DESIGN AND BUILDING OF SMART STREET LIGHT SYSTEM

A

Project Exhibition -1

Submitted in partial fulfillment for the award of the degree of

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Specialization in

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Submitted to

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CANDIDATE'S DECLARATION

I hereby declare that the Dissertation entitled "**DESIGN AND BUILDING OF SMART STREET LIGHT SYSTEM** " is my own work conducted under the supervision of DR.ABHISHEK JOSHI, Assistant professor, SEEE at VIT University, Bhopal.

I further declare that to the best of my knowledge this report does not contain any part of work that has been submitted for the award of any degree either in this university or in other university / Deemed University without proper citation.

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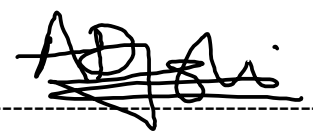

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CERTIFICATE

This is to certify that the work embodied in this Project Exhibition -1 report entitled **"DESIGN AND BUILDING OF SMART STREET LIGHT SYSTEM "** has been satisfactorily completed by **Ms. KRITIKA TRIPATHI** (21BAC10032) and **MR. RAKESH LODHI** (21BAC10034) in the School of Electrical & Electronics Engineering at VIT University, Bhopal. This work is a bonafide piece of work, carried out under my/our guidance in the School of Electrical & Electronics Engineering for the partial fulfilment of the degree of Bachelor of Technology.

PROJECT GUIDE

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Executive Summary

Most of basic street lighting systems are switched ON/OFF at regular intervals of time. In this project the system is to develop a design and building of smart street light system to reduce energy if no vehicles pass through certain roads. The proposed system saves a large amount of the electrical power. In addition, it may increase the lifetime of the lamps. Operation of this system is to maintain the intensity of street lighting to 40% of the maximum intensity if no vehicles passing through the road. When the IR sensor detects movement of the vehicle, the street lights will be switched to 100% intensity. This project technical aspect of smart street light system and the possible energy saved by implementing this proposed system.

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List of Symbols & Abbreviations

IR	Infra Sensor
LDR	Light Dependent resistor
LED	Light Emitting Diode
PWM	Pulse Width Modulation
DBSSLS	Design and building of smart street light system

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Chapter 1

1. Introduction

In present scenario, continuously electricity supply to the consumers is not possible because of production of electricity is less than the utility of electric energy. The solution can be save the electrical energy rather than production of the energy. Saving the energy is more economical than the produce the electrical energy. We all know that, street lighting is one of the important parts of a city's infrastructure where the main function is to lightning the streets of area if cities during the night. The demand of electricity increases day by day. So, energy saving plays a vital role in present scenario. As energy is generated at huge amount, the energy consumed also is at the same rate. And the electrical energy is generated mostly due to non-conventional energy which is depleting day by day. In present scenario the energy consumption is increasing as per the demand, either the same amount of power is to be generated or the power consumption should be reduced. On the national highway there are approximately 500 street lights and each street light consume approx.

1.1 Motivation of the study

All we know is that The current system of street lights consists of manual controls which need Human intervention . This causes the loss of energy due to manual control, so for energy saving we are implementing design and building of smart street light system.These systems are designed in such a way that they could reduce their intensity of light and save energy as much as possible.

1.2 Objective of the work

1.2.1 Automatic switching of streetlights

1.2.2 Maintenance cost reduction

1.2.3 Energy saving

1.2.4 Improved system control

Chapter 2

2. Literature review

[1] Leo Louis et.al [2016] proposed the working principle of Arduino and using it as a tool for study and research. In his paper he discussed the working principle of Arduino and its applications. The different types of Arduino boards and their comparison was discussed and tabulated. The programming part was done with Ardunio IDE tool and explained with some of the examples like Arduino Satellite (ArduSat), Ardupilot (Ardupilot Mega-APM) and Lilly pad Arduino.

[2] S. Suganya (2018) has discussed about Street Light that Glow on detecting vehicle movement using sensor that utilizes the latest technology for sources of light as LED lamps. It is also used to control the switching of street light automatically according to the light intensity to develop flow based dynamic control statistics using infrared detection technology and maintain wireless communication among lamppost and control terminal using ZigBee Wireless protocol. It also combines various technologies: a timer, a statistics of traffic flow magnitude, photodiodes , LED, power transistors.

