Group-5

MASTER OF COMPUTER

APPLICATIONS(2022-2024)

INTERNET OF THINGS AND ROBOTICS

LAB VI: ROBOTICS AND IOT LABSEMESTER III

(2023-NOVEMBER 2023)

SMART STREET LIGHT

Department of Computer Science

and Applications

The Gandhigram Rural Institute

(Deemed to be University)

(Ministry of Human Resource Development, Government of India)Accredited by NAAC with 'A' Grade(3rd Cycle)

Gandhigram-624302

Group-5

TITLE: SMART STREET LIGHTING SYSTEM USING ARDUINO AND IR SENSORS

GROUP DETAILS:

M.Jenitha Joy(22322041)

Y.Sagaya Nishalini(22322012)

A.Mithra(22322040)

1.INTRODUCTION:

Street lights are an essential part of all cities and the highways, that's helpful to prevent accidents and unwanted thefts or robbery. Thousands of Street lights are installed beside the highways and the main roads. But the main problem is these street lights consume about 25-30% of the total energy spent in the city.

In this project, our main aim is to develop a "Smart Street light system" that will reduce electric power consumption. The normal street lights always glow with high intensity, who consumes high electricity. But in the case of a smart street lights system, it will glow with high intensity if there are vehicles or human movement on the road otherwise the lights will remain dim. Another advantage of this system is, street lights will automatically turn on in the evening, and turn on automatically at day time (presence of sunlight). By using this system we can save enough amount of electricity and off-course money, this saved electricity can be used to lighten few more homes in the rural areas.

2.COMPONENT REQUIRED

1. IR sensors
2. Arduino Uno
3. LED
4. Jumper wires
5. LDR module
6. BreadBoard

2.1 TABLE OF COMPONENTS NEEDED

Component	**Description**
LDR Module	Measure the intensity of light.
Arduino UNO	Interface with sensors and control data collection.
Jumper Wires	Connecting two points to each other without soldering
LED	Used as Street light.
IR Sensors	To detect motions.

2.2 EXPLANATION WITH DIAGRAM

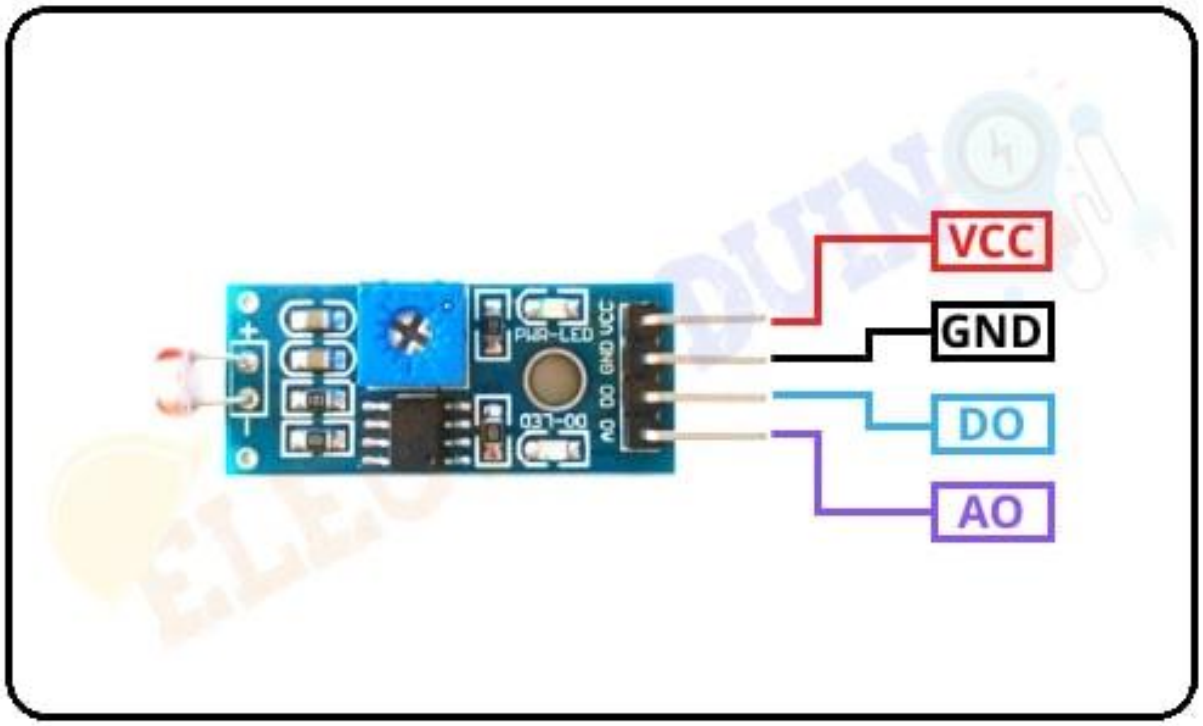
1.LDR Module:

LDR sensor module is a low-cost **digital sensor** as well as **analog sensor** module, which is capable to measure and detect light intensity. This sensor also is known as the **Photoresistor sensor**. This sensor has an onboard LDR(Light Dependent Resistor), that helps it to detect light.

Key Features of LDR Module

- The maximum voltage at 0 lux is 200V
- The peak wavelength is 600nm
- Minimum resistance at 10lux is 1.8kΩ

- Maximum .resistance at 10lux is 4.5kΩ
- Typical resistance at100lux is 0.7kΩ



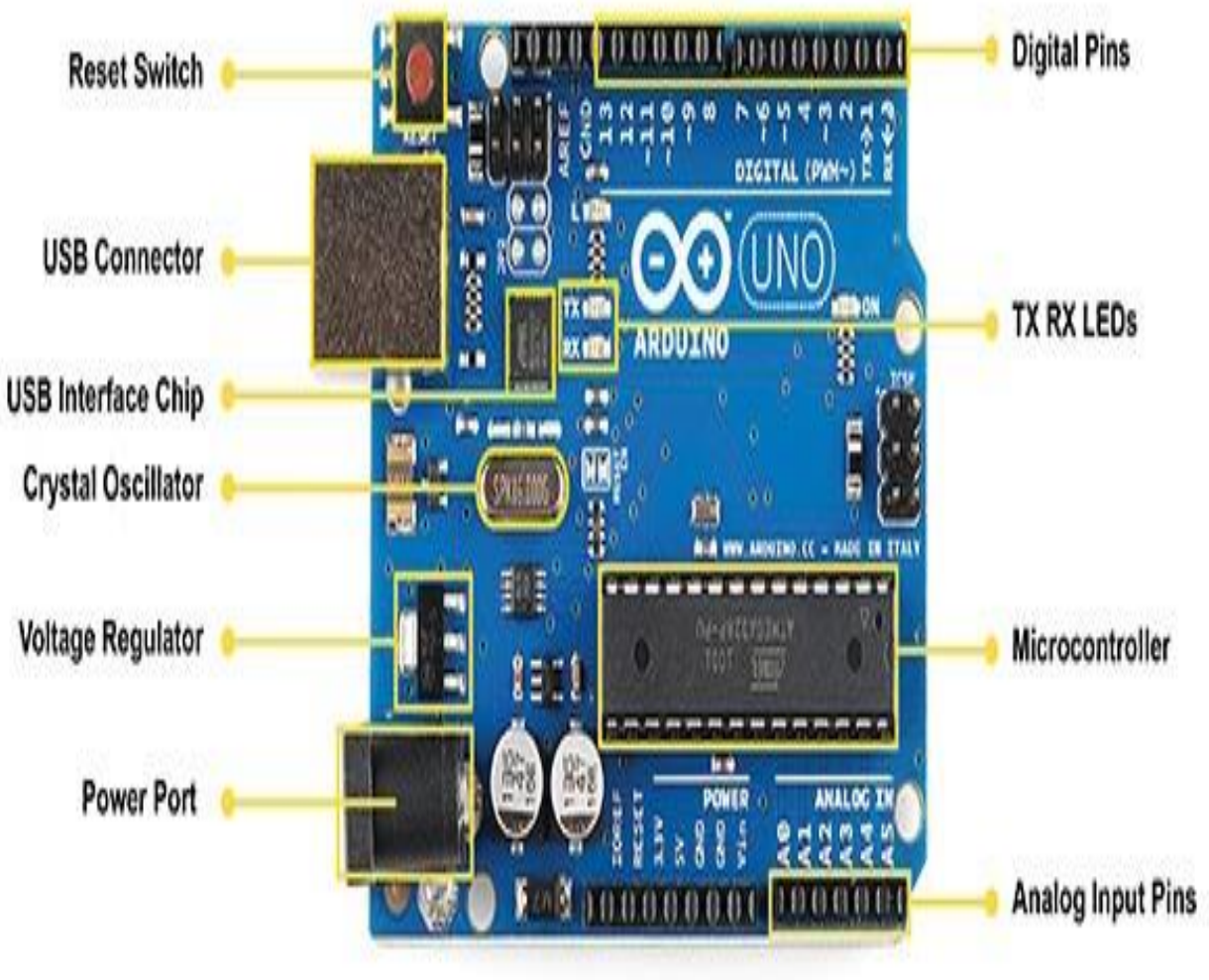
2.Arduino UNO

The Arduino Uno comes with USB interface, 6 analog input pins, 14 I/O digital ports that are used to connect with external