

Experiment 7

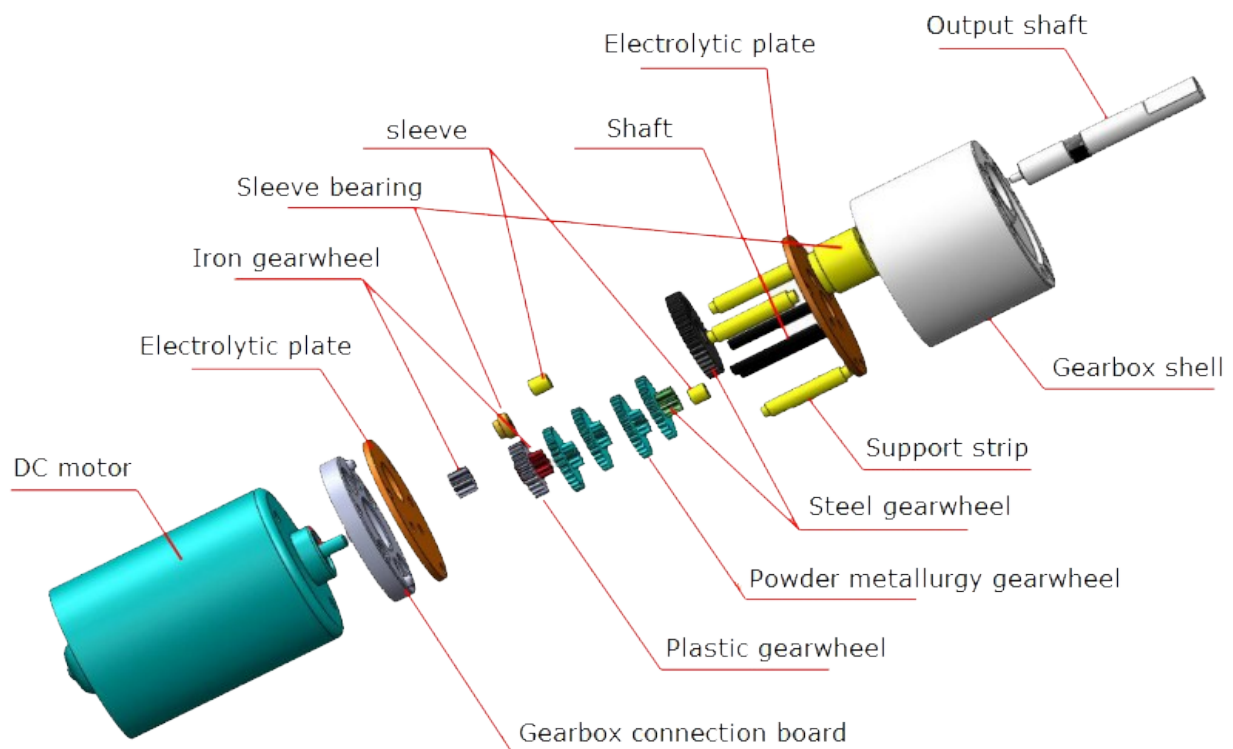
DC Motor

Outline

In this experiment, it is expected from you to,

1. Learn the DC motor structure and usage
2. Learn the transistor structure and usage
3. Assemble and test the DC motor circuit
4. Modification

1. DC Motor



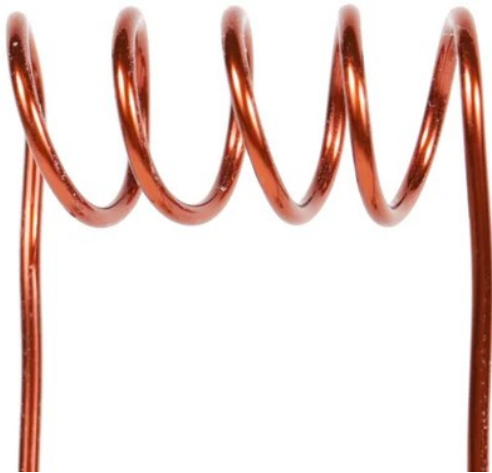
Structure of DC Motor

DC motors are rotary motors that convert direct current (DC) electrical energy into rotational mechanical energy. The basic principle behind this conversion relies on the interaction between magnets.

