AMRITA VISHWA VIDYAPEETHAM | School Of Computing

Internet Of Things
19CSE446

Smart Street Light System with Multi-Sensor Integration

Amrita Vishwa Vidyapeetham Chennai
– 601 103, Tamil Nadu, India.

March 2023

Done By

Dinesh Kumar [CH.EN.U4CYS21014]
Jawakar [CH.EN.U4CYS21025]

Abstract:

The Automatic Street Light System with Sensor Integration and Wireless Communication aims to improve the efficiency and safety of street lighting by incorporating sensors and wireless modules. This project utilizes Light Dependent Resistors (LDR) to detect environmental brightness and Passive Infrared (PIR) sensors to detect vehicle motion. The system adjusts street light intensity based on ambient light levels and vehicle presence, optimizing energy usage and enhancing safety. Additionally, it employs an ESP8266 Wi-Fi module for wireless communication, facilitating fault detection and remote monitoring. The project demonstrates the feasibility and benefits of smart infrastructure in urban environments.

Introduction:

Traditional street lighting systems often operate inefficiently, leading to energy wastage and inadequate safety measures. The Automatic Street Light System addresses these issues by integrating sensors and wireless communication modules. This report provides a detailed overview of the project's objectives, methodology, components used, and results. The thought of outlining a new framework for the streetlights that do not devour immense measure of power and light up vast zones with high intensity. smart streetlights framework is an essential piece of the smart city which represents 10-40% of aggregate power utilizations which is a discriminating attentiveness toward general society powers. So, vital and productive vitality advancements are to be executed for monetary and social security.

Project Description:

1.Sensor Integration:

1.1) Light Dependent Resistor (LDR):

- The LDR sensor detects ambient light levels to determine whether streetlights should be activated.

- During low light conditions or nighttime, the LDR triggers the activation of streetlights to ensure visibility and safety.

- Additionally, the LDR sensor facilitates fault detection by identifying light malfunctions, such as burnt-out LEDs, and communicates these issues to the control room via the wireless module.

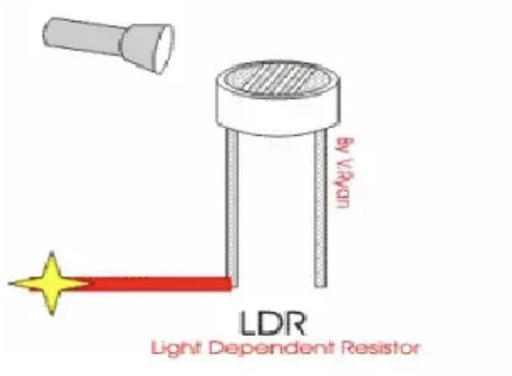


Fig: 1.1) Schematic illustration of the LDR

1.2) Passive Infrared (PIR) Sensor:

- PIR sensors are used to detect the motion of vehicles or pedestrians near streetlights.
- When motion is detected, the system adjusts the intensity of the streetlights to ensure optimal visibility and safety.
- Integration with the LDR sensor allows for intelligent control, ensuring that streetlights respond appropriately based on both ambient light levels and motion detection.

