INSTITUTE OF ENGINEERING AND TECHNOLOGY LUCKNOW

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEEROING

A PROJECT REPORT
ON
PHOTO-SENSITIVE LIGHTENING

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With immense pleasure we are presenting "**Photosensitive Lightening"** project report as part of the curriculum of mini project/assesment would like to express my deepest appreciation to all those who provided me the possibility to complete this report.

A special gratitude I give to my seminar guide, **"Mr Nitin Verma"** whose contribution in stimulating suggestion and encouragement helped me to complete this report.
Furthermore, I would also like to acknowledge with much appreciation the crucial role of ''Mr Nitin Verma'', who conducted this mini project session perfectly and also to the respected HOD, ''Mr. SRP SINHA''.

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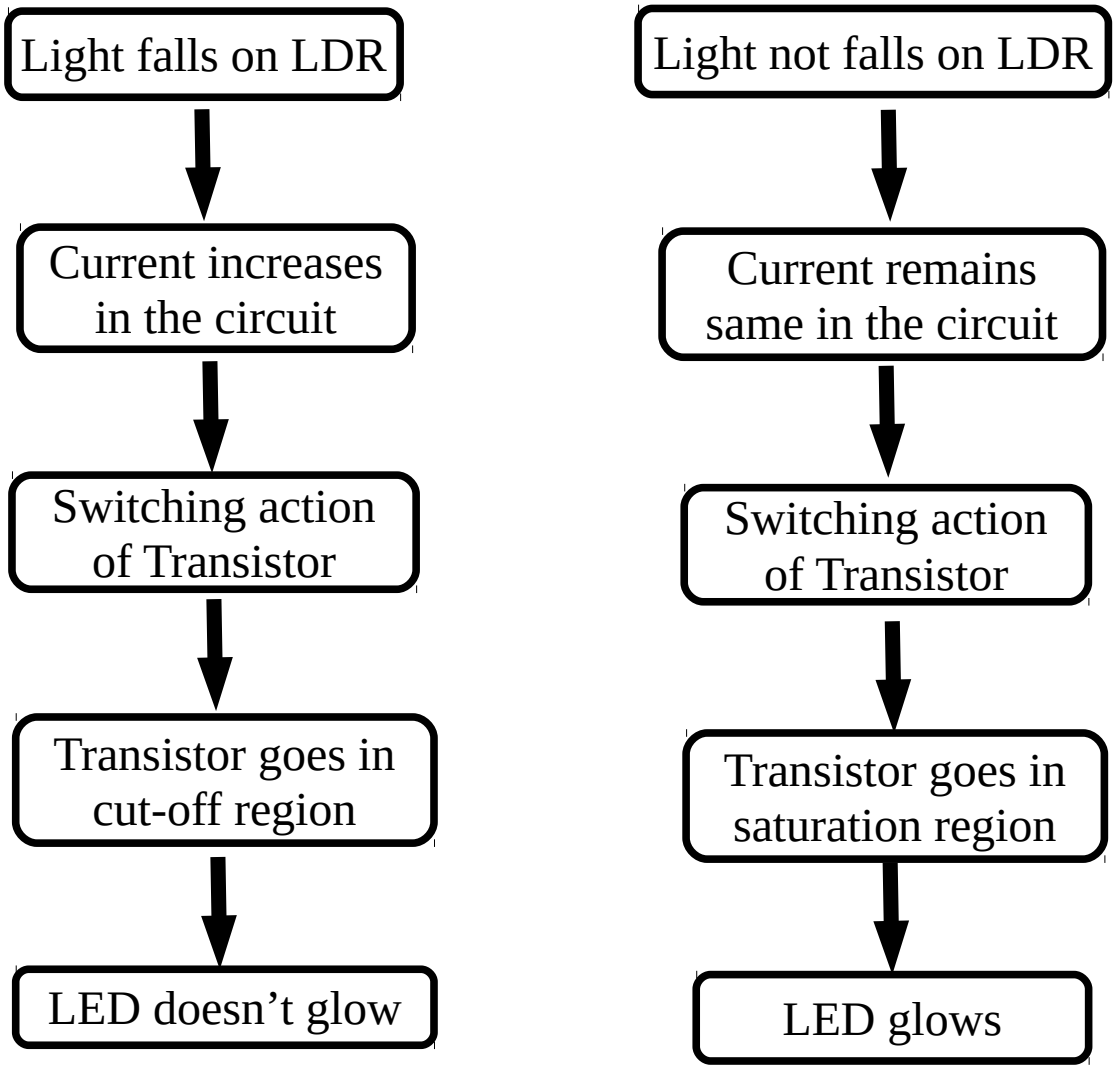
INTRODUCTION

