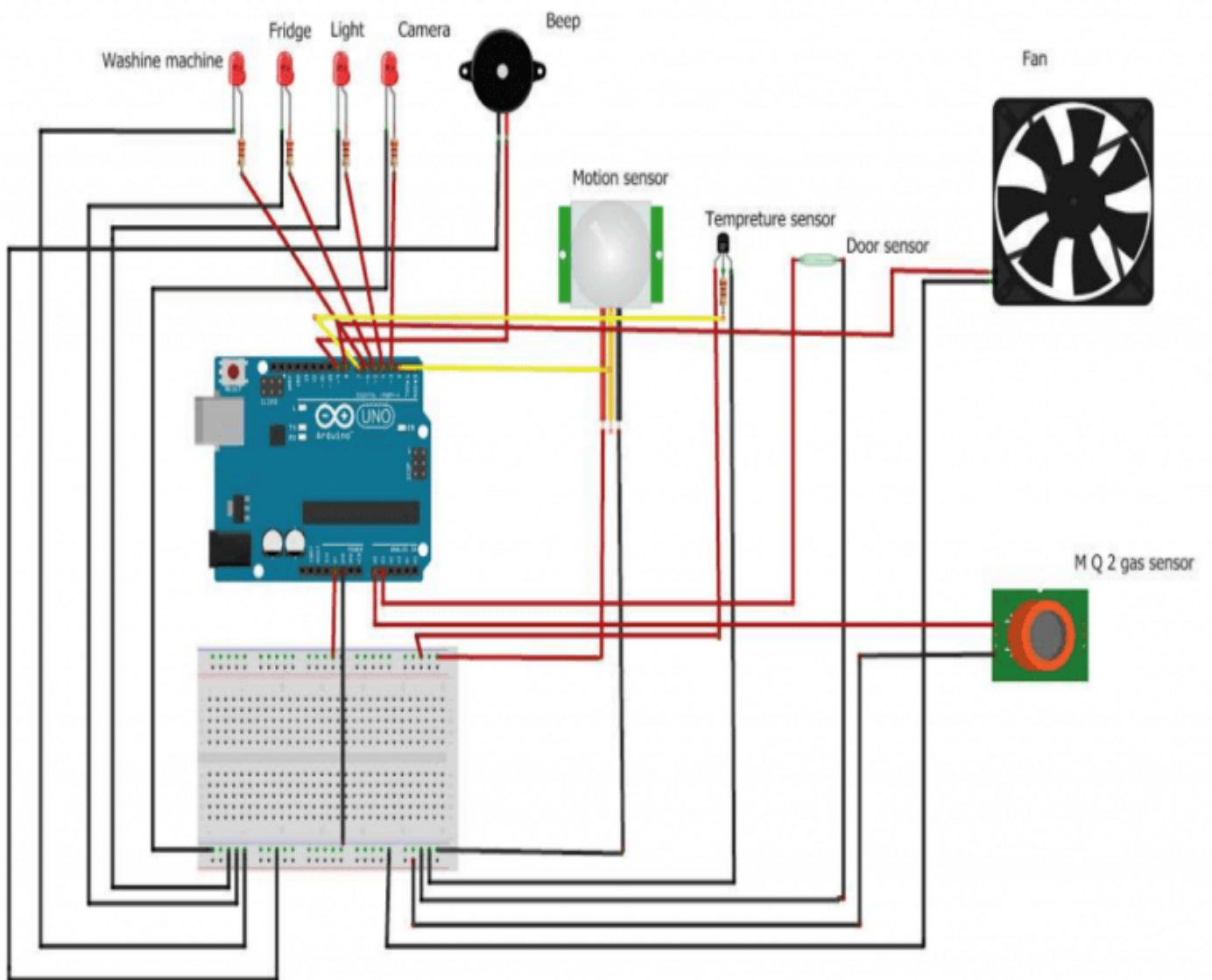
DESIGN & IMPLEMENTATION:

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.


HOME AUTOMATION AND SECURITY SYSTEM
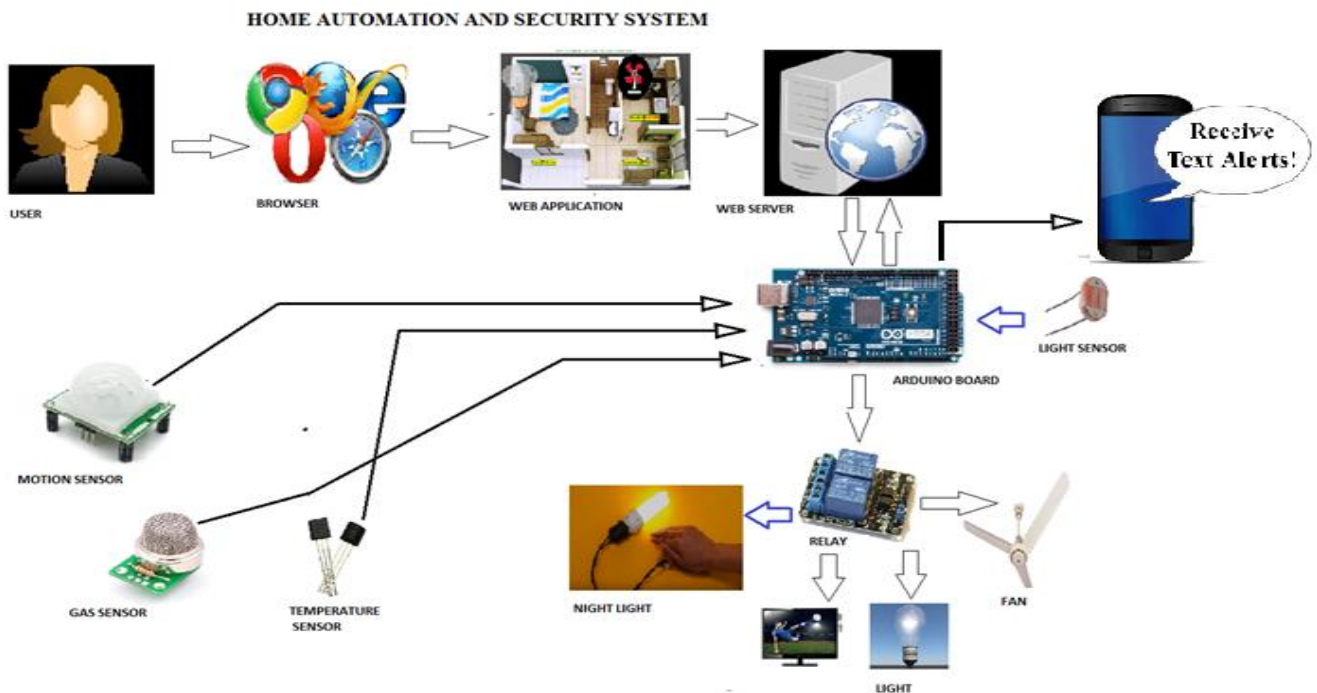
To maintain all home appliances user using mobile phone or pc browsing specific IP as URL he can access the dashboard. After completing log in authentication user can access the control panel and control the light fan. When user click on light button to turn on light then a signal pass to web server. 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

CONTROL ELECTRICAL APPLIANCE:

The following figure easily describes how the electrical home appliances are controlled and monitor.
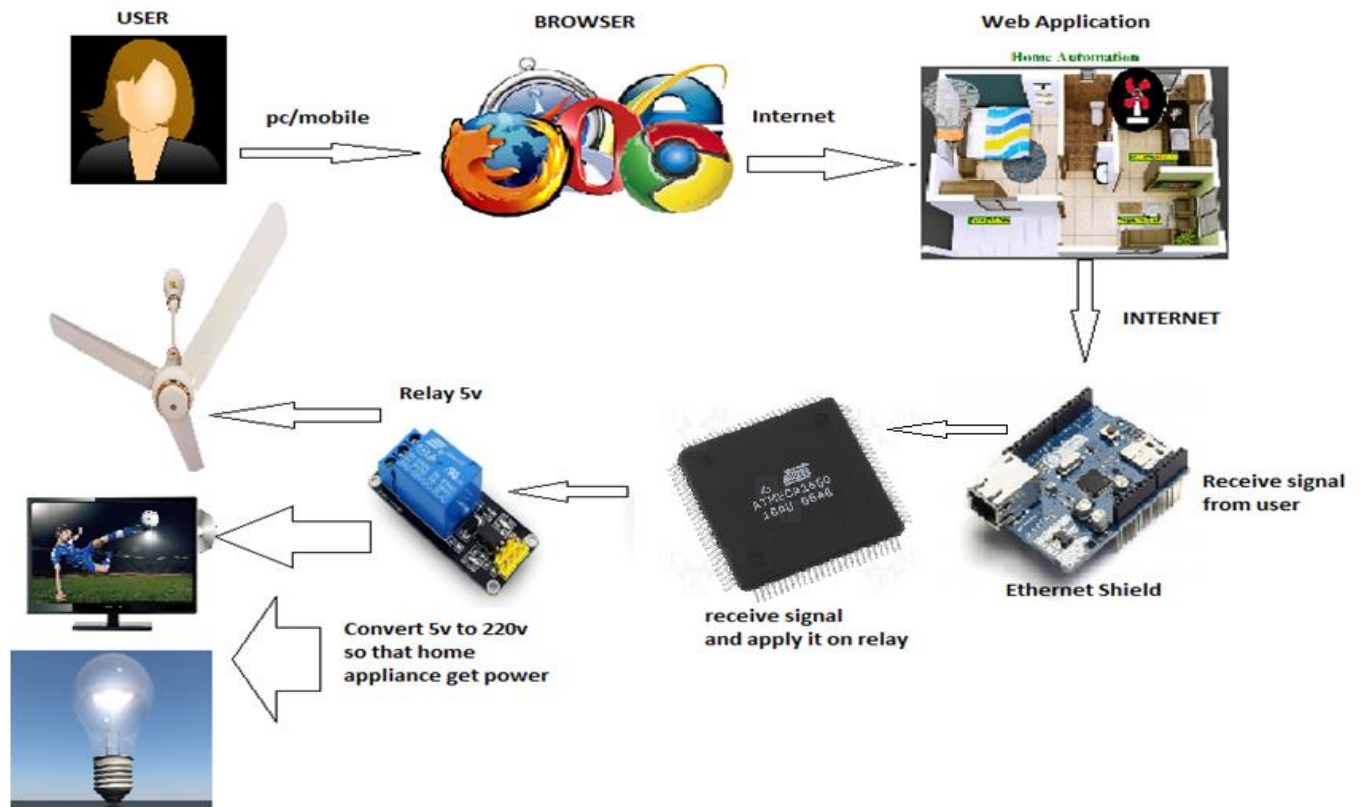
Using any browser from mobile or computer user access to web application through a specific ip address . After log in he can see the application. User can see the current status of electrical appliance. Either it's on or off. When user click on fan to turn on the signal passing to Arduino Mega microcontroller 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.

CONTROLLING SENSOR:
Sensor work divided in two parts.

