

PI CODE CLUB

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This is cover page

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Teachers note

1. This Book Contains Circuits Projects and Illustrations to teach students between the age group of 5 and above
2. Depending on the students knowledge level - Chapters should be covered
3. Most care should be taken while students are using the components
4. Components should be used under the supervision of the Mentors
5. Wrong Connections may damage the Circuits
6. Unused and Drained batteries should be discarded in a safe manner

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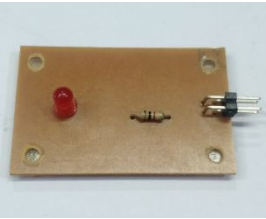
1. Introduction to mav bits

What is mav bits?

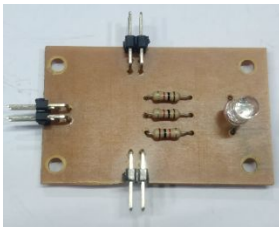
MavBits consists of small circuit boards with specific functions built to snap together , without soldering, wiring, or programming. Each bit has its own specific function, such as light, sound, sensors, or buttons. There are "hundreds of combinations" possible in the MavBits kit library.

What it contains .. Component list

1. Led bit



2. RGB Led bit

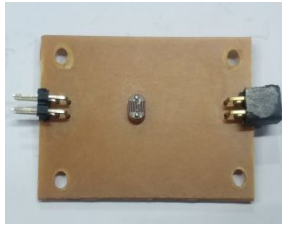


3. Potentiometer bit

4. Motor bit

5. LDR bit

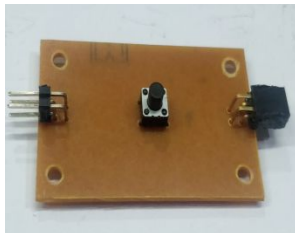
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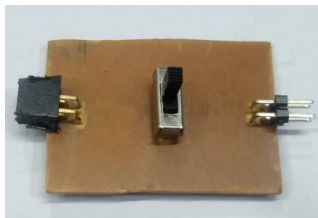
6. Buzzer bit



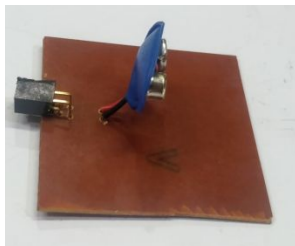
7. Push Button bit



8. Switch bit

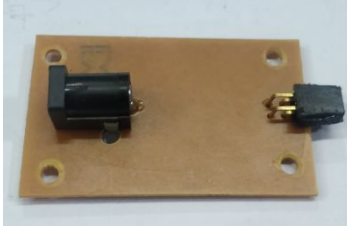


9. Battery Cap bit



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10. Power Jack bit



11. 9 Volt Battery bit

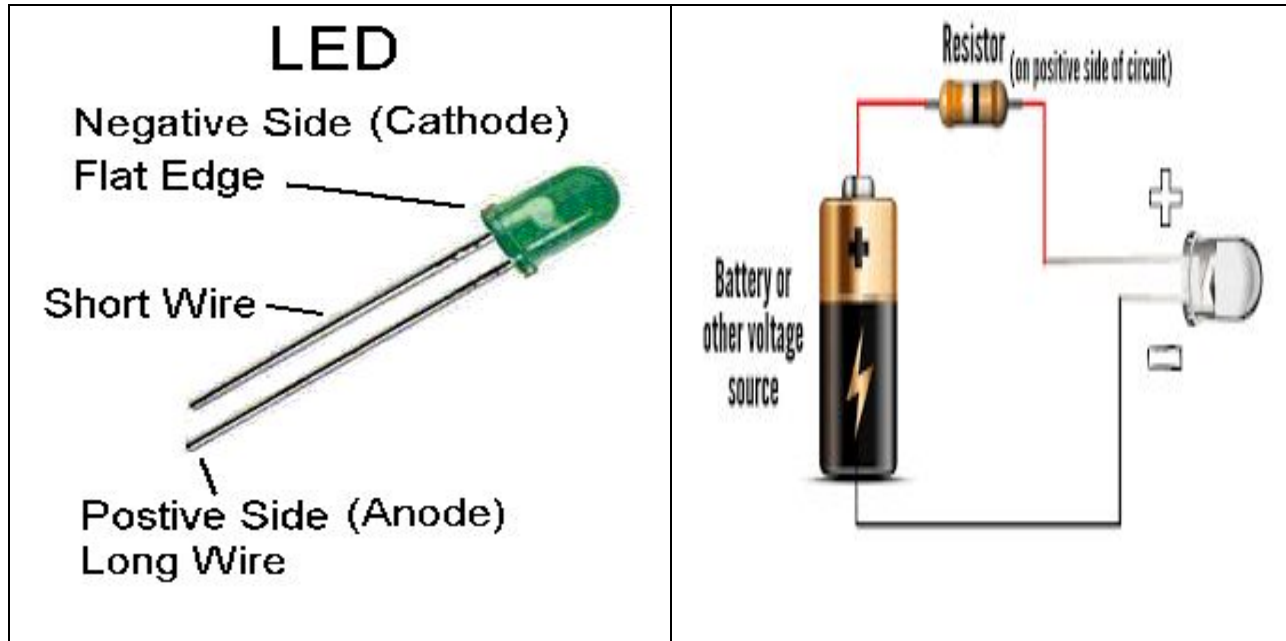
12. Power Cable bit

2. Lets explore Lights and colours

What is led?

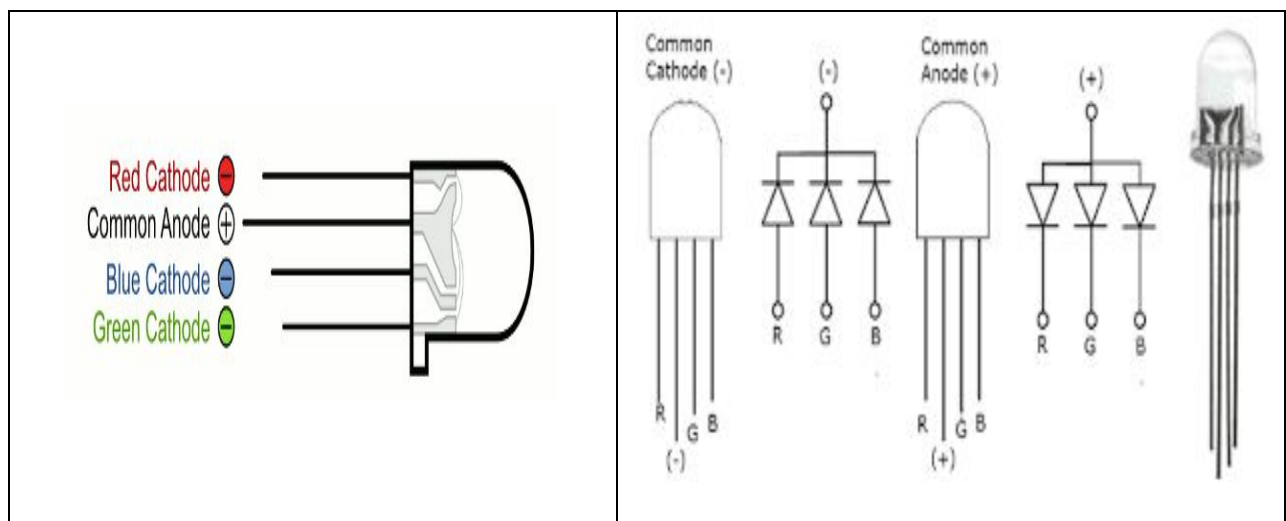
In the simplest terms, a light-emitting diode (LED) is a semiconductor device that emits light when an electric current is passed through it. Light is produced when the particles that carry the current (known as electrons and holes) combine together within the semiconductor material.

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What is RGB?

RGB LED means red, blue and green LEDs. RGB LED products combine these three colors to produce over 16 million hues of light. Note that not all colors are possible. Some colors are “outside” the triangle formed by the RGB LEDs. Also, pigment colors such as brown or pink are difficult, or impossible, to achieve.



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Pictures of led and lightings



What is a Battery?

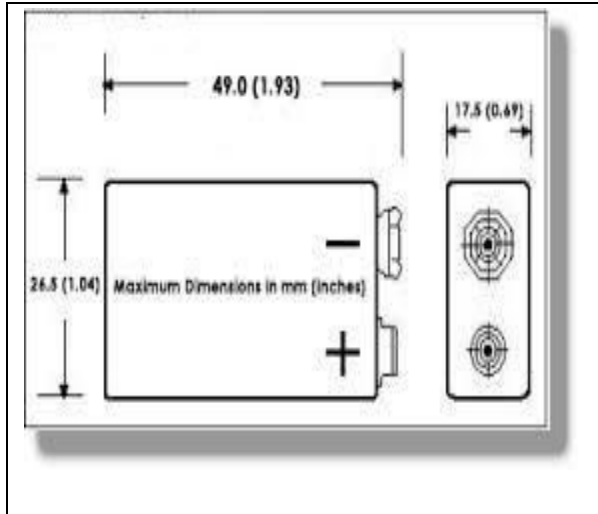
A battery is a collection of one or more cells that go under chemical reactions to create the flow of electrons within a circuit.

