Intelligent Street Lighting System using Automatic Solar LED Lamps

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Abstract

Countries today have started looking towards the non-conventional sources of energy as these are not only environment friendly but also very economical. As the energy used to operate a device is important, its proper utilisation too has its own importance. This paper gives an insight of the present trend of using Automatic Solar Light Emitting Diode (LED) street lights for illumination of streets. A basic model and working of this street light system and all the equipments used is presented. This new system of automatic solar LED light is, no doubt, very economical and environmental friendly.

Keywords: Automatic, Illumination, Light Emitting Diode, Non-conventional, Solar, Street Lights

I. INTRODUCTION

The earth provides enough to satisfy every man's need but not every man's greed, said Gandhiji. Today, we are largely dependent on fossil fuels (coal, petroleum etc.) to fulfil the energy needs of ever growing population.

Energy, mainly electrical energy is of utmost importance for developing country like India. Electricity is the basic need of any country. Today, about 88% of total electrical energy production of India is dependent on fossil fuels. The fossil fuels like coal, petroleum, etc. are not only exhaustible but they cause a lot of pollution too in the process of electricity generation. Besides this Energy generation through fossil fuels is very costly and troublesome. Keeping this in mind, it is need of time to start looking at the non-conventional sources and also the efficient utilization of electricity generated from them. To begin this at the ground level, the street lighting system, which forms the basis of infrastructure of any city is the thing which can be changed.

Today, the reduction in amount of electricity used for illumination is a major concern. In particular, energy conservation for large scale illumination tasks such as street light is gaining considerable importance. In most places, the street lights used HID lamps, halogens, sodium vapour lamps, etc. for outdoor illumination. Although these traditional sources of light are still widely used but global concerns are rising concerning the huge amount of power consumed by these sources and consequently the CO_2 released to generate this power. Due to these concerns, the solar powered automatic LED street lights are receiving a lot of attention.

II. ADVANTAGES OF SOLAR LED LAMPS

Solar powered automatic LED street lamps completely outweigh the traditional street lamps in every aspect, be it the lifetime running cost, environment, their maintenance and many others. The various advantages of solar powered automatic LED street lights are-

A. Minimal Power Consumption:

The power consumed by LED lamps is significantly less as compared to that consumed by traditional lamps. Not only this, the solar energy operated street lamps are far more energy efficient as the power required to run these lamps comes from the non-conventional, inexhaustible source of energy instead of fossil fuels.

B. Very Low Running Cost:

As the power required to run these street lamps is very low and all the required power is generated by the lamp mounted solar plate, the running cost of Automatic solar LED street lamp is almost nil.

C. No Manual Switching:

By the use of simple LDR (Light Dependent Resistor) sensors, the manual switching ON/OFF of the street lamps is completely eliminated. This not only saves the cost of human labour but is also very energy efficient as the light will turn ON only when it is required and also they will turn OFF automatically when the day light is sufficient.

D. Very Low Maintenance Cost:

The maintenance cost is reduced to a great extent as compared to the maintenance cost of traditional HID lamps, as the life and quality of solar powered LED lamps is very good. Also, as this system is not connected to any utility grid i.e. street lamps are free from common electric supply, there is very less chance of faults and power cut.

III. BASIC EQUIPMENTS USED

The four major things required for this system to operate are-

A. Led Street Lamp

An LED street light is basically an integrated light emitting diode (LED) light fixture that is used for street lighting. In other words, for a particular wattage of street lamp, a fixed number of LEDs are embedded in a single unit. In manufacturing, the LED light cluster is sealed on a plane and then assembled to the LED Panel with a heat sink to prepare an integrated fixture.

Fig. 1: Actual Solar LED Street Lamp

B. Light Dependent Resistor (LDR):

LDR is an acronym for Light Dependent Resistor. As the name suggests, the resistance of this semiconductor device depends on the light falling on it.

The resistance of an LDR decreases with increasing light intensity. This is the basic key to automatic activation of street lights. The LDR senses the natural lighting conditions. As the daylight becomes low in the evening, the light dependent resistor turns on the street lamp and the street lamps turns off automatically in the morning when there is sufficient light.

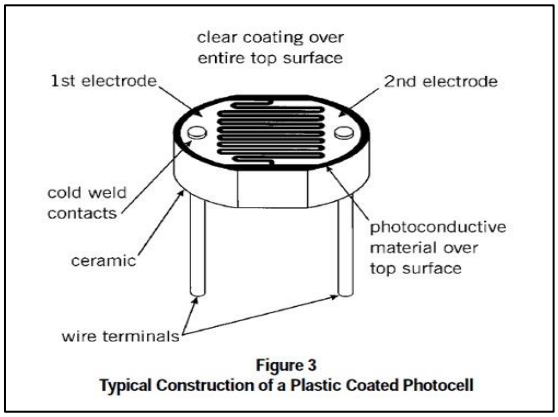

Fig. 2: Typical Construction of a Light Dependent Resistor (LDR)

C. Solar Panel:

Solar panel refers to a set of solar photo voltaic modules electrically connected and mounted on a supporting structure. A photovoltaic (PV) module is a packaged, connected assembly of most important units called Solar Cells.

