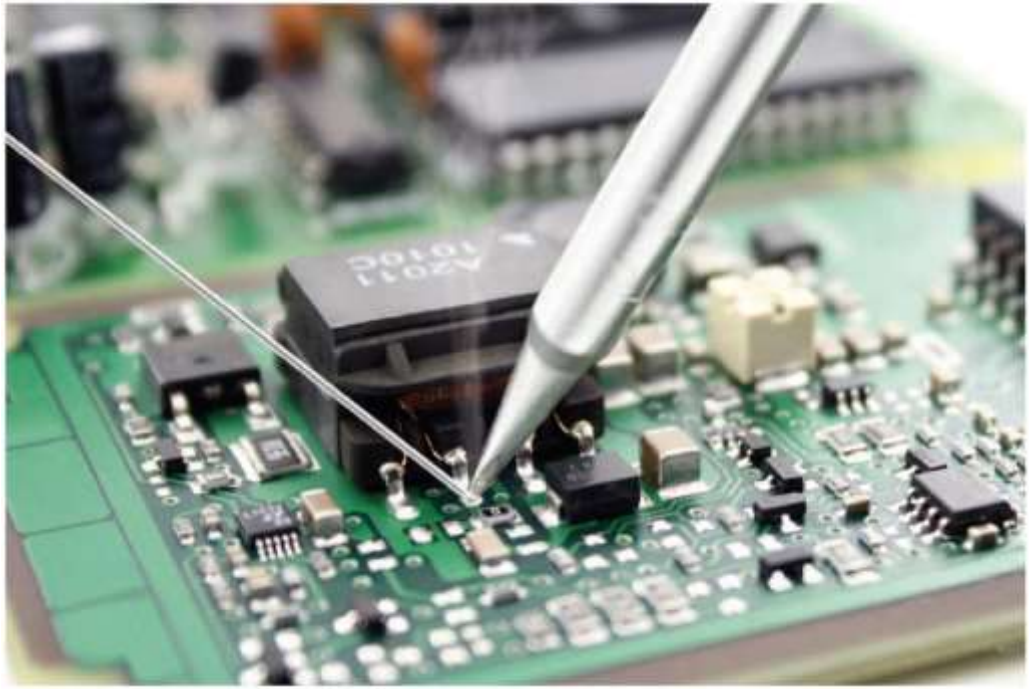
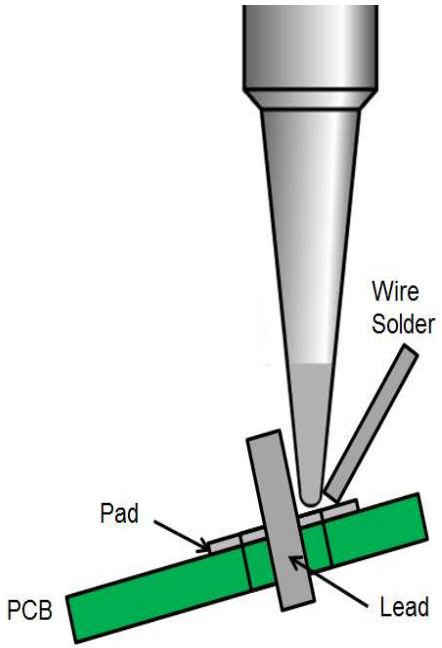
Introduction to Soldering and PCB





Zero PCB [Printed Circuit Board]

Zero Printed Circuit Board refers to an all-purpose & conventional **PCB** that embeds the circuits arbitrarily to ensure the continuous functioning of the hardware. The layers of general purpose circuit board are coated with copper as to allow appropriate soldering of the components of **PCB.**

What is Soldering?

- Soldering is a process in which two or more metal items are joined together by melting and then flowing a filler metal into the joint—the filler metal having a relatively low melting point.
- Soldering is used to form a permanent connection between electronic components.

Soldering Station

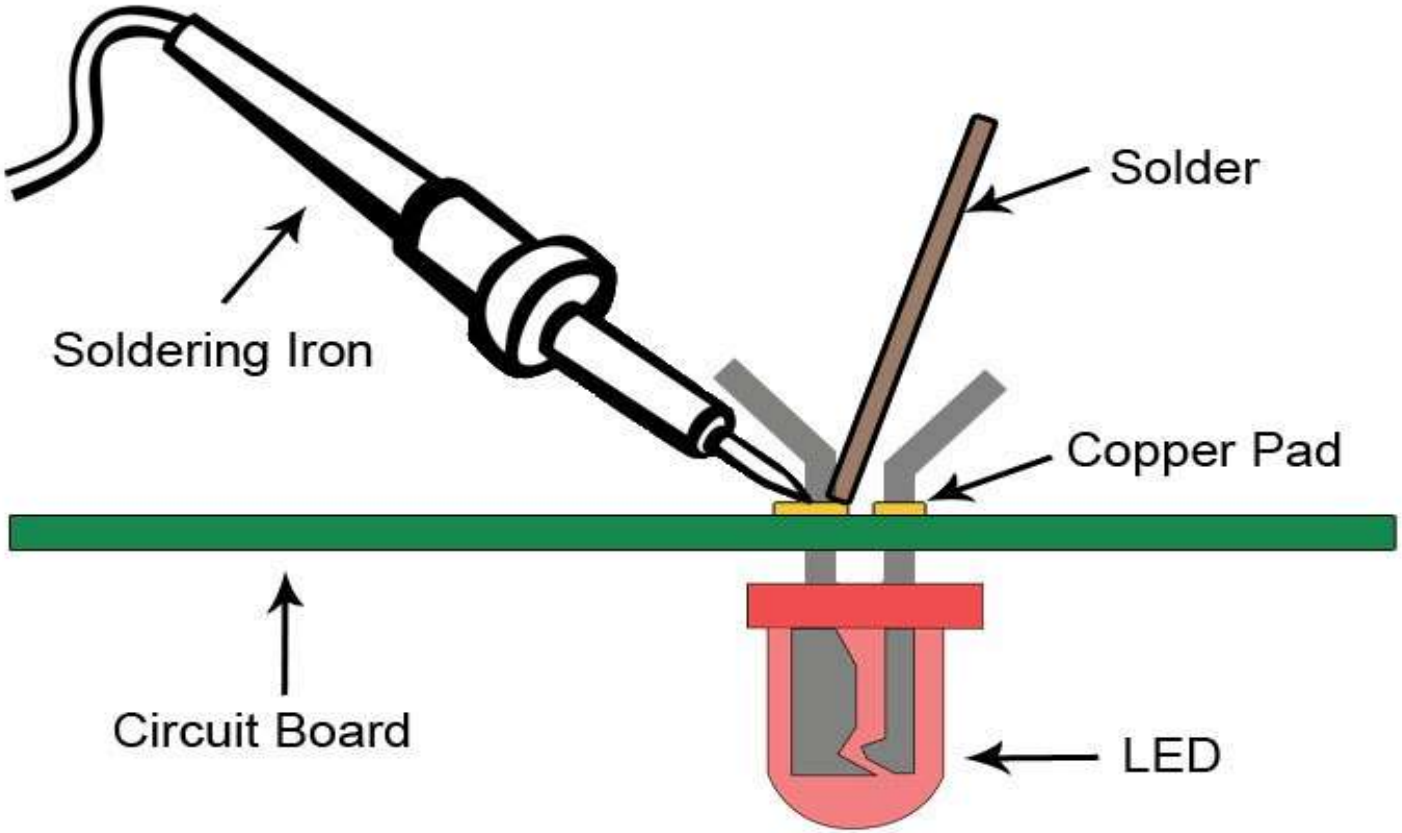
A **soldering station** is a multipurpose power soldering device designed for electronic components soldering. This type of equipment is mostly used in electronics and electrical engineering.

Soldering station consists of one or more soldering tools connected to the main unit, which includes the controls (temperature adjustment), means of indication, and may be equipped with an electric transformer.

It may include some accessories –

- Holders and stands
- Soldering tip cleaners

How To Solder



Solder Iron

A **soldering iron** is a hand tool used in soldering. It supplies heat to melt solder so that it can flow into the joint between two workpieces.

A soldering iron is composed of a heated metal tip and an insulated handle. Heating is often achieved electrically, by passing an electric current (supplied through an electrical cord or battery cables) through a resistive heating element.

Soldering Wire

Soldering filler materials are available in many different alloys for differing applications. In electronics assembly, the eutectic alloy with 63% tin and 37% lead (or 60/40, which is almost identical in melting point) has been the alloy of choice.

Soldering Flux

While soldering the metals, flux is used as threefold purpose, as it removes the oxidized metal from the surface to be soldered. Some fluxes are corrosive, so the parts need to be cleaned with damp sponge or other absorbent material after soldering to prevent damage.

Desoldering Pump

A **desoldering pump**, colloquially known as a **solder sucker**, is a manually-operated device which is used to remove solder from a printed circuit board.

Safety Precautions

- Never touch the element or tip of the soldering iron. They are very hot (about 400°C) and will burn.
- Hold wires to be heated with tweezers or clamps.
- Keep the cleaning sponge wet during use.
- Always return the soldering iron to its stand when not in use.
- Turn unit off or unplug it when not in use.

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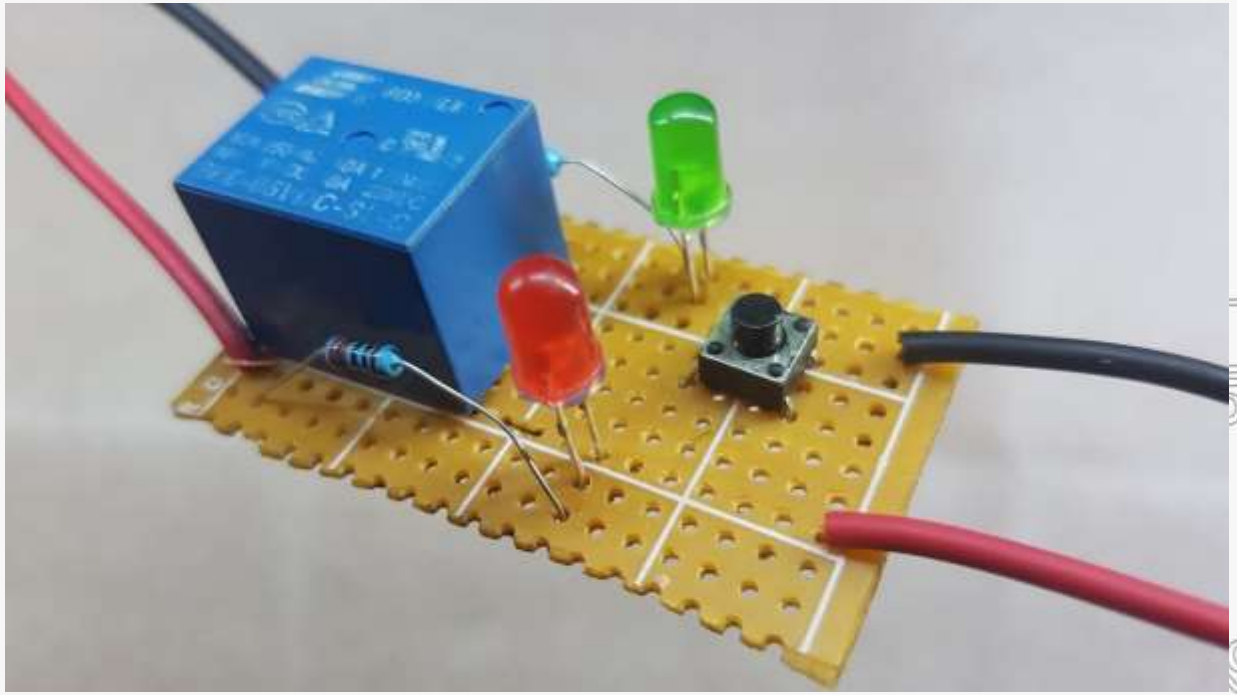
Short Circuit Protection Project



Relay

- A relay is classified into many types, a standard and generally used relay is made up of electromagnets which in general used as a switch.
- Relay means the act of passing something from one thing to another, the same meaning can be applied to this device because the signal received from one side of the device controls the switching operation on the other side.
- So relay is a switch which controls (open and close) circuits electromechanically.

Working principle of Relay

- The main operation of this device is to make or break contact with the help of a signal without any human involvement in order to switch it ON or OFF.
- It is mainly used to control a high powered circuit using a low power signal. Generally a DC signal is used to control circuit which is driven by high voltage like controlling AC home appliances with DC signals from microcontrollers.

Switch

- When the button is pressed, the **switches** turn **ON** and when the button is released, the **switches** turn **OFF**.
- A **switch** is a device whose operation is perceptible by touch. The click response of the button lets the user feel the response of the operation from the **switch**.

About Project

Short circuit protection is protection against excessive currents or current beyond the acceptable current rating of equipment and it operates instantly. As soon as an overcurrent is detected, the device trips and breaks the circuit.