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

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.
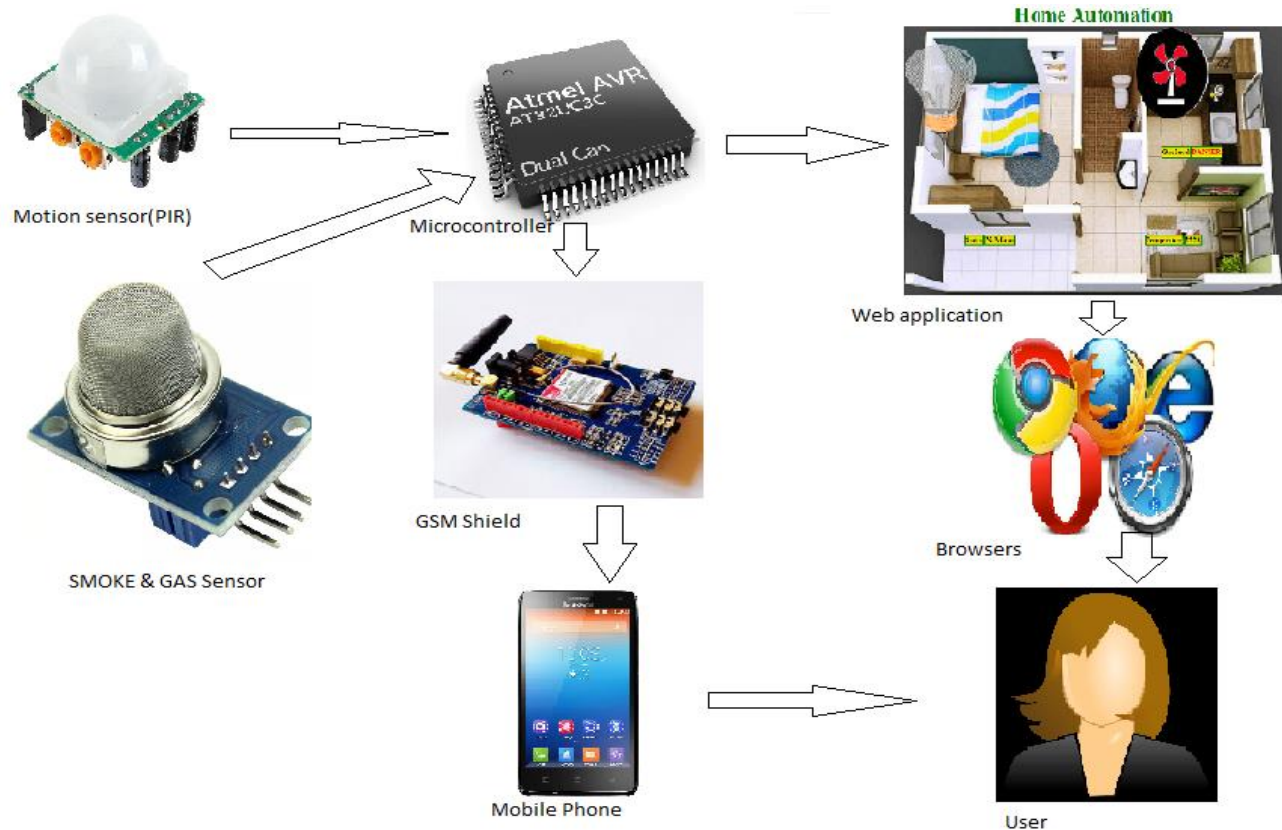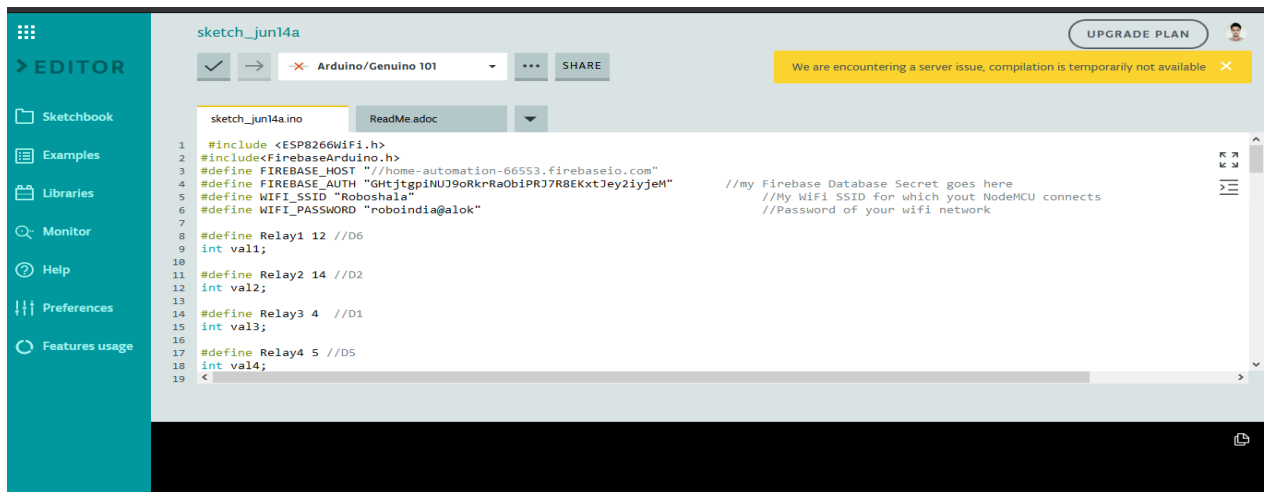
When a warm body like a human or animal passes by, it first intercepts one half of the PIR sensor,which causes a *positive differential* change between the two halves. When the warm body leaves the sensing area, the reverse happens, whereby the sensor generates a negative differential change. If any 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.
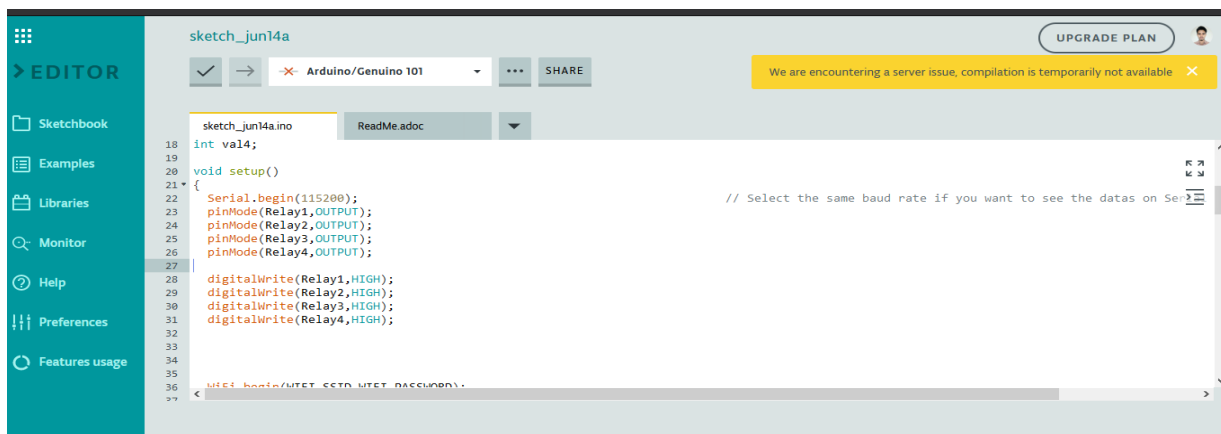
LM-35 and LDR control: LM-35 receives temperature from the environment and send it web application using internet. The light sensor (LDR) continuously sends the brightness value to microcontroller from the environment. The microcontroller checks this value with the threshold value. The threshold value 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.
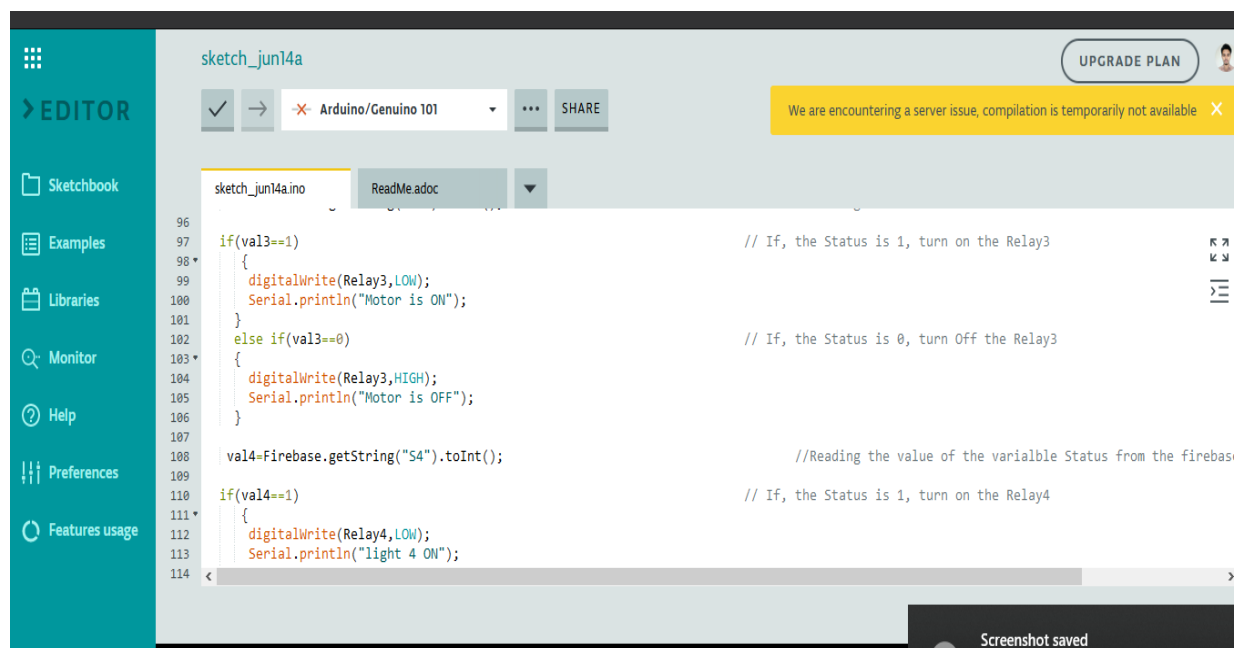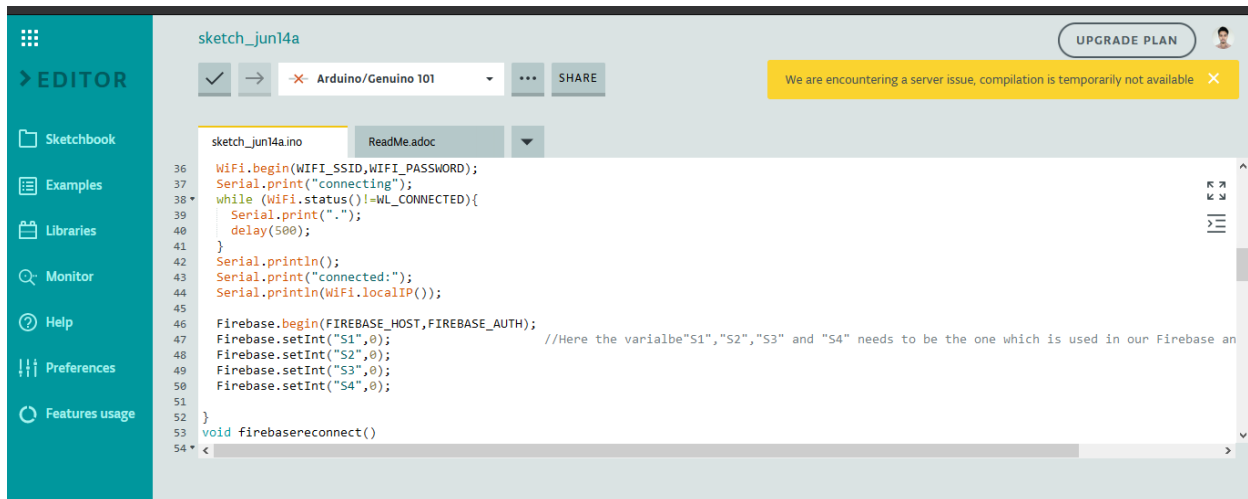
Data Sensing, Collecting and Communication

