Chapter-1

Introduction

Street lights play a crucial role in ensuring safety and security on roads and highways. However, the conventional street lighting systems consume a significant amount of energy, contributing to high electricity bills. To address this issue, we propose a "Smart Street Light System" that optimizes energy usage while maintaining safety.

Project Concept

The core components of our system include:

1. **Light Dependent Resistor (LDR):** The LDR senses ambient light levels. During the day, when sunlight is abundant, the system keeps the street lights off. As evening approaches, the LDR detects darkness and triggers the system to activate the lights.
2. **Infrared (IR) Sensor:** The IR sensor acts as the "eyes" of our system. It detects the presence of vehicles or pedestrians on the road. When no movement is detected, the lights remain dim. However, if a vehicle or person is detected, the lights illuminate at full intensity.
3. **Rain Sensor:** Although not explicitly mentioned, integrating a rain sensor enhances the system's efficiency. During rainy conditions, the system can adjust the light intensity based on rain intensity or even turn off unnecessary lights to save energy.

Working Principle

1. **Daytime Operation:**
    - LDR detects sunlight.
    - System keeps street lights off.
    - Energy savings during daylight hours.
2. **Evening/Night Operation:**
    - LDR senses darkness.
    - Street lights turn on automatically.
    - IR sensor monitors road activity.
    - If no movement detected, lights remain dim.
    - Upon detecting vehicles or pedestrians, lights glow brightly.
    - Rain sensor (if included) adjusts lighting based on rain conditions.

Benefits

1. **Energy Efficiency:**
    - Reduced energy consumption compared to traditional street lights.
    - Savings contribute to overall energy conservation.
2. **Cost Savings:**
    - Lower electricity bills for municipalities.
    - Funds can be redirected to other community needs.
3. **Safety and Security:**
    - Bright lights when needed (vehicle/pedestrian presence).
    - Dim lights during idle periods (energy savings).

By implementing this Smart Street Light System, we can create more sustainable and cost-effective urban lighting solutions. Let's illuminate our streets intelligently while minimizing our environmental impact!

Automation systems are being preferred over the manual mode because it reduces the use of energy to saves energy. These automation systems play an essential role in making our daily life more comfortable and facilitate users from ceiling fans to washing machines and in other applications. Among all exciting applications, street lights play a vital role in our environment and also plays a critical role in providing light for safety during night-time travel. In this scenario, when the street lights are in working functionality over the whole night that consumes a lot of energy and reduces the lifetime of the electrical equipment such as electric bulb etc. Especially in cities' streetlights, it is a severe power consuming factor and also the most significant energy expenses for a city. In this regard, an intelligent lighting control system can decrease street lighting costs up to 70% and increase the durability of the equipment. The traditional lighting system has been limited to two options ON and OFF only, and it is not efficient because this kind of operations meant power loss due to continuing working on maximum voltage. Hence, wastage of power from street lights is one of the noticeable power loss, but with the use of automation, it leads to many new methods of energy and money saving. In this regard, controlling lighting system using Light Dependent Resistor (LDR), IR obstacle detector sensor and Arduino together is proposed in the past. In the meanwhile, the importance of smart light system has motivated a lot of studies and the series of research work has been done. In previous works, the street light systems are based on LDR, and most of them are passive infrared receiver-based systems that are controlled with timers and analog circuits. Sun tracking sensors are also utilized to power OFF the street lights by the detection of the sunlight luminance. Furthermore, street light control with the use of solar energy, and ZigBee based system to control street light have also been implemented. Distinguished from turning ON/OFF the electricity, another approach is introduced to dim the light in fewer traffic hours that might be useful to reduce the power consumption, but the electric bulbs are in continuous usage condition. To the best of our knowledge, a need is still existed to design a system that controls the dim light, connect the power ON/OFF with the vehicle's motion detection, calculate the total number of vehicles passed through the road, and control the entrance gate at night to reduce criminal activities.

The most natural solution is to control the street lights according to the outside lighting condition. This is what our paper is aiming for in smart lighting system in which the street lights will be turned OFF when there are no motion detections or day-time, otherwise the lights will be remained Dim/ON. Our proposed design is aimed at efficiently replacing any light systems that are manually controlled, and this is accomplished with the properly arrangements of microcontroller Arduino Uno, IR obstacle avoidance sensor, LDR, and Resistors. In this scenario, when the intensity of sunlight impinges with LDR, street lights can be further controlled as per the desired requirement, automatically. Most importantly, a counter is set to count the number of vehicles/objects passing through the road, which will be displayed on the serial monitor of Arduino IDE [6]. Moreover, the high-intensity discharge street bulbs [23] are replaced with LEDs to further reduce the power consumption. An automatic street light system does not help us in reducing the power consumption only, but also to reduce accidents, criminal activities and maintenance costs.

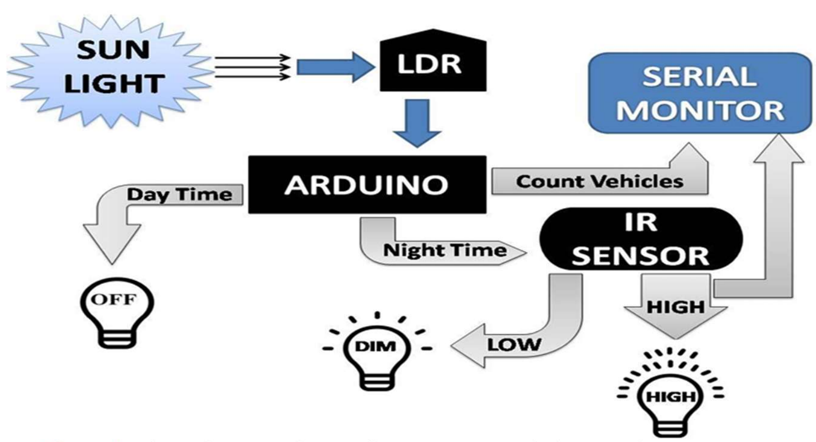


Figure 1. The architecture design of automatic street light control system.

