

BASIC ELECTRICAL AND ELECTRONICS ENGINEERING.

- Mini Project Report -

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Computer Science and Design.
2021-22



MET's INSTITUTE OF ENGINEERING

DEPARTMENT OF COMPUTER SCIENCE AND DESIGN

CERTIFICATE

This is to certify that this Micro Project Report

"LED and Photodiode"

Under Course

Basic Electronics And Electric Engineering

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MAYBORG

2021-22

As a part of Micro project work as prescribed by

Mahrastra State Board Of Technical Education, Mumbai.

And that I have Guided Them for the said work from time to time and I Found them satisfactorily progressive.

And that , the said work has been assessed by me and I am Satisfied that the same is upto the standard envisaged for the level of the course

Prof. SUJATA AVHAD

LECTURER AND PROJECT GUIDE

Computer Science And Design

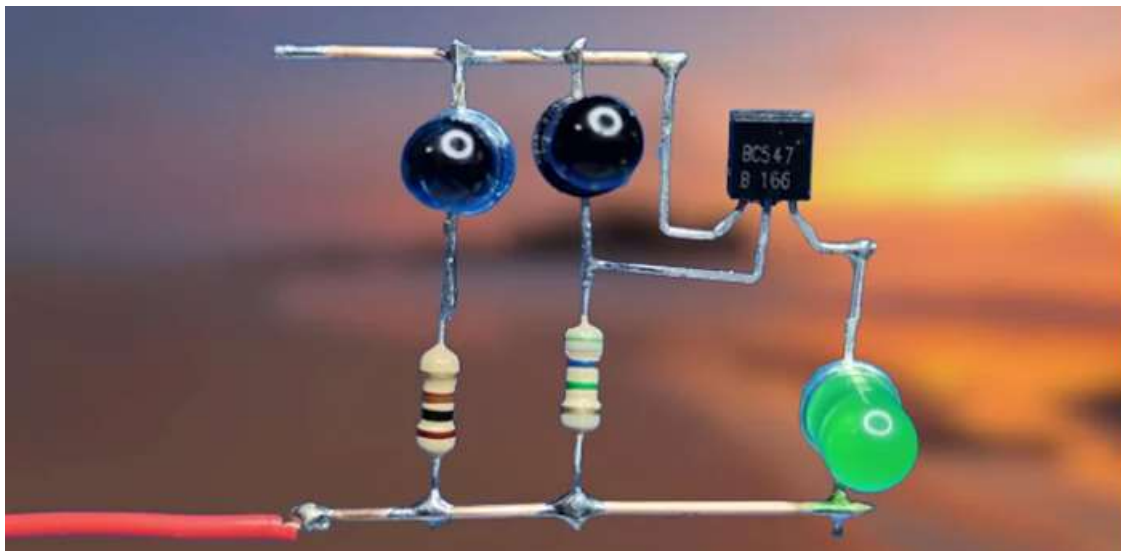
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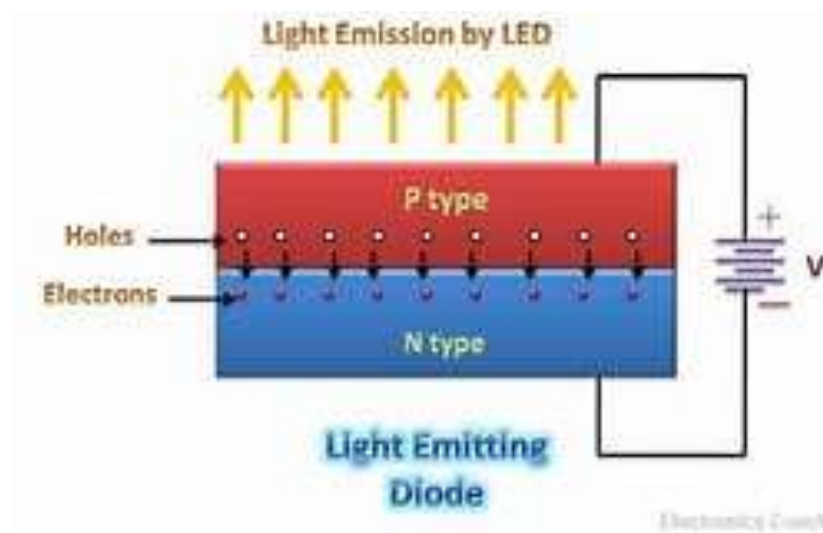
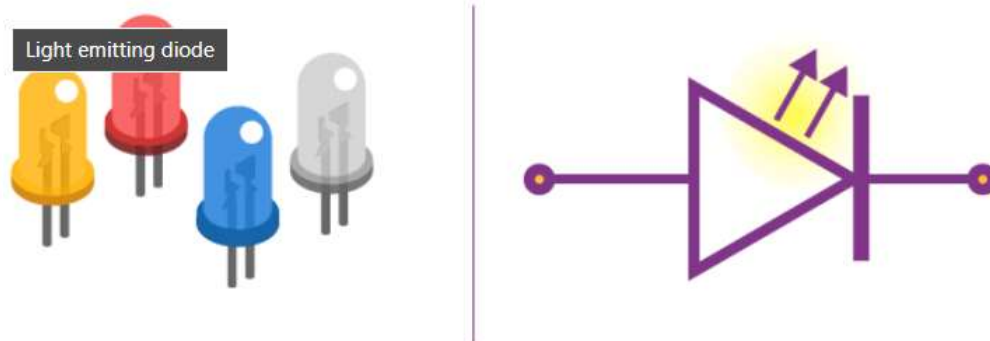
Demonstration of Properties of LEDs And Photo diodes by Constructing Proximity Sensor.