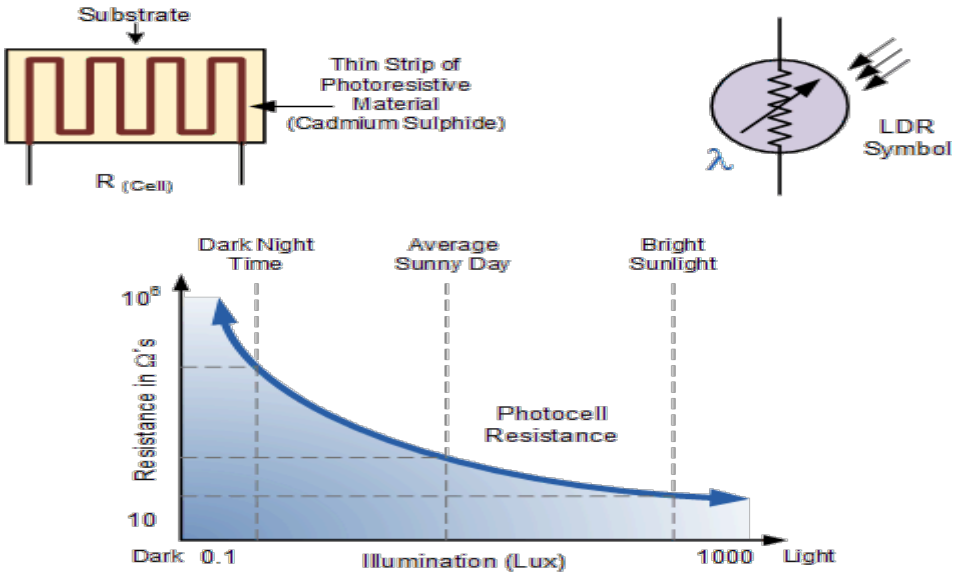
We have prepared working model illustrating the working of photo sensitive diode (or say light detector).For this purpose we have used Cadmium Sulphide photo resistor, also known as CdS cell. A photo resistor changes its resistance based on the amount of light that hits it.When a lot of light hits it, it has almost zero resistance – it conducts electricity very well.When no light hits it, it has high resistance – it conducts elctricity poorly. CdS cell cannot draw enough current to activate the relay when light hits it.Therefore we need to add a transistor to amplify the current that flows through CdS cell.

BLOCK DIAGRAM



COMPONENTS

(1) Light Dependent Resistor



Light Dependent Resistor (LDR) is made from a piece of exposed semiconductor material such as cadmium sulphide that changes its electrical resistance from several thousand Ohms in the dark to only a few hundred Ohms when light falls upon it by creating hole-electron pairs in the material.

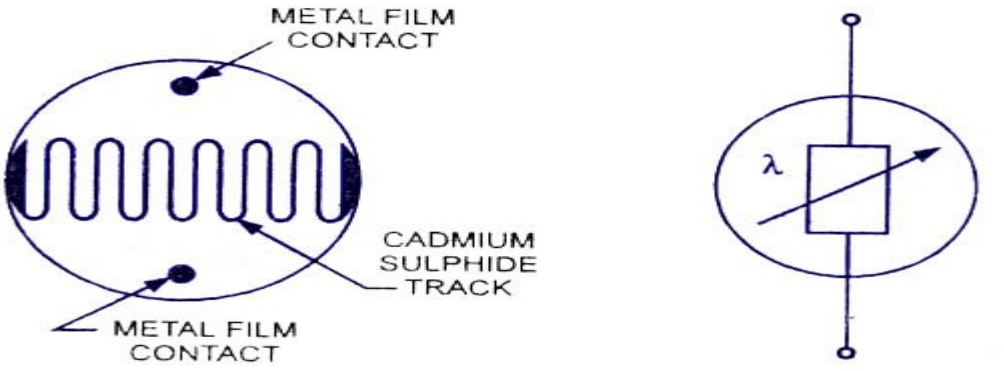
The net effect is an improvement in its conductivity with a decrease in resistance for an increase in illumination. Also, photoresistive cells have a long response time requiring many seconds to respond to a change in the light intensity.

