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Smart Building System using IoT

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Abstract: ***Now a days Internet of Things (IOT) is the technology which is growing rapidly in present world and everybody is looking for a comfortable home with the best qualities at very low cost. By looking many aspects we designed a prototype which is very secured, controlled and energy saving prototype for our home and offices by using the ATmega328 micro controller. This necessary program is developed by using the embedded c language. The main aim of this paper is to build features for the home and offices with low cost which could be affordable by common persons also for automatic energy control. This project demonstrates the ability to measure accurately the number of persons entering into the room and number of persons leaving the room. It also stores the details of the electrical appliance status and sensor details in the cloud by using the ESP8266 Wi-Fi-module. The global system mobile communication (GSM) module is included for protection of the home by using IOT.***

I. INTRODUCTION

This paper is arranged as follows. Section I explains the introduction. Section II indicates the components description which is used for designing this system. Section III gives the algorithm and methodology. Section IV shows the results and the discussion.

Home monitoring and security systems are growing rapidly in the present scenario. These are provided with the help of the semi conductor technologies which are growing in this modern world. The semiconductor technology made the impossible things possible.

This project is done with the help of the famous motion sensor called the passive Infrared Sensor (PIR) which detects the motion of the person with the help of the radiation in our body. This can be sensed more accurately of human presence. we will get a doubt that how it senses very accurately. With the help of the PIR sensor we can decrease the sensitivity level so, that PIR cannot detect small objects. [2]. .

In this project we used two PIR sensors which are required to detect whenever a person is entering in to the room and leaving the room. If number of rooms is increased, one more PIR is required for every room. These sensors can also be used for detecting thieves by using GSM module

In this system we included two sensors, first one operates the light and second one operates the fan. One more sensor is used to control the moisture for the plants in the backyard.

II. HARDWARE DESCRIPTION

1. PASSIVE INFRARED SENSOR:

The main important part of the Passive Infrared Sensor is pyroelectric sensor which generates energy when exposed to heat that explains that when a creature or a animal will get in to the scope of that sensor it will identify the development since human or creature body discharges heat vitality in a type of infrared radiation that is the reason why the name is termed as passive infrared sensor the term passive suggest that the sensor is not using any energy for detecting it just works by detecting the energy given by the other objects the module also consists of a specially designed named fessel lens which focuses the infrared signals on to the pyroelectric sensor. it has two potentiometers one for adjusting the sensitivity of the sensor and the other for adjusting the time which ranges from 0.3 to 5 seconds. Passive Infrared Sensor has three pins named voltage, digital output and ground. The voltage required for activating the PIR sensor is 3.3 volts.[6].

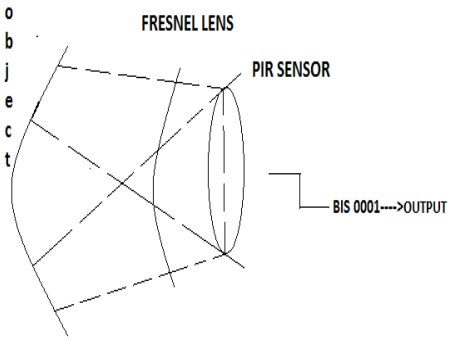

Figure IIA working of PIR sensor

2. ESP 8266 Wi-Fi module

ESP 8266 Wi-Fi module is a leading low cost platform for Internet of Things. The prominence of ESP8266 is primarily due to its dual functionality. It works as a Wi-Fi adapter and drives the entire applications. The ESP 8266 has multiple general purpose input output pins (GPIOS) which can be used to interface directly with the microcontroller unit. It is embedded with a 32 bit micro controller which drives the communication power modes and the GPIOS on the board. It works in the power range of 3 to 3.6 volts.

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We are using the 3.3 volts pin to power up the ESP8266 module. It is essentially on a chip with capabilities for 2.4 Gaga Hertz Wi-Fi communications. It also has the Transmission control protocol (TCP) Internet protocol (IP) communication IP protocol stack written on to the firmware for ready to use. Serial peripheral interface (SPI) and Universal asynchronous receiver transmitter(UART) serial communication is enabled to this platform. We will use the SPI and UART to send appropriate commands from Arduino to it for performing different functions. The advancements in each version are primarily the number of available GPIOS. For interfacing the peripheral devices, development of standalone IDE and libraries for the self controlled functionalities of the ESP8266. The voltage Controlled Converter (VCC) and ground pins are provided to supply power to this board. It works from 3.3 to 3.6 volts. The reset pin is an input pin for the for external reset signal. It works in the active low mode. The channel (CH_PD) pin is for enabling the chip. The chip works properly when signal of the pin high. The transmission (TX) and reception (RX) pins are used for transmitting and receiving the data in case of serial communication. This ESP8266 has two GPIO pins which can take a digital input and provide the digital output. The application is ranges from home automation to the industrial control. Due to its wireless communication and serial interfacing capabilities it can also be used for a multiple applications. We can design IP Cameras and sensor networks by using additional microcontroller units. Innovative products like wearable electronics can also be designed and interfaced with the internet using ESP8266 WIFI module.[1].