1.2 Problem statement

The urban areas of our cities face a significant challenge in managing street lighting effectively. Traditional street light systems consume excessive energy, leading to high operational costs and environmental impact. The consequences include increased energy bills, inefficient resource utilization, and unnecessary light pollution. However, this issue is further complicated by various factors such as varying traffic patterns, changing weather conditions, and the need for safety and security.

The urban landscape grapples with an urgent challenge: inefficient street lighting systems. These conventional setups drain excessive energy, leading to soaring operational costs and environmental repercussions. The consequences include wasteful resource utilization, elevated energy bills, and unnecessary light pollution. Moreover, the issue is compounded by varying traffic patterns, unpredictable weather conditions, and the critical need for safety and security.

Addressing this problem is crucial because it directly impacts our cities' sustainability, financial health, and overall quality of life. By developing a smart street light system that adapts intelligently to environmental cues and road activity, we can enhance energy efficiency, reduce costs, and create safer, more sustainable urban spaces.

1.3 Objectives

The key objectives for the Smart Street Light System project:

1. **Energy Optimization:** Develop an intelligent system that minimizes energy consumption by activating street lights only when necessary (i.e., during low ambient light conditions or when road activity is detected).
2. **Adaptive Brightness:** Implement dynamic brightness control based on real-time factors such as traffic flow, pedestrian presence, and weather conditions. Dim lights during idle periods and increase brightness when needed.
3. **Cost Reduction:** Reduce operational costs for municipalities by optimizing energy usage. Redirect saved funds to other community needs.
4. **Safety Enhancement:** Ensure well-lit roads for pedestrians and drivers during nighttime hours. Detect and respond to road activity promptly.
5. **Environmental Impact:** Contribute to sustainability by minimizing energy waste and light pollution.

Chapter 2

Literature survey

literature survey on smart street lighting systems using data from several research papers. Here are key findings and insights:

"Smart Street Lighting Using IoT",2020: Examines transformative potential of smart street lighting. Utilizes advanced technologies like LED lighting, adaptive controls, and IoT sensors. Achieves energy savings up to 50% compared to traditional lighting. Collects real-time data on pedestrian activities, weather conditions, and traffic flow. Enhances safety measures and urban planning.

"Smart Street Light System",2022:Discusses various sensor technologies (IR sensors, PIR sensors, ultrasonic sensors). Highlights benefits: energy savings, improved safety, and reduced maintenance costs.

"Assessment of Energy-Efficient Smart Street Lighting",2022: Provides a step-by-step approach for evaluating feasibility. Considers European and American standards. Compares results using data from worldwide cities.

"IoT-Based Smart Street Lighting Surveillance System",2022: Focuses on control of street lights using IoT. Addresses cost implications in city infrastructure.

The proposed methodology is a cost effective and the safest way to reduce power consumption. It helps us to get rid of today's world problems of manual switching and most importantly, primary cost and maintenance can be decreased easily. The LED used in this system consumes less energy and it emits cool-white light. Also, it has a better life. This system can be easily implemented in agriculture field monitoring, street lights, smart cities, parking lights of hospitals, home automation, timely automated lights, malls, airport, universities and industries etc.

Chapter 3

Implementation

3.1 Methodology/Flow chart

Fig. 2 shows the circuit design of automatic street light control system based on vehicle detection using Arduino Uno having feature of Dim light capability. In this task, 01 LDR sensor, 12 LEDs, 13 resistors, 03 IR obstacle detector sensors and 01 Arduino UNO have been used.

