**1. Project Title**

DIY Smart Street Lights

**2. Team Members**

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**3. Problem Definition**

Street lights stay on all night, wasting electricity. This project makes street lights smarter by turning them on only when needed, saving energy..

**4. Introduction**

In the modern world, smart cities are becoming increasingly important as urbanization continues to grow. One essential component of any smart city is the integration of intelligent infrastructure that promotes safety, efficiency, and sustainability. **Smart street lighting** is a key part of this initiative, as traditional street lights often consume excessive amounts of energy and remain on unnecessarily, even when not needed. Additionally, many older street lighting systems lack features that enhance public safety or contribute to a more eco-friendly environment.

**DIY Smart Street Lights** aim to address these challenges by creating an energy-efficient, responsive, and cost-effective lighting system. By integrating **sensors** and **automation**, these lights can adjust based on real-time conditions such as ambient light levels and motion detection. This makes them more adaptive to their environment and significantly reduces energy consumption, as they are only illuminated when needed. Furthermore, these smart systems can improve public safety by increasing light intensity when motion is detected, ensuring well-lit streets when pedestrians or vehicles are nearby.

**5. Objectives**

1. Save electricity by using automatic lighting.
2. Improve street safety with smart lighting.
3. Create a low-cost and eco-friendly lighting system.
4. Use sensors to detect motion and light levels.

**6. Expected Outcomes**

1. Less electricity waste.
2. Lights that turn on only when needed.
3. Longer life for street lights.
4. A simple and budget-friendly solution.

**7. Hardware Components**

(Mention the hardware components used in the project.)

1. Input Devices:

* PIR Motion Sensor:
  + Function: Detects movement within a certain range, such as pedestrians, vehicles, or animals. The sensor triggers the lights to turn on when motion is detected and may adjust the brightness of the lights based on the level of activity in the area.
* Ambient Light Sensor (LDR - Light Dependent Resistor):
  + Function: Measures the surrounding ambient light levels (e.g., natural sunlight). The sensor helps decide when the streetlights should be switched on or off based on the amount of daylight. For example, it ensures the lights are off during the day when it's bright enough, and they automatically turn on when it gets dark.

2. Microcontroller:

* ESP32:
  + Function: The heart of the system. The ESP32 microcontroller processes inputs from the sensors and manages the logic for controlling the streetlights. It can also handle communication with remote devices via Wi-Fi for real-time monitoring and control. The ESP32 is also used to send alerts or notifications when certain events occur, such as motion detection or if there is a failure in the system.

3. Actuators:

* Relay Module:
  + Function: A relay module allows the ESP32 to control high-power devices, such as the streetlights. It acts as a switch that turns the lights on or off depending on the signals it receives from the microcontroller. The relay module is essential for safely handling the electrical load required to power the lights.
* LED Streetlight:
  + Function: Energy-efficient LED lights serve as the streetlights in this system. They provide bright and clear illumination while using significantly less power than traditional bulbs, making them ideal for energy savings. LEDs can also be dimmed or adjusted based on the data from sensors, which further contributes to reducing energy consumption.

4. Power Supply:

* Power Supply Unit:
  + Function: Provides the necessary voltage and current to power the ESP32, sensors, relay module, and streetlights. It's crucial that the power supply can handle the total load of the system.

5. Mobile/Web Application:

* Blynk IoT Application:
  + Function: Provides a user-friendly interface for remote monitoring and control of the streetlight system. With the Blynk app, users can check the status of the lights, monitor sensor data (motion and light levels), and manually control the system, if necessary. The app can also send notifications when the lights are turned on or off or if the system detects unusual activity.

6. Mode of Communication:

* Wi-Fi:
  + Function: The ESP32 connects to the local Wi-Fi network, enabling communication between the streetlight system and the Blynk app or web dashboard. This allows for real-time data transmission, remote monitoring, and control over the internet, making the system flexible and accessible from anywhere.

**8.Reference**

**1.** **ESP32-CAM & ESP32 Development**:

* ESP32 Official Documentation
* [ESP32 Resources - GitHub](https://github.com/espressif)

**2.** **PIR Motion Sensor**:

* PIR Motion Sensor Overview and Tutorial - Adafruit

**3.** **Ambient Light Sensor (LDR)**:

* LDR (Light Dependent Resistor) Basics and Interfacing - Electronic Wings

**4.Relay Module**:

* Relay Module Overview - SparkFun

**5**.**LED Streetlights**:

* Benefits and Features of LED Street Lights

**6.** **Blynk IoT Application**:

* [Blynk Official Website](https://blynk.io/)
* Blynk Documentation

**7.** **Wi-Fi Communication with ESP32**:

* ESP32 Wi-Fi Tutorial by Random Nerd Tutorials

**8.** **Power Supply for ESP32 and Sensors**:

* Choosing the Right Power Supply for ESP32 - Tescaglobal