Components Required

- Zero PCB
- Soldering Machine
- Soldering Wire
- Relay
- Switch
- LEDs
- Resistors(1kohm)
- Battery 9V
- Battery clap

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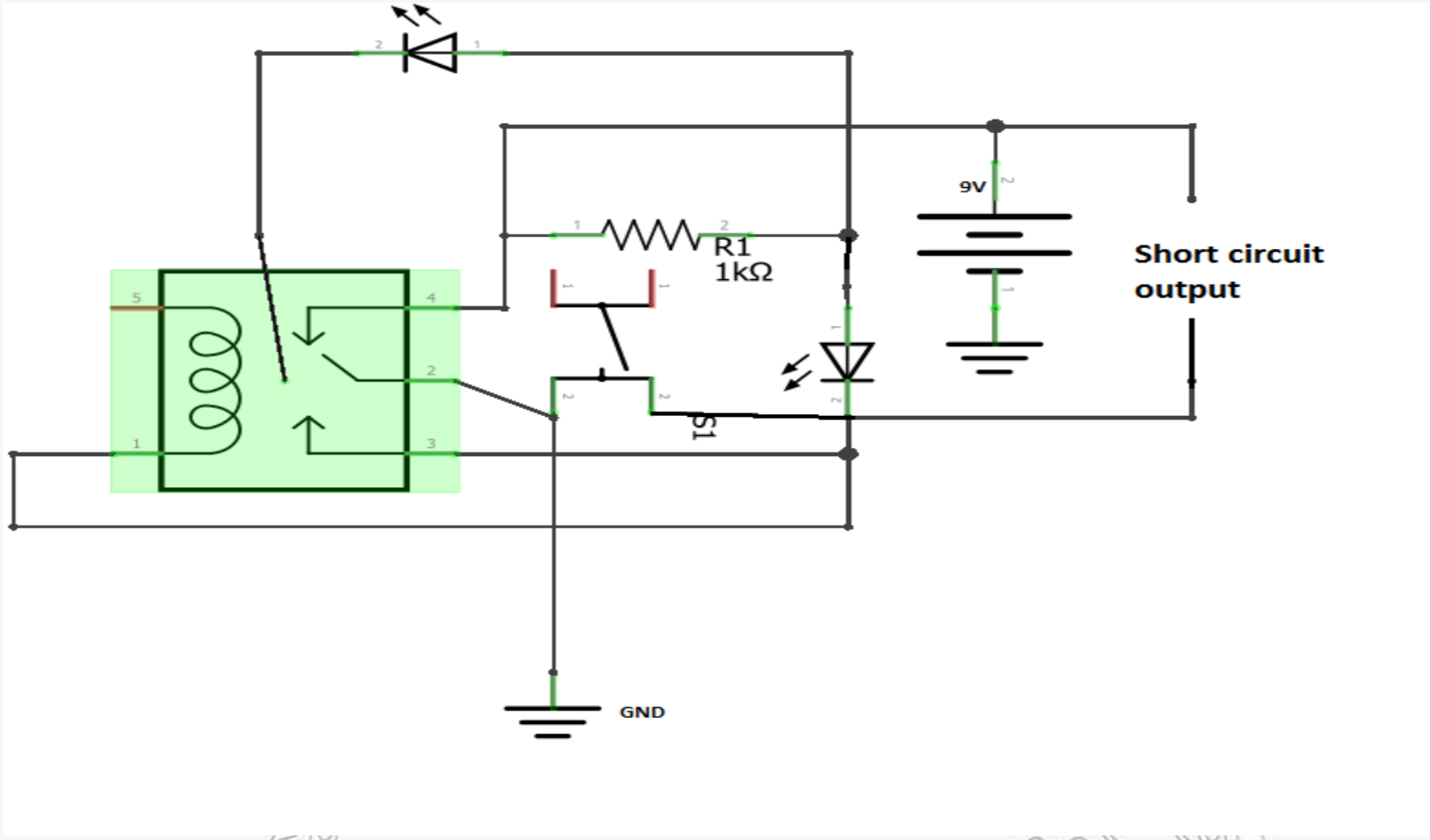
Connection Diagram

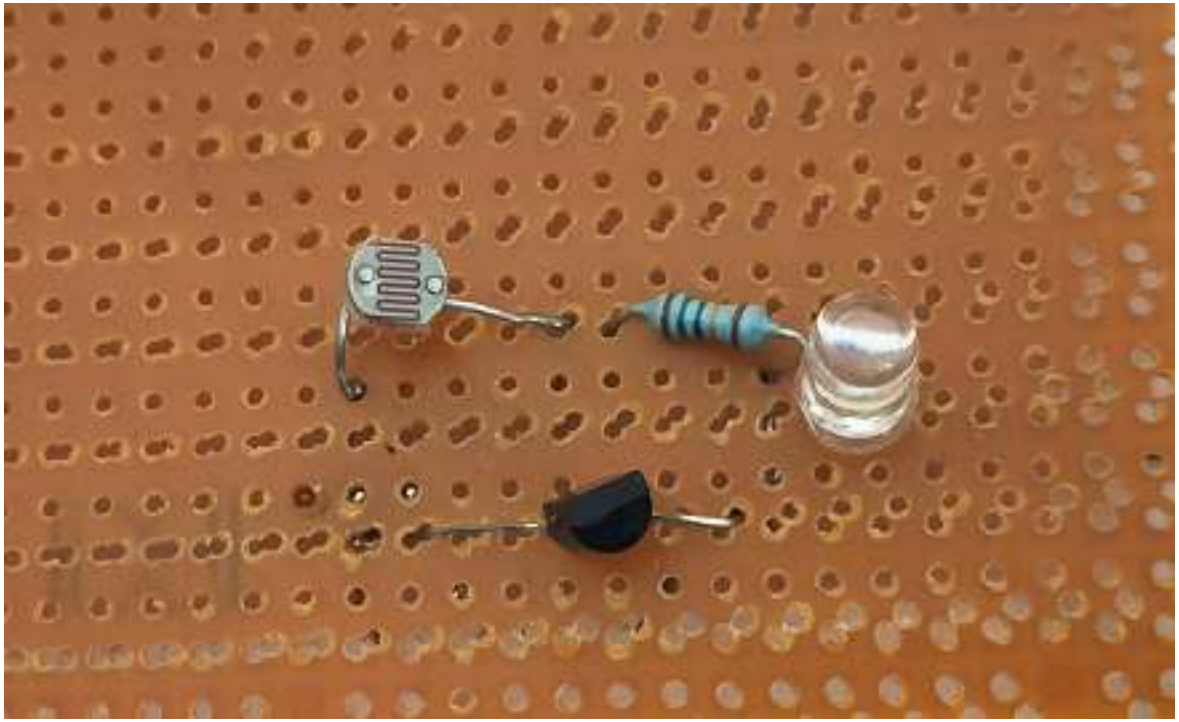


Future Scope

Overload relays are used in a motor circuit to protect motors from damage caused by prolonged periods of overcurrent. Short circuit protection is protection against excessive currents or current beyond the acceptable current rating of equipment and it operates instantly.

Project Link : https://youtu.be/BOQHUBTCY9I

Automatic Night Light

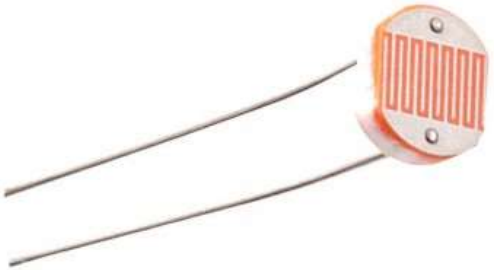


About Project

It senses the light intensity from surroundings and find whether its day or night. And it automatically turns ON when the surrounding is dark and it turns OFF when it receives light from surroundings. A sensor called **LDR,** which is used to detect the light intensity.

Light Dependent Resistor [LDR] Sensor

An **LDR** is a component that has a (variable) resistance that changes with the light intensity that falls upon it. This allows them to be used in light **sensing** circuits. A Light Dependent **Resistor** (**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.

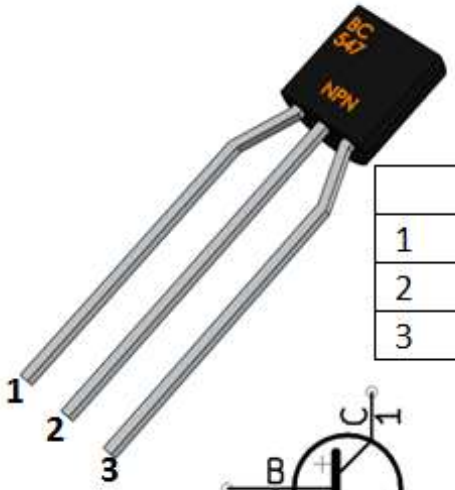


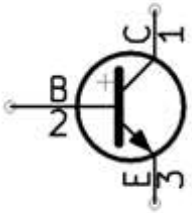
Working of LDR sensor

- We will use a LDR and a resistor together in series. An LDR is simply a device that changes resistance based on ambient light. The brighter the light, the lower the resistance, the dimmer the light, the higher the resistance.
- When there is no light , LDR will offer high resistance and less current flows through the resistor and voltage across resistor will be less near to GND.
- When light falls on LDR, its resistance decreases and current flow through it increases. Then voltage across the resistor increases and LED gets a HIGH signal.

BC547

BC547 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.



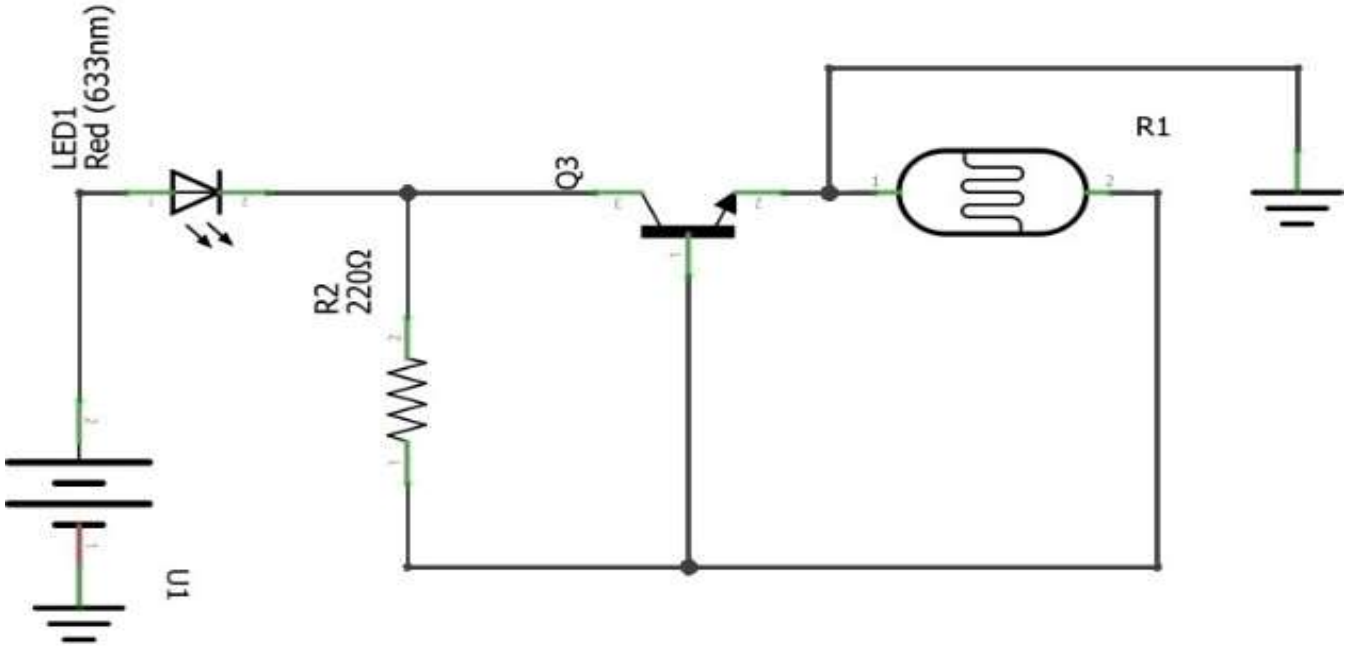


BC-547	
1	Collector
2	Base
3	Emitter

Components Required

- Zero PCB
- Soldering machine
- Soldering wire
- LDR [1]
- BC547 Transistor [1]
- LED [1]
- Resistor220ohm*1
- Battery 9v
- Battery connector

Connection Diagram

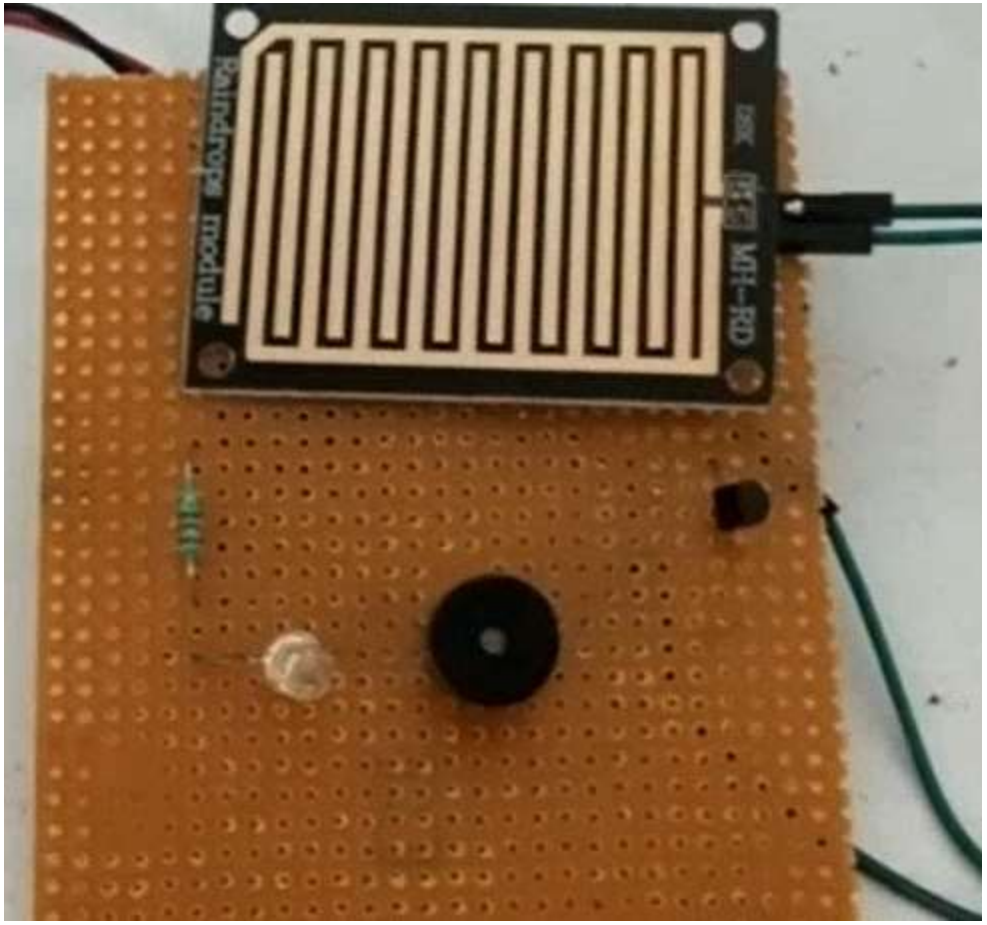


Future Scope

Automatic street light system have the various advantages. These makes the work easier so you don't have require the labor force because as the name indicate it is **automatic**. These are reliable **lights** for streets and effective one. Whenever you want these can be converted from auto to manual mode easily.

