

Smart Lighting and Security Solution Using Arduino, WI-FI Module and PIR Sensors

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ABSTRACT

- Due to increase in requirement of energy in both industry sector and residential sector, we must need some smart solution to save electricity. According to IEA (International Energy Agency) report, it shows energy use is increasing day by day. We also require some security solution to protect our home from thieves. So, in this paper I am providing solution to smart lighting and security solutions which helps one in saving energy and protecting their home from thieves.

Keywords: Smart Lighting Solutions, Lighting Solutions using Arduino and Wi-Fi Module, Use of PIR Sensors, Smart Security Solution

I. INTRODUCTION

This paper provides smart solutions of energy and security using arduino uno microprocessor, Wi-Fi module and PIR Sensors. PIR (Passive infrared sensor) sensors actually use to sense availability of any person in the room. It uses infrared signals to sense the person's movement. Range of PIR sensors is approximately 10 meters, if you want more range then you can also create network of sensors. I have also used arduino in my solution because it is open source hardware and software solution that reads the sensor and sends necessary commands to relay to turn on the lights. In this paper, I have mentioned below topics.

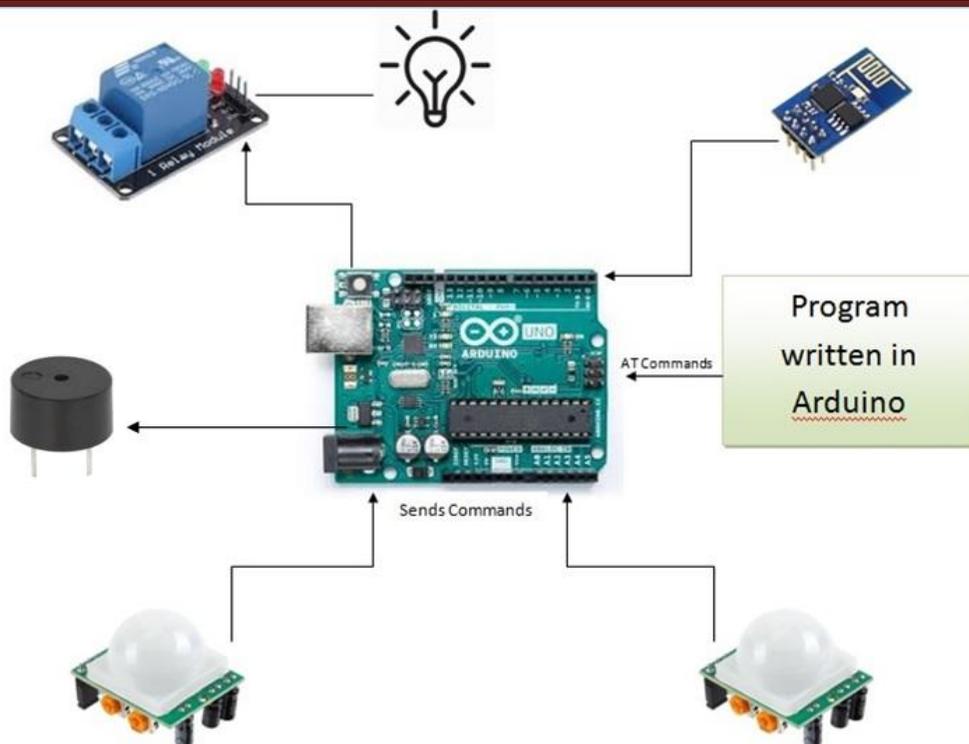
- 1) Abstract
- 2) Introduction
- 3) About Solution of Smart Lighting and Security
- 4) Future Extension
- 5) Conclusions

II. ABOUT SMART LIGHTING AND SECURITY SOLUTIONS

One needs this solution to cut the electricity cost and for protecting their homes. In this solution, I have used following components.

- 6) Arduino Uno Microprocessor
- 7) ESP8266 Wi-Fi Module
- 8) Relay
- 9) Buzzer
- 10) Connectors
- 11) Breadboard

As shown in below Figure 1, arduino is connected to all components that are relays, buzzer, Wi-Fi modules etc. In the background there is an arduino program written and uploaded on arduino which controls the components connected to arduino uno board. Arduino program uses AT commands which are used to control the Wi-Fi modules, to connect cloud, to set the mode of Wi-Fi module etc. I have used two PIR sensors in my solution IN sensor and OUT sensor, IN sensor is activated when someone enters the room and OUT sensor activates when someone leaves the room. When PIR sensors detect something, it sends signals to arduino and arduino sends signals to the relay to perform necessary action with status that is LOW or HIGH. LOW means relay will switch off the light and HIGH means relay will switch on the lights. Buzzer is also connected to breadboard, so when relay switches on the lights buzzer will make some noise to indicate some action has occurred. This is used for security purpose. For example, if it is evening time or night time and you are not there in room and someone enters the room unauthentically then buzzer will ring and you will get to know that someone is there in room. In this solution, I have used Wi-Fi module due to its range and Wi-Fi module is perfect network for home automation compared to Bluetooth and other networks due to its range and availability.