Batteries came into play due to the need to store generated electrical energy. As much as a good amount of energy was being generated, it was important to store the energy so it can be used when generation is down or when there is a need to power standalone devices which cannot be kept tethered to the supply from the mains. Here it should be noted that only DC can be stored in the batteries, AC current can't be stored.

A battery is a device that produces electrons through electrochemical reactions, and contains positive (+) and negative (-) terminals.

A battery consists of one or more electrochemical cells, which transform stored chemical energy directly into electrical energy. When an external load connects to a battery, electrons cross from the negative to the positive terminal, creating an electrical current. This current may power a motor, a light bulb, a clock, a computer, a cellphone, and other electronic devices or equipment.

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Types Of Battery

We categorized the batteries into three different sectors: household (rechargeable and non-rechargeable), Industrial and Vehicle batteries.

Household Batteries

These are the most common types of batteries powering devices you use everyday.



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Non-Rechargeable : Some are non-rechargeable or single-use, once they are fully discharged, they should be recycled.

Rechargeable : Some are rechargeable, you can plug them in to charge and get multiple uses before the battery needs to be replaced.

1. Nickel-Cadmium Batteries

The nickel–cadmium battery (NiCd battery or NiCad battery) is a type of rechargeable battery which is developed using nickel oxide hydroxide and metallic cadmium as electrodes. Ni-Cd batteries excel at maintaining voltage and holding charge when not in use. However, Ni-Cd batteries easily fall a victim of the dreaded “memory” effect when a partially charged battery is recharged, lowering the future capacity of the battery.



2. Nickel-Metal Hydride Batteries :

Nickel metal hydride (Ni-MH) is another type of chemical configuration used for rechargeable batteries. The chemical reaction at the positive electrode of batteries is similar to that of the nickel–cadmium cell (NiCd), with both battery type using the same nickel oxide hydroxide (NiOOH). However, the negative electrodes in Nickel-Metal Hydride use a hydrogen-absorbing alloy instead of cadmium which is used in NiCd batteries

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A NiMH battery can possess two to three times the capacity of a NiCd battery of the same size



3. Lithium-ion Batteries

Lithium ion batteries are one of the most popular types of rechargeable batteries. They are found in different portable appliances including mobile phones, smart devices and several other battery appliances used at home. They also find applications in aerospace and military applications due to their lightweight nature.

Lithium ion batteries generally possess high energy density, little or no memory effect and low self-discharge compared to other battery types.

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4. Lead-Acid Batteries

Lead acid batteries are a low-cost reliable power workhorse used in heavy duty applications. They are usually very large and because of their weight, they're always used in non-portable applications such as solar-panel energy storage, vehicle ignition and lights, backup power and load leveling in power generation/distribution. The lead-acid is the oldest type of rechargeable battery and still very relevant and important into today's world.



Industrial Batter :

These are the Batteries used in Industry

Vehicle Battery :

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Vehicle Battery or An automotive battery is a rechargeable battery that supplies electrical current to a motor vehicle. Its main purpose is to feed the starter, which starts the engine.

What Type of Batteries we are going to use?

We are going to use 9-volt Non-Rechargeable battery for Mav Bits Projects

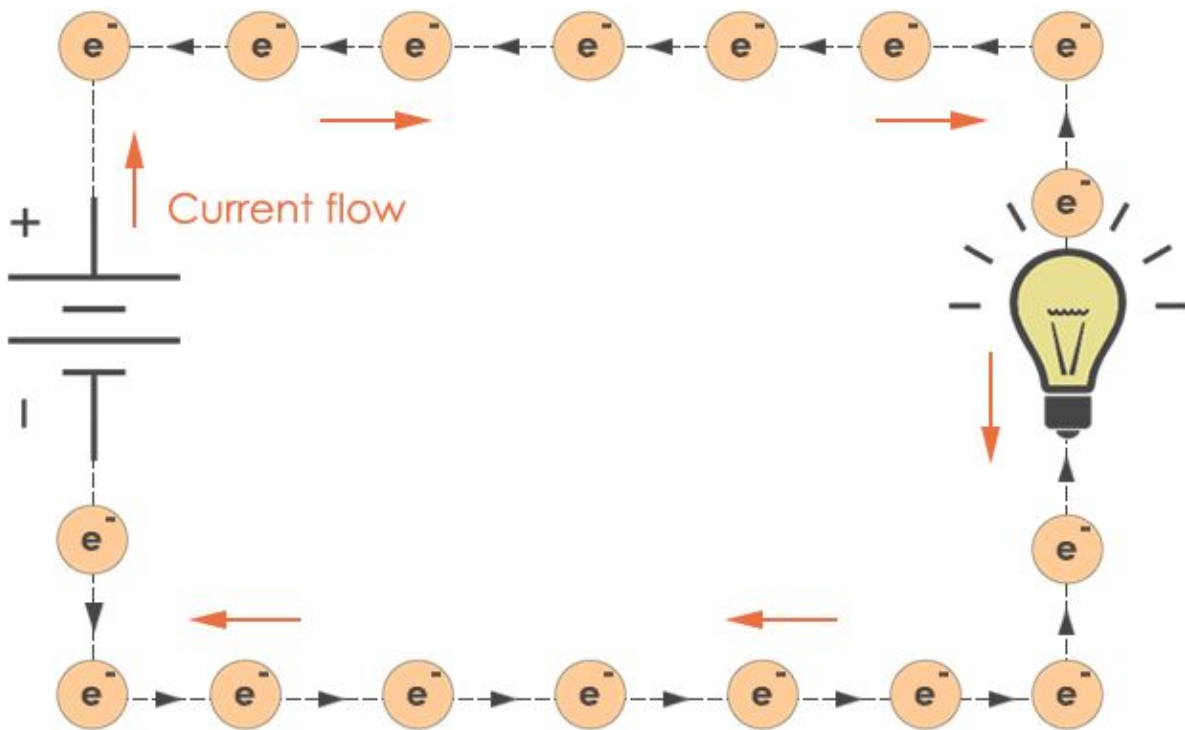


How Current Flows?

An electric circuit is an unbroken path along which an electric current exists and/or is able to flow. A simple electrical circuit consists of a power source, two conducting wires (one end of each being attached to each terminal of the cell), and a small lamp to which the free ends of the wires leading from the cell are attached.

When the connections are made properly, the circuit will “close” and current will flow through the circuit and light the lamp.

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PROJECT NO 1 : GLOWING LED

In this project we are going to show how to power on an LED . Connection is shown in the following images. Connect the components as per the circuit diagram.

Working:- When positive of battery is connected to positive of led and to complete the circuit the other terminal of led is connected to ground, Led starts glowing. Current flows in a closed path from higher terminal(+ve) to lower terminal(-ve). Metals are good conductors of electric current.

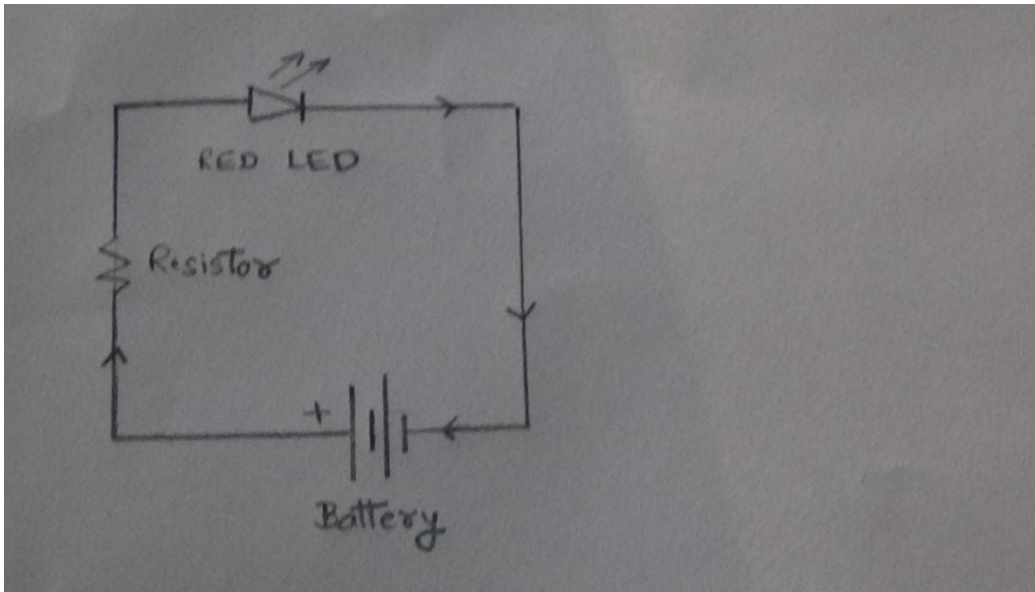
Components Required :

