

Smart Solar Lamp

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Abstract— This research aims at designing an advanced development to save energy of household lights. Solar energy is a renewable source of energy, which is long-lasting and eco-friendly. It can be easily handled and also economic in long term. It is most essential for the system to be automatic, then it is easy to conserve energy as well as to maximize the efficiency of the system. Comfort and safety is one of the biggest requirement in our life, but many real system fails to provide safety and comfort that is required. We are designing such a system which will sense the light and motion as per the requirement and then the whole circuitry will be activated. The lamp consists of following main parts – Solar panel, Led light, PIR sensor (motion detector sensor), LDR, Battery, Burglar alarm.

Keywords: Motion detection, Solar panel, LED, Solar charging controller

I. INTRODUCTION

A smart solar lamp is not a normal lamp which is used in our day to day life. This is efficiently utilizing both the power sources A.C. and Solar energy on the basis of requirement. It contains a photo-voltaic solar panel, an A.C source, an LED lamp, a PIR motion detector and a rechargeable battery. Solar lamps are used for generally illumination where centrally generated power is not conveniently or economically available. The world cannot depend only on fossil fuels for the energy requirements for very long time. Therefore, we must consider renewable source of energy such as solar energy, wind energy, tidal energy, geothermal heat and others. In this research, we choose solar energy which is photo-voltaic system and ideal for providing electrical power. With the help of this power, we light the lamp and run our household devices. One of the biggest advantages of solar energy is that its non-polluting. Other various advantages such as noise free and friendly toward nature. It doesn't harm the natural resources and is very cheap for long term usages. The main aim of this research is illustrating how we can get maximum usages and storage of this energy for further usages. As the topic states that this solar lamp is a smart lamp because If the weather is bad such as cloudy or winter season and electricity is unavailable for some consecutive days, due to which the battery will not properly charge. Therefore, we have given an exception of charging the battery by means of AC supply by means of adaptor. For this automatic switching, we have designed such a circuit which will automatically switch the charging circuit to AC mains by means of relay. Due to this technique, we can be charged the battery whenever mains power is available. This lamp also having a special function of “Motion Detecting” and “light intensity sensing”. We used passive infrared sensor (PIR), which automatically turn on the device when any live object comes toward it. So, whenever any stranger person will try to be closer to the solar lamp and led starts glowing, also the sensor starts

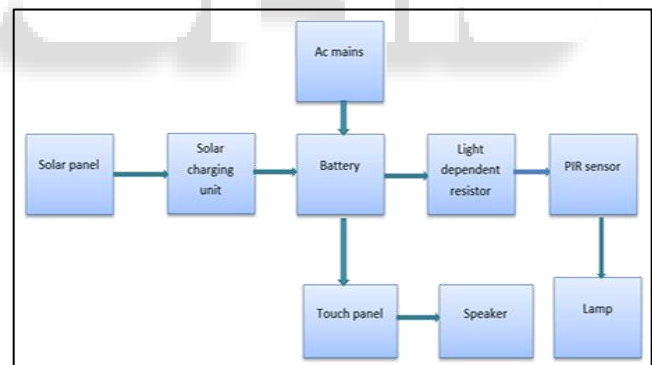
making a noise through a speaker and we get to know who is the person in the installed area of the lamp.

The history of modern lamp was started through Thomas Edison which has invent electric light. We use LED which is two-lead semiconductor light source. It is p-n junction diode, when a suitable voltage applied to the leads electrons are able to recombine with electron holes within the device, due to this energy release in the form of photons. This effect is called electroluminescence, and shade of the light is determined by the energy band gap of the semiconductor. LEDs have many advantages over incandescent light sources such as low power consumption, long life, smaller size, faster switching and other.

II. OBJECTIVE

The objective of the proposed work is to design and construct the solar lamp which is fully atomized with numerous features. This lamp will cover features such as automatic switching of charging mode, turning on Led light, also it provides safety by means of burglar alarm, also it prevents wastage of electrical energy as our project is based on solar energy. It is a fully PCB based project and economically efficient. Reduces mechanical work once the lamp is installed which is very helpful for handicap people.

