DELHI TECHNOLOGICAL UNIVERISTY

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ABSTRACT

Our motive behind this project is to analyze present day condition of Indian automobile industry and its standard and by keeping the current information in mind introduce a concept vehicle that can not only enhance the present standard of safety and comfort in Indian automobiles but also tackle the nightmare of pollution and shortage of fuel as well .

The Anti–Collision system is a detection device meant to be incorporated into vehicles for the purpose of safety. As opposed to the anti–collision devices present in the market today, this system is not designed to control the vehicle. Instead, it serves as an alert in the face of imminent collision.

The device is made up of an infrared transmitter and receiver. The device works by sending out streams of infrared radiation and alerts when any obstacle is present within specific range or safe distance, to take the necessary precaution to avert a collision. The device would still alert once by an alarm even though it is not recieving infrared beams from the oncoming vehicle. This is due to reflection of its own infrared beams.

At the end of the design and testing process, overall system was implemented with a constructed work, tested working and perfectly functional. The anti collision and system is based on INFRA RED sensors. The entire system is developed by keep in mind of Indian automobile industry and their customers.

INTRODUCTION

Due to the accident cases reported daily on the major roads in all parts of the developed and developing countries, more attention is needed for research in the designing an efficient car driving aiding system.

It is expected that if such a device is designed and incorporated into our cars as a road safety device, it will reduce the incidence of accidents on our roads and various premises, with subsequent reduction in loss of life and property.

When it comes to the use of a motor vehicle, accidents that have occurred over the years tell us that something needs to be done about them from an engineering point of view.

Now it is sufficent to say that the implementation of certain highway safety means such as speed restrictions, among others, has done a lot in reducing the rates of these accidents. The issue here is that policies of safe driving alone would not eradicate this, the engineer has a role to play, after all the main issue is an engineering product (the motor vehicle).

Many motorists have had 2 to travel through areas with little light under much fatigue, yet compelled to undertake the journey out of necessity. It is not always irresponsible to do this. A lot of cases reported is as a result of drivers sleeping off while driving, and when he/she eventually woke up, a head-on collision might have taken place.

Not many have had the fortune to quickly avert this. It is therefore imperative to consider the advantages of an early warning system where the driver is alerted of a

possible collision with some considerable amount of time before it occurs.

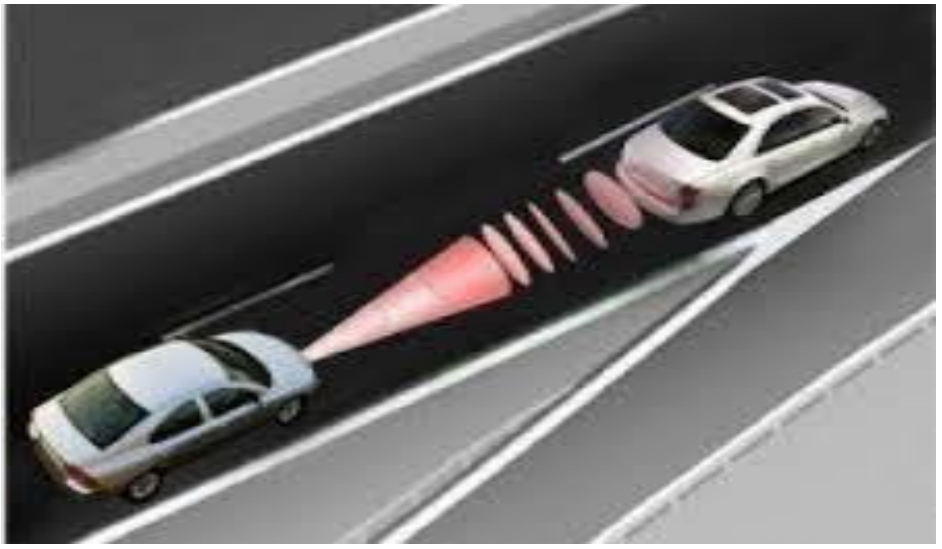
The idea of incorporating radar systems into vehicles to improve road traffic safety dates back to the 1970s. Such systems are now reaching the market as recent advances in technology have allowed the signal processing requirements and the high angular resolution requirements from physically small antennas to be realized. Automotive radar systems have the potential for a number of different applications including adaptive cruise control (ACC) and anti-collision devices. The problem with this brand of cars is that they are expensive. This becomes an even bigger challenge when you consider a developing country like India.

The Infrared Anti-Collision Device are expected to be made of relatively inexpensive components for easy purchase and incorporation. This research aims at the design of a prototype showing how this could function. The main objective is to find a way to implement a minimum spacing for cars in traffic in an affordable way, alongside to achieve safety for passengers of a moving car. The anti-collision device, when wired into the circuitry of a vehicle would help in the reduction of road mishaps.

Though not every kind of collision can be helped by this, and it must be stated here that no allusion is being made that technology is the best line of action to take. It should be further noted that some already existing laws made use of technologies like the street lights and traffic lights. This would be a supplementation and not a replacement. Now we will study the main specifications of this project .

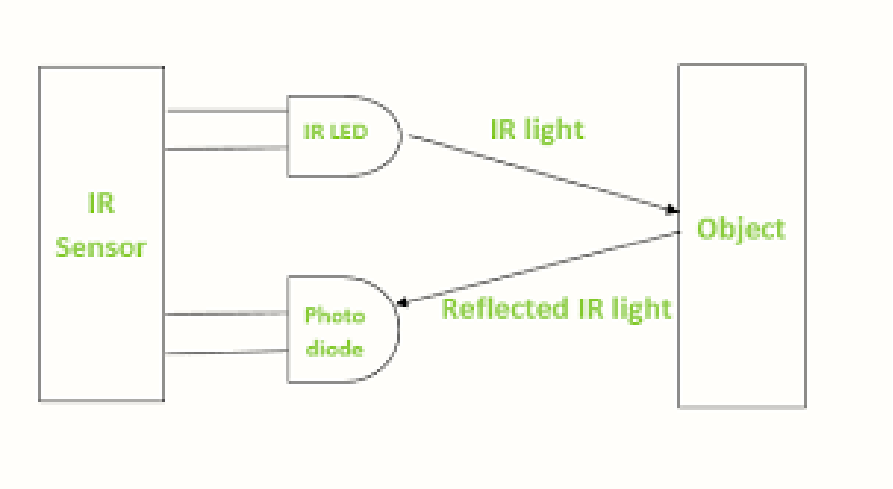
❖ ANTI COLLISION SYSTEM

The Anti–Collision device is a detection device meant to be incorporated into cars for the purpose of safety. This system is designed to serves as an alert in the face of imminent collision. The device is intended to find a way to implement a minimum spacing for cars in traffic in an affordable way. It would also achieve safety for the passengers of a moving car.