1. LED Bit

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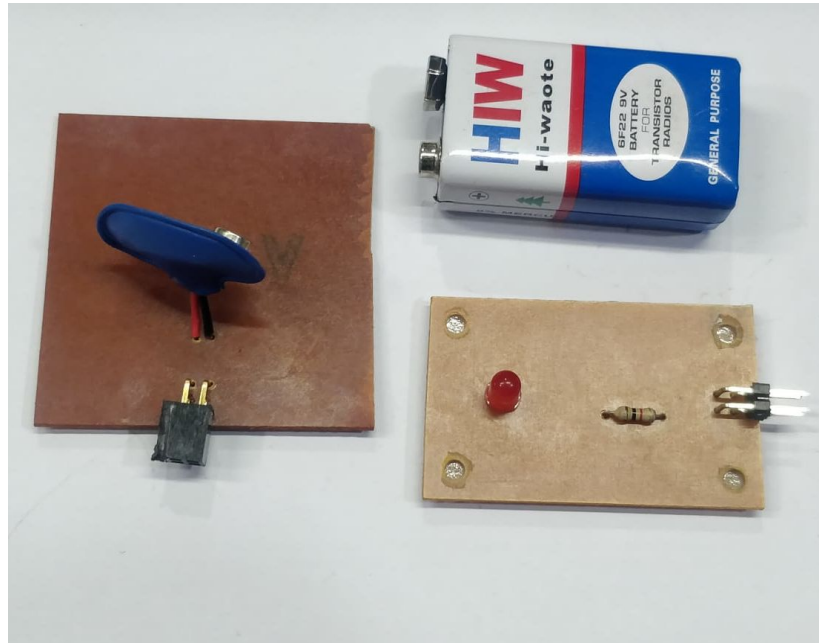
2. Battery

3. Battery Cap Bit

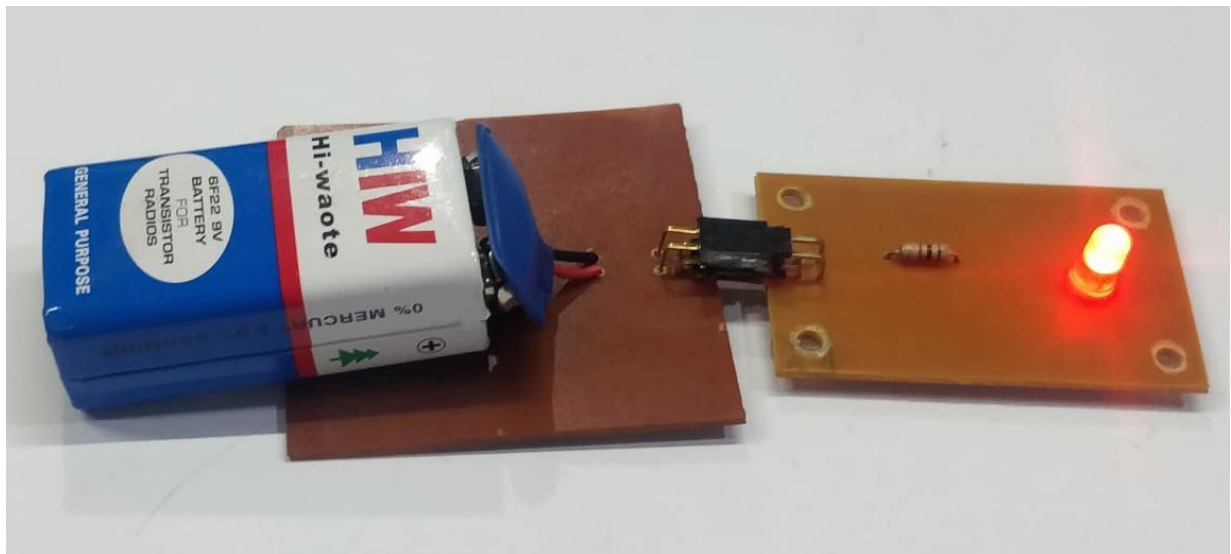


STEP 1: Take LED, Battery and Connector

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STEP 2: Connect LED Battery Cap and Battery



Result :

The LED will start Glowing

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Working of RGB LED

With an RGB LED you can, of course, produce red, green, and blue light, and by configuring the intensity of each LED, you can produce other colors as well.

For example, to produce purely blue light, you'd set the blue LED to the highest intensity and the green and red LEDs to the lowest intensity. For a white light, you'd set all three LEDs to the highest intensity.

To produce other colors, you can combine the three colors in different intensities. To adjust the intensity of each LED you can use a PWM signal.

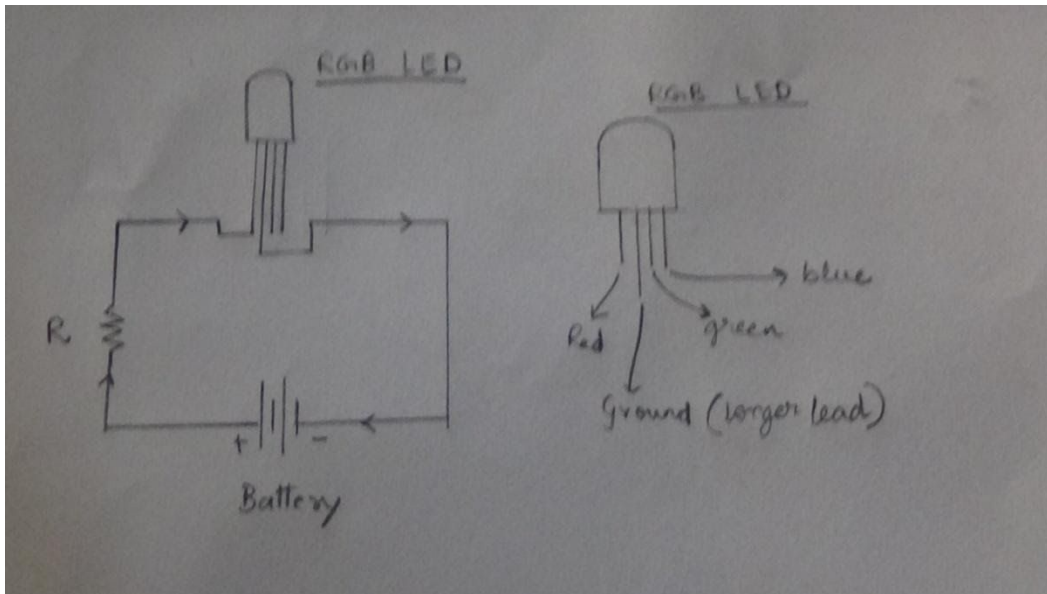
PROJECT NO 2 Glowing RGB Led

In this project we are going to show how does an RGB Led glows. Connection is shown in the following images. Connect the components as per the circuit diagram.

Working:- RGB Led has four leads (Red, *Ground, Green and blue. When positive of battery is connected to one lead of led and to complete the circuit the other terminal of RGB led is connected to ground, RGB Led starts glowing as soon as closed path is provided. In this case you shall see three colours Red, Green and Blue, depending upon which lead is selected. Current flows in a closed path from higher terminal(+ve) to lower terminal(-ve). Metals are good conductors of electric current.

