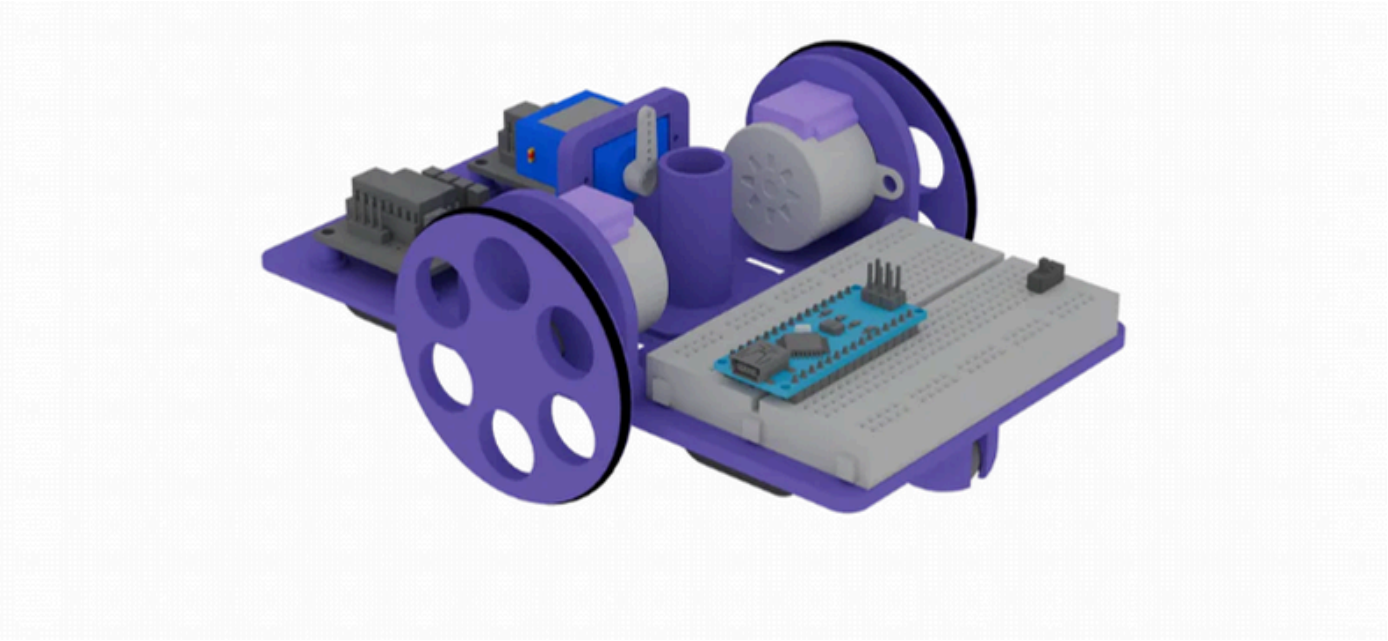

RISE Drawing Bot Kit Instructions

Version 1.0

Your Guide to Assembling and Programming the Kit

Ages:

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Programming

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3x Battery Holders

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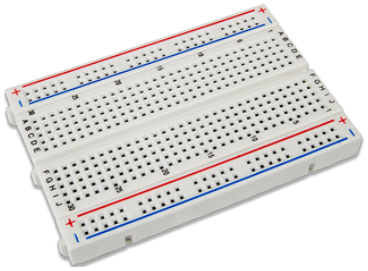

Switch

Capicator

6x Male/Male Jumper Wires

12x Male/Female Jumper Wires

Steel Ball Bearing

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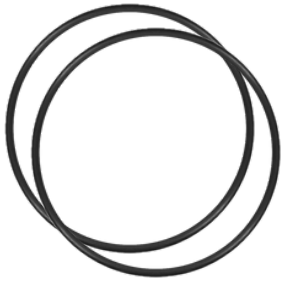
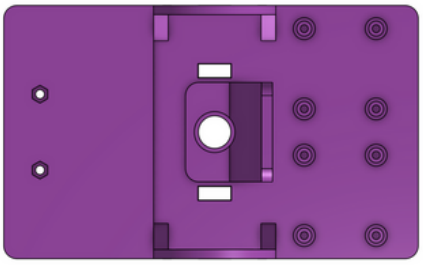
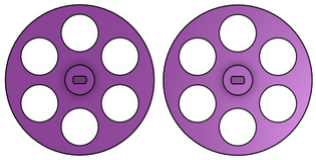


Chassis



Wheels

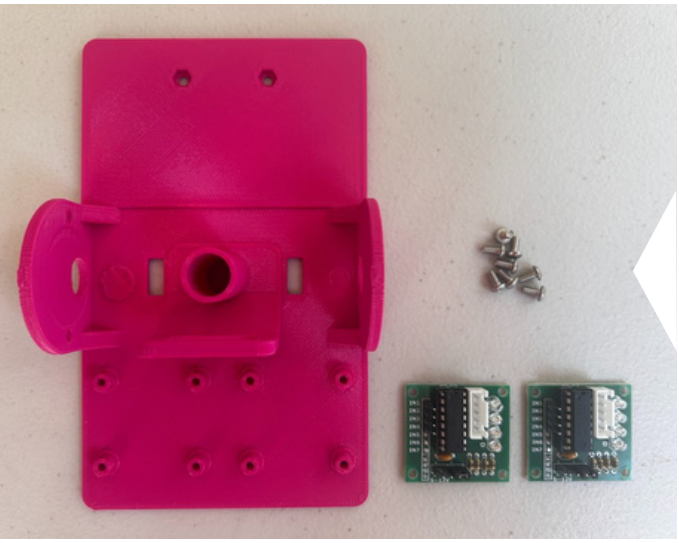


Ball Caster

Stepper Motors

Step 1

The first step to building your robot is adding the stepper motors to the chassis. These motors will be what allows your robot to drive!

