

Design And Construction Of Moveable Solar Energy Street Light For Use In Nigerian Institute Of Leather And Science Technology.

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Abstract: The solar energy is tapped and converted directly in to electricity by the solar panel (photovoltaic cell) which is being used to power a solar street light. The battery stores the excess solar energy during the day which the charge controller prevents the battery from overcharging and also charges the battery. This project unveils the design and construction of a solar energy street light system with dusk to dawn operation with the aid of light dependent resistor (LDR). The basic system components include a 50 watt solar panel, 100Ah solar battery, 12 volt charge controller, 15 watt energy saving bulb 3.5 meter pole and interconnecting cables. However, the result obtained shows that the charge controller served a dual purpose in channeling electricity (DC) from the photovoltaic module to both the battery and DC electric load. The charge controller also monitoring the system performance and provide system protection.

Keywords: solar panel (photovoltaic cell) solar battery, charge controller, energy saving bulb, pole and interconnecting cables.

1 INTRODUCTION

Solar energy is radiant energy produced in the sun as a result of nuclear fusion reactions. It is transmitted to the earth through space by electromagnetic radiation in quanta of energy called photons, which interact with the earth's atmosphere and surface [1]. The strength of solar radiation at the outerside of the earth's atmosphere when the earth is taken to be at its average distance from the sun is called the solar constant [2].

According to [6], the most reliable value for the solar constant is $1370+6w/m^2$ the intensity is constant however it appear to vary by about 0.2 percent in 30 years. As pollution increases and most accessible coal, gas and oil go up in smoke, renewable energy looks increasingly attractive. It does not cause acid rain, add to the green house effect, or share the problems of nuclear power. The strength of the solar energy available at any point on the earth depends in a complicated but predictable way, on the day of the year, the time of the day, the latitude of the collection point. Furthermore, the amounts of solar energy that can be collected depend on the orientation. Of the collecting object [1]. Solar energy is inexhaustible and non polluting, but converting solar radiation to electricity energy is not yet commercial competitive, because of high cost of producing large scale solar cell arrays and the inherent inefficiency in converting light to electricity. Today, solar research has a similar pattern to nuclear energy, the emphasis is a narrow technical option and test facilitates. An example is a power tower, which is a system for collecting solar energy from a large field of mirrors and converting it to heat at high temperature for efficient generation of electricity. All the mirrors track the sun and the heat is focused on a single boiler thermal system. The purpose is to only cover the midday load as experienced by utilities. To counter the effect of passing cloud there is thermal storage capability fields with oil [6]. Solar research and technology development aimed at finding the most efficient way of capturing the lower desisting solar energy to useful purpose. Also significant potential as power sources are the indirect form of solar energy, wind, biomass, hydropower and the tropical ocean surfaces, [4]. However, four major technologies using solar energy are being developed.

- The heat content of solar radiation is used to provide moderate temperature for space comfort conditioning of buildings, moderate and high temperature heat for industrial processes, and high temperature for generating electricity.
- Photovoltaic convert solar energy directly to electricity.
- Wind energy system generates mechanical energy primarily for conversion to electric power.
- Biomass technology export the chemical produced through photosynthesis to produce energy rich fuel and chemicals and provide direct heat for many uses. [5].

NATURAL TRANSFORMATION OF SOLAR ENERGY

Natural collection of solar energy occurs in the earth atmospheric oceans and plant life. The oceans and the atmosphere for example produce the winds, which have been used for centuries to turn wind mills. Modern application of wind energy use strong, light weather resistant, aero-dynamically designed wind turbines that when attached to generators produce electricity local specialized use or as part of a community or regional, net work of electric power distribution. Approximately 30 percent of the solar energy reaching the outerside of the atmosphere is consumed in the hydrological cycle which produced rain fall and the potential energy of water in mountain stream and rivers. The power produced by these following waters as they pass through modern turbines is called hydro-electricity power [3]. The aims and objective of this project is to prove street light using solar energy with dusk to dawn (automatic) operation with the help of light dependent resistor (LDR). The street light is to be erected at Science Laboratory Technology Department, Nigeria Institute of Leather and Science Technology.