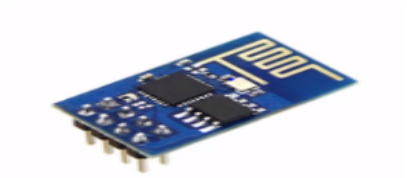

Figure IIB Image of ESP 8266 module

3. RELAY DRIVER MODULE:

A relay is an electrically operated switch. It uses a small amount of power to move an armature that is able to switch a much larger amount of power. Sensors need to drive bigger use of pieces of equipment that drives larger current but most sensors produce very small currents. It helps to make small currents activate large currents as shown in the figure IIC. They are two types of the relays the first one is electromechanical relays which follows the principle of electromagnetic induction that actuates a relay contacts connected to a load circuit. Another type of the relay is the solid state relay. It is purely an electronic relay with no moving parts. It uses Thryistor as the switch for the relay and an opto coupler (LED and Light sensor) allows for the electrical isolation. We used an electromechanical relay. It has a soft iron core wounded by the coil of wires it acts like a magnet when a current passes through the coil. It is activated by current from the sensor. The movable magnetic strip is known as the armature in this magnetic field generated in the electromagnet attracts an armature.

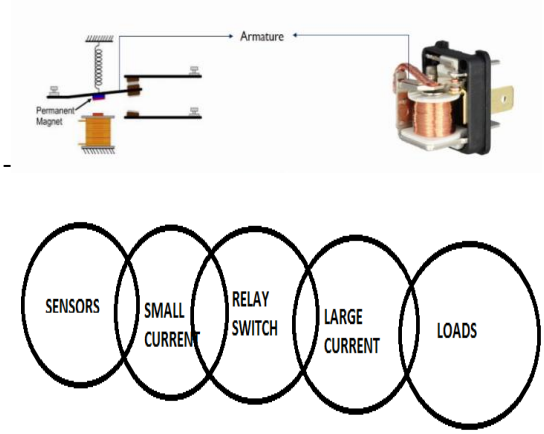

Figure IIC Block diagram of relay driver module.

4. ARDUINO MICROCONTROLLER:

As shown in the figure IID Arduino is an open-source hardware stage. Arduino has developed from only an implanted domain to construct propelled items for IOT, wearable and 3D painting and so on. Equipment structure schematics, PCB records and the code for the product are unreservedly accessible. This gives the adaptability for the clients to adjust and produce for their very own undertakings. Arduino is a combination of the boards, kits, shields and accessories and an integrated development environment. They are multiple boards available of arduino for different applications. Arduino uno is the most broadly utilized small scale controller board and the best board to begin with the gadgets and the coding. Arduino Nano is an example of smaller board .Arduino lillypad and derivatives of it are primarily used for developing wearable technology that have compact in nature. Shields and elements can be plugged on to stand alone boards to add features for the board.

Figure IID Image of Arduino

5. MOISTURE SENSOR: [3].

It measures the moisture content in the soil. It has two long conductors separated by a distance those are called electrodes. It has vcc, ground, analog and digital pin which provides high or low signals. It will gives the analog value proportional to the amount of moisture in the soil. The two electrodes are inserted into the soil which measures the conductivity of the soil. More conductive indicates that it contains more moisture. This direct measurement of conductance of the soil gives analogue value depending on the amount of the moisture. The voltage value of potential drop at the electrode changes with the same unit of the conductance of the soil. We can detect only in the change in the moisture content but cannot directly measure the standard value.