Materials used as the semiconductor substrate include, lead sulphide (PbS), lead selenide (PbSe), indium antimonide (InSb) which detect light in the infra-red range with the most commonly used of all photoresistive light sensors being **Cadmium Sulphide** (Cds).

Cadmium sulphide is used in the manufacture of photoconductive cells because its spectral response curve closely matches that of the human eye and can even be controlled using a simple torch as a light source. Typically then, it has a peak sensitivity wavelength (λp) of about 560nm to 600nm in the visible spectral range.

(2) Transistor(2N2222 A 331)

It is a high speed switching transistor used for switching purpose as well as a NPN voltage amplifire circuit.



(a) Basic Structure *(b) Symbol*

LDR

2N2222A is a NPN transistor hence the collector and emitter will be left open (Reverse biased) when the base pin is held at ground and will be closed (Forward biased) when a signal is provided to base pin. 2N2222A has a gain value of 110 to 800, this value determines the amplification capacity of the transistor. The maximum amount of current that could flow through the Collector pin is 800mA, hence we cannot connect loads that consume more than 800mA using this transistor. To bias a transistor we have to supply current to base pin, this current (IB) should be limited to 5mA.When this transistor is fully biased then it can allow a

maximum of 800mA to flow across the collector and emitter. This stage is called Saturation Region and the typical voltage allowed across the Collector-Emitter (VCE) or Base-Emitter (VBE) could be 200 and 900 mV respectively. When base current is removed the transistor becomes fully off, this stage is called as the Cut-off Region and the Base Emitter voltage could be around 660 mV.

(3) Carbon Resistor (1 k-ohm)

In the circuit shown we have used carbon resistor of 1k-ohm resistance because light sensitive diode (CdS cell),Transistor and LED have an operating voltage range <5 volt and we have given power supply through 9 volt battry which, if directly connected to the terminals of the LED will destroy it.
Thus it is compulsory to use carbon resistor in series.

(4) Power Supply(9 volt DC source)

We have used high watt 9 volt power supply battery as a DC source for constructing the circuit of our project.
It is connected to the circuit using battery connector.

(5) LED (Light Emitting Diode)

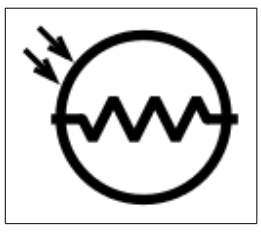
As is evident from its name, LED (Light Emitting Diode) is basically a small light emitting device that comes under “active” semiconductor electronic components. It’s quite comparable to the

normal general purpose diode, with the only big difference being its capability to emit light in different colors.

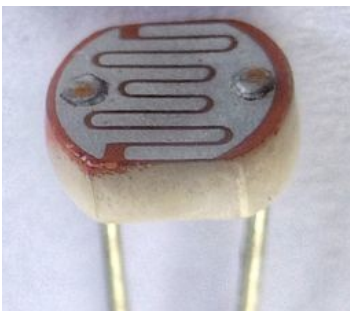
The two terminals (anode and cathode) of a LED when connected to a voltage source in the correct polarity, may produce lights of different colors, as per the semiconductor substance used inside it.

A light-emitting diode is a two-lead semiconductor light source. It is a p–n junction diode that emits light when activated. When a suitable voltage is applied to the leads, electrons are able to recombine with electron holes within the device, releasing energy in the form of photons. This effect is called electroluminescence, and the color of the light (corresponding to the energy of the photon) is determined by the energy band gap of the semiconductor.

