

# Solar Panel Automatic Brightness Control System

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**Abstract:** As we all know that energy consumption has increased a lot and sources of energy are limited so in order to meet the increasing demand of energy use of renewable sources of energy is a must. Keeping this in mind in this paper we are discussing about SOLAR LED STREET LIGHT WITH AUTO INTENSITY CONTROL. This street light is driven by solar energy and apart from this it also controls its intensity from dusk to dawn depending upon the brightness. This street light can save a large amount of electricity compared to the tradition one which are alight to their maximum intensity at all times after they are switched on.

**Keywords:** Lux, lumens, efficacy, colour retention.

## 1. INTRODUCTION

The main function of the streetlight is to illuminate the street at dark hours. Earlier, the street lighting was very simple and also accounted for less investment as the number of streets were less. But, with rapid urbanization the number of streets increased rapidly and this led to increase in number of street lights and investment associated with them.[1]. For designing a proper street light various factors are to be considered which includes its efficiency to provide proper lighting on the street, its harmful environmental effect, installation and running cost etc. So before designing a street light all these factors should be considered properly and efforts should be made to incorporate technologies which are more cost effective like the one we have discussed here "SOLAR LED STREET LIGHT WITH AUTOMATIC INTENSITY CONTROL".[2] There are various types of street lights according to the lamp used such as incandescent light, mercury vapour light, metal halide light, high pressure sodium light, low pressure sodium light, fluorescent light, compact fluorescent light, induction light and LED light. For the past several years high and low pressure sodium lamps have been used for street and security lighting but improved LED technology and

their lower prices have the potential to replace them in future. The efficacy and life span of various street lighting technologies are shown in table 1.[3]

TABLE 1: COMPARISON OF EFFICACY AND LIFE

Type of lamp	Luminous efficacy (lm/w)	Colour retention property	Lamp life (in hr)
High pressure sodium	50-150	Fair	15,000-24,000
Low pressure sodium	100-190	Very poor	18,000-24,000
High pressure mercury vapour	35-65	Fair	10,000-15,000
Metal halide	70-130	Excellent	8,000-12,000
Low pressure mercury fluorescent lamp	30-90	Good	5,000-10,000
Energy efficient tubular fluorescent lamp	100-120	Very good	15,000-20,000
Light emitting diode	70-160	Good	4,000-90,000

LED can easily replace traditional street light lamps because they have higher efficacy and longer life apart from this they are compact, robust and requires comparatively less power. They are very flexible towards new technology so concept of automatic intensity control is easily applicable to them.

A simple and beneficial concept in which street light controls its intensity according to the brightness of the surrounding. Street light is automatically switched ON when the sunlight goes down and is automatically switched OFF when there is sufficient sunlight. This function is done by a sensor called Light Dependent resistor (LDR) which senses the light actually like our eyes. This system removes manual work of switching ON and OFF of street light.

## 1.2 Working Principle

This circuit uses microcontroller and photo resistors to control the brightness of the street lights and also to switch on/off the street lights. Photo resistors are used along with series resistance to provide the variable amount of voltage to the microcontroller. Photo resistors are special type of resistance whose value depends on the brightness of the light which is falling on it. It has resistance of about 1 mega ohm in total darkness, but a resistance of only about 5k ohms when illuminated. It responds to a large part of light spectrum. In this project, we made a potential divider circuit with

Photo resistors and resistance connected in series. We know that voltage is directly proportional to conductance so more voltage we will get from this divider when Photo resistors is getting light and low voltage in darkness. This divided voltage is given to the microcontroller. Sensitiveness can be adjusted using the microcontroller programming. The working of this project mainly depends on the following points;

- Getting power from solar panel
- Getting values from photo resistor
- Control of light with arduino
- Display on LED

### 1.3 Components required

**Jumper wires** – To connect all the components to each other

**Arduino Uno** - Microcontroller used (The brain of the project)

**Solar Panel** - Generate voltage when light falls on it

**LED's** - Used to demonstrate the street light

**Resistors** – To limit the voltage entering at the base of transistor

**Potentiometer** - controls the amount of brightness of lcd display

**DC Power Supply** – powers the Arduino Microcontroller board

**Photo resistor** – Used to sense the light in surroundings

**PCB Plate** – Used to mount/solder all the components

## 2. CONTROL CIRCUIT FOR SOLAR STREET LIGHT

Monitoring and controlling of street lights is utmost importance in developing country like India to reduce the power consumption. The idea of designing a new system for the street light that do not consume huge amount of electricity and illuminate large areas with the highest intensity of light is concerning each engineer working in this field.

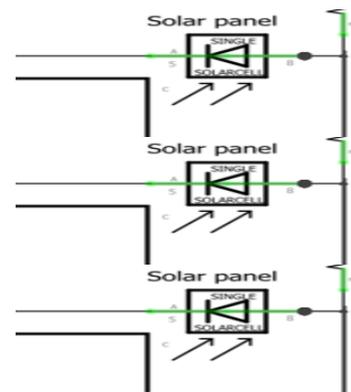
Providing street lighting is one of the most expensive and important responsibilities of a city. Lighting can account for 12-38% of the total energy bill in typical cities worldwide Street Lighting is a particularly critical concern for public authorities in developing countries because of its strategic importance for economic and social stability. Inefficient lighting system wastes significant financial resources every year, and poor lighting system creates unsafe conditions.