[3] S. Bhosale, K. Gaware, (2013) has discussed about a new solution for street light control system that consists of wireless technology. The street lights are controlled by the base server.The system solves the energy efficiency problem of conventional solar-powered street lamp system, ensure the traffic safety and prevent crime against night-time walking. It will also help in making our city a Smart City. He use Raspberry ,relay circuit .

[4] K.Santha et al have surveyed on Street Lighting System Based on Vehicle Movements. The system operates in the automatic mode which regulates the streetlight according to brightness and dimness algorithm and light intensity. The control can be made according to the seasonal variation. It includes a time cut-out function and an automatic control pattern for conserving more electricity. The whole project was implemented using a PIC microcontroller.

Chapter 3

3.Problem formulation and proposed methodology

In most of the area, the street lights are ON when it is not needed and It is OFF when is not needed. Because of these situations the huge energy expenses for a area gets wasted. Usually the lights are ON in the evening after the sunset, it continues to be ON till the sun rises in the next day morning.

3.1 PROBLEM FORMULATION

3.1.1 Disadvantages of Classical Street Light:

- Street lights remain always on when there is presence of light.
- These street lights need a manual switching operation.
- It also needs man power.
- These street lights are unnecessarily glowing with its full intensity in the absence of any activities in the street.
- High power consumption and waste of energy.

3.1.2 Advantages of the Proposed System:

- Automatic Switching of Street lights.
- Maintenance Cost Reduction.
- Reduction in CO_2 emission.
- Reduction of light pollution.
- Energy Saving.
- Reduction of manpower

3.2 Proposed methodology

The present system employs power delivery via a single phase line to the streetlight. The proposed system involves five more components to regulate the power delivery. [7] An Infra -Red Proximity Sensor at the base of the street light detects presence in a small area around the street light. The data from the sensor is sent to the Arduino which forms brain of the circuit. The Arduino then commands to switch between dim and bright modes depending upon the requirement and thus controls the brightness of the street light. A battery eliminator, also powered by the single phase line, is used to supply 5V inputs to the sensors and Arduino.

● 3.2.1 Components

Arduino :A microcontroller board contains on-board power supply, USB port to communicate with PC, and an Atmel microcontroller chip. In 2005, building upon the work of Hernando Barragán (creator of Wiring), Massimo Banzi and David Cuartielles created Arduino, an easy-to-use programmable device for interactive art design projects, at the Interaction Design Institute Ivrea in Ivrea, Italy. It is an open source hardware, anyone can get the details of its design and modify it or make his own one himself. Basically there are different types of Arduino boards are available. In this project we used Ardunio uno.

Fig 3.2.1.1Arduino

- **LDR:** A Light Dependent Resistor (LDR) or a photo resistor is a device whose resistivity is a function of the incident electromagnetic radiation. Hence, they are light sensitive devices. They are also called as photo conductors, photo conductive cells or simply

photocells. They are made up of semiconductor materials having high resistance. A light dependent resistor works on the principle of photo conductivity.

Fig 3.2.1.2 LDR

- **IR Sensor:** An infrared sensor is an electronic instrument that is used to sense certain characteristics of its surroundings by either emitting and/or detecting infrared radiation. It is also capable of measuring heat of an object and detecting motion. Infrared waves are not visible to the human eye.

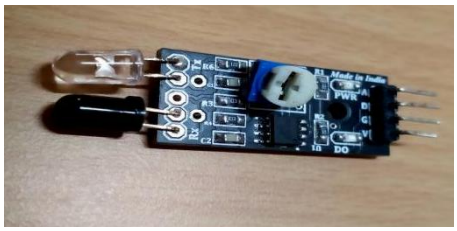


Fig 3.2.1.3 IR sensor

The design basically includes three working modes:-

- **OFF mode:** When there is enough natural light in the surrounding i.e. during the daytime, the entire system is switched off and the batteries are charging.

- **Active mode:** When the natural light drops below a certain level the system automatically turns on and the motion sensors are powered.

- **ON mode:** On the presence of pedestrians, the sensors turns on which in turn switches on the LED lights. These lights turns off after a period of time.