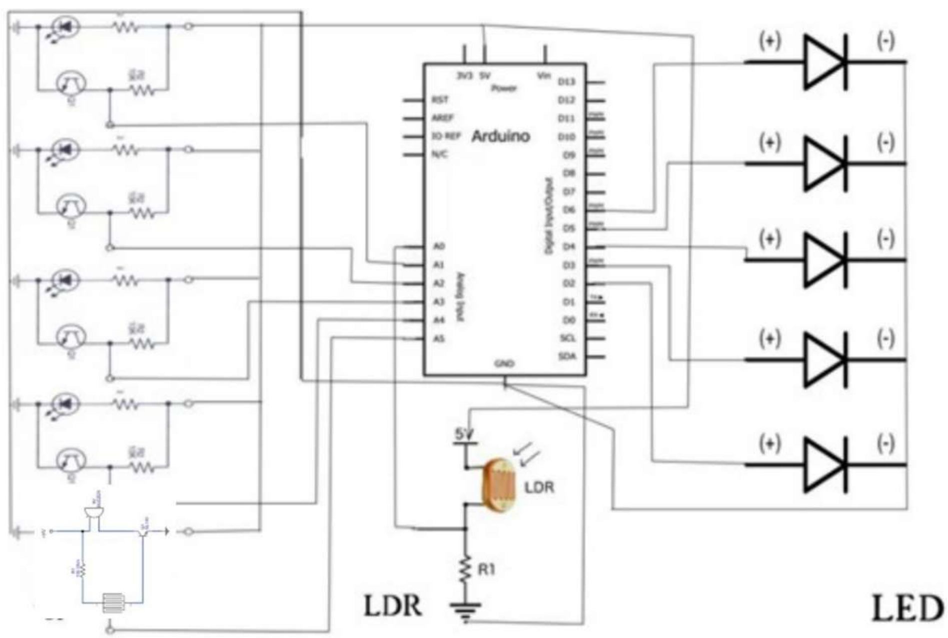


Figure3.1.1 circuit design

One leg of LDR sensor is connected to Arduino analog pin number A0 and another leg to VCC pin and same with a resistor to the ground port of Arduino. In addition, the threshold value is adjusted to 10 from the discrete values (0-1023) for understanding whether it is day or night. After that, all the positive terminals of the LEDs are connected with resistors to pin number 3, 5, 7, 8, 9 and 11, depicting the streetlights as the outputs of the Arduino signals. Furthermore, connected the ground of all the LED’s to Ground port as per the circuit diagram shown in Fig. 7. The IR obstacle avoidance sensors are connected to the Arduino port from pin number 2, 4 and 10, respectively, which is the input signal to the Arduino board. Similarly, the ground of all the IR obstacle avoidance sensors are connected to GND port and all VCC of IR obstacle avoidance sensors are attached to Arduino 5V pin.

Initially, set the IR obstacle avoidance sensors to HIGH at the start if there is no motion. After connecting all these devices to the corresponding pins in Arduino according to Fig.2, the Arduino Software from the official website "www.arduino.cc" is downloaded and installed.

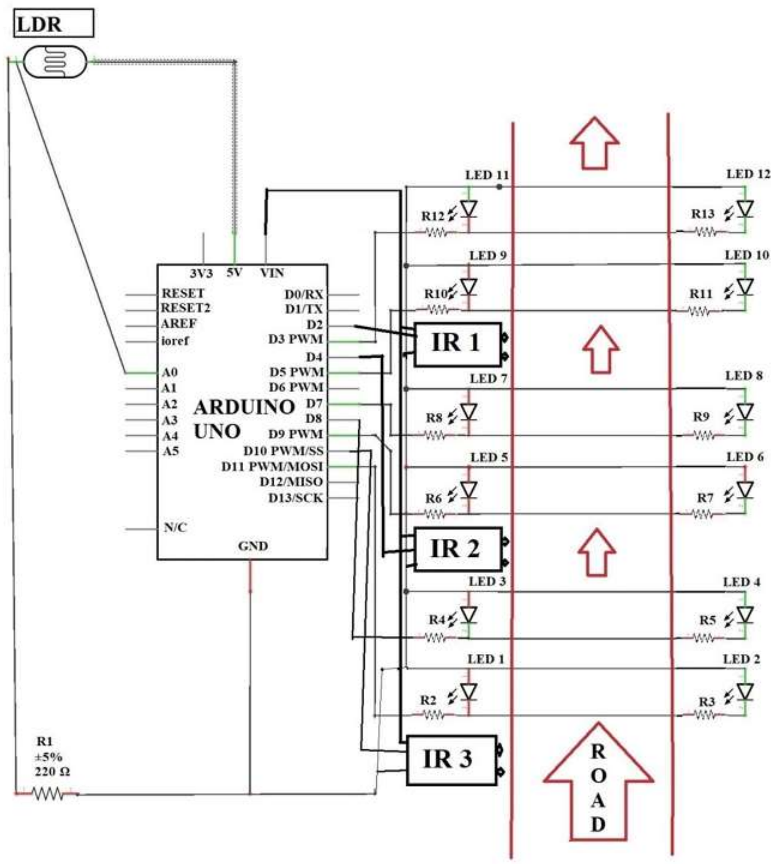


Figure 3.1.2 circuit design

3.2 Block diagram

block diagram for the Smart Street Light System using LDR, rain sensor, and IR sensors. Each block represents a functional component of the system:

1. **Sensor Module:**
   - This block includes the LDR (Light Dependent Resistor), rain sensor, and IR sensor.
   - The LDR detects ambient light levels, the rain sensor detects rain or moisture, and the IR sensor detects movement (vehicles or pedestrians).
   - These sensors provide input to the control system.
2. **Control System:**
   - The heart of the system, this block processes sensor data and makes decisions.
   - When the LDR detects darkness (low ambient light), the control system activates the street lights.
   - It also monitors the rain sensor to adjust lighting intensity during rainy conditions.
   - The IR sensor input helps determine whether to keep the lights dim or bright based on road activity.
3. **Lighting System:**
   - This block represents the actual street lights.
   - When the control system signals, the lighting system turns on or adjusts brightness.
   - Energy-efficient LED lights are commonly used.
4. **Power Supply:**
   - Provides electrical power to the entire system.
   - May include solar panels for sustainable energy.

