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Solar Lamp Using Renewable Energy Source

Shubham Dhengre¹, Ranjeet Thakur², Sagar Khade³, Prof.S.k.Mude⁴

Student, Dept. of Electrical Engineering, KDKCE Nagpur Maharashtra, India¹

Student, Dept. of Electrical Engineering, KDKCE Nagpur, Maharashtra, India²

Student, Dept. of Electrical Engineering, KDKCE Nagpur, Maharashtra, India³

Assistant Professor, Dept. of Electrical Engineering KDKCE Nagpur, Maharashtra, India⁴

ABSTRACT: Comfort and safety is one of the biggest requirements in our life. But many real systems fail to provide safety and comfort that we need. Making such a system is a big challenge because of need to make many controlling systems which can run in same time. We create such a system which have multipurpose lighting as well as security system. Our project capsuled three systems as – Solar powered lightning, motion-based lightning, touch based security, which will give the idea of using renewable source of energy at large scale with minimum

KEYWORDS: Solar lamp, Security, Burglary alarm, Light, Emergency, Energy efficient, Motion detection, automatic.

I. INTRODUCTION

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 sun energy on the basis of requirement. It contains a photovoltaic 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 generated power is not conveniently or economically available. The world cannot depend only on fossil fuels for the energy requirements for very long time. Fossil fuel is limited on our earth, in which speed it uses, one day come when it will end. When we burnt them, they produce air pollution which is biggest factor of global warming, acid rain, health issue and others.

Therefore, we must choose 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 photovoltaic system and ideal for providing electrical power. With the help of this power, we light the lamp and run our home appliances. One of the biggest advantages of solar energy is non-polluting. Other various advantages such as noise free and ecofriendly. It does not harm the natural resources and very cheap for long term usages. The main aim of this research is illustrated 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 emergency 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 proper charge. We use a 12v charger which has been charge the battery using relay switch. With the help of this technique we can be charged the battery whenever mains power is available.

This smart solar lamp also having a special function of “Motion Detecting”. We used passive infrared (PIR) sensor, which automatically switch on the device when any living object comes closer to it. So, whenever any person will try to be touch to the touch panel of surrounding area to the solar lamp then the alarm starts making a noise through a speaker

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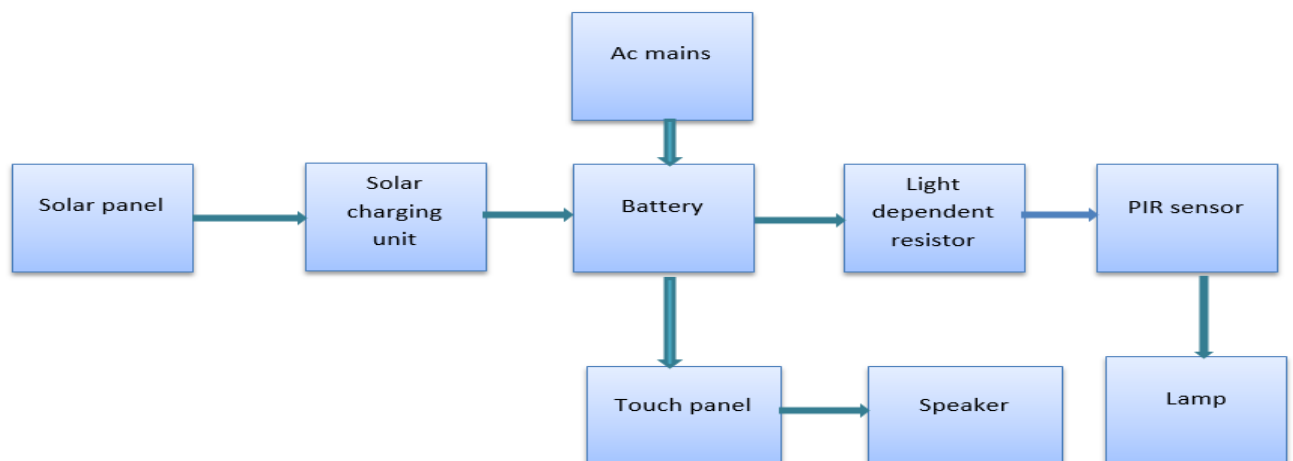
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II. OBJECTIVE

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. Reduces mechanical work once the lamp is installed which is very helpful for handicap people.

III. BLOCK DIAGRAM



IV. WORKING PRINCIPAL

The solar lamp described here has 51 white LEDs. It is powered either by solar power or AC mains or 12V SMF battery, under normal operation the lamp is powered by the battery. Here the circuit is basically divided into two parts: A charging unit and Load unit.

The lamp will work with AC mains with battery voltage lower than 10V, 230V is given through charger unit, DC voltage is around 12v. We used capacitor C1 because it increases the response time of relay, due to this switching occurs sometime later when the voltage across it falls below 10V. When battery charges through A.C source then capacitor filters the rectified output. Switching time of relay is very important and delay in switching is depends on the value of capacitor.

When the battery voltage drops to 10V, the battery-charge-controller circuit goes into operation. Selection between a solar panel and AC mains for charging is done with the help of solid-state relays. If both sources are connected, the system selects solar power over AC mains for charging the battery. When battery voltage is lower than 10V Output of comparator circuit will be high, which is shown by the on state of green LED.