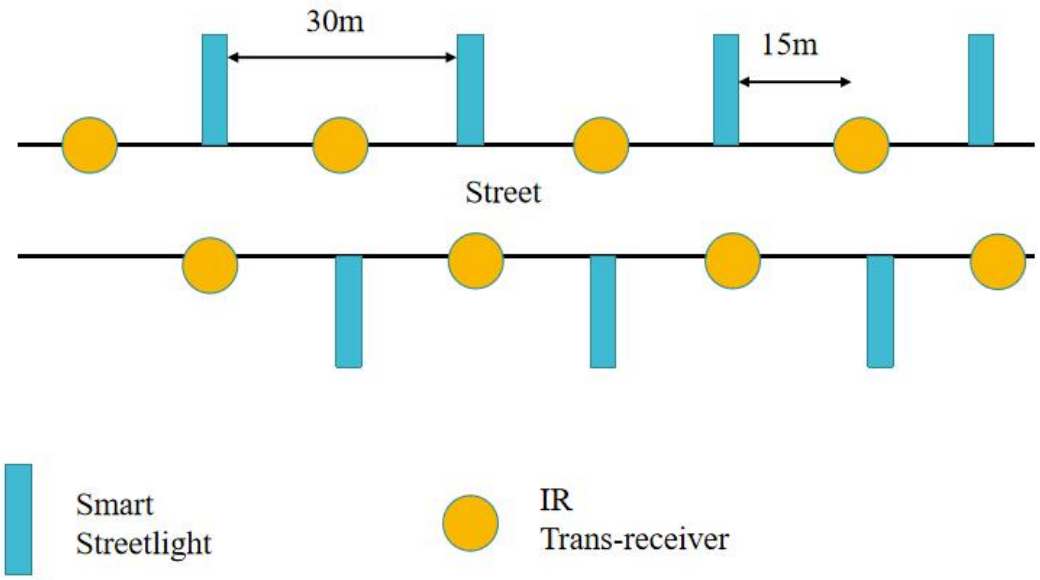


fig.3.2.1 design of model

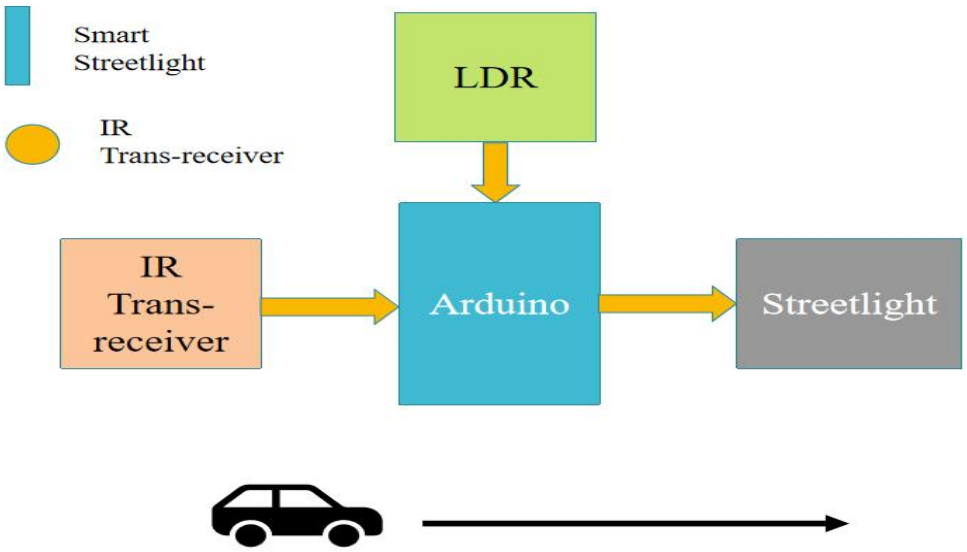
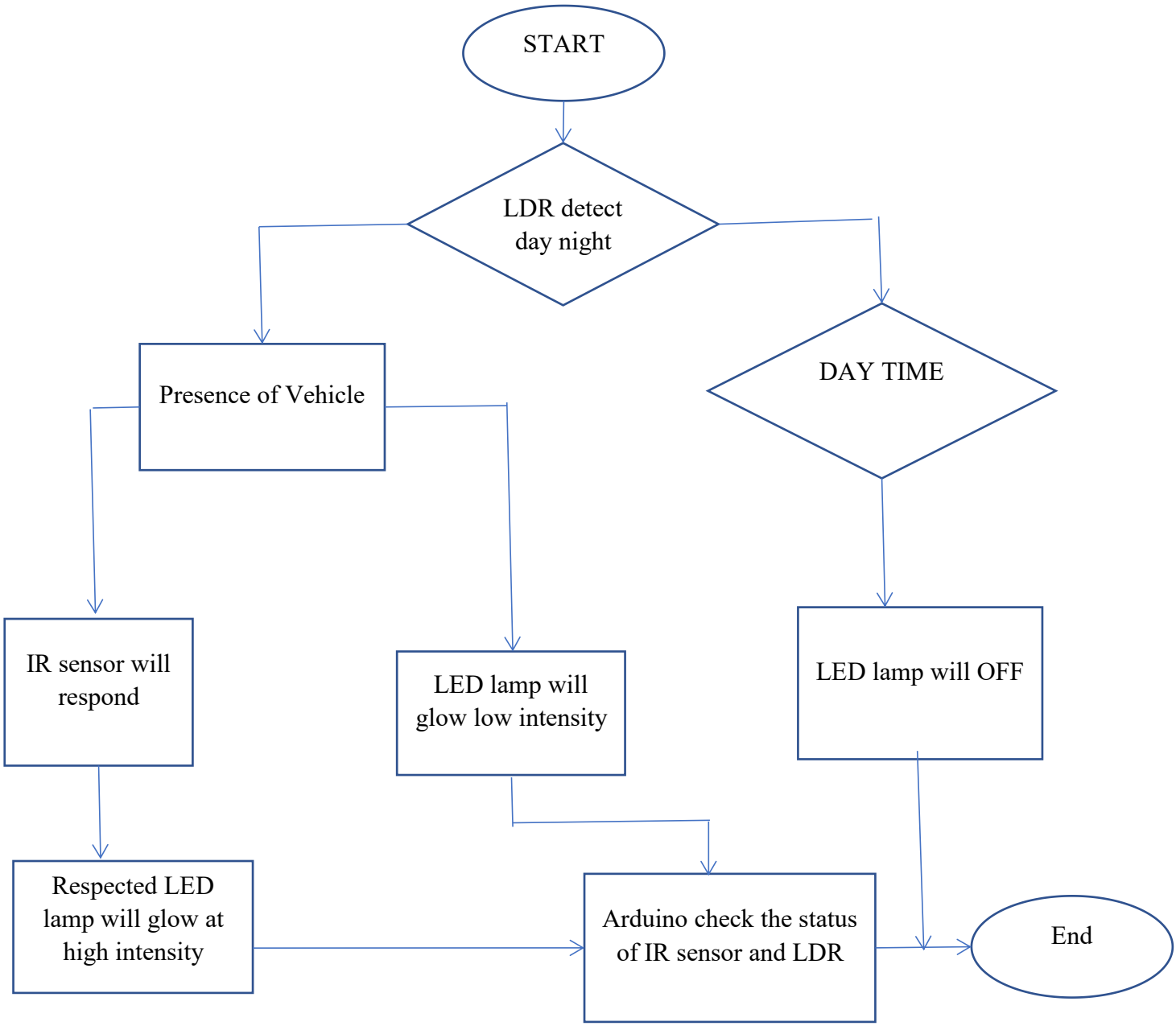


Fig 3.2.2 block diagram

Flow chart of Smart lighting system:



Flow chart 3.2.3 flow chart

3.3 Implementation

Overview: We have used one LDR circuit to know the day and night . LDR with a small register (220ohm) in series is connected across the 5V and GND of the Arduino Uno and from the midpoint of the LDR potential divider circuit the output of the circuit is feed to A0 of the Arduino which turn on all the street lights which are represented by Led connected to the output PWM pin (3 ,5 ,6 ,9 ,).