(*Please Note: First connect Ground of battery to Ground of RGB Led(the lead which has no resistor is ground in case of RGB Led)

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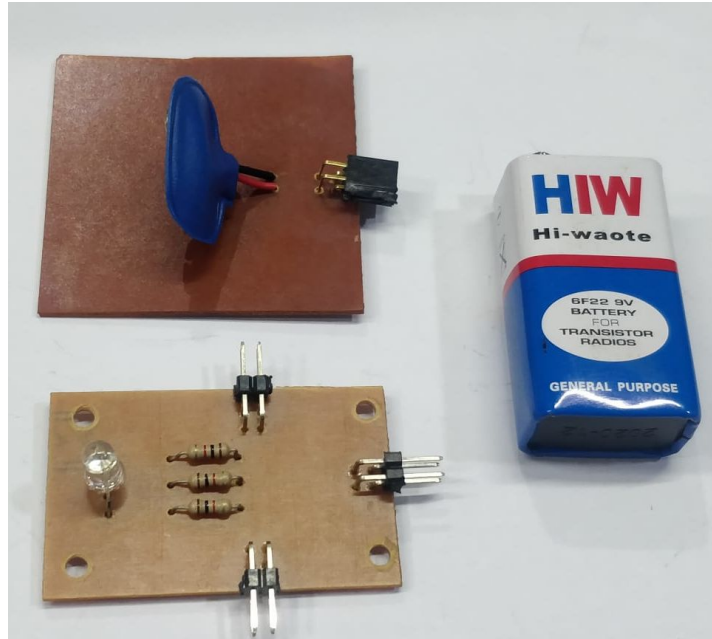


Components Required :

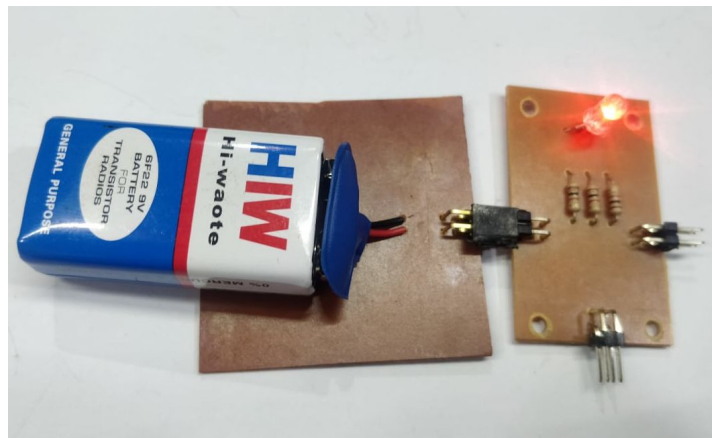
1. RGB Bit
2. Battery Cap Bit
3. Battery

STEP 1 : Take Battery, Battery Cap Bit and RGB Bit

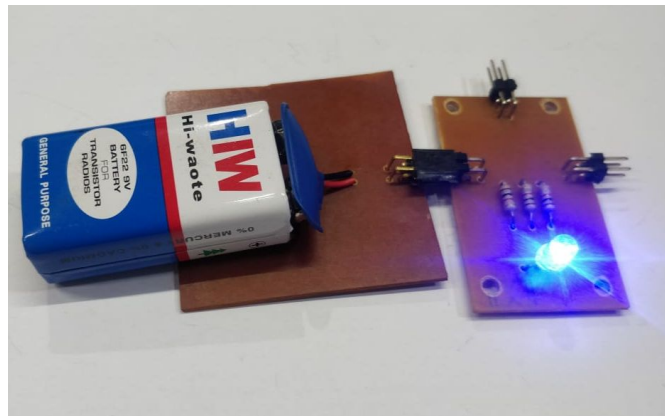
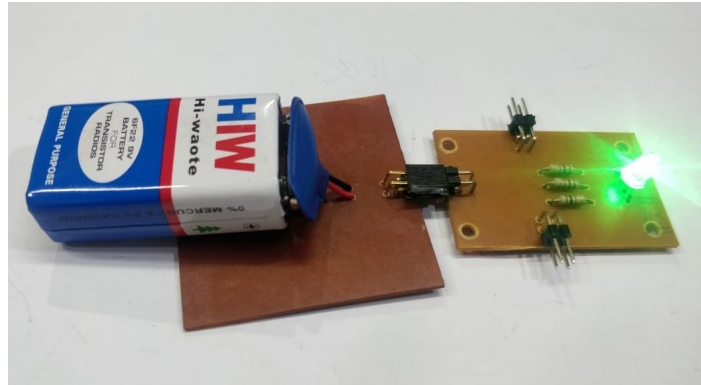
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STEP 2 : you can see 3 Input Pins to RGB Bit. Connect All 3 Pins of RGB with Battery One by One.



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Conclusion : You can see different Color Light from Different Points

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Chapter 3 -Sound

What is Sound

Sound is Vibrations that travel through the air or another medium and can be heard when they reach a person's or animal's ear.

What is Buzzer

A buzzer or beeper is an signaling device, which produces sound. It may be mechanical, electromechanical, or piezoelectric . Typical uses of buzzers and beepers include alarm devices, timers, and confirmation of user input such as a mouse click or keystroke.



Working of Buzzer

The main working principle is based on the theory that, whenever an electric potential is applied across a piezoelectric material, a pressure variation is generated. A piezo buzzer consists of piezo crystals in between two conductors.

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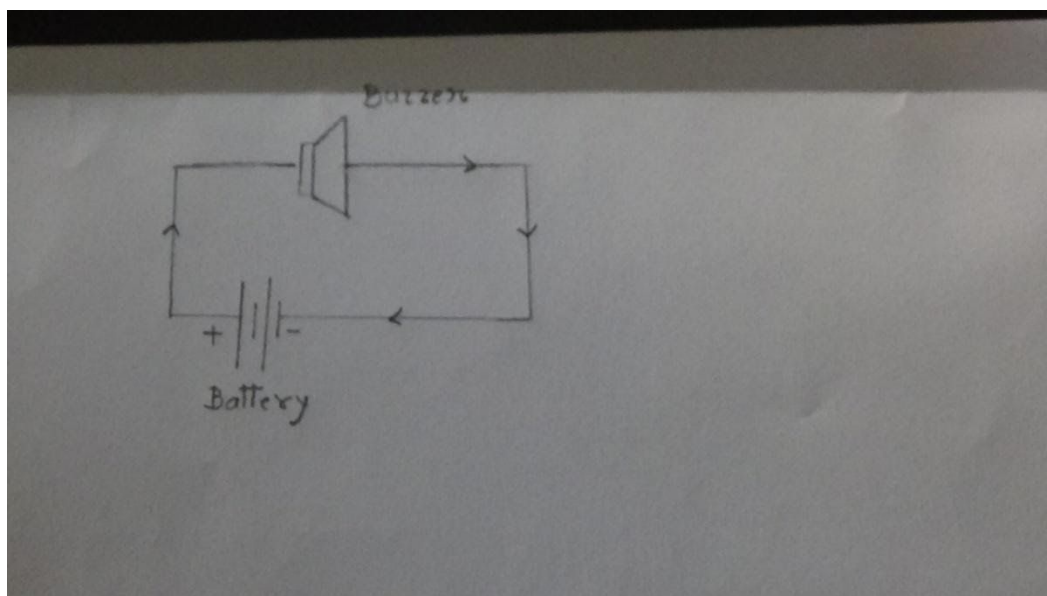
When a potential difference is applied across these crystals, they push one conductor and pull the other conductor by their internal property. The continuous pull and push action generates a sharp sound wave.

Piezo buzzers generates a loud & sharp sound. So,they are typically used as a alarm circuits.

PROJECT NO 3 : Buzzer

In this project we are going to show how to power a buzzer. Connection is shown in the following images. Connect the components as per the circuit diagram.

Working:- When positive of battery is connected to one lead of buzzer and to complete the circuit the other terminal of buzzer is connected to ground ,buzzer starts ringing as soon as closed path is provided. Current flows in a closed path from higher terminal(+ve) to lower terminal(-ve). Metals are good conductors of electric current.



Components :

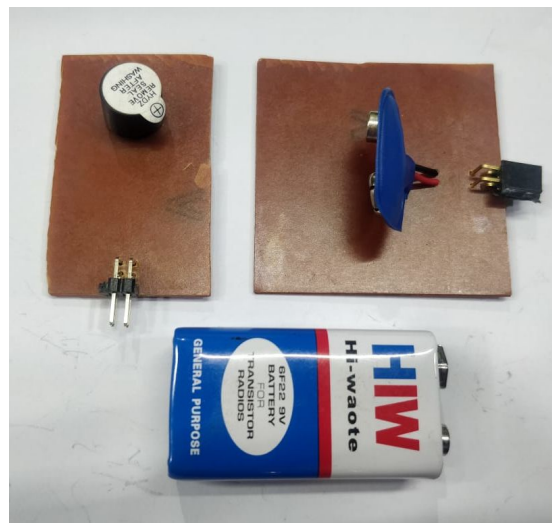
1. Buzzer Bits

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2. Battery

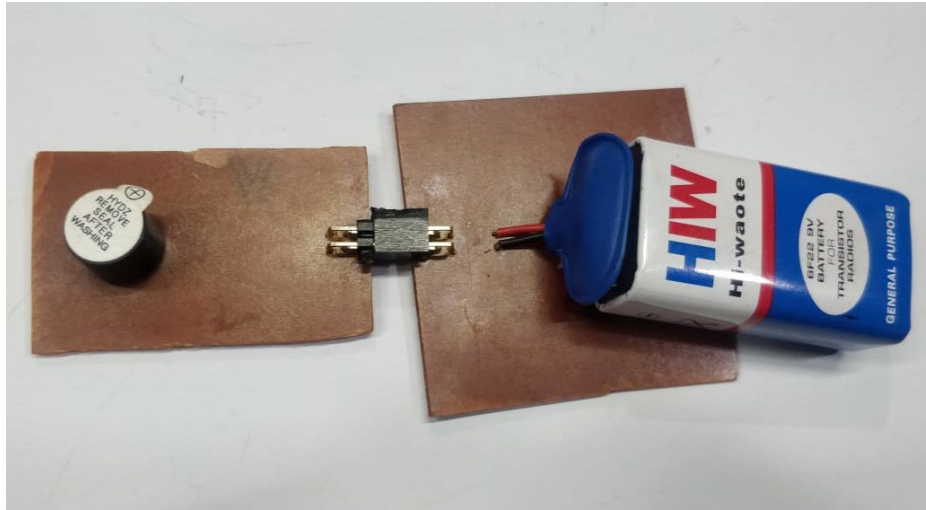
3. Battery Cap Bit

STEP 1 : Take Buzzer Bits, Battery and Battery Cap Bit



STEP 2 : Connect Buzzer with Battery

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Conclusion :

