

# Solar Based Automatic Street Light Control

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**Abstract:** *Our domain name is street light. It is sure that we can't leave in a society without power. So we need to maximize the usage of renewable energy so that we can preserve conventional resources. Normal solar PV based street lighting system lacks automation. The problem is that it will be on state even though there is no need of light and hence it causes loss of power. Yet another problem is that in these system which is not automated, when any fault occurs we may not be able to know about the problem and hence the problem remains won't be rectified. In this design a new technique is suggested to automate the entire system. Here when there is no necessity of light the system will go into a power down mode and the lamp won't glow. Presence sensor is used to detect the presence of humans or cars then it gets turned on automatically. So in the absence of the object, the light won't be on. So that's energy be saved. And we can use maximum use of solar energy in street light and can reduce unnecessary use.*

**Index Terms -** Solar module, Battery, LED light.

## I. INTRODUCTION

Automatic Street Light Control System is a simple and powerful concept, which uses transistor as a switch to switch ON and OFF the street light automatically. By using this system manual works are removed. It automatically switches ON lights when the sunlight goes below the visible region of our eyes. It automatically switches OFF lights under illumination by sunlight. This is done by a sensor called Light Dependant Resistor (LDR) which senses the light actually like our eyes. By using this system energy consumption is also reduced because now-a-days the manually operated street lights are not switched off properly even the sunlight comes and also not switched on earlier before sunset. In sunny and rainy days, ON time and OFF time differ significantly. Automatic Streetlight needs no manual operation of switching ON and OFF. The system itself detects whether there is need for light or not. When darkness rises to a certain value then automatically streetlight is switched ON and when there is other source of light, the street light gets OFF. The extent of darkness at which the street light to be switched on can also be tailored using the potentiometer provided in the circuit. Moreover, the circuit is carefully designed to avoid common problems like overload, relay chattering and inductive kick back in relay. The automatic streetlight control system operates on 12 V DC supply. The automatic streetlight controller has a photoconductive device whose resistance changes proportional to the extent of illumination, which switches ON or OFF the LED with the use of transistor as a switch. Light dependent resistor, a photoconductive device has been used as the transducer to convert light energy into electrical energy. The central dogma of the circuit is that the change in voltage drop across the light dependent resistor on illumination or darkness switches the transistor between cut-off region or saturation region and switches OFF or ON the LED.

## II. SOLAR TECHNOLOGY <sup>[4]</sup>

Solar energy is radiant light and heat from the Sun that is harnessed using a range of ever-evolving technologies such as solar heating, photovoltaic, solar thermal energy, solar architecture, molten salt power plants and artificial photosynthesis. It is an important source of renewable energy and its technologies are broadly characterized as either passive solar or active solar depending on how they capture and distribute solar energy or convert it into solar power. Active solar techniques include the use of photovoltaic systems, concentrated solar power and solar water heating to harness the energy. Passive solar techniques include orienting a building to the Sun, selecting materials with favourable thermal mass or light-dispersing properties, and designing spaces that naturally circulate air. The major application of solar technology:

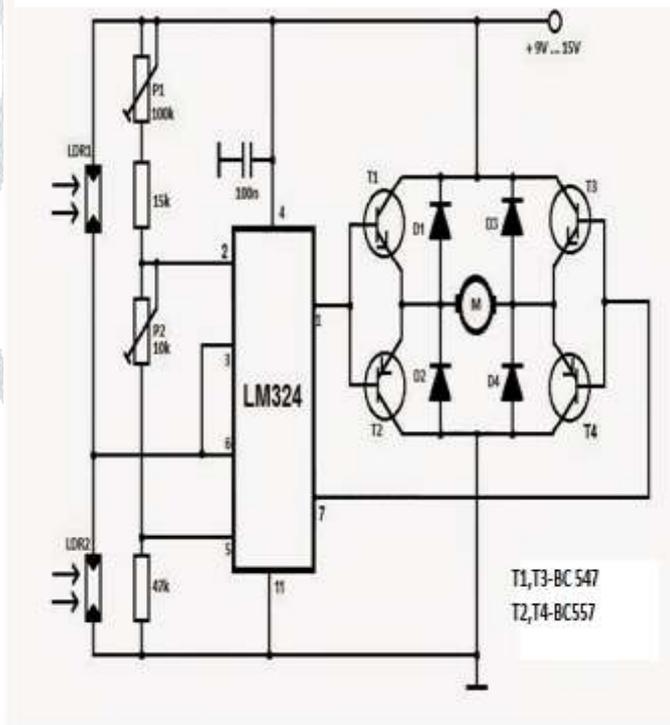
- Water heating
- Heating, cooling and ventilation
- Electricity production