Project Link : https://youtu.be/rTD9n20815M

Rain Water Alarm



Raindrop sensor

- **The Raindrop sensor module** is used for rain detection. It is also for measuring rainfall intensity.
- The module includes a rain board and a control board that are separate for more convenience. It has a power indicator LED and an adjustable sensitivity though a potentiometer.

Concept of Raindrop Sensor

- The module is based on the LM393 op amp. It includes a printed circuit board(control board) that “collects” the rain drops. As rain drops are collected on the circuit board, they create paths of parallel resistance that are measured via the op amp.

- The lower the resistance (or the more water), the lower the voltage output. Conversely, the less water, the greater the output voltage on the analog pin. A completely dry board for example will cause the module to output five volts.

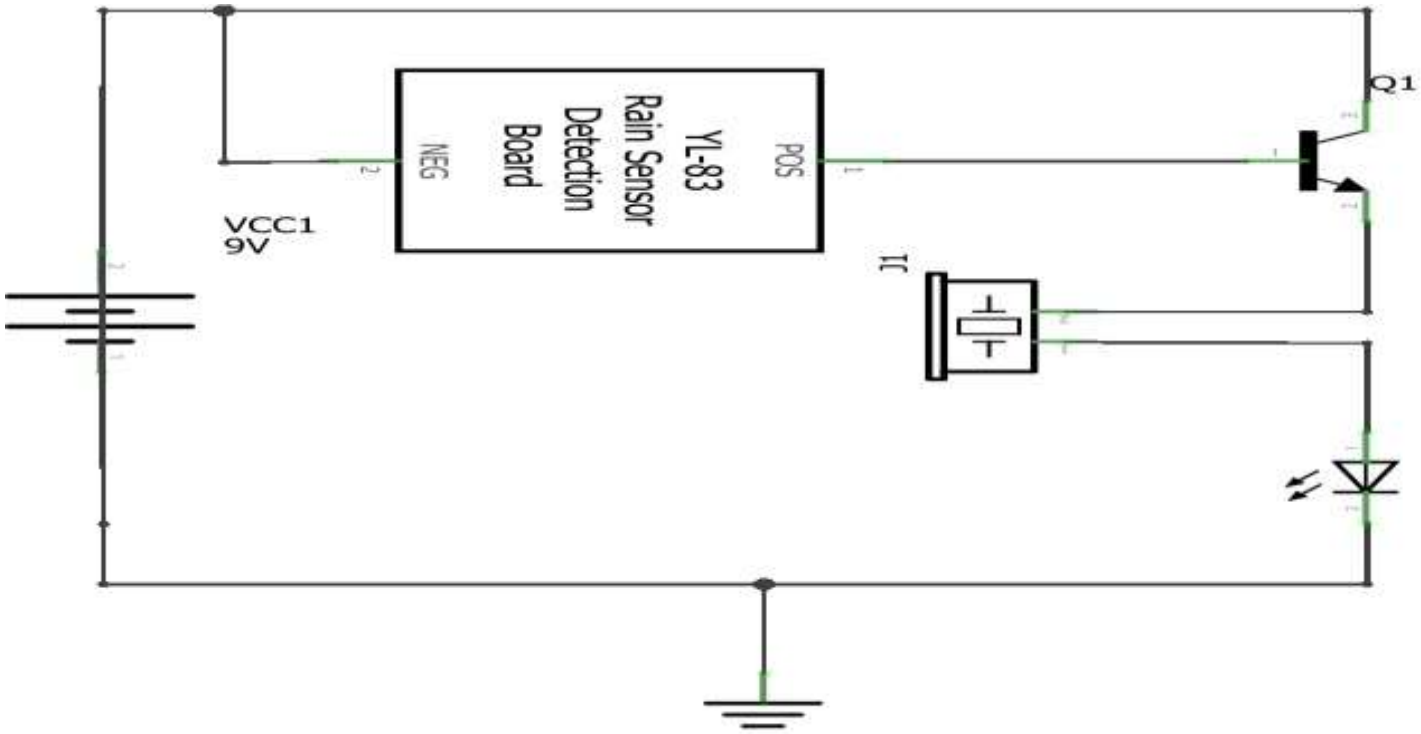
Working of Raindrop Sensor

- In this project basically raindrop sensor senses **rain** when comes, LED will blink.
- A **Rain sensor** or **Rain** switch is a switching device activated by rainfall.
- As rain drops are collected on the circuit board, they create paths of parallel resistance that are measured via the opamp.

About Project

Rain Alarm Project is a simple but very useful project that detects Rain (Rain Water) and automatically triggers an alarm or buzzer. Rain water detector will detect the rain and make an alert.

Connection Diagram



Components Required

- Zero PCB
- Soldering iron
- Soldering Wire
- BC 547 Transistor
- Buzzer 5V-12V
- LED
- Resistor[220ohm]
- Rain Detector Plate
- 9V battery
- Battery Connector

Working of project

Rain Alarm is a device which is used to give the information is the rain is occurring as it gives sound when rain falls between the two aluminum rods. As the rain drop comes between the two rods the circuit gets completed then buzzer will create alarm indicating the falling of rain.

Future Scope

- In the irrigation, it will detect the rain and immediately alert the farmer.
- In automobiles, when the rain detector detects the rain it will immediately active the wipers and inform the driver.
- In communications, it will boost the power of the antenna and increase the signal strength to send or receive the signals.
- In normal house hold, with the help of rain water detector we can automatically save the rain water.

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Project Link : https://youtu.be/4CoOCMDS3uw

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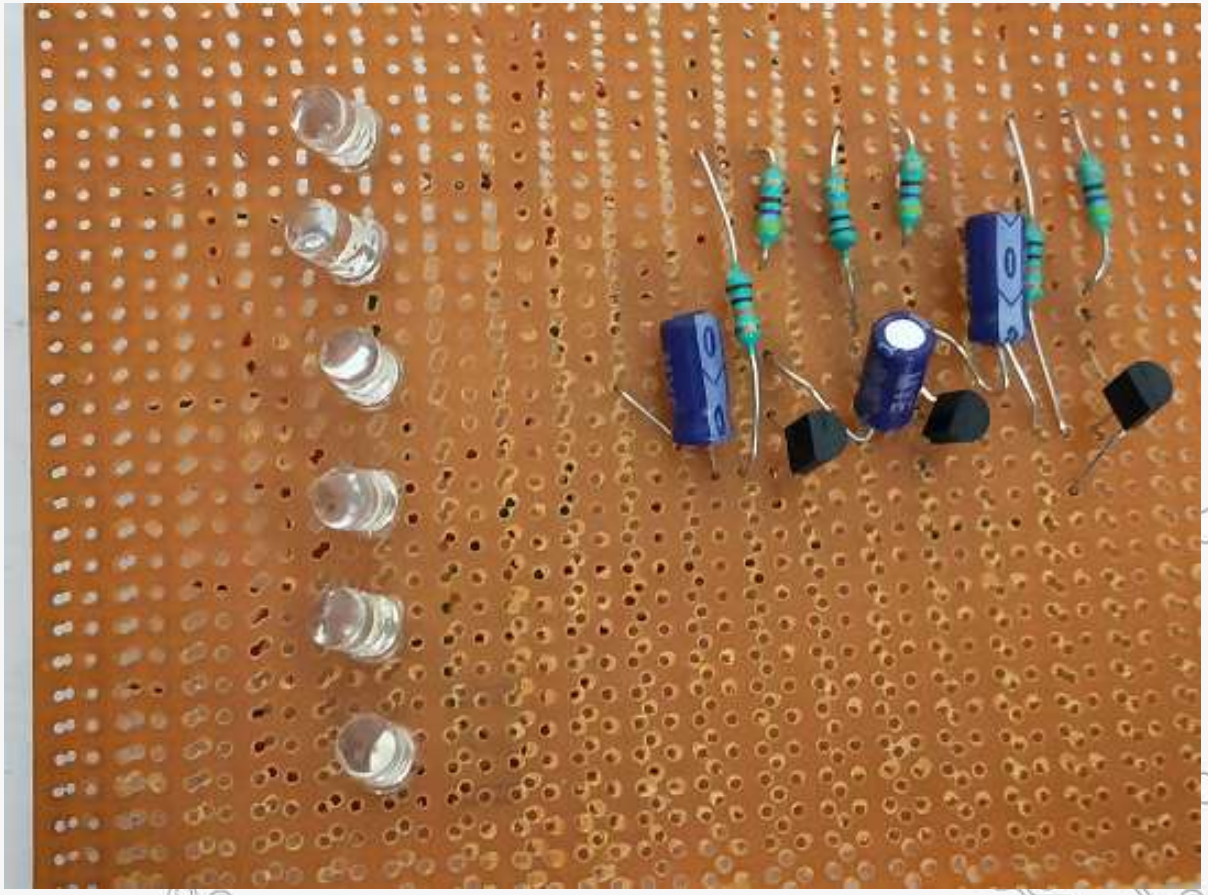
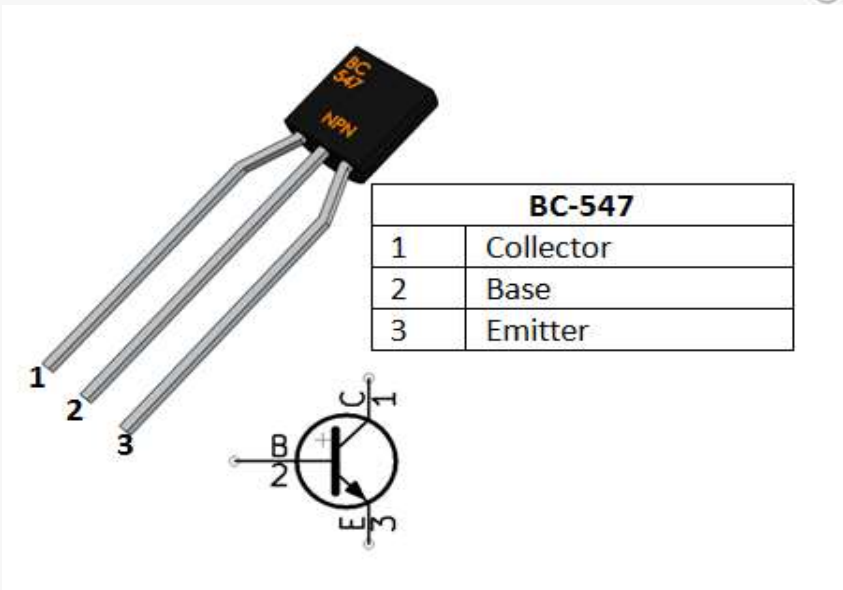
LED Chaser



BC547

BC547 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.



BC-547	
1	Collector
2	Base
3	Emitter

About Project

In this project, an array of LEDs are arranged in such a way that individual LEDs (or small groups of LEDs) turn on and off in a predetermined and repeating sequence, thus producing a visually attractive display in which one or more ripples of light seem to repeatedly run through a chain or around a ring of LEDs.