Four infrared receiver and sender circuits are made to detect the movements and output from the receiver is fed to the input terminal (2,4,,7,8)which corresponds to the led connected to 3 ,5 ,6 ,9 , respectively. All the object sensors are connected between 5V and GND of the Arduino UNO.

Working of the circuit: The output from the LDR is connected to the A0 and initially LDR value is set to zero. The value of LDR reference value is initialized and set to 500(baud rate). If the Arduino UNO reads any value from LDR whose value is less than the LDR reference value than it will turn on the street lights . The output from lR1 and lR2, lR3, and lR4 are connected to the pin 2,4,7,8 corresponds to led connected to ~3,~5,~6,~9,and~10. If any IR sensor detects any presence of objects then then respectively LED will glow with 100% of its intensity otherwise LEDS will be glow with 40% brightness.m If LDR value is more than the LDR reference value than it will turn OFF the street lights .

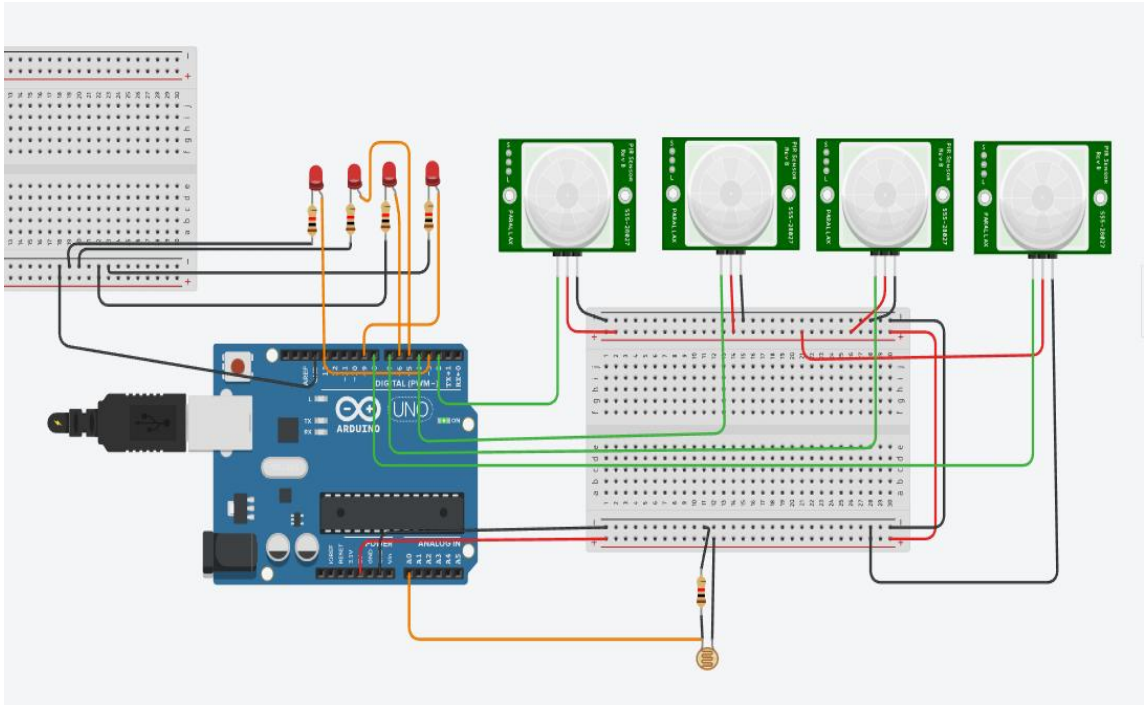


fig 3.3.1 simulation

Chapter 4

4. Results and discussion

Day time LDR>500

Sensors	LED	status
IR1	1	OFF
IR 2	2	OFF
IR 3	3	OFF
IR 4	4	OFF

Table4.1

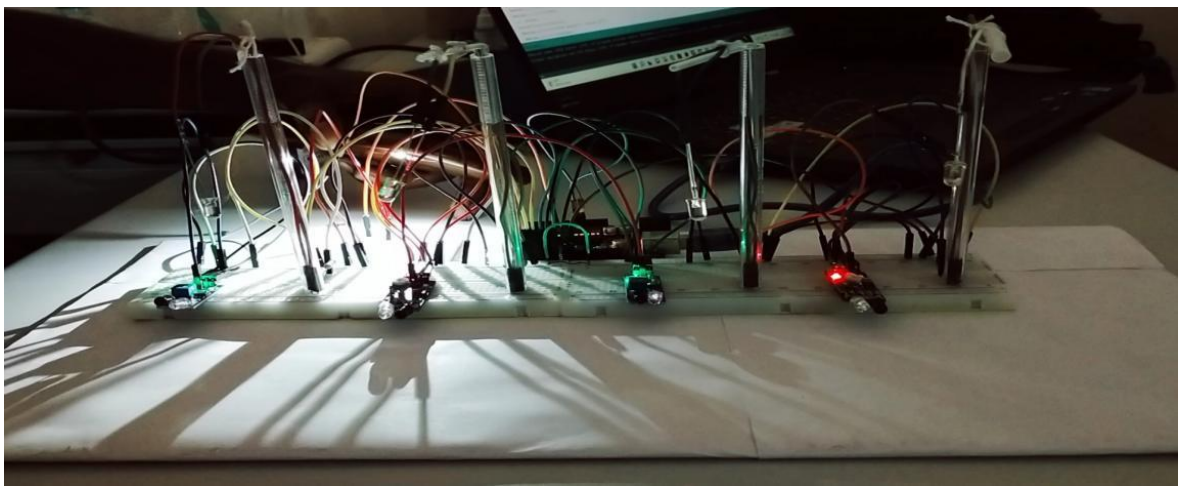


Fig4.1 day time ldr>500

Initial state ldr<500) no obstacle

Sensors	LED	status
IR1	1	40% (Glow)
IR 2	2	40% (Glow)
IR 3	3	40% (Glow)
IR 4	4	40% (Glow)

Table4.2

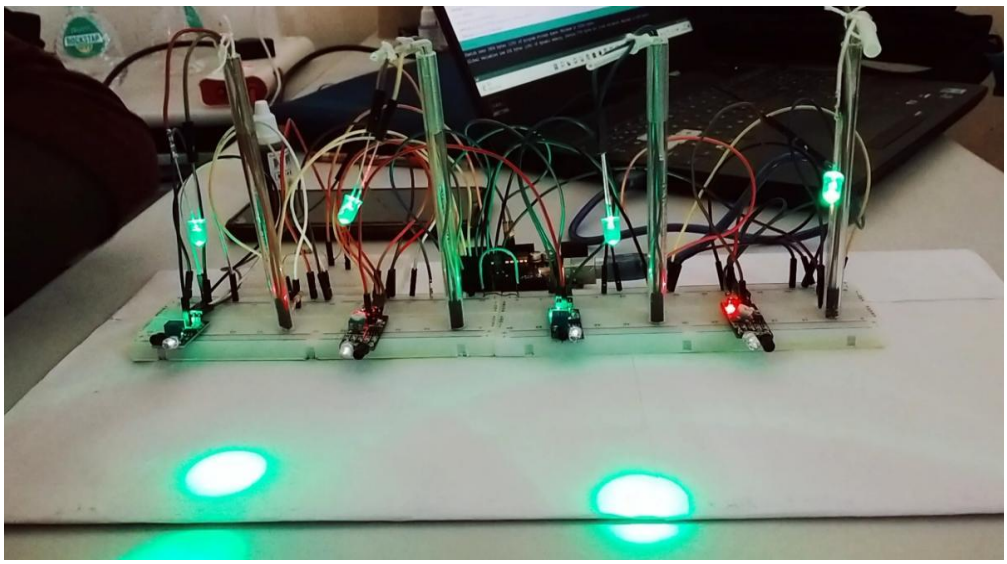


fig.4.2(initial state ldr<500) no obstacle)

IR1 HIGH (LDR<500)

Sensors	LED	status
IR1	1	100% (Glow)
IR 2	2	40% (Glow)
IR 3	3	40% (Glow)
IR 4	4	40% (Glow)

