Sagar Institute of Science Technology and Research

Organized the

Skill Based Training Program by the

Department Of Electronics and Communication

Project Name: - Object detector using alert buzzer

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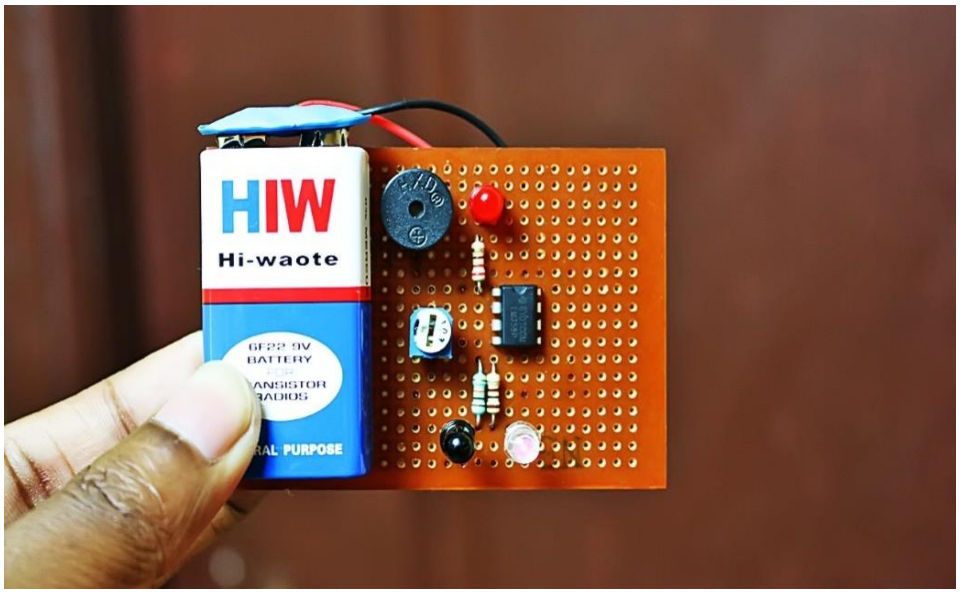
IR Based Object Detector Kit

Introduction: - Infrared technology is widely used for Wireless applications and the mostly in alert and sensing. The basic concept of an infrared Sensor which is used for Object detector is to transmit an infrared signal, this infrared single bounces from surface of and an object and the signal is received by the Infrared receiver. This sensor is analogous to human's visionary senses. The activity of this sensor is so basic when an object is Infront of it, so the alarm and LED will glow up. We have two IR LEDs, a transmitter and a receiver. At the point when the current goes through the transmitter, it will emit IR beams. This can be seen by utilizing any camera device.



IR Sensor: - IR technology is used in daily life and also in industries for different. For purposes example, TVs use an IR Sensor to understand the signals which are transmitted from a remote control. The main benefits of IR sensors are low power usage, their simple design & their convenient features. IR signals are not noticeable by the human eye. The IR radiation in the Electromagnetic Spectrum can be found in the regions of the visible & microwave. Usually, the wavelengths of these waves range from 0.7 µm 5 to 1000µm.

The IR spectrum can be divided into three regions like near-infrared, mid, and far-infrared.

The near IR region's wavelength ranges from 0.75 – 3µm.

The mid-infrared region's wavelength ranges from 3 to 6µm.

The far IR region's infrared radiation's wavelength is higher than 6µm.

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Infrared sensors are electronic devices that measure and detect infrared radiation from their surroundings. When an object comes close to it, the infrared ray from the IR LED (Also called Transmitter) reflects from the object and is detected by the IR receiver (Also called Photodiode).

There are two types of IR Sensors: -

- Passive IR Sensor
- Active IR Sensor

Passive IR Sensor: - Passive infrared sensors detect energy emitted by obstacles in the field of view and do not use any infrared source. There are two types: -

- Thermal IR Sensor
- Quantum IR Sensor

❖ Thermal IR Sensor: - Thermal infrared sensors use infrared energy as the source of heat and are independent of wavelength.

❖ Quantum IR Sensor: - Quantum IR Sensor is an infrared photodetector, which uses electronic intersubband transitions in quantum wells to absorb photons. In order to be used for infrared detection.