The device works by sending out streams of infrared radiation and when these rays are seen by the other equipped vehicle, both are meant to take the necessary precaution to avert a collision. The device would still sound an alarm even though it is not receiving infrared beams from the oncoming vehicle .

This is due to reflection of its own infrared beams. At the end of the design and testing process, overall system was implemented with a constructed work, tested working and perfectly functional.



Transmission and reception of the waves by IR sensors

This is due to reflection of its own infrared beams. At the end of the design and testing process, overall system was implemented with a constructed work, tested working and perfectly functional.

❖ PROJECT WORK DETAILS :

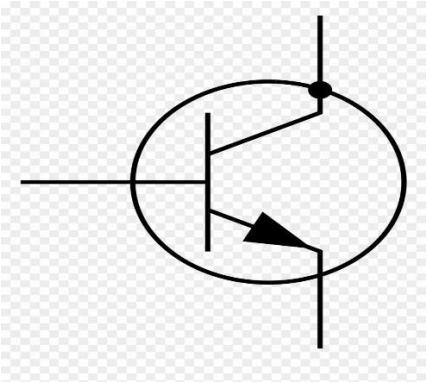
Hence below is the list of components used in our project :

1. Transistor As A Switch And As an Amplifier
2. IR Detection System
3. Ultra Sonic Distance Sensor
4. Shocking Circuit and Alarm Alert system
5. Main and Secondary powersupply
6. Piezocrystal Circuit For Automatic Call Alert

❖ TRANSISTOR AS A SWITCH AND AS AN AMPLIFIER

Hence here we can see that how a transistor acts as a switch and as an amplifier . A transistor is a semiconductor device used to amplify and switch electronic signals and electrical power. It is composed of semiconductor material with at least three terminals for connection to an external circuit.

A voltage or current applied to one pair of the transistor's terminals changes the current through another pair of terminals. Because the controlled (output) power can be higher than the controlling (input) power, a transistor can amplify a signal.

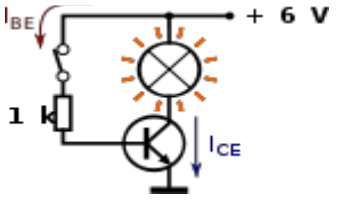


➢ TRANSISTOR AS A SWITCH

Transistors are commonly used as electronic switches, both for high-power applications such as switched-mode power supplies and for low-power applications such as logic gates.

In a grounded-emitter transistor circuit, such as the light-switch circuit shown, as the base voltage rises, the emitter and collector currents rise exponentially. The collector voltage drops because of reduced resistance from collector to emitter. If the voltage difference between the collector and emitter were zero (or near zero), the collector current would be limited only by the load resistance (light bulb) and the supply voltage. This is called saturation because

current is flowing from collector to emitter freely. When saturated, the switch is said to be on.



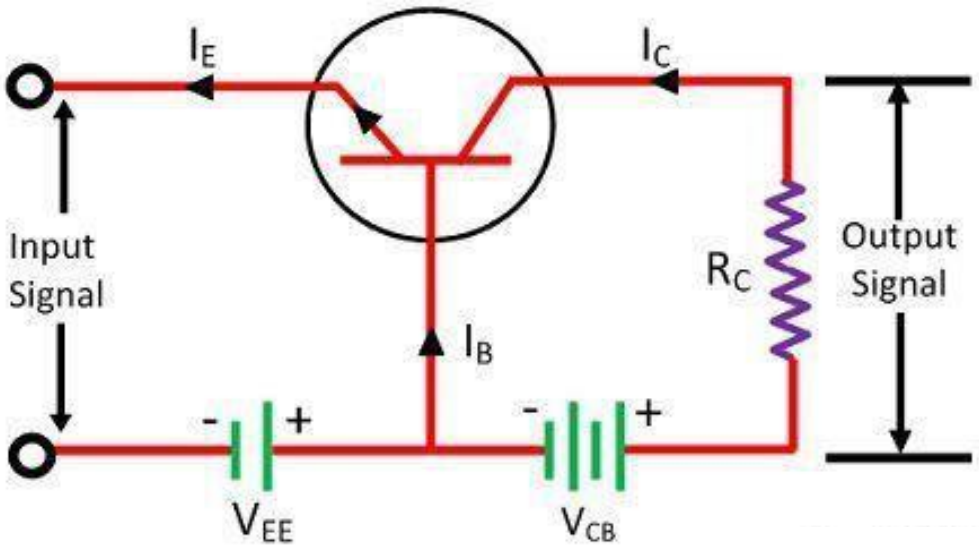
Transistor as a switch in grounded emitter configuration

Providing sufficient base drive current is a key problem in the use of bipolar transistors as switches. The transistor provides current gain, allowing a relatively large current in the collector to be switched by a much smaller current into the base terminal. The ratio of these currents varies depending on the type of transistor, and even for a particular type, varies depending on the collector current. In the example light-switch circuit shown, the resistor is chosen to provide enough base current to ensure the transistor will be saturated.

In any switching circuit, values of input voltage would be chosen such that the output is either completely off, or completely on. The transistor is acting as a switch, and this type of operation is common in digital circuits where only "on" and "off" values are relevant.