Magnets have 2 polarities (North and South). Same poles of the magnets repel each other while opposite poles attract each other. Aside from permanent magnets, this effect can also be achieved by using electrical current by creating an electromagnetic field. Magnets achieved with this principle are called electromagnets.

To create an electromagnetic field you need to create a wire coil like shown below and flow an electrical current through it. If you want to increase the intensity of the electromagnetic field you can increase the number of coils and/or can add a core that consists of iron. Poles of the electromagnets can be changed by changing the direction of the current flowing through them.

LESS

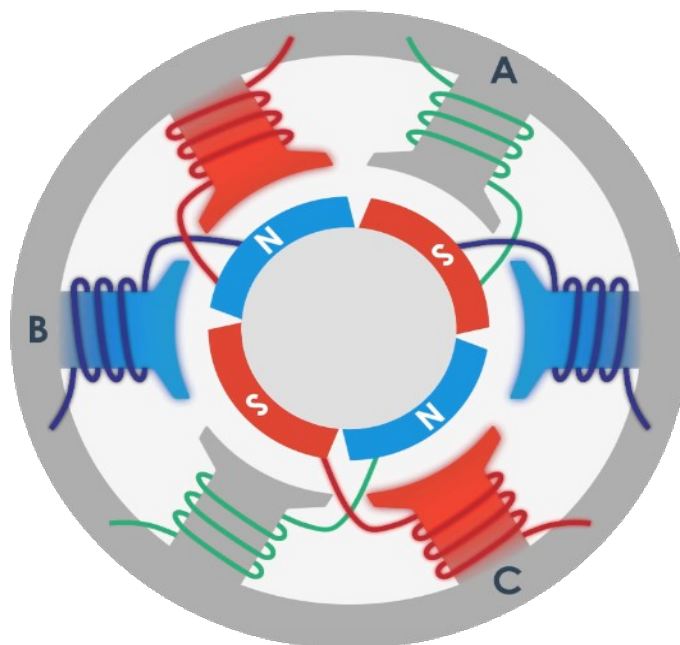


MORE



Structure of Wire Coil

DC motors utilize the interaction between magnets and the ability of changing poles of the electromagnets to output rotational mechanical energy. For this each motor combines permanent magnets with electromagnets like shown below.



Structure of Brushless DC Motor

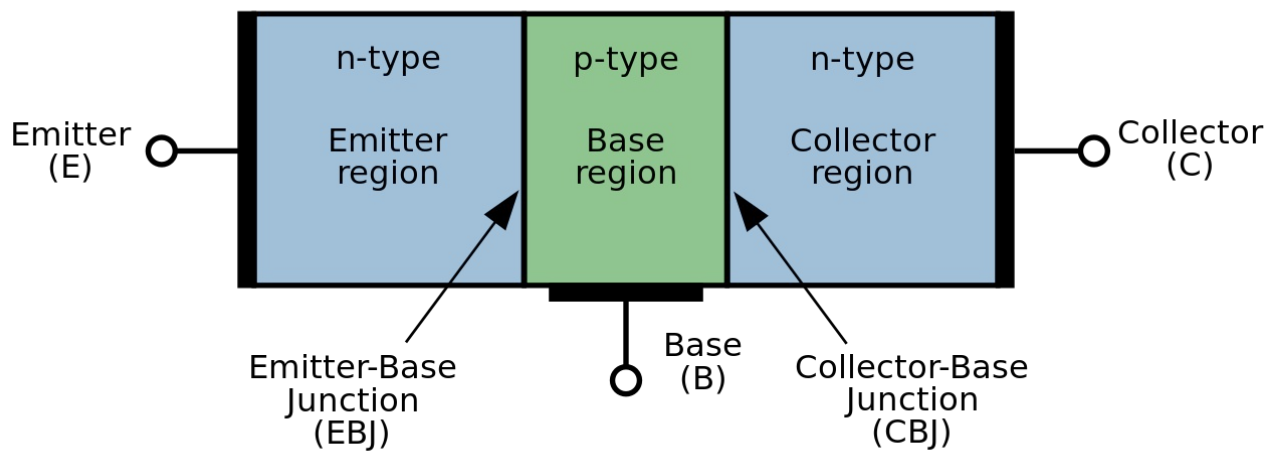
The most used types of DC motors are brushed and brushless. If you want further explanation of how do they work you can use the links below,