Active IR Sensor: - Active infrared sensors consist of two elements: infrared source and infrared detector. Infrared sources include an LED or infrared laser diode. Infrared detectors include photodiodes or phototransistors. The energy emitted by the infrared source is reflected by an object and falls on the infrared detector.

COMPONENTS REQUIRED: -

1. LM 358 IC
2. 1 InfraRed LED Photo
3. Diode pair
4. Resistors: 1k,100ohm, 10K
5. Potentiometer: 20k
6. 1N4007
7. Molex
8. Capacitor :0.1uf
9. 7805 IC
10. LED
11. Zener Diode 5.1v
12. BC547
13. Buzzer

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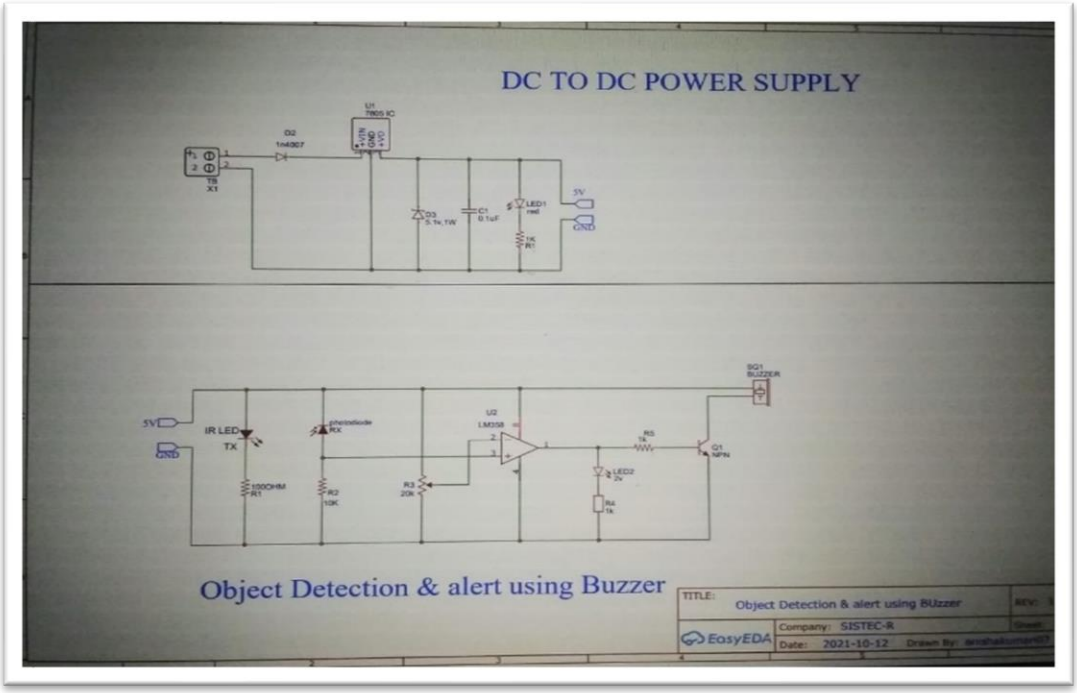
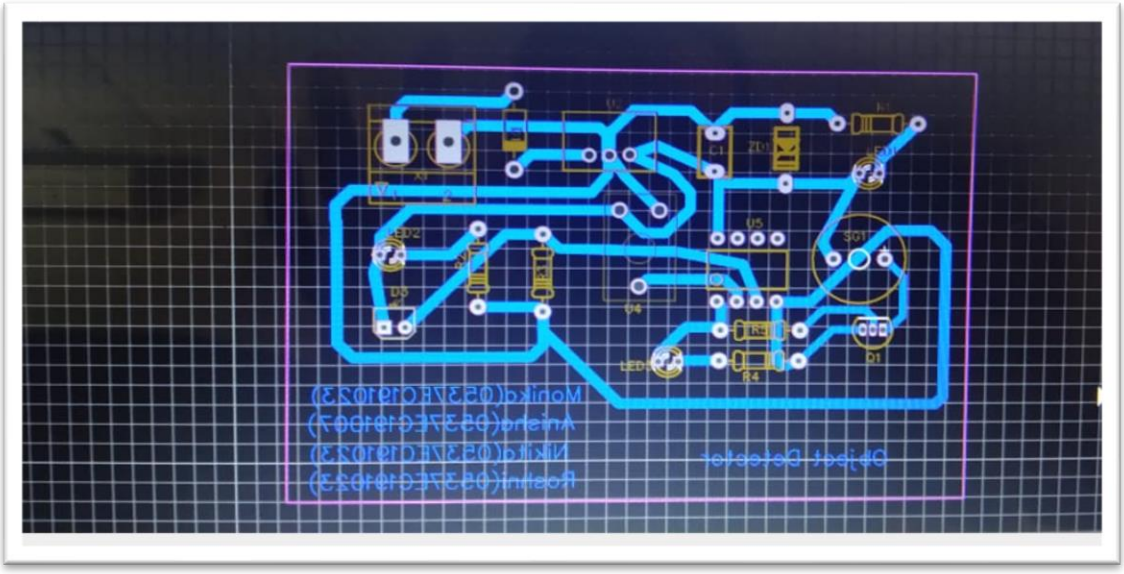
Working of Object Detector Kit: - In this Kit, the pin no. 8 of IC LM358 is connected to power supply (Molex 9v) and pin 4 is connected to the ground.