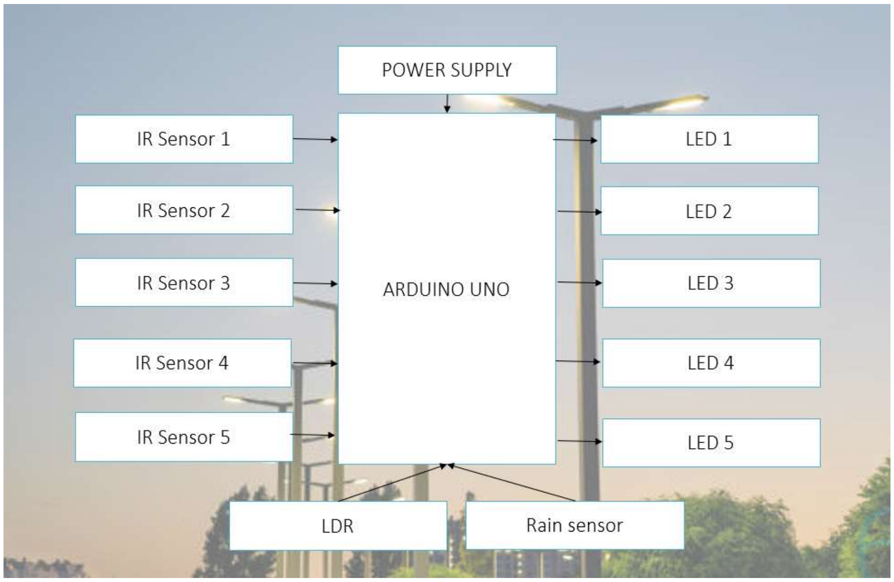


Figure 3.2.1: block diagram

algorithm for the Smart Street Light System using LDR, rain sensor, and IR sensors:

1. **Initialization:**
    - Initialize the LDR, rain sensor, and IR sensor.
    - Set default lighting intensity (e.g., dim lights during daytime).
2. **Main Loop:**
    - Continuously monitor sensor inputs.
    - If LDR detects darkness (low ambient light):
        - Activate street lights.
        - Check rain sensor:
            - If rain detected:
                - Adjust lighting intensity (optional).
            - Else:
                - Maintain default intensity.
        - Monitor IR sensor:
            - If movement detected (vehicle/pedestrian):
                - Increase brightness.
            - Else:
                - Keep lights dim.

3. **Energy Optimization:**
    - Periodically check energy consumption.
    - If no activity detected for a certain duration:
        - Dim lights further or turn off (energy-saving mode).
4. **Safety Measures:**
    - Ensure lights are bright during active road hours.
    - Respond promptly to IR sensor inputs.

3.3 Hardware /Software tools used

Hardware Tools:

1. **Arduino uno:**
    - These platforms handle sensor data, control lighting, and manage communication.
2. **Sensors:**
    - **Light Dependent Resistor (LDR):** Detects ambient light levels.
    - **Rain Sensor:** Detects rain or moisture.
    - **Infrared (IR) Sensor:** Detects movement (vehicles or pedestrians).
3. **LED Lights:**
    - Energy-efficient LEDs for street lighting.
    - May include dimmable LEDs for adaptive brightness.
4. **Power Supply:**
    - AC/DC power supply or solar panels (for sustainable energy).

Software Tools:

Arduino ide:

The **Arduino IDE** (Integrated Development Environment) is essential for uploading code to Arduino boards. Instead of writing code at the assembly level, the IDE allows you to write in high-level languages like C and C++.

Chapter-4

Hardware / Software tools Used

Hardware tools:

1.arduino uno:

Figure 4.1 Arduino uno

The **Arduino Uno** is an open-source microcontroller board developed by Arduino.cc. It's based on the **Microchip ATmega328P** microcontroller and was initially released in **2010**. Here are some key details about the Arduino Uno:

- **Digital I/O Pins**: It has **14 digital input/output pins**, with **6** of them capable of **PWM output**.
- **Analog Inputs**: There are **6 analog input pins**.
- **Clock Speed**: The Uno runs at a **16 MHz** clock speed using a **ceramic resonator**.
- **Programming**: You can program it using the **Arduino IDE (Integrated Development Environment)** via a **USB connection**

2.LDR

Figure 4.2 LDR module

An **LDR sensor** (Light Dependent Resistor) is a device that detects light. Also known as a **photo resistor**, **photocell**, or **photoconductor**, it has a variable resistance that changes based on the amount of light falling on its surface.

1. **Working Principle**:
   - LDRs operate on the principle of **photoconductivity**.
   - When light falls on the LDR, its material conductivity decreases.
   - Electrons in the valence band get excited to the conduction band.
   - The incident light's energy must exceed the semiconductor material's band gap for this effect.
2. **Resistance Variation**:
   - In darkness, LDR resistance is high.
   - In brightness, LDR resistance decreases.
   - A typical LDR has a resistance of around **1 MOhm** in darkness and a few **KOhms** in bright light.

3.IR sensor:

Figure 4.3 IR Sensor

An **IR sensor** (infrared sensor) is an electronic component that detects specific characteristics in its surroundings by either emitting or detecting **infrared (IR) radiation**.

- IR sensors consist of two main components: an **IR LED (emitter)** and an **IR photodiode (receiver)**.
- The IR LED emits infrared light, which interacts with nearby objects and reflects back to the photodiode.
- When infrared light falls on the photodiode, its resistance and output voltage change proportionally.
- These changes allow the sensor to detect the presence of objects, measure heat, or sense motion.

3.Rain sensor

Figure 4.4 Rain Sensor

A **rain sensor** is a device that detects rainfall and triggers specific actions.

1. **Automotive Rain Sensors**:
   - Installed on car windshields.
   - Works on the principle of **total internal reflection**.
   - An infrared light shines at a 45-degree angle on the windshield.
   - When it rains, wet glass scatters the light, reflecting less back to the sensor.
   - Supports automatic windshield wipers adjustment.

