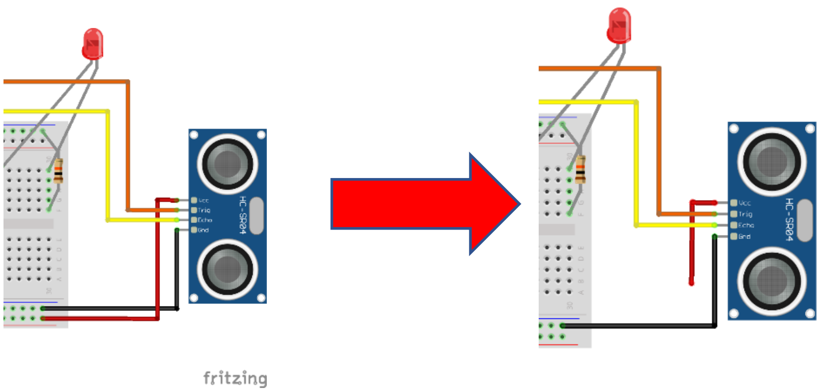
Module 8 – Working with DC Motors

For this module you will need:

- ESP32
- Breadboard
- Thin jumper wires
- DC Motors

Be sure the ESP32 is unplugged, and the battery pack power switch is OFF.

Unplugg the Ultrasonic sensor Vcc jumper from the board.

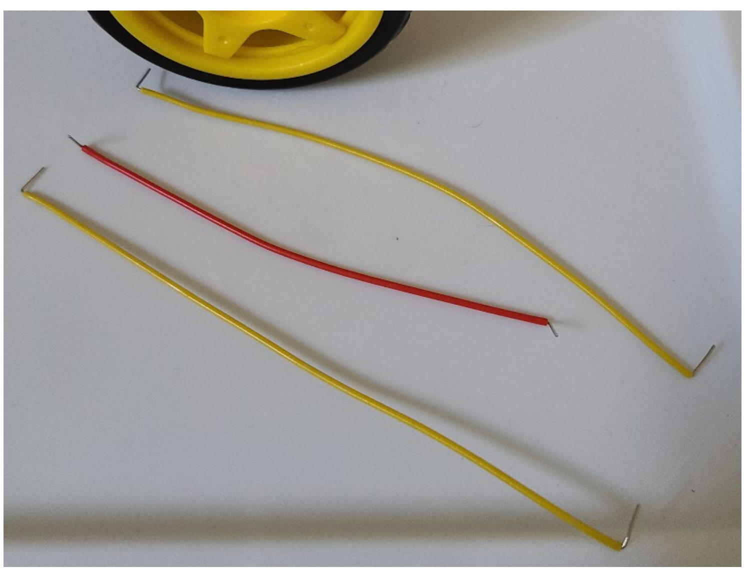


Disconnect Vcc from breadboard!

We will now work with DC motors.

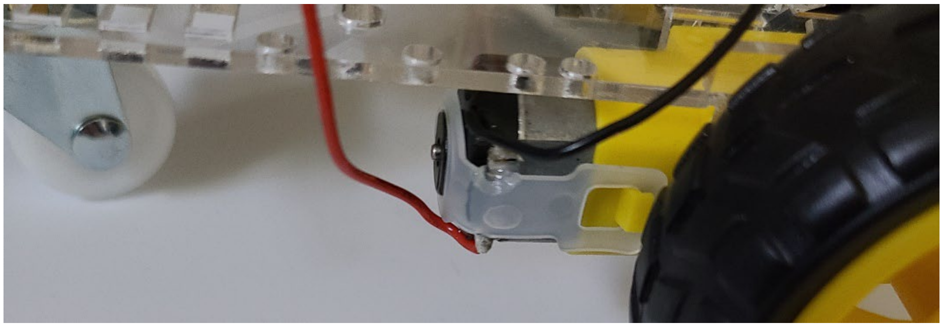
Take your car (with its motors) to a soldering station.

Take two of the thin jumper wires and solder them to the leads of the motors.