From that point onward, we will place the potentiometer in circuit and make sure that each of the three pins must be connected. Then we associate the pins of the potentiometer as follows in the below Schematic of object detector.

Schematic Representation of Circuit: -



PCB Layout Of Object Detector Kit: -

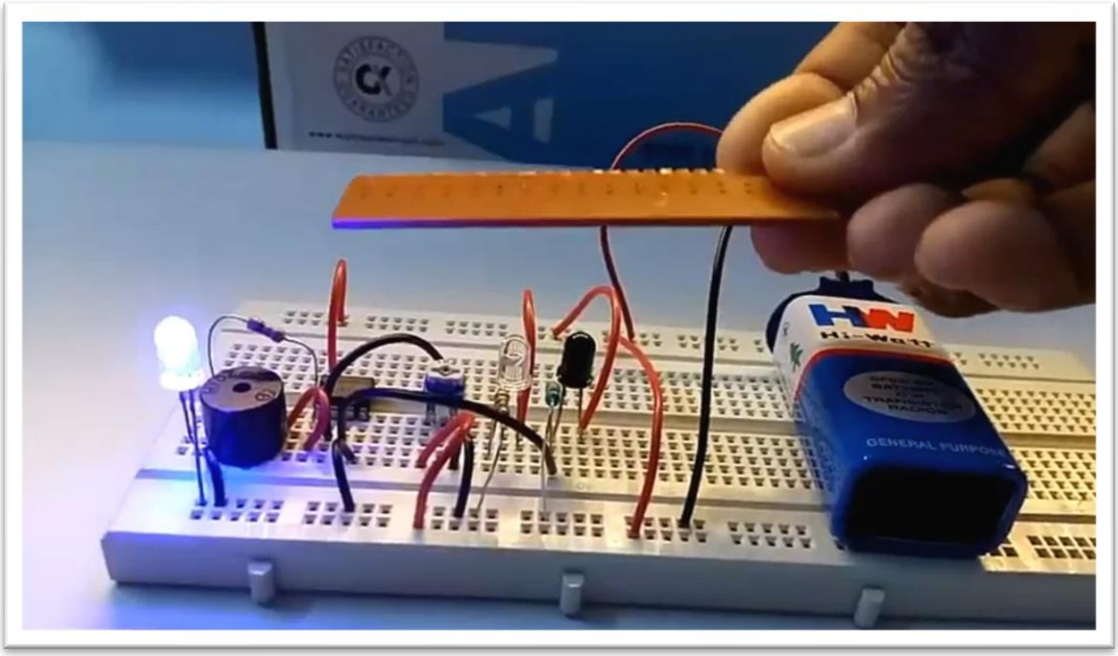


IR Based Object Detector Kit

The sensing component in this circuit is the IR receiver. If the amount of infrared light will increase on their receiver, more current will flow through it (Energy from the IR transmitter is absorbed by electrons at the p-n junction of the photodiode, which causes current to flow through it).