Software tools:

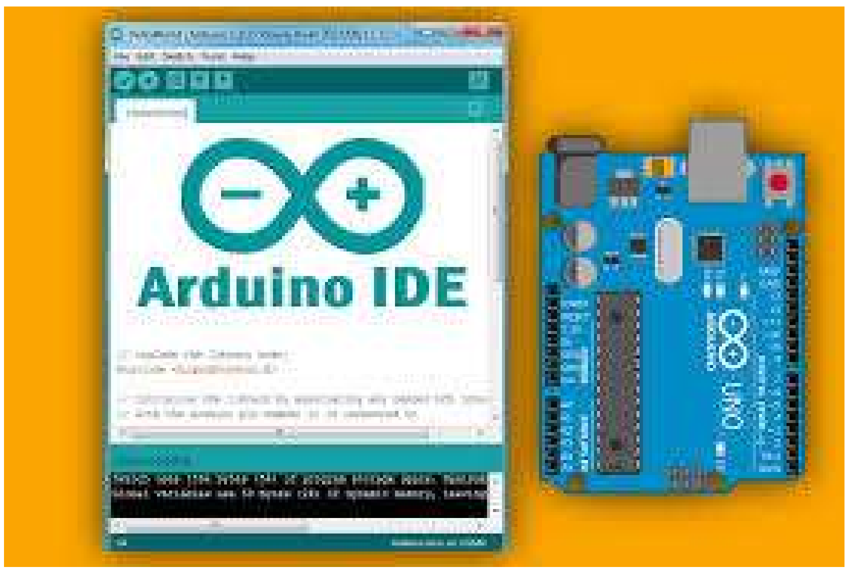


Figure 4.5 Arduino ide

The **Arduino Uno** is an open-source microcontroller board developed by **Arduino.cc**. It's based on the **Microchip ATmega328P** microcontroller and was initially released in **2010**. Here are some key details about the Arduino Uno:

- **Microcontroller**: It uses the **Atmega328**.
- **Operating Voltage**: **5V** (input voltage can vary from **7V to 12V**).
- **Digital I/O Pins**: **14** (including **6 PWM pins**).
- **Analog Input Pins**: **6** (labeled A0 to A5).
- **Communication Protocols**: Supports **UART**, **SPI**, and **I2C**.
- **Flash Memory**: **32 KB** (with **0.5 KB** used by the bootloader).

- **SRAM**: **2 KB**.
- **EEPROM**: **1 KB**.
- **Power Sources**: **DC Power Jack** and **USB Port**.

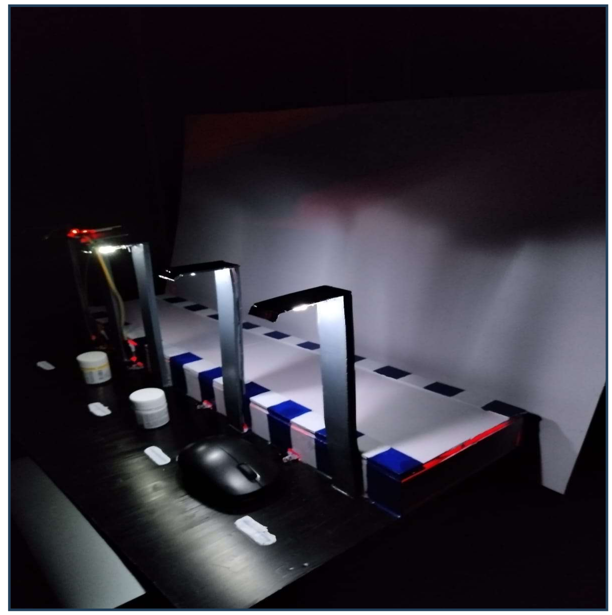
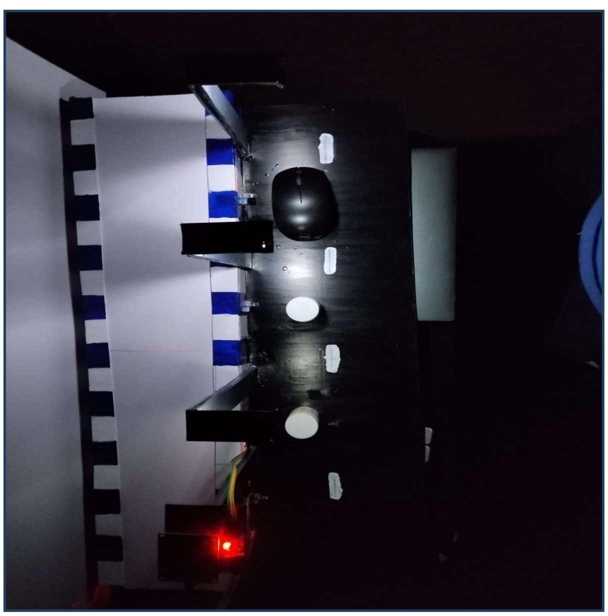
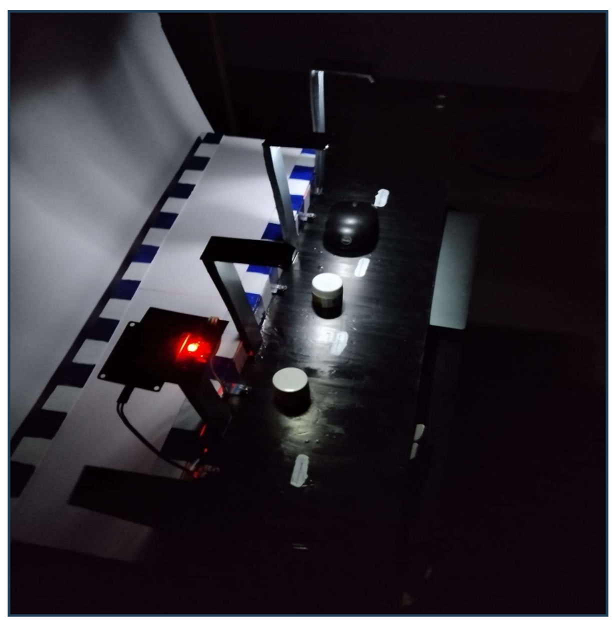
The **Arduino IDE (Integrated Development Environment)** is used to write, compile, and upload code to Arduino boards. It's a cross-platform application available for **Mac**, **Windows**, and **Linux**