<https://www.youtube.com/watch?v=CWulQ1ZSE3c>

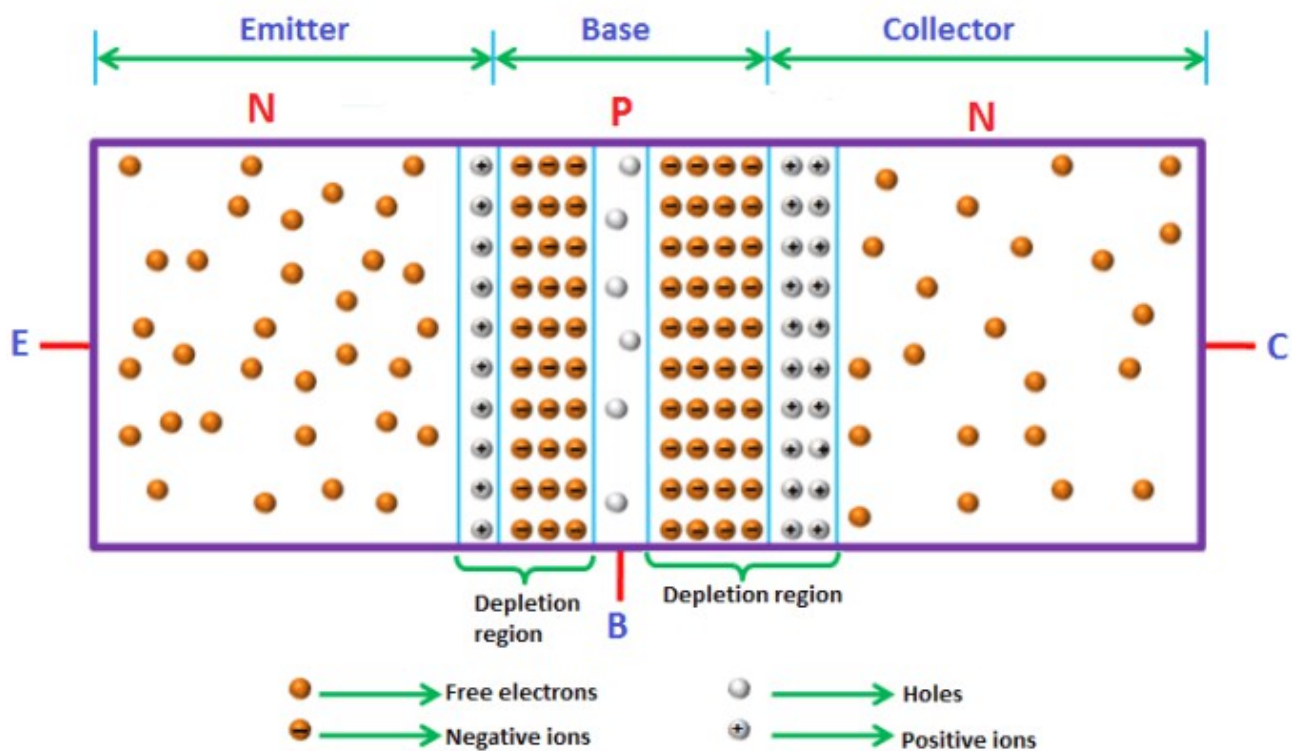
<https://www.youtube.com/watch?v=uOQk8SJso6Q>

2. Transistor

Transistors are semiconductor devices those used to amplify or switch electrical signals and power.



