AUTOMATIC LIGHTING SYSTEM ON PRESENSE OF OBJECTS TO SAVE ENERGY

Rayhan Islam Rabbi, Muhammad Masum Billah Mozumdar, Shakiruzzaman, Md Kamrul Hasan
Department of Electrical & Electronic Engineering
Chittagong University of Engineering & Technology, Chattogram-4349
u1902022@student.cuet.ac.bd u1902023@student.cuet.ac.bd u1902032@student.cuet.ac.bd

Abstract: Automatic lighting system is an Arduino and sensor based home automation system that works by detecting objects in a certain distance and automatic calling turns on the bulb. It can be used where there is no need for the lights all the time, rather at the presence of human. As the lights are not turned all the time, only when needed to light up, it saves energy by avoiding unnecessary consumption of power by the bulb. It can be used in mainly used on staircase, balcony, also in home, street, reading room, washrooms, etc. the main components used in this system are Arduino uno, pir motion sensor, ultrasonic sensor, LDR sensor and LED.

Keywords: Automation, Arduino, Ultrasonic Sensor, PIR Sensor, LDR, PCB.

1. INTRODUCTION:

Automation is the hot topic of today's technology enthusiastic which involves the control and automation of lighting, cooling, ventilation, heating and other system. It attracted everyone's concern as it is related to comfort and case of life. Devices when controlled automatically without manually turn on and turn off are an important constituent of automation. Automatic lighting system is an intelligent network based lighting control solution that establishes communication between various forms of system inputs and outputs related to lighting control using one or more control computing devices. Automatic lighting system use the principles of automation where various sensor collects data from the specific area and detects the presence of an object. This data is used them to confirm the presence of person with the help of microcontroller and is interfaced with the light and turns it on. The major advantage of lighting control system over stand alone lighting controls or conventional manual switching is the ability to control individual lights or groups of lights from a single user interface device. The main purpose of automatic lighting system is to save energy. The longevity of lights is also obtained by reduced use of the lamp. Also there is no need for manual switching for the light. Every installation process and cost effective as well power consumption for the Arduino and other seams is very low. In this paper we will be studying various methods for detecting presence of person in a certain area , in a certain distance using different sensors, and categorizing the accuracy and the effectiveness and range of each sensor for data classification after the data is acquired it will be transformed to microcontroller to ensure the presence or movement of a person, distance from sensor.

2. LITERATURE REVIEW:

With the advancement of nano technology and semiconductors including the automation system has become popular worldwide and received researchers attraction. There are several journal papers that have been published on smart lighting by various researchers. Continuous effort have been being made for better efficiency and lower power consumption. One of the researchers Richu Sam Alex et al proposal a system which reduced the power consumption of street lights about 30y compared to conventional design. It also uses Arduino for automation and analyse the performance of the system. Another researcher Daeho Kim et al. worked on smart LED lighting system by using Infrared and Ultrasonic sensors simultaneously. In their project, they proposed a model which continuously tracks the human motion. The output is based on the human tracking data which is obtained by these sensors are responsible for switching the LED lighting on-off. Previously existing system fails to continuously monitor the motion of an object by using each sensors separately. For the same reason, the existing system has low efficiency. By the hardware implementation, they developed a prototype to improve the efficiency which helps in smart lighting. The proposed approach make use of various sensors in which IR sensor sends the sensed data to the MCU board which in turn sends the same data to the microcontroller. Depending on the results of the sensed data microcontroller turns on the lighting system. Human presence is detected by IR sensor and continuous tracking is made by the Ultrasonic (US) sensor. As before the sensed values are transferred to the MCU board by US sensor which controls the On-Off of the lighting. US-IR positioning based system has to be studied more in future [2]

Raja R et al, worked on the energy saving concepts using automation. Here, smart sensor networks in DC electrical appliances like lighting, helps for reducing of energy usage. Conventional lamps are powered by AC grid but for LEDs, DC supply is adequate. Dimming of light can also be achieved by using appropriate protocol which helps in energy saving. Replacing the traditional lamp by LED makes 44% energy saving.[3] Michele Mango et al. developed a low cost, wireless, adaptable sensor based smart lighting system which makes use of PIR sensors and motion sensors. It is helpful for controlling the light intensity and power consumption efficiency using LED lights. Dimming of light is achieved using PIR sensor only in motion of obstacles around. Main advantage of this system is energy conservation.[4]

