

PHYSICS INVESTIGATORY PROJECT

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INFRARED DETECTOR

ACKNOWLEDGMENT

It is a genuine pleasure to express our deep sense of thanks and gratitude to our physics teacher miss Nisha as well as our Principal to provide us the wonderful opportunity to do this delightful project on the topic "Infrared Detector", which helped us to link the textual knowledge to the practical life issues and helped in doing a lot of research.

Lastly, we would like to thank our parents, who provided constant support and resources and

our classmates and friends for encouraging us to finalise this project in the given time constraints.



INDEX

SR.NO	TOPIC
1.	INTRODUCTION
2.	AIM
3.	APPARATUS
4.	THEORY
5.	CONSTRUCTION
6.	CIRCUIT DIAGRAM
7.	MODEL PHOTO
8.	WORKING
9.	ADVANTAGES
10.	APPLICATIONS
11.	CONCLUSION
12.	BIBLIOGRAPHY

1 -_ INTRODUCTION

This project of "Infrared Detector" is based on the topic

"Infrared Waves" of Physics. This project highlights the functioning of the infrared waves. It gives an opportunity to study and gives an insight into the various properties, characteristics and overall functioning of infrared lights. Infrared waves are produced by hot bodies and molecules. Infrared radiation also plays an important role in maintaining earth's warmth and average temperature through green house effects. Infrared waves are also useful in our day to day life and is extensively used in various applications like televisions, satellites and military use.

2 -_ AIM

The aim of the project is to study and get an insight into the various properties, characteristics and overall functioning of infrared lights. It will also give an opportunity to look forward as to how the characteristics infrared waves can be useful in our day to day lives.

This project is a self made project involving electronic components like infrared transmitter, infrared receiver, resistors, transistors, LED lights, battery, bread board, etc.

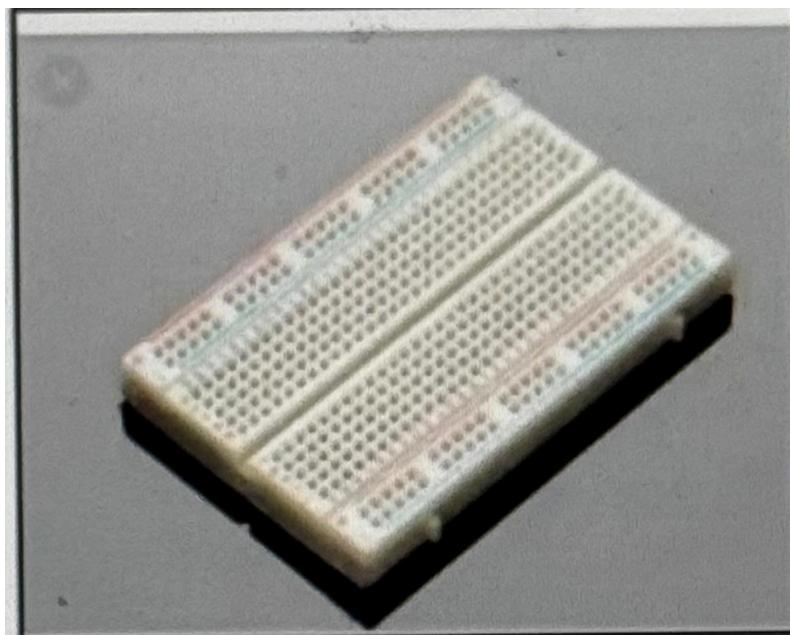
This project also gives an insight into the actual functioning of the various electronic components and help in learning and provides hands on experience on practical handling of various electronic components