Sound will be Generated on Connecting Battery with Buzzer

Chapter 4 Motor

What is Motor

Motor is the electro-mechanical machine which converts the electrical energy into mechanical energy. In other words, the devices which produce rotational force is known as the motor.

Types of Motor

They are the AC motor and the DC motor. The AC motor takes alternating current as an input, whereas the DC motor takes direct current.

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DC Motors

The DC Motor or Direct Current Motor to give it its full title, is the most commonly used actuator for producing continuous movement and whose speed of rotation can easily be controlled, making them ideal for use in applications where speed control, servo type control, and/or positioning is required.

DC Motors can come in : 9V, 12V or 24V



BO Motor

BO (Battery Operated) Motor is a light weight DC geared motor which gives good *torque and **rpm at lower voltages. This motor can run at approximately 200 rpm when driven by a single Li-Ion cell. Great for battery operated light weight robots. It can do reverse and forward directions.

* Torque is the twisting force that tends to cause rotation. The point where the object rotates is known as the axis of rotation. The higher the torque, the higher the pickup and force at the wheels.

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** RPM stands for revolutions per minute, and it's used as a measure of how fast any machine is operating at a given time.

Types of BO Motor



Single Shaft - I Shape



Double Shaft - I Shape



Single Shaft - L Shape



Double Shaft - L Shape

Servo Motor

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Hobby servos are small in size actuators used for controlling RC toys cars, boats, airplanes etc. They are also used by engineering students for prototyping in robotics, creating robotic arms, biologically inspired robots, humanoid robots and so on.



Stepper Motor

The speed of the motor is controlled by the frequency of the pulses. The stepper motor is used for precise positioning with a motor, such as hard disk drives, robotics, antennas, telescopes, and some toys

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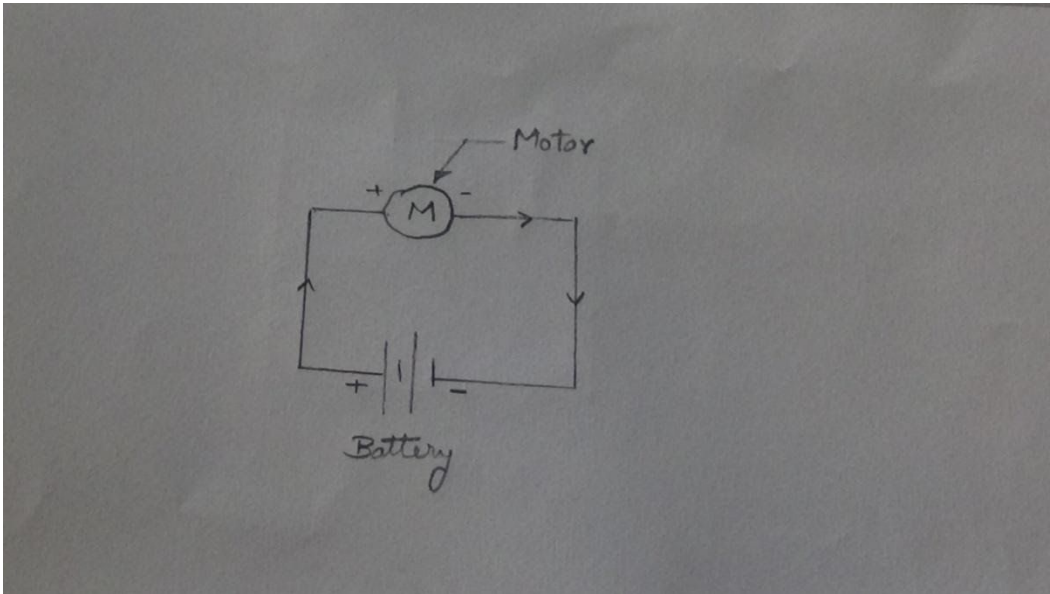


PROJECT NO 4 : Operating BO Motor

In this project we are going to show how to power a simple DC motor. Connection is shown in the following images. Connect the components as per the circuit diagram.

Working :-When positive of battery is connected to one lead of Motor and to complete the circuit the other terminal of motor is connected to ground, DC motor along with fan starts rotating as soon as closed path is provided. Current flows in a closed path from higher terminal(+ve) to lower terminal(-ve). Metals are good conductors of electric current.

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Components Required :

1. BO Motor
2. Battery
3. Battery Cap Bit

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Chapter 5 : Switches

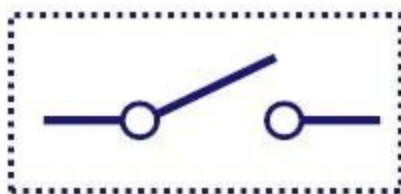
What is Switch

A switch is a component which controls the open-ness or closed-ness of an electric circuit. They allow control over current flow in a circuit (without having to actually get in there and manually cut or splice the wires). Switches are critical components in any circuit which requires user interaction or control.

Types of Switches

Single Pole Single Throw Switch (SPST)

- This is the basic ON and OFF switch consisting of one input contact and one output contact.
- It switches a single circuit and it can either make (ON) or break (OFF) the load.
- The contacts of SPST can be either normally open or normally closed configurations .



Symbol



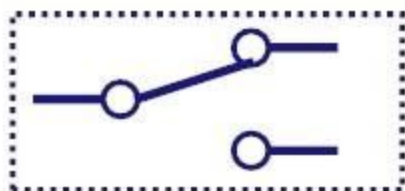
SPST Switch

Single Pole Double Throw Switch (SPDT)

- This switch has three terminals one is input contact and remaining two are output contacts.
- This means it consist two ON positions and one OFF position.
- In most of the circuits, these switches are used as changeover to connect the input between two choices of outputs.

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- The contact which is connected to the input by default is referred as normally closed contact and contact which will be connected during ON operation is a normally open contact.



Symbol

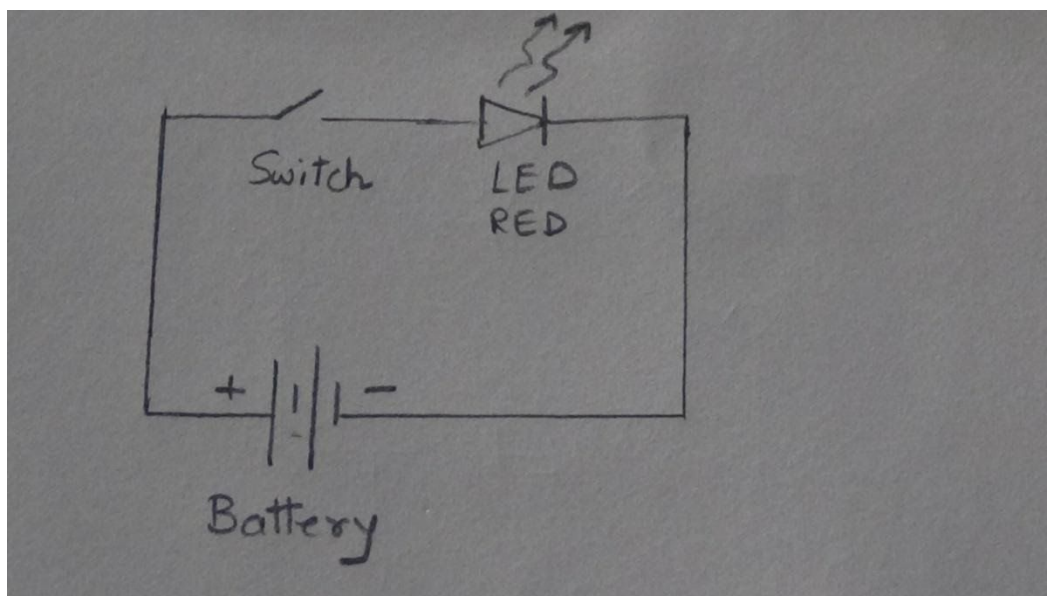


SPDT Switch

PROJECT NO 5 : LED with Button

In this project we are going to show you how to ON and OFF LED with the help of Button . So let's do it. For this we required LED , push button and Battery. Connection is shown in the following images. Connect the components as per the circuit diagram.