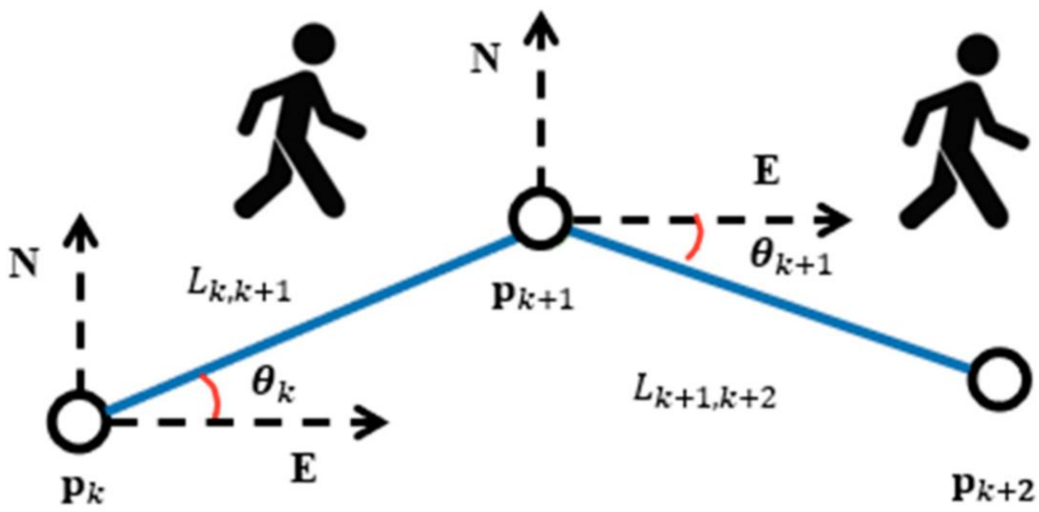


Figure: 1.2) Schematic illustration of the PDR.

1.3) Ultrasonic Sensor:

- Ultrasonic sensors are employed to detect the presence and distance of objects, particularly vehicles or pedestrians crossing the street.

- The sensor enhances the system's ability to detect and respond to approaching objects, allowing for more precise control of street light intensity.

- Integration with the PIR sensor further enhances the system's capability to adapt street light operation based on real-time environmental conditions and pedestrian movement.

- The ultrasonic sensor is a non-contact type of sensor used to measure an object's distance and velocity.

- Ultrasonic transducers and ultrasonic sensors are devices that generate or sense ultrasound energy. They can be divided into three broad categories: transmitters, receivers and transceivers

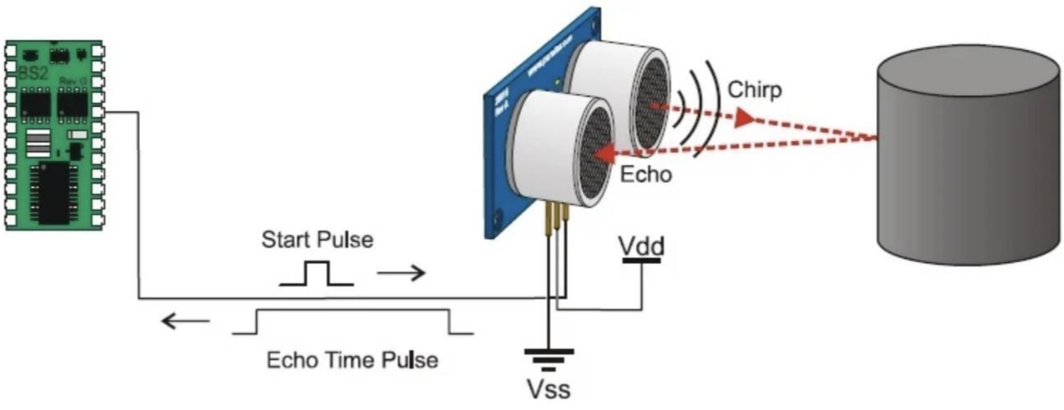


Figure: 1.3) Schematic illustration of the Ultrasonic

2.Motion Detection:

- PIR sensors are utilized for motion detection.
- Ultrasonic sensors help to detect the person or motion of vehicle.

- PIR sensors detect the heat signature of vehicles or pedestrians, triggering the adjustment of street light intensity when motion is detected.
- Ultrasonic sensors complement the motion detection capabilities by accurately measuring the distance of approaching vehicles, enabling the system to anticipate and respond to vehicle movement more effectively.

3.Wireless Communication:

Prior to packets going through rule matching, preprocessors are modules. By managing operations like protocol normalization, stream reassembly, and defragmentation, they make it possible to identify sophisticated attacks with greater accuracy.

