

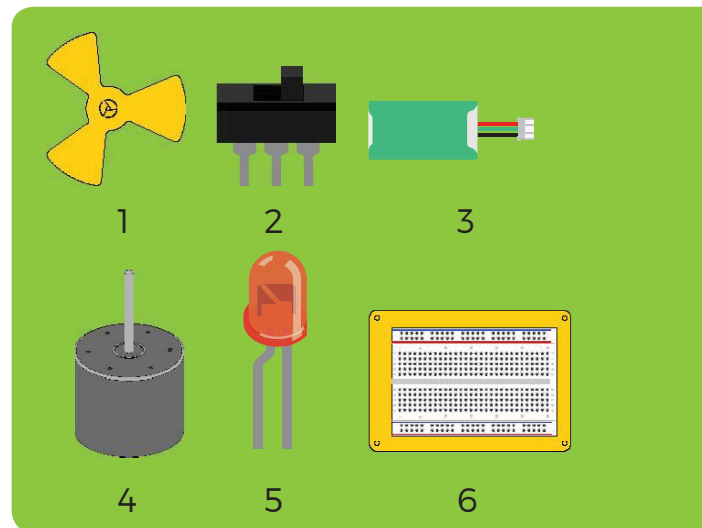
You would have come across the word 'circuit' in your life. What comes into your mind when you see this word? In this activity we will create circuits to use a fan and a lamp. We will also understand what happens in a simple circuit.

What we will achieve from this:

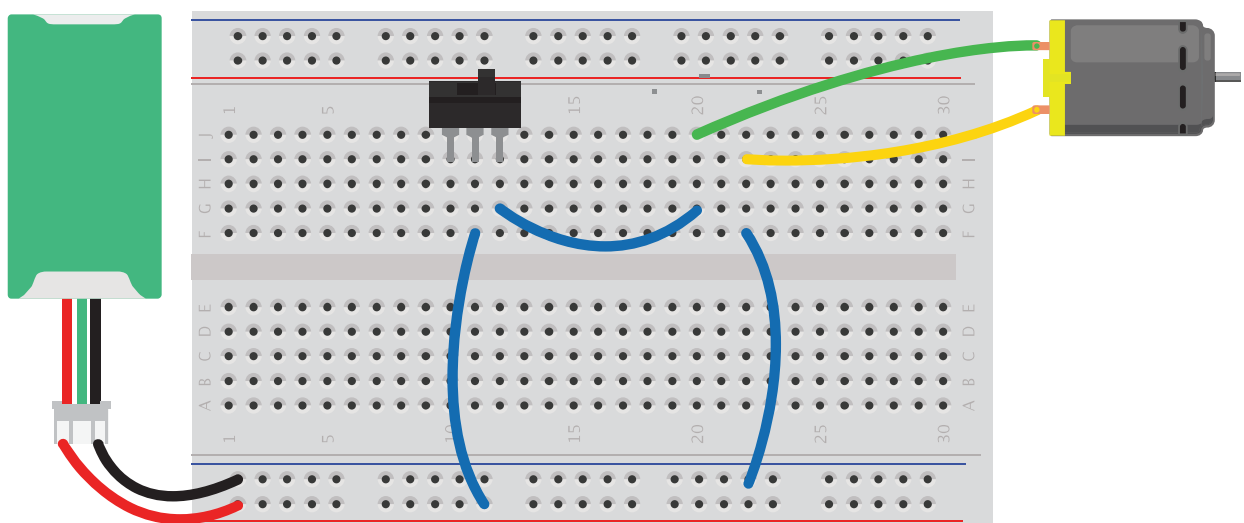
- Operating a DC Motor and Lamp. Using them for various purposes.
- Understanding the dynamics of circuits (open & close circuit).
- Understanding switches to control the flow of current.