3. METHODOLOGY:

- **Flow Diagram:**

Figure 01

- **Sensor's Flow Diagram:**

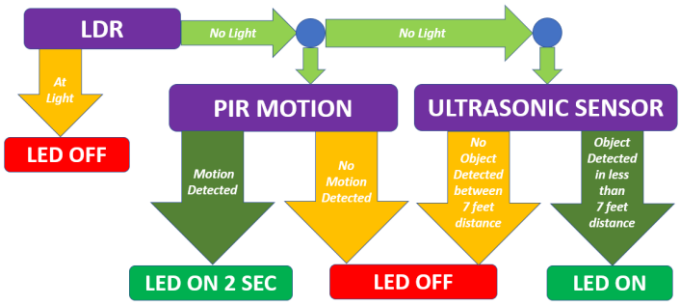


Figure 02

In figure 02 we see the basic block diagram of automatic lighting system on the input side we used LDR for detecting whether it is day or night, because the system works only in night as there is no light in day. If the LDR detects no light then pir motion sensor and ultrasonic sensor starting to collect data. Pir motion sensor can detect any of motion in the specific area and ultrasonic sensor continuously determined any kind of object in specific range.

- **Arduino Code:**

Safing_Electricity__Motion_Photoresistor_Ultrasonic_sen

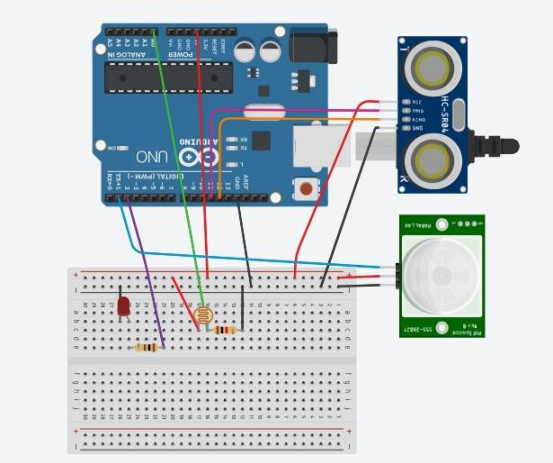
```
int lightPin=A0;
float lightVal;
int motion = 1;
int led = 2;
int state;
String msg="lightVal=";
int trigPin=11;
int echoPin=12;
int dTime=25;
float pingTravelTime;
float pingTravelDistance;
float distanceToTarget;
void setup()
{
  pinMode(lightPin, INPUT);
  //Serial.begin(9600);
  pinMode (motion , INPUT);
  pinMode (led, OUTPUT);
    pinMode(trigPin, OUTPUT);
  pinMode(echoPin, INPUT);
}
void loop()
{
  lightVal=analogRead(lightPin);
  //Serial.print(msg);
  //Serial.println(lightVal);
  //delay(500);

  if (lightVal> 300)
  {
    digitalWrite(led, 0);
  }
  else
  {
  state = digitalRead(motion);
  if (state == 1)
  {
    digitalWrite(led, 1);
    delay(2000);
    digitalWrite(led, 0);
  }
    else
    {
      digitalWrite(led, 0);
    }
  digitalWrite(trigPin, 0);
  delayMicroseconds(dTime);
  digitalWrite(trigPin, 1);
  delayMicroseconds(dTime);
  digitalWrite(trigPin, 0);
  pingTravelTime=pulseIn(echoPin,1);
  pingTravelDistance=pingTravelTime*0.01375;//0.014
  distanceToTarget=pingTravelDistance/2;
  //delay(dTime);
  //Serial.print("Ping Travel Time= ");
  //Serial.println(pingTravelTime);
  //Serial.print("Target Distance");
  //Serial.print(distanceToTarget);
  //Serial.println(" inch");


  if (distanceToTarget<=5)
  {
    digitalWrite(led, 1);
    delay(500);
  }
  else
  {
    digitalWrite(led, 0);
  }
}
}
```

- **Arduino Software (IDE):**

The Arduino Integrated Development Environment or Arduino Software (IDE) contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino hardware like Arduino UNO, Arduino Nano, Arduino Mega etc to upload programs and communicate with them.[9]

4. SOFTWARE SIMULATION:

- **Tinkercad Simulation: Circuit/Block Diagram:**



Arduino UNO Pin Out	Connection Point
1	Out Pin of PIR Motion Sensor
2	LED Pin through 100Ω Resistor
11	Trig Pin of Ultrasonic Sensor
12	Echo Pin of Ultrasonic Sensor
A0	LDR sense pin at Common Point of LDR and 1kΩ Resistor
5V	All Other Positive Pin & 5V
GND	All grounds of LED & SENSORS