(1)

Below I have mentioned small snippet of my arduino program that is written to control different components connected to arduino board.

```

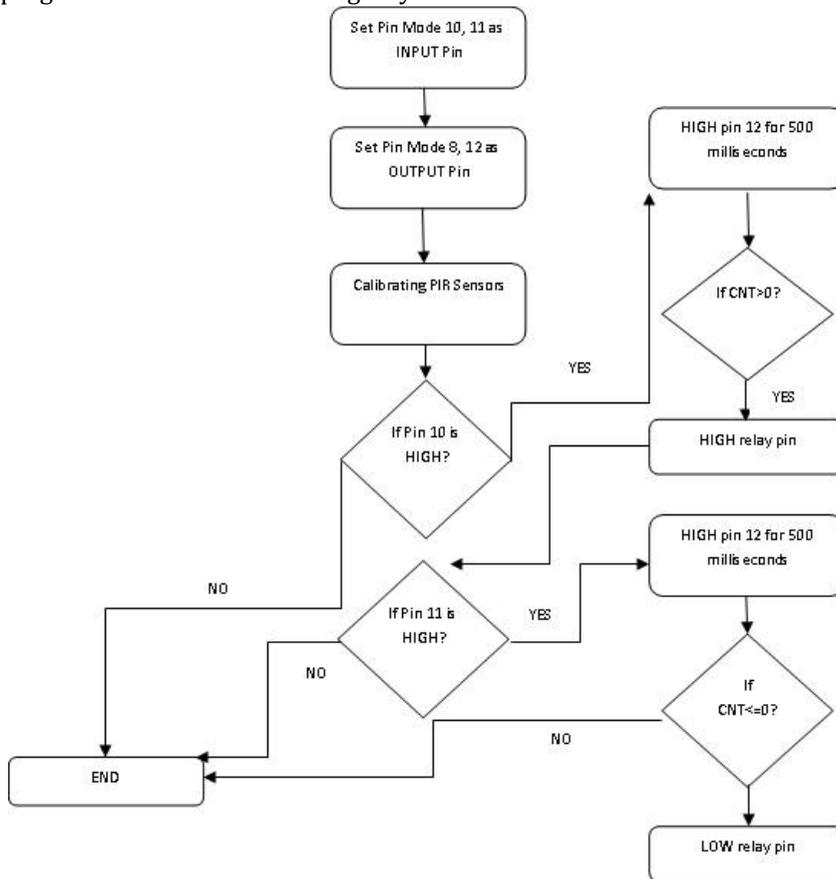
{
  data=digitalRead(10);
  data1=digitalRead(11);

  if(data==HIGH&&lock==true)
  {
    lock=false;
    digitalWrite(12,HIGH);
    delay(500);
    digitalWrite(12,LOW);
    Serial.print("Sensor IN");
    cnt ++;
    if(cnt >0)
    {
      digitalWrite(8,HIGH);
    }
    delay(4000);
    lock=true;
  }

  if(data1==HIGH&&lock==true)
  {
    lock=false;
    digitalWrite(12,HIGH);
    delay(500);
    digitalWrite(12,LOW);
    Serial.print("Sensor OUT");
    cnt --;
  }
}
    
```

```
if(cnt==0)  
{  
    digitalWrite(8,LOW);  
}  
delay(4000);  
lock=true;  
}  
}
```

As shown in above snippet of arduino program, I have attached my relay module to pin 8 of arduino, buzzer is connected to pin 12 of arduino, Sensors are connected to pin 10 and 11 of arduino. So, when sensor value is HIGH and lock is true then it will HIGH pin number 12 where buzzer is connected and buzzer will ring for 500 milliseconds and after that buzzer will stop to make noise (digitalWrite(12,LOW)). I have taken cnt variable which is used to count number of persons in room. So, according to above program when cnt is greater than 0 then it change the status of relay pin with HIGH flag and when cnt is 0 then it will LOW relay pin. This is how arduino works and provide smart solution for electricity and security. So, concluding this, program will work on following way.



III. FUTURE EXTENSION

The problem exist with this solution is that light will also switch on in the morning because PIR sensor does not recognize day and light. So we need sensors like photoelectric to recognize day and light. We can combine PIR sensors with photoelectric sensors. We can use fusion of sensors to overcome this problem.

IV. CONCLUSION

So, as shown in above solution, with the use of arduino, relay, PIR sensors, we can provide best smart home solution for energy and security. Range of PIR sensor is approximately 10 meters but if your room length is more than 10 meters then you can also use number of sensors to cover your whole room. By using

sensor information you can also store value of number of persons somewhere or on the cloud, so that you can monitor the security of your home. According to one survey by NREL [7] simple occupancy sensor only accurately detect people about 75% of the time. If a person do not move for mentioned minutes then occupancy sensors will switch off the light and person need to turn it on manually.



To overcome this problem NREL has developed Image Processing Occupancy Sensor (IPOS) that combines an inexpensive camera with a high-speed microprocessor and algorithms. This new type of occupancy sensor detects more than 90% people present and motion accurately.

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