When the current flows through the 10 KΩ resistor, there will create a potential difference. As the value of the resistor is constant, the voltage across the resistor is directly proportional to the current flowing, which in turn is directly proportional to the number of infrared waves on the receiver. So, when an object comes to the infrared sensor, the amount of IR rays from the IR transmitter falls on the IR receiver increases, and therefore the voltage at the resistor increases.
Here in this infrared sensor, the LM358 IC is used as a comparator for comparing it and the reference voltage. The positive terminal of the IR receiver is connected to the non-inverting terminal of Op-Amp and the reference voltage is connected to the inverting terminal of Op-Amp.
The Op- Amplifier works in a way that whenever the voltage of the non-inverting terminal is more than the voltage of the inverting terminal, the output will high and the led will turn on. When no object is near the sensor, there will no output as for no detection, and the led will turn off. We can adjust the potentiometer to drive the desired distance we need to measure. In the equivalent, when the object moves a long way from the infrared sensor, the voltage at non-inverting input diminishes, which causes Op-Amp to turn the LED or alarm off.

Project: -



IR Based Object Detector Kit

Applications of Infrared Sensor: -

1. It can measure the warmth of an item just as it distinguishes the movement.
2. This type of sensor measures just infrared radiation, instead of discharging it that is known as an inactive infrared sensor.
3. It can also use for Object detection in Robotics industry.
4. Night Vision Devices

   Infrared technology is implemented in night vision equipment if there is not enough visible light available to see unaided. Night vision devices convert ambient photons of light into electrons and then amplify them using a chemical and electrical process before finally converting them back into visible light.

5. Infrared Astronomy

   Infrared astronomy is a field of astronomy that studies astronomical objects that are visible in infrared radiation. By using telescopes and solid-state detectors, astronomers are able to observe objects in the universe which are impossible to detect using light in the visible range of the electromagnetic spectrum.

6. Infrared Tracking

   Infrared tracking, also known as infrared homing, is a missile guidance system that operates using the infrared electromagnetic radiation emitted from a target to track it. These missile systems are often known as 'heat-seekers' as infrared is radiated strongly by hot bodies such as people, vehicles, and aircraft.

7. Art History Restoration

   Infrared reflectography is used by art historians in order to reveal hidden layers in paintings. This reflectography technique is useful in helping to decide whether a painting is an original version or a copy and whether it has been altered by restoration work.

8. Hyperspectral imaging

   Hyperspectral imaging accumulates and processes information from across the electromagnetic spectrum and can be used to track nanoparticles inside large living organisms.

Other key application areas that use infrared sensors include:

IR Based Object Detector Kit

- Climatology
- Meteorology
- Photo biomodulation
- Gas detectors
- Water analysis
- Anaesthesiology testing
- Petroleum exploration
- Rail safety

LM358: - As we know that there are available in various forms of 555 timers, single logic gates, microcontroller, microprocessor, voltage regulator and op-amps like different ICs IC LM741, LM7805, LM35, LM324 IC, LM337, LM338, LM339 IC, LM1117 and many more ICs are available. Here we have to learn or introduce about IC LM358 because it has low power and easy to use dual channel op-amp IC. This IC is designed specially to operate from a single power supply over a wide range of voltages. It is a good, standard operational amplifier and the most important point for this IC is suitable for your needs. LM358 IC is available in a small size as a chip. This IC is most commonly used in the device due to its cost-efficiency. Let us have a deep insight into the introduction, pinout, configuration, features, packages, advantages, applications of LM358.

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Introduction to LM358: - LM358 consists of two independent compensated operational amplifiers with high gain frequency. LM 358 IC is available in the cheap sized package so this must be used in real-life applications include DC gain block, conventional OP-AMP circuits design, active filters, transducer amplifier, this post also gives some information about this ICs like Pinout of LM358, features, Applications, advantages, Pin configuration of LM358, also give some real-life applications of LM358. So, you have to learn some different ideas related to your project you are the right place to study.

Pinout LM358: - LM 358 has eight (8) pins in total having different individual functions associated with each of them.