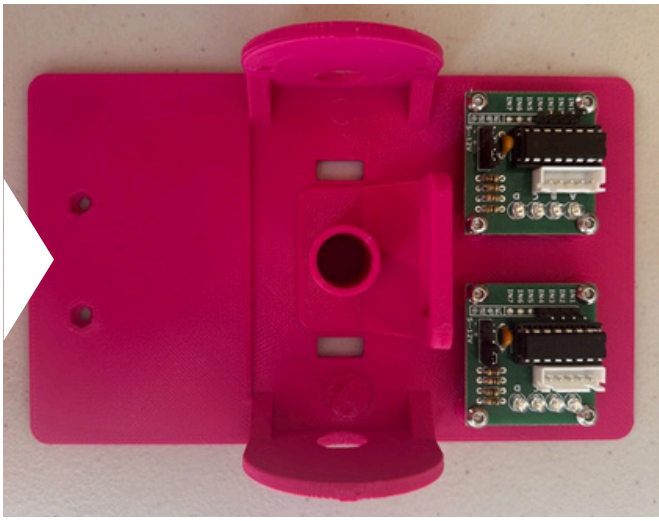


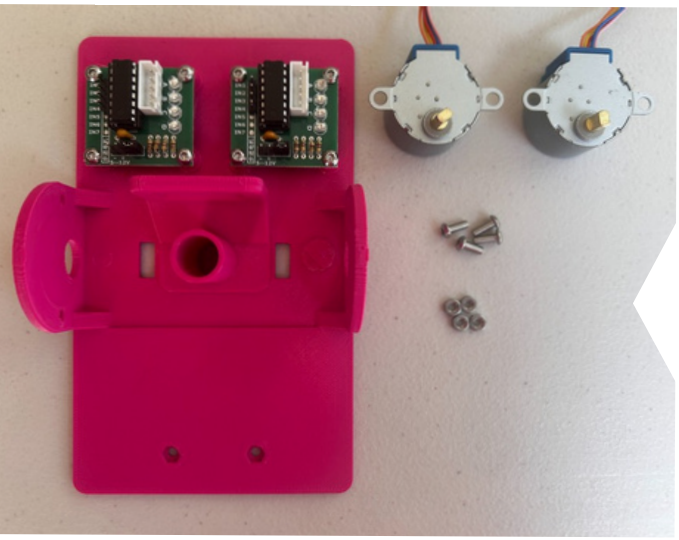
To begin, collect: 3D printed chassis, stepper motor driver boards (x2), screw driver, and 8 6mm screws.

Tip: If you are struggling to find the 6mm screws, they are the shorter screws that come in a set of 8.

Position the motor driver boards on top of the raised standoffs found on the front of the chassis. Make sure the rotation is correct so the screw holes line up. Pay attention to orientation!

Tighten the screws using the screwdrivers until they are fully inserted.





Now that the stepper motor driver boards are installed, we can attach the motors.

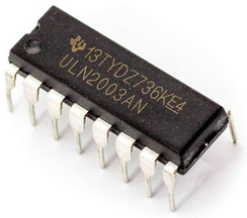
Collect these parts: stepper motors (x2), screwdriver, (4x) 8mm screws, and (4x) hex nuts.

What Does It Do?

The **ULN2003** stepper motor driver board helps the motor turn by sending it the right signals in the right order.

It includes a small control chip (called the **ULN2003**) and a board that makes it easy to plug in wires and the motor.

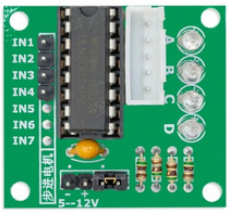
ULN2003



The **ULN2003** is an integrated circuit (IC), which means it's a tiny chip that contains many electronic parts inside to help control things like motors.

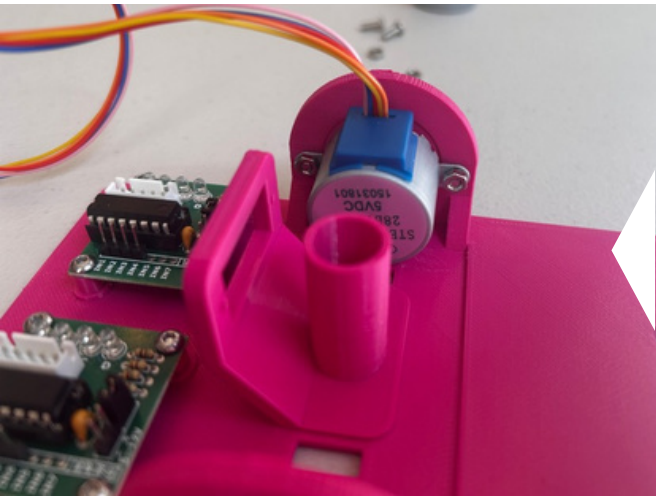
In our case, it will be controlling the motors that spin the wheels on the robot!

Breakout Board



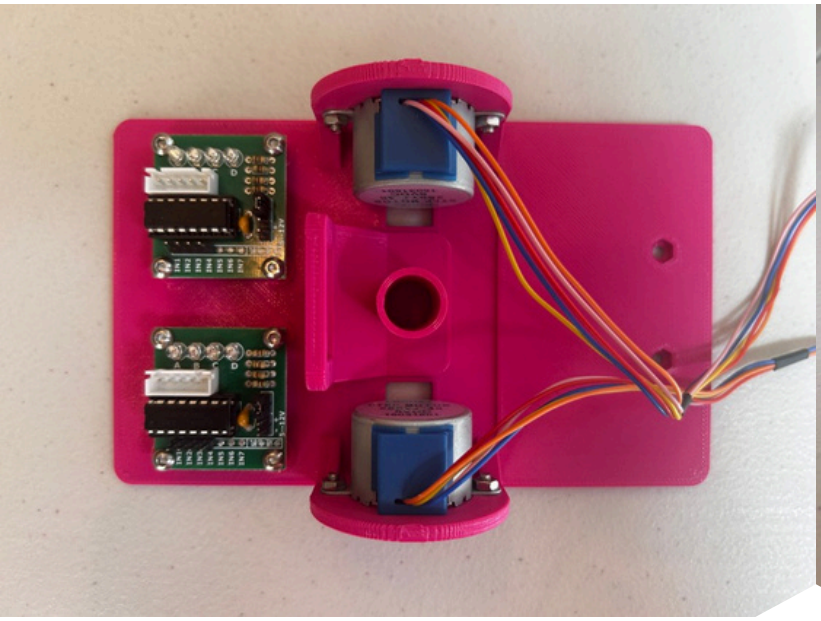
A **breakout board** is a small circuit board that makes a chip easier to use by adding connectors and pins for easy wiring.

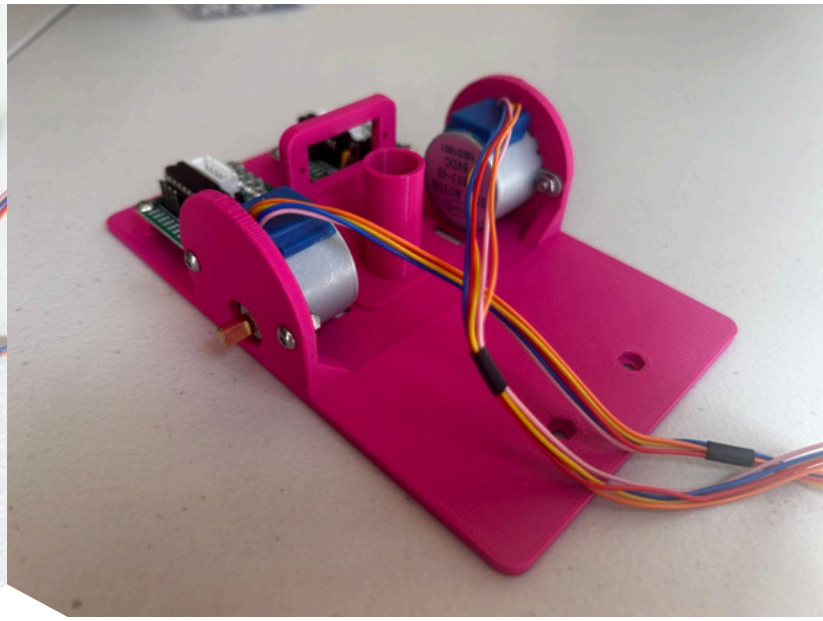
This one includes motor and wire connectors, plus lights that show the motor is moving.



