

Solar Powered Led Street Light With Intensity Control

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ABSTRACT

We know sources of energy are limited. To meet the increasing demand of energy, the energy conservation and use of renewable energy sources is necessary. The focus of this project is to make the most efficient use of the energy of sun for street light in city. The solar panel collect the energy from the sun at day time & this energy is used to drive LED lamp. The system is consisting of Light Emitting Diodes, sensors, LDR, microcontroller, timer, power transistor. The battery stores the energy at day time and discharges at night time. The LED street lamp glows at night time automatically & turn off in day time. The detection of object is done through the IR sensor. Around the 75%-80% reduction in power can be achieved by using automatic LED street light system with the help of traffic application.

Keywords: Solar energy, Solar panel, Sensor, movement of vehicles, street light

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I. INTRODUCTION

The main function of the streetlight is to illuminate the street at night time. In previous years the streets were less so street light was very simple and the cost for it was also less. But with rapid increase in the population and development of the cities, the number of the street increased. Before designing the street light system some factors should be considered properly. The various factors considered during the installation of street light are solar panel size and it's rating, battery capacity, environmental effects, installation cost, efficiency etc. There are different types of the streetlight like incandescent light, mercury vapour light, compact fluorescent light, metal halide light, high pressure sodium light, low pressure sodium light, fluorescent light etc. Because of the disadvantages of other lamps like more power consumption, less efficiency and high cost, the LED lamps are used to reduce the power consumption. In summer the hours of day are longer so the energy can easily provide to street lights, but in winter the night time are longer. To operate the lamp for longer hours with short days is difficult. The position of the sun changes in the year, so

the collection of the solar power is difficult. The mounting angle of the solar panel is important in the designing of the street light system.

A photovoltaic system collects the energy from the sun during the day time and stores this in a battery through a charge controller to drive LED street lamps at night. The charge controller circuit is used to supply the battery for its charging. Charge controller circuit protects the battery from overcharge by the solar panels & over discharge by the street lamps. With the help of the output from Light Dependent Resistors (LDR), the charging circuit operates only during day time, and the energy collected by the solar panel is supplied to the battery. When the LDR gives the signal of night-time then the discharging circuit starts its operation. During this time, the discharge of the battery to the load is done through a driver circuit that maintains constant current through the LED lamps. Both the driver circuit and the charge controller circuit are controlled by the microcontroller. For the charge controller circuit, the PIC

detects the current and voltage of the battery. The driver circuit operates by detecting the current through the LED with the help of a sensor. Brightness of the lamp also depends on the output of the sensor, used to detect the volume of traffic present on the road. The LED lamps operate with full brightness when there is high traffic on the road, and with lower brightness for lower traffic. When night turns to day, the LDR will give signal to the PIC and the LED & sensors will become off state and charging process will start again.

II. PROPOSED SYSTEM

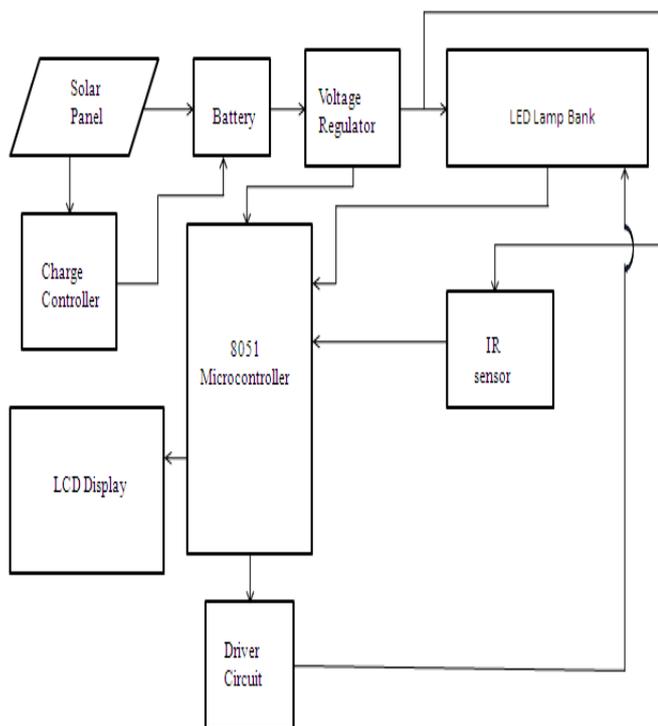


Fig 1. Block Diagram

Module Description:

Solar panel

The solar panel converts the light energy to electrical energy. It absorbs the solar radiations falling on the earth surface and converts it into the electrical energy. The output from the solar panel is in the form of DC. The mounting angle, rating and the efficiency of the solar panel is considered in the street light system. The energy from the solar panel is used to charge the battery at day time.