3 -- APPARATUS

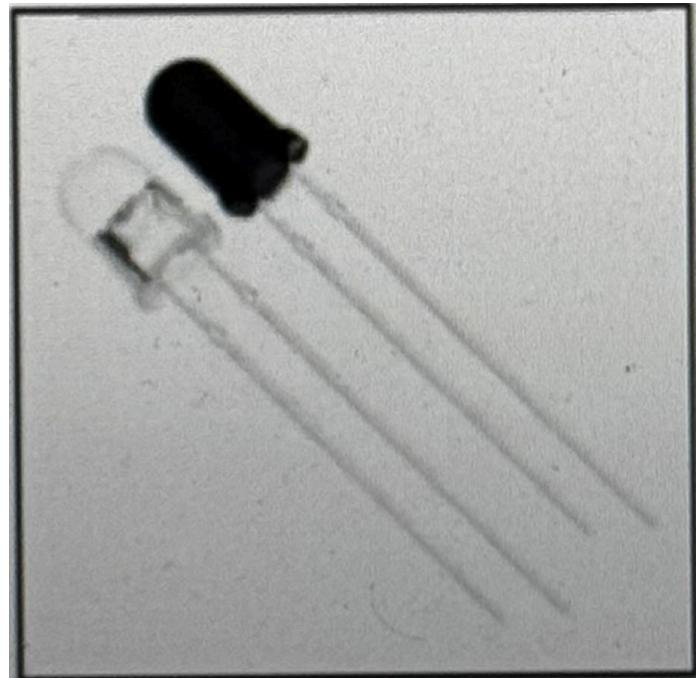
The following apparatus was used in making this project

The Details Are:

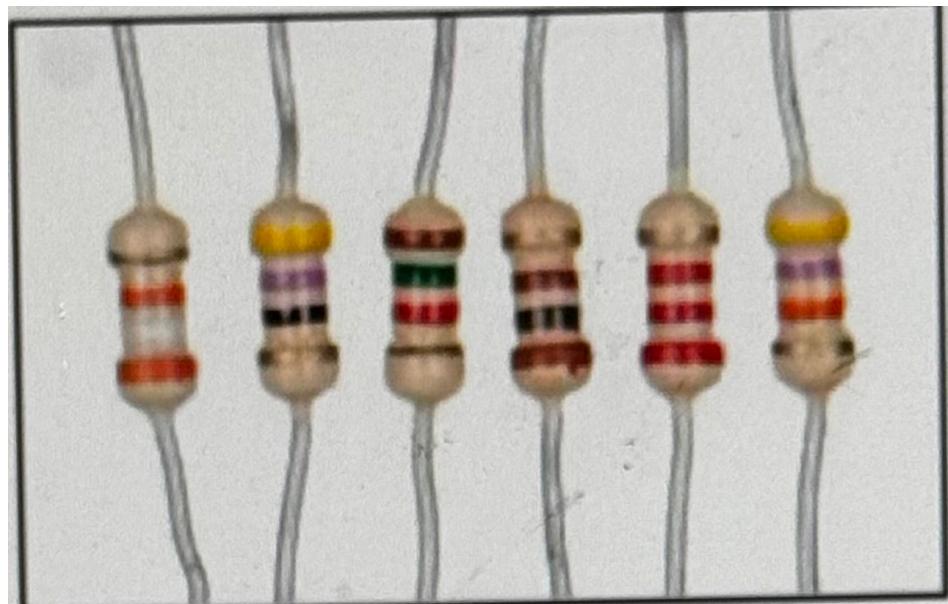
1 -- Board:



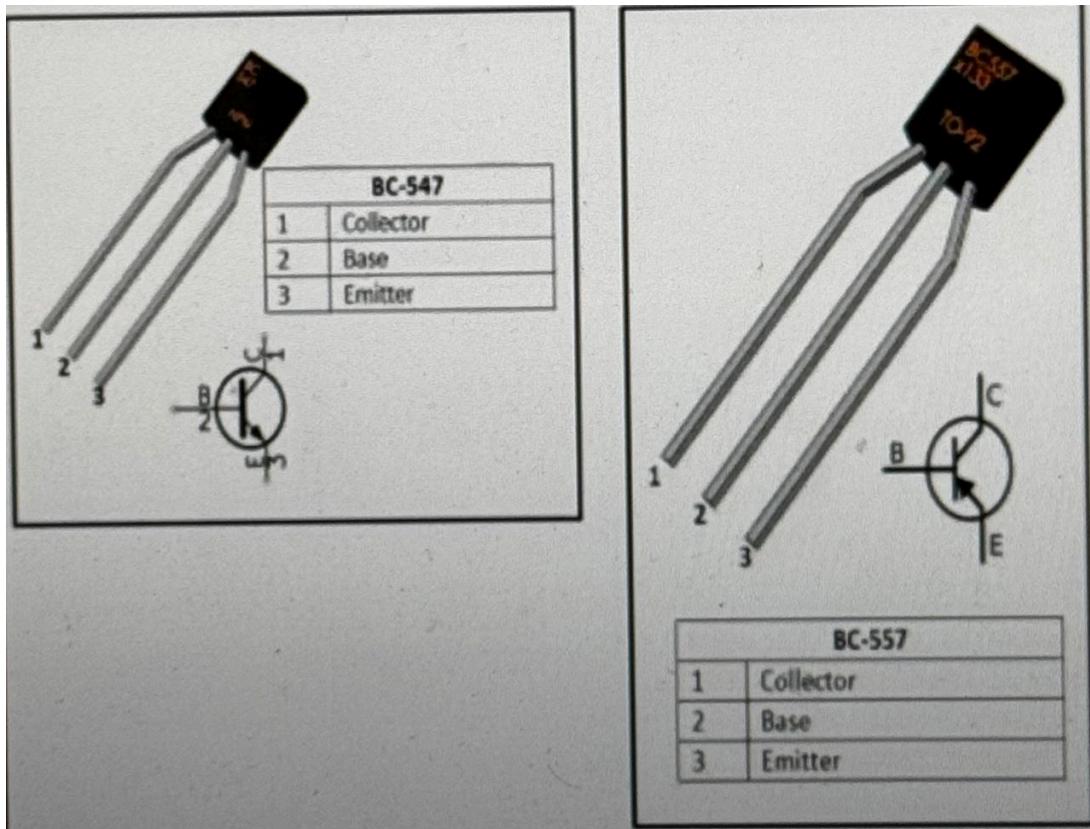
2 -- Infrared LED Transmitter & Receiver:



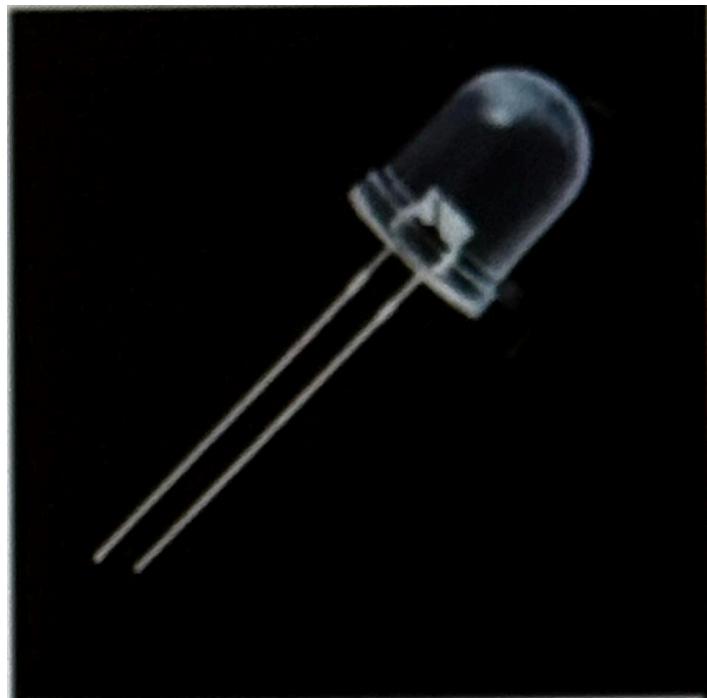
3 -- Resistors:



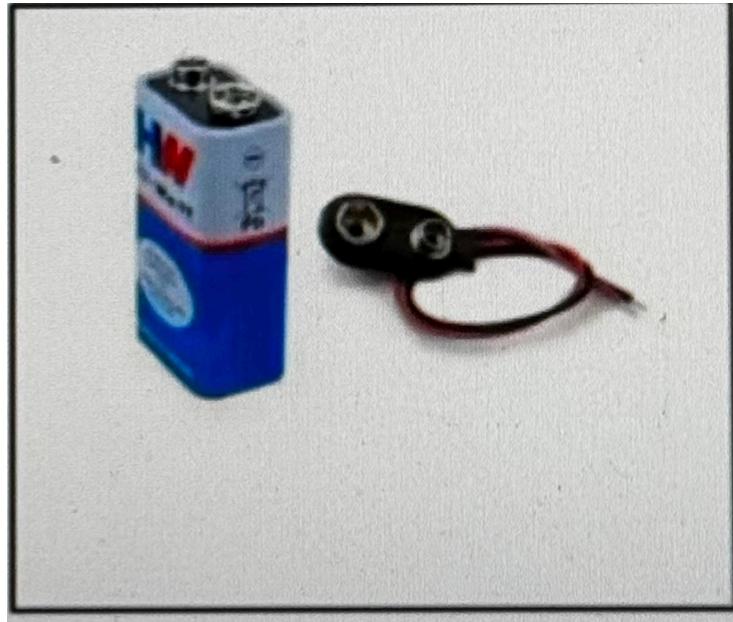
4 -- Transistors - BC 547 & BC 557 :



5 -- LED Light:



6 -- 9 V Battery



4 - THEORY

Infrared radiations, sometimes called, infrared light is an electromagnetic radiation with longer wavelength than those of visible light. It is therefore generally invisible to the human eye although IR (Infrared Radiations) with wavelengths upto 1050 nano meters from specially pulsed lasers can be seen by humans under certain conditions. IR wavelengths extends from nominal red edge of visible spectrum at 700 nano meters to 1 mili meter. Most of the thermal radiations emitted by objects near room temperature is infrared. As with all EMR, IR carries radiant energy, and behaves both like a wave and like its quantum particle the photon.

Infrared radiations was discovered by astronomer Sir William Herschel, who discovered a type of invisible radiation in the spectrum lower in energy than the red light by means of its effect on the thermometer. Slightly more than half of total energy from the sun was eventually found to arrive on earth in the form of infrared. The balance between absorbed and emitted infrared radiations has a critical effect on earth's climate.

Infrared spectroscopy examines transmission and absorption of photons in the infrared range.



5 - CONSTRUCTION

The components described in the apparatus are all taken before starting the construction of the circuit for the "Infrared Detector". The following steps are to be followed towards construction of the Infrared Detector.

1. The circuit diagram of the IR Detector is kept in front.
2. All the components legs are cleaned for any grease or any other coating which might cause loose or no connection.