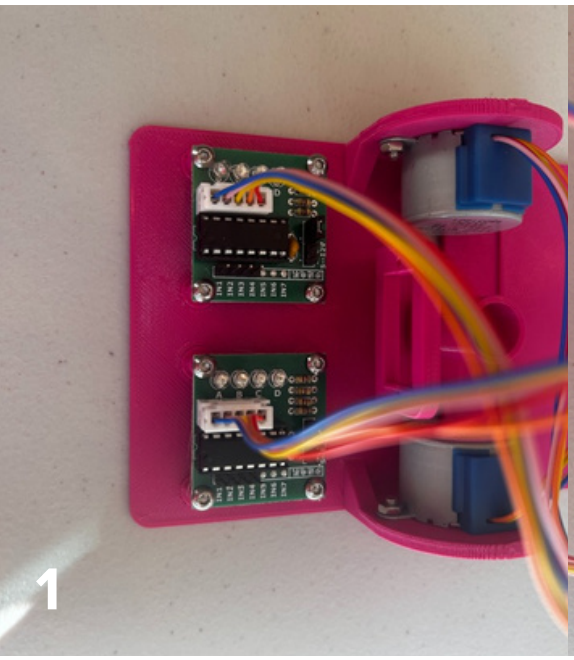
Place the screws through the rounded motor mounts on the chassis, then fit the stepper motor onto the screws and secure it with nuts. Make sure the screws are pointing out of the robot

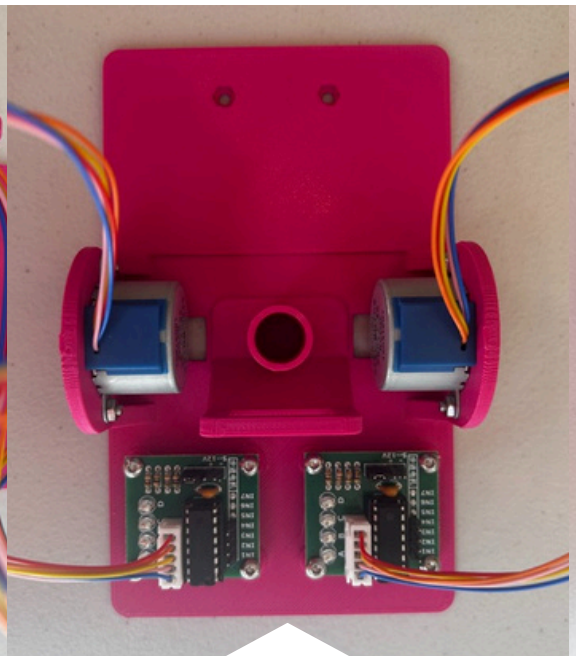
Repeat on the other side.