electronic circuits. Out of 14 I/O ports, 6 pins can be used for PWM output. It allows the designers to control and sense the external electronic devices in the real world.

components of Arduino UNO board are as follows:

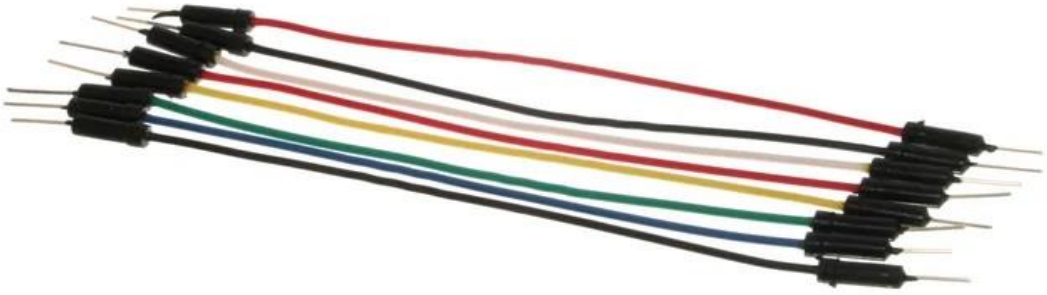
- USB connector
- Power port
- Microcontroller
- Analog input pins

- Digital pins
- Reset switch
- Crystal oscillator
- USB interface chip
- TX RX LEDs



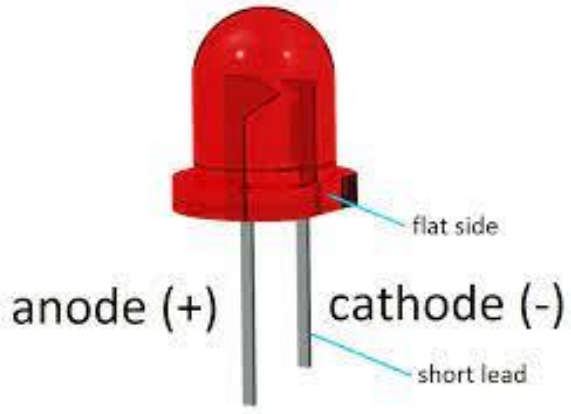
3.Jumper wires:

A jumper wire is an electric wire that connects remote electric circuits used for printed circuit boards. By attaching a jumper wire on the circuit, it can be short-circuited and short-cut (jump) to the electric circuit.