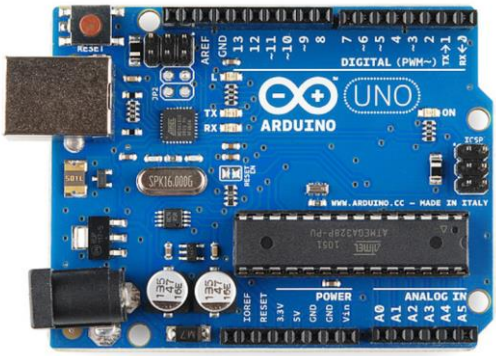
- **Tinkercad Simulation Software:**

Tinkercad is a free 3D modeling program known for its ease of use. It's 100% web-based, making it available to anyone with an internet connection. Kids, educators, and hobbyists use it to design anything imaginable. Utilizing 3D printing, laser cutting, or building blocks can bring Tinkercad projects into real life.Best of all, Tinkercad Circuits provides a bottomless supply of virtual components that students can use to build and simulate their projects. When they're ready to physically prototype their projects, Tinkercad Circuits makes it easy to export their code as a native Arduino. [7]

5. HARDWARE IMPLEMENTATION

- **Components Description:**

Arduino UNO: The Arduino Uno is a microcontroller board based on a removable, dual-inline-package (DIP) ATmega328 microcontroller. The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform.The Arduino Uno contains a set of analog and digital pins that are input and output pins which are used to connect the board to other components. There are a total of fourteen I/O pins placed inboard in which six are analog input pins. The board has a USB connection that can be used to a power supply to the board.Arduino is an open-source platform used for building electronics projects. Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board.[1,5]

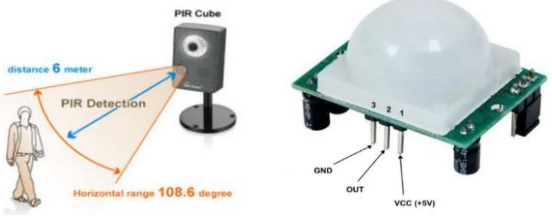


Ultrasonic Sensor HC-SR04: This sensor is used to measure the distance of any object by using ultrasonic sound pulse. It has 4 pin, Vcc, Trig, Echo & Gnd. Trig pin is used to trigger ultrasonic sound pulses. By setting this pin to HIGH (1) for 10µs (microseconds), the sensor initiates an ultrasonic burst. Echo pin goes HIGH when the ultrasonic burst is transmitted and remains HIGH until the sensor receives an echo, after which it goes LOW (0). By measuring time, the Echo pin stays HIGH, the distance can be calculated.

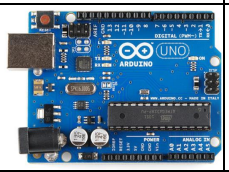
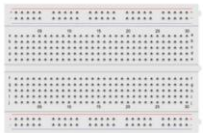
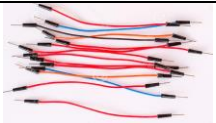
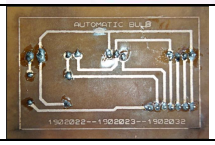
All of these starts when the trigger pin is set HIGH for 10µs. In response, the sensor transmits an ultrasonic burst of eight pulses at 40 kHz. This 8-pulse pattern is specially designed so that the receiver can distinguish the transmitted pulses from ambient ultrasonic noise. These eight ultrasonic pulses travel through the air away from the transmitter. Meanwhile the echo pin goes HIGH to initiate the echo-back signal. If those pulses are not reflected back, the echo signal times out and goes low after 38ms (milliseconds). A pulse of 38ms indicates no obstruction within the range of the sensor. If those pulses are reflected back, the echo pin goes LOW as soon as the signal is received. This generates a pulse on the echo pin whose width varies from 150 µs to 25 ms depending on the time taken to receive the signal.[6]