Working:- As we know the basic principle of the button is to pass the current when the button is pressed otherwise stop the current when unpressed. When you pressed the button current is passed from battery to LED and LED starts glowing and when you release the button current stops going from battery to LED so LED stops glowing.

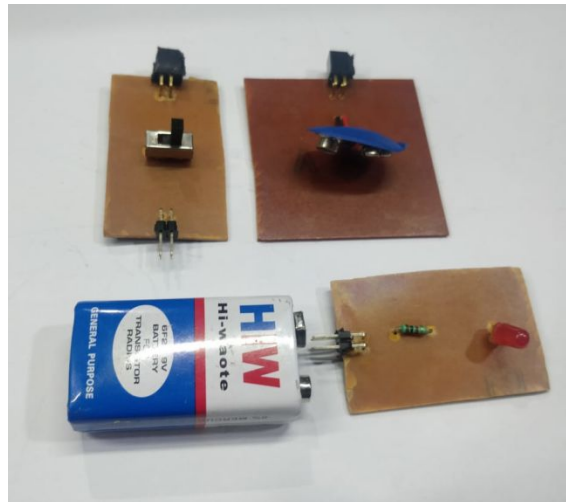


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Components Required :

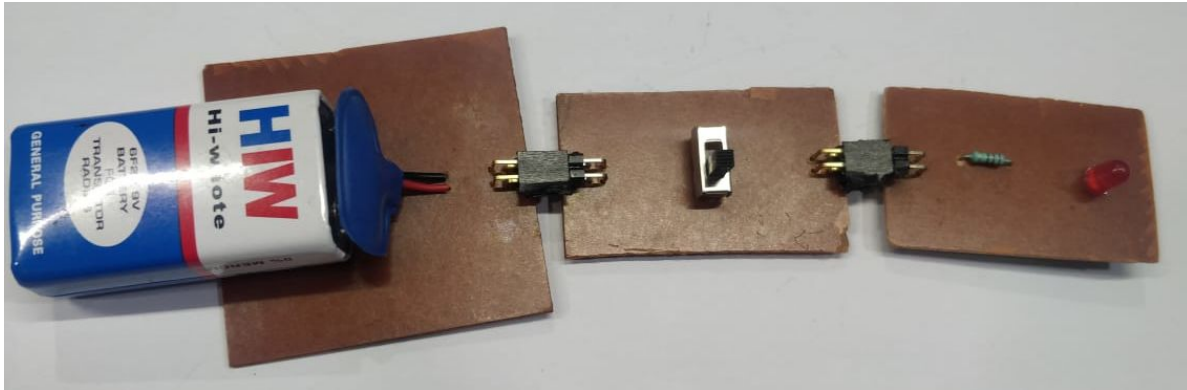
1. LED Bit
2. Push Button Bit
3. Battery
4. Battery Cap Bit

STEP 1 : Take Battery, Battery Cap Bit, switch Bit and LED Bit

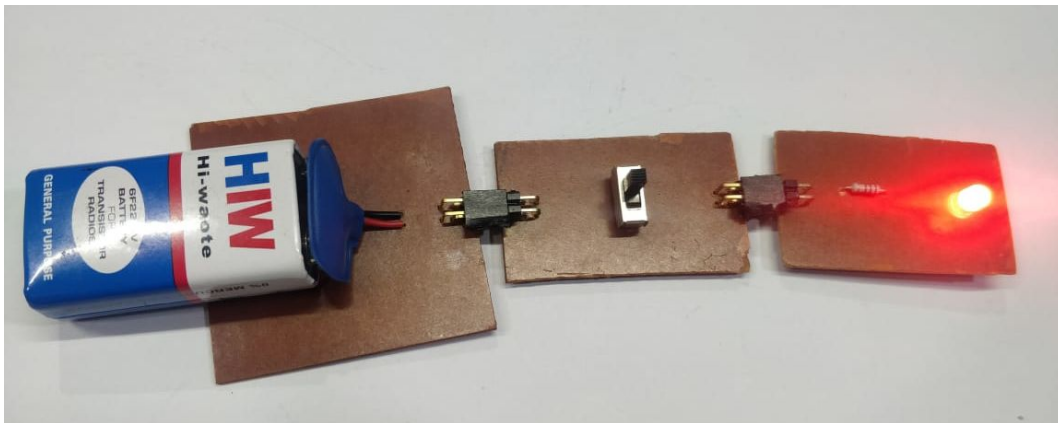


STEP 2 : Connect Battery with Switch and LED

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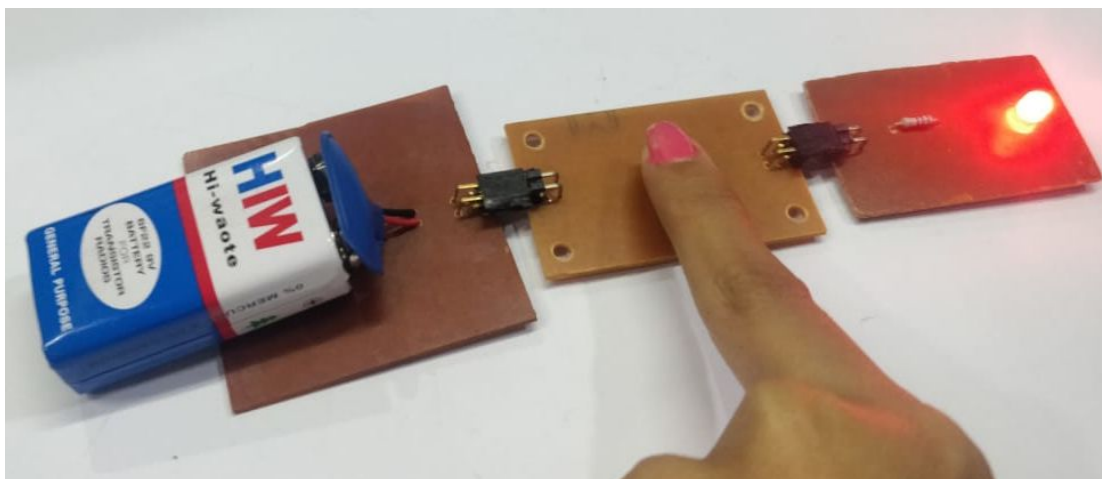
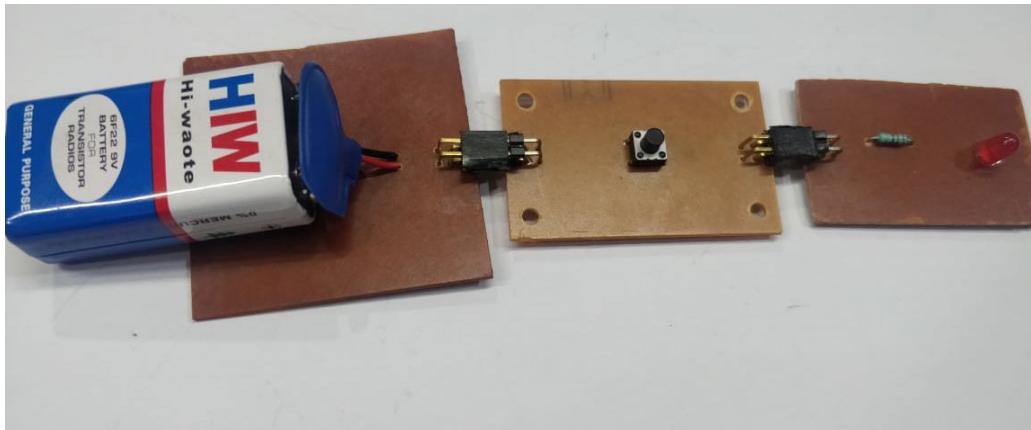
STEP 3 : Turn the switch on to Glow the LED



Conclusion : LED will glow when push button is pressed and Circuit gets Completed

Similarly we can use push button in the place of switch. LED will Glow when push button is pressed