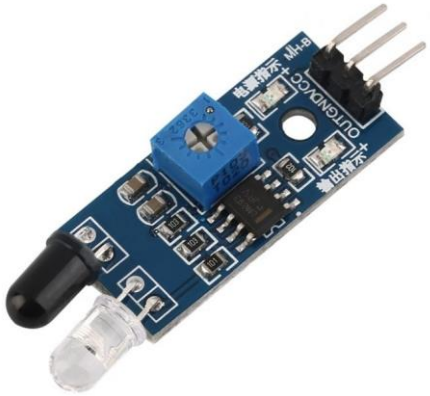
4.LED:

Light-emitting diode (LED) is a widely used standard source of light in electrical equipment. It has a wide range of applications ranging from your mobile phone to large advertising billboards. They mostly find applications in devices that show the time and display different types of data.



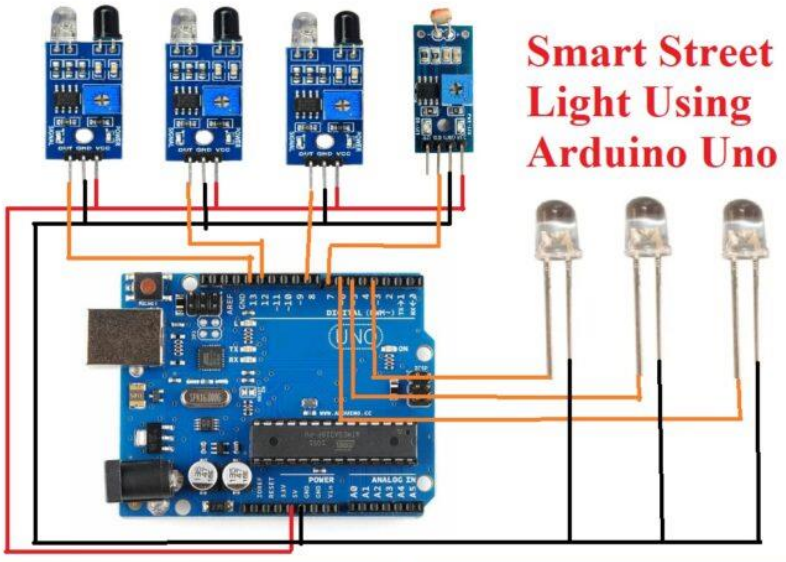
5.IR Sensors:

IR sensor is an electronic device, that emits the light in order to sense some object of the surroundings. An **IR sensor** can measure the heat of an object as well as detects the motion. Usually, in the **infrared spectrum**, all the objects radiate some form of thermal radiation. These types of radiations are invisible to our eyes, but infrared sensor can detect these radiations.



3.EXPRIMENTAL APPROACH:

3.1 SCHEMATIC DIAGRAM:



3.2 CONNECTION PROCESS:

An LDR is connected to the analog pin of the Arduino. It controls the LEDs by detecting the presence or absence of sunlight.