Requirements:

1. Propeller extension for DC Motor
2. Toggle Switch
3. Battery Pack
4. DC Motor
5. Incandescence Lamp
6. Breadboard
7. Jumper Wires



Steps to do:



Step 1. Connect the 3.7V battery pack to the breadboard on the horizontal power lines.[404]

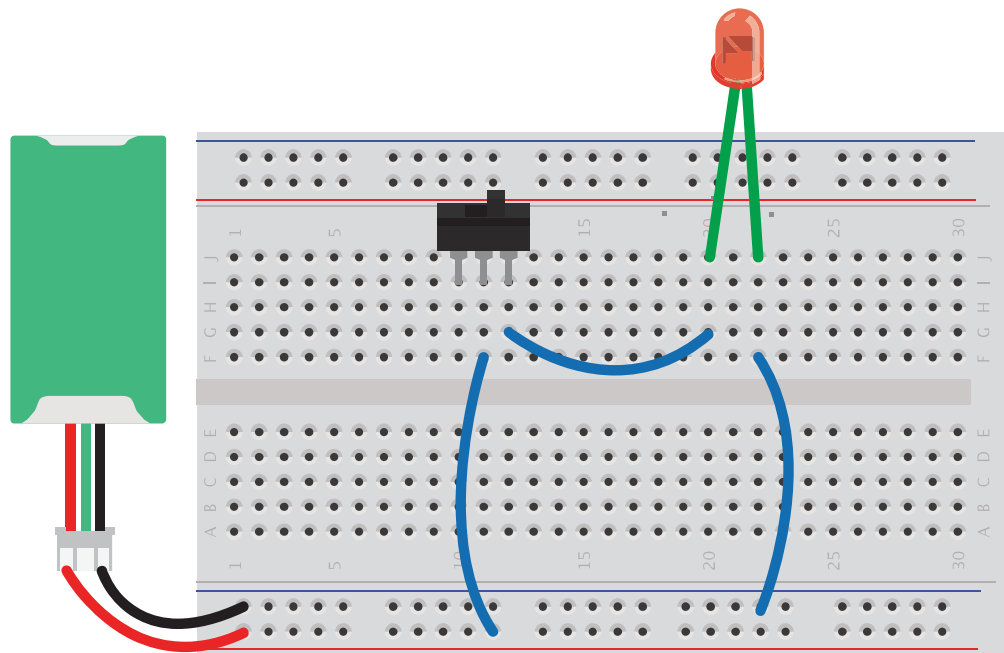
Step 2. Place a switch on the breadboard.

Step 3. Connect the central terminal of the switch to the positive power line on breadboard.

Step 4. Connect one terminal of the DC motor to one of the end terminals of the switch and the other terminal to the negative power line on breadboard.

Step 5. Toggle the switch position, to turn the motor on or off.

Step 6. Switch the motor off and attach the propeller on the motor shaft. This is similar to the working of the fan at your home.



Step 7. Replace the motor terminals with incandescence lamp terminals to control a lamp in similar fashion.

Technical Explanation:

This closed loop which generates a path between the positive and negative terminal of power source (battery in this case) is known as

'circuit'. When the switch is adjusted such that the motor starts rotating or the lamp starts glowing, the circuit is termed as 'closed', otherwise it is called 'open'. In this case, the switch is controlling this transformation between closed and open circuit.

Related Assignments:

Since the switch we are using can work in both directions, try to make a small circuit on breadboard for the following function. When the switch is adjusted in one direction, the fan should work and lamp should be disconnected while in other state, lamp should glow and fan should be disconnected. You can also check the amount and direction of current flowing through the circuit at any point of time with the help of Multimeter.

Application in Real World:

All switches on electrical board do the same job of connecting and disconnecting circuits. When the switch is closed, the circuit gets completed and electrical appliance starts working. And when the switch is off, circuit is not completed and hence the appliance does not work. The switches at your home work the same way.

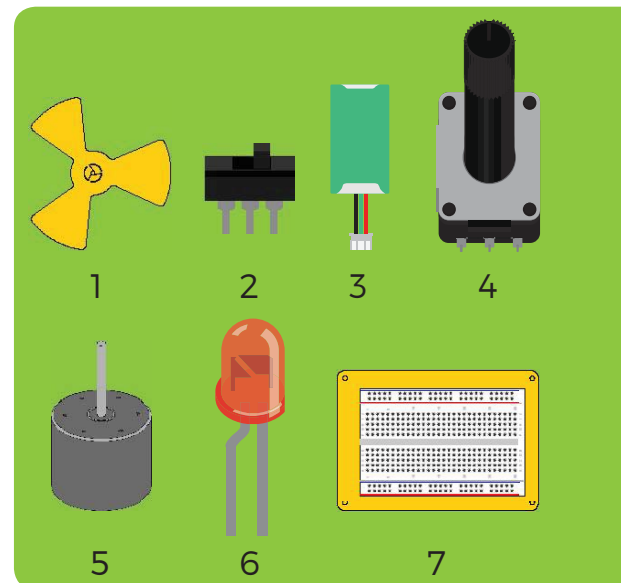
You used a fan in the previous activity. In this activity we will create a mini fan regulator so that we can control the speed of motor and intensity of lamp. We will also get to learn about the relationship between current, resistance and voltage.