➢ TRANSISTOR AS AN AMPLIFIER

The transistor raises the strength of a weak signal and hence acts an amplifier. The transistor amplifier circuit is shown in the figure below. The transistor has three terminals namely emitter, base and collector. The emitter and base of the transistor are connected in forward biased and the collector base region is in reverse bias. The forward bias means the P-region of the transistor is connected to the positive terminal of the supply and the negative region is connected to the N-terminal and in reverse bias just opposite of it has occurred.



The input signal or weak signal is applied across the emitter base and the output is obtained to the load resistor R_C which is connected in the collector circuit. The DC voltage V_{EE} is applied to the input circuit along with the input signal to achieve the amplification. The DC voltage V_{EE} keeps the emitter-base junction under the forward biased condition regardless of the polarity of the input signal and is known as a bias voltage.

When a weak signal is applied to the input, a small change in signal voltage causes a change in emitter current (or we can say a change of 0.1V in signal voltage causes a change of 1mA in the emitter current) because the input circuit has very low resistance. This change is almost the same in collector current because of the transmitter action.

In the collector circuit, a load resistor R_C of high value is connected. When collector current flows through such a high resistance, it produces a large voltage drop across it. Thus, a weak signal (0.1V) applied to the input circuit appears in the amplified form (10V) in the collector circuit.

❖ INFRARED DETECTION SYSTEM

Here we can see that whenever any obstacle comes ahead of the IR sensors then the IR circuit is activated and hence the further actions are performed . Here in below diagrams we will see the components of the IR circuit .We have mounted following components in this circuit

- Transmitter and Receiver IR sensors
- LED and secondary power supply
- Two 22 ohm and two 1 kilo ohm resistors
- Two BC548 n-p-n transistors
- Relay

Here as we can see that the figure consists of two sensors i.e. one is of white colour and other is of black colour . The sensor looking white , in left hand side is transmitter . The other one , of black colour , is the receiver for the I.R. circuit .

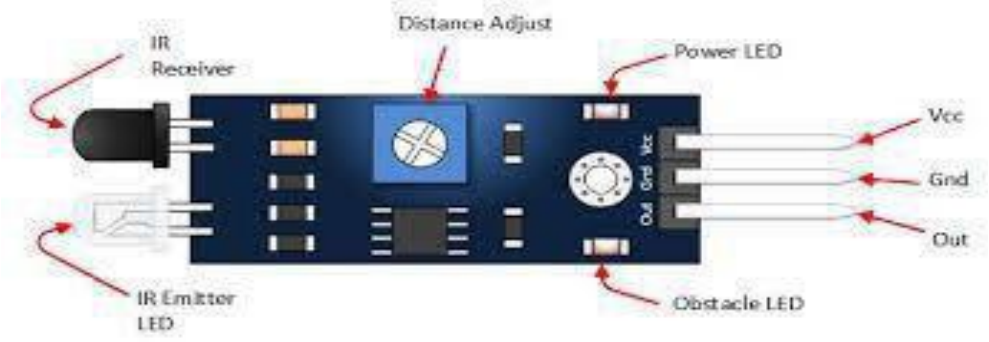
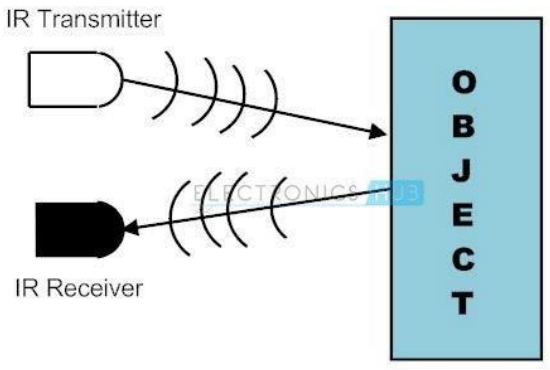


Fig :- Labelled Diagram of IR Sensor



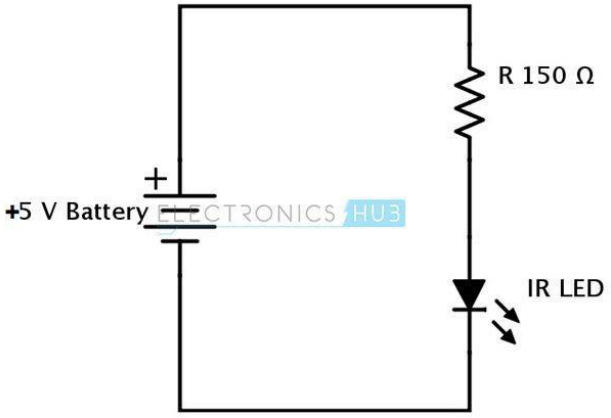
➢ IR Transmitter

Infrared Transmitter is a light emitting diode (LED) which emits infrared radiations. Hence, they are called IR LED's. Even though an IR LED looks like a normal LED, the radiation emitted by it is invisible to the human eye.

The picture of a typical Infrared LED is shown below.

There are different types of infrared transmitters depending on their wavelengths, output power and response time.

A simple infrared transmitter can be constructed using an infrared LED, a current limiting resistor and a power supply. The schematic of a typical IR transmitter is shown below.



When operated at a supply of 5V, the IR transmitter consumes about 3 to 5 mA of current. Infrared transmitters can be modulated to produce a particular frequency of infrared light. The most commonly used modulation is OOK (ON – OFF – KEYING) modulation.