6. PHOTO RESISTOR:

It is a device whose resistivity is a function of the incident electromagnetic radiation that is why they are light sensitive devices. They are also called as photoconductors. [4]. Photo conductive cells or simply photo cells they are made up of semi conductor materials having high resistance. This resistor works on the principle of photo conductivity. It is nothing but, when the light falls on its surface, then the material conductivity reduces and also the electrons in the valence band of the device are excited to the conduction band. When the light falls photons falls on the device the electrons in the valance bonds of the semiconductor materials are excited to the conduction band. These photons in the incident light should have energy gap greater than the band gap of the semiconductor material to make the electrons jump from the valence bond to the conduction band. Hence, when light having enough energy strikes on the device more and more electrons are excited to the conduction band which results in the large number of charge carriers.

7. GSM MODULE:

GSM is nothing but the global system for mobile communications. It works under the different frequencies. In this project the purpose of this module to send an alert signal whenever a thieves enter into the house.

III. PROPOSED METHOD AND METHODOLOGY

The figure IIIA shows the flowchart of this system. The Arduino control supply is to be switched on for the activity of this framework. At first it will check the flag bit if it is high at that point whole directions will be exchanged to the GSM module with the assistance of microcontroller for sending alert messages to the proprietor when thieves are entered to our house. Otherwise if the flag bit is low then entire instructions will be transferred to the microcontroller in a way that it will check the number of persons count with the help of PIR sensors. It will go to the next instruction for switching on lights, fans by checking intensity level and temperature in a room whenever the count is greater than zero. The next direction is for sending an alert message to the owner by checking the moisture level of sand in the backyard of a house, whenever the moisture level is low. All these information's are transferred into relay for switching on and off the loads by checking various conditions. Then output of the system is given feedback to the PIR sensor for checking the number of persons count.

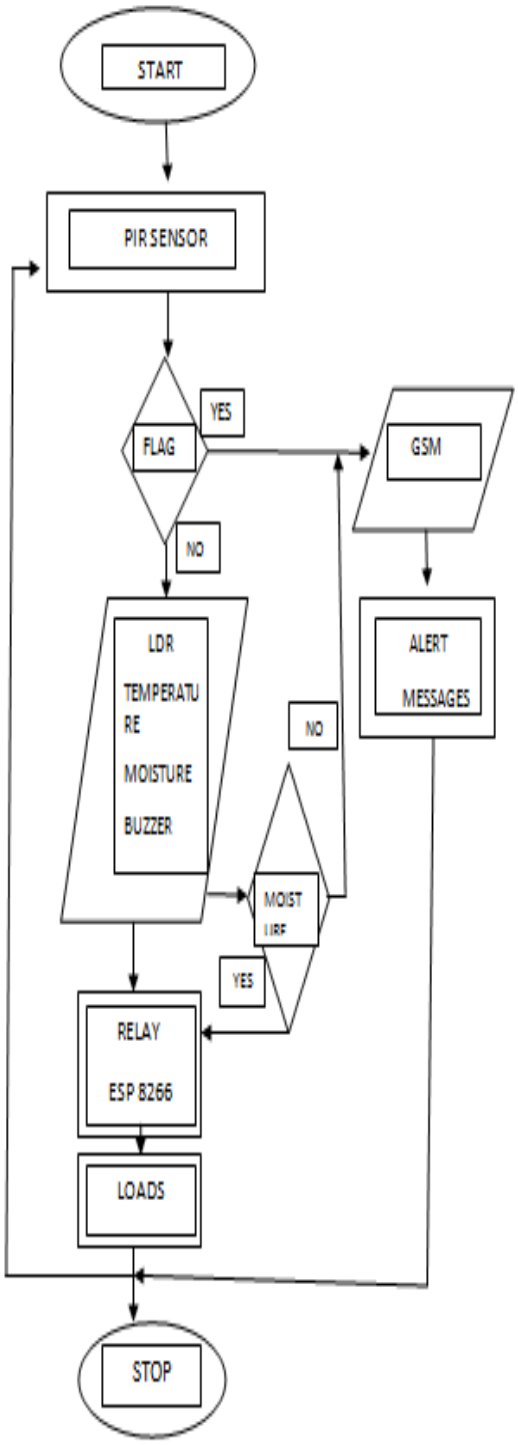

Figure IIIA Flowchart of the system.

The figure IIIB is the block diagram of this system. The first and foremost thing we can see is passive infrared sensor this signal output is given to the microcontroller. From microcontroller it will send signals to different sensors, GSM and ESP 8266 modules.