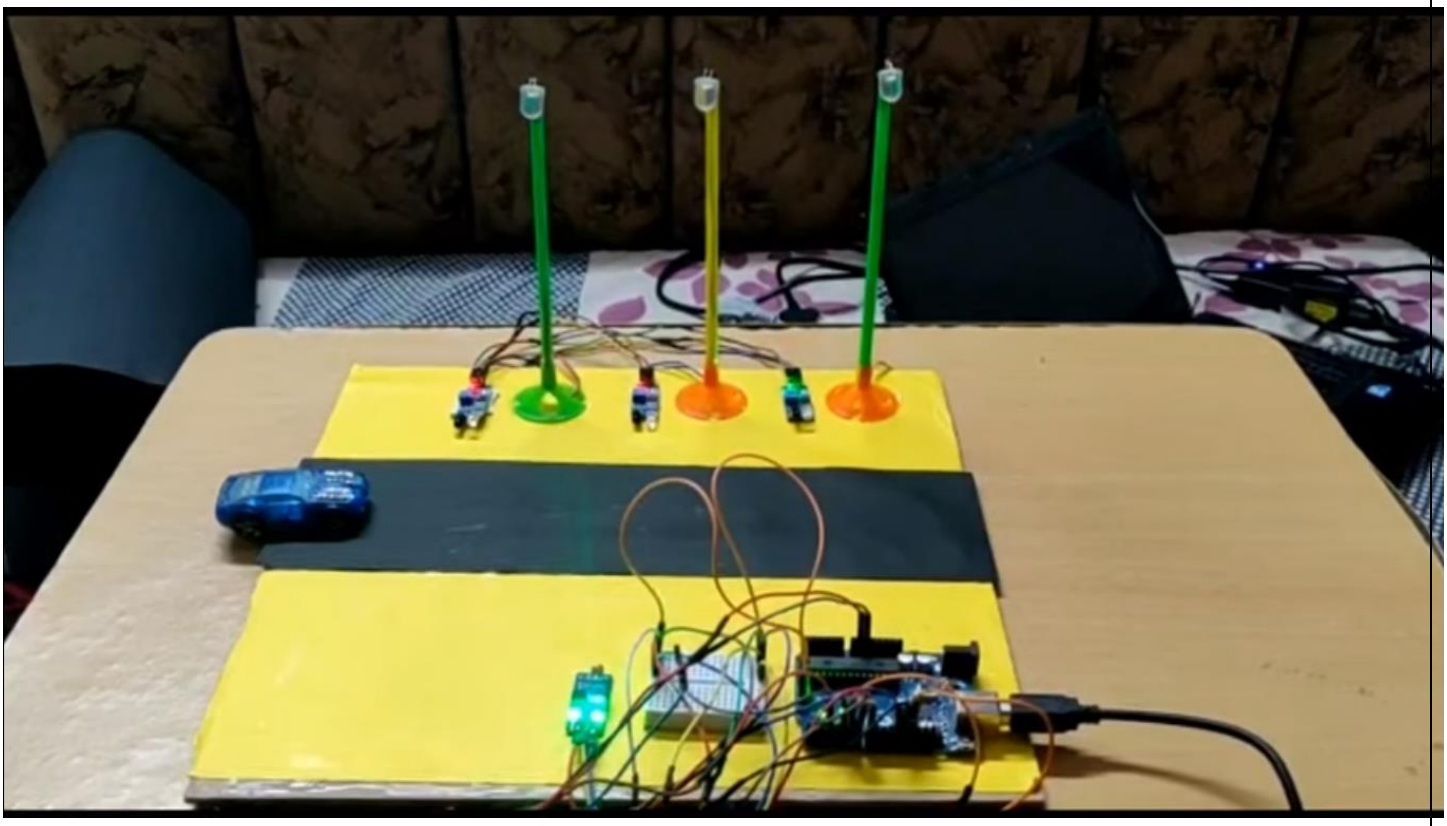
When sufficient sunlight is present in the surroundings, then the LDR offers high resistance and acts as an insulator. In this case, the Arduino read high analog output values from the LDR and automatically turn off all LEDs (streetlights).

During the absence of sunlight, the LDR detects dark and offers Low resistance, and acts as a conductor. In this case, the Arduino read Low analog input values from the LDR and automatically turn on the LEDs (streetlights). At the same time, the IR sensor also starting its operations and start detecting any vehicles or people moving on the road.

In this project, we are using 3 IR sensors that are connected to the digital pins of the Arduino. We also use 3 LEDs that represent the streetlights, each LED connected to the PWM pins of the Arduino. Each IR sensor controls 1 LED.

When any of the IR sensors sense the position of the vehicle or human, its output goes LOW (0). Then the Arduino read Low output value from that sensor and increase the light intensity of two LEDs by using Pulse Width Modulation (PWM) technique.

When the IR sensors don’t detect any vehicle or human position, its output goes High (1). Then the Arduino read High output value from that sensor. Now the Arduino decreases the light intensity of the LEDs by using Pulse Width Modulation (PWM) technique.