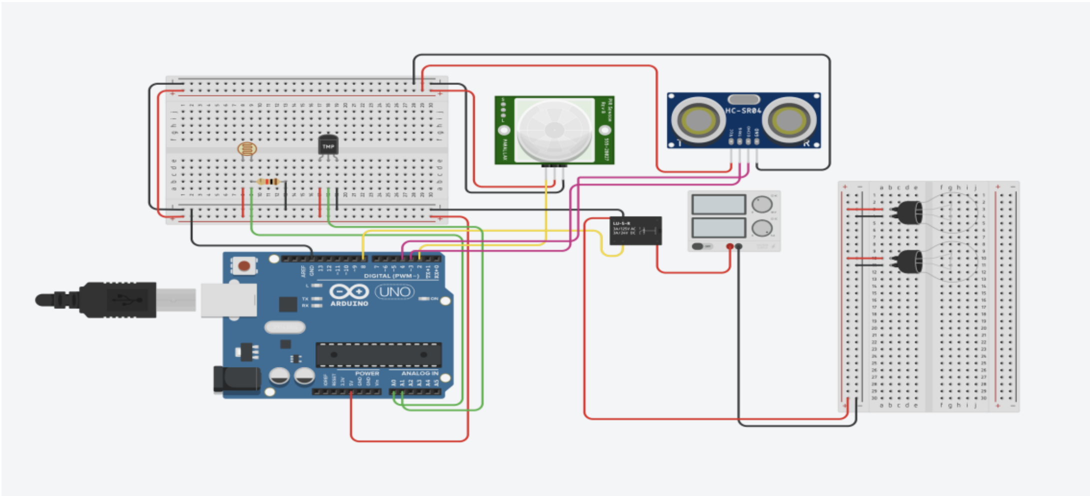
- **Logging and Alerting: Snort can log events it detects to output formats, such as databases, text files, and syslog servers.** Additionally, it produces warnings instantly, giving managers advance notice of possible security concerns.

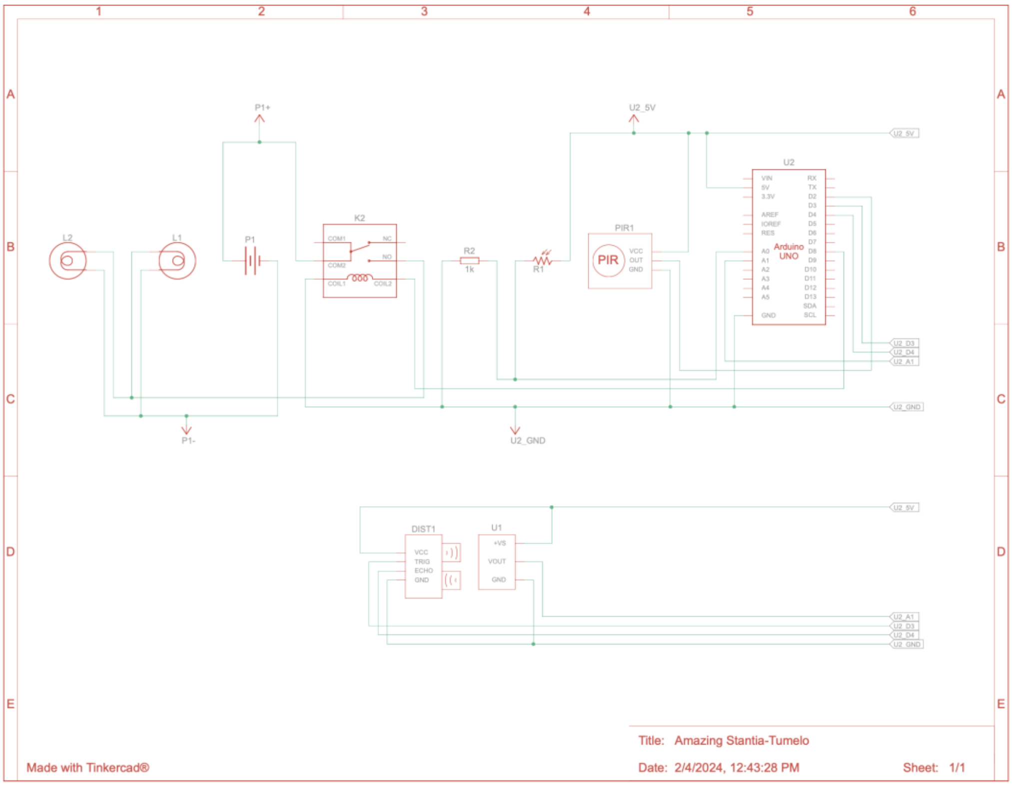
- **Output Plugins**: With the help of these plugins, Snort can be more easily integrated with other systems for additional analysis, reporting, or reaction actions.