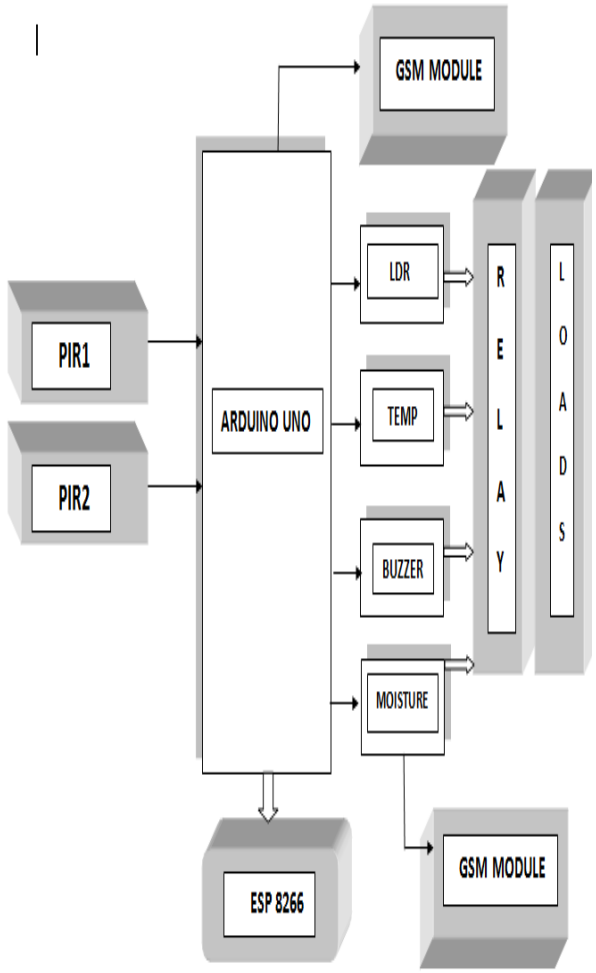

Figure IIIB Block Diagram of the system

The following table shows the components and their costs of the smart building system using IOT. Everybody can afford and save the energy by using this device.

Table 1 components and their costs of the smart building system using IOT.

S.NO	NAME OF THE COMPONENT	COST(RS)
1	PIR sensors	78*2=156
2	Arduino Uno	350
3	ESP8266	165
4	GSM module	399
5	LDR	7
6	LM35	35
7	Moisture sensor	25
8	Buzzer	90
9	Relay	136
	Total	1363

IV. RESULTS AND DISCUSSION

The below charts are the results of this system. Chart1 shows that on 28- February-2019 the maximum number of persons entered are 4 and 7-march-2019 room are 2. From 29-February-2019 to 6-march-2019 graph says that there no persons in a room. From chart2 values shown on the x-axis are date and Y-axis are numbers. These values says that on 28-feb-2019 and 7-march-2019 the electrical appliance is in switched on condition. Chart 3 values explain that values of light intensity recorded at different times on 28-february-2019 and 7-march-2019. Chart 4 and chart 5 explains the temperature in Celsius and Fahrenheit recorded at different instantaneous time on February 28 and 6-March-2019. Chart 6 explains in this way. At 10:54 6-march-2019 the moisture value in the backyard of house is -80 and it varies to 210 at 10:59 6-March-2019. Figure IVA shows the results in serial monitor of connecting Wi-Fi module to the smart building system using IOT. From figure IVB we can observe that it sends an alert signal to the user mobile phone when thieves are entered into the house. Figure IVC shows sending an alert signal when the moisture level is low in the backyard of a house. Figure IVD is the hardware arrangement for this system and Figure IVE mentions the time of 1 mille second 11 micro seconds to switch on and off all the loads.