Working

1. **Initialization:**
    - Set up the hardware components (LDR, rain sensor, IR sensor, LEDs, microcontroller).
    - Initialize the microcontroller (e.g., Arduino) and configure pins for sensor connections.
2. **Sensor Readings:**
    - Continuously read data from the sensors:
        - **LDR:** Detect ambient light levels.
        - **Rain Sensor:** Detect rain or moisture.
        - **IR Sensor:** Detect movement (vehicles or pedestrians).
3. **Decision Logic:**
    - If LDR detects darkness (low ambient light):
        - Activate street lights.
        - Check rain sensor:
            - If rain detected, adjust lighting intensity (optional).
        - Monitor IR sensor:
            - If movement detected, increase brightness.
            - Otherwise, keep lights dim.
4. **Energy Optimization:**
    - Periodically check energy consumption:
        - If no activity detected for a certain duration:
            - Dim lights further or turn them off (energy-saving mode).
5. **Safety Measures:**
    - Ensure bright lights during active road hours (based on IR sensor inputs).

Chapter-5

Photographs of the model:

Chapter-6

Results and Discussions

The results or the outcome of the mini-project work could be summarized as follows…

Implementing a Smart Street Light System using LDR, rain sensor, and IR sensors can yield several positive outcomes:

1. **Energy Efficiency:**
    - Reduced energy consumption compared to traditional street lights.
    - Significant cost savings for municipalities and utility providers.
2. **Maintenance Savings:**
    - Smart systems allow remote monitoring and control, reducing maintenance costs.
    - Improved reliability due to real-time monitoring.
3. **Enhanced Safety and Security:**
    - Brighter and adaptive lighting based on road activity (IR sensor).
    - Integrated CCTV cameras enhance safety.
4. **Environmental Impact:**
    - Lower carbon emissions due to energy savings.
    - Reduced light pollution.
5. **Potential for Renewable Energy Integration:**
    - Smart streetlights can operate using renewable sources (e.g., solar or wind) in off-grid scenarios

Figure 6.1 street light

The Smart Street Light System with rain sensors offers several advantages over a traditional automated system without rain sensors:

1. **Energy Efficiency:** The system adjusts lighting based on real-time conditions, saving energy compared to fixed-time schedules.
2. **Cost Savings:** Reduced energy consumption leads to cost savings for municipalities and utility providers.
3. **Safety Enhancement:** Adaptive brightness ensures well-lit roads during rain or low visibility conditions.
4. **Environmental Impact:** By optimizing energy usage, it contributes to reducing the carbon footprint.

In contrast, traditional systems lack these dynamic features and may waste energy unnecessarily. The rain sensor adds a crucial layer of intelligence to street lighting!

Chapter-7

Advantages, Outcome and Limitations

Advantages:

1. **Energy Efficiency:**
    - Reduced energy consumption compared to traditional street lights.
    - Significant cost savings for municipalities and utility providers.
2. **Safety Enhancement:**
    - Adaptive brightness ensures well-lit roads during active hours.
    - Improved safety for pedestrians and drivers.
3. **Environmental Impact:**
    - Lower carbon emissions due to energy savings.
    - Reduced light pollution.
4. **Data-Driven Decision Making:**
    - Provides valuable data for city optimization.
    - Enables better management and maintenance.

Outcomes:

1. **Cost Savings:**
    - Reduced operational expenses for municipalities.
    - Funds can be redirected to other community needs.
2. **Sustainability:**
    - Contributes to a more sustainable urban environment.
    - Minimizes resource wastage.
3. **Improved Quality of Life:**
    - Safer streets enhance residents' well-being.
    - Efficient lighting positively impacts daily life.

Limitations:

1. **Initial Investment:**
    - Implementing smart systems requires upfront costs (sensors, controllers, etc.).
2. **Maintenance Complexity:**

- Smart systems involve more components, which may require specialized maintenance.

3. **Dependency on Sensors:**
    - Reliability depends on accurate sensor readings.
    - Sensor failures can impact system performance.