Components Required

- Zero PCB
- Soldering Machine
- Soldering Wire
- LED (white) [6]
- BC547 Transistor [3]
- Resistor 220ohm [6]
- Battery 9v
- Capacitor 10uf [3]
- Battery connector

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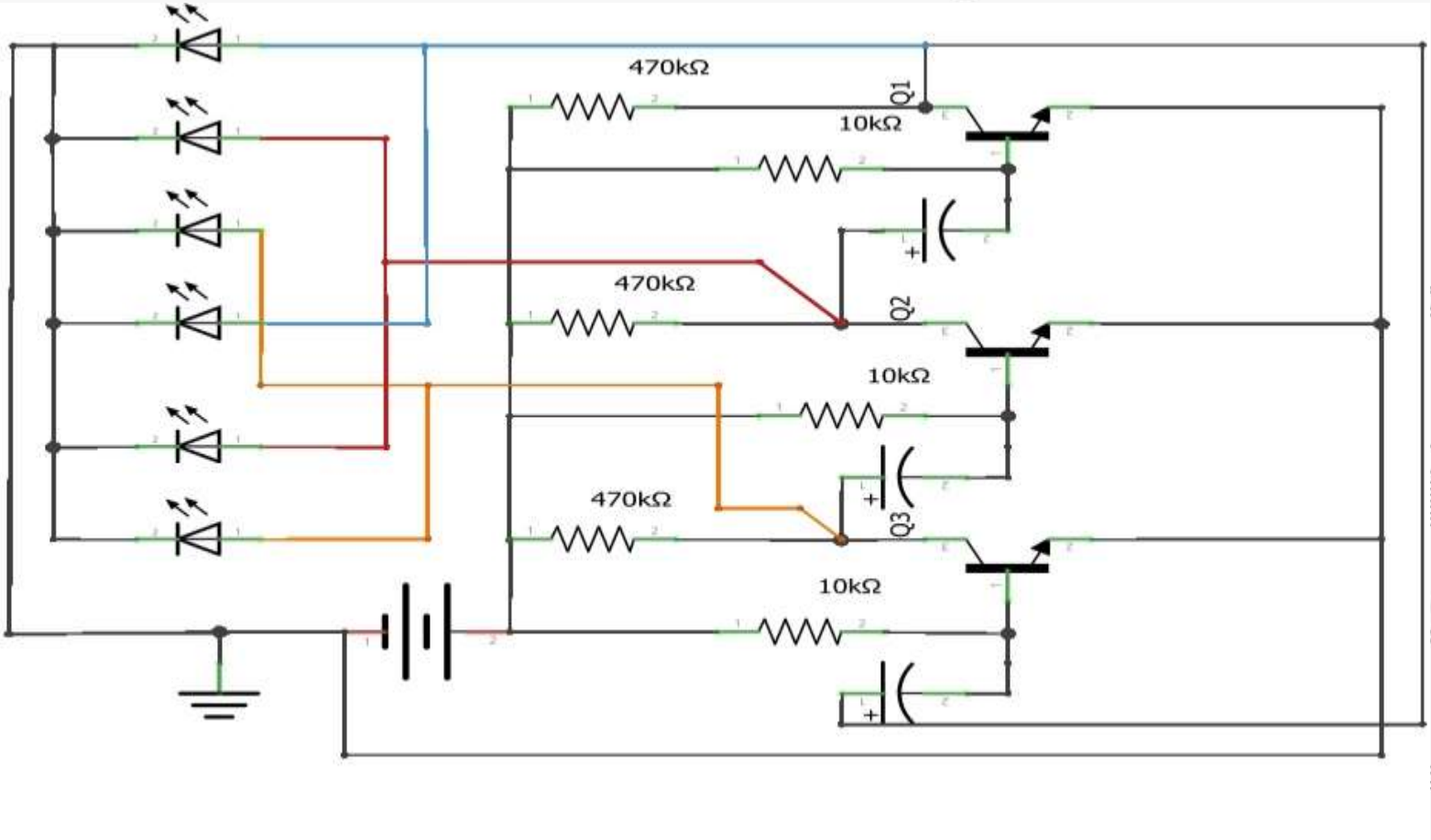
Connection Diagram

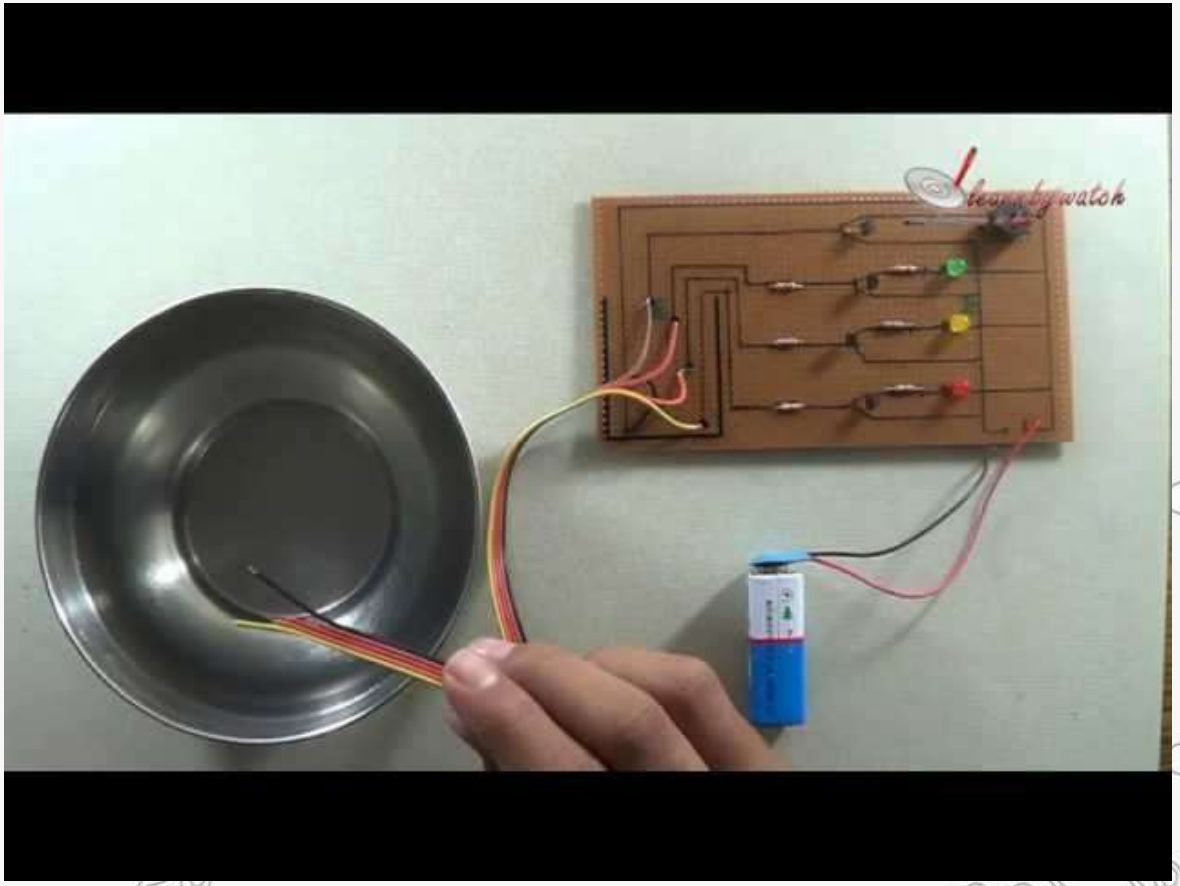


Future Scope

LED light minimizes the operating and maintenance cost and is also considered as environment friendly lighting, as it does not emit harmful gases. **LEDs** emit very less heat compared to incandescent bulbs and CFLs.

Project Link : https://youtu.be/M99CksZb4ik

Water Level Indicator



About Project

Water tank overflow is a common problem which leads to the wastage of water. Though there are many solutions to it like ball valves which automatically stop the water flow once the tank gets full. But being an electronics enthusiastic wouldn't you like an electronic solution for it? So here is a simple and handy DIY that will guide you to make a circuit which will detect the water level and will indicate the water tank full or a preset level.

Components Required

- Soldering Iron
- Soldering wire
- Zero PCB
- Resistor 220ohm*5
- White LED*5
- Transistor BC547*5
- Connecting Wire
- Battery 9v
- Battery connector

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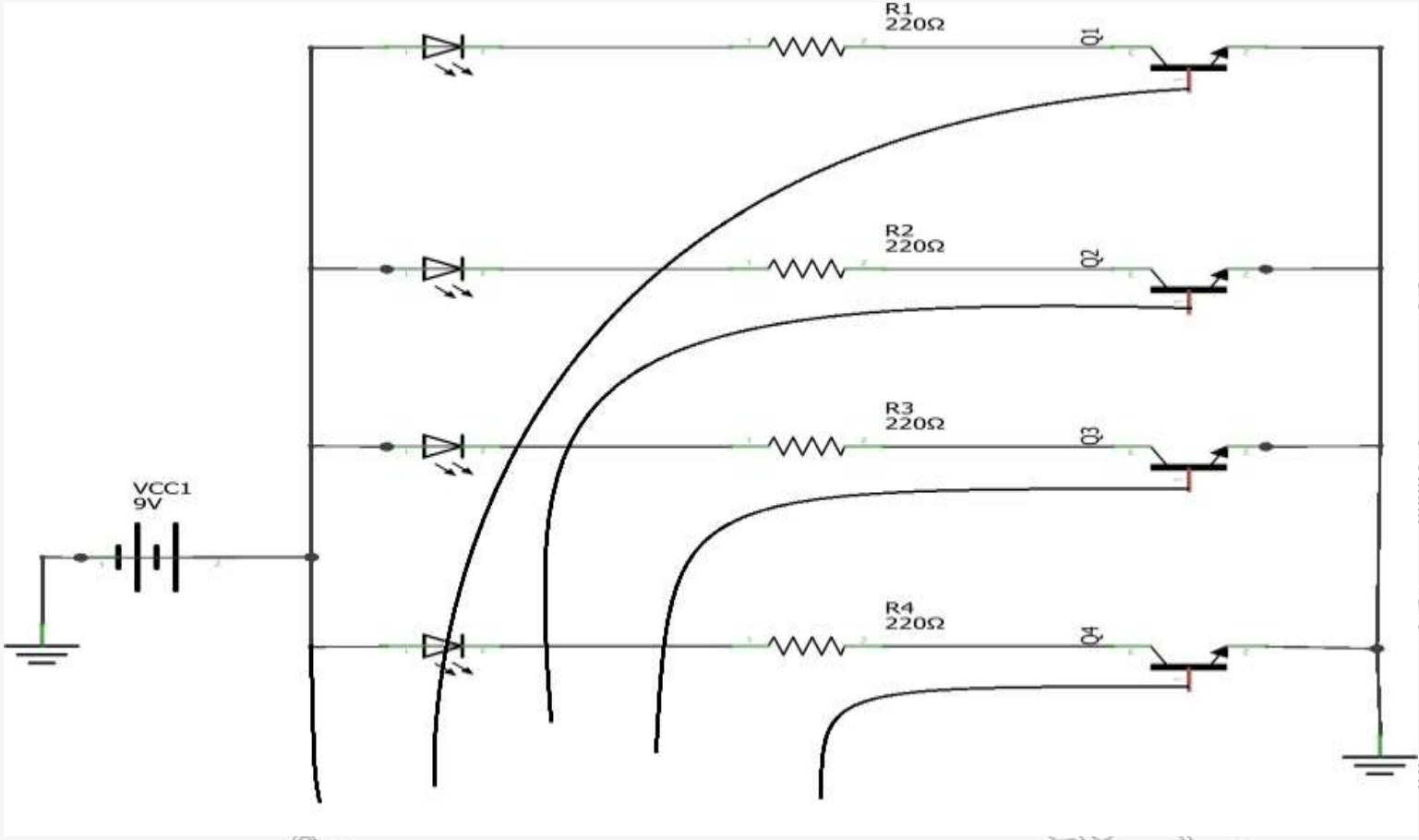
Connection Diagram



Working of project

The circuit is based on 5 transistor switches. This project makes the transistors conduct to glow LEDs one by one and indicate the level of water. The ends of probes of the water tank level indicator are connected to corresponding points in the circuit as shown in above circuit diagram.

Future Scope

The water level indicator is used in :-

- Hotels,
- Home Apartments
- Commercial Complex
- Factories.

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Project Link : https://youtu.be/CdmaZAGCVow

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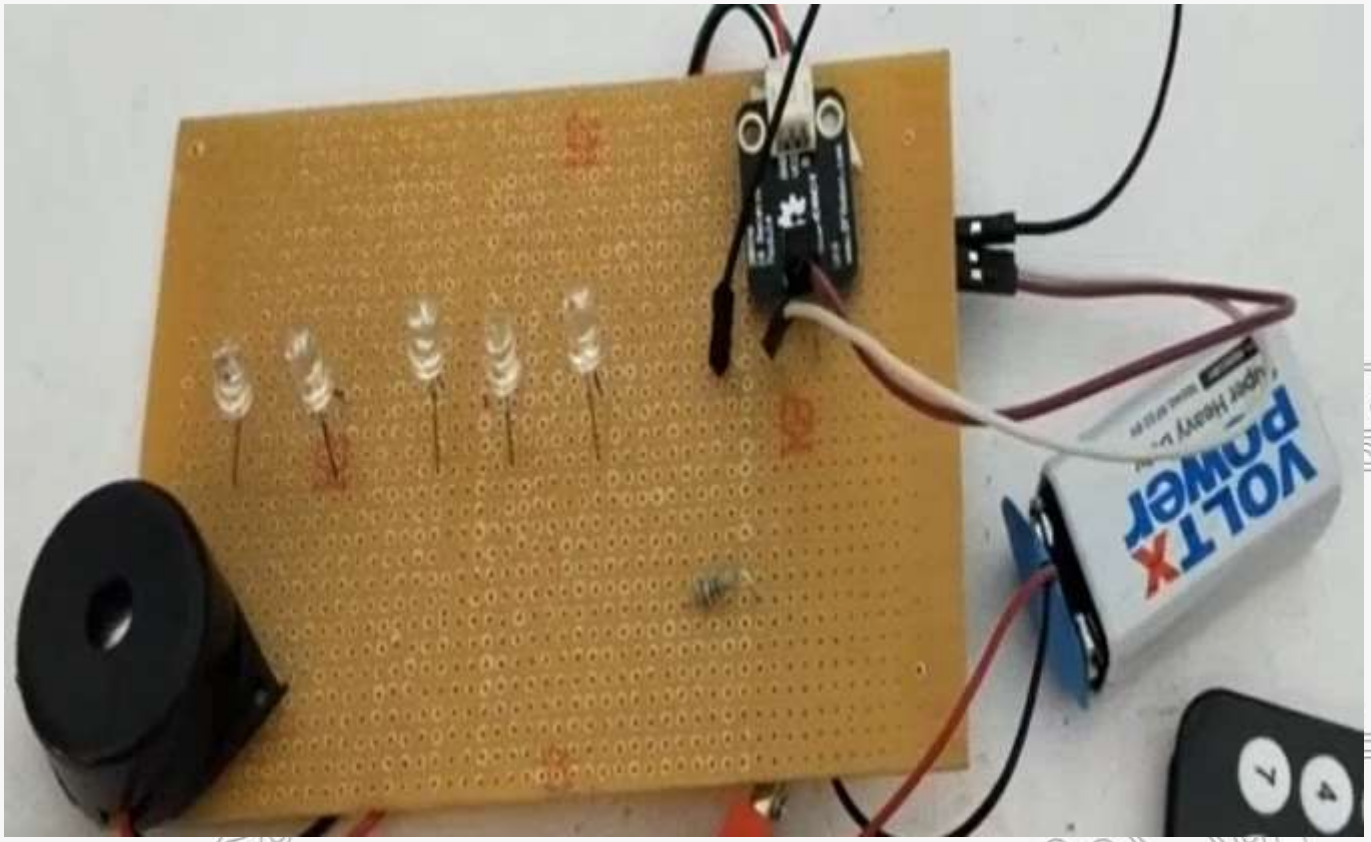
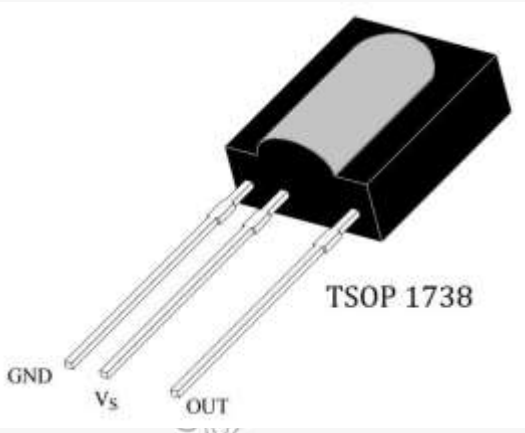
Remote Control Light