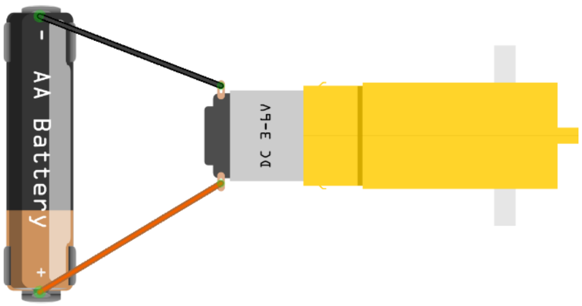


The positive terminal is on the bottom, the negative terminal is on the top.

Be sure both motors have wires connected to their terminals.



Using your fingers, connect the positive terminal to a AA battery (+) and a negative terminal to AA battery (-)



The motor should begin turning slowly.

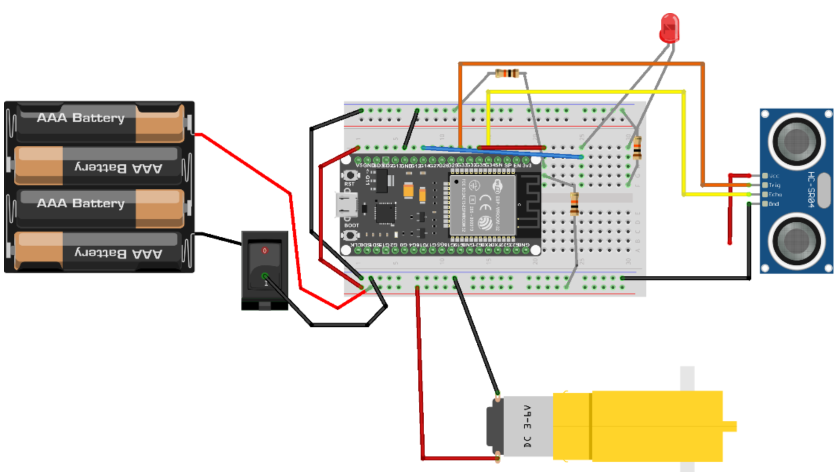
Swap the leads, the motor should begin turning the opposite direction slowly.

Now connect the motor leads to the **red 5V rail** and a blue rail.

Disconnect Ultrasonic Vcc from breadboard before continuing!

Be sure the ESP32 USB is unplugged, then turn the power switch **on**.

The motor should spin faster because it is connected to more voltage than the single AA battery previously. Turn the power switch off.



DC Motors Explained

There are three different types of motors –

- DC motor
- Servo motor
- Stepper motor

A DC motor (Direct Current motor) is the most common type of motor. DC motors normally have just two leads, one positive and one negative. If you connect these two leads directly to a battery, the motor will rotate. If you switch the leads, the motor will rotate in the opposite direction.

Warning – Do not drive the motor directly from ESP32 board pins. This may damage the board.

A direct current (DC) motor is a type of electric machine that converts electrical energy into mechanical energy. DC motors take electrical power through direct current, and convert this energy into mechanical rotation.

DC motors use magnetic fields that occur from the electrical currents generated, which powers the movement of a rotor fixed within the output shaft. The output torque and speed depends upon both the electrical input and the design of the motor.

DC motors include two key components: a **stator** and an **armature**. The stator is the stationary part of a motor, while the armature rotates. In a DC motor, the stator provides a rotating magnetic field that drives the armature to rotate.

A simple DC motor uses a stationary set of magnets in the stator, and a coil of wire with a current running through it to generate an electromagnetic field aligned with the centre of the coil. One or more windings of insulated wire are wrapped around the core of the motor to concentrate the magnetic field.

The windings of insulated wire are connected to a commutator (a rotary electrical switch), that applies an electrical current to the windings. The commutator allows each armature coil to be energised in turn, creating a steady rotating force (known as torque).

When the coils are turned on and off in sequence, a rotating magnetic field is created that interacts with the differing fields of the stationary magnets in the stator to create torque, which causes it to rotate. These key operating principles of DC motors allow them to convert the electrical energy from direct current into mechanical energy through the rotating movement, which can then be used for the propulsion of objects.