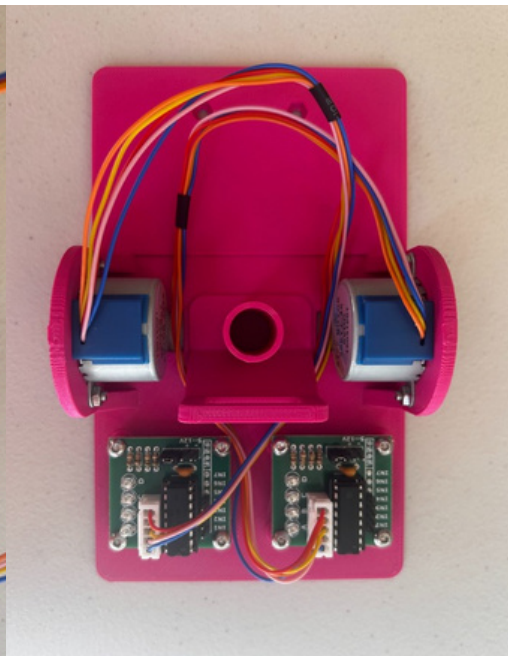




Check that your robot looks like the pictures above



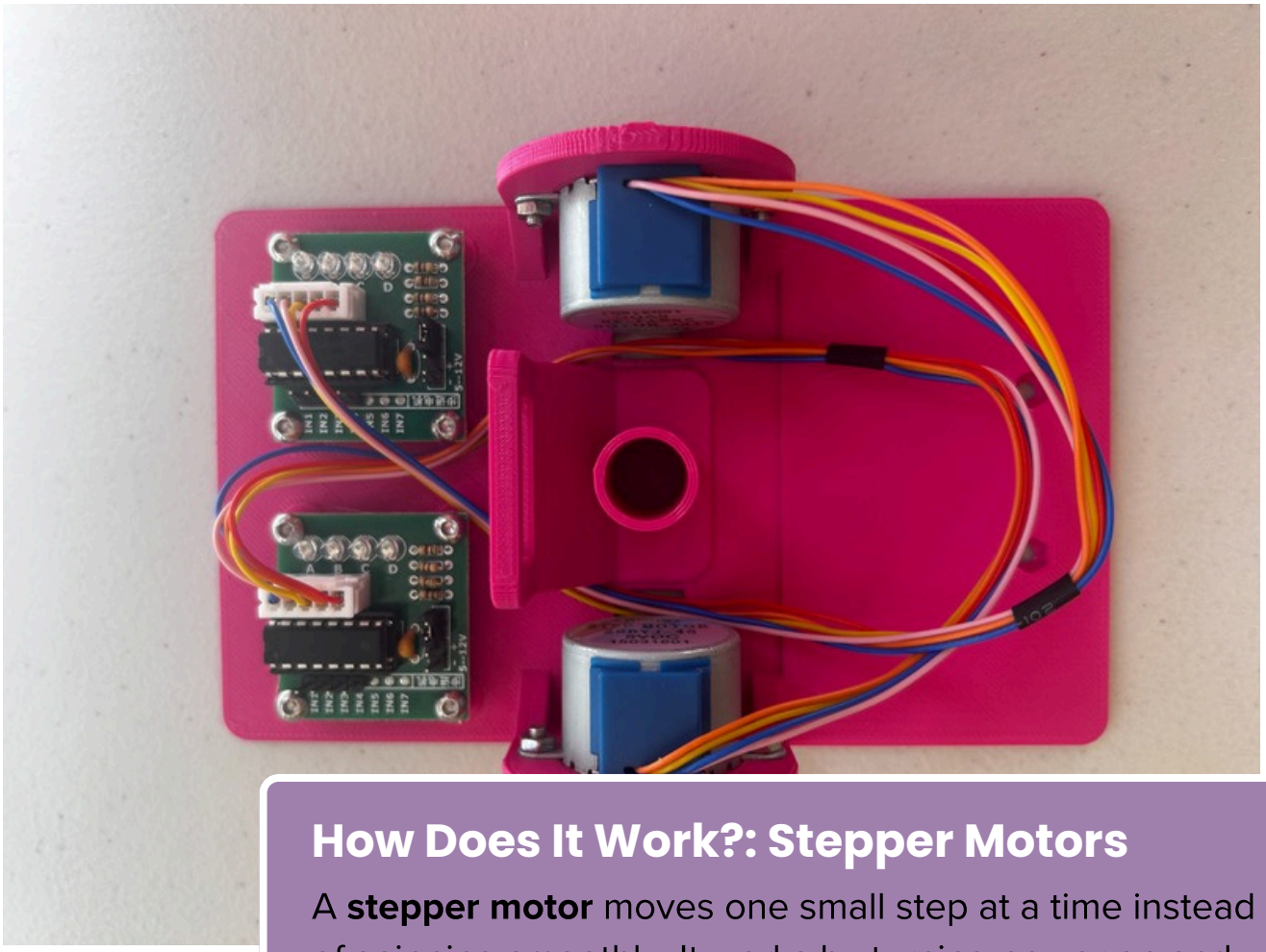




1

Connect the motor wires to the white connectors on the driver boards. The left motor goes to the left breakout board, and the right motor to the right breakout board. (Picture 2)

Push the wires down firmly so they don't stick out. (Picture 3)



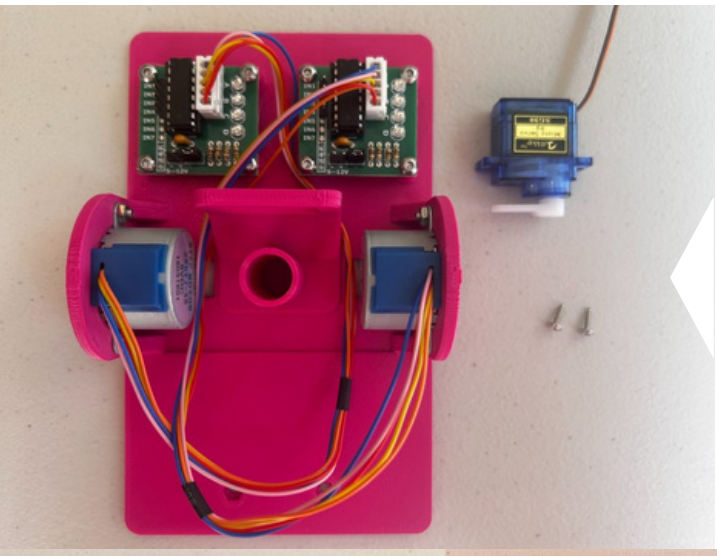
How Does It Work?: Stepper Motors

A **stepper motor** moves one small step at a time instead of spinning smoothly. It works by turning power on and off to different parts inside the motor in the right order. This makes it perfect for our robot because we can control exactly where it moves to draw accurately!

Servo Motor

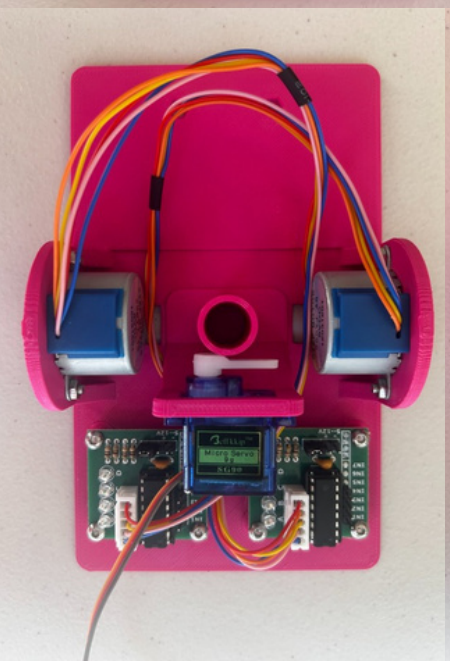
Step 2

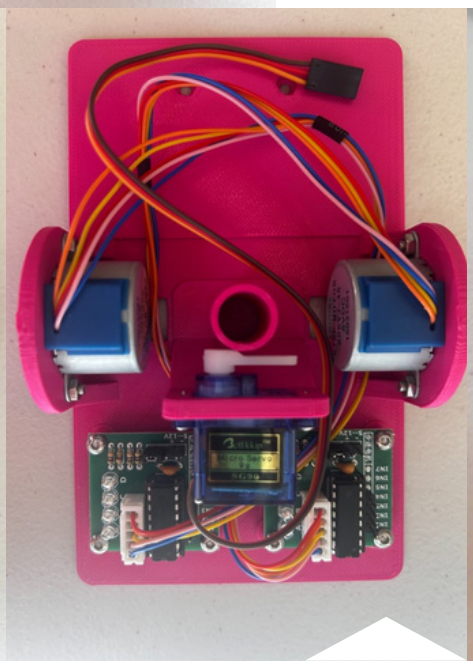
The servo motor is responsible for raising and lowering the marker. Without it your robot would only be able to draw in continous lines, not very useful!

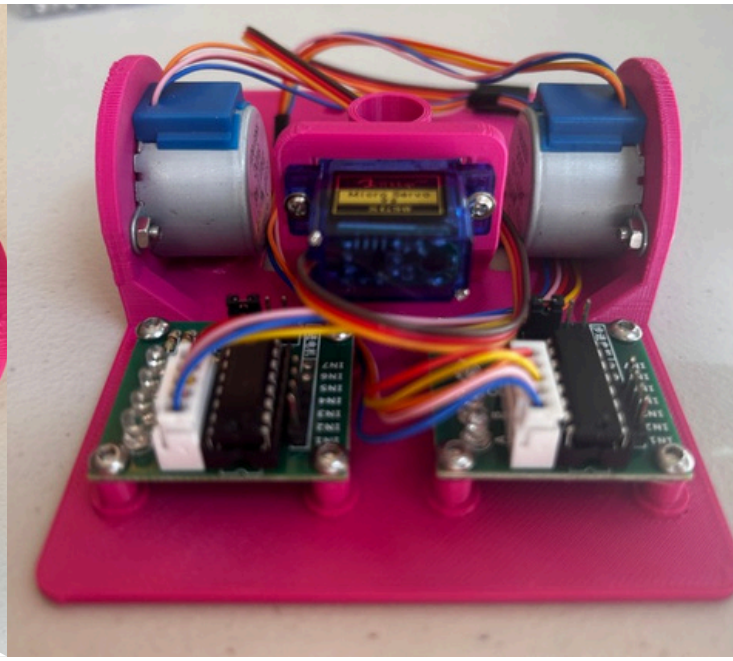


Collect these parts: servo motor, smallest servo motor horn, servo mounting screws. If it's not already attached, connect the servo horn to the top of the servo.