An IR proximity sensor works by **applying a voltage to a pair of IR light emitting diodes (LED's)** which in turn, emit infrared light. This light propagates through the air and once it hits an object it is reflected back towards the sensor. If the object is close, the reflected light will be stronger than if the object is further away.



INTRODUCTION

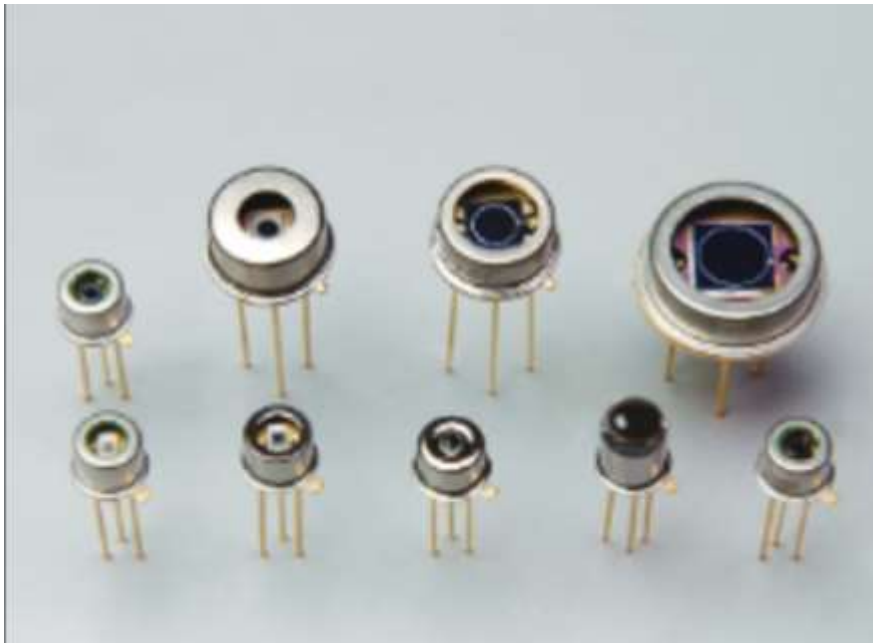
LIGHT EMITTING DIODES



LED (light emitting diode):

The LED operates on the principle of **electroluminescence** while **photodiode** works on the principle of the **photoconduction**. In a Light emitting diode, when electrons and holes recombine, the energy is released in the form of light. Thus, it is termed as Light-emitting diode.

PHOTO-DIODES :



SYMBOL:

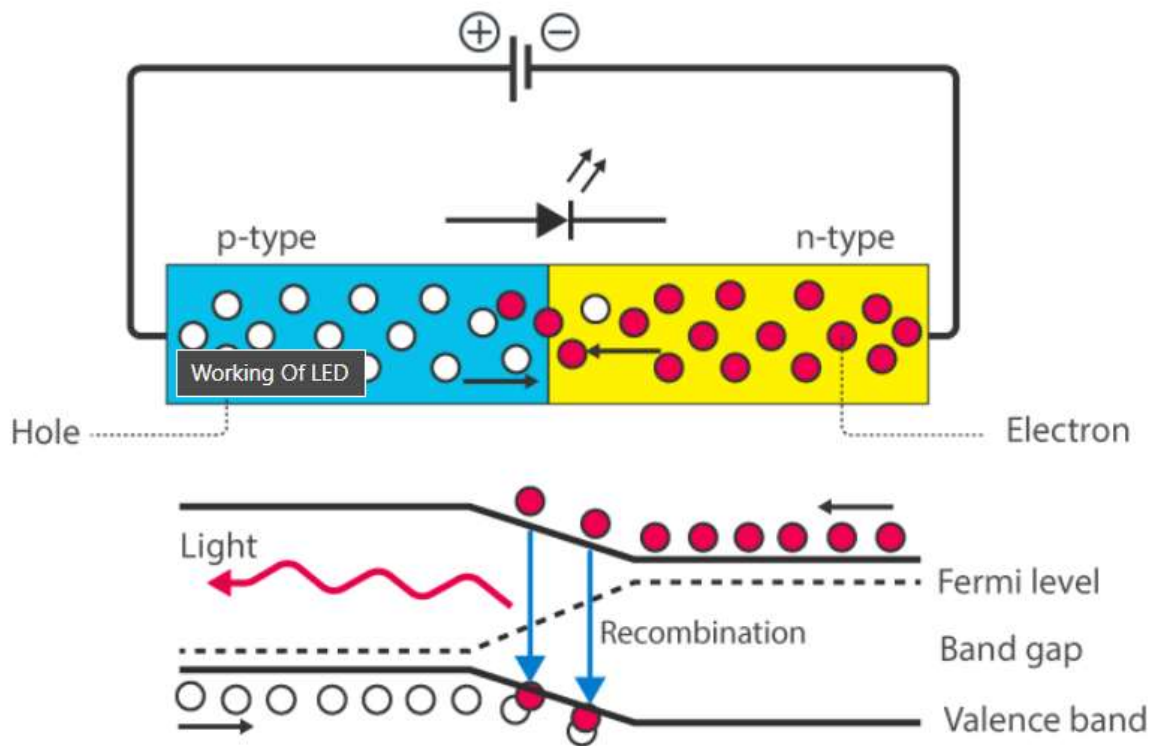


PHOTODIODE:

A **photodiode** is a PN-junction diode that consumes light energy to produce an electric current. They are also called a photo-detector, a light detector, and a photo-sensor. Photodiodes are designed to work in reverse bias condition. Typical photodiode materials are **Silicon**, **Germanium** and **Indium gallium arsenide**.