For network intrusion detection, Snort provides a strong and adaptable solution that enables enterprises to proactively guard against a variety of cyberthreats, including DDoS attacks.

Snort is a useful tool for preserving the security and integrity of network infrastructures when it is configured correctly and is continuously monitored.

Tinker Cad:





Schematic View: Smart Street Light System with Multi-Sensor Integration

6. Components:

1. Arduino or similar microcontroller for central processing
2. Light Dependent Resistor (LDR) sensor to detect ambient light levels
3. Passive Infrared (PIR) sensor to detect motion
4. Ultrasonic sensor to measure distance
5. LED streetlights or similar actuators for illumination
6. ESP8266 Node MCU Wi-Fi module for wireless communication
7. Breadboard and jumper wires for circuit connections
8. Power source, such as a battery or power adapter
9. Resistors, capacitors, and other electronic components for circuitry

7.Source Code:

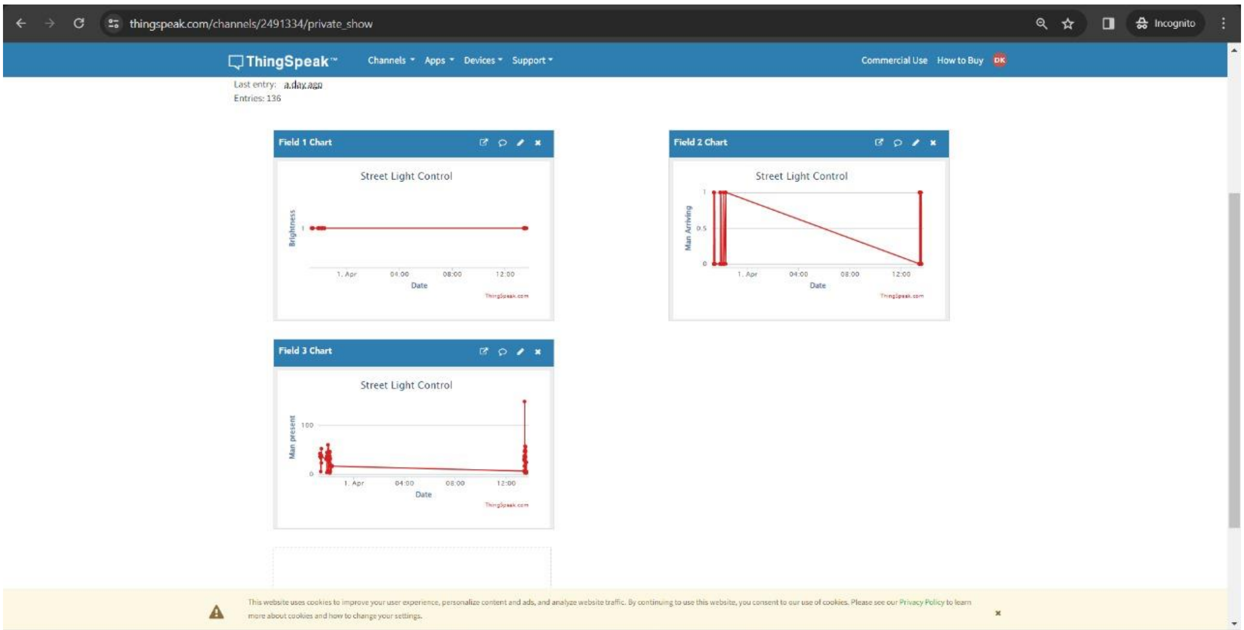
```
#include<ESP8266WiFi.h>

String API_KEY = "POXPR2L8AEQBB6F4";
String ssid = "Dinesh's";
String password = "12345678";
String server = "api.thingspeak.com";


int PHOTO_SEN = 16;
int LIGHT = 5;
int PIR_SEN = 4;


int US_TRIGGER = 12;
int US_ECHO = 14;
float distance, duration;
```

```
WiFiClient client;

void setup(){
  pinMode(PHOTO_SEN, INPUT);
  pinMode(LIGHT, OUTPUT);
  pinMode(PIR_SEN, INPUT);
  pinMode(US_ECHO, INPUT);
  pinMode(US_TRIGGER, OUTPUT);
  Serial.begin(115200);
  delay(10);
  pinMode(2, OUTPUT);
  digitalWrite(2, 0);
  Serial.print("Connecting to ");
  Serial.println(ssid);
  WiFi.begin(ssid, password);

  while(WiFi.status() != WL_CONNECTED){
    delay(500);
    Serial.print(".");
  }
  Serial.println("");
  Serial.println("Wifi Connected");
}


void loop(){
  int light_val = digitalRead(PHOTO_SEN);


  String data = API_KEY;
  data+= "&field1=";
  data+= light_val;


  if(light_val==1){
    int pir_val = digitalRead(PIR_SEN);

    data+= "&field2=";
    data+= pir_val;
    if(pir_val==1){
      Serial.println("Man Coming");
      digitalWrite(LIGHT, HIGH);
      delay(3000);
    }
    else digitalWrite(LIGHT,LOW);
```

```
digitalWrite(US_TRIGGER,HIGH);