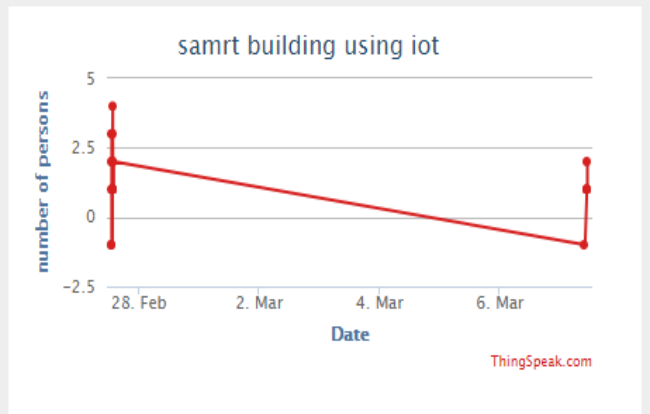

Chart 1- Number of persons count stored in the cloud

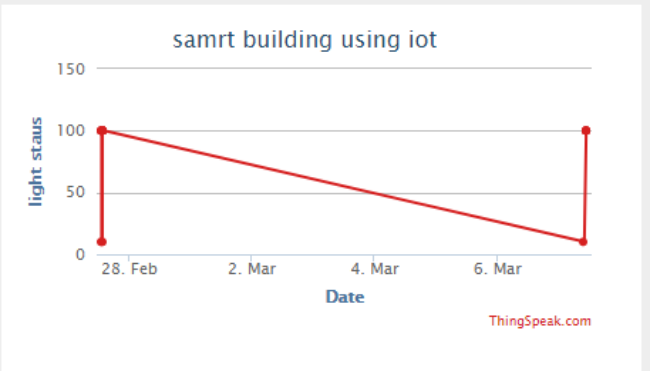

Chart 2-Electricity appliance status

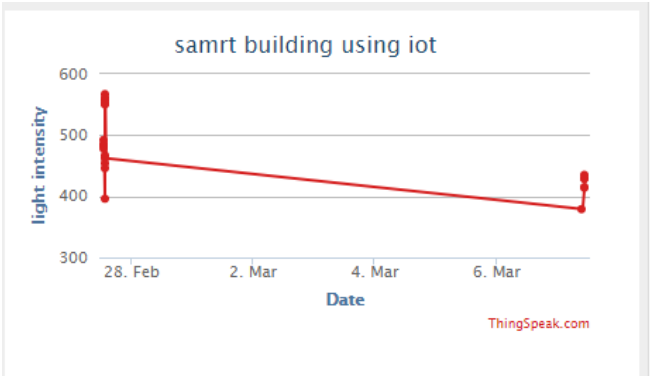

Chart 3- Room light intensity

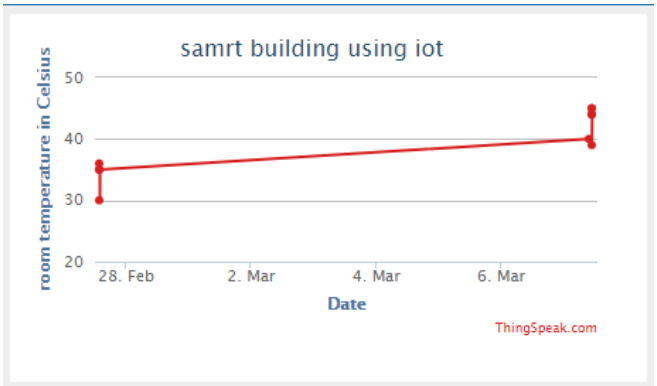

Chart 4- Room temperature in Celsius

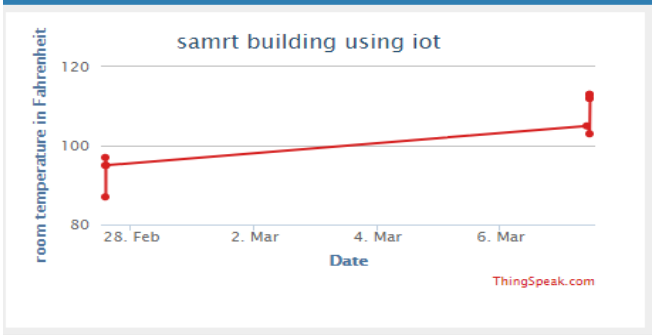

Chart 5- Room temperature in Fahrenheit

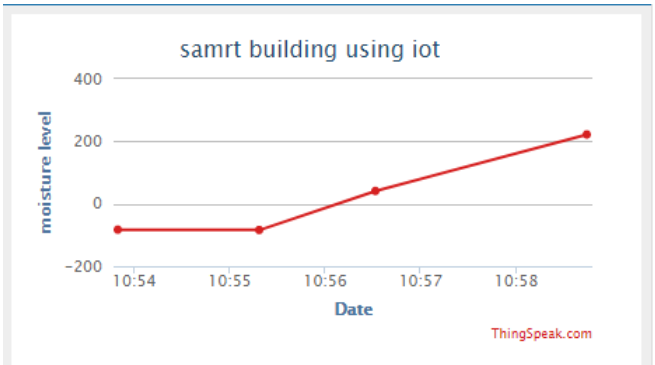

Chart 6- Moisture level status in the backyard of a house

```
AT+RST

OK
WIFI DISCONNECT
b@$□Rch□□uQN□qUN□I□□ □ B$□ 7
4□□□□□>□|□<□"□Q2□*□□XA□
ready
AT

OK
WIFI CONNECTED
□AT+CWMODE=1

OK
WIFI GOT IP
AT+CWJAP="Sumanthdhawan","nanamma123"
WIFI DISCONNECT
 □T+CIFSR
+CIFSR:STAIP,"192.168.1.104"
+CIFSR:STAMAC,"84:f3:eb:04:c2:11"

OK
AT+CIPMUX=0

OK
Calibrating Sensor.............................done
Sensor active
Sensor INNumber of Persons:1
Light status:1
AT+CIPSTART="TCP","api.thingspeak.com",80
CONNECT

OK
AT+CIPSEND=54

OK
>
```

Figure IVA Connecting Wi-Fi module to this system.

```
AT+CMGF=1
AT+CMGS="+919177082408"
hi sumanth!!! someone entered in to your room
Done message has been sent


Calling through GSM Modem
Called ATD+918639084719
```

Figure IVB Sending alert message and call to the owner mobile