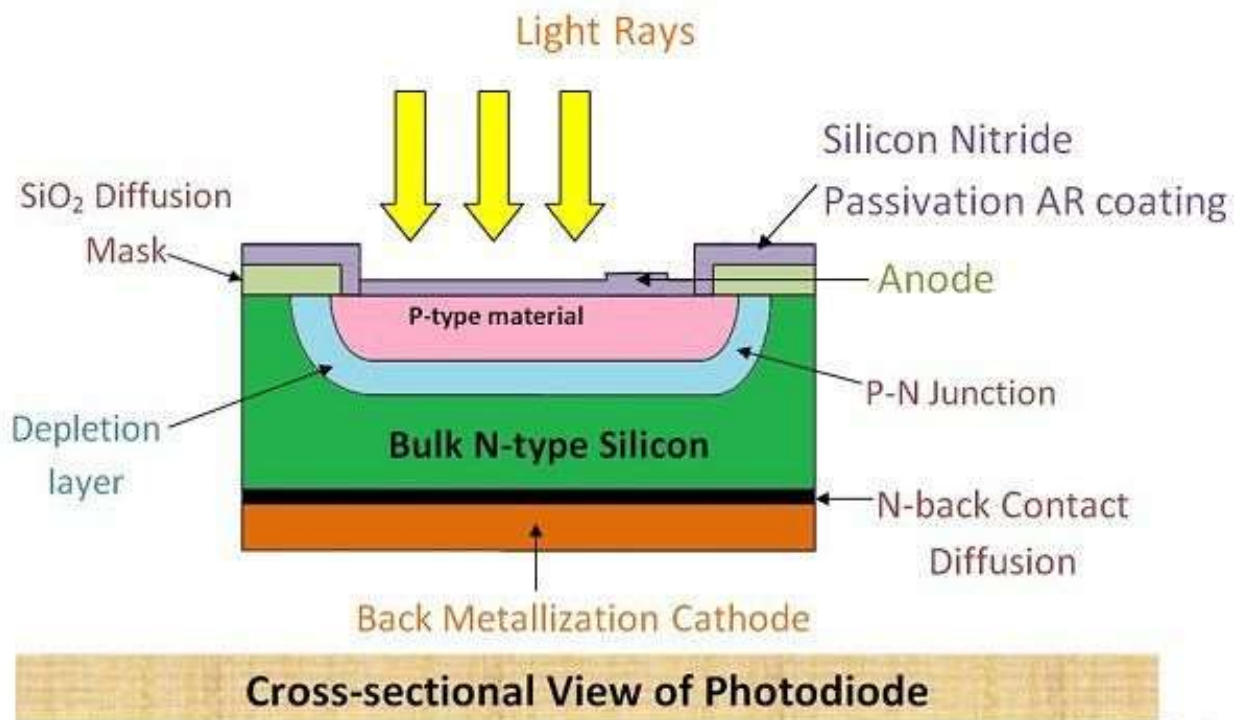
TECHNOLOGY

WORKING OF LED :



The energy is released in the form of photons on recombination. In standard diodes, the energy is released in the form of heat. But in light-emitting diodes, the energy is released in the form of photons. We call this phenomenon electroluminescence. Electroluminescence is an optical phenomenon, and electrical phenomenon where a material emits light in response to an electric current passed through it. As the forward voltage increases, the intensity of the light increases and reaches a maximum.

WORKING OF PHOTODIODE :



Working of Photodiode:

A photodiode is subjected to photons in the form of light which affects the generation of electron-hole pairs. If the energy of the falling photons ($h\nu$) is greater than the energy gap (E_g) of the semiconductor material, electron-hole pairs are created near the depletion region of the diode. The electron-hole pairs created are separated from each other before recombining due to the electric field of the junction. The direction of the electric field in the diode forces the electrons to move towards the n – side and consequently the holes move towards the p-side. As a result of the increase in the number of electrons on the n – side and holes on the p-side, a rise in the electromotive force are observed. Now when an external

load is connected to the system, a current flow is observed through it.

The more the electromotive force created, the greater is the current flow. The magnitude of the **electromotive force** created depends directly upon the intensity of the incident light. This effect of the proportional change in photocurrent with the change in light intensity can be easily observed by applying a reverse bias.

Since photodiodes generate current flow directly depending upon the light intensity received, they can be used as photodetectors to detect optical signals. Built-in lenses and optical filters may be used to enhance the power and productivity of a photodiode.

IMPLEMENTATION

Here we are going to make a simple a simple proximity sensor circuit using the LEDs and Photodiodes. The implementation of the Photodiode is to detect the infrared radiation emitted by infrared LED. After detection of the light it will send the signal to B547 transistor which will eventually turn the indicator LED ON when Light is detected .

REQUIREMENTS :

Knowledge required :

- 1) Handling of various electrical accessories.
- 2) Properties of electrical components .
- 3) Awareness of electrical circuitry.
- 4) Theoretical background of the electrical components.

Components required:

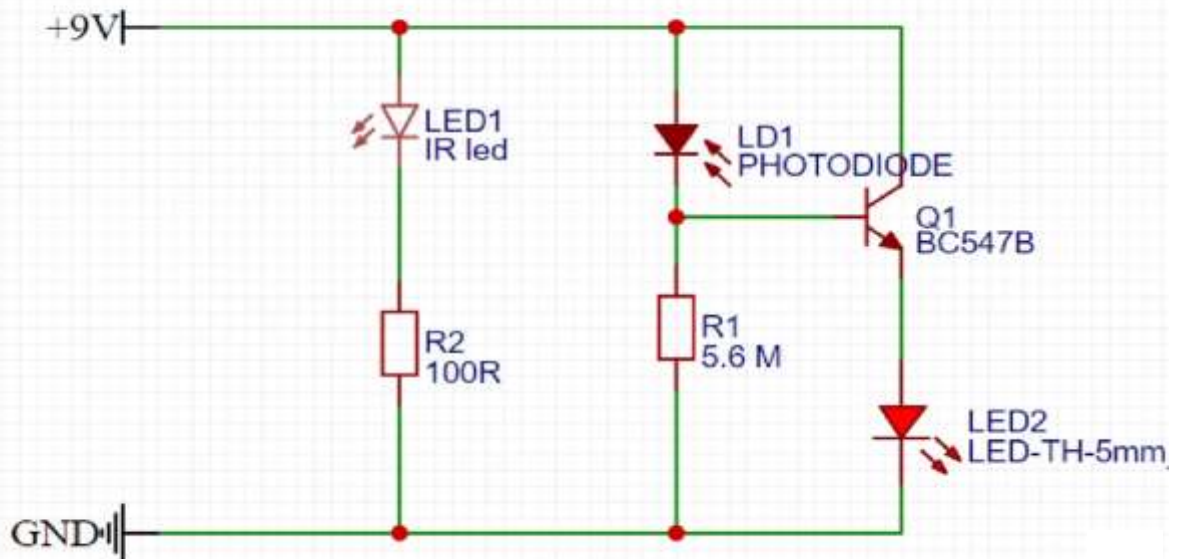
- 1) Infrared LED (Light Emitting Diode)
- 2) Indicator LED
- 3) Photodiode
- 4) Resistor (100ohm & 5.6Mohm)
- 5) Transistor (B547)
- 6) Battery
- 7) Zero PCB
- 8) Various electrical accessories.