Table4.3

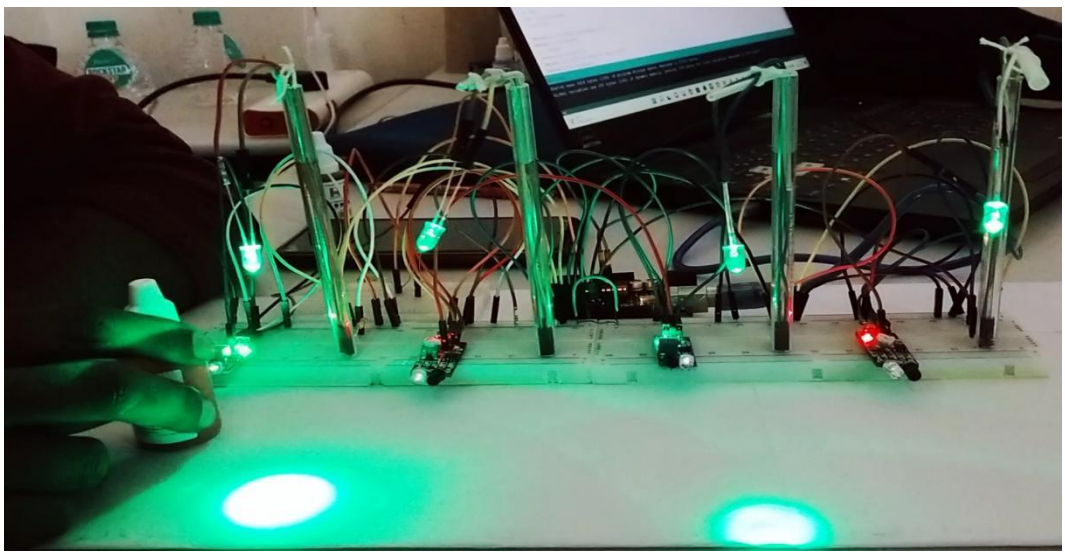


fig 4.3(IR1 HIGH (LDR<500)

Chapter 5

5. Conclusion and future scope

This project discusses the technical aspect of smart street light system and the possible energy saved by implementing this proposed system. The current problem with the conventional system is the long hour operational time which cause a lot of electricity cost. This is a huge waste if it is not taken seriously. Thus, this project proposed the solution to save the energy consumption of street light. Two sensors were used in this proposed smart street light system which is IR Sensor and LDR sensor. By using IR sensor to detect obstacle, it can control the light intensity level which lead to saving energy. Besides, LED bulb used in this project is also able to control the power consumption use by street light and saves the energy up to 40% to 45% .

In future Using this project, we will also estimate the speed of the vehicle, recognizing the number plate, recognizing the accidents took place on roads and also by using IOT we will get alerts related to any damage or fault of each particular streetlight and also we will resolving any technical issue like sorting the faulty streetlight would be easier through the application.

References

[1] Leo Louis, "Working principle of Arduino and using it as a tool for study and research," IJCACS vol 1 ,No 2,April 2016

[2].S. Suganya, "Street light glow on detecting vehicle movement using sensor",International Research Journal of Engineering and Technology (IRJET),2018

[3] S. Bhosale, K. Gaware, "Iot based dynamic control of street lights for smart city", International Research Journal of Engineering and Technology (IRJET), 2013.

[4]. K.Santha Sheela,S.Padmadevi, Survey on Street Lighting System Based On Vehicle Movements