A solar cell is an electrical device that converts energy of light directly into electricity. It produces electricity when exposed to sunlight. The electricity generated by the solar cells of solar panel, which is mounted on street light, is stored in batteries which provide DC current for turning ON the lights.

D. Battery:

An electric battery is a device consisting of two or more electrochemical cells that convert stored chemical energy into electrical energy. The electrical energy generated by the solar panels is stored in the DC battery connected with them. Typically, a 10-15 Ampere-hour (Ah) DC battery is used.

This battery charges from the electricity generated by solar panels. This battery thus, provides the necessary electrical energy or electricity required for the operation of LED street amp.

IV. BASIC WORKING

The flow chart given below gives a very easy understanding of the working of automatic solar LED street lighting system.

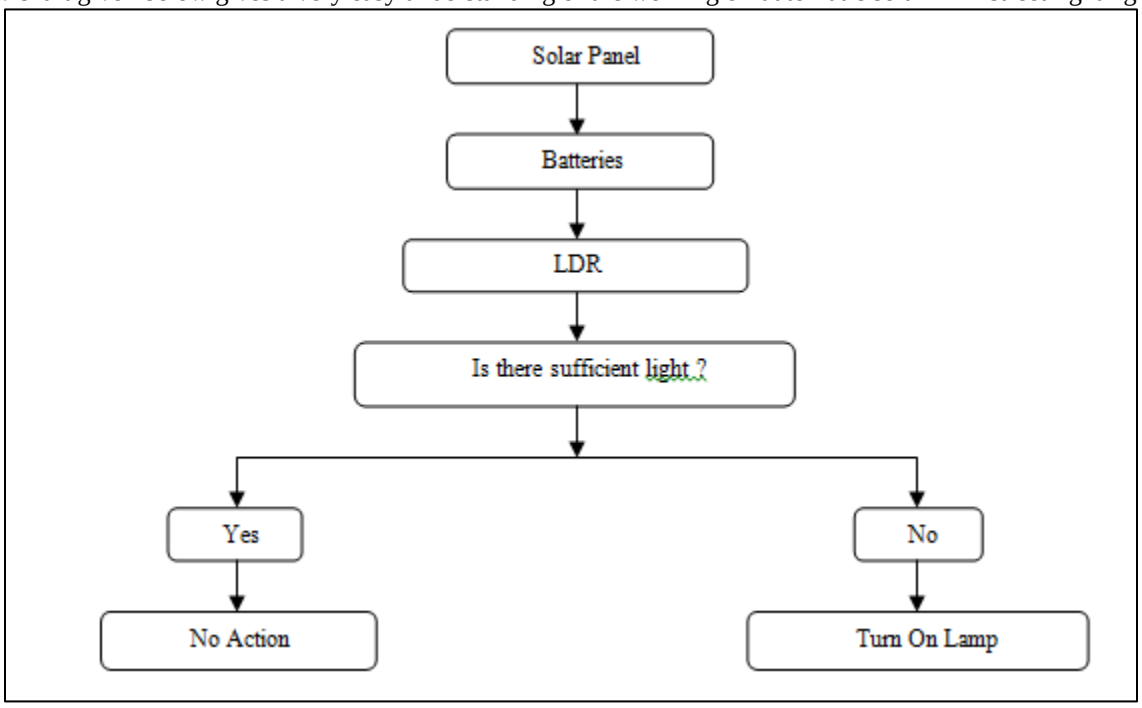

Fig. 3: Flow Chart explaining the basic working of Automatic Solar LED Street Light System

V. CONCLUSION

The system of automatic solar LED street lighting is undoubtedly very efficient in every aspect, be it financial, environmental and many others. Making a short comparison and calculation, if the nearly 2 years of LED street light is employed about 85-90 % of energy can be easily saved. In summary by using intelligent street lighting system, we can save a huge amount of energy. Also solar energy as one of the important and major renewable source of energy also proves itself useful in functioning of constructions of street lights. This system provides an effective measure to save energy by preventing unnecessary production and wastage of energy. Also manual switching is completely eliminated which saves a lot of human labour.
In short this system is very versatile and in accordance with the needs of the present.

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