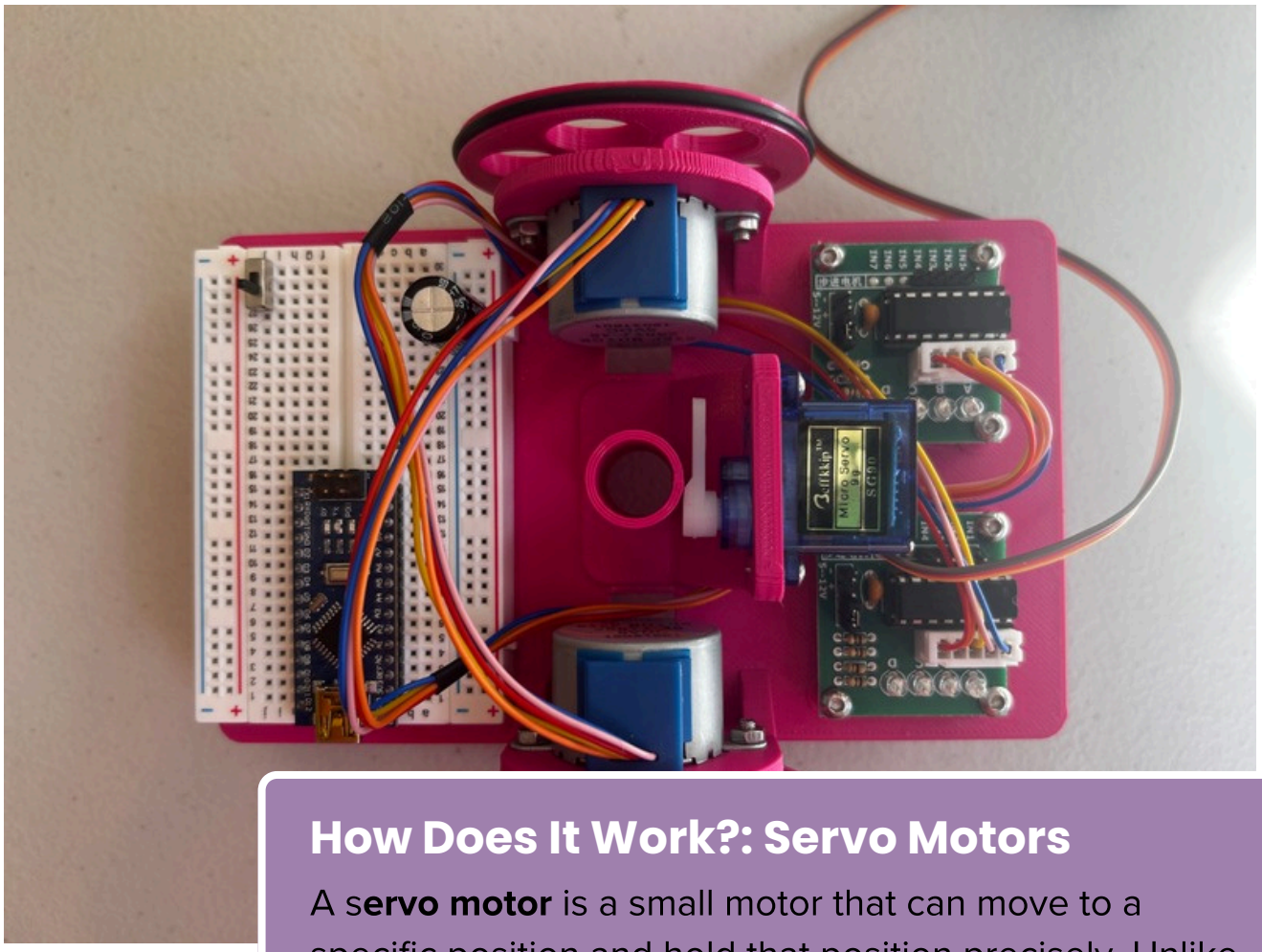
Tip: The servo screws are the largest pair of screws that come in a set of two with the servo.







Position the servo in the servo bracket as seen in the pictures. Line up the screw holes on the servo with the screw holes on the bracket. Use the servo mounting screws and a phillips head screwdriver to secure the servo in place.



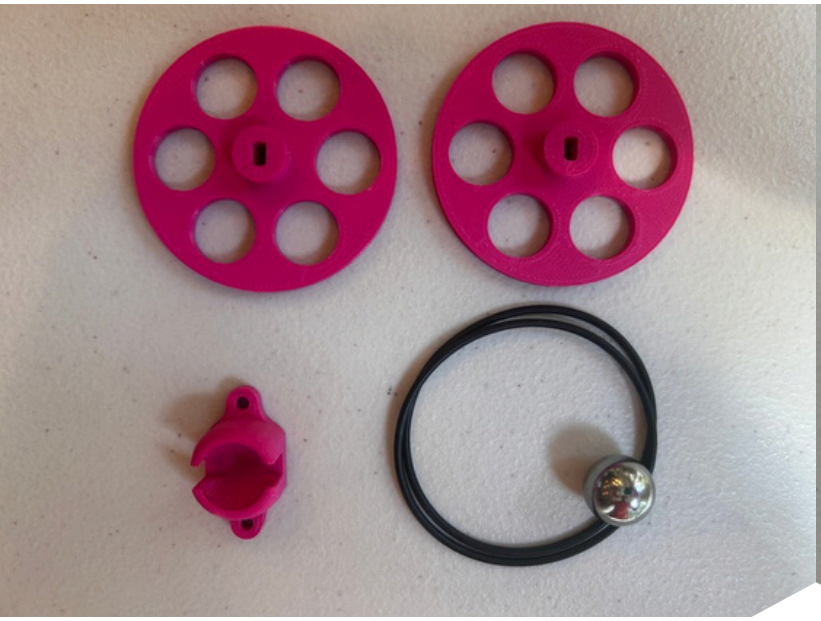
How Does It Work?: Servo Motors

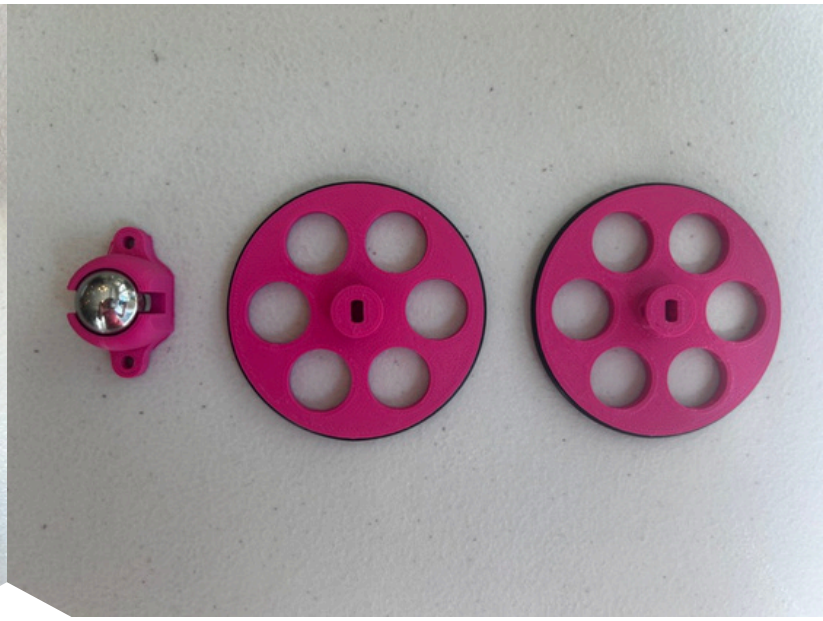
A s**ervo motor** is a small motor that can move to a specific position and hold that position precisely. Unlike regular motors that just spin continuously, a servo motor can turn to an exact angle you tell it to — like pointing a robot's arm or steering a car's wheels. It's great for making precise movements in robots, toys, or gadgets.