    delay(10);
    digitalWrite(US_TRIGGER,LOW);
    duration = pulseIn(US_ECHO,HIGH);
    distance = duration*0.034/2.0;

    data+= "&field3=";
    data+= distance;


    digitalWrite(LIGHT, (distance<=30)?HIGH:LOW);


    data+="\r\n\r\n";
    if(client.connect(server,80)){
      client.print("POST /update HTTP/1.1\n");
      client.print("Host: api.thingspeak.com\n");
      client.print("Connection: close\n");
      client.print("X-THINGSPEAKAPIKEY: "+ API_KEY +"\n");
      client.print("Content-Type : application/x-www-form-urlencoded\n");
      client.print("Content-Length: ");
      client.print(data.length());
      client.print("\n\n");
      client.print(data);
      delay(1000);
      Serial.print("Distance : ");
      Serial.println(distance);
    }

    client.stop();
  }



  else{
    Serial.println("Morning");
    digitalWrite(LIGHT, LOW);
  }
}
```

7. Results/Output:

Online Web Application Control System



Online Cloud Data Analytics

8.Conclusion:

More effective in case of cost, workforce and security as compared with today's running complicated and complex light controlling systems. Automatic Street Light Controlling System puts up a very user-friendly approach and could increase the power. The Streetlight controller using LDR based Light intensity & traffic density, in today's growing countries will be paper elaborates the design and construction of automatic street control system circuit. Circuit works properly to turn streetlamp ON/OFF. After designing the circuit which controls the light of the street as illustrated in the previous sections. LDR sensors are the main conditions in working the circuit. If the two conditions have been satisfied the circuit will do the desired work according to the program.

Each sensor controls the turning ON or OFF the lighting column. The streetlights have been successfully controlled by microcontroller. With commands from the controller the lights will be ON in the places of movement when it's dark. Furthermore, the drawback of the street light system using timer controller has been overcome, where the system depends on photoelectric sensor. Finally, this control circuit can be used in a long roadway between them.