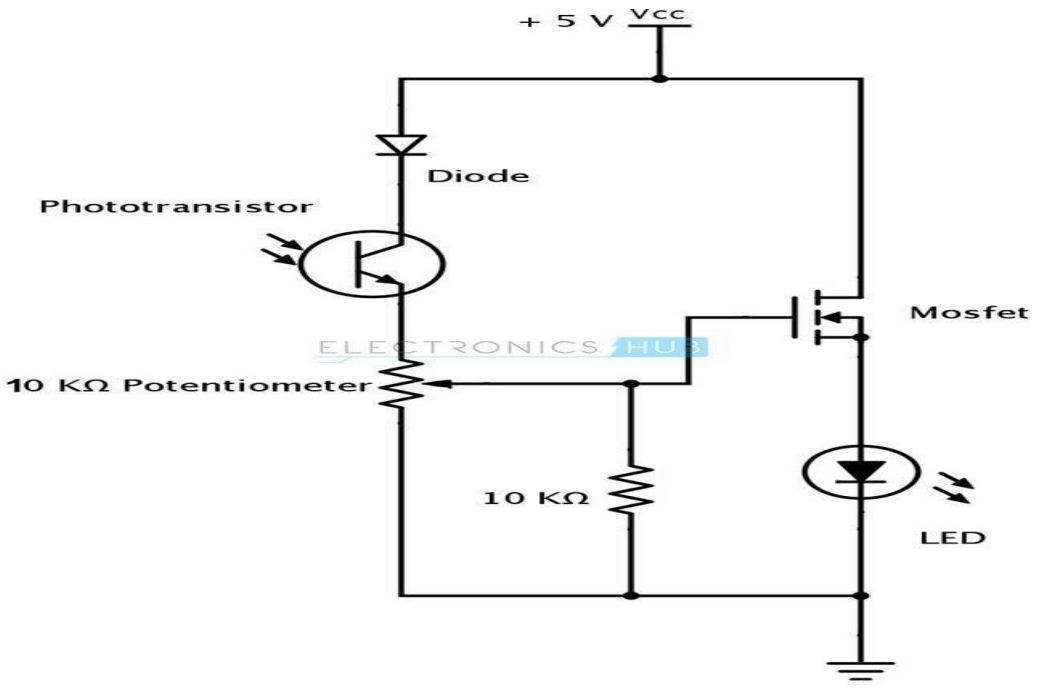
IR transmitters can be found in several applications. Some applications require infrared heat and the best infrared source is infrared transmitter. When infrared emitters are used with Quartz, solar cells can be made.

➢ IR RECIEVER

Infrared receivers are also called as infrared sensors as they detect the radiation from an IR transmitter. IR receivers come in the form of photodiodes and phototransistors. Infrared Photodiodes are different from normal photo diodes as they detect only infrared radiation. The picture of a typical IR receiver or a photodiode is shown below

Different types of IR receivers exist based on the wavelength, voltage, package, etc. When used in an infrared transmitter – receiver combination, the wavelength of the receiver should match with that of the transmitter.

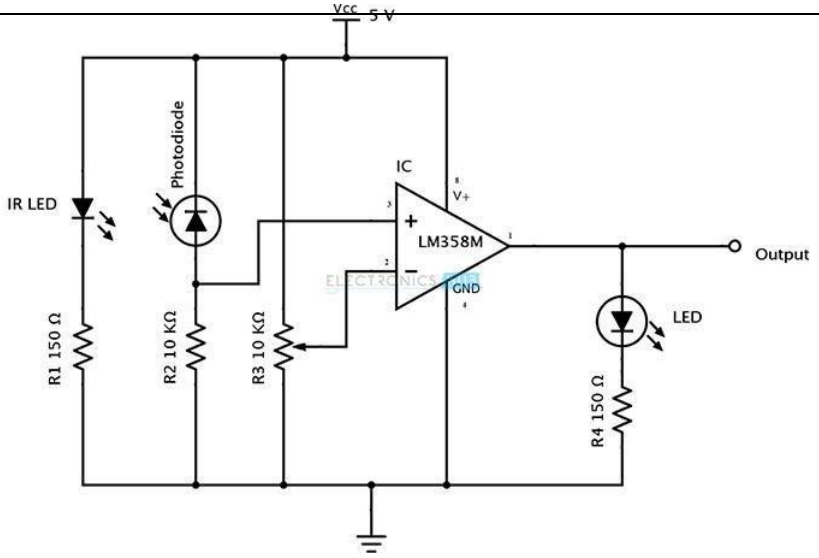
A typical infrared receiver circuit using a phototransistor is shown below.



It consists of an IR phototransistor, a diode, a MOSFET, a potentiometer and an LED. When the phototransistor receives any infrared radiation, current flows through it and MOSFET turns on. This in turn lights up the LED which acts as a load. The potentiometer is used to control the sensitivity of the phototransistor.

➢ WORKING

The principle of an IR sensor working as an Object Detection Sensor can be explained using the following figure. An IR sensor consists of an IR LED and an IR Photodiode; together they are called as Photo – Coupler or Opto – Coupler.



It consists of an IR LED, a photodiode, a potentiometer, an IC Operational amplifier and an LED. IR LED emits infrared light. The Photodiode detects the infrared light. An IC Op – Amp is used as a voltage comparator. The potentiometer is used to calibrate the output of the sensor according to the requirement.