What we will achieve from this:

- Understanding of resistance
- Understanding of Ohm's law
- Understanding of potentiometer and variable resistors

Requirements:

1. Propeller extension for DC Motor
2. Toggle Switch
3. Battery Pack
4. Potentiometer
5. DC Motor
6. Incandescence Lamp
7. Breadboard
8. Jumper Wires

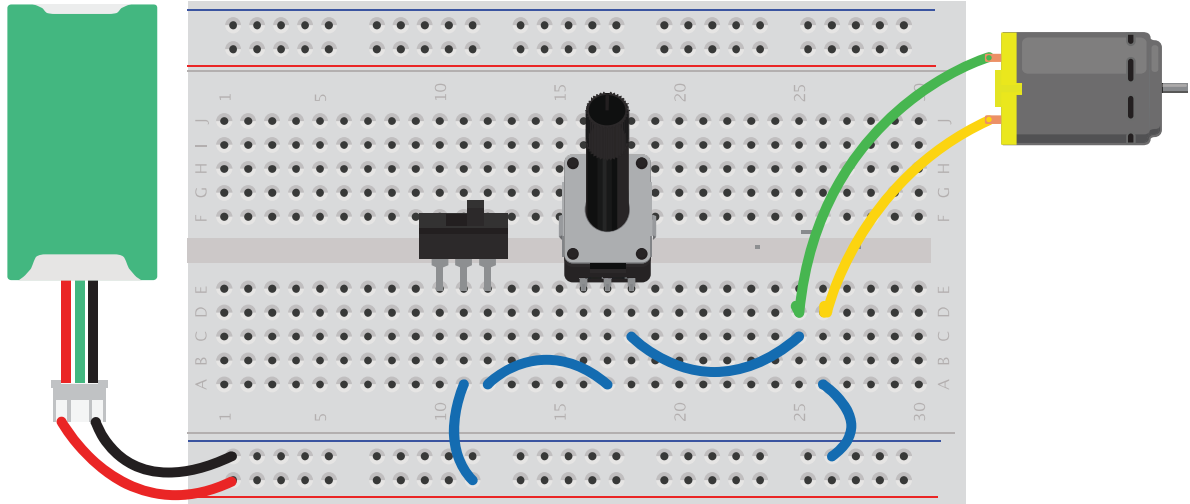


Steps to do:

- Step 1. Connect the 3.7 V battery pack to the breadboard on the horizontal power lines.
- Step 2. Place potentiometer on the breadboard.
- Step 3. Place a switch on the breadboard and connect one of its end terminals with the central pin of potentiometer.
- Step 4. Connect the middle pin of the switch to the positive power line on breadboard.
- Step 5. Connect one leg of the motor (with propeller connected at its shaft) to the negative power line on breadboard.
- Step 6. Connect the other end of the motor to one of the end pins on

potentiometer.

Step 7. Rotate potentiometer knob to control speed of motor.



Step 8. Replace motor with incandescent lamp to view fading effect.

Technical Explanation:

It is a fact that the speed of a motor increases when the potential difference across its two ends increases. Similarly the brightness of the lamp increases with an increase in the potential difference.

When we rotate the potentiometer, it changes the potential difference across the motor or the lamp. That is why you can observe a change in its speed or brightness.

Application in Real World:

Many devices have potentiometers within them. Potentiometers are used in speakers to control the volume.