Getting Moving!

Step 3

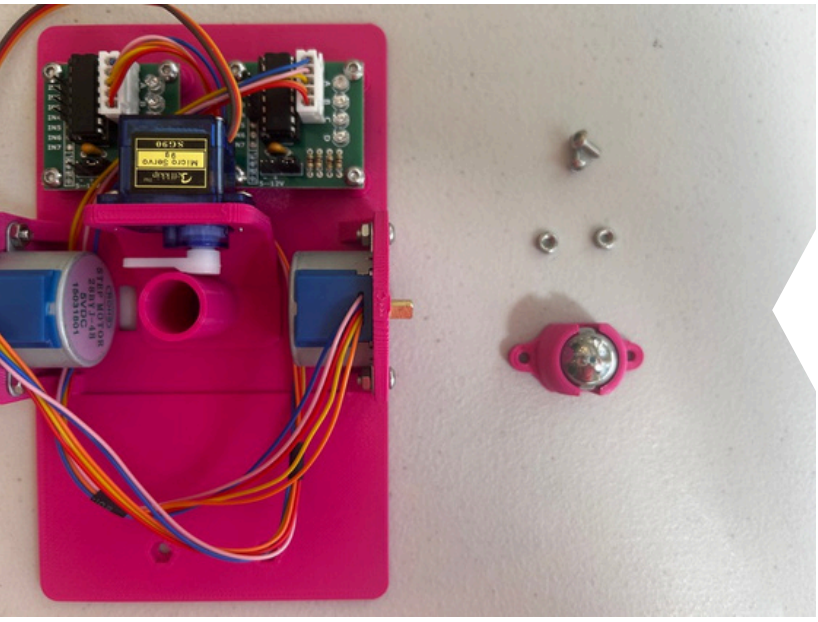
Now that we have all of the motors attached its time to add wheels and get this robot moving!



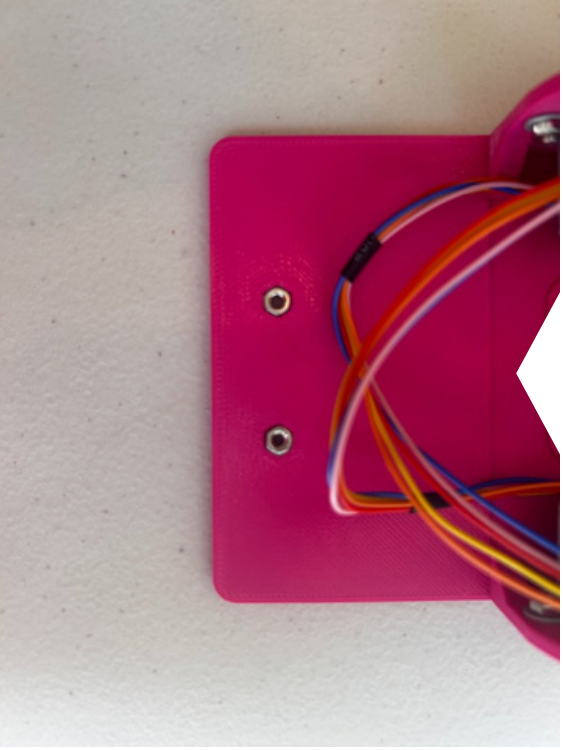


Collect these parts: wheels, o-rings, ball caster, steel ball bearing.

Push the steel ball bearing into the ball caster. Take the o-rings and wrap them around the wheels in the groove.

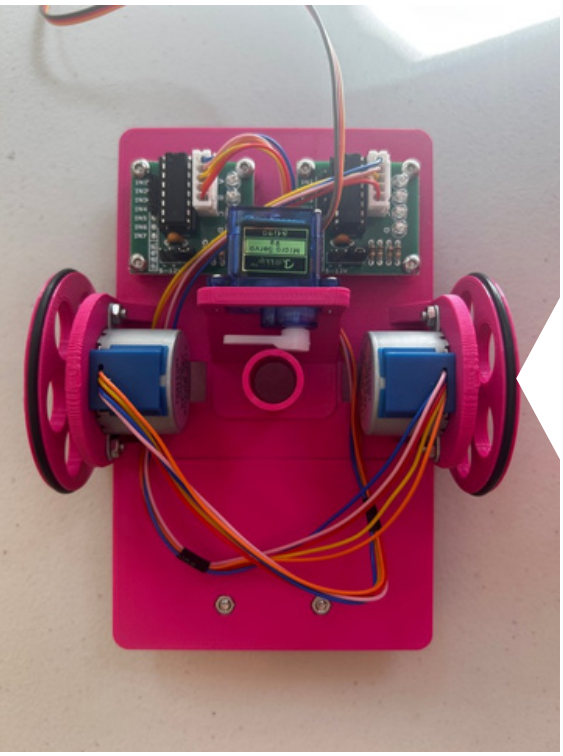


Collect these parts: ball caster and bearing (from last step), 2 8mm screws, 2 nuts



Place the nuts in the hexagonal slots towards the back of the chassis. Push down to ensure they stay in place.

Flip the robot over, line up the ball caster screw holes with the nuts, and screw the ball caster in securely.

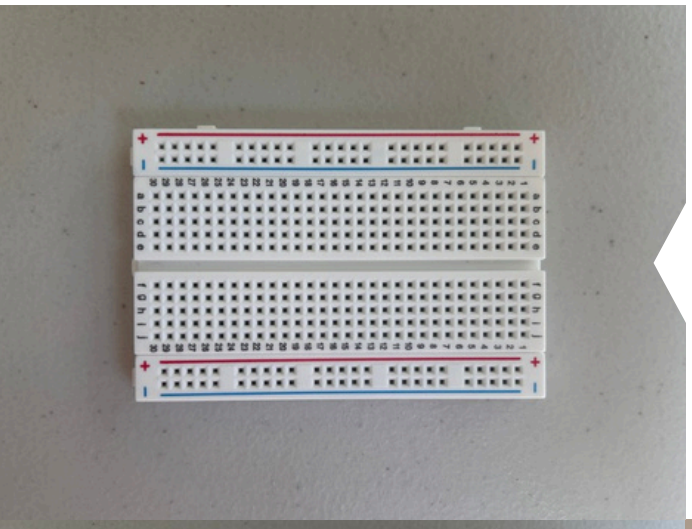


Flip the robot over again and push the wheels onto the motor shafts. Make sure that the motor shaft lines up with the wheels before pushing!