3.3 PIN CONNECTIONS:

SENSOR CONNECTIONS:

- Vcc → 5V
- Out →A0
- GND →GND

LED CONNECTIONS:

- GND →GND
- Vcc →5V
- Out → D0

4.CODE

4.1 SOURCE CODE:

```
int IR1 = 8;
int IR2 = 12;
int IR3 = 13;
int LDR = 7;
int led1 = 3;
int led2 = 5;
int led3 = 6;
int val1;
int val2;
int val3;
int val4;

void setup()
{
pinMode(IR1,INPUT);
pinMode(IR2,INPUT);
pinMode(IR3,INPUT);
```

```
pinMode(LDR,INPUT);
pinMode(led1,OUTPUT);
pinMode(led2,OUTPUT);
pinMode(led3,OUTPUT);

}

void loop() {
val1 = digitalRead(IR1);
val2 = digitalRead(IR2);
val3 = digitalRead(IR3);
val4 = digitalRead(LDR);

if(val1==1&&val4==0&&val2==1&&val3==1)
{
digitalWrite(3,LOW);
digitalWrite(5,LOW);
digitalWrite(6,LOW);

}
else if(val1==1&&val4==1&&val2==1&&val3==1)
{
analogWrite(3,20);
analogWrite(5,20);
analogWrite(6,20);
}

else if(val1==0&&val4==1&&val2==1&&val3==1)
{
analogWrite(3,500);
analogWrite(5,20);
analogWrite(6,20);
}
else if(val1==1&&val4==1&&val2==0&&val3==1)
{
analogWrite(3,20);
analogWrite(5,500);
analogWrite(6,20);
}
else if(val1==1&&val4==1&&val2==1&&val3==0)
```

```
{
analogWrite(3,20);
analogWrite(5,20);
analogWrite(6,500);
}
}
```

4.2 Code Explanation:

This Arduino code controls several pins connected to infrared sensors (IR) and Light Dependent Resistor (LDR) as well as LEDs.

Pin Assignments:

- **int IR1 = 8;**, **int IR2 = 12;**, **int IR3 = 13;**, **int LDR = 7;**: These variables hold the pin numbers where the IR sensors and the LDR are connected.
- **int led1 = 3;**, **int led2 = 5;**, **int led3 = 6;**: These variables hold the pin numbers where the LEDs are connected.

setup() Function:

The **setup()** function is used for initialization and runs once at the start of the program. Here, it sets the modes for the various pins:

- **pinMode(IR1, INPUT);**, **pinMode(IR2, INPUT);**, **pinMode(IR3, INPUT);**, **pinMode(LDR, INPUT);**: Sets the IR sensors and LDR pins as input.
- **pinMode(led1, OUTPUT);**, **pinMode(led2, OUTPUT);**, **pinMode(led3, OUTPUT);**: Sets the LED pins as output.

loop() Function:

The **loop()** function continuously runs after **setup()**. It reads the values from the sensors and controls the LEDs based on the conditions.

Control Logic:

- It reads the digital values from the IR sensors and the LDR using **digitalRead()** and stores them in variables **val1**, **val2**, **val3**, and **val4**.
- Then, it checks different combinations of these sensor readings and controls the LEDs accordingly using **digitalWrite()** and **analogWrite()** functions.