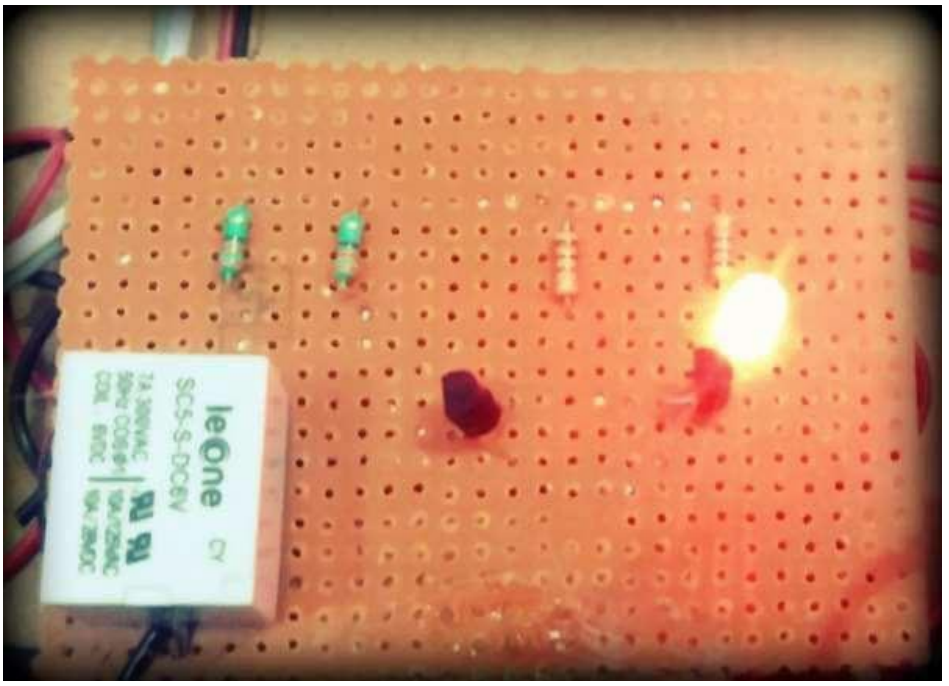
When the light emitted by the IR LED is incident on the photodiode after hitting an object, the resistance of the photodiode falls down from a huge value. One of the input of the op – amp is at threshold value set by the potentiometer. The other input to the op-amp is from the photodiode's series resistor. When the incident radiation is more on the photodiode, the voltage drop across the series resistor will be high. In the IC, both the threshold voltage and the voltage across the series resistor are compared. If the voltage across the resistor series to photodiode is greater than that of the threshold voltage, the output of the IC Op – Amp is high. As the output of the IC is connected to an LED, it lightens up. The threshold voltage can be adjusted by adjusting the potentiometer depending on the environmental conditions.

The positioning of the IR LED and the IR Receiver is an important factor. When the IR LED is held directly in front of the IR receiver, this setup is called Direct Incidence. In this case, almost the entire radiation from the IR LED will fall on the IR receiver. Hence there is a line of sight communication between the infrared transmitter and the receiver. If an object falls in this line, it obstructs the radiation from reaching the receiver either by reflecting the radiation or absorbing the radiation.

There **are two main situations** i.e. in one there is no any obstacle and in other one, there is an obstacle . Hence both are shown below :-

(i)When any obstacle is **NOT** present, then in this case LED is lightened and it indicates

that the way is clear , no obstacle present .



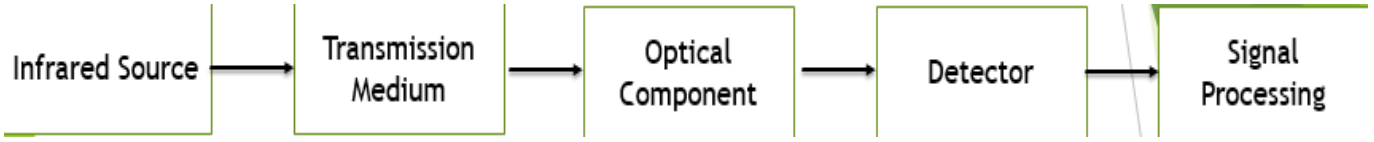
LED is on i.e. no any obstacle is present

ii) When an obstacle **is** present in the way of vehicle then in this case the Receiver receives the signal and sends it to the circuit mounted on vehicle , which makes the LED OFF on the detection of the obstacle which can be seen below as :-

LED is OFF i.e the obstacle is present before the vehicle or sensor .

➢ BLOCK DIAGRAM OF IR CIRCUIT

A typical system for detecting infrared radiation is given in the following block diagram :



➢ INFRARED SOURCE

All objects above 0 K radiate infrared energy and hence are infrared sources. Infrared sources also include blackbody radiators, tungsten lamps, silicon carbide, and various others. For active IR sensors, infrared Lasers and LEDs of specific IR wavelengths are used as IR sources.

➢ TRANSMISSION MEDIUM

Three main types of transmission medium used for Infrared transmission are vacuum, the atmosphere, and optical fibers. The transmission of IR – radiation is affected by presence of CO2, water vapour and other elements in the atmosphere. Due to absorption by molecules of water carbon dioxide, ozone, etc. the atmosphere highly attenuates most IR wavelengths leaving some important IR windows in the electromagnetic spectrum; these are primarily utilized by remote sensing applications.

- Medium wave IR (MWIR:3-5 µm)
- Long wave IR (LWIR:8-14 µm)

Choice of IR band or a specific wavelength is dictated by the technical requirements of a specific application.

➢ OPTICAL COMPONENTS

Often optical components are required to converge or focus infrared radiations, to limit spectral response, etc. To converge/focus radiations, optical lenses made of quartz, CaF2, Ge and Si, polyethylene Fresnel lenses, and mirrors made of Al, Au or a similar material are used. For limiting spectral responses, band pass filters are used. Choppers are used to pass/ interrupt the IR beams.

➢ INFRARED DETECTORS

Various types of detectors are used in IR sensors. Important specifications of detectors are

- Photosensitivity - Responsivity is the Output Voltage/Current per watt of incident energy. Higher the better.
- Noise Equivalent Power (NEP) - NEP represents detection ability of a detector and is the amount of incident light equal to intrinsic noise level of a detector.
- Detectivity(D*: D-star)

D* is the photosensitivity per unit area of a detector. It is a measure of S/N ratio of a detector. D* is inversely proportional to NEP. Larger D* indicates better sensing element.