APPENDICES

```
//CODE
void setup() {
// PIN CONNECTION
  Serial.begin(9600);
  pinMode(3,OUTPUT);
  pinMode(5,OUTPUT);
  pinMode(6,OUTPUT);
  pinMode(9,OUTPUT);
  pinMode(2,INPUT);
  pinMode(4,INPUT);
  pinMode(7,INPUT);
  pinMode(8,INPUT);

}

void loop() {
  int ldr;
   ldr= analogRead(A0);
  delay(100);

  Serial.println("the ldr value is");
  Serial.println(ldr);
  int value;
  value=digitalRead(2);
```

```
Serial.println("the sensor0  value is");
Serial.println(value);
int value1;
value1=digitalRead(4);
 Serial.println("the sensor1  value is");
Serial.println(value1);
int value2;
value2=digitalRead(7);
 Serial.println("the sensor2  value is");
Serial.println(value2);
int value3;
value3=digitalRead(8);
Serial.println("the sensor3  value is");
Serial.println(value3);




if( ldr<500){
//When there is no obstacle
if (value==HIGH&&value1==HIGH&&value2==HIGH&&value3==HIGH)
{
  analogWrite(3,40);
  analogWrite(5,40);
  analogWrite(6,40);
  analogWrite(9,40);
```

```
}
//2 obstacle in front of 4th IR sensor
else if (value==HIGH&&value1==HIGH&&value2==HIGH&&value3==LOW)
{
  analogWrite(3,40);
  analogWrite(5,40);
  analogWrite(6,40);
  analogWrite(9,255);

}
//3obstacle in front of 3rd IR sensor
else if (value==HIGH&&value1==HIGH&&value2==LOW&&value3==HIGH)
{
  analogWrite(3,40);
  analogWrite(5,40);
  analogWrite(6,255);
  analogWrite(9,40);

}
//4 obstacle in front of 3rd & 4th IR sensor
 else if (value==HIGH&&value1==HIGH&&value2==LOW&&value3==LOW)
{
  analogWrite(3,40);
  analogWrite(5,40);
  analogWrite(6,255);
  analogWrite(9,255);
```

```
 }
 //5
else if (value==HIGH&&value1==LOW&&value2==HIGH&&value3==HIGH)
 {
   analogWrite(3,40);
   analogWrite(5,255);
   analogWrite(6,40);
   analogWrite(9,40);

 }
 //6
 else if (value==HIGH&&value1==LOW&&value2==HIGH&&value3==LOW)
 {
   analogWrite(3,40);
   analogWrite(5,255);
   analogWrite(6,40);
   analogWrite(9,255);

 }
 //7
 else if (value==HIGH&&value1==LOW&&value2==LOW&&value3==HIGH)
 {
   analogWrite(3,40);
   analogWrite(5,255);
   analogWrite(6,255);
```

```
  analogWrite(9,40);


}
//8
else if (value==HIGH&&value1==LOW&&value2==LOW&&value3==LOW)
{
  analogWrite(3,40);
  analogWrite(5,255);
  analogWrite(6,255);
  analogWrite(9,255);


}
//9
else if (value==LOW&&value1==HIGH&&value2==HIGH&&value3==HIGH)
{
  analogWrite(3,255);
  analogWrite(5,40);
  analogWrite(6,40);
  analogWrite(9,40);


}
//10
else if (value==LOW&&value1==HIGH&&value2==HIGH&&value3==LOW)
{
  analogWrite(3,255);
  analogWrite(5,40);
```

```
  analogWrite(6,40);
  analogWrite(9,255);

}
//11
else if (value==LOW&&value1==HIGH&&value2==LOW&&value3==HIGH)
{
  analogWrite(3,255);
  analogWrite(5,40);
  analogWrite(6,255);
  analogWrite(9,40);

}
//12
else if (value==LOW&&value1==HIGH&&value2==LOW&&value3==LOW)
{
  analogWrite(3,255);
  analogWrite(5,40);
  analogWrite(6,255);
  analogWrite(9,255);

}
//13
else if (value==LOW&&value1==LOW&&value2==HIGH&&value3==HIGH)
{
  analogWrite(3,255);
```

```
  analogWrite(5,255);
  analogWrite(6,40);
  analogWrite(9,40);
}
//14
else if (value==LOW&&value1==LOW&&value2==HIGH&&value3==LOW)
{
  analogWrite(3,255);
  analogWrite(5,255);
  analogWrite(6,40);
  analogWrite(9,255);

}
//15
else if (value==LOW&&value1==LOW&&value2==LOW&&value3==HIGH)
{
  analogWrite(3,255);
  analogWrite(5,255);
  analogWrite(6,255);
  analogWrite(9,40);

}
//16
else if (value==LOW&&value1==LOW&&value2==LOW&&value3==LOW)
{
  analogWrite(3,255);
```

```
   analogWrite(5,255);
   analogWrite(6,255);
   analogWrite(9,255);

 }
 }
else{

   analogWrite(3,0);
   analogWrite(5,0);
   analogWrite(6,0);
   analogWrite(9,0);

 }
 delay(100);
}
```