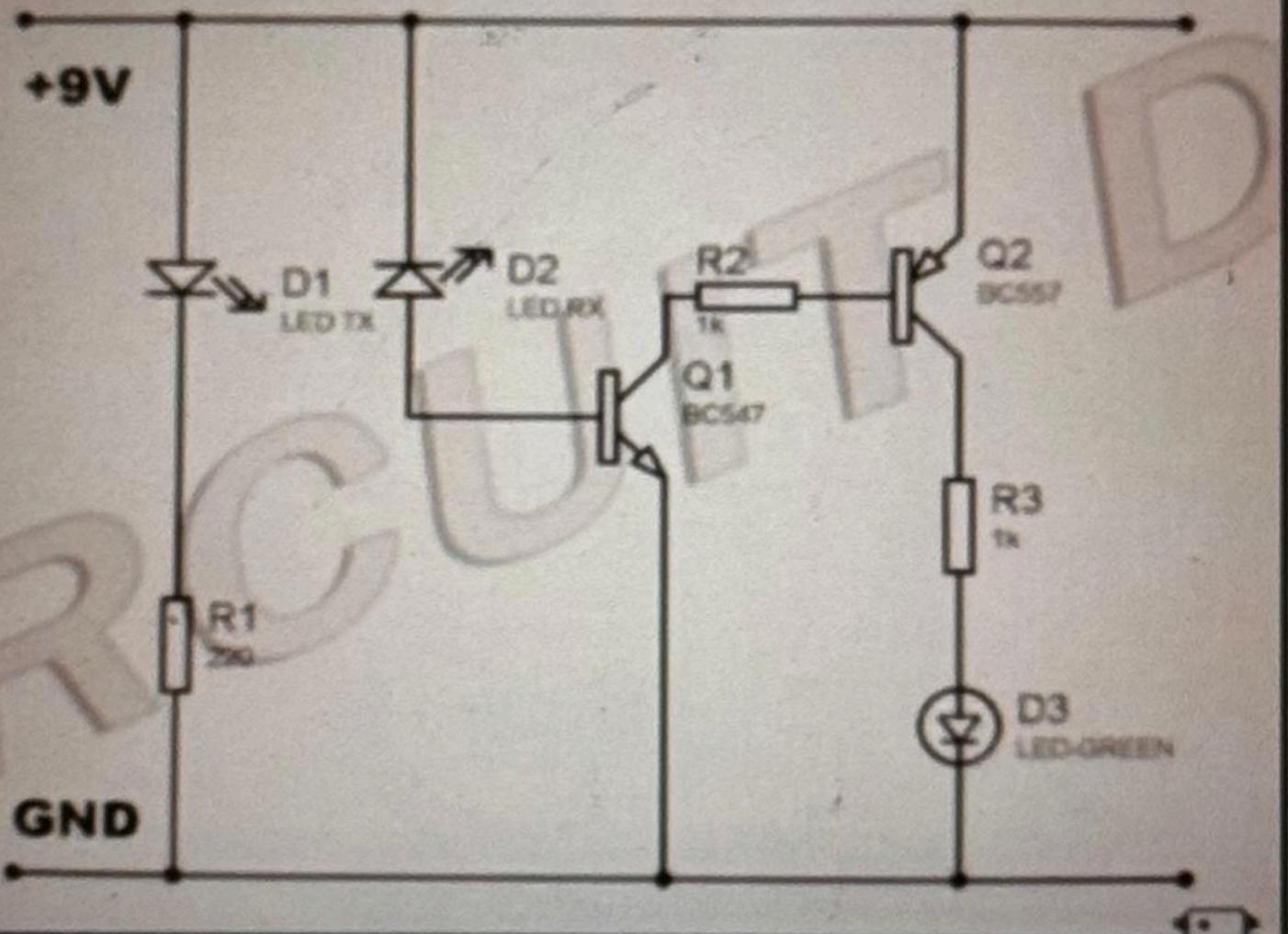
3. The breadboard is taken and initially the infrared transmitter is designed first as per the circuit diagram.
4. The main component for IR Transmitter is the IR LED transmitter.
5. Then, the infrared receiver is designed as per the circuit diagram. The main components of the IR receiver is the IR LED receiver, the two transistors, resistors and the LED light. All the components are fitted on the board as per the circuit diagram.
6. Then, 9V Battery is taken and power supply of the circuit is given as per the polarity given in the circuit diagram.
7. The LED Light on the breadboard glows in normal circumstances, It indicates that the receiver and transmitter, both are functioning properly as all the components are in a forward bias condition.
8. When any non conducting object is brought between the IR LED transmitter and IR Led receiver, the IR LED receiver is reverse biased and does not conduct. Accordingly, the IR LED receiver circuit stops from conducting causing the LED light to go off.
9. Thus, it indicates that due to presence of IR waves from the IR LED transmitter, the IR LED receiver is forward biased and conducts causing the entire IR LED receiver circuit function causing the LED light on the breadboard to glow.