## III. CIRCUIT DIAGRAM

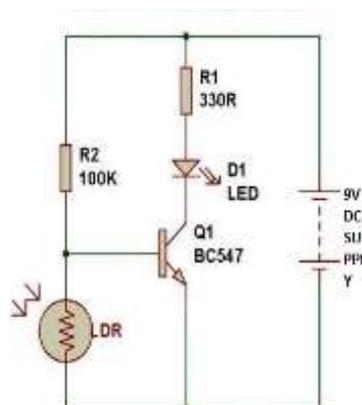
### 1. TRACKING CIRCUIT

S.No.	Component	Nos	Used
1	Solar panel	1	Power generate
2	100K Resistor	1	To offer resistance
3	15K Resistor	1	To offer resistance
4	47K Resistor	1	To offer resistance
6	Diode	4	Indicator
7	10K Variable Resistor	1	Switch ON point tuning
8	LDR 10 mm	2	Photoconductor
9	Battery (9v-12v)	1	To storage supply
10	BC 547 Transistor	2	Amplifier and switch
11	BC 557 Transistor	2	Amplifier and switch
12	LM 324	1	Op-amp IC
13	Stepper motor (10 RPM)	1	Rotate panel
14	PCB	1	Circuit Board

Fig.2TRACKING CIRCUIT



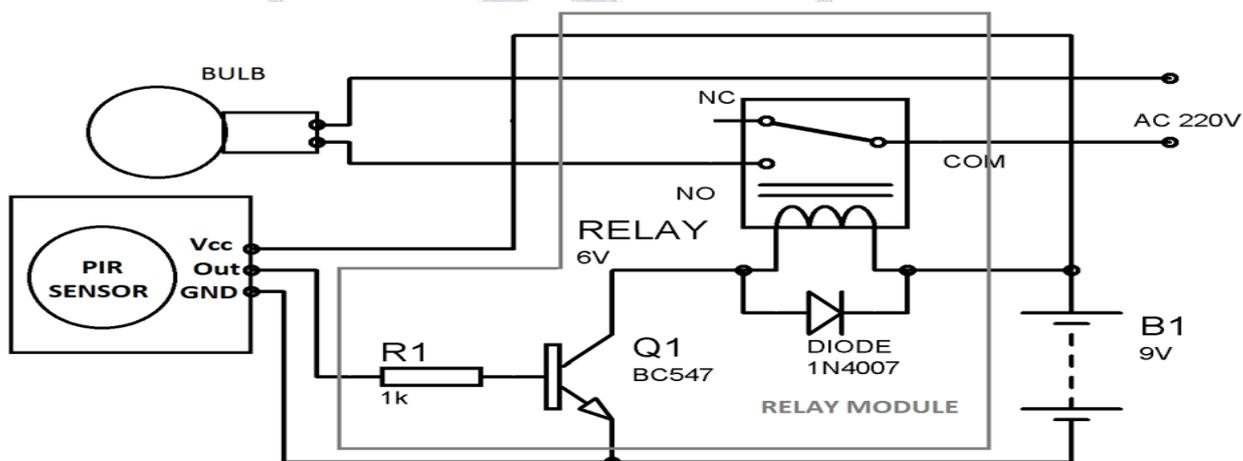
2. DARK CIRCUIT



S.No.	Component	Nos	Used
1	330 OHM Resistor	1	To offer resistance
2	100K Resistor	1	To offer resistance
3	PCB	1	Circuit Board
4	Diode	4	Indicator
5	BC-547	1	Switch ON point tuning
6	LDR	2	Photoconductor
7	Battery (9v-12v)	1	To storage supply