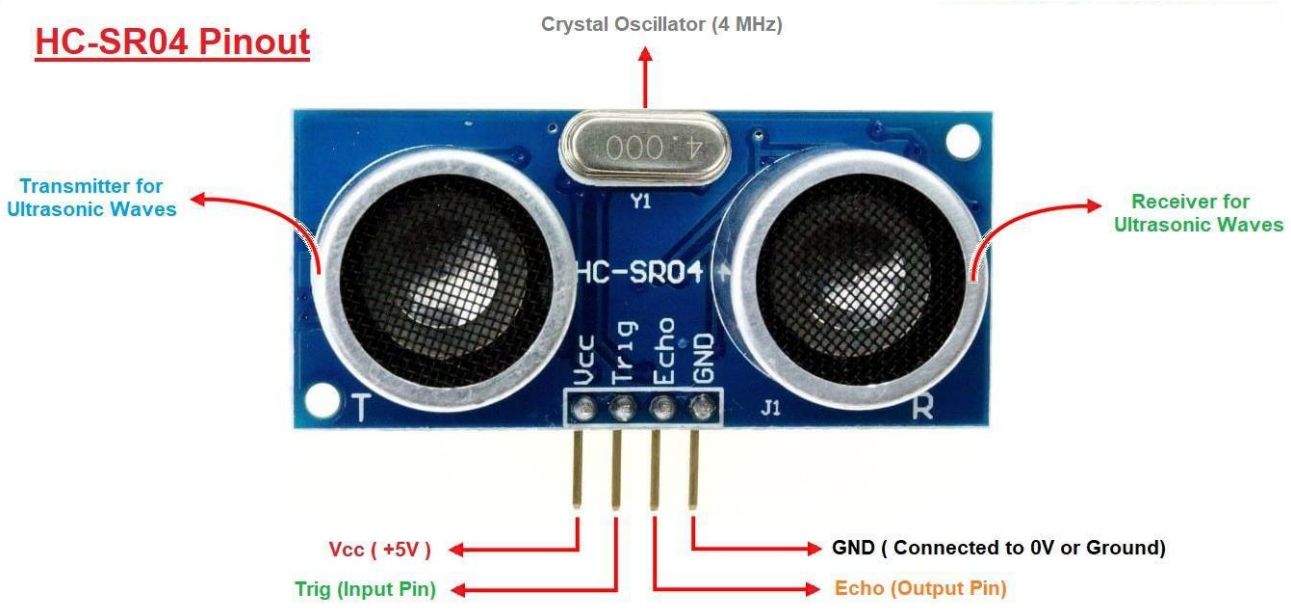
In addition, wavelength region or temperature to be measured, response time, cooling mechanism, active area, no of elements, package, linearity, stability, temperature characteristics, etc. are important parameters which need attention while selecting IR detectors.

➢ SIGNAL PROCESSING

Since detector outputs are typically very small, preamplifiers with associated circuitry are used to further process the received signals. We used these sensors as a detector which provides early detection.

❖ ULTRA SONIC DISTANCE SENSOR

An ultrasonic sensor is an electronic device that measures the distance of a target object by emitting ultrasonic sound waves, and converts the reflected sound into an electrical signal. Ultrasonic waves travel faster than the speed of audible sound (i.e. the sound that humans can hear). Ultrasonic sensors have two main components: the transmitter (which emits the sound using piezoelectric crystals) and the receiver (which encounters the sound after it has travelled to and from the target).



In order to calculate the distance between the sensor and the object, the sensor measures the time it takes between the emission of the sound by the transmitter to its contact with the receiver. The formula for this calculation is **D = ½ T x C** (where D is the distance, T is the time, and C is the speed of sound ~ 343 meters/second).

Ultrasonic sensors are used primarily as proximity sensors. They can be found in automobile self-parking technology and anti-collision safety systems. Ultrasonic sensors are also used in robotic obstacle detection systems, as well as manufacturing technology. In comparison to infrared (IR) sensors in proximity sensing applications, ultrasonic sensors are not as susceptible to interference of smoke, gas, and other airborne particles (though the physical components are still affected by variables such as heat).

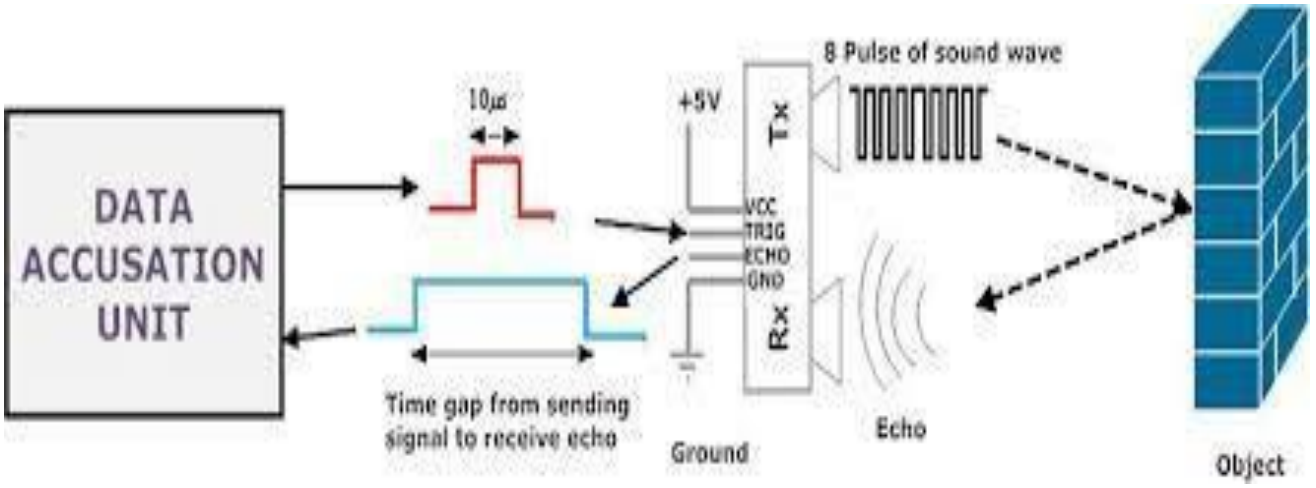
➢ Working

The working principle of this module is simple. It sends an ultrasonic pulse out at 40kHz which travels through the air and if there is an obstacle or object, it will bounce back to the sensor. By calculating the travel time and the speed of sound, the distance can be calculated.