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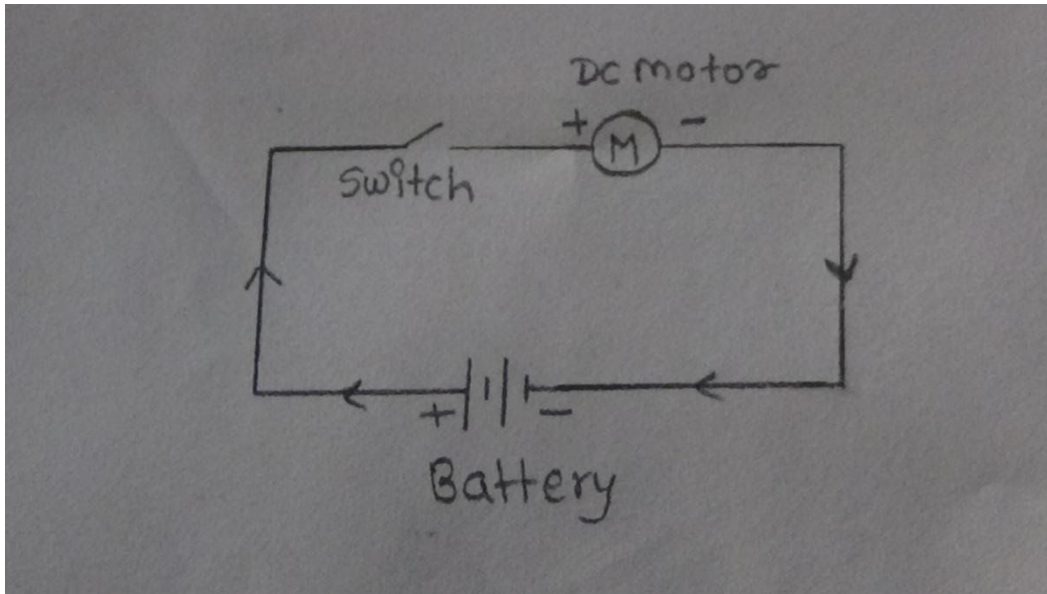
PROJECT NO 6 : DC motor with Button

In this project we are going to show you how to ON and OFF Fan with the help of Button . So let's do it. For this we required DC motor with Plastic Fan , push button and Battery. Connection is shown in the following images. Connect the components as per the circuit diagram.

Working:- As we know the basic principle of the button is to passed the current when button is pressed otherwise stop the current when unpressed. When you pressed the

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button current is passes from battery to DC motor and fan starts rotating and when you release the button current stops going from battery to DC motor so motor stops rotating.



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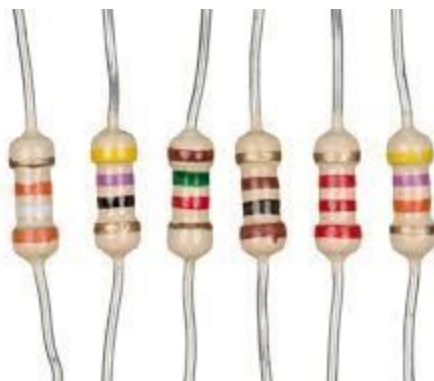
Chapter 6 : Resistance

What is Resistance :

- Resistance is the opposition that a substance offers to the flow of electric current. Resistance is a material's tendency to resist the flow of charge (current).

What is Resistor :

A resistor is an electrical component that limits or regulates the flow of electrical current in an electronic circuit. Resistors can also be used to provide a specific voltage for an active device such as a transistor.



What is Potentiometer :

The measuring instrument called a potentiometer is essentially a voltage divider used for measuring electric potential (voltage); the component is an implementation of the same principle, hence its name.

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Potentiometers are commonly used to control electrical devices such as volume controls on audio equipment.

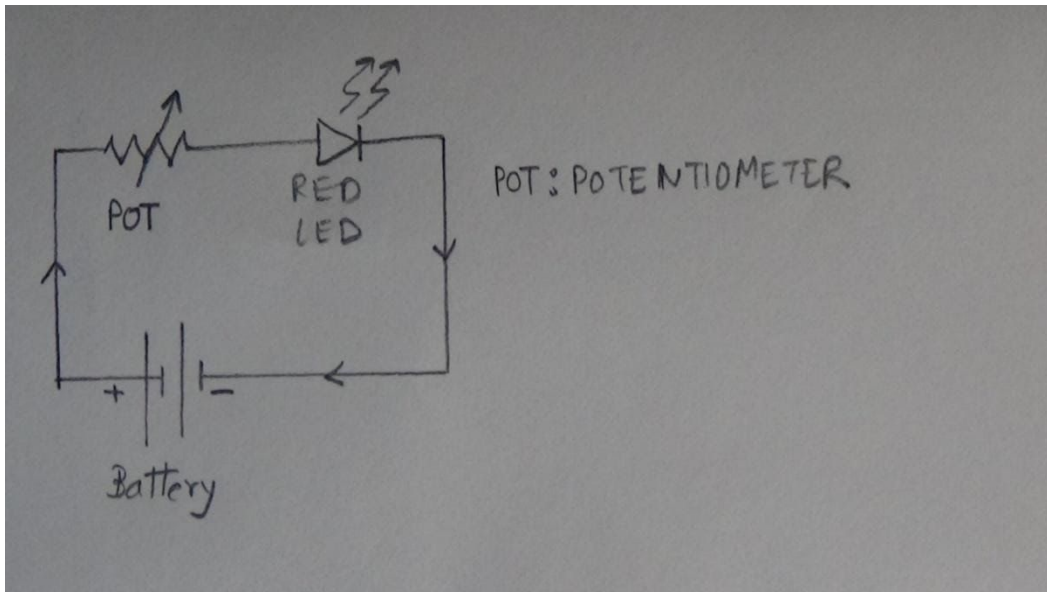


PROJECT NO 7 LED with Potentiometer

In this project we are going to show you how to control the brightness of LED with the help of Potentiometer. So let's do it. For this we required LED , Potentiometer and Battery. Connection is shown in the following images. Connect the components as per the circuit diagram.

Working:- When we move the potentiometer from lower position to higher position the brightness of the LED is also changing. If my potentiometer is at lower position LED brightness is also low. And when it goes up LED's brightness increases.

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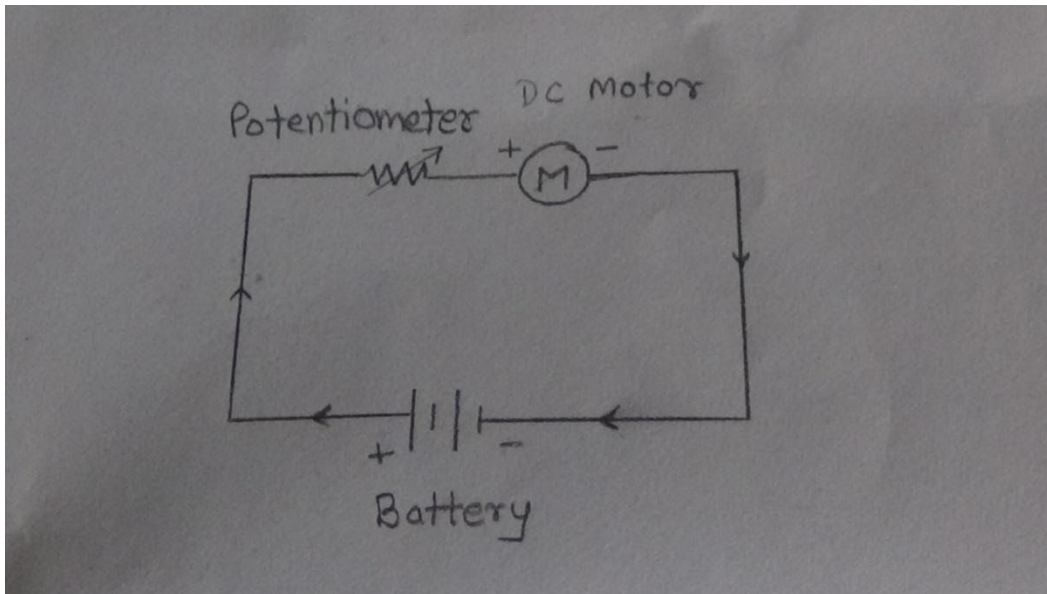


PROJECT NO 8 : Fan with Potentiometer

In this project we are going to show you how to control the speed of Fan with the help of Potentiometer. So let's do it. For this we required DC motor with Plastic Fan , Potentiometer and Battery. Connection is shown in the following images. Connect the components as per the circuit diagram.

Working:- Potentiometer is like a variable resistor. When we move the potentiometer from lower position to higher position the speed of the Fan is changing. If my potentiometer is at lower position speed of the Fan is low. And when it goes up Fan's speed is also increases.