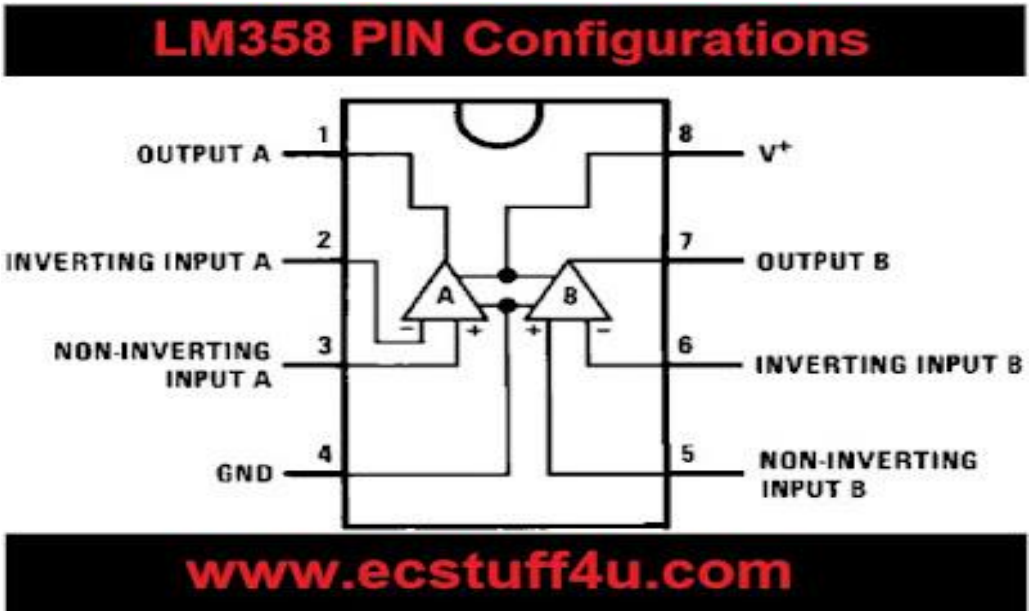
- Pin-1 and pin-8 are the output of the comparator.
- Pin-2 and pin-6 are inverting inputs.
- Pin-3 and pin-5 are non-inverting inputs.
- Pin-4 is the GND terminal.
- Pin-8 is VCC+.

LM358 pin configurations: -

Here I have to represent with completely pin diagram along with full animations.

- A properly labelled pin diagram of any device results in better standing of the user, so the users can easily understand pin configurations.
- The complete pinout diagram along with animation, a real image of LM358 and symbolic representation is shown in the figure below.

IR Based Object Detector Kit



Features of LM358 IC: -

- It consists of 2 OP-AMP internally.
- The output voltage swing is high.
- The large DC voltage gain is around 100 dB.
- Wider bandwidth in 1 MHz (Temperature compensated).
- The supply current drain is very low.
- Wider power supply, in the single power supply, is 3V to 32 V while the dual power supply is +or-1.5 V to +or- 16 V.
- 2mV low input offset voltage.
- Common mode input voltage range comprises ground.
- The differential input voltage range is similar to the power supply voltage.
- Internally frequency compensated for unity gain.
- Short circuit protected outputs.
- Soldering pin temperatures in 260 C.
- The available package is TO-99, SOIC, DSBGA, CDIP.

Advantages of the LM358 IC: -

- Two operational amplifiers are compensated internally.
- Permits direct sensing close to GND and VOUT.
- Well suited with all methods of logic.
- Power drains appropriate for the operation of the battery.
- Two internally compensated for OP-AMP.

- Eliminates the need for dual supplies.

LM358 applications: -

LM358 has a wide range of real-life applications, we have to represent the major application of LM358 are listed below:

- It must be used in the DC gain block.
- It can be used signal conditioning.
- It is used for active filters.
- Current loop transmitter for 4 to 20mA.
- It can be also used in transducer amplifiers in real-life applications.
- This IC also be used in operational circuits.
- It must be used in real-life applications like shock alarm circuits and dark sensor circuits.

Capacitor: - The capacitor is an electric component that has the ability to store energy in the form of electrical charges that creates a potential difference, which is a static voltage, much like a small rechargeable battery.
The most basic design of a capacitor consists of two parallel conductors (Metallic plate), separated with a dielectric material. When a voltage source is attached across the capacitor, the capacitor plate gets charged up. The metallic plate attached to the positive terminal will be positively charged, and the plate attached to the negative terminal will be negatively charged.