PARTS THAT MAKES UP SOLAR STREET LIGHT

(1) SOLAR PANEL

Its task is to convert the sun's energy into electricity, Different sizes and power output and available. Solar panel should be able to withstand and deliver in extreme weather conditions, some are designed unbreakable

(vandal proof), other with work well in over case weather A 20 years warranty on good solar panels is not unusual.

(2) SOLAR CONTROLLER

The basic circuitry on most solar powered street light consists essentially of an automatic battery charge fed by the solar panel and a lighting controller automated for dusk to dawn operation. Automatic lighting can be triggered by a photo cell or a timer on some models a special, feature dims the light at a given time, thus allowing a longer operation time.

(3) BATTERY

Maintenance-free batteries are generally used on solar street lights. In addition to providing energy for dusk to dawn operation, they must also be able to supply few days of backup power in case of bad weather or charge failure.

(4) LAMPS

The choice of lamps to use in solar powered light is dictated by the kind of application it is to be used for.

- LEDs (Light emitting Diodes) also known as SSL (Solid State Lighting) have a good color rendition. A cluster of extra or ultra bright LEDs forms the lamp, solar LED Street light are an emerging and promising application for LED Technology

(5) LIGHT SOURCE

This is an important indicator which is generally used in low-voltage lamps, solar energy lamps, low pressure sodium lamp, LED light source.

(6) LAMP AND LAMP SHELL

The poles should be based on the high road the width of the pitch lighting, illumination of the road to determine the standard. According to owner collection of lamps shell a number of foreign solar lights, the beautiful and energy saving, energy saving choice of the majority of all, the appearance of the light do not ask for much, the relative utility on the line.

(7) MECHANICAL COMPONENTS (POLE)

The pole is of mild steel pipe with a height of 3.5 meter (approximately 12 feet) above the ground level after grounding and final installation. The pole has a moveable platform which ensures the mobility of the pole from one place to another. The pole will have the provision to hold all weather proof lamp housing. A galvanized metallic frame structure was fixed on the pole to hold the pole to the solar panel. The frame structure has provision to adjust its angle of inclination to the horizontal between 0-90°, so that it can be installed at the specified tilt angle.

(8) SENSOR (LIGHT DEPENDENT RESISTOR-LDR)

An LDR is an input transducer (sensor) which consists brightness sensed (light) to resistance. And the resistance decreases as the brightness of light falls on the LDR increases. A multi-meter can be used to find the resistance in darkness and bright light. The Light Dependent Resistor (LDR) is a sensor where resistance decreases when light impinges on it, the kind of sensor is commonly used in light sensor circuit in urban areas, to

control street lamps for example LDR are made of semiconductor as light sensor sensitive materials on an isolating base.

HOW SOLAR STREET LIGHT WORK

Solar powered streetlights are full of electronics. The solar panel converts the sun's energy to DC electricity. The voltage is then regulated to a specific value by an electronic circuit to charge the battery. A solar controller protects the battery from too low and over charge. Now for the lighting, contrary to LEDs, HID and CFL lamp require a high voltage, particular current, and frequency to work. We now need to control the lamp. To do so timer or photo-cell does the job of switching the light from dusk to dawn. On some advanced solar powered street light, models intensity and color can even be adjusted.

SOLAR STREET LAMP WITH THE BASIC PRINCIPLE OF DESIGN

As the earth increasingly scarce resources, infrastructure investment in energy costs rise ever, a variety of safety and pollution risk is everywhere, solar energy as an "inexhaustible" safety, environmental protection and new energy sources. At the same time along with solar photovoltaic technology development and progress, environment protection, solar energy saving lamps in the dual advantages of solar energy street lamp, courtyard, etc. lawn light has been gradually scale, solar street lighting in the area of development has become increasingly perfect.