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PIR sensor detects infrared radiation of the human body. It has a single output that goes high when motion is detected. In the case of security when the person touches the panel surrounding area restricted by wires then alarm start.

V. COMPONENT USED

i. PIR Motion Detector

This is a great invention called passive infrared sensor (PIR), every object have the temperature above zero value emits thermal energy forms of radiation radiates wavelengths of 5-6 meters of time of day The PIR sensor is used to detect the detect any wavelength when humans passes in this range The term pyro means the generate electrical signal t low amplitude this sensor doesn't have the infrared source of its own that's why its called passive infrared sensor its work as the passive its range has a 5 meters its widely used in automatic door lock system ,elevator, automatic lights system shops , where human presence or absence puts the device into passive or active state .PIR sensor detects a human being moving around within approximately 10m from the sensor. This is an average value, as the actual detection range is between 5m and 12m.PIR are fundamentally made of a pyro electric sensor, which can detect levels of infrared radiation. For numerous essential projects or items that need to discover when an individual has left or entered the area. PIR sensors are incredible, they are flat control and minimal effort, have a wide lens range, and are simple to interface with.



PIR SENSOR

ii. SOLARPANEL

The solar panel is primary source of energy in this project. It provides D.C current to the monitoring circuit where it is used to charge the battery. Basically, three types of solar panel available they are single crystalline, polycrystalline and thin film. We used single crystalline in this project. It is the most efficient and its efficiency is approx. 15-18%. A large chunk of silicon crystal makes it different from others.

Solar panel efficiency refers to the amount of sunlight converted to electricity in specific area. Under above two types of solar panel technology, mono crystalline is best in efficiency. Monocrystalline have highest efficiency of up to 20%, require less space but they are little expensive than polycrystalline solar panel. A 100-watt poly and mono crystalline panel will generate the same amount of power but the mono-crystalline panel will take up less space than a poly-crystalline panel.

Mono-crystalline efficiency – 20%

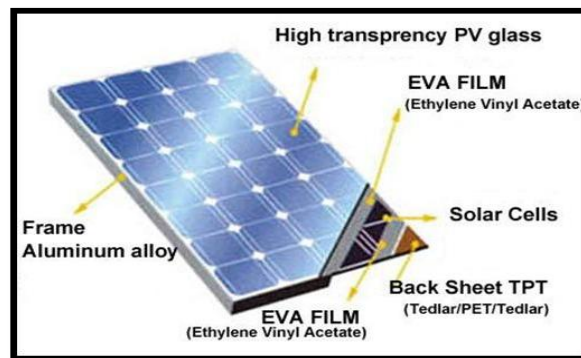
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Poly-crystalline efficiency– 17%



SOLAR PANEL

VI. COMPONENT AND SOFTWARE REQUIRED

Software Requirements:

- i. Express PCB.
- ii. Proteus:
- iii. 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.

Hardware Requirements:

- i. Transistor (BC547, BC548, BC549)
 - ii. PIR sensor
 - iii. Relay Unit: +12V dc to 230Vac
 - iv. Power Supply: 230V, 50Hz ac
 - v. Solar Module: 12V, 10W
 - vi. S.M.F. Battery: 12V, 7.2Ah
 - vii. Buzzer
 - viii. LED lamp
 - ix. Capacitor: (1000 μ f, 35V) and (220 μ f, 35V)
 - x. LEDs
- Registers

VII. EXPERIMENTAL RESULTS

I. LOAD CALCULATION

- Total 126 LED
- 9 LED in Series & 14 LED Lines in parallel.
- Watt = V x I

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- Supply voltage =12V, 12V/9 LED= 1.5Volt each LEDconsuming.
- 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= 3.36Watt.
System Voltage = 12 Volt.

II. BATTERY CAPACITY:

- Takingbattery'sdepthofdischarge(DOD)=70% (Deep dischargeprotection)
- Ah = Ampere Hour (Current perhour)
- Battery Ah = Total Watt/systemvoltage.

$$=(12 \times 1.3) / 12$$

$$= 15.6 / 12$$

$$= 1.3 \text{Ah}$$

- With DOD usable capacity = 1.3 X 0.7 =0.91Ah ,So 1.3-0.91=0.39Ah
- Total Ah required with DoD= 1.3+0.39=1.69Ah
- Total Ah required with DoD = 1.69Ah
- TotalAh=CalculatedAh*BackupHr.(e.g.1.3 x 20 Hr. = 26Ah)
- Butaspermarketbatteryavailabilitywehave
1.3 Ah battery available which will give 20 Hrs. batterybackup.

III. 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:

$$T=0.986RaC$$

$$Ra=12\text{kohm}$$

$$C=1000\text{Uf}$$

$$T=0.986 \times 12\text{kohm} \times 1000\text{Uf}$$

$$= 12 \text{ sec}$$

Where $R_a=R_2$ & $C=C_1$ (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.



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VIII. 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. To design this system, we will use PIR sensor for motion detection and good materials at low cost. Our target is to design a system in such a way that its components will be able to provide better light in night and ensure the safety of nearby area. The whole system operates automatically. So, it does not need any expert person to operate it. It is portable and not so expensive. This 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 reasonable diversity of usage

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