TSOP1738

- **TSOP1738** is a infrared receiver tuned to receive IR of frequency 38 kHz only. It is perfect for making obstacle sensors and to read signals from most IR remotes(TV, AC, Home Theatre Remotes, etc).
- It is used as a receiver in distance sensors, also provides better performance as it allows better reception and protection from ambient light compared to other IR receivers. It can be used to read signals of most IR Remotes.



Working principle

- The TSOP1738 IR sensor module consists of a PIN diode and a pre amplifier which are embedded into a single package.
- The output of TSOP is active low and it gives +5V in off state. When IR waves, from a source, with a centre frequency of 38 kHz incident on it, its output goes low.
- Lights coming from sunlight, fluorescent lamps etc. may cause disturbance to it and result in undesirable output even when the source is not transmitting IR signals.

About Project

- Remote Controlled Light Switch is an application where a remote is used to turn ON or OFF an AC Light. We used a simple remote and TSOP 1738 IR Receiver at the transmitter and receiver side of the circuit.
- Normally, we **use remote** controls to turn ON or OFF appliances like TV, DVD Player, Music System, etc.

Components

- Zero PCB
- Soldering iron
- Soldering Wire
- Led [5]
- 1000hm Resistor
- TSOP1738
- IR LED or Remote
- Big Buzzer
- 9V battery and battery connector

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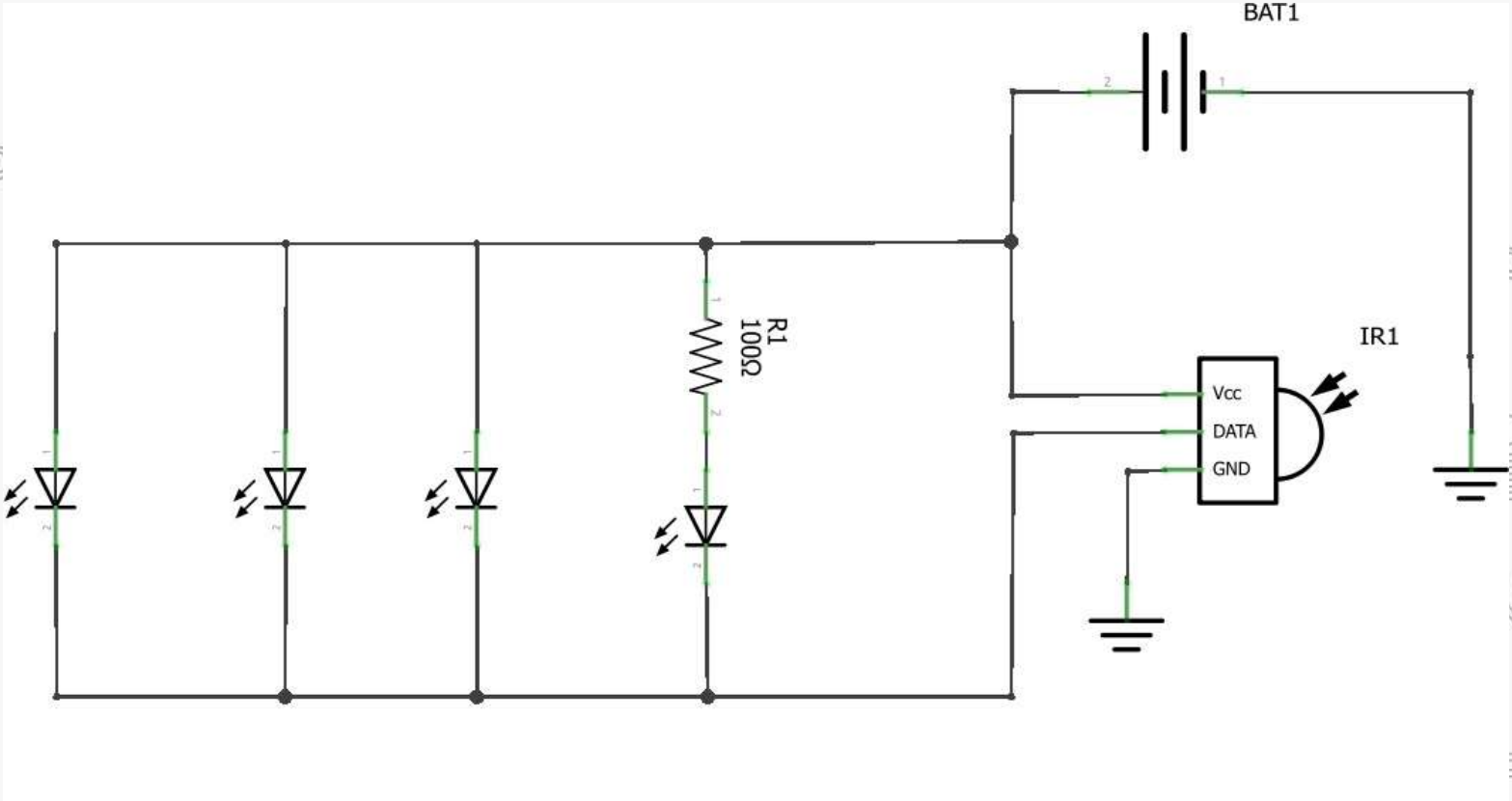
Connection Diagram



Working of project

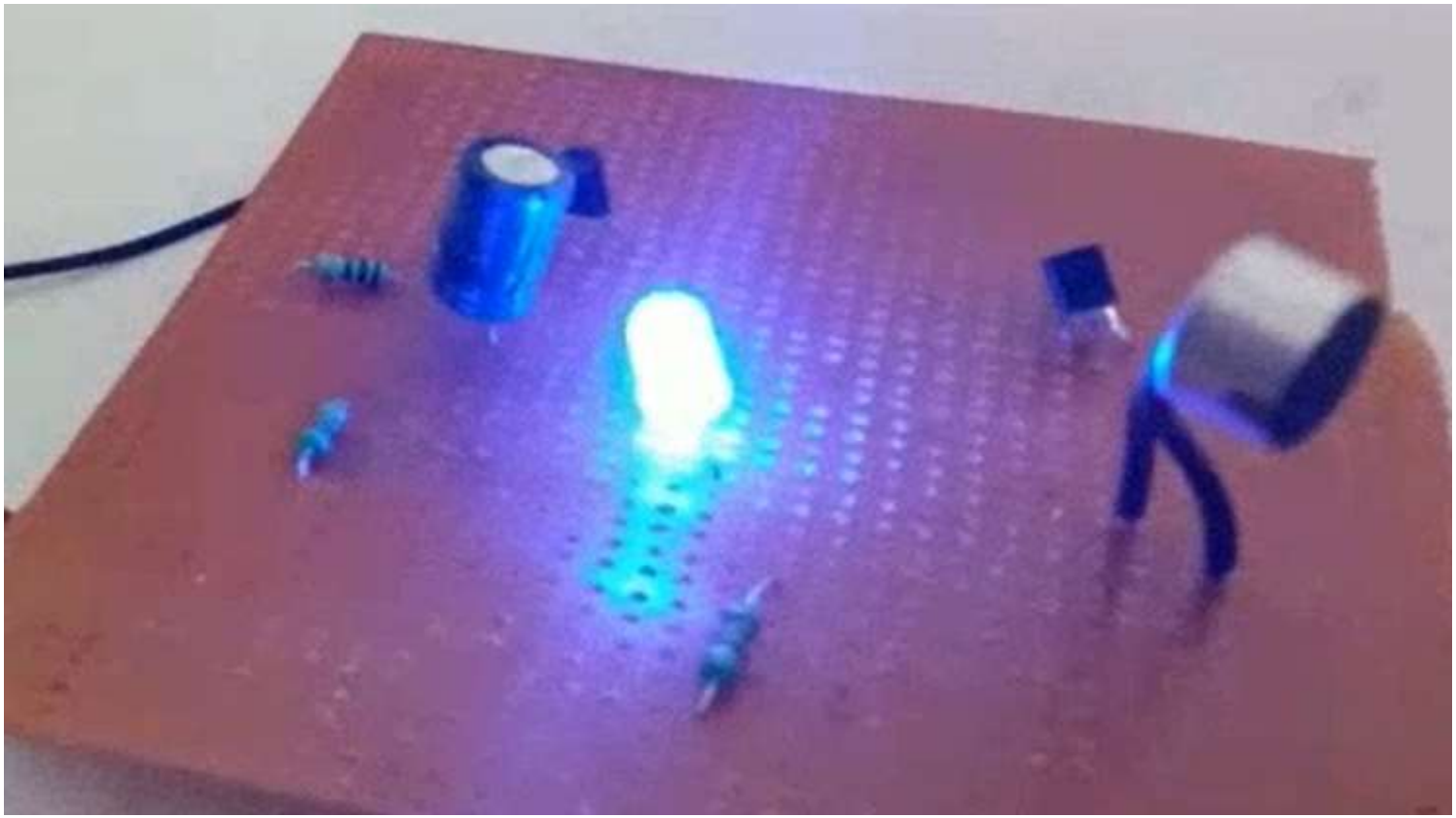
- When an IR LED is transmitting data onto the TSOP, every time the IR led goes high, the TSOP will go LOW and vice versa. Remote control signals are often bytes of data that is encoded and transmitted by pulsing(switching ON & OFF the IR LED at a specific frequency).
- Most TV remote controls work at 32-40 Khz frequency and most receivers can receive this range.

Future Scope

- You can connect this circuit to any of the home appliances like TV, radio, lamp, fan etc, to make their switching on and off options simpler. This circuit can be activated from about 10 meters distance.
- Infrared remote control switches are used to control multiple things like, thyristor power control, TVs, video games, space related equipments (NASA), etc.

Project Link : https://youtu.be/eTi8Ivh3iqo

Clap Circuit Project



About Project

Clap circuit is a basic electronics mini-project, made with the help of the basic components. Clap switch has the ability to turn ON/OFF any electrical component or circuit by the clap sound. The main component of this clap switch circuit is the electric condenser mic, which has been used as a sound sensor.

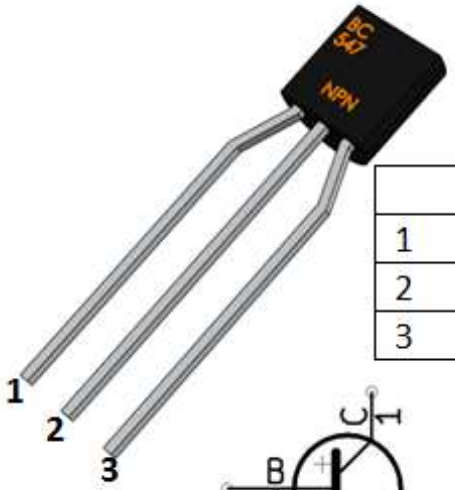
Microphone

• A **microphone** is a device that captures audio by converting sound waves into an electrical signal. This signal can be amplified as an analog signal or may be converted to a digital signal, which can be processed by a computer or other digital audio device.

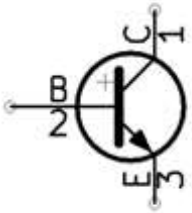
• Vibration of the diaphragm causes surrounding components of the **microphone** to vibrate. Conversion of these vibrations is delivered as an audible signal.

BC547

BC547 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.



BC-547	
1	Collector
2	Base
3	Emitter



Working of BC547 Transistor

BC547 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 100mA, hence we cannot connect loads that consume more than 100mA using this transistor. To bias a transistor we have to supply current to base pin, this current (I_B) should be limited to 5mA.

When this transistor is fully biased then it can allow a maximum of 100mA to flow across the collector and emitter. This stage is called **Saturation Region** and the typical voltage allowed across the Collector-Emitter (V_{CE}) or Base-Emitter (V_{BE}) 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.