Energy efficient technologies and design mechanism can reduce cost of street lighting.

There are various numbers of control strategy and methods in controlling the street light system are used among the control circuit of solar LED street lighting system which depends on climatic conditions and object movements.

### Getting power from solar panel

The solar panel used in this project is capable of generating 10V. Firstly, the light is incident upon it, because of which the solar panel generate voltage across its terminals. This voltage is then sent to Led's and Arduino microcontroller.



### Getting values from photo resistor

Photo resistor is the component which helps to sense the amount of light in the surroundings. The photo resistor change its resistance according to the light falling on it. These values are then sent to the Arduino.

### Control of light with Arduino

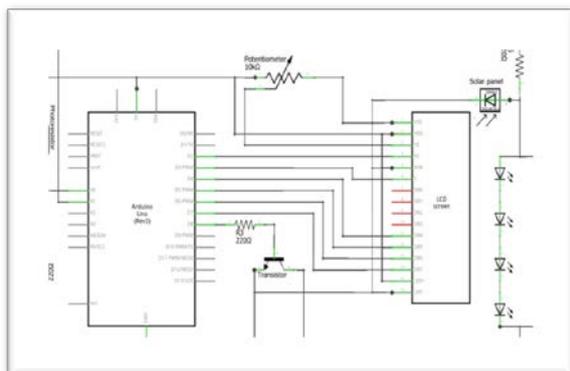
Once the values from solar panel and photo resistor are sent to arduino, the processing part begins. If the voltage coming from the solar panel is above 5V, then the arduino switch ON the transistor pin, and the LEDs are powered, controlled as per the values received from the photo resistor. Once the values from solar panel is above 5V, then the arduino switch ON the transistor pin and the amount of the brightness is controlled as per the values received from the photo resistor.

### Displaying Data on LCD Screen

All the values received from the solar panel and photo resistor are shown on the LCD screen in the form of voltage and brightness levels.



### 3. CIRCUIT DIAGRAM



### 5. CODE LIBRARIES AND FUNCTION

```
#include <LiquidCrystal.h>
LiquidCrystal lcd(7, 6, 5, 4, 3, 2);
int solar_pin = A1;
int photoresistor_pin = A0;
int transistor_pin = 9;
```

#### The setup()function

The setup function in Arduino IDE runs only once and is used to define the functions of pins of Arduino.

```
void setup()
{ pinMode(transistor_pin, OUTPUT);
  lcd.begin(16, 2);
  lcd.setCursor(0,0);
  lcd.print("Solar Automatic");
  lcd.setCursor(0,1);
  lcd.print("Brghtnes Control");
  delay(3500);
  lcd.clear();
  lcd.setCursor(0,0);
  lcd.print("By:Aditya Vivek");

  lcd.setCursor(0,1);
  lcd.print("Shubham, Rishabh,chirag");
  delay(3500);
  lcd.clear();
  lcd.setCursor(0,0);
  lcd.print("Brightness: ");
}
```

#### The loop()function

The loop function in Arduino IDE runs again & again and is the part of the code where the data is processed.

```
void loop()
int
solar_val,photoresistor_val,voltage,brightness;
solar_val=analogRead(solar_pin);
photoresstor_val=analogRead(Photoresistor_pin
);
voltage=solar_val;
brightness=photoresistor;
lcd.setCursor(10,0);
lcd.print(voltage);
if(voltage>5)
{
  lcd.setCursor(14,1);
  lcd.print(brightness);
  analogWrite(transistor_pin,brightness);
}
else
{
  analogWrite(transistor_pin,0);
  lcd.setCursor(14,1);
  cd.print("NA");
}
Delay(100);
}
```

### 4 RESULT

The result comprises the successful operation of the 'SOLAR POWERED LED STREET LIGHT WITH AUTO INTENSITY CONTROL'. The circuit is stationed in a suitable location that is exposed to sunlight so that immediately it is dark the system automatically switches "ON" the lamps and when the illumination is above 50 lux the lamps are automatically switched "OFF". The values of illumination, voltage, current and temperature are noted from the LCD.

### 5. CONCLUSION

This project 'SOLAR POWERED LED STREET LIGHT WITH AUTO INTENSITY CONTROL' is a cost effective, practical, eco-friendly and the safest way to save energy. It clearly tackles the two problems that world is facing today, saving of energy and also disposal of incandescent lamps, very efficiently. According to statistical data we can save more than 40% of electrical energy that is now consumed by the highways. Initial cost and maintenance can be the drawbacks of this project. With the advances in technology and good resource planning the cost of the project can be cut down and also with the use of good equipment the maintenance can also be

reduced in terms of periodic checks. Considering the above fact we come to know that solar led with automatic intensity control is better than traditional street lights in terms of energy saving and cost effectiveness. This technology is being improved and full version conversion will help to save a large amount of energy.

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