(6) LDR (Light Dependent Resistor)



Electronic symbol



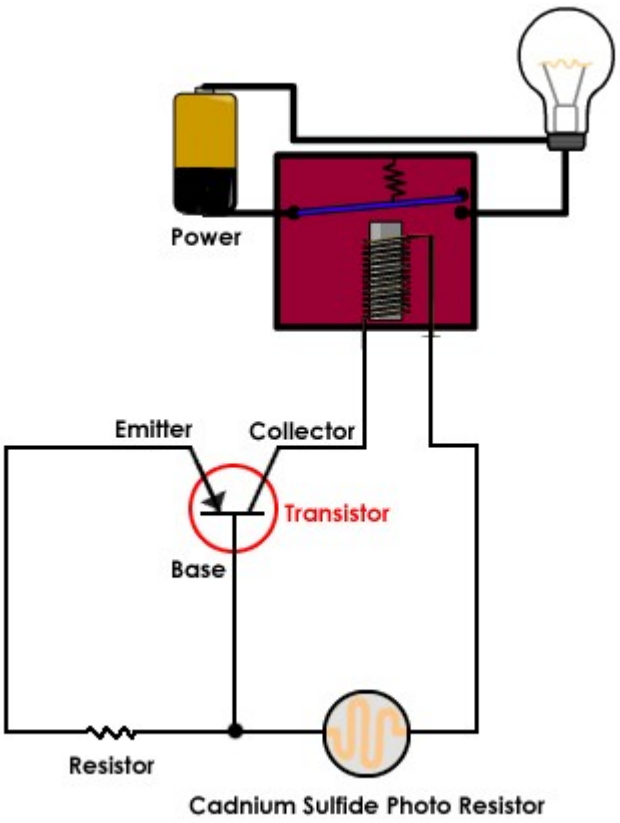
A LDR or a photo resistor is a device whose resistivity is a function of the incident electromagnetic radiation. Hence, they are light sensitive devices. They are also called as photo conductors,

photo conductive cells or simply photocells.It works on the principle of photoconductivity. The passive component is basically a resistor whose resistance value decreases when the intensity of light decreases.

This optoelectronic device is mostly used in light varying sensor circuit, and light and dark activated switching circuits. Here, we have used Cds LDR as it is cheap and readily available in the market.

The snake like track shown on LDR is the Cadmium Sulphide (CdS) film which also passes through the sides. On the top and bottom are metal films which are connected to the terminal leads. It is designed in such a way as to provide maximum possible contact area with the two metal films. The structure is housed in a clear plastic or resin case, to provide free access to external light.

CIRCUIT DIAGRAM



WORKING

As explained above, the main component for the construction of LDR is cadmium sulphide (CdS), which is used as the photoconductor and contains no or very few electrons when not illuminated. In the absence of light it is designed to have a high resistance in the range of megaohms. As soon as light falls on the sensor, the electrons are liberated and the conductivity of the material increases. When the light intensity exceeds a certain frequency, the photons absorbed by the semiconductor give band electrons the energy required to jump into the conduction band. This causes the free electrons or holes to conduct electricity and thus dropping the resistance dramatically (< 1 Kilo ohm).

The equation to show the relation between resistance and illumination can be written as

R = A.E^a

where, E–Illumination(lux)
R–Resistance(Ohms)
A,a – constants

The value of ‘a’ depends on the CdS used and on the manufacturing process. Values usually range betwee 0.7 and 0.9.

If a small amount of current flows from emitter to base, then a large amount of current can flow from emitter to collector. In other words, if the base is grounded, it turns the "switch" on. So when light shines on the photocell, it turns the transistor on, other transistor does the switching action “OFF”, which turns the light off. When it is dark, the photocell has high resistance, so no

current flows through the base and the transistor does the switching action “ON” -- the light is on.

Usually, however, a CdS cell cannot draw enough current to glow the LED when light doesn’t hits it. Therefore you need to add a transistor to amplify the current that amplifies the current passing through the LED.

RESULT

We have studied the construction, working and charactristics of Photo sensitive resistor , 2222A 331 transistor, LED and carbon resistor and also prepared a circuit showing the working of these as a phot-sensitive lightening (which is similar to street light).

APPLICATION

1)It is used for making automatic street light.

2) It is used for making self adjustable lightening in home and offices for power saving purpose.

3)Other lightening purposes.