Breadboard

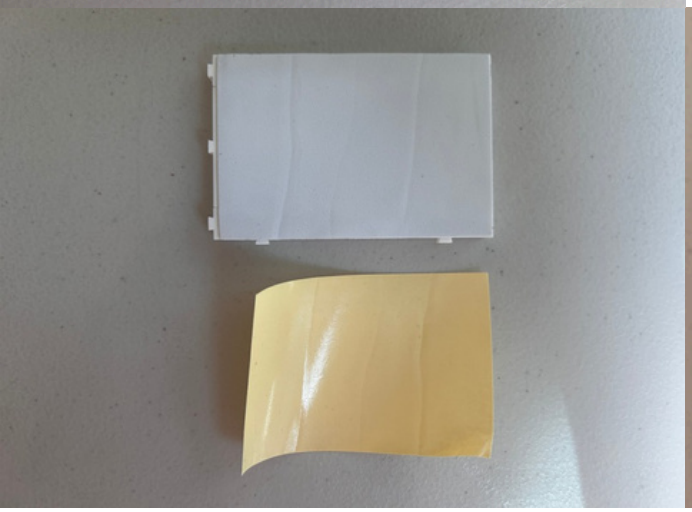
Step 4

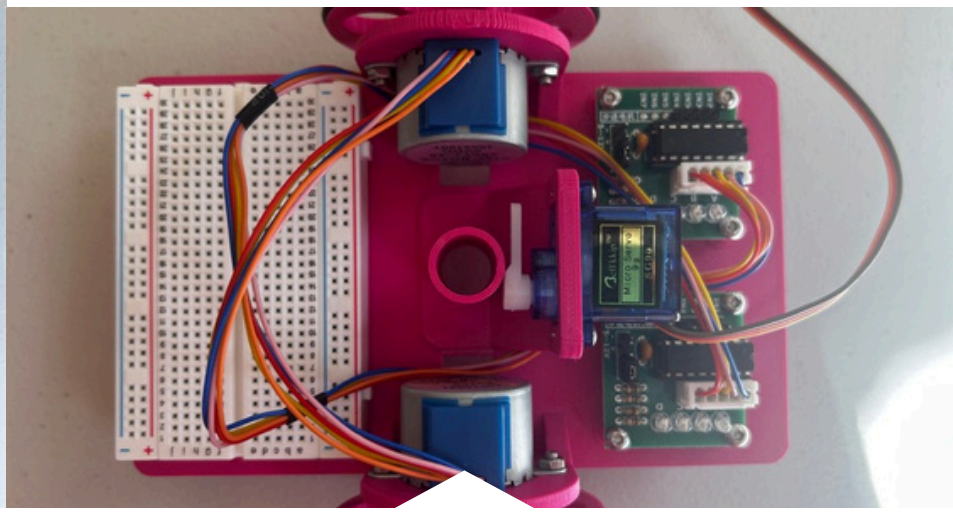
Next, we'll attach the breadboard, which is where all the electronic parts will connect to make the robot work.



Collect these part: breadboard, robot chassis

Peel the yellow protective backing off the breadboard.





Carefully align the breadboard over its space on the back of the chassis, making sure it fits fully on the surface without hanging over the edges.

Breadboard Explained

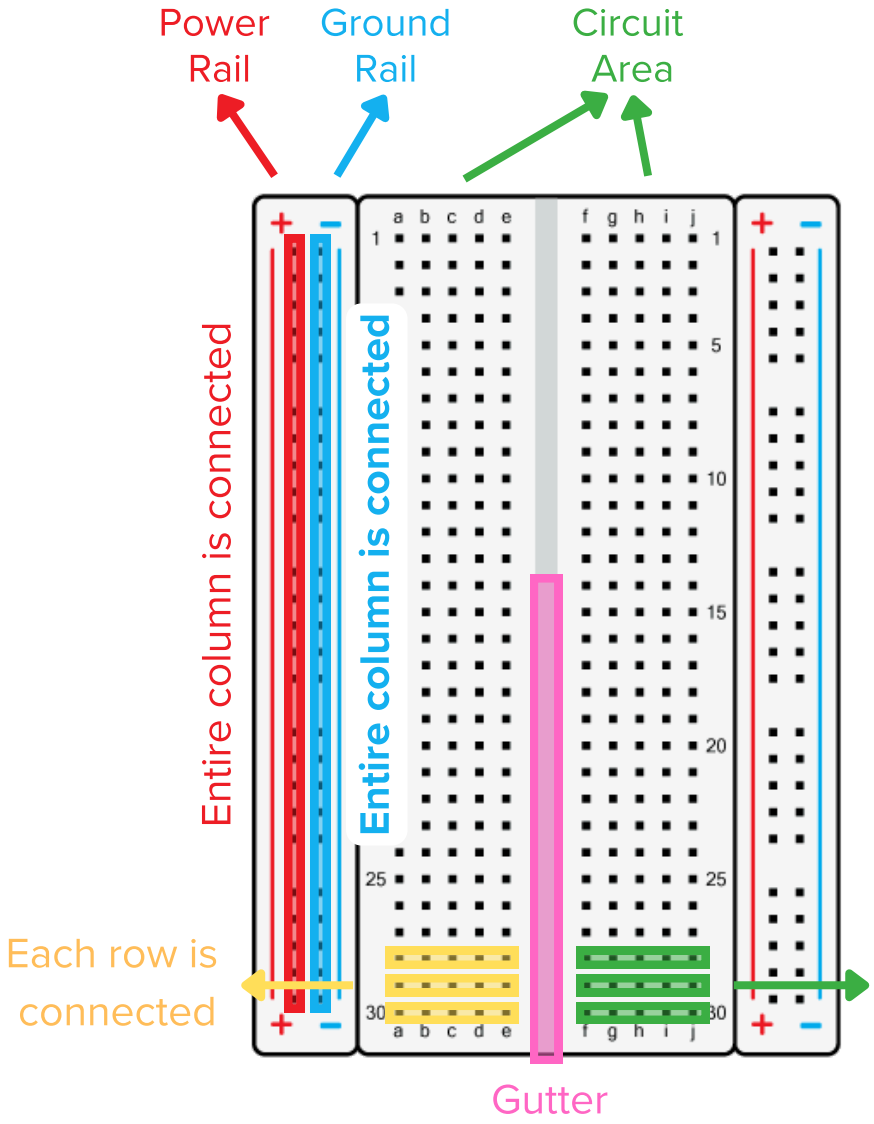
Have you ever wondered how a breadboard works or what it's useful for?

