

Original Article

Automatic System for Realtime Street Light Fault Detection & Auto Intensity Control using IoT

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Abstract: In urban areas, the nighttime hours are particularly significant, with street lights accounting for 8–10% of overall electricity use. The way this streetlight is operated is crucial, and the most popular method is manual operation. We included automatic street lighting based on sunshine intensity in our suggested scheme. We generated electricity using piezoelectric sensors in addition to solar panels. The pressure created by the presence moving on the road is converted into electrical energy by the piezoelectric sensors. Power can be used in this fashion, and road safety precautions can be implemented. Furthermore, we presented the defect detection.

Keywords: IOT, Smart Street light, Fault Detection, Wi-Fi Module, Arduino Uno.

INTRODUCTION

We have been using the street lights in the past few days. Those street lights require human labor and may require manual operation. The lights will continue to glow in the morning as if the operator was running late for work, wasting electricity. In the past, a technician would have to manually examine the street lights to determine whether there was a problem. Accidents could result from any delays in the technical check procedure. Thus, an IoT-based street light system has been designed to address this issue. We use Internet of Things-based systems these days. This IoT system relies on timers to function. These timers are made to turn on and off at specific times, such 10 p.m. and 6 a.m. However, when there are differences in the time between sunrise and sunset (due to seasonal and climatic changes), this approach has certain drawbacks. It is necessary to introduce a new IOT-based system as a result. We have included an LDR sensor in our suggested system to identify the presence of sunlight. By doing this, we can solve the issues raised above. We have also employed an infrared sensor in this setup. The system is in active mode, or it shines brightly, if a vehicle or pedestrian moves; otherwise, it is in dim position. The circuit uses the WiFi module in the event that there is a street light failure. The control room receives the specific street light information from the WiFi module. This can identify the failure light much more easily and fix the problem as soon as possible. There is no possibility of receiving enough sunshine to charge the solar panels during the winter and wet season. As a result, we are producing electricity alternatively by utilizing speed breakers and piezoelectric sensors.

OBJECTIVE

The project's primary goal is to conserve power. There are a lot of problems with rural communities' power these days. There is no effective electricity available in rural regions due to the high power usage in industry and metropolitan areas. Currently, water is used to generate power. We are unable to provide for everyone's requirement for energy since there is not enough water. Oceans contain vast amounts of water, but this saline water is not suitable for producing power. As a result, we are choosing to use hardware like rotating speed breakers and piezoelectric sensors in addition to non-renewable energy sources like solar energy. Because we are producing power from non-renewable sources, we may also supply it to rural regions by carrying out these actions. Our project's concept allows us to reduce power use as well. In order to supply power to every area of our nation and turn it into a developed nation. The primary goals of this undertaking are:

- In order to prevent needless light waste.
- Install a smart, automated, and energy-efficient lighting system.
- Entirely dependent on renewable energy.
- Increased longevity.
- Conserving Energy.

Problem Statement

First statement: Even in situations where there is ample natural light, street lights remain on.

Statement 2: When there are no cars or people, the street lights are on.



Statement 3: No method exists for detecting light failures.

METHODOLOGY

This issue has been covered in four main sections. They're:

- Create architectural designs
- Hardware details
- Development of software
- Controlled by IOT

A.Design Architecture:

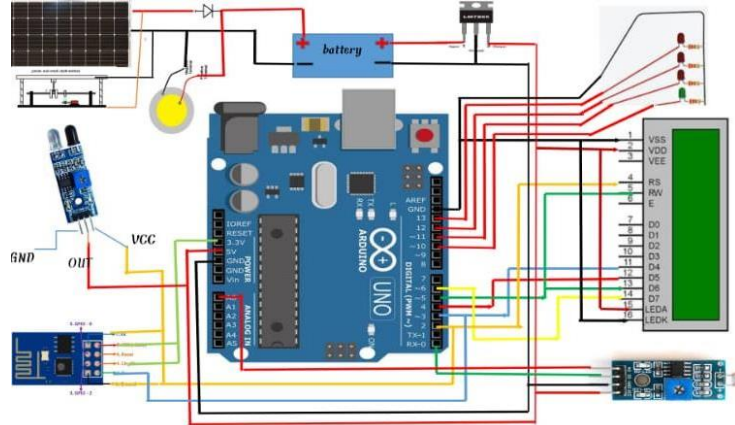


Figure 1: Hardware Model Connections

B. Hardware Specifications:

The following is a list of the parts that went into creating a solar-powered streetlight with automatic intensity management and problem detection:

Table 1: Hardware Components

S.No	Components	Specifications
1	Solar panel	10Watt, 12Volts
2	Light dependent resistor sensor	100Ω in sunlight, 10MΩ in absolute darkness
3	Infrared sensor	up to 20CM
4	Arduino Uno	ATmega328P
5	Wi-Fi module	ESP8266
6	Light emitting diode	0.2V
7	Piezo electric sensors	Up to 13V
8	Lcd display	2×16 line display
9	Battery	12V
10	Bypass Diode	--
11	Rotating speed breaker	Up to 5V