- Data from the sensors and store and process sensed data

- Data transport

sketch_jun14a.ino   ReadMe.adoc

```
36   WiFi.begin(WIFI_SSID,WIFI_PASSWORD);
37   Serial.print("connecting");
38   while (WiFi.status()!=WL_CONNECTED){
39     Serial.print(".");
40     delay(500);
41   }
42   Serial.println();
43   Serial.print("connected:");
44   Serial.println(WiFi.localIP());
45
46   Firebase.begin(FIREBASE_HOST,FIREBASE_AUTH);
47   Firebase.setInt("S1",0);                    //Here the varialbe"S1","S2","S3" and "S4" needs to be the one which is used in our Firebase an
48   Firebase.setInt("S2",0);
49   Firebase.setInt("S3",0);
50   Firebase.setInt("S4",0);
51
52 }
53 void firebasereconnect()
54 {
```

sketch_jun14a.ino   ReadMe.adoc

```
61   if (Firebase.failed())
62     {
63       Serial.print("setting number failed:");
64       Serial.println(Firebase.error());
65       firebasereconnect();
66       return;
67     }
68
69   val1=Firebase.getString("S1").toInt();            //Reading the value of the varialble Status from the firebase
70
71   if(val1==1)                                        // If, the Status is 1, turn on the Relay1
72     {
73       digitalWrite(Relay1,LOW);
74       Serial.println("light 1 ON");
75     }
76   else if(val1==0)                                   // If, the Status is 0, turn Off the Relay1
77     {
78       digitalWrite(Relay1,HIGH);
79
```

sketch_jun14a.ino   ReadMe.adoc

```
96
97   if(val3==1)                                        // If, the Status is 1, turn on the Relay3
98     {
99       digitalWrite(Relay3,LOW);
100      Serial.println("Motor is ON");
101    }
102   else if(val3==0)                                  // If, the Status is 0, turn Off the Relay3
103    {
104      digitalWrite(Relay3,HIGH);
105      Serial.println("Motor is OFF");
106    }
107
108   val4=Firebase.getString("S4").toInt();            //Reading the value of the varialble Status from the firebas
109
110   if(val4==1)                                        // If, the Status is 1, turn on the Relay4
111    {
112      digitalWrite(Relay4,LOW);
113      Serial.println("light 4 ON");
114
```
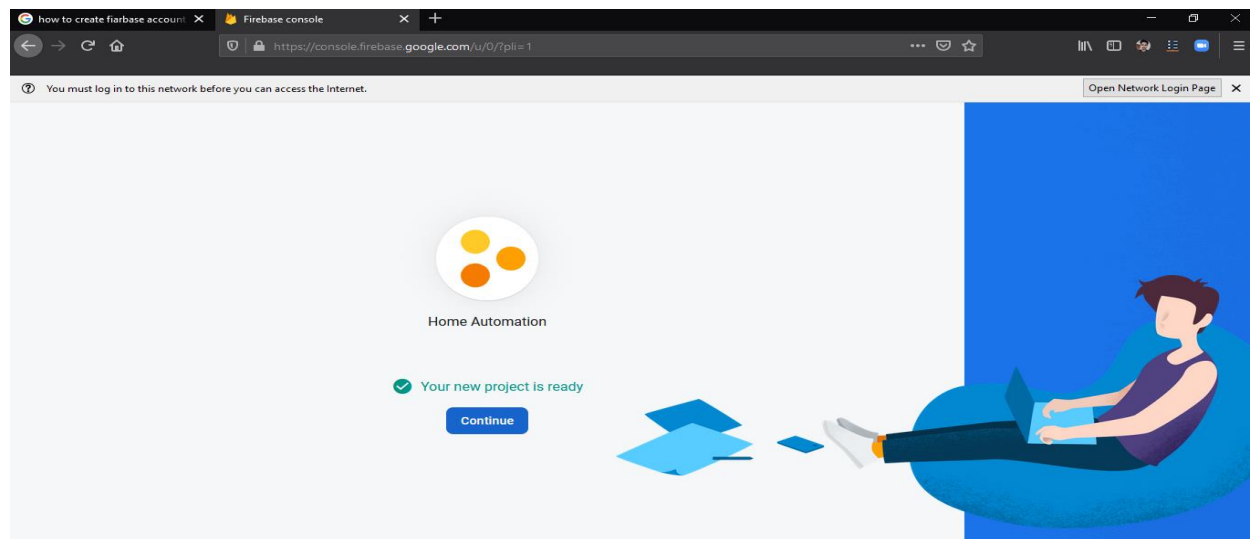
Screenshot saved

Connectivity to the cloud

Firebase connection procedure:

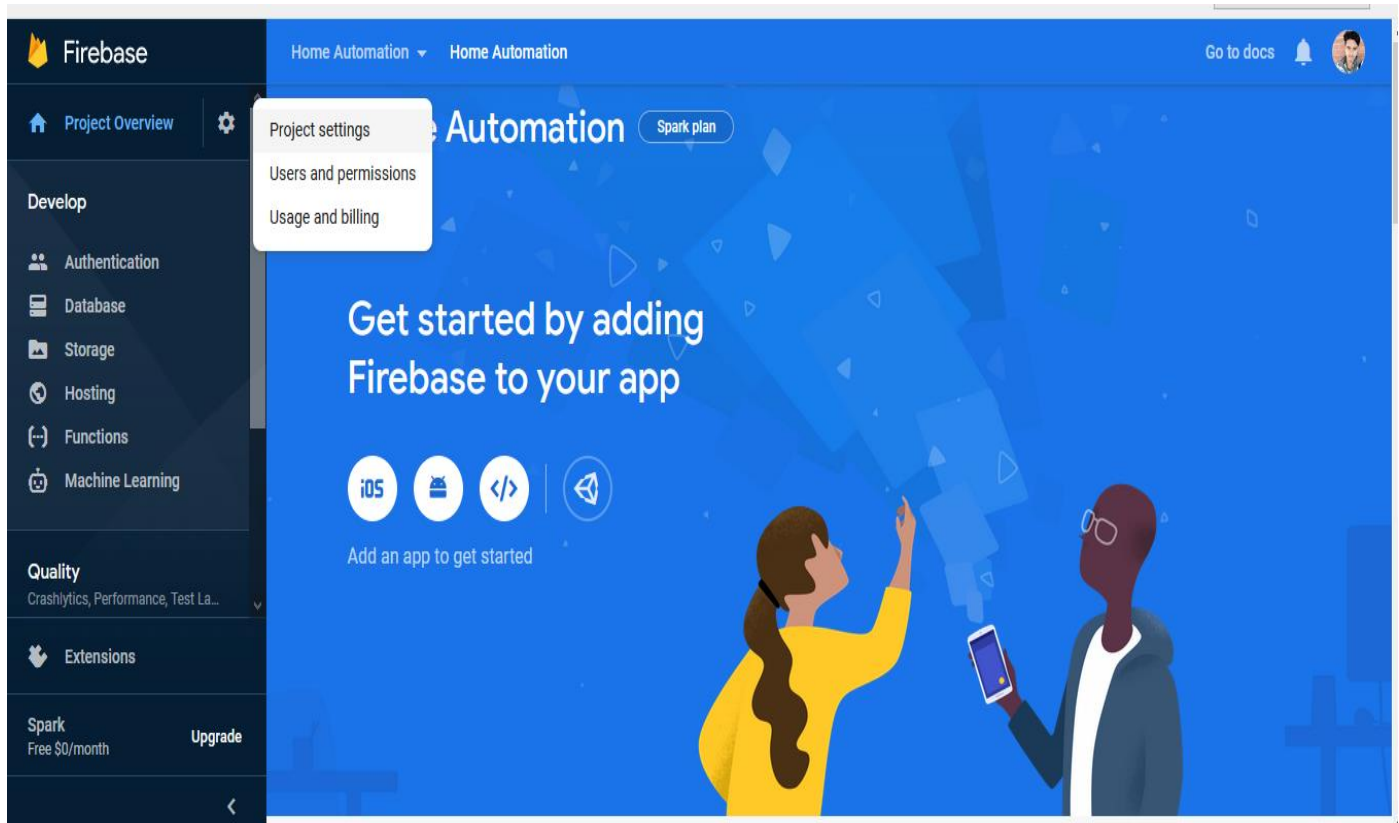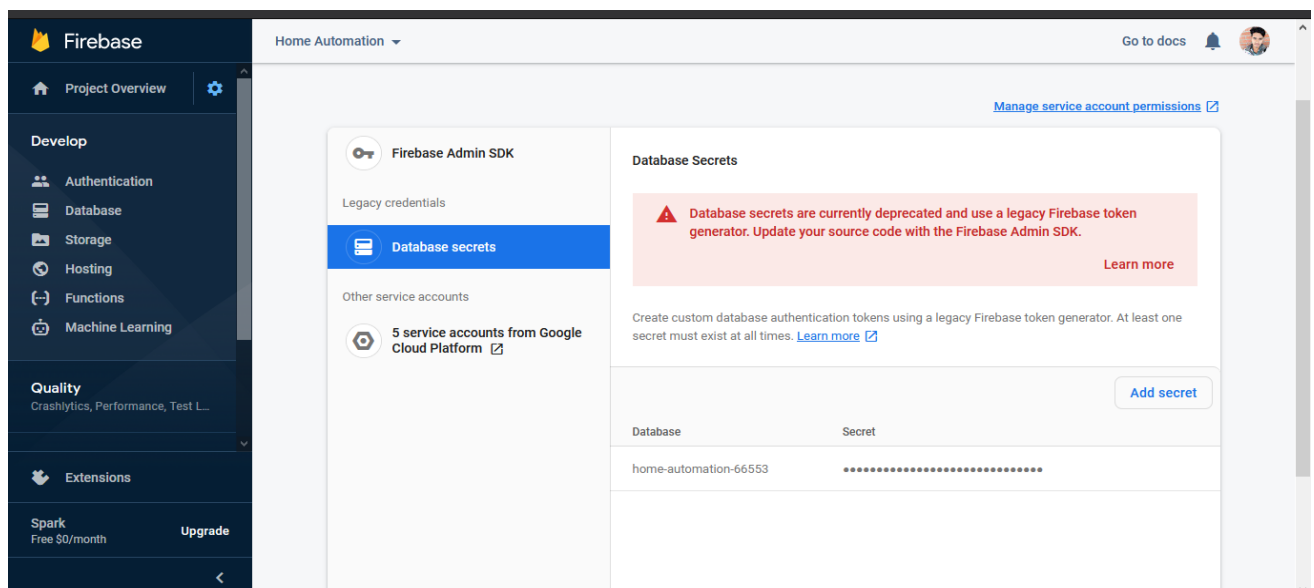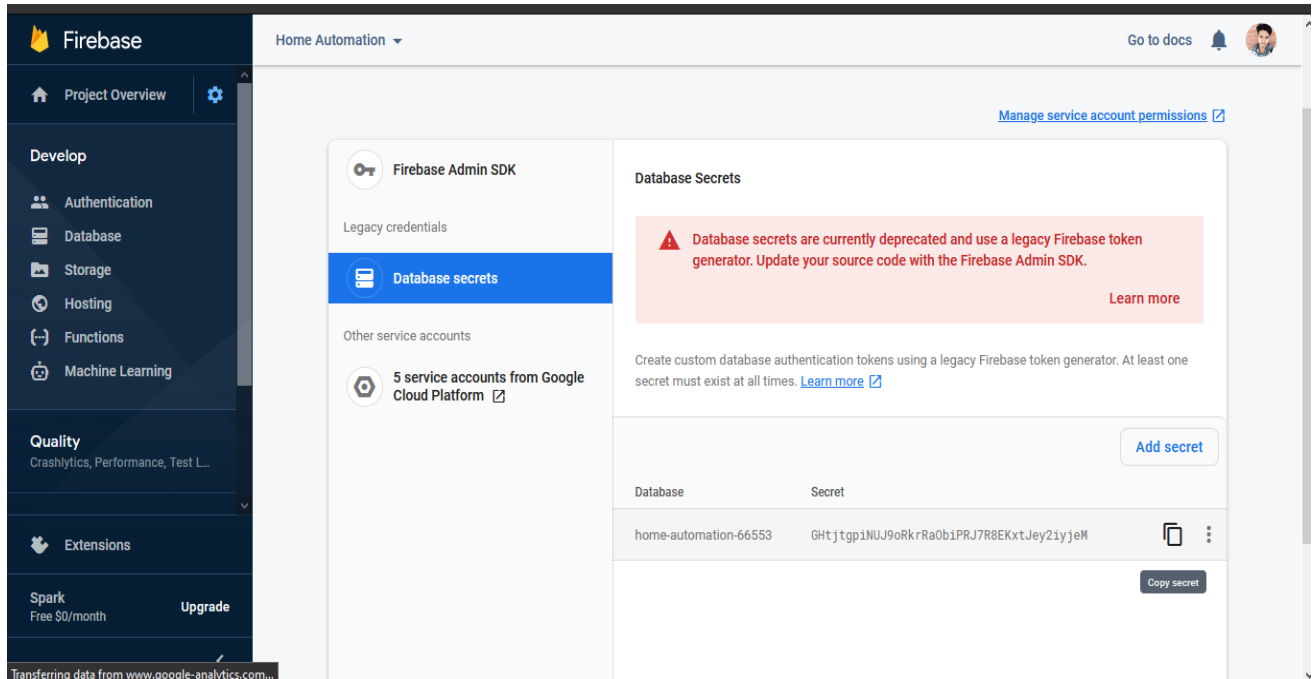1. Create a firebase database
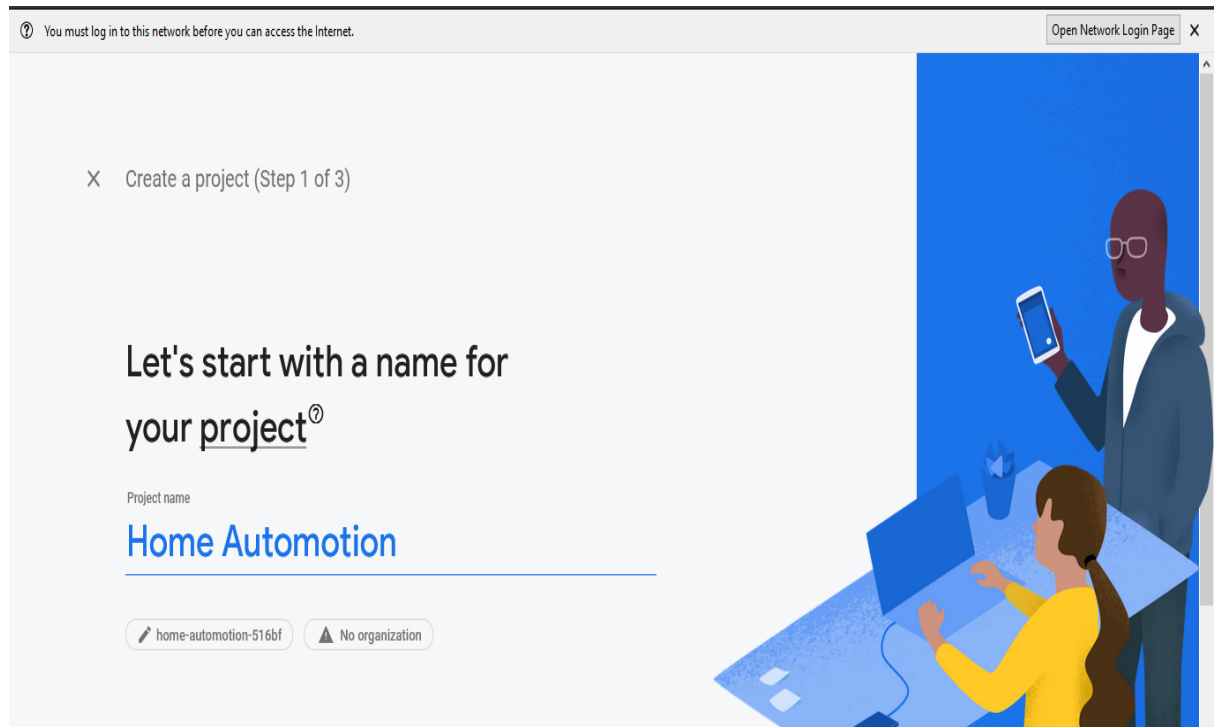
2. **Click Continue**