Ultrasonic sensors are a great solution for the detection of clear objects. For liquid level measurement, applications that use infrared sensors, for instance, struggle with this particular use case because of target translucence.

For presence detection, ultrasonic sensors detect objects regardless of the color, surface, or material (unless the material is very soft like wool, as it would absorb sound.)

To detect transparent and other items where optical technologies may fail, ultrasonic sensors are a reliable choice.



Ultrasonic sensors are also used as level sensors to detect, monitor, and regulate liquid levels in closed containers (such as vats in chemical factories). Most notably, ultrasonic technology has enabled the medical industry to produce images of internal organs, identify tumors, and ensure the health of babies in the womb.

❖ BRAKING DISTANCE

The braking distance is the main factor considered in this system. Braking system for a particular speed is the distance between the point of application of the brakes and the point at which the vehicle comes to a complete stop from the present speed, it is calculated by using following formula.

Braking distance= $v^2/2\mu g$ (meter)

Where,

V=velocity of the vehicle (m/s)

μ=coefficient of friction of road=0.8 (in all Indian roads)

g=acceleration due to gravity=9.81 (m/s^2)

In this formula the condition of brakes and the road conditions are not considered for coefficient of fraction μ.

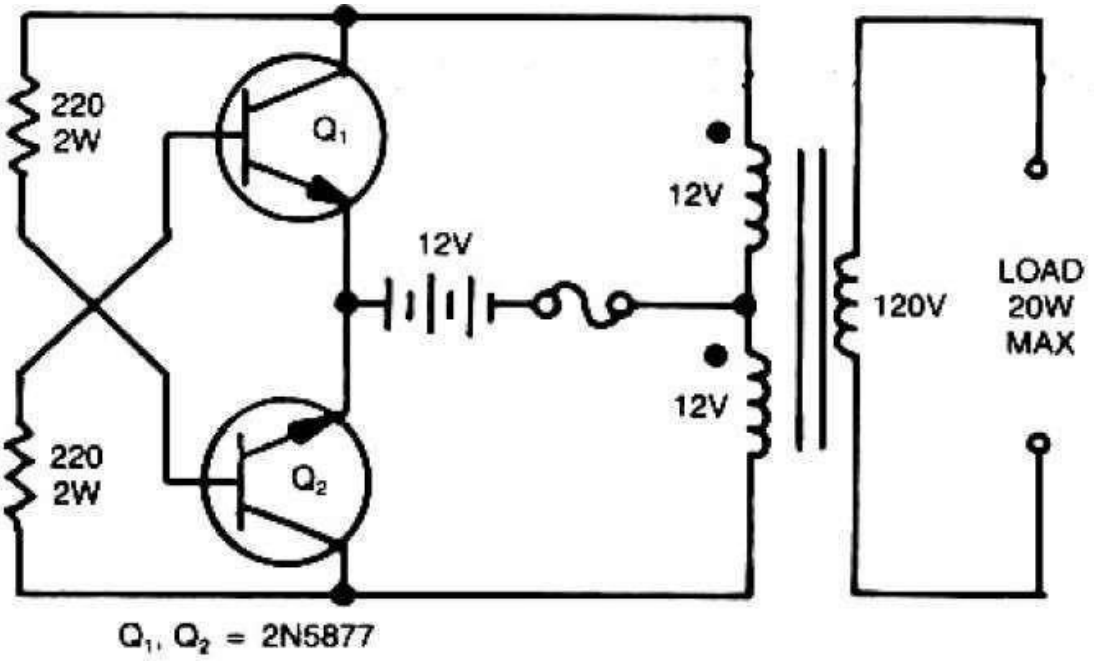
The table showing the braking distance:

Velocity(km/hr)	Braking Distance (m)
60	17.69
50	12.28
40	7.86
30	4.42

❖ SHOCKING CIRCUIT AND ALARM ALERT SYSTEM

Shocking system or circuit in this vehicle is initiated whenever it gets a positive signal from the IR circuit i.e. the IR circuit on receiving the signal from the receiver processes it with the help of transistors and the signal coming outside activates the relay and then relay works as a switch and activates the invertor circuit . shocking circuit .

For providing a shock to the driver to awaken him is based upon a high watt inverter circuit that provide ten time enhanced current as compared to the input provides to it. In our project we are providing 40 watt current wave that specifically awaken the driver when it is on the confluence of neap.



This is a simple 120 V 24 V , centre - tapped (CT) control transformer and four additional components can do the operation. This circuit outputs a clean about 120 volt - 200 volt at 60 Hz and can supply up to 20 Watt. The circuit is self starting and free running.

Transistor Q1 and Q2 use 2N5877 or similarity .If Q1 is faster and higher gain than Q2

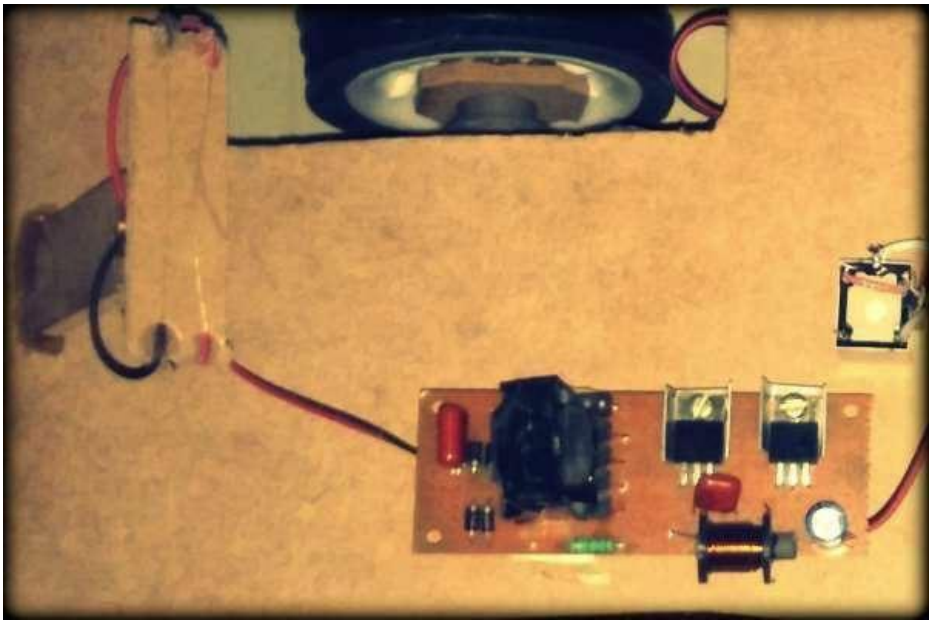
, it will turn on first when apply the input power and will hold Q2. Load current and the transformer magnetizing current the flows in the upper half