```
AT+CMGF=1

AT+CMGS="+919177082408"

hi sumanth!!! The moisture level is very low :

Done message has been sent
```

FIGURE IVC SENDING ALERT MESSAGE ABOUT MOISTURE LEVEL TO THE OWNER MOBILE

Figure IVE Operating Time of the system.

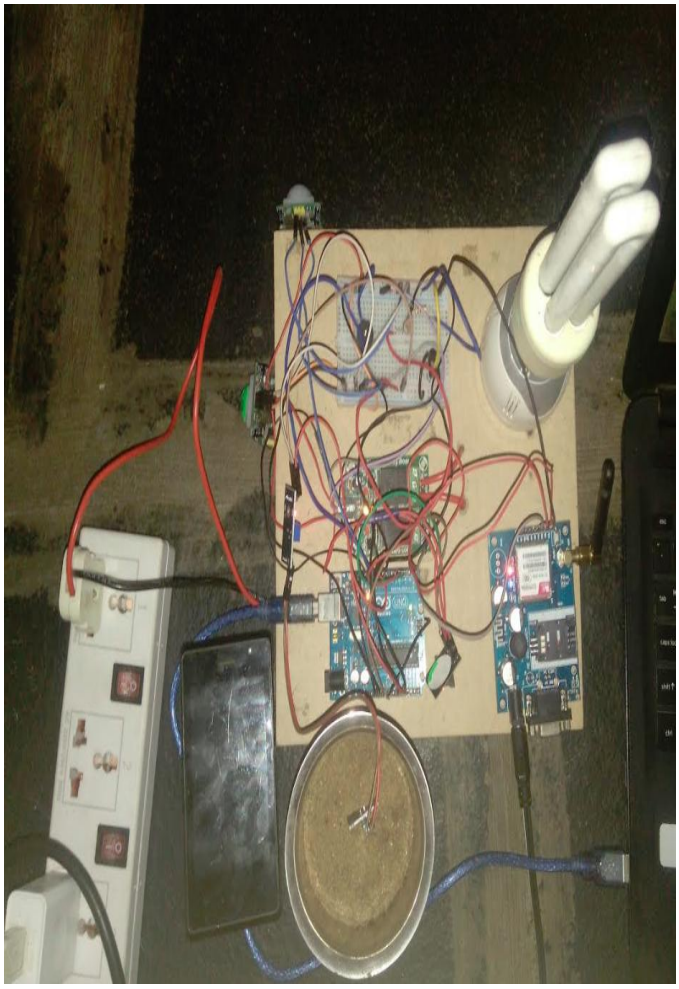

Figure IVD Prototype of this system

V. CONCLUSION

The smart building system is fabricated using IOT as shown in figure IVD. This device consists of mainly Wi-Fi module, PIR sensors, GSM module and sensors. The cost of the system is approximately rupees 1363. It is demonstrated for checking the workability of the device. During the demonstration buzzer has given the alarm and lights from the GSM and ESP8266 module has shown glow. These indications conformed that the system is working. It is also demonstrated energy saving by sending the people into the room and bringing out of the room since the lights are on when people are inside and they are off when they come out. This paper describes introduction, Hardware, working principle and results of graphs in the cloud. This device consumes low power. It requires 5volts DC supply. It operates within a time of 1.011 mille seconds approximately.

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