III. BLOCK DIAGRAM



IV. WORKING PRINCIPAL

The working principle of solar lamp is it has a panel mounted in a particular arrangement at an in such a way that it can receive solar radiation with high intensity easily from the sun. The solar panel turns solar energy into electrical energy. This electrical energy is stored in batteries by using a solar charging circuit. The main function of solar charger is to increase the current from the panel while batteries are charging, It also disconnects the solar panel from the batteries when they are fully charged and also connect to the panel when the charging in batteries is low.

From battery the supply (12V) is passed to the LDR (Light Dependent Resistor) which will sense the intensity of the surrounding light. As we want that the light should turn ON only when the intensity of light is too low

i.e. dark. Thus the LDR will sense the intensity of light and pass the signal to the PIR (Passive Infrared Sensor) when there is darkness. The PIR sensor will sense the motion within its range and thus turn ON the lights for a while(10-20 sec) and gets turn OFF, if there is presence of any motion in its range it turns ON again and if not then it will be remain OFF.

Also supply from the battery given to the burglar alarm circuit. From the burglar alarm circuit two wires are drawn which is to be joint to the ends of the any conductor separated apart from each other. As soon as someone touches both the conductor the circuit gets completed, and alarm starts.

V. COMPONENTS AND SOFTWARE REQUIRED

A. Software Requirements:

- Express PCB.
- Proteus:
- It is a Software used for simulation and designing of PCB layout. It was created by Simone Zanella in 1998. It is fully functional and procedural. It consists of many functions and languages.

B. Hardware Requirements:

- Transistor (BC547,BC548,BC549)
- PIR sensor
- Relay Unit: +12V dc to 230V ac
- Power Supply: 230V,5Hz ac
- Solar Module: 12V, 10W
- S.M.F. Battery: 12V, 7.2 Ah
- Buzzer
- LED lamp
- Capacitor: (1000µf,35V) and (220µf,35V)
- LEDs
- Registers

VI. EXPERIMENTAL RESULT

A. Load calculation:

- Total 126 LED
- 9 LED in Series & 14 LED Lines in parallel.
- Watt = V x I
- Supply voltage =12V, 12V/9 LED= 1.5Volt each LED consuming.
- With reference to data sheet of LED we know each LED consumes 20 milliamp= 0.02 Amp. Of current.
- Hence each Line of LED consumes = 12V x 0.02 Amp=0.24 Watt. Thus 14 Lines of LED will consume = 0.24 x 14= 3.36 Watt. System Voltage = 12 Volt.

B. Battery Capacity:

- Taking battery's depth of discharge (DOD) = 70% (Deep discharge protection)
- Ah = Ampere Hour (Current per hour)
- Battery Ah = Total Watt/system voltage.
= (12x1.3)/12
= 15.6/12
=1.3 Ah

- With DOD usable capacity = 1.3 X 0.7 =0.91Ah ,So 1.3-0.91=0.39 Ah
- Total Ah required with DoD= 1.3+ 0.39 =1.69Ah
- Total Ah required with DoD = 1.69 Ah
- Total Ah = Calculated Ah * Backup Hr. (e.g. 1.3 x 20 Hr. = 26 Ah)
- But as per market battery availability we have 1.3 Ah battery available which will give 20 Hrs. battery backup.

C. Led glow timing

The lamp will turn ON only when the light intensity is lower than the set value in LDR and a motion is detected by the PIR sensor. The light will stay awake till:

$$T=0.986RaC$$

$$Ra=12kohn$$

$$C=1000Uf$$

$$T=0.986 \times 12kohm \times 1000Uf$$

$$= 12 \text{ sec}$$

Where Ra=R2 & C=C1 (refer Fig2). After this time T, in sec the light will automatically turn OFF. The light will stay OFF until no low intensity of light is detected by it.

VII. CONCLUSION

This project is intended to design a simple and low cost multitasking hybrid solar lamp with a motion detector. This is not only a simple solar lamp, it is having an additional feature of charging better by mains supply if the weather is cloudy and having a motion detector sensor which ensure the safety. While constructing this system, we will be using PIR sensor as motion detector and good materials at low cost. Our aim is to design such a system in such a way that its components will be able to provide better lighting in night and provide safety to nearby area.since the whole system is operating automatically, so it does not need any experienced person to operate it. It is portable and not so expensive. The design has much more scope for future research and development. Though it is a project, we hope some modification in this project will lead to a wide variety of usage.

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