Conditions For Demonstration :

- 1) Low ambience .
- 2) Less proximity to the device.
- 3) Monitored and regulated power supply.

PROJECT MODEL

CIRCUIT DESIGN :



Principle of Proximity Sensor :

A sensor that can be used for detecting the presence of objects surrounding it without having any physical contact is termed as a proximity sensor. This can be done using the electromagnetic field or electromagnetic radiation beam in which the field or return signal changes in the event of the presence of any object in its surrounding.

This object sensed by the proximity sensor is termed as a target.

Thus, if we discuss about different types of targets such as plastic target, metal target, and so on requires different types of proximity sensors such as capacitive proximity sensor or photoelectric proximity sensor, inductive proximity sensor, magnetic proximity sensor and so on. The range in which the proximity sensor is able to detect an object is termed as nominal range. Unlike the other sensors, proximity sensors can last for long life and have very high reliability as there are no mechanical parts as well as no physical contact exists between the sensor and sensed object.

Explanation of Circuit diagram:

Here when the circuit is close the IR LED connected to the circuit emits Infrared radiations which cannot be seen by naked eyes. IR sensitive Photo diode detects the Infrared Wavelength and starts conducting this triggers the BC547 transistor which is then connected to the Indicator LED terminal thus the indicator LED glows.

The Indicator only Glows when the IR sensitive Photo diode starts conducting and Behaves as close switch . the IR sensitive Photodiode detects the light reflected from the nearby objects and thus starts conducting thus it can sense the proximity of the object from photo diodes.

APPLICATIONS :

When you need object detection for a robot or other electronics project, an IR proximity sensor can be a great solution. These devices are probably most common as a small PCB, and after using one for his [automatic hand sanitizer](#), Automatic door opening systems , Intrusion Detection , etc.

When sufficient IR light is reflected back to the receiver, it signals the first transistor, which in turn signals the second transistor to provide power to a green LED. This lights up to indicate that something is around. There's no sensitivity pot, but if needed the emitter/receiver sensor can be bent so as to avoid false readings. A 100 ohm resistor is added to the positive leg of the LED to avoid sending it excessive current, and powered is supplied by a 9V battery.

Perhaps several of these could be used together for a full robotics setup, or one could even be integrated into a revised non-contact hand sanitizer!

USES of This Device :

- 1) Automatic Door openers.
- 2) Automatic Hand sanitizing.
- 3) Light sensitive Ambience.
- 4) Robotics .

ADVANTAGES :

1) Greater Sensitivity :

It is modest sensitive to Infrared Wavelength which makes it accurate in detecting the nearby objects .

2) Cost Efficient :

The components used in this circuit are too much cheap and easily accessible this make it a best device to implement in various areas.

3) Not Energy Efficient :

The components like BC547 transistor , LEDs , Photodiode And Resistors Consumes more Energy.

4) Less use of complex circuitry :

This device minimizes the use of various components like motion sensitive circuits and ICs for detection of proximity.

5) Compact Design :

As the circuit has very few no. of components it is very compact and portable.

6) Simple design and great looks.

DISADVANTAGES :

1) Not Energy Efficient :

The components like BC547 transistor , LEDs , Photodiode And Resistors Consumes more Energy.

2) Cannot be used in Outdoor conditions :

As the sunlight contains various wavelengths of light .It is hard for this device to detect the proper light emitted from its own source and thus malfunctioning.

MAYBORG

SKILLS DEVELOPED

- 1) Learnt the application of Photo diode in a circuit.
- 2) Learnt the uses of various components of electrical circuits.
- 3) Studied the logic of the transistors .
- 4) Learnt the construction of the circuit.
- 5) Understood the working of various electronic components.
- 6) Learnt to solder the components on PCB.

CONCLUSION

The demonstration of the Photodiode and LED is Carried out successfully , photodiode started conducting at its specific absorbing rate . Thus the properties of photodiode and LEDs can be observed.



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