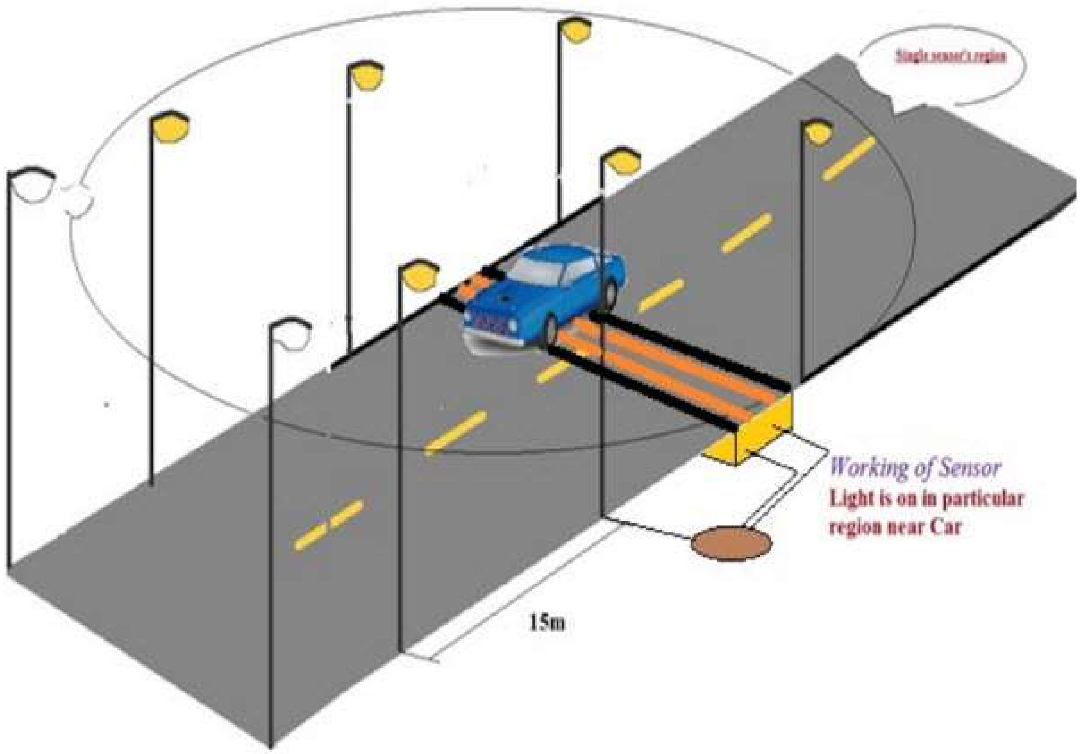


Figure 7.1 animated view of automated street light system

Chapter-8

Conclusions and Future Work

Conclusion:

The Smart Street Light System, integrating LDR, rain sensor, and IR sensors, represents a significant leap in urban lighting technology. By dynamically adjusting brightness based on real-time conditions, it achieves energy efficiency, cost savings, and enhanced safety. The outcomes include reduced energy bills, minimized environmental impact, and improved quality of life for residents.

Future Work:

1. **Advanced Algorithms:**
   - Explore machine learning algorithms to predict optimal lighting levels based on historical data and real-time inputs.
   - Adaptive brightness can become even more precise.
2. **Integration with Smart Cities:**
   - Integrate street lighting with broader smart city initiatives (traffic management, waste management, etc.).
   - Create a cohesive urban infrastructure.
3. **Sensor Fusion:**
   - Combine data from multiple sensors (LDR, rain sensor, IR sensor) for robust decision-making.
   - Enhance reliability and responsiveness.
4. **Community Engagement:**
   - Involve citizens in monitoring and reporting system performance.
   - Gather feedback for continuous improvement.
5. **Communication :**
   - Interface with a central control station via Wi-Fi, GSM, or other communication modules.
6. **Data Logging :**
   - Record sensor data and energy usage for analysis and optimization.

References

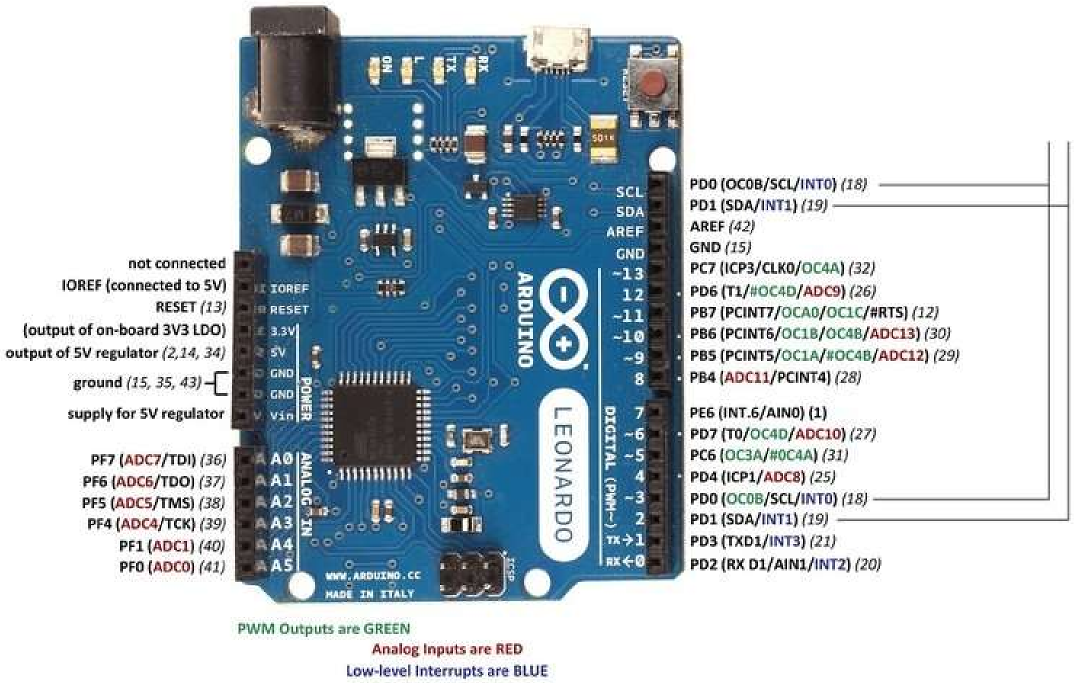
[1] Jagdish Patel, Saloni Thorat, Srushti Dusane, “Automatic Street Lighting Control System Using Microcontroller and Sensors”, IJSRSET(International Journal of Scientific Research in Science, Engineering and Technology) , Volume 7 | Issue 2 | Print ISSN: 2395-1990,2020.