Components Required

- Zero PCB
- Soldering iron
- Soldering wire
- BC547 Transistor [2]
- Microphone [1]
- LED [1]
- Resistors(220ohm,120k,10k) [1]
- Capacitor 47uf
- Battery 9V
- Battery connector

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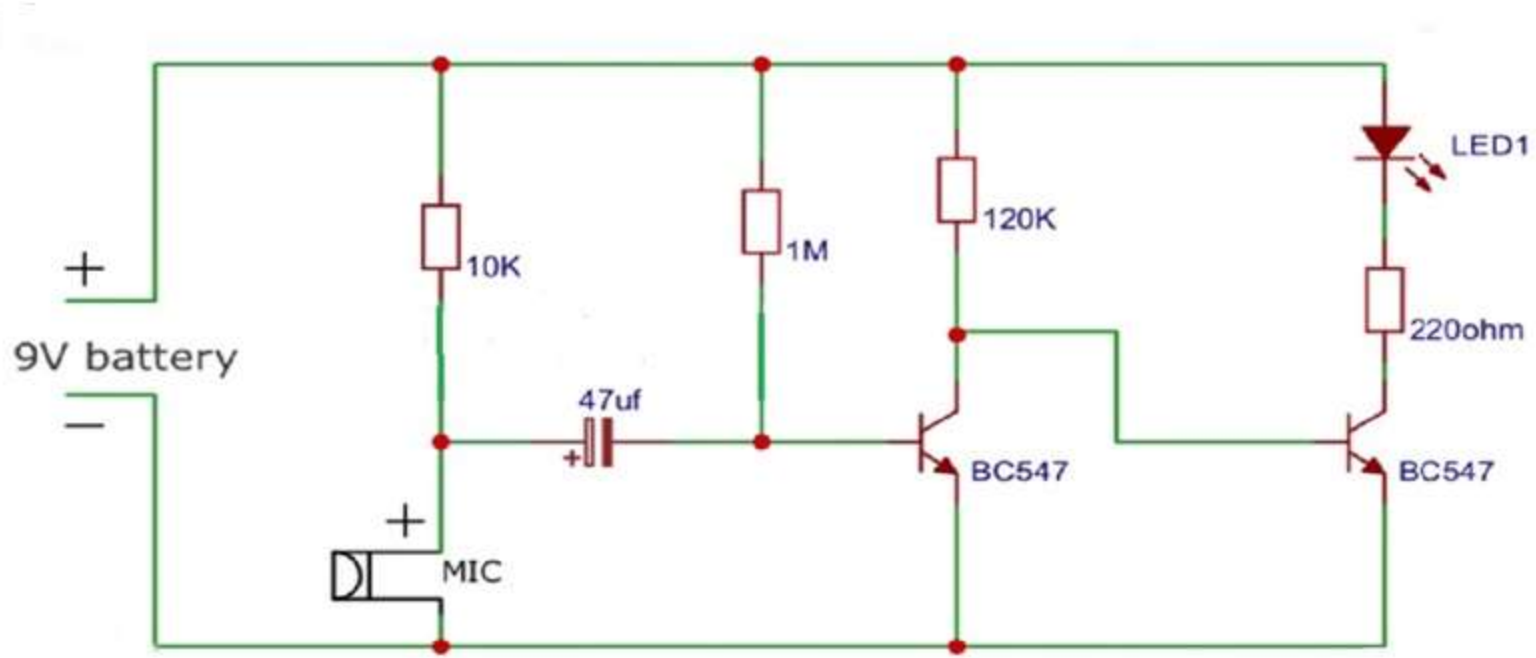
Connection Diagram

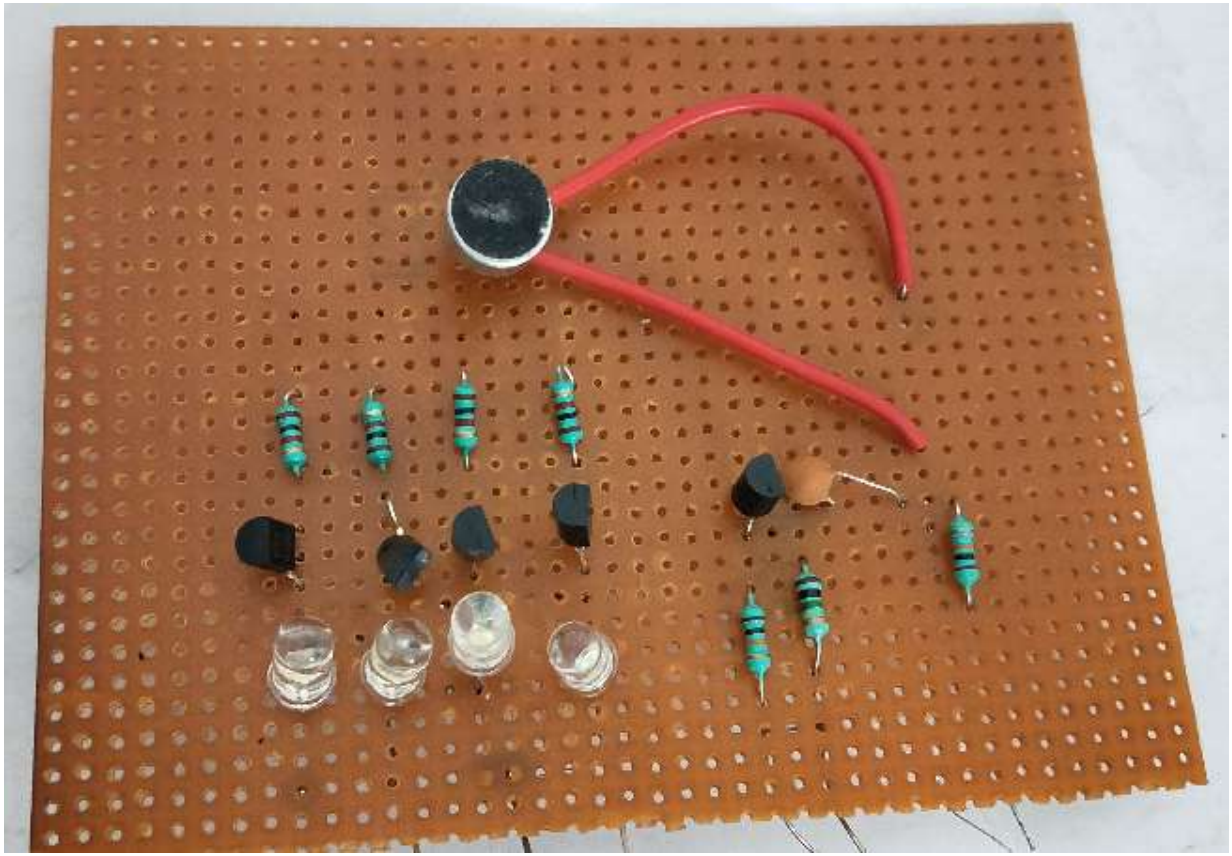


Future Scope

- Clap Switch is not restricted to turn the LEDs ON and OFF, but it can be used in any electric appliances such as Tube Light, Fan, Radio or any other basic circuit which you want to turn ON by a Sound.
- Clap switch is generally used for a light, television, radio or similar electronic device that the person will want to turn on/off from bed.

Project Link : https://youtu.be/0Kna4GY5kws

Music Rhythm Led Dancing Light



Microphone

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BC547

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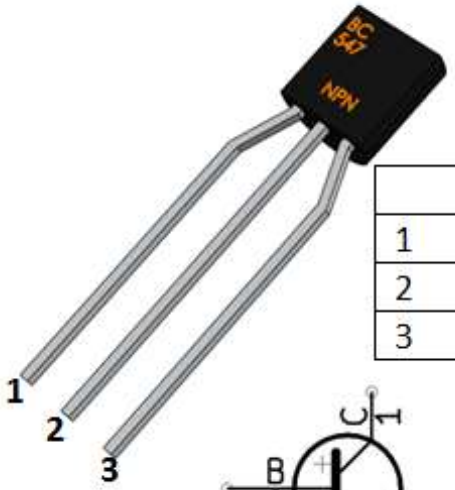
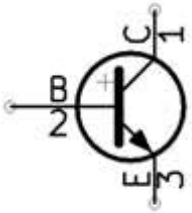


BC-547	
1	Collector
2	Base
3	Emitter



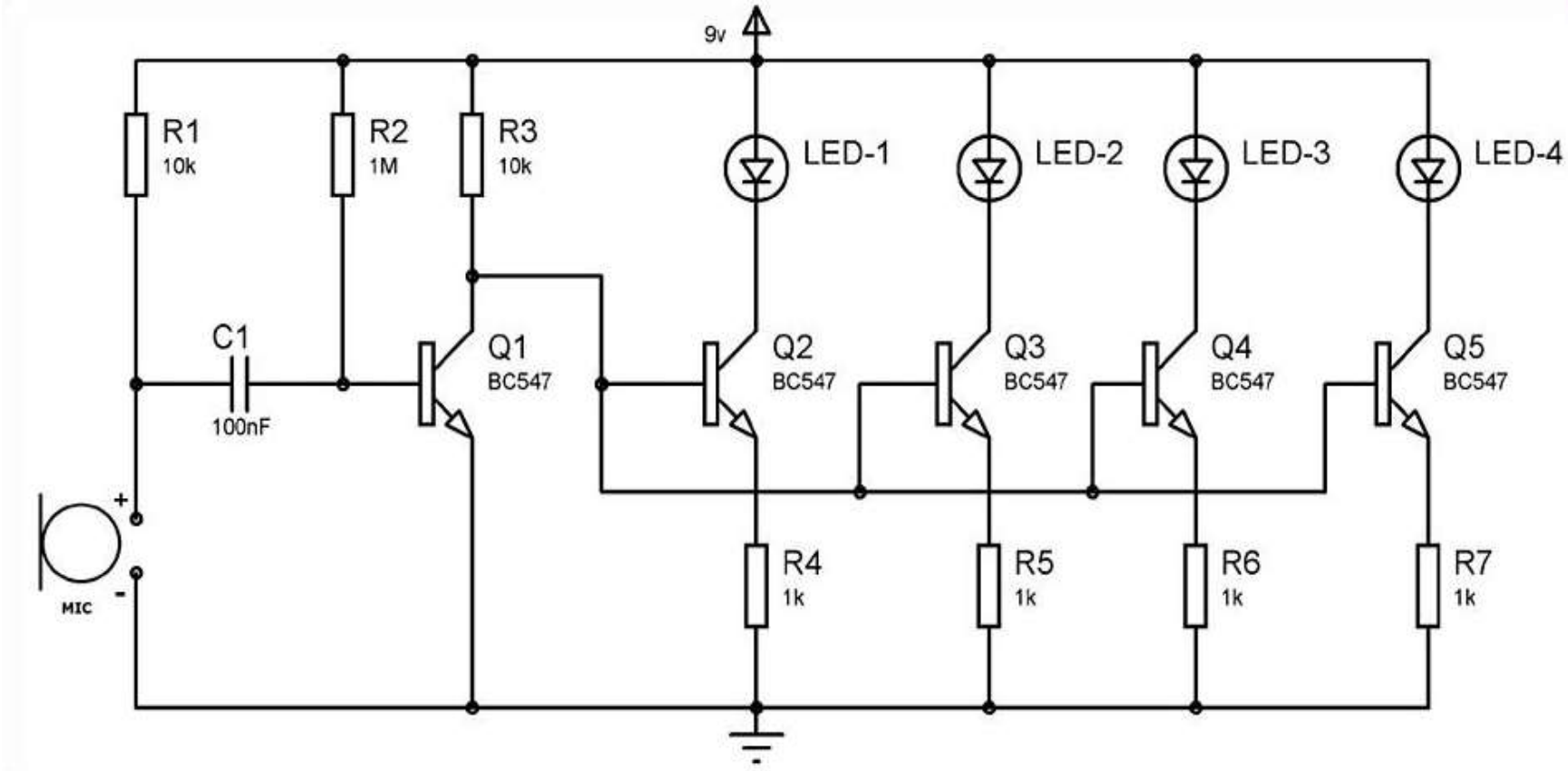
About Project

In this project we are going to show you how to make Music rhythm LED flash light using LEDs & Transistors. You might have seen the Disco Lights or DJ lights or light during a function that turn ON and OFF according to the beats or rhythm of the music. This Music rhythm LED flash light circuit is based on transistor BC547. This circuit is very simple and easy to build, it just requires few basic components.