of primary coil, and auto transformer supplies the base drive (two transistor) until the transformer saturates.

The transformer can use the 3A CT transformer an use the secondary coil for input and primary coil use to output, And input use the 12 volt secondary coil. Use 12 battery to power input , such as 12 V accurate.

In this circuit we have mounted :

- Electrolytic Capacitor
- Primary MOSFET
- Secondary MOSFET
- Ceramic Capacitor
- Heat Sink Coil
- Step Up transformer
- IN4007 Diode
- 33 ohm Resistance
- Shocking current wires mounted on the steering It all can seen with the help of below diagrams :



Shocking Circuit

The other alarm alert circuit consists of

- An alarm
- A relay

Alarm alert Circuit

❖ MAIN AND SECONDARY POWER SUPPLY

Main power supply is for complete circuit and the secondary power supply is only for the Led and Ir ciruit activation . Specification of both the supplies are –

- **Main power supply – 2 Batteries i.e. 4 V and 1.5 ampere**

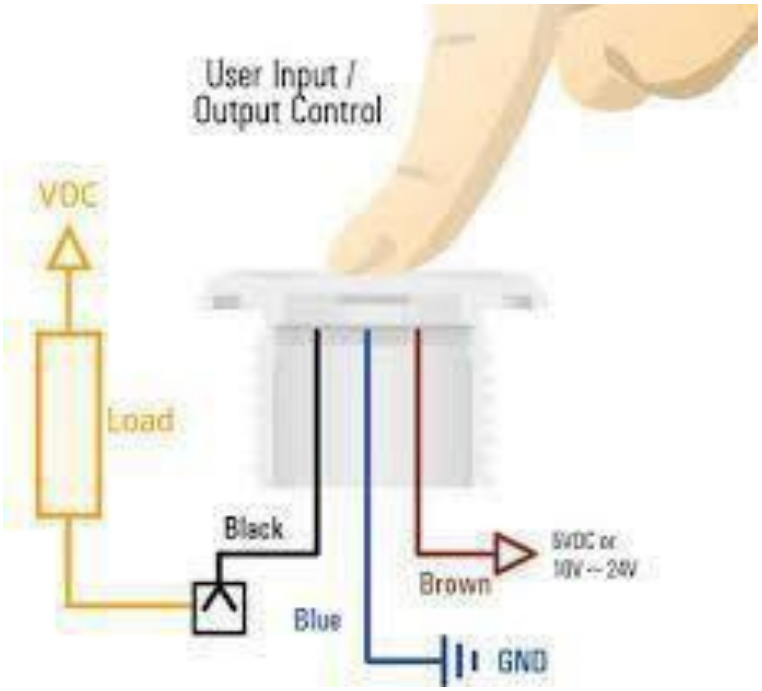
- **Secondary Power Supply – 9V battery**

Secondary Power Supply

❖ PIEZOCRYSTAL CIRCUIT FOR AUTOMATIC CALL ALERT

Here this circuit consists of

- A Piezocrystal switch
- A headphone connected to the switch
- An Android operating system based cell phone equipped with an special headphone button controller application



A Piezo switch is a solid-state switching technology based on the functional principle of the piezoelectric crystal that utilizes the direct piezoelectric effect. Piezo switch elements typically have a piezoelectric component physically mounted on the back of a thin metal surface, the size of which is based on desired force requirements of the user. The characteristics behind this component are such that when an action force is applied to the piezoelectric element there is a small displacement and subsequent strain on the dielectric material. This strain causes a build up of an electric field that causes a voltage to be induced due to a charge transfer. The voltage generated is converted by the electronic connection into a polarity-neutral, electronic switch contact.

One of the main advantages of the Piezo switch is that there are no moving parts such as contacts, springs or actuator systems, resulting in fewer failures, reduced wear, and extending the life cycle. The flat actuation surface is completely sealed, preventing the intrusion of liquids or other contaminants.

CONCLUSION

The hybrid car concept designed and developed by us is a state of the art concept and behind this our endeavour is to project a fully indigenous hybrid car concept in Indian car market so that the entire India in general and economic and rural community in India in particular can be benefited.

This concept is a single lined solutions of so many existing socio economic problems like pollution, energy shortage and parking shortage. The concepts which are presented in this car like wind energy device, solar energy device, active suspension device and folding car concept are made this car concept unique and also sate of the art in particular.

The system which is the design and construction of an anti-collision system for vehicles was designed considering some factors such as economy, availability of components and research materials, efficiency, compatibility, portability and also durability. The performance of the system after test met design specifications. The general operation of the system and performance is dependent on the presence of two moving cars as they get closer to each other.

Based on our research from 2002-2018, we have come across too many accidents to count and found no real time measures taken to regulate these accidents and here we are proposing a project that would help in reducing the number of accidents taking place in foggy environment, putting our effort to make it a real time project. Ultrasonic sensors are usually used to detect objects and calculate the distance, whereas the Bluetooth notifies the driver through an app regarding objects while driving in fog environment, in this project. As compared with others, the benefit of this approach is to utilize the structural information to help vision based techniques for vehicle detection and classification. Here Verified with GPS location through GSM when accidents occurs.