Structure of NPN Type Transistor

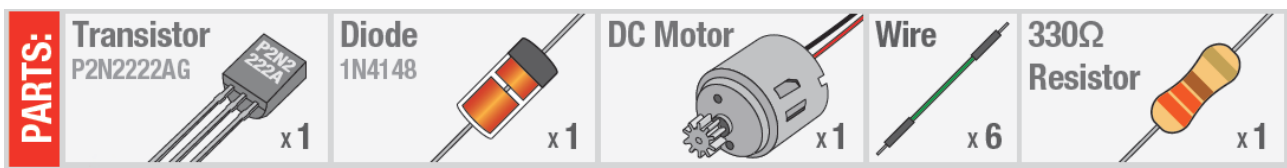


State of the Electrons in the Unpowered Transistor

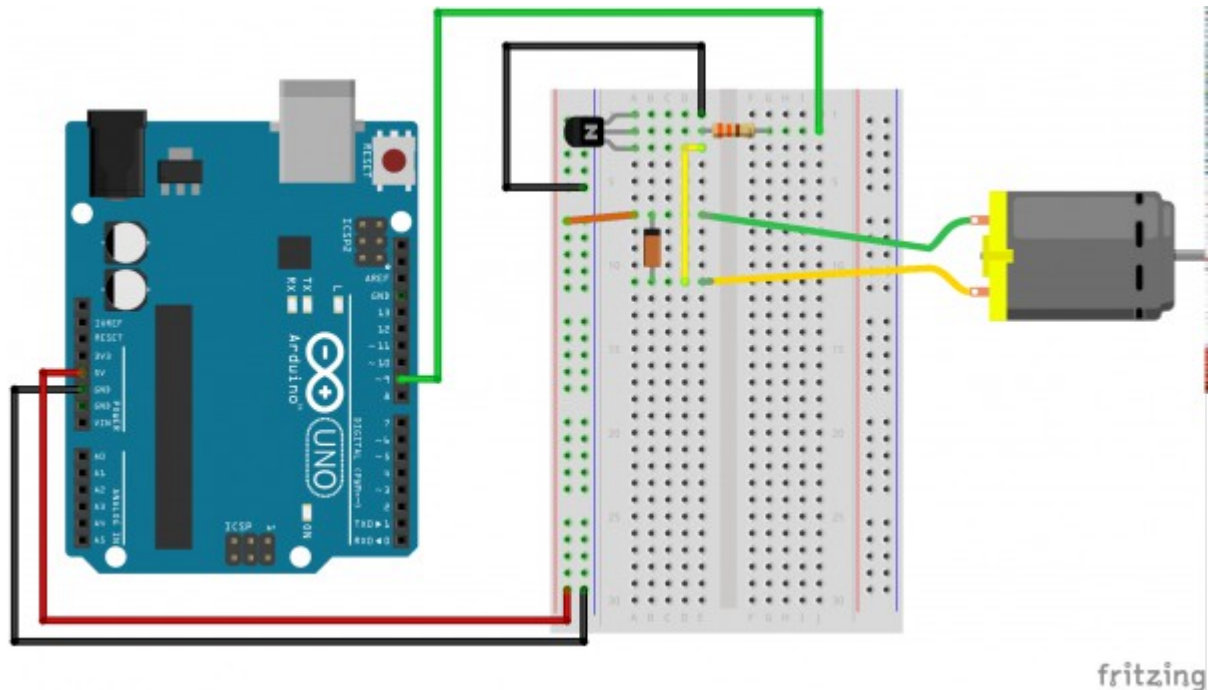
For further explanation you can check the link below,

<https://www.youtube.com/watch?v=7ukDKVHnac4>

3. Assembling the DC Motor Circuit



Required Parts



Fritzing Diagram of the Circuit

1. Select your resistors (330 Ω) by using the color code table
2. Connect your DC motor, transistor and diode as shown in the diagram
3. Verify and upload your code to the arduino board
4. Observe the result and compare it with the expected outcome

Expected Outcome: DC motor should start spinning the shaft.

4. Testing the DC Motor Circuit

1. Try to find the direction of your diode that let the current flow.
 - To do that you can use a multimeter to check the resistance posed in each direction
 - If you do not have a multimeter, you can assemble a simple LED circuit and try each direction of your diode

Modification

Use a DC motor, 2 buttons and the serial port as follows,

1. Buttons will be used for increasing and decreasing the speed of the DC motor
2. Serial port will be used to read input
 - There will be 2 inputs
 - "start" to turn on the DC motor
 - "stop" to turn off the DC motor