Ultrasonic Sensor HC-SR04 Configuration and Specification

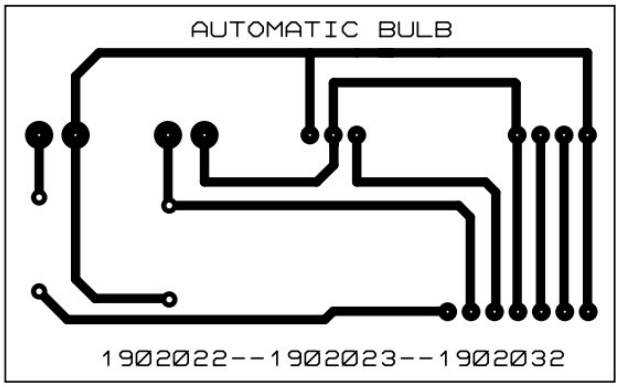
PIR Motion Sensor: A PIR (passive infrared) sensor is an electronic sensor made of a pyroelectric sensor, which is able to detect different levels of infrared radiation. It measures infrared light radiating from objects in its field of view (shown in picture). Every object in the world emits varied level radiation. A PIR sensor can detect infrared radiation that is emitted by particles. It's most often used in PIR-based motion detectors. A PIR can detect animal/human movement in an adequate range. Here the detector does not emit any energy but passively receives it by detecting infrared radiation from the environment of different objects. Thus, this sensor is commonly used in different alarms and automatic lighting etc.



LDR: An LDR (Light Dependent Resistor) is also known as a photoresistor, photocell or photoconductor. The bigger one wire is positive of LDR and the other is negative. This LDR can be used to sense the presence of light. It has a variable resistance that changes when light falls on it. This characteristics of LDR allows them to be used in light sensing circuits. It is variable resistor whose resistance varies depending on the amount of light falling on its surface. When the light falls on the resistor, the resistance decreases & when there is no light falls on it resistance increases. When the LDR is in dark, LED ON when it is in light, LED OFF.

SL No.	Components	Range	Image	Quantity
01	Arduino UNO			1
02	Ultrasonic sensor HC-SR04	2cm – 400cm		1
03	PIR Motion Sensor	Adjustable from 0 to : 3-7 meter Angle <140’		1
04	LDR (Light Dependent Resistor)/ Photoresistor			1
05	LED			1
06	Resistor			2
07	Breadboard			1
08	Wire			14
09	PCB			1

- **PCB implementation picture:**

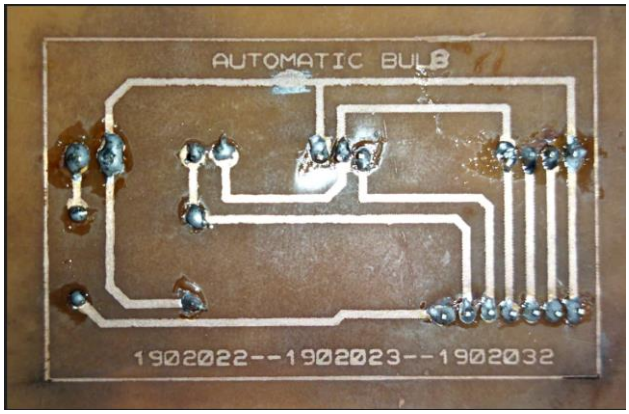


PCB design on Proteus Design Suite

- **Proteus Design Suite:**

The Proteus Design Suite is a proprietary software tool suite used primarily for electronic design automation. The software is used mainly by electronic design engineers and technicians to create schematics and electronic prints for manufacturing printed circuit boards.

The PCB Layout module is automatically given connectivity information in the form of a netlist from the schematic capture module. It applies this information, together with the user specified design rules and various design automation tools, to assist with error free board design. PCB's of up to 16 copper layers can be produced with design size limited by product configuration.[8]



PCB Board

6. RESULT AND OUTPUT

According to this project we can save more and more energy that would have been waste. After receiving the command, sensor will active automatically so there is no need to be worried about on off for this system. It will reduce energy waste as well as our time. This system is easy and very secured. So overall its performance is excellent as well as good efficiency type system.

7. APPLICATION AND FUTURE WORK

This automatic lighting system can be used mainly in staircase, balcony, also in home, street, reading room, washrooms, etc. In future, it can be produced commercially for saving energy in root level.

8. CONCLUSION

Over the past few years, Automation have achieved unprecedented success as it can control itself as well without any kind of manual instructions. On the other hand saving energy has become an important task for today's world and our automatic lighting project will do it by controlling itself. In this project we are offering LEDs will turn on when they need to be turn on otherwise they will be off. We believe this system will play very vital role for save energy in every house. To achieve this goal we have to spread this idea so that we get the most optimum results.

9. REFERENCES

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[8]https://en.wikipedia.org/wiki/Proteus_Design_Suite

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