

Smart Solar Lamp with Auto Turn-On Mechanism

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Abstract -

Lights are important in day-to-day life of human beings. There are various types of lights in the market according to different requirement. They are mainly LEDs, CFLs, Incandescent lights etc. This research mainly deals with LED lights. Here we are trying to contribute for safer and greener environment so we are using solar energy. The entire circuit will be energized with a form of clean energy. Comfort and safety are one of the biggest requirements in our life. But many systems fail to provide such and making such kind of a thing is a big challenge because to make many controlling systems which can run in same time is a difficult task. We have tried to create automation in lighting system through this research.

Key Words: Solar Lamp, LED, Battery, Sensors

1.INTRODUCTION

Solar lamps are used for illumination where centrally generated power is not conveniently or economically available. In this research we choose solar energy which is photovoltaic cell system, an ideal for providing electrical power.

It is also provided with sensors. They are there for the smart action of the lamp. It has a PIR sensor that will detect the motion in its vicinity and an LDR sensor to check the light intensity of the surrounding. Also, another add-on feature is of burglar alarm which is provided for safety purpose. The main purpose behind it is to provide the function of automation. This lamp wouldn't require somebody to go near it and turn it ON.

This system is smart enough to charge the battery either by solar energy or by ac mains. If the solar energy is adequate then it will charge from there otherwise if the weather is cloudy or solar energy is not properly available then it will charge through ac mains.

2.LED TURNING ON MECHANISM

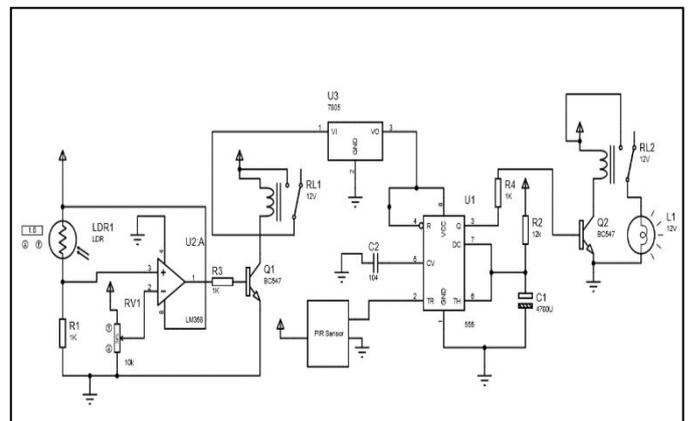


Fig-1: Circuit Diagram for Turn-On Mechanism of LED

The above circuit diagram is mounted on PCB. In above diagram, LM 358 IC is used as a comparator. The LDR is connected in series with resistance R₁. The LDR and R₁ used as voltage divider. When the light intensity decreases, the voltage drop across LDR also decreases. The non-inverting pin of Op-Amp is connected to LDR. The inverting pin of Op-Amp is connected to potentiometer. The potentiometer is used to set the voltage of comparator. When the intensity of light decreases, the output of the Op-Amp is set to high and accordingly the relay is set on and connect the next stage for performance. The next stage is performance of human sensor detection system. In this system, PIR sensor is used to detect the human presence, if the human presence is detected, then at that time the mono-stable multivibrator will set the relay ON for some time. When the human being is present then at that time the LED light will turn ON, and when there is no human in the area then light will automatically turn OFF. Relay is driven through transistor BC547, the relay is used for connecting LED lamp on battery.

3. BLOCK DIAGRAM AND ITS EXPLANATION

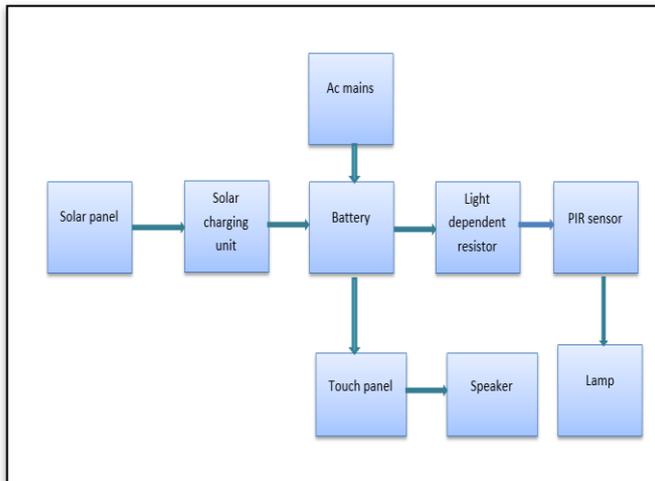


Fig-2:Block Diagram of Solar Lamp

The working principle of solar lamp is it has a panel mounted in a particular arrangement 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. Also, it 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. When the solar power is not enough to charge the battery then a relay connected will act and immediately will switch the charging of battery to ac mains automatically. It is to be noted that ac mains is considered as an alternative source in case solar energy not available.

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 and gets turn OFF, if there is presence of any motion in its range it turns ON again and if not then it will 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.

4. CALCULATIONS

The lamp will turn ON when the light intensity is low than the set value in LDR and a motion is detected by the PIR motion sensor.

The light will stay in ON condition for a time period of;

$$T = 0.986R_aC$$

Where $R_a = R_2$ and $C = C_1$ (Refer Fig-1).

$$R_a = 12000\Omega \text{ and } C = 1000\mu f$$

$$T = 0.986 * 12000 * 1000$$

$$= 12 \text{ sec}$$

After a motion is detected the light will turn ON and stay in glow state for T period. After T time it will automatically turn OFF. The light will stay in OFF till no further low intensity of light sensor is detected.

5. ADVANTAGES

1. No Maintenance Required.
2. Reduced Electricity Bill.
3. Easy installation.

6. APPLICATIONS

1. Outdoor lighting scheme of home and for security purpose.
2. College's outdoor premises.
3. Garden or park

7. CONCLUSIONS

We intend to make a simple low- cost and multi-tasking solar lamp based on working of sensors like motion sensor and light sensor. The system also has an add-on feature of charging through AC supply incase if proper solar energy is not available. The design has more scope for future research and development. Though it is a project, we hope some modification will lead to wide variety of usage.

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