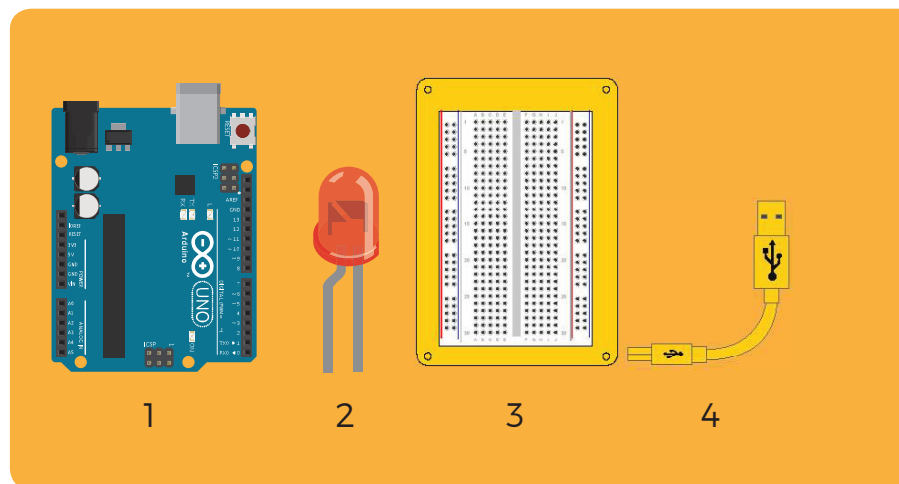
With this activity you are entering the world of computing. So don't forget to say "hello world". In this activity you learn how to use a microcontroller. Using a microcontroller, you will control a LED and use it to create few things.

What we will achieve from this:

- Controlling an LED
- Customizable control of circuit by programming a Microcontroller
- Create blinking diwali lights

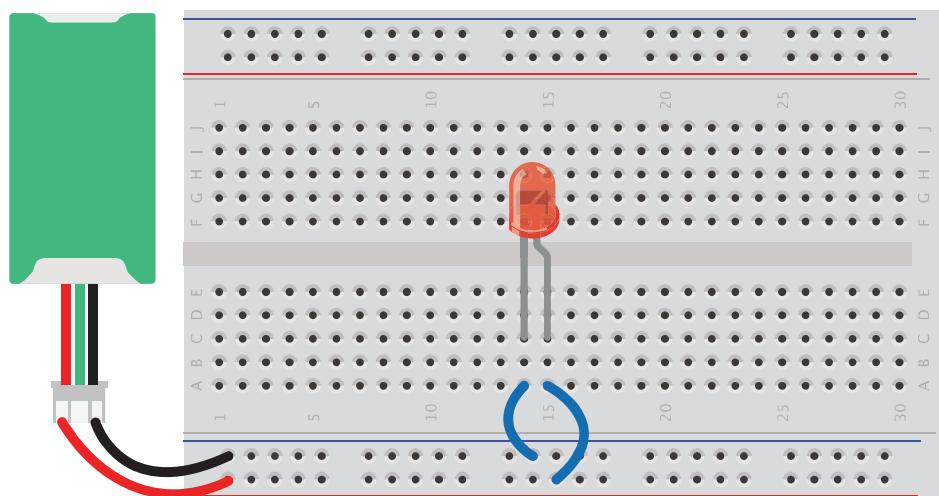
Requirements:

1. Arduino Uno
2. Led
3. Bread Board
4. USB Cable
5. Jumper Wires
6. Computer



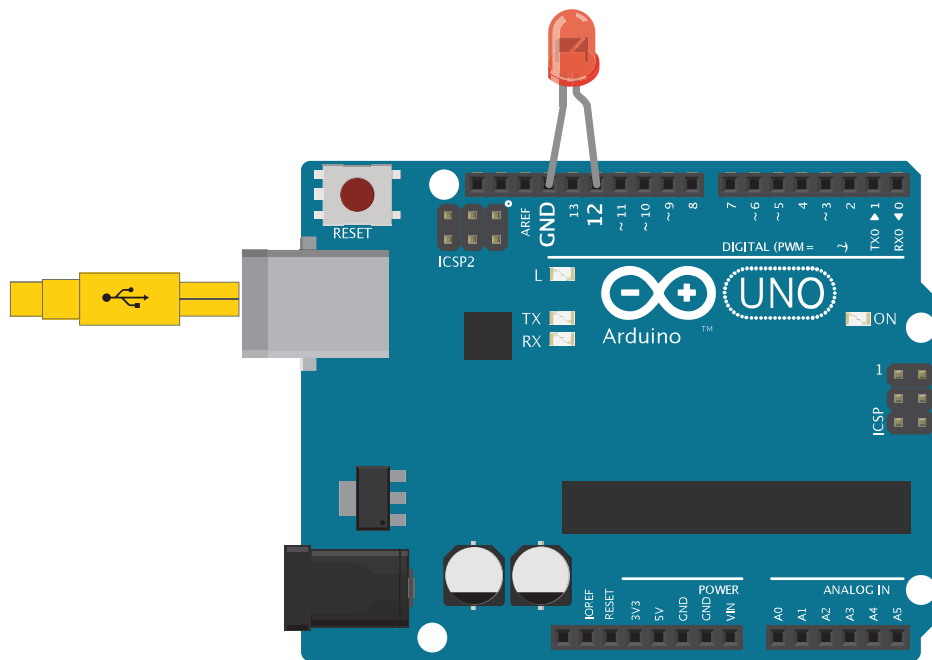
Steps to do:

The tasks we will perform in this activity use LED as an electronic component for its operation. So first we will create an LED Circuit



Step 1. Put an LED on the breadboard

- Step 2. Join the positive end (anode) of the LED terminal to positive power line on the breadboard.
- Step 3. Join the negative end (cathode) of the LED terminal to negative power line on the breadboard.
- Step 4. Connect the positive and the negative terminals of the 3.7V battery pack to the positive and negative power lines on the breadboard respectively.



If the LED is glowing it means that you have created the circuit correctly. But we did not just want to make the LED glow; we also want to control the LED. For this purpose we replace the battery and shall power the led using the Arduino. In the circuit created in the previous activity instead of the positive terminal of the battery use the Pin Number 12 from Arduino Board. Also replace the negative terminal of battery with a connection to the ground pin of the Arduino. Upload the following code after making the connections.

```
int led=12;
```

```
void setup()  
{
```

Creating an integer variable called LED and assigning a value of 12 to it.

Here we use this variable to store the pin number connected to the LED.

Whenever Arduino is started, setup function is performed first. The steps needed to be executed just once by the microcontroller and in the beginning needs to be defined within the setup function.

```

    pinMode(led,OUTPUT);
}

void loop()
{
    digitalWrite(led,HIGH);
}

```

pinMode is a function which sets the LED pin as an OUTPUT pin. Here we set the pin in OUTPUT mode as pin will provide power to the LED.

digitalWrite is used here to set the value on the led pin as high. This command will tell the pin number 12 (as led variable has value 12) to give a high voltage.

Till now we have just learnt to make the LED glow using an Arduino. But our intended aim was to control the led not just to glow it. So now we will make the LED blink.

We have to make the LED blink. This is done by turning it on and then off with a delay of 1 second. So the Arduino should provide power to the LED pin for 1 second and then turn off the power on the LED pin after 1 second. Upload the following code to do this.

```

int led=12;
void setup()
{
    pinMode(led,OUTPUT);
}
void loop()
{
    digitalWrite(led,HIGH);
    delay(1000);

    digitalWrite(led,LOW);
    delay(1000);
}

```

First we make the LED on by making the pin 12 provide a high voltage using the digitalWrite(led,HIGH) command. Then we use delay which is a system defined function. delay(millisseconds) is used to delay the next operation for the number of milliseconds passed as an argument within the brackets. e.g. delay(1000) delays the operation for 1000 milliseconds or 1 second.

Next we make the light off by using the digitalWrite(led,LOW) command.

Then we add a delay of 1 second for the next operation of the microcontroller.

All these commands are in the loop function which is called infinitely by the microcontroller. So the light shall show a blinking action by infinitely going on and off after 1 sec.

In this activity we have understood how to program an Arduino. We have also learnt how to control its pins and providing power through them. At the end of this activity you would have created an LED that can blink with 1 millisecond delay time between two flashes.

Application in Real World:

Many gadgets use LED as an indicator. For example many smart-phones use them to show notifications. LED is used as a source of light itself in many torches and lamps. These LEDs require a control mechanism too.

Related Assignments

You can now play with the delay used in the code to try these tasks:

- Making the LED glow for different time durations of on and off states.
- Making Diwali lights by using multiple LEDs. You can control the Diwali lights using the Arduino as a switch and make them blink.