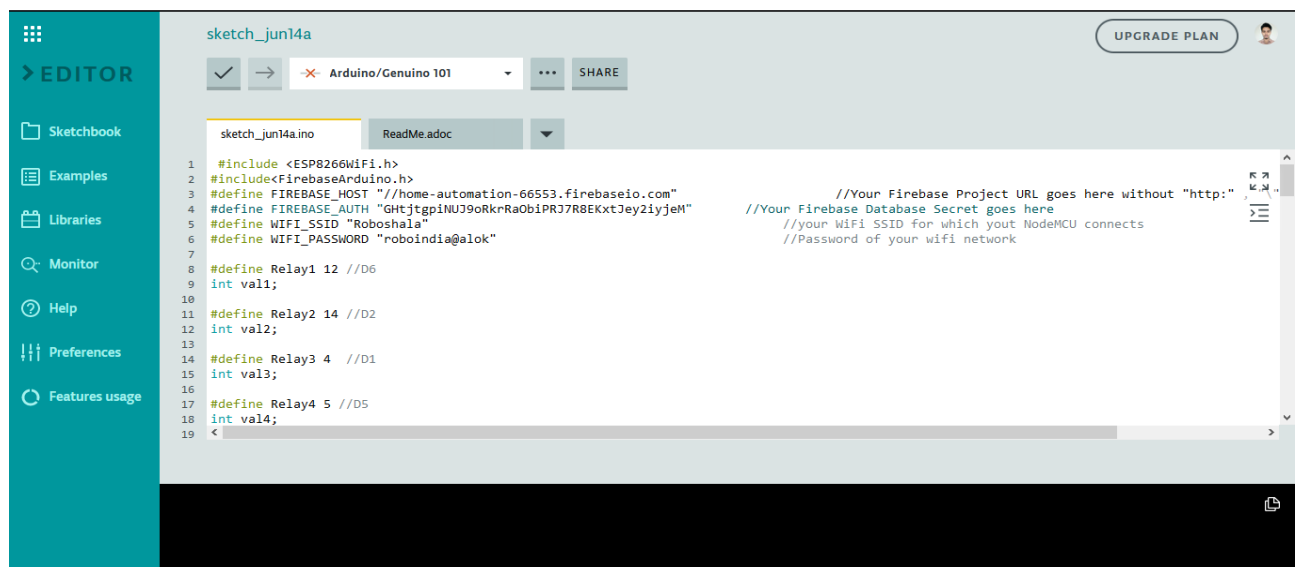3. Then go to >**Project Setting**

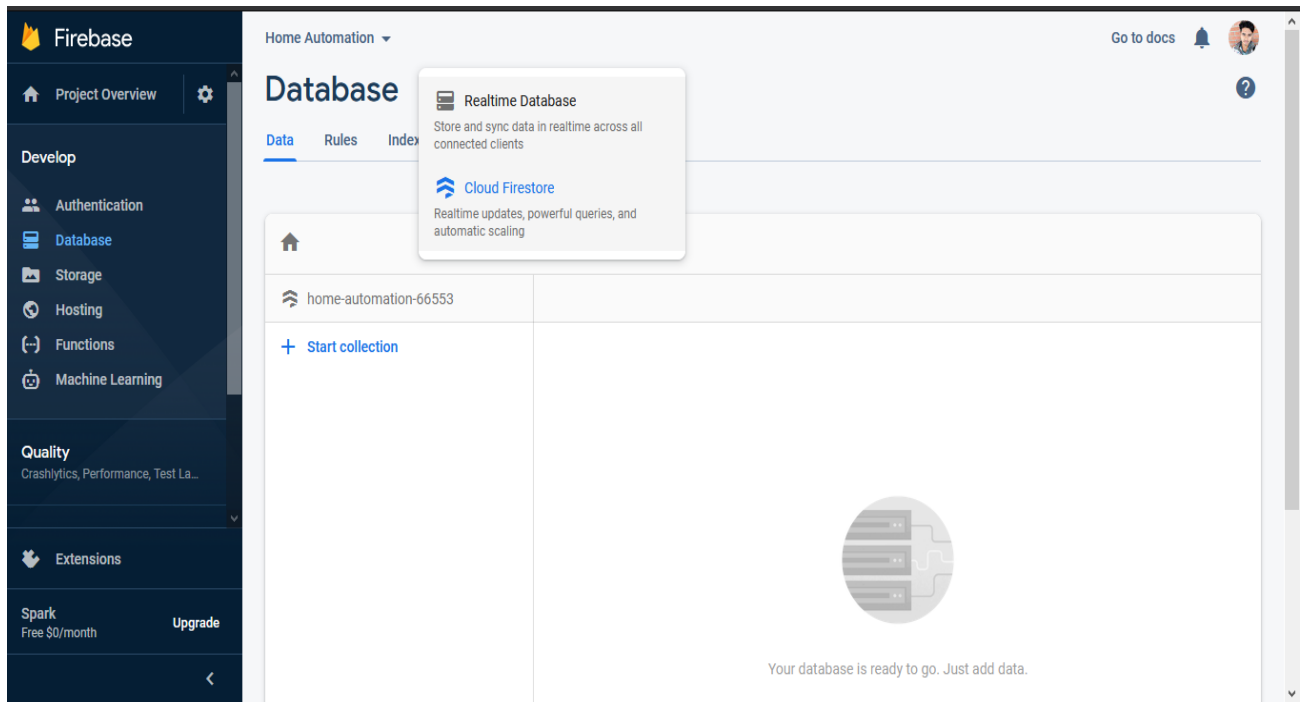4. Than we have to select -> **Service account ->Database Secret**

5. After clicking "Show" we will get our 'AUTH' key. This Authorization key is used in our code in order to store our sensor values to the database we Copied it.
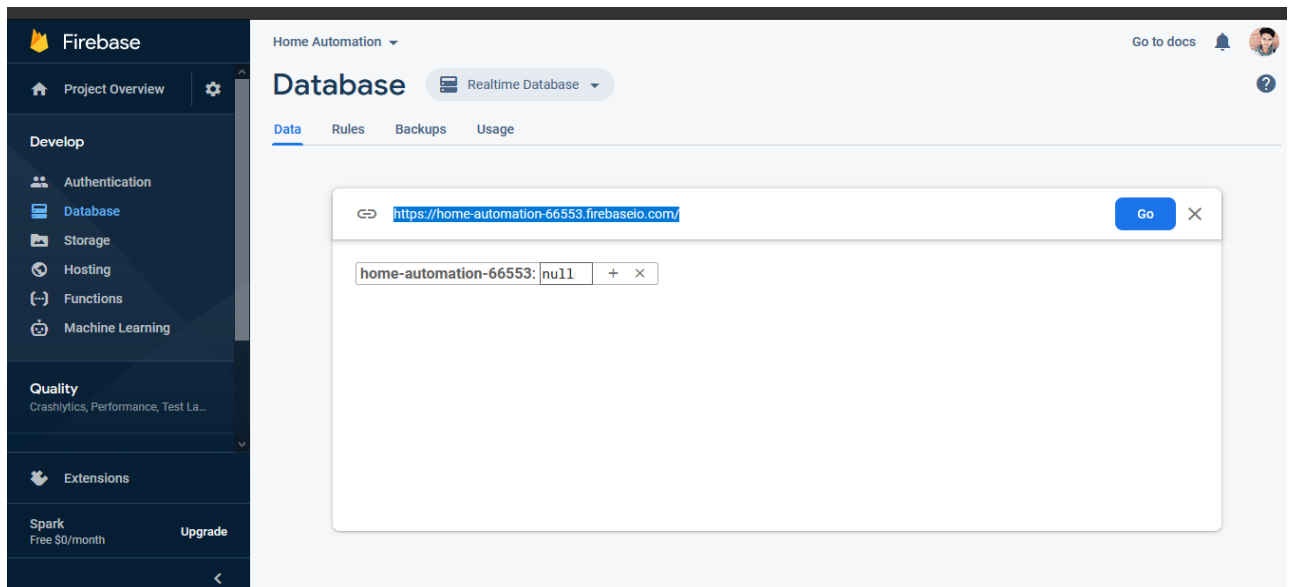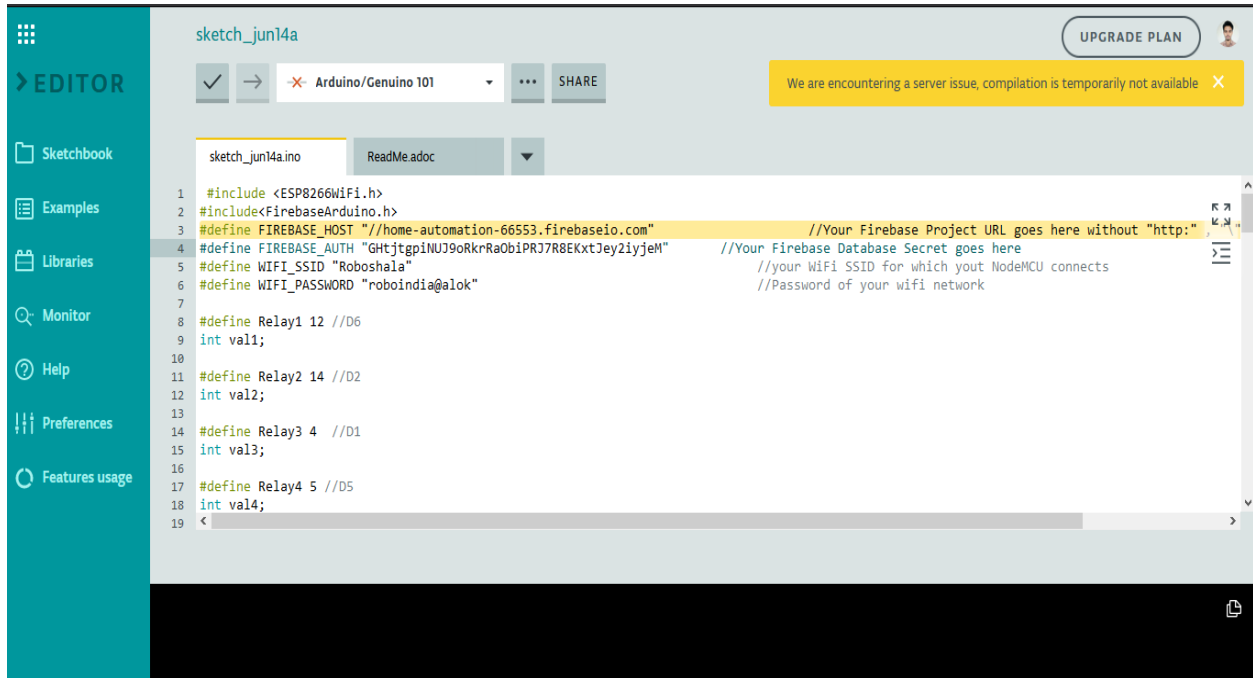