MATERIALS AND METHODS

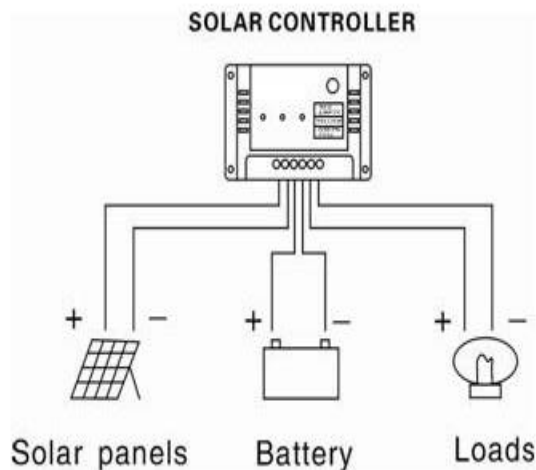
MATERIALS

The materials used are:-

- Solar panel
- Solar controller
- Battery
- Light sources
- Low energy serving lamp
- Non polar light
- Lamps and lamp shells

METHODS

Installed the anti-skid, unloaded the lamp pole, and installed the bracket on the solar panel, the solar panel's direction and angle was adjusted, then the screw tightened at last. The LED Street light was then placed on the lamp pole arm and the screw tightened, the street light was then fixed on the lamp pole arm and then the wires connected through the controller, there are two screws on the back of the control box, these two screws were then used to fix the control box on the lamp pole. Two corresponding screw holes were confirmed to be on the pole first. Thereafter, the wires were connected to the battery to give you the best of solar street light. Further explanation will come through the circuit diagram.



RESULT AND DISCUSSION

After the proper installation have been carried out, that is the appropriate connection of all inter connection cable and ensuring proper internal connection ranging from the solar panel to the battery. And the sensor not accepting the energy saving bulb the result obtained is as follows:- The 15w energy saving bulb turn on when the sensor is shaded with an object and turn off when the sensor is shaded with an object and turn off when the object is removed, indicating dust to dawn operation of the sensor. The more the intensity of the sun the brighter the output and vice versa. However, the charge controller presents the solar battery from overcharging and thus protecting the entire system from damage.

SAFETY PRECAUTION

To ensure proper functioning of the system.

To ensure proper angle of inclination.

Cleaning the solar panel with water and detergent solution.

Don't bend the solar panel.

Do not use measuring equipment of which you know that it is damage or defect.

Ensure proper tightness of the screw with the cable when connecting.

Prevent the battery from radiation of the sun.

The solar charge controller should not be place where sunlight can reach.

MAINTENANCE OF SOLAR STREET LIGHT SYSTEM

Solar energy street light require predict assessment and regular maintenance to keep them operating competently. Also from time to time, components may require repair or substitute. You might be able to handle some of the inspection and maintenance tasks on your own, but others may require a competent technician.

GENERAL MAINTENACE

Photo -voltaic installation should be inspected yearly. However, checks that all fixing and electrical connections are tight and corrosion free. Accumulated dust and dirt should be removed from the front surface of the photo-voltaic modules by washing with water and detergent

solution. Solvent or harsh cleaners should not be use on any parts of the photo-voltaic modules.

CONCLUSION AND RECOMMANDATION

CONCLUSION

Solar energy is inexhaustible and non pollution but converting solar radiation to electric energy is not yet commercial competitive; because of high cost of producing large scale solar cell arrays and the inherent inefficiency in converting light to electricity in poles. The solar street light is a solar energy which spread so widely that it is hard to collect and concentration in large amount. Conclusively, if a good storage, distribution facilities is in place solar energy effectiveness in building will be ensured.

RECOMMENDATION

Solar Street light can be converted to useful solar work or heat by using a collector to absorb solar radiation, allowing much of the sun's radiant energy to be used directly in road by converting it to electric power. However, an indirect passive solar system can therefore be designed both to provide heat to main pole in cold weather and to help cool the pole during hot periods. I hereby recommend the use of solar energy street light system for use in residential, commercial and institutions since solar energy is inexhaustible and non-polluting compared to other energy sources which are not renewable and possess potential health hazard.

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