C. Software Development:

The Arduino Software (IDE) is also known as the Arduino Integrated Development Environment. It includes a text editor for writing code, a message box, a text terminal, a toolbar with buttons for frequently used tasks, and other menus. In order to upload and interact with programs, it establishes a connection with the Arduino hardware. Sketches is programs created with the Arduino Software (IDE). These drawings are created in a text editor and stored as files with the.ino extension. The editor offers tools for searching through and replacing text as well as cutting and pasting. In addition to displaying faults, the message box provides feedback when exporting and saving. The Arduino Software (IDE) produces text output, which is shown on the console along with further information and comprehensive error messages. The configured board and serial port are shown in the window's lower right corner. You may create, open, and save drawings, validate and upload programs, and access the serial monitor using the toolbar buttons.

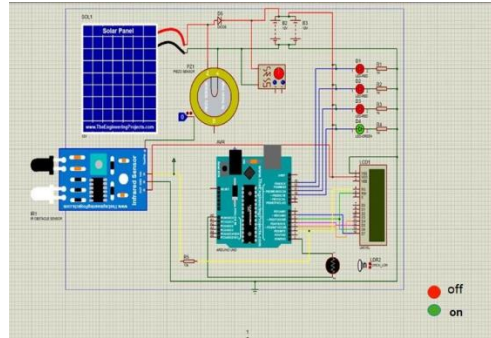


Figure 2: Simulation Diagram

D. IOT based control

In addition to checking the condition of the IR and LDR sensors, if a car or pedestrian is detected throughout the night, the IR sensor will be triggered and the corresponding led bulb will shine brightly while drawing power from the battery. The LEDs revert to their dimmest level once the car or pedestrian leaves the street light. This scenario doesn't occur during the day because the suggested system's primary purpose is to cut power usage at night.

To extend the life of the LEDs, we are dimming the lights in this area. The lifespan of the LEDs will be impacted if the lights are turned on and off often. LED lights consume less energy than other types of lighting. That's why we're utilizing LED lighting to use less energy.

PROPOSED SYSTEM

In the daytime, Direct current electricity is produced by solar panels using sunlight as a source of energy; however, the DC signal must first be converted to AC before being stored in a battery. The Arduino Uno is linked to sensors like IR and LDR.

The light source is detected using an LDR sensor. In the event that the surroundings are dim, LDR resistance is really high. In the presence of strong light, it has little resistance. Using this variation in resistance under various lighting situations, a circuit may automatically turn on and off the lights at night and during the day. The IR sensor senses movement on the road from vehicles, pedestrians, and animals, and when it does, it increases the intensity of the street light. The light automatically dims when there is no movement from the vehicle. When there is sunshine, the street lights will automatically switch off. When a street light fails, a message about it is transmitted to the control room via a Wi-Fi module. This enables the repair of defective street lights quickly, which lowers the number of accidents. In order to produce power, we also use spinning speed breakers and piezoelectric sensors. When turning or in a blind spot, infrared sensors pick up movement and send a signal—a red light—to the car in the other direction.

RESULTS

The light will be in the off position during the day. The amount of light rises as the amount of sunlight decreases. An infrared sensor detects whether a vehicle or pedestrian is within a 15-20 meter range, at which point the light intensifies. Prior to it, the illumination will be faint. The LDR sensor will identify any light outage and use the WI-FI module to send a message to the control room. Therefore, a significant amount of energy may be saved by utilizing renewable resources to regulate LED intensity without reducing LED lifetime. moreover, remote monitoring assists in identifying light outages that result in a reduction in labor. In addition, compared to sodium lights, the solar-powered streetlight system offers superior lighting, optimal electricity utilization, and lower operating and maintenance costs after installation. We can save a significant amount of energy by putting this idea into action now, which will benefit future generations. Additionally, we are utilizing spinning speed breakers and piezoelectric sensors as input sources.

CONCLUSION AND FUTURE SCOPE

As a result, our project uses a huge quantity of solar energy to create power. This energy can be preserved for our next generations. The energy produced by rotating speed breakers and piezoelectric sensors can be utilized for household needs. Both personnel reduction and the identification of defective street lights

are aided by remote monitoring. When compared to the previous system, we can conserve power by employing the dimming effect. If we can execute our project in real-time, we can save a significant amount of energy and create a large quantity of electricity using a variety of approaches. With the help of this clever invention, we can also determine the speed of the cars and identify their license plates using picture processing. Li-Fi technology can also be applied to this project in addition to these. Two-way communication between the cars is possible using LiFi technology. Through the vehicle's headlights, the information will be transmitted to the other cars in this two-way connection. If any obstructions occur on the road, the cars will be informed of them by the street lights and their headlights. The information may also be presented on an LCD screen or over a voice message system.

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