6. And Paste it in our code

7. Then we selected Realtime database from Firebase Console.

8. Here we will get our firebase HOST name. We copied it.

9. Then paste it in our code.

Dummy Data

Here are some Sample Data of the sensors from database. The real-time database can store only the information of the instantaneous moment.

Here all Sensor value is 1 which means light on , fan on, temperature sensor on, gas detect sensor is on .
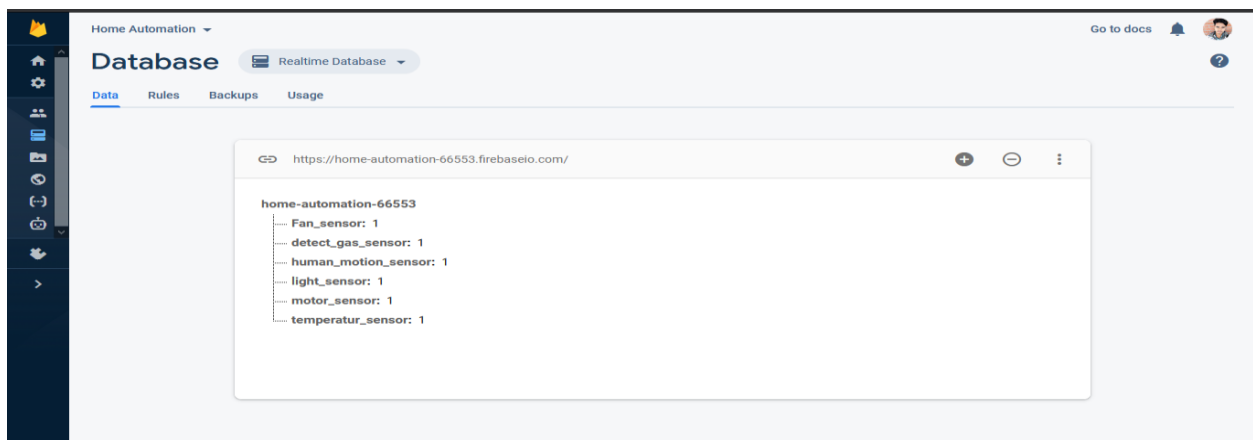
Here Fan sensor value is 0 so fan off, light sensor value is 0 so light off, but rest of sensor value is 1 so rest of sensor is on.
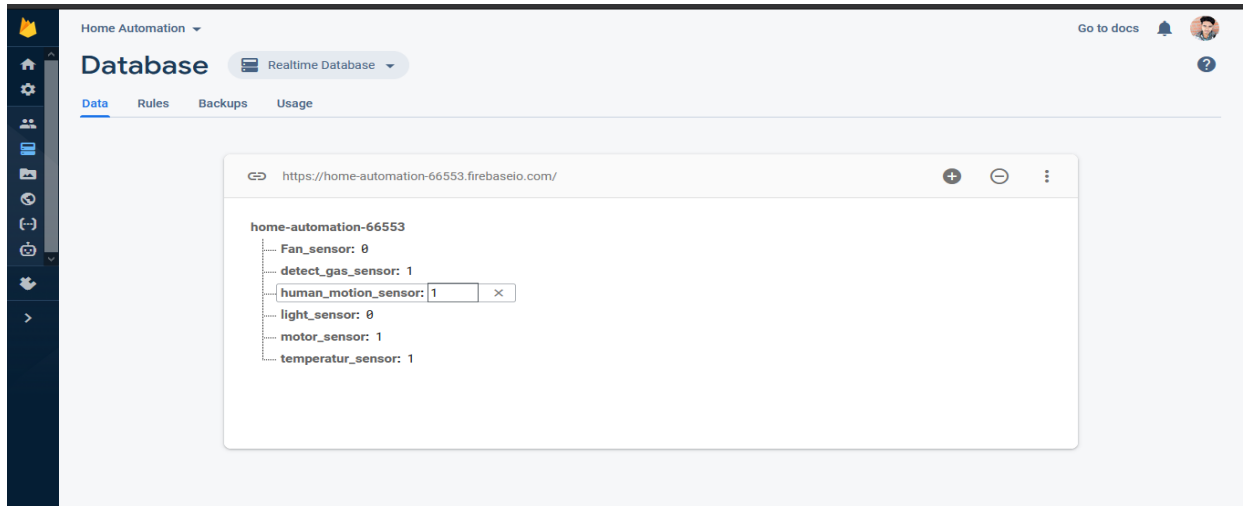
Here Fan sensor value 0 so fan off , light sensor value 0 so light off, motor sensor value is 0 so motor is off but rest of sensor value is 1 so rest of sensor i