Battery

The power generated by the solar panel is used to charge the battery. During day time energy produced by the solar panel

is supplied to the battery. The battery discharges at night time to drive the load i.e. LED lamp bank.

IC 7805 voltage regulator

Voltage regulators are used to regulate the voltage. The output of the 7805 voltage regulator is 5v. Microcontroller requires 5v supply so the output from the battery which is 12v dc is converted into 5v by using the voltage regulator.

Charge controller

The charge controller monitors the voltage of battery. The main function of the charge controller is prevent the battery from overcharging and over-discharging. The switches are used to operate the charge controller, they may be relay, MOSFET, Power transistors etc.

Microcontroller

Microcontroller is the heart of the system. The microcontroller requires the 5v supply. The 7805 voltage regulator provides the 5v supply to the microcontroller. Microcontroller controls the overall operation of the system. It controls the functions of driver circuit and charge controller circuit.

Light emitting diode(LED)

The LED lamps are used in the street light system because of its advantages such as Low cost, High efficiency, More life and Less power consumption. The LED lamp receive the energy from battery during night time. LED gives more brightness when there is more traffic on the road and its brightness decreases when the traffic is less.

IR sensor

The IR sensor is used as the obstacle detector. It has transmitter and receiver. The presence of the obstacle is detected by the sensors. When obstacles passes and detected by the sensor then the intensity of the LED lamp increases and in the absence of the obstacle the intensity of LED lamp decreases.

LCD display

LCD display is used to display the output of the Light dependant register (LDR). The LDR senses the day time and night time and displays on the LCD. The count of the vehicle is also displayed on the LCD.

Driver circuit

MOSFET is used as Driver circuit. The microcontroller controls the operation and working of the driver circuit, and it control the intensity of LED lamp bank.

III.COMPARISON OF LED LAMP WITH DIFFERENT LAMPS

Type of Lamps	Lamp life in hours	Lumens per Watt	Properties
Incandescent Lamp	1000-5000	11-15	Short life time, very inefficient
Mercury Vapour Lamp	12000-24000	13-48	Very inefficient, ultraviolet radiation
Metal Halide Lamp	10000-15000	60-100	High maintenance, contains mercury & lead
High Pressure Sodium Lamp	12000-24000	45-130	Contains mercury & lead
Low Pressure Sodium Lamp	10000-18000	80-180	Contains mercury & lead
Fluorescent Lamp	10000-20000	60-100	UV radiation Contains mercury
Compact Fluorescent Lamp	12000-20000	50-72	Low life, dimmer in cold weather & contains mercury
LED Lamp	50000-100000	70-150	Most efficient, long life

Table 1. Comparison of Led Lamp With Different Lamps

Hence above table shows the difference between the LED lamp and other lamps used for the lightning system.

IV.APPLICATION AND ADVANTAGES

Advantages:

- Energy Saving
- Low cost
- Non polluting
- Minimum risk of accidents in operation

Application:

In street lighting system



Without Traffic



With Traffic

V. CONCLUSION

Solar energy is renewable source useful in functioning of applications like street light. Around 75% -80% of power consumption can be reduced by using this system towards providing a solution of energy saving. The minimal components including low cost controller and LED module produce the better saving in terms of cost. Streetlights are a large consumer of energy for cities using up to 50 percent of a city's energy budget. If every city installs the proposed system then a lot of power can be saved. Proposed system is power saving mechanism for street lights by using LED lamps as replacement of normal lamps and using special power savings mechanism. Design of solar powered street light system is complicated by the fact that during summer when we get maximum sunlight, minimum energy is needed to operate the street lights due to shorter summer nights; whereas, during winter when sunlight is minimum, maximum energy is needed due to longer winter nights.

The various advancements in the field of solar based LED street light ,the use of solar tracking system has greatly increased the system and has helped to increase its overall output. Whereas the use of charge control circuit in the solar based LED street light has not only helped in saving the battery power but also in preventing the battery from getting deep discharged, overcharged, thereby conserving a lot of energy.

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