10. Due to obstruction, the IR waves generated from the IR LED Transmitter is not able to reach the IR LED receiver causing it to stop functioning.

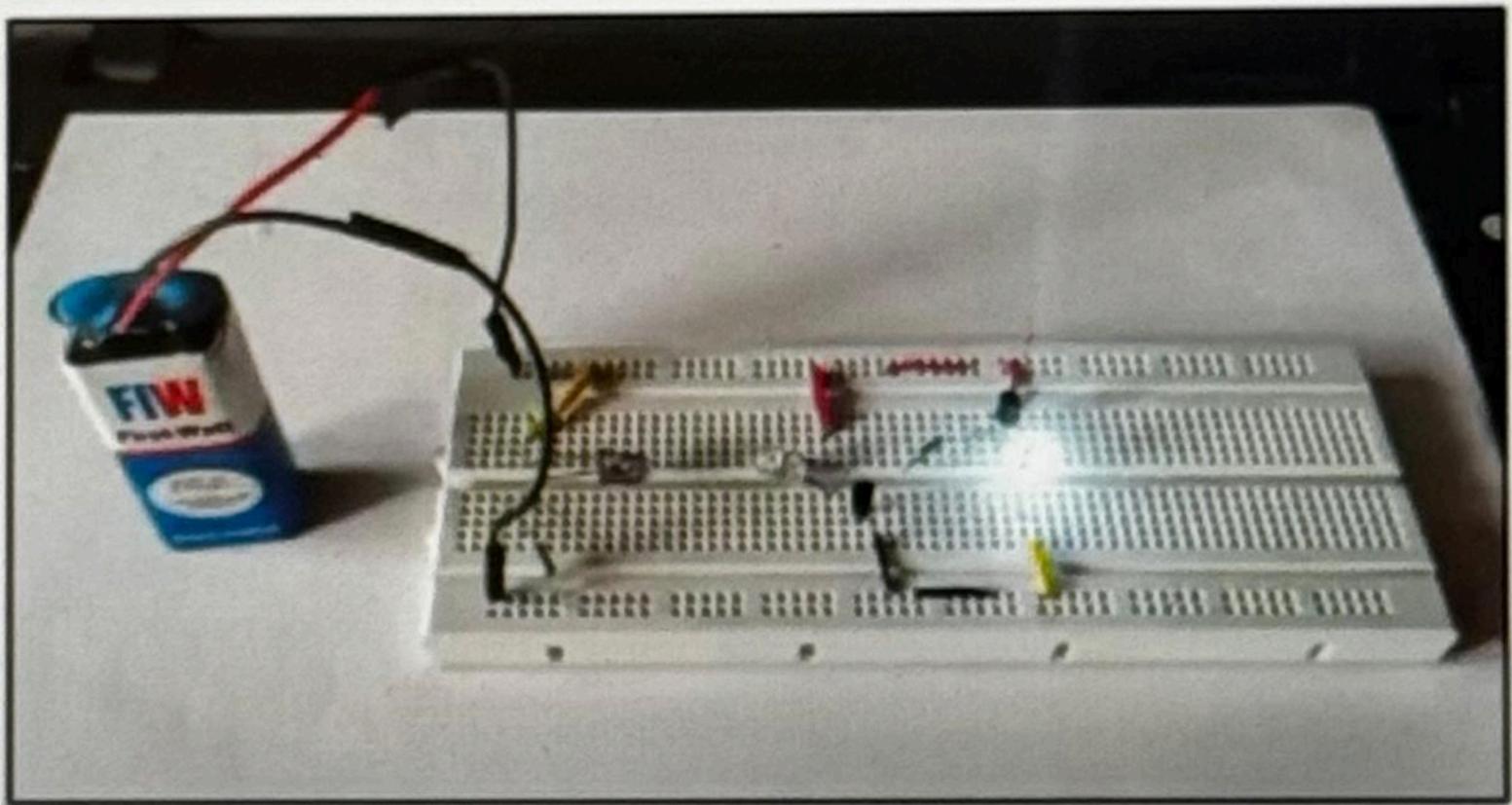
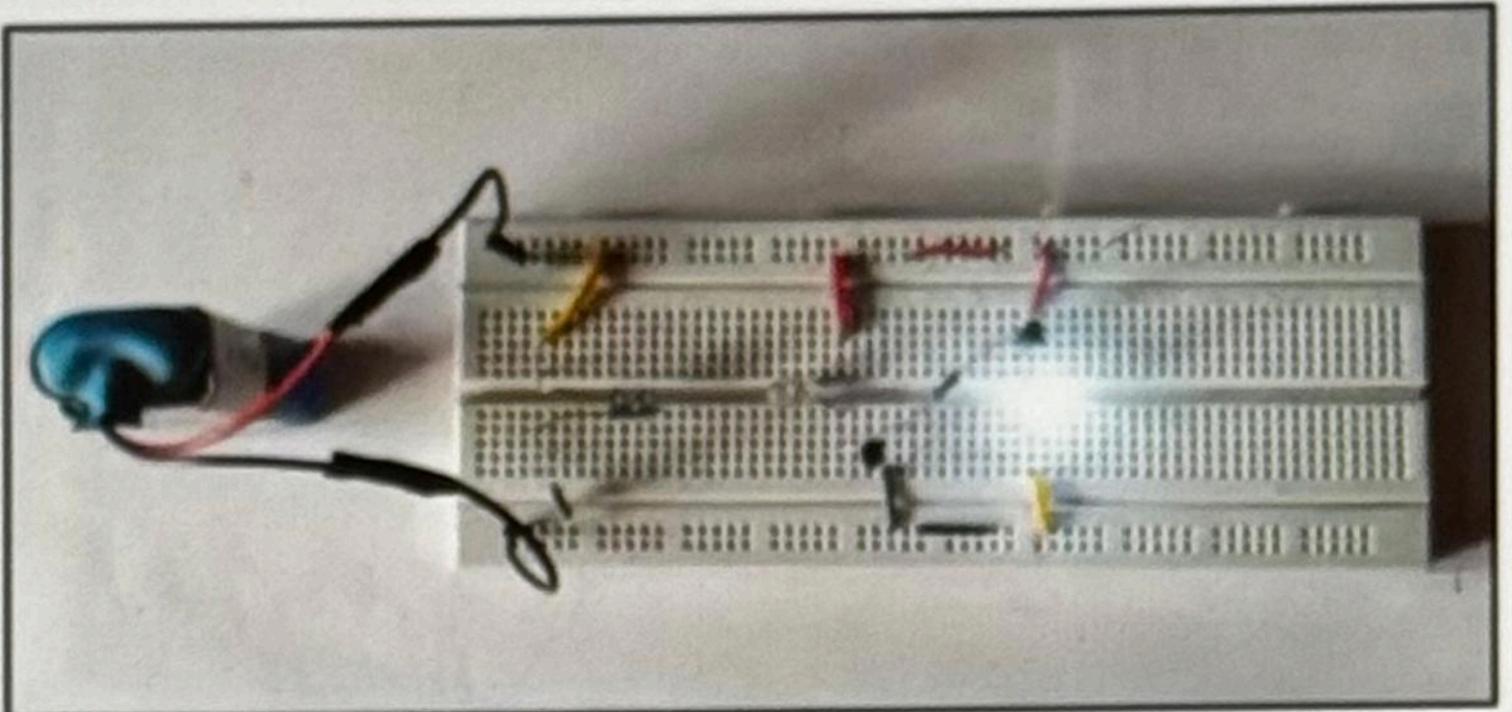
11. When the obstruction is removed, the IR waves from the IR LED Transmitter reaches the IR receiver causing it to conduct and thereby causing the entire IR LED Receiver Circuit to functions and thereby causing the LED light to glow.