Types of Capacitors: -

1. **Film Capacitors:** Film capacitors are the ones that use plastic film as the dielectric medium. They are available in nearly any value and voltages up to 1500 volts. They range from 10% to 0.01% in any tolerance. Additionally, film condensers arrive in a combination of shapes and case styles. There are two types of film condensers, radial type lead, and axial type lead.

2. **Ceramic Capacitors:** Ceramic capacitors are the ones that use ceramic as the dielectric material. It is used in high-frequency circuits such as audio to RF. In ceramic capacitors, one can develop both high capacitance and low capacitance by altering the thickness of the ceramic disc.

3. **Electrolytic Capacitors:** Electrolytic capacitors are the ones that use the oxide layer as the dielectric material. It has a wide tolerance capacity. There are mainly two types of electrolytic capacitors, tantalum, and aluminium. They are available with working voltages of up to approximately 500V, but the maximum capacitance values

are not available at high voltage, and higher temperature units are available but are rare.

4. Variable capacitor: Variable capacitors mostly use air as the dielectric medium. A Variable Capacitor is one whose capacitance can be mechanically adjusted several times. For example, this form of the capacitor is used to set the resonance frequency in LC circuits to change the radio to match impedance in antenna tuner devices.

LED: - In the simplest terms, a light-emitting diode (LED) is a semiconductor device that emits light when an electric current is passed through it. Light is produced when the particles that carry the current (known as electrons and holes) combine together within the semiconductor material.

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Different colours: - Inside the semiconductor material of the LED, the electrons and holes are contained within energy bands. The separation of the bands (i.e., the bandgap) determines the energy of the photons (light particles) that are emitted by the LED.

The photon energy determines the wavelength of the emitted light, and hence its color. Different semiconductor materials with different bandgaps produce different colors of light. The precise wavelength (color) can be tuned by altering the composition of the light-emitting, or active, region.

LEDs are comprised of compound semiconductor materials, which are made up of elements from group III and group V of the periodic table (these are known as III-V materials). Examples of III-V materials commonly used to make LEDs are gallium arsenide (GaAs) and gallium phosphide (GaP).

Until the mid-90s LEDs had a limited range of colors, and in particular commercial blue and white LEDs did not exist. The development of LEDs based on the gallium nitride (GaN) material system completed the palette of colors and opened up many new applications.

Trimmer: - A trimmer potentiometer is a miniature adjustable electrical component. They're designed for "set and forget" applications to "trim" the value of a resistor in order to provide an exact gain, output voltage, or current. They are common in precision circuitry like A/V components, calibrating instruments and setting the bias current on power amplifiers. Trimmer potentiometers are mounted directly on circuit boards, set with a small screwdriver and designed for few adjustments during operation. They may either be single or multi-turn, with the multi-turn used in applications that require more precise settings. They can also be mounted either vertically or horizontally, depending on the requirements for adjusting the component. In 1952, Marlan Bourns patented the first trimming potentiometer, calling it the "Trimpot".

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Switches: - A switch is a device in a computer network that connects other devices together. Multiple data cables are plugged into a switch to enable communication between different networked devices. Switches manage the flow of data across a network by transmitting a received network packet only to the one or more devices for which the packet is intended. Each networked device connected to a switch can be identified by its network address, allowing the switch to direct the flow of traffic maximizing the security and efficiency of the network.

Types of Switches: -

Basically, Switches can be of two types. They are: -

- Mechanical
- Electronic

Mechanical Switches are physical switches, which must be activated physically, by moving, pressing, releasing, or touching its contacts.

Electronic Switches, on the other hand, do not require any physical contact in order to control a circuit. These are activated by semiconductor action.

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Troubleshooting Manage: -

If your circuit doesn't work, Follow the steps below. If it doesn't help, feel free to ask us in comment section of our videos.

1. Check the IC (OP-AMP) (COMPARATOR)

2. Make sure you have connected the pins of comparator the right way

3. Make sure other connections are okay

4. Make sure your Photodiode is okay, Try using another one

5. Make sure your IR LED Is okay by connecting it to any battery along with a 1K OHM Series resistor and seeing it through a digital camera (It looks pinkish in colour and is not visible by naked eye)

6. Make sure that your potentiometer is connected the right way

7. If your LED OR BUZZER Blinks or sounds continuously than turn your potentiometer more towards Positive power supply

8. Make sure your power supply is connected the right way, Your circuit may be damaged by exposing it to high voltages or reverse polarities.