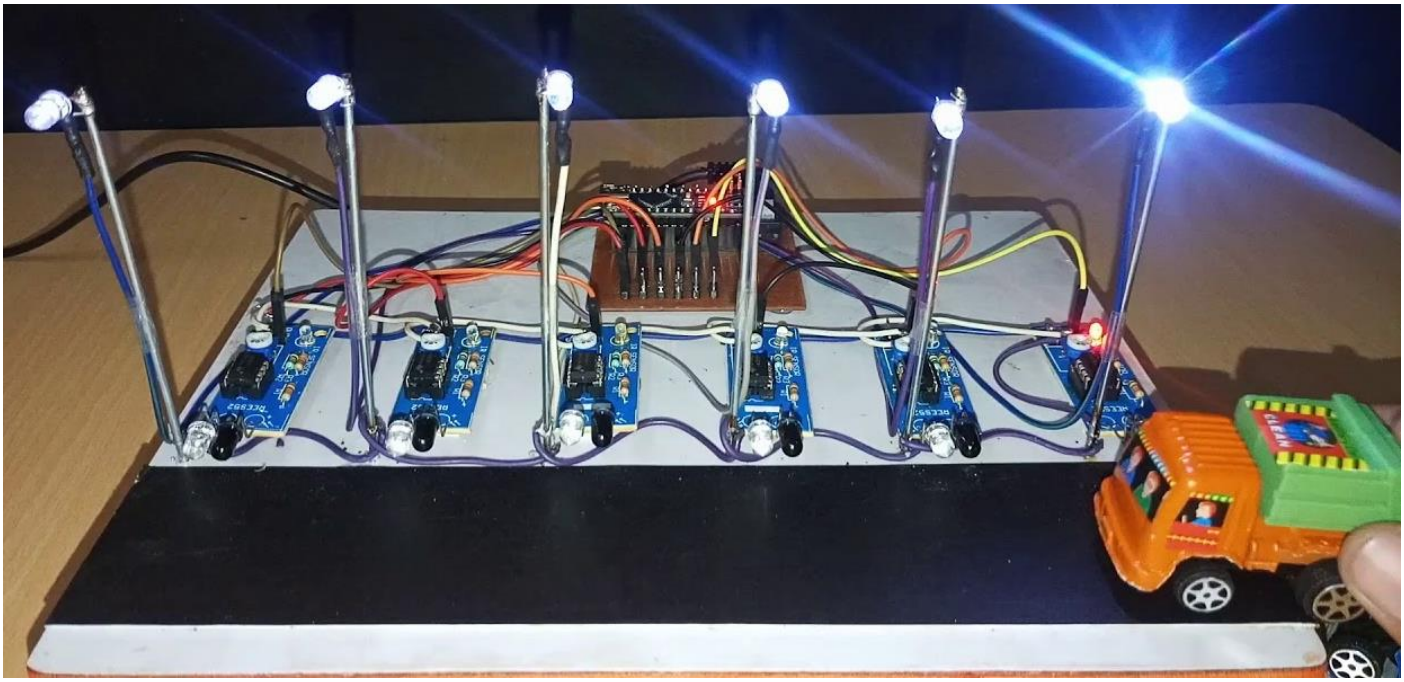
Conditions:

- **if**, **else if** conditions check different sensor readings:
    - If certain combinations of sensors are triggered (**val1**, **val2**, **val3**, **val4** are in certain states), it turns off all the LEDs (**LOW**) or sets them to specific brightness levels using **analogWrite()**.

The LED control is based on specific conditions related to the readings of the IR sensors and the LDR. For instance, if **val1** is 1, **val4** is 0, **val2** is 1, and **val3** is 1, all LEDs are turned off. Other conditions result in different LED brightness settings based on the combination of sensor readings.

5.Experimental Result and Discussion:

In the daytime, the system detects the sunlight by the LDR and it will be turned OFF the street lights (LED). When the system detects dark (after evening), then it will turn on the street lights (LED). After turn on the streetlight, if the system doesn't detect any vehicles or human movement on the road by the IR Sensor, then it will glow the lights with low intensity. When the system detects vehicles or human movement by the IR Sensor, then it will glow the street lights with high intensity.



DISCUSSION:

Street Lights using IoT will also reduce Light pollution. Power Consumption is quite low in these street lights using IoT which also leads to energy conservation. No large manpower is required to maintain these street lights using IoT.

Street lights illuminate the adjoining areas of the road and the area beyond the range of the vehicle headlights to help drivers be vigilant and to alert them of possible hazards. The accident rate on unilluminated roads at night-time is about three times the day time rate.

6.CONCULSION:

Smart street lighting consumes the energy efficiently with the help of solar panel. It also reduces the manual work of controlling the lighting systems. Motion detection of the object is made and the street lights are switched ON and OFF according to that.

REFERENCES:

https://www.electroduino.com/smart-street-light-system-using-ir-sensor-and-arduino/