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Chapter 7 : Light Dependant Resistor

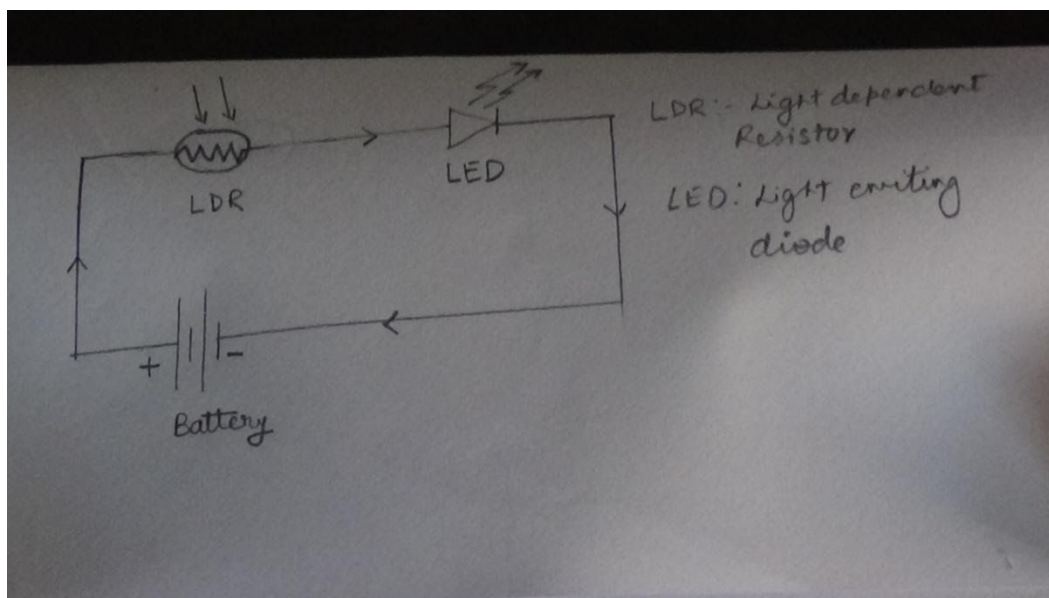
A Light Dependent Resistor (LDR) or a photoresistor is a device whose resistivity is a function of the incident electromagnetic radiation. Hence, they are light sensitive devices. They are also called as photo conductors, photo conductive cells or simply photocells

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PROJECT NO 9 :LED with LDR

In this project we are going to show you how to control LED with the help of LDR(Light Dependent Resistor). So let's do it. For this we required LED , LDR and Battery. Connection is shown in the following images. Connect the components as per the circuit diagram.

Working:- LDR is the device whose resistance depends on light. In this project we are going to show you how LDR works. When light falls on LDR it becomes active and it passes the current that's why our LED is glowing, but when we place the finger on it (if darkness occur on LDR) LED becomes OFF. We see this type of circuit in street light. After sunset street light gets automatically ON.



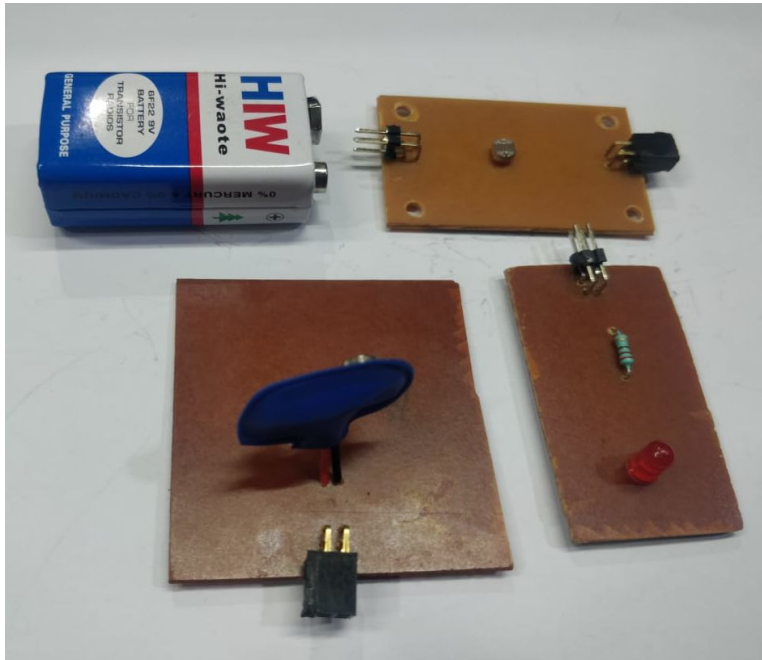
Components Required :

1. LED Bit
2. LDR Bit
3. Battery

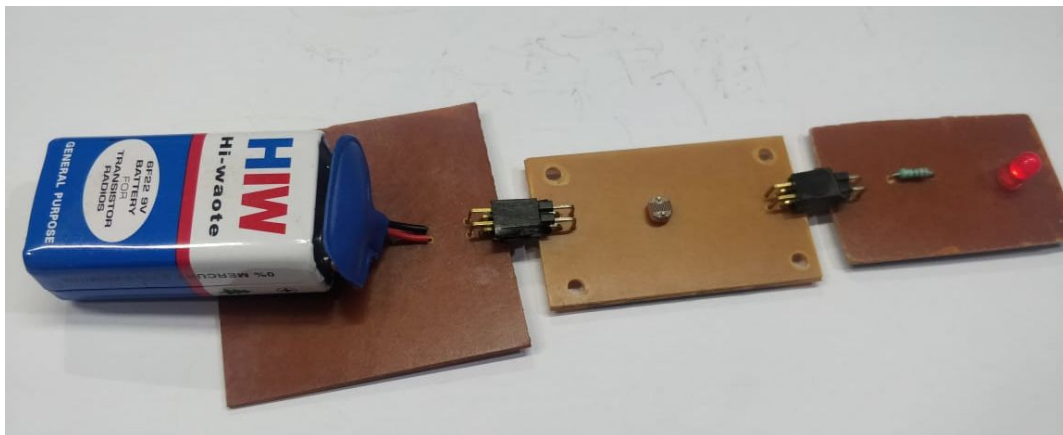
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4. Battery Cap Bit

Step 1 : Take LED Bit, LDR Bit, Battery, Battery Cap Bit



Step 2 : Connect LED Bit, LDR Bit, Battery, Battery Cap Bit



Step 3 : Cover the LDR with Finger and LED will turn off

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Chapter 8 : Complex Circuits

Now we will learn to connect multiple components with battery at a time.

for connecting multiple components at a time, we need to understand following concepts

Current in Parallel

A parallel circuit has two or more paths for current to flow through. Voltage is the same across each component of the parallel circuit. The sum of the currents through each path is equal to the total current that flows from the source.

Current in Series

Current has a single path and voltage is divided as per the resistance values in series circuit.

Rules regarding Series and Parallel Circuits

With each of these two basic circuit configurations, we have specific sets of rules describing voltage, current, and resistance relationships.

Series Circuits:

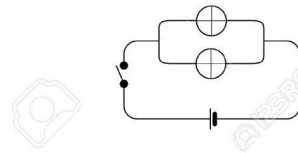
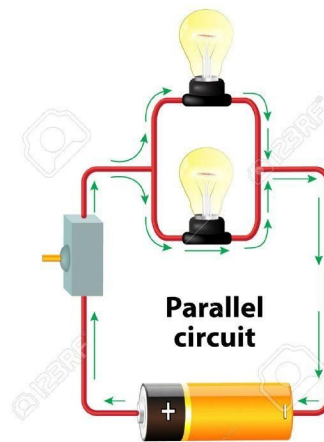
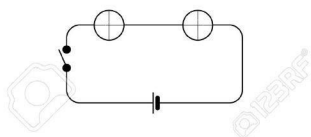
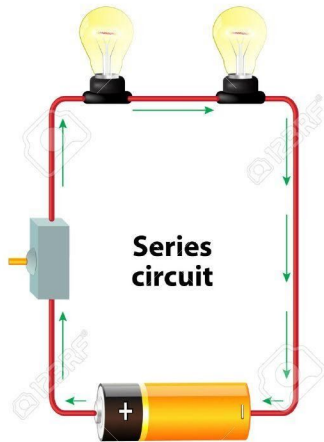
- Voltage drops add to equal total voltage.
- All components share the same (equal) current.
- Resistances add to equal total resistance.

Parallel Circuits:

- All components share the same (equal) voltage.
- Branch currents add to equal total current.
- Resistances diminish to equal total resistance.

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Series and parallel circuits



Project 10 : LED + Buzzer

Project 11: LED + Buzzer with Switch

Project 12 : LED + Buzzer + Motor

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