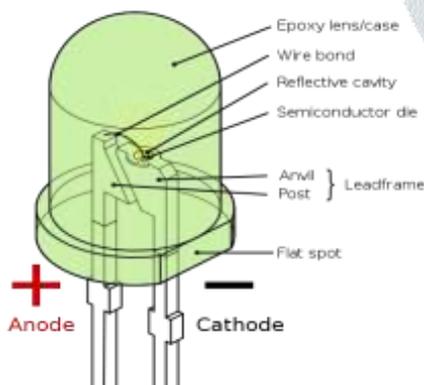
Fig.1 DARK CIRCUIT

3. PIR SENSOR CIRCUIT



IV. COMPONENT WITH DESCRIPTION

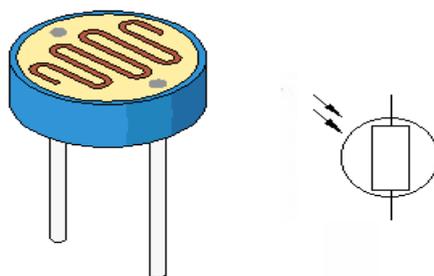
A. LIGHT EMITTING DIODE



Led (watt)	Average lumen	Watt per day (10 hour glow)
9	1000	12
15	1600	16
18	1800	19

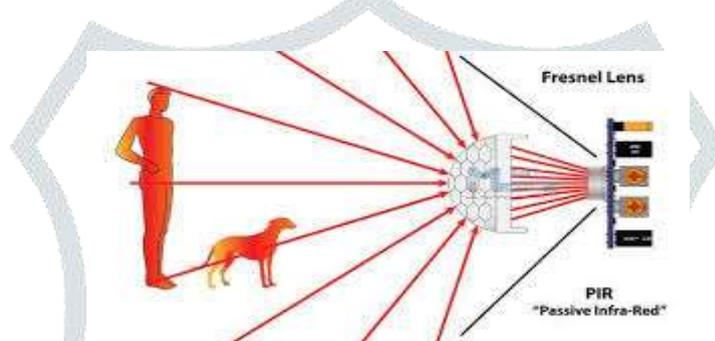
Light-emitting diodes are elements for light signalization in electronics. The basic principle behind the working of LED is electroluminescence. The Light emitting diode should be forward biased to get the light. In Light emitting diodes, electrons are injected from low work function cathode to the conduction band of the n-type semiconducting material and holes are injected from high work function anode to the valence band of the p-type semiconducting material. When the electron in the conduction band combines with the hole in the valence band, energy is released. In case of indirect band gap semiconductors, phonon will be released to conserve of both energy and momentum. But in case of direct band gap semiconductor, light will be emitted whose wavelength depends on the band gap of the semiconductor. The main advantage of Light emitting diode over other light sources is its increased efficiency. LEDs are available in red, orange, amber, yellow, green, and blue and white. Blue and white LEDs are much more expensive than the other colors. We have employed low cost Red LED in our electronic circuit.

B. LIGHT DEPENDENT RESISTER



A light dependent resistor is a resistor whose resistance changes with the intensity of incident light. The working principle of light dependent resistor is photoelectric effect. A light dependent resistor is made of a high resistance semiconductor. If the energy of the incident light is greater than the band gap of the semiconductor, electron-hole pairs are generated. The photo generated electron-hole pair transits the device giving rise to photoconductivity. The essential elements of a photoconductive cell are the ceramic substrate, a layer of photoconductive material, metallic electrodes to connect the device into a circuit and a moisture resistant enclosure. Light sensitive material is arranged in the form of a long strip, zigzagged across a disc shaped base with protective sides. For additional protection, a glass or plastic cover may be included. The two ends of the strip are brought out to connecting pins below the base as shown above. The above mentioned features drive us to opt for CdS based LDR in our electronic circuit for Automatic street light controller.

C. PIR SENSOR [8]



When the **sensor** is idle, both slots detect the same amount of IR, the ambient amount radiated from the room or walls or outdoors. When a warm body like a human or animal passes by, it first intercepts one half of the **PIR sensor**, which causes a positive differential change between the two halves.