6 -- CIRCUIT DIAGRAM

IR DETECTOR



7 - MODEL PHOTO



8 - WORKING

1. After the circuit is ready as per the circuit diagram, 9 V battery is taken and connected to the circuit diagram as per the polarity given in the diagram.
2. When the battery is connected, the IR LED transmitter receives power supply and it starts emitting IR Waves directed towards the receiver.
3. Parallelly, the IR LED receiver also receives power supply through the 9 V Battery.
4. In normal circumstances, the IR LED receiver circuit also functions. The IR LED receiver receives IR waves from the IR LED transmitter and starts to conduct. The IR LED receiver is connected in reverse bias condition and will conduct only when it receives IR LED waves. Thus, when the IR LED receiver conducts, the two transistors also are properly biased and begin to conduct.
5. The LED light is connected to the collector of the transistor IC 557. When the transistor IC 557 conducts, current flows through it and further through the LED light which is forward bias and begins to glow.
6. When a non conducting is obstruction is brought between the IR LED transmitter and IR LED receiver, the waves from the IR LED transmitter are obstructed and thereby not able to reach the IR LED receiver. This causes

the IR LED receiver to stop functioning due to reverse bias condition and not receiving IR LED waves.

7. As the IR LED Transmitter stops, the biasing to the two transistors is cut off and thus stop functioning
8. This causes the cutoff of current flow through transistor BC 557 and thus it stops functioning. As the transistor stops functioning, the LED light connected to its collector, stops as current stops flowing through it.
9. Thus, we are able to detect the IR waves being flowing from the IR LED transmitter to the IR LED receiver.
10. When the obstruction is removed, the flow of IR waves from the transmitter to receiver is resumed causing both the transistors to conduct and thereby causing the LED light to glow.

9 - ADVANTAGES

1. IR has a low power requirement and also the technology is very cheap.
2. Ideal for laptops, telephones, etc.
3. IR has a low circuitary cost.
4. IR has a Simple circuitary. No special or proprietary hardware is required and can be easily incorporated into

the integrated circuit of a product.

5. IR has a higher security. It means that the information is not easily leaked or spilled to nearby devices when it is transmitted.

6. IR beam has a certain directionality. Thus it helps in enhancing the security of information transmitted through IR waves.

7. IR waves does not interfere with other signals and is not susceptible to interference from other signals.

8. IR waves cannot pass through walls.

9. No license required.

10 -- APPLICATIONS

1. Construction of Night Vision Devices.

2. Application in Infrared Astronomy.

3. It is useful in Infrared Tracking installed in the Missile Guidance System and other defence applications.

4. It is used in remote switches of household electronic devices like the TV / TV Remote, video recorders and hi-fi

systems.

5. Infrared lamps are used in physical therapy.
6. Infrared Reflectography is used by art historians in order to reveal hidden layers of painting to detect its originality
7. Other key application areas include :
 - a. Climatology
 - b. Meteorology
 - C. Gas Detectors
 - d. Water analysis
 - e. Petroleum exploration
 - f. Rail Safety
 - g. Information Technology Devices / Computers like wireless Keyboard and mouse.



The following can be concluded :

- A. The project gave an opportunity to learn and understand the functioning of the IR Waves and IR Sensor.

- B. The project helped me to understand the characteristics of the IR Waves
- C. The project helped me to understand the various applications of IR Waves and its usefulness in our day to day lives.
- D. The project also gave an opportunity to handle the various electronic projects during the course of the project and to understand the functioning of these components.
- E. The IR Waves and the IR Sensors have become an integral part of our day to day lives.

Further, it can be concluded that IR Waves / IR detectors are going to play vital role in new electronic fabrication processes, software developments and implementations and will dictate the growth of sensor technology in future.

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