APPLICATION TESTING

**Password authentication check:**

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

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.
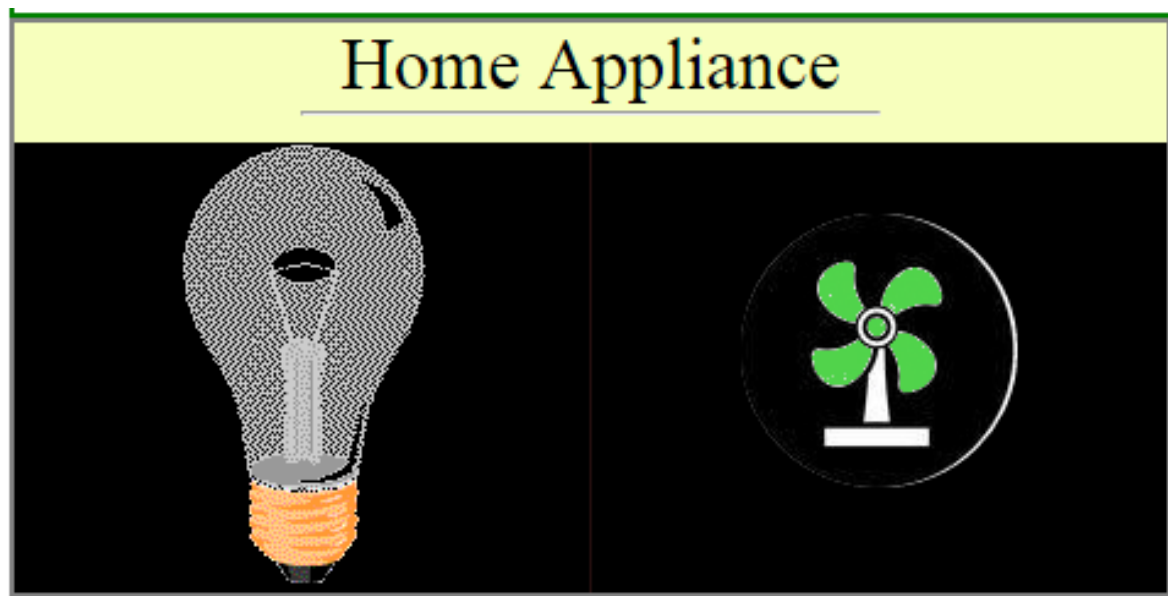
Light and fan is turn on:

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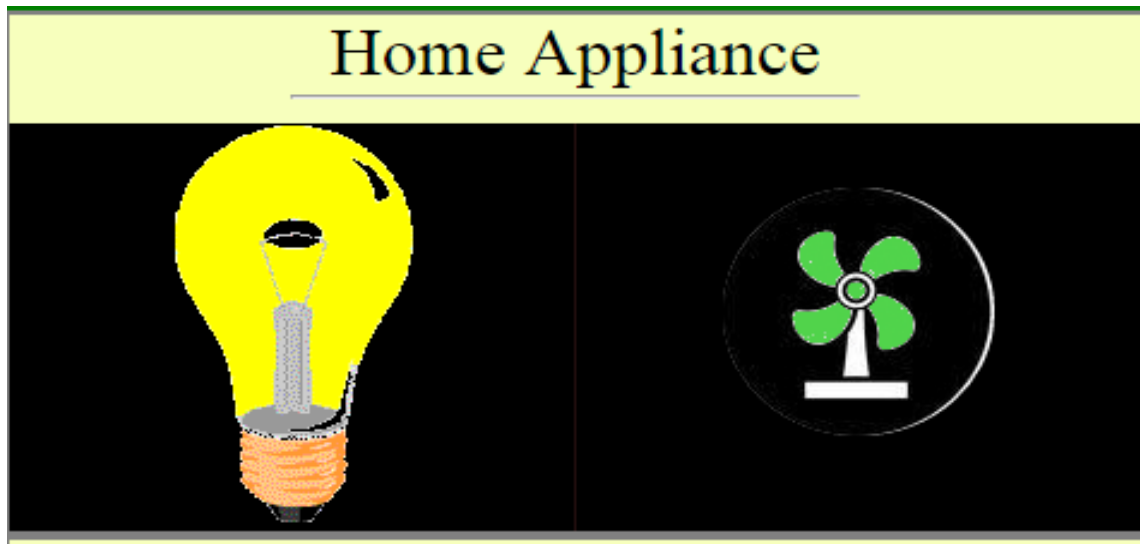
Light off fan turn on:

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.
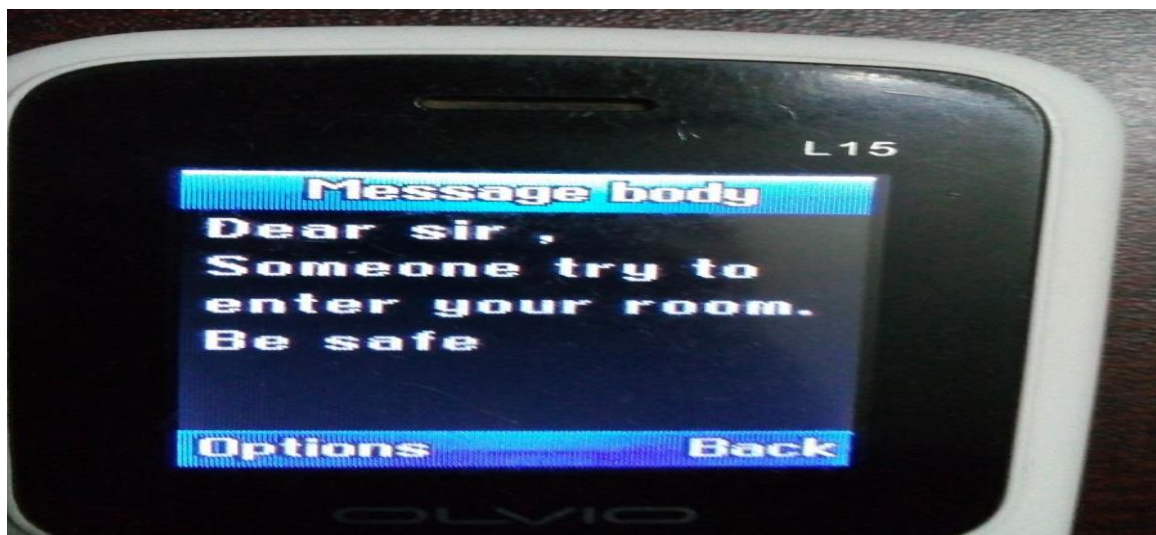
Light turn on and Fan Turn off:

If users try to turn off the light then the application shows the following interface. The red fan indicates that fan is turn off.
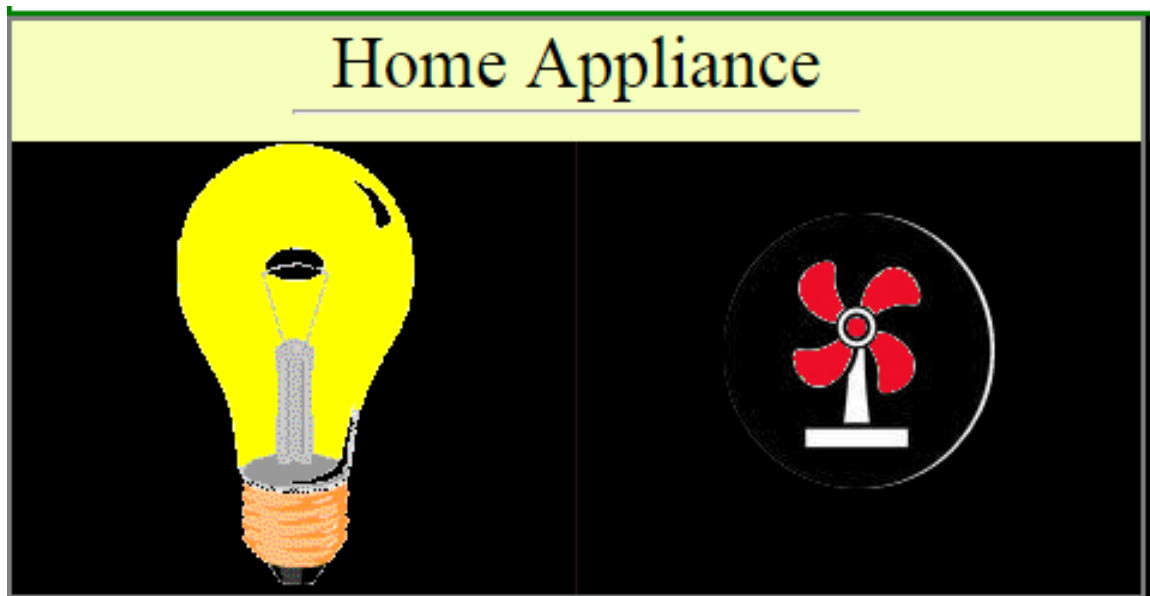
Motion Sms alert:

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

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

Home Status

Temperature	32*C
Motion Status	MOTION DETECTED
Gas level	General

Check smoke /gas:

Detect the gas level and show "DANGER

Home Status

Temperature	32*C
Motion Status	No Motion
Gas level	DANGER

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.

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.