[2] Ms.Priti, S.Dhaygude, Ms.Sakshi S. Dhage, Ms.Samina R. Pathan, Ms.Monali V. Dhage,” Smart Street light using Arduino”, 2022 IJRTI | Volume 7, Issue 7 | ISSN: 2456-3315.

[3] Kavita Jain, Mudit Surana, Prince Meena, Pushpendra Meena, Rahul Meena, “SMART STREET LIGHT SYSTEM BASED ON ARDUINO”, International Research Journal of Modernization in Engineering Technology and Science (Peer-Reviewed, Open Access, Fully Refereed International Journal) Volume:04/Issue:05/May-2022.

Appendix

IC Pin Configurations



Software descriptions:

The **Arduino IDE** (Integrated Development Environment) is an open-source software designed by **Arduino.cc**. It serves as a powerful tool for writing, compiling, and uploading code to various **Arduino boards**. Here are the key points:

1. **Purpose**:
   - The Arduino IDE simplifies the process of creating and managing code for Arduino projects.
   - It's suitable for beginners and experienced users alike.
2. **Features**:
   - **Cross-Platform**: Available for **Windows**, **Mac OS**, and **Linux**.
   - **C/C++ Support**: Allows you to write code in C and C++ languages.
   - **Sketches**: Programs written using the Arduino IDE are called **sketches** (saved with the .ino extension).
   - **Toolbar and Menus**: The IDE provides a toolbar with buttons for common functions (e.g., verify, upload) and various menus.

- **Text Editor**: Write your code in the text editor area.
- **Message Area**: Displays feedback, errors, and other information.
- **Board Selection**: Choose the appropriate Arduino board and port.

3. **Getting Started**:
   - Connect your Arduino board to your computer.
   - Open the Arduino IDE.
   - Select the correct board and port.

Hardware descriptions

1. **Sensor Modules:**
   - **Light Dependent Resistor (LDR):** Detects ambient light levels.
   - **Infrared (IR) Sensor:** Detects movement (vehicles or pedestrians).
   - Other sensors (e.g., rain sensors) can enhance system functionality.
2. **Power Modules:**
   - These provide electrical power to the streetlights.
   - May include solar panels for sustainable energy.
3. **Microcontroller:**

   Arduino uno is the microcontroller used which controls the complete system.

Developed Code

```
int led = 6;
int led1 = 5;
int led2 = 4;
int led3 = 3;
int led4 = 2;

int ldr = A0;

int ir = A1;
int ir1 = A2;
int ir2 = A3;
int ir3 = A4;
int rainsensorpin = A5;

void setup()
{
  Serial.begin (9600);
```

```
  pinMode (led,OUTPUT);
  pinMode (led1,OUTPUT);
  pinMode (led2,OUTPUT);
  pinMode (led3,OUTPUT);
  pinMode (led4,OUTPUT);

  pinMode (ldr,INPUT);

  pinMode (ir,INPUT);
  pinMode (ir1,INPUT);
  pinMode (ir2,INPUT);
  pinMode (ir3,INPUT);
  pinMode (rainsensorpin,INPUT);
}
void loop()
{
       int  ldrStatus = analogRead(ldr);
       int  rainvalue = analogRead(rainsensorpin);
        if (analogRead(A1)<500 && ldrStatus>=80 || analogRead(A1)<500 &&
ldrStatus>=80 && rainvalue<500)       // IR 1 CODE
               {
                digitalWrite(led,HIGH); // if the value of IR sensor is
<500 then led will glow
               }
            else
                {
                  digitalWrite(led,LOW); // led will not glow
                  delay(100);
                }
         if (analogRead(A2)<500 && ldrStatus>=80 || analogRead(A2)<500 &&
ldrStatus>=80 && rainvalue<500)       // IR 1 CODE
               {
                digitalWrite(led1,HIGH);
               }
            else
                {
                  digitalWrite(led1,LOW);
                  delay(100);
                }

          if (analogRead(A3)<500 && ldrStatus>=80 || analogRead(A3)<500 &&
ldrStatus>=80 && rainvalue<500)           // IR 2 CODE
               {
                digitalWrite(led2,HIGH);
               }
            else
                {
```

```
                  digitalWrite(led2,LOW);
                  delay(100);
                }

           if (analogRead(A4)<500 && ldrStatus>=80 || analogRead(A4)<500 &&
ldrStatus>=80 && rainvalue<500)           // IR 2 CODE
               {
                digitalWrite(led3,HIGH);
               }
            else
                {
                  digitalWrite(led3,LOW);
                   delay(100);
                }

            if (analogRead(A5)<500 && ldrStatus>=80 || analogRead(A5)<500
&& ldrStatus>=80 && rainvalue<500)           // IR 2 CODE
               {
                digitalWrite(led4,HIGH);
               }
            else
                {
                  digitalWrite(led4,LOW);
                  delay(100);
                }

}
```