Components

- Zero PCB
- Soldering Machine
- Soldering Wire
- Microphone
- LED
- Resistors 10k, 1M, 1k
- Transistors BC547
- Capacitor 100nf
- 9v battery
- Battery connector

Connection Diagram



Working of project

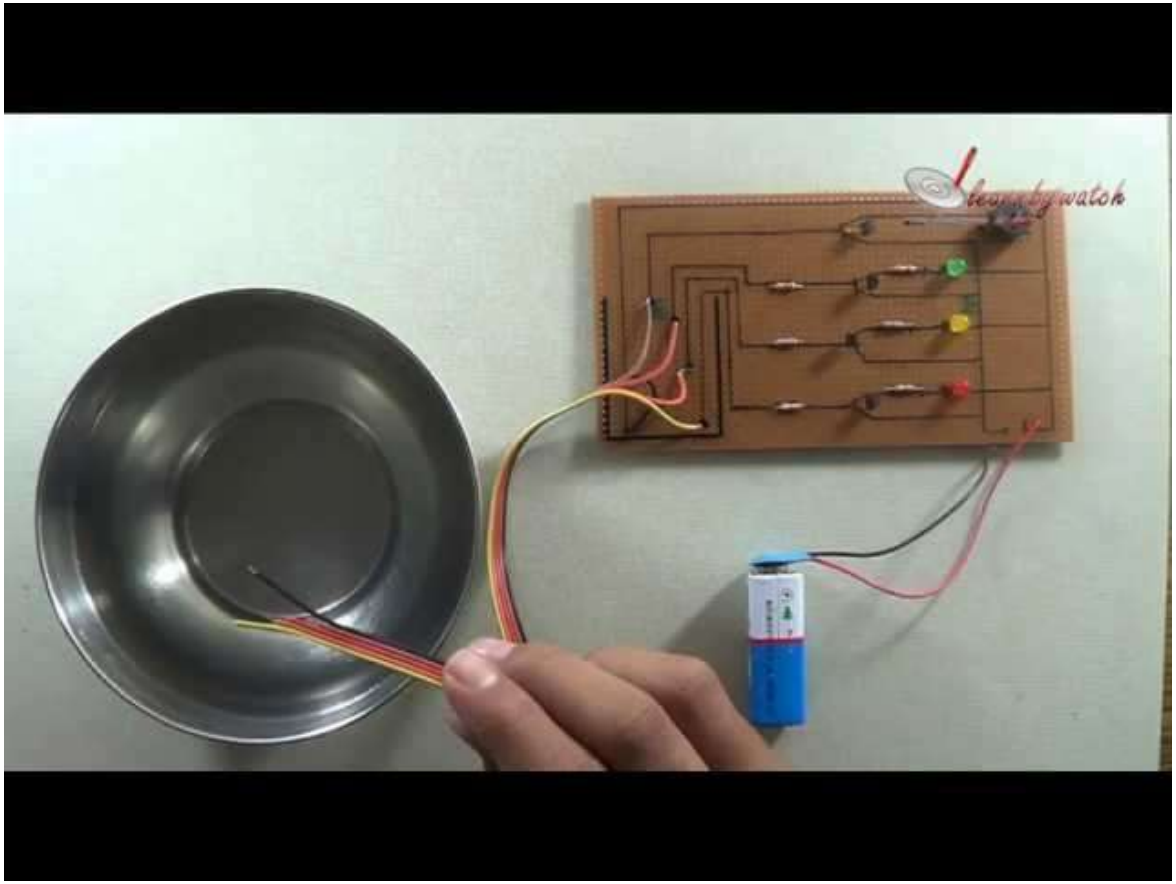
In this Music rhythm LED flash light, condenser mic picks up the sound signals and converts them into voltage levels. These voltage signals are further fed into R-C filter or HIGH PASS filter (R2 and C1), to eliminate the noise from the sound. Further a NPN transistor (Q1- BC547) is used to amplify the signals, from the High Pass filter. Then finally these music signals are given to the array of four transistors. Transistor in this array works as amplifier, and glows the four LEDs according to the sound pattern. This generates a very interesting sequence of dancing LEDs which follows the beats as per their intensity or pitch. We can also add more LEDs with transistor.

Future Scope

- The future scope of this project would be to design a mechanism that would be helpful in music therapy treatment and provide the music therapist the help needed to treat the patients suffering from disorders like mental stress, anxiety, acute depression and trauma.
- The proposed system also tends to avoid in future the unpredictable results produced in extreme bad light conditions and very poor camera resolution.

Project Link : https://youtu.be/C1-a_zR0I-o

Water Level Indicator



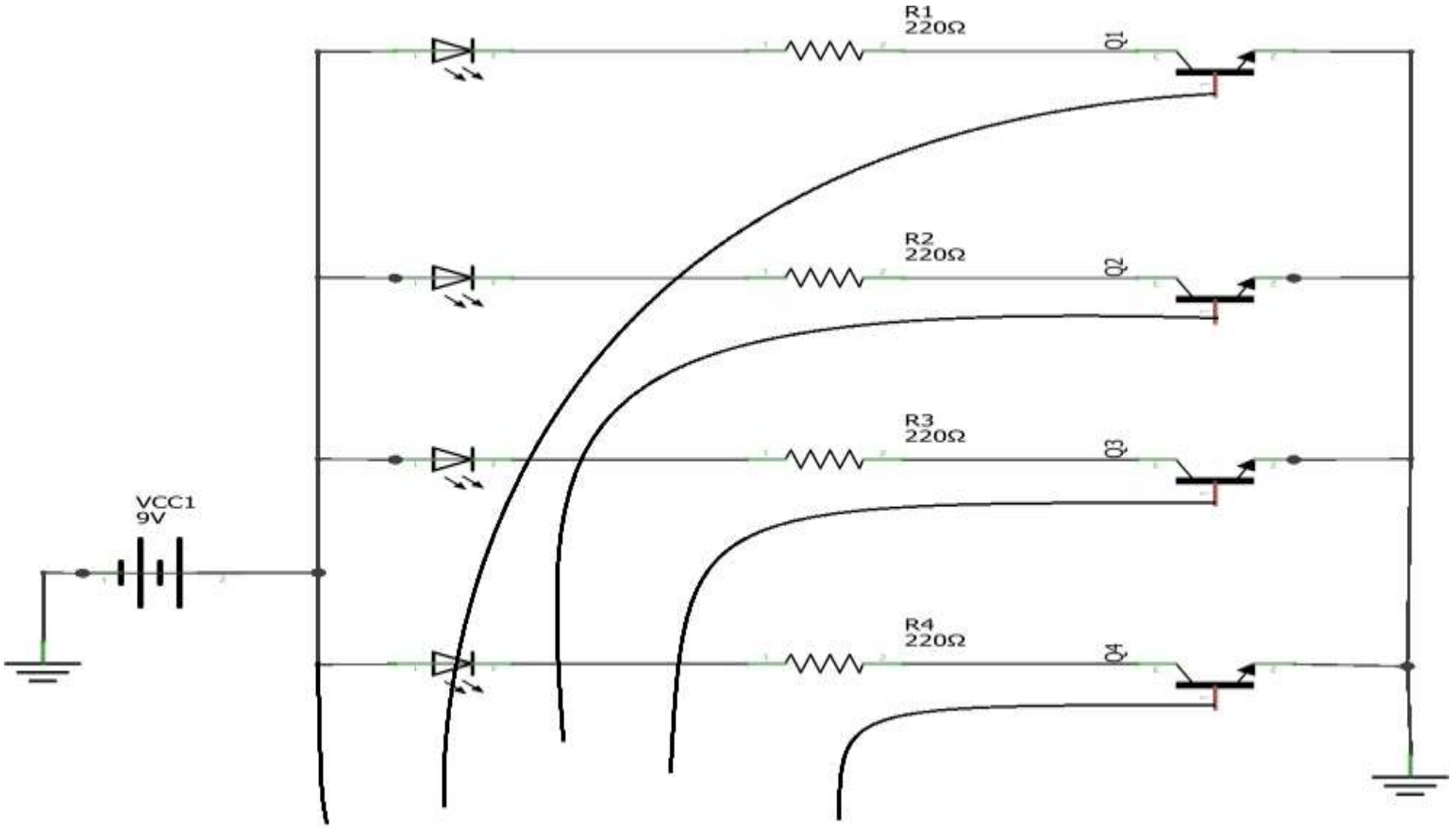
About Project

Water tank overflow is a common problem which leads to the wastage of water. Though there are many solutions to it like ball valves which automatically stop the water flow once the tank gets full. But being an electronics enthusiastic wouldn't you like an electronic solution for it? So here is a simple and handy DIY that will guide you to make a circuit which will detect the water level and will indicate the water tank full or a preset level.

Components Required

- Soldering Iron
- Soldering wire
- Zero PCB
- Resistor 220ohm*5
- White LED*5
- Transistor BC547*5
- Connecting Wire
- Battery 9v
- Battery connector

Connection Diagram



Working of project

The circuit is based on 5 transistor switches. This project makes the transistors conduct to glow LEDs one by one and indicate the level of water. The ends of probes of the water tank level indicator are connected to corresponding points in the circuit as shown in above circuit diagram.

Future Scope

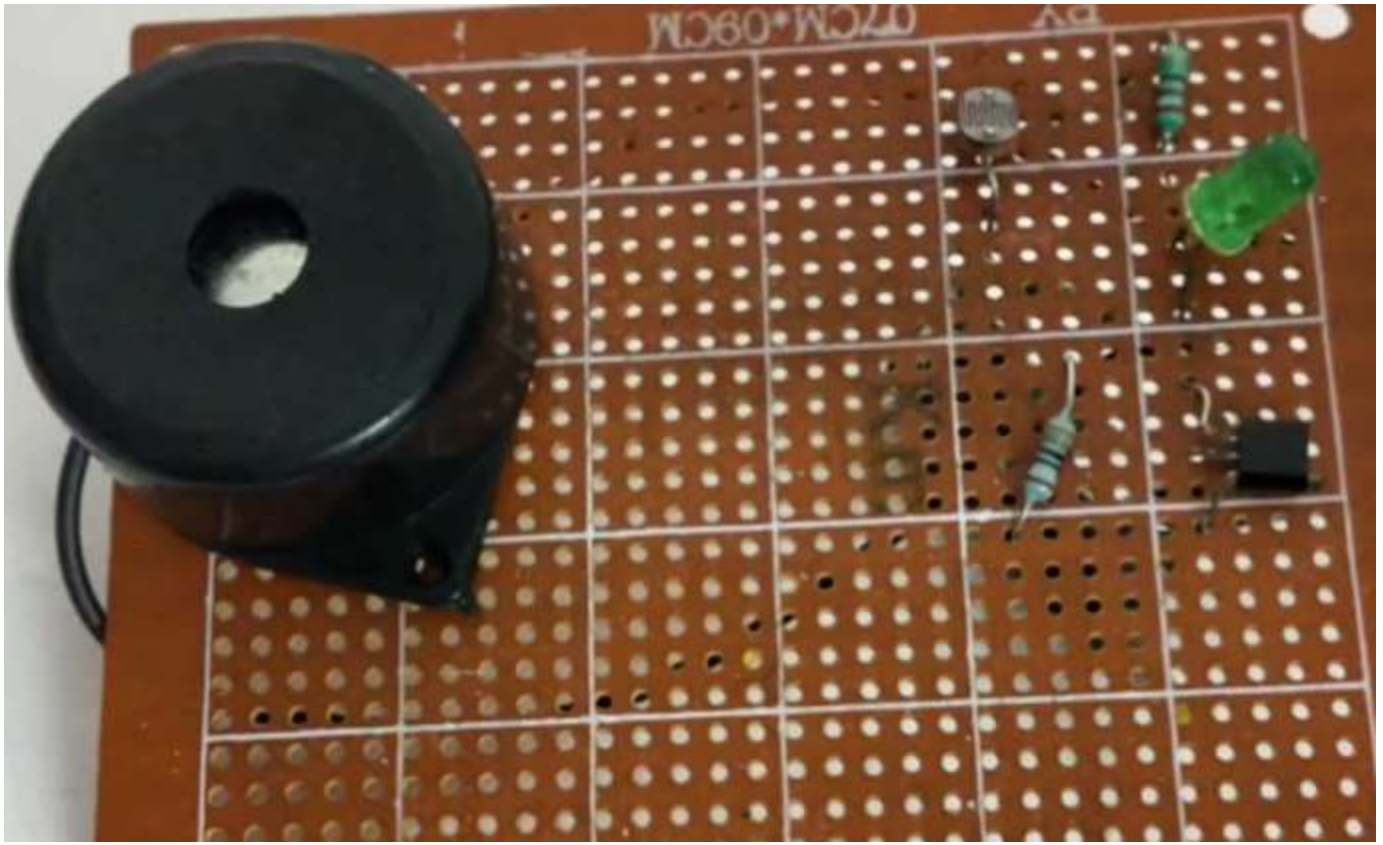
The water level indicator is used in :-

- Hotels,
- Home Apartments
- Commercial Complex
- Factories.

ABLEDUCATION™
ACTIVITY BASED LEARNING

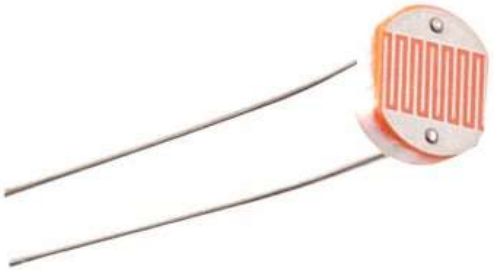
Project Link : https://youtu.be/CdmaZAGCVow

Security Alarm System



Light Dependent Resistor [LDR] Sensor

An **LDR** is a component that has a (variable) resistance that changes with the light intensity that falls upon it. This allows them to be used in light **sensing** circuits. A Light Dependent **Resistor** (**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.

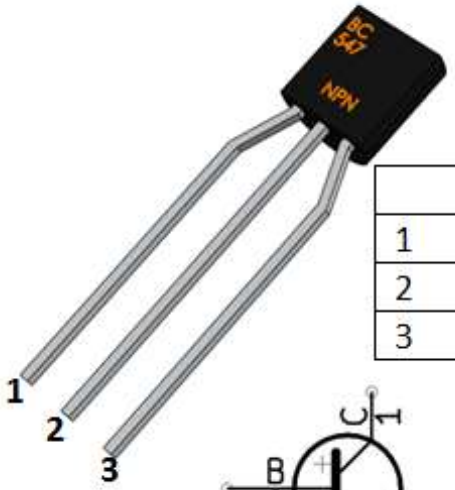


Working of LDR sensor

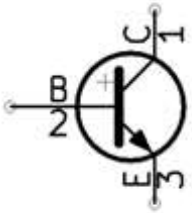
- We will use a LDR and a resistor together in series. An LDR is simply a device that changes resistance based on ambient light. The brighter the light, the lower the resistance, the dimmer the light, the higher the resistance.
- When there is no light , LDR will offer high resistance and less current flows through the resistor and voltage across resistor will be less near to GND.
- When light falls on LDR, its resistance decreases and current flow through it increases. Then voltage across the resistor increases and LED gets a HIGH signal.

BC547

BC547 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.