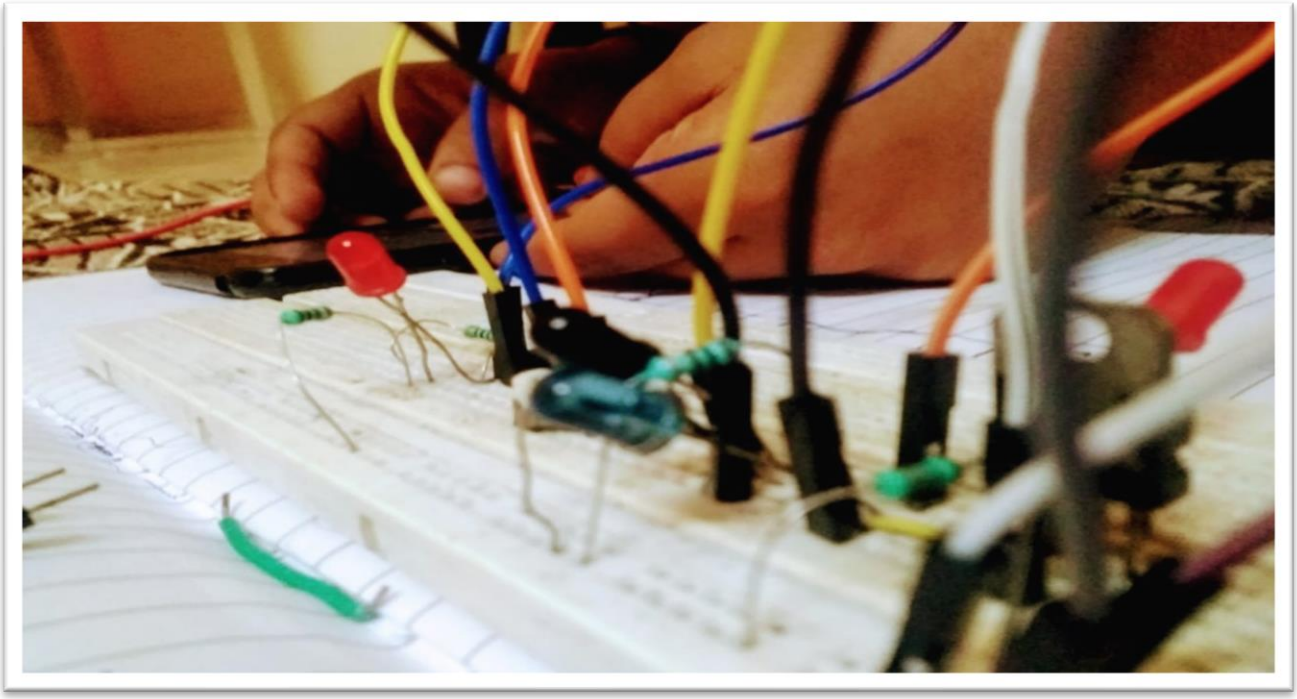
CONCLUSION: -

This project shows how to make an Infrared sensor (IR) object Detection module circuit Using IR LED & Photodiode.

The IR Object Detection sensor module is quite easy to make. This sensor circuit below is a low cost - low range infrared object detection module that you can easily build at home using IR LED's. The Maximum input Voltage is 5 Volts.

We will use a photodiode and IR LED to make a simple circuit. IR led looks like a regular LED that you usually see in Television Remote controls.

IR Based Object Detector Kit



There are five basic elements used in a typical infrared detection system: an infrared source, a transmission medium, optical component, infrared detectors or receivers and signal processing. Infrared lasers and Infrared LEDs of specific wavelength can be used as infrared sources. The three main types of media used for infrared transmission are vacuum, atmosphere and optical fibres. Optical components are used to focus the infrared radiation or to limit the spectral response. Optical lenses made of Quartz, Germanium and Silicon are u to focus the infrared radiation. Infrared receivers can be photodiodes, phototransistors etc. some important specifications of infrared receivers are photosensitivity, detectivity and noise equivalent power. Signal processing is done by amplifiers as the output of infrared detector is very small.