D. SOLAR CELL EFFICIENCY IN DIFFERENT MATERIAL [7]

Common Solar Cell Material	Efficiency in %
Single Silicon(SI)	15%-20%
Poly/Mono Silicon(SI)	10%-15%
Amorphous Silicon(A-SI)	5%-10%
Gallium Arsenide (GA As)	25%-30%
Cadmium Telluride(Cd Ta)	7%
Copper Indium Diselenide (CSI)	10%

E. DISTANCE BETWEEN TWO POLE [6]

Solar Street Light	Pole (meter)	Height	LED Street Light (power)	Optimum Distance B/W Pole (meter)	Max. Illumination (lux)	Beam Angle
1	4	9		10-12	10	45
2	4	15		12-18	18	60
3	5	18		14-20	20	60
4	6	30		18-24	22	65
5	7	50		21-28	32	70

F. SOLAR STREET LIGHT INSTALLATION

Lamp	15 W
Battery	12V 25Ah
Solar Module	30W
Pole	M.s with nut and bolt foundation
Wire	2 core 2.5 segment with sleeve
Height	18.8 feet

## V. PROBLEM ASSUMPTION

- To keep the various parameter in street light to installation in the rural area in India.
- To optimize the cost of the solar street light and distance between the two pole.
- To optimum area of the installation of street light in villages of India.
- To calculation of the battery and panel in using of street light by according of the use of light (CFL &LED).
- To show the effect of the emission of pollution and heat effect on the environment.
- To doing the economy and good payback period of the solar street light.

## VI. SUGGESTED SOLUTION

The renewable energy sources have implementation of the solar street light. Solar Street light is achieves the good position of the global market. Solar street light has become the friendly and economically for the streets of rural and urban areas in India. We have studied about the solar panel, LED light, CFL light, chargeable battery, control charge and the calculation of needs of solar panel. Now the street light has become the main power of the renewable energy sources. We have studied in this project how street light is beneficial and efficient to the government of India. Solar Street light in LED light is best for installation and high efficiently. LED light is increasing and good for cost effectiveness. LED street light has less maintenance and the save electricity in actual due to this it has become the motivation part of the solar street light. We have also discussed about the how street light reduced the criminal cases in rural area and urban area in night. In this report we have replaced the fluorescent lamp to the CFL and study how efficient CFL as compare to the fluorescent lamp. And also replace the CFL to the LED light and calculate the efficiency each other. The calculation of LED light is show the life more time period as compare to another lamps.

## VII. APPLICATION

By employing this circuit, energy consumption can be reduced considerably as the light switches ON or OFF automatically in appropriate time. Moreover, errors which occur due to manual operation also can be eliminated completely. The Automatic street light controller unit fabrication is cost-effective with good sensitivity and high reproducibility. Moreover, the construction of the circuit is also simple so that it can be done easily as it involves locally available components. The circuit is designed in such a way that the extent of darkness at which the light has to switch ON or OFF also can be tailored whenever it is needed. It can be used for other purposes like garden lighting, balcony lighting etc.

## VIII. CONCLUSION

Automatic control using LDR helps to save a large amount of electric power which is wasted in conventional street lighting system. The automatic switching operation observed using the control circuit is found to be very efficient and the maintenance cost is very less. The circuit controls the turning ON or OFF the streetlight. The street lights have been successfully controlled by automatic. With commands from the sensor the lights will be ON when it's dark. Furthermore the drawback of the street light system by just using timer controller has been overcome, where the system depends on both sensor and LDR.

## IX. ACKNOWLEDGMENT

We take this opportunity to express our deep gratitude towards **Dr.SUBHASH TECHNICAL CAMPUS** of **ELECTRICAL ENGINEERING DEPARTMENT** with who help and guidance we achieved success in our project. We sincerely thank our guide **Prof. RAHUL CHANDEGARA, Prof. MANAN DESAI** for valuable assistance and above advice to us in the development of our project. We are thankful to him for her innovation ideas and suggestions on this project which help us to make this project batter. We would like to thanks to our professor for his encouragement and guidance towards our project. We miraculous attention towards our project work. We would also thank our entire group member who encouraged & helped this project making successful.

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