BC-547	
1	Collector
2	Base
3	Emitter



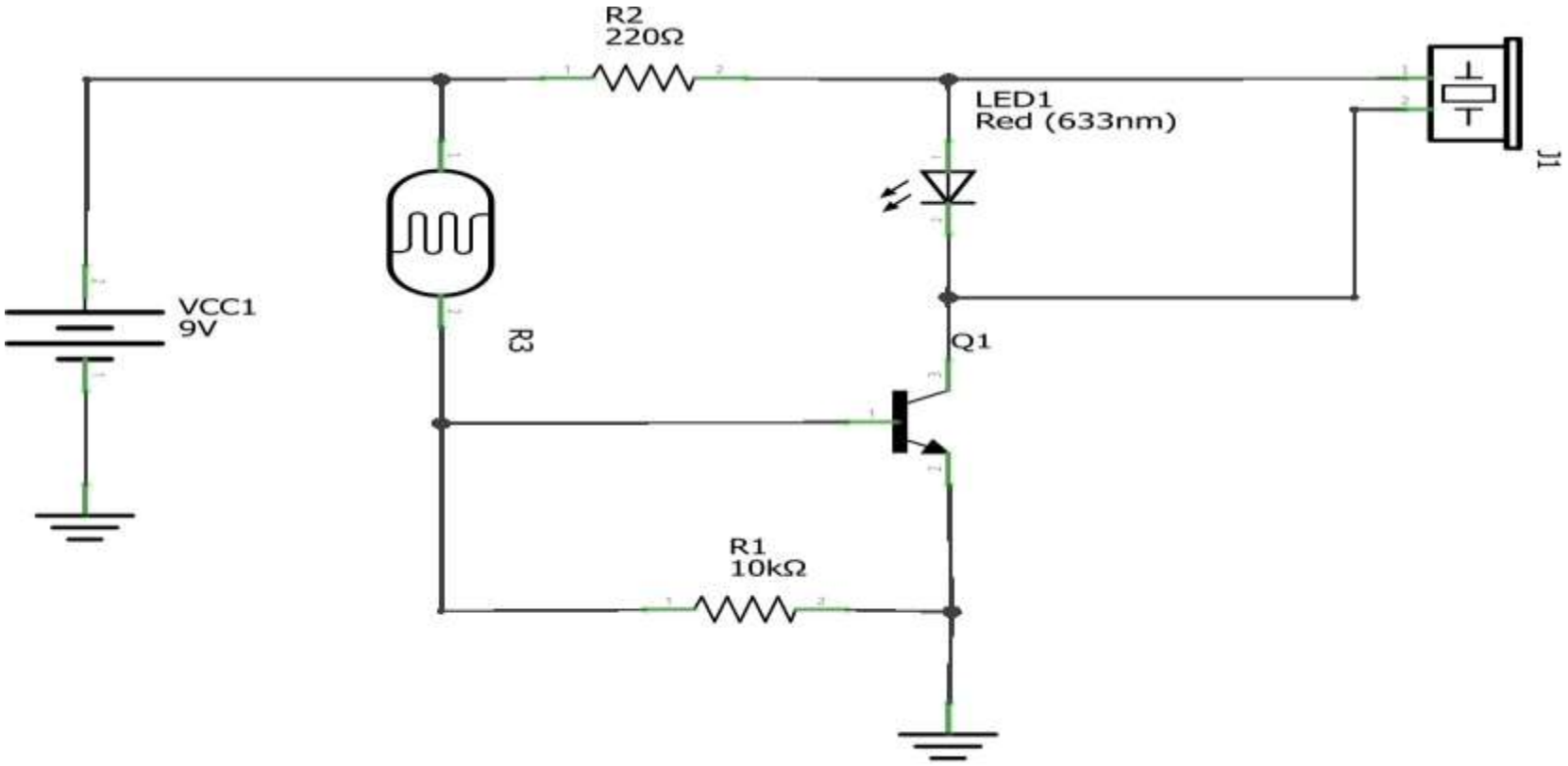
About Project

A Security Alarm System operates by projecting a beam of invisible laser light across a doorway or window opening. When the light is broken, it activates a buzzer or alarm. The principles are very similar to those of lower tech burglar alarms. A laser alarm requires only slightly more sophisticated electronics and can be put together by anyone with a soldering gun and a knack for tinkering with basic circuits and transistors.

Components Required

- Zero PCB
- Soldering machine
- Soldering wire
- LDR*1
- BC547 Transistor*1
- Led*1
- Buzzer(BIG)*1
- Resistor 220ohm*1,10kohm*1
- Battery 9v
- Battery connector

Connection Diagram



Working of project

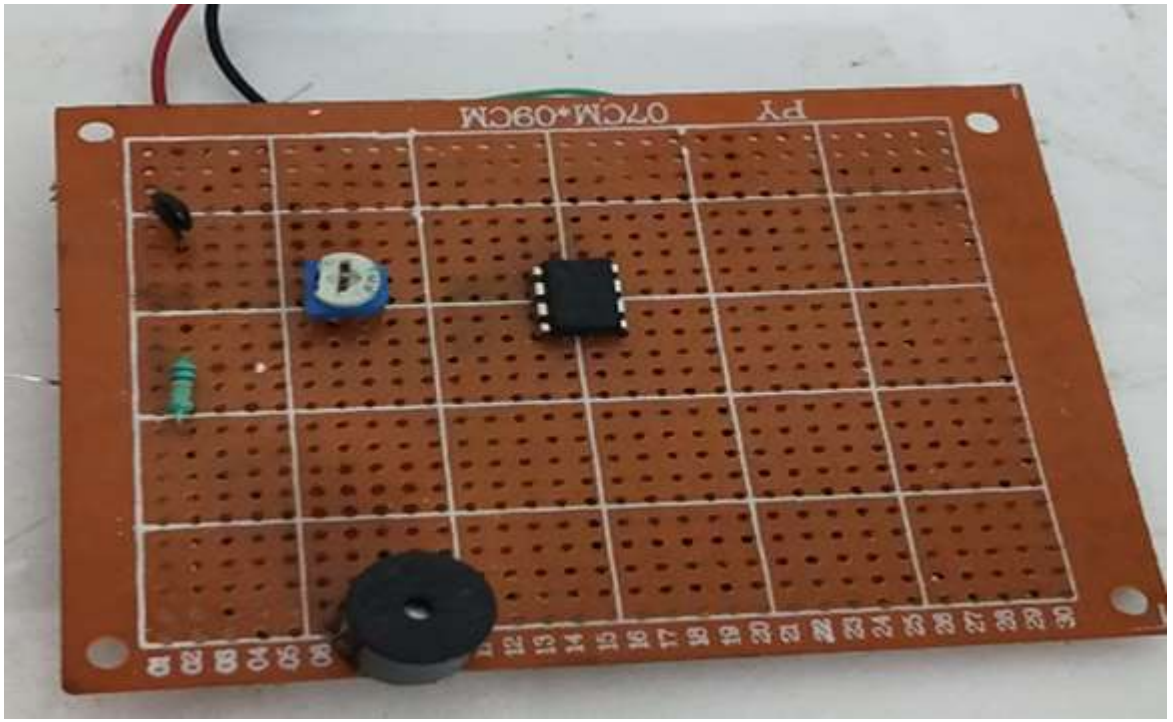
In order to detect a person, an LDR is used as the sensor. Light on the LDR determines whether a person is present or not. When there is any object at the entrance, LDR is in dark and buzzer starts ringing and the LED starts glowing.

Future Scope

- It is used in company or industries.
- It is used in unauthorized entry into a building or area.
- It is used in home security purpose.
- Development of Biometric sensors

Project Link : https://youtu.be/ivGY6CxrliM

Fire Alarm System



LM358 IC

- The LM358 IC is a great, low power and easy to use dual channel op-amp IC. It consists of two internally frequency compensated, high gain, independent op-amps.
- This IC is designed for specially to operate from a single power supply over a wide range of voltages. The LM358 IC is available in a chip sized package and applications of this op amp include conventional op-amp circuits, DC gain blocks and transducer amplifiers.
- LM358 IC is a good, standard operational amplifier and it is suitable for your needs. It can handle 3-32V DC supply & source up to 20mA per channel.

Thermistor

- A thermistor is a thermally sensitive resistor that exhibits a precise and predictable change in resistance proportional to small changes in body temperature.
- How much its resistance will change is depend upon its unique composition. Thermistors are part of a larger group of passive components.
- And unlike their active component counterparts, passive devices are incapable of providing power gain, or amplification to a circuit.

About Project

Fire Alarm Circuit is a simple circuit that detects the fire and activates the Siren Sound or Buzzer. Fire Alarm Circuits are very important devices to detect fire in the right time and prevent any damage to people or property.

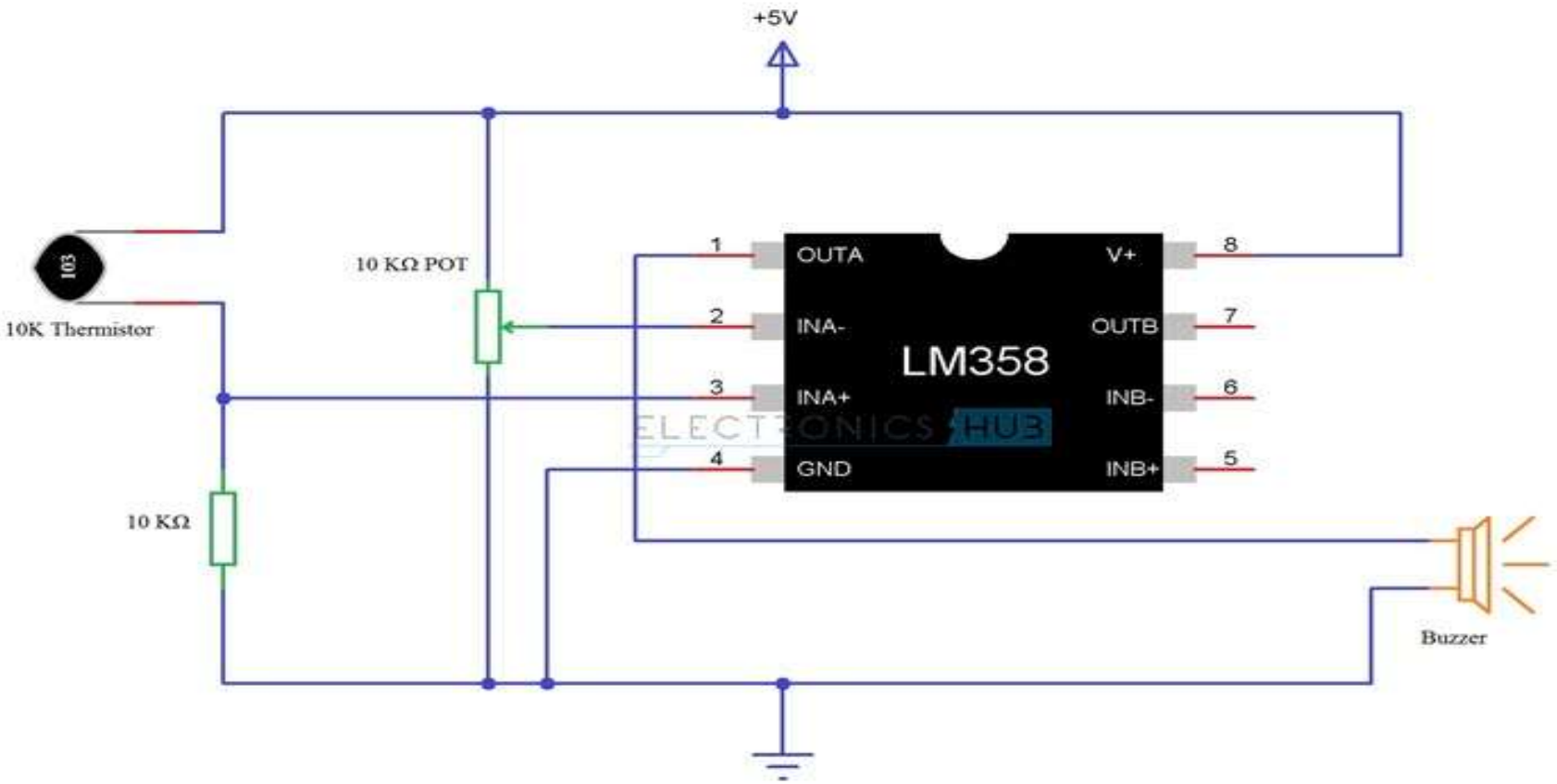
Working of project

- In this project, first thing to know is that the main component in detecting the fire is the 10 K Thermistor. If the temperature increases, the resistance of the Thermistor decreases.
- In case of fire, the temperature increases. This increase in temperature will reduce the resistance of the 10 K Thermistor. As the resistance decreases, the output of the voltage divider will increase. Since the output of the voltage divider is given to the non – inverting input of the LM358 Op – Amp, its value will become more than that of the inverting input. As a result, the output of the Op – Amp becomes high and it activates the buzzer.

Components Required

- 10 K Thermistor
- LM358 Operational Amplifier (Op – Amp)
- 4.7 KΩ Resistor (1/4 Watt)
- 10 KΩ Potentiometer
- Small Buzzer (5V Buzzer)
- Soldering wire
- Soldering IRON
- Zero PCB
- Battery Connector
- 5V Power Supply

Connection Diagram



Future Scope

- Fire Alarm Circuits are very useful in homes, offices, schools, labs, etc. to detect and prevent any disasters due to fire.
- Fire Alarm Systems can work as a stand - alone devices or can be a part of a complex home security system with other security features like smoke detection, intruder alert, motion detection, etc.

Project Link : https://youtu.be/R0XhJmFG7Lw