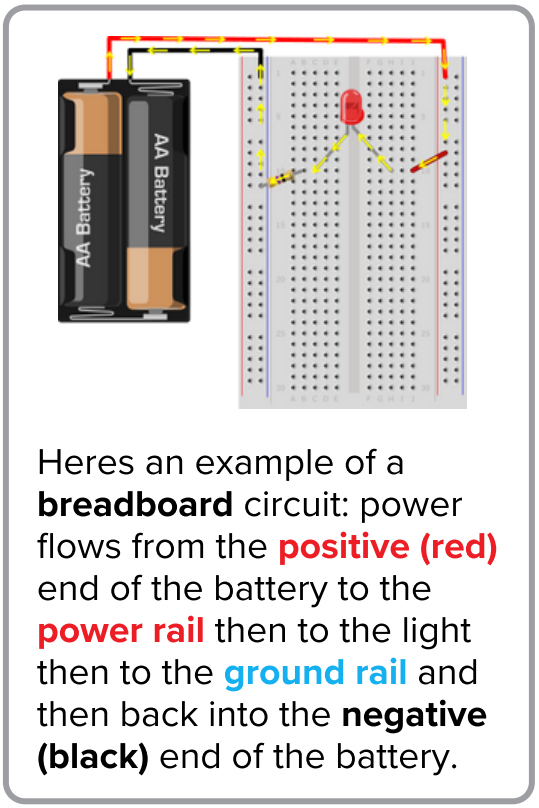
A **breadboard** is a tool used to easily connect electronic components without soldering. It lets you build circuits by simply plugging in wires and parts.

Power rail: A long row on the side of the breadboard that distributes power (+).

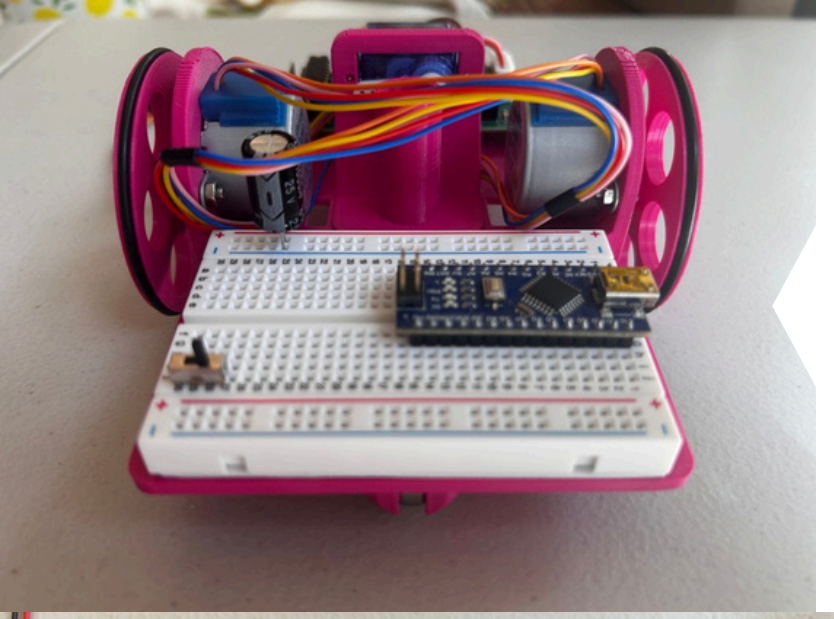
Ground rail: A matching row next to the power rail used to connect all parts to ground (-). Ground is where power flows back to, completing the circuit.

Circuit area: The middle section where you place and connect components to build your circuit.

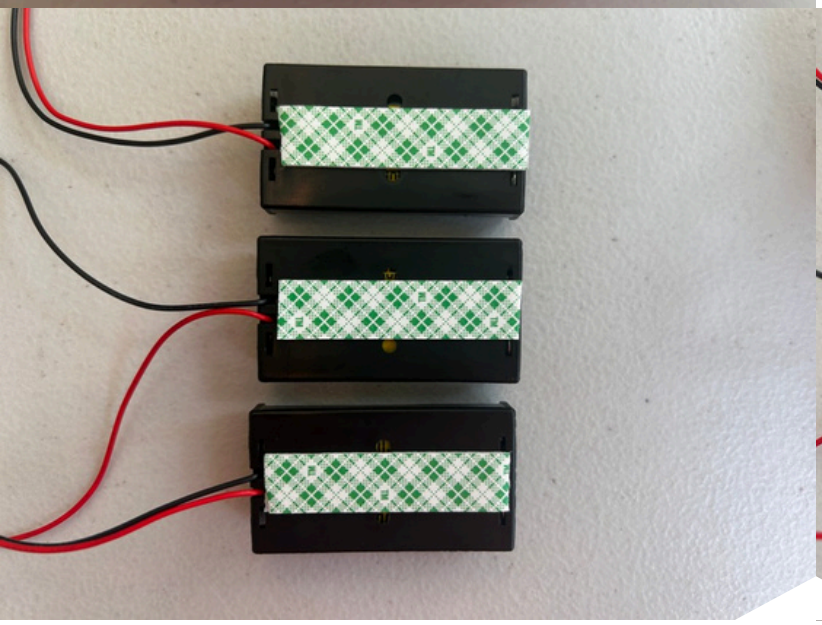


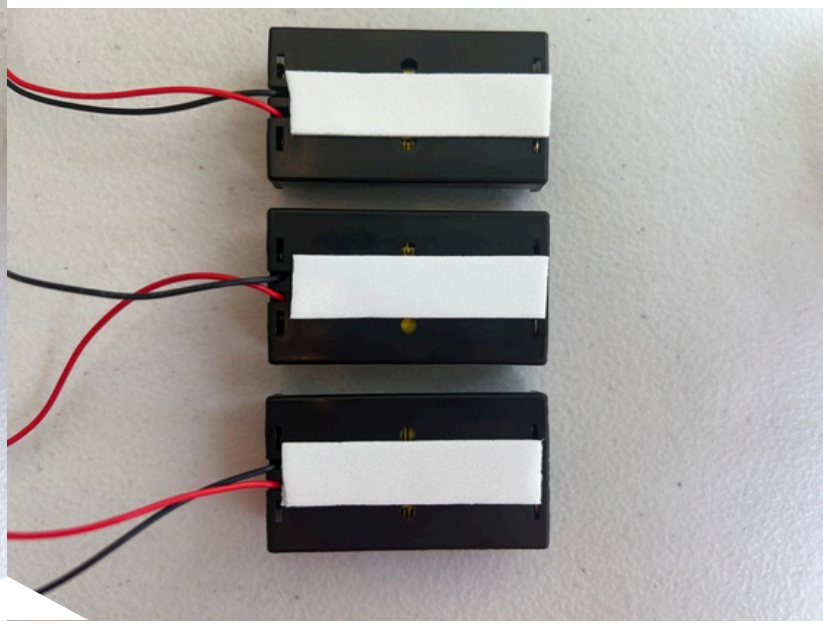


Heres an example of a **breadboard** circuit: power flows from the **positive (red)** end of the battery to the **power rail** then to the light then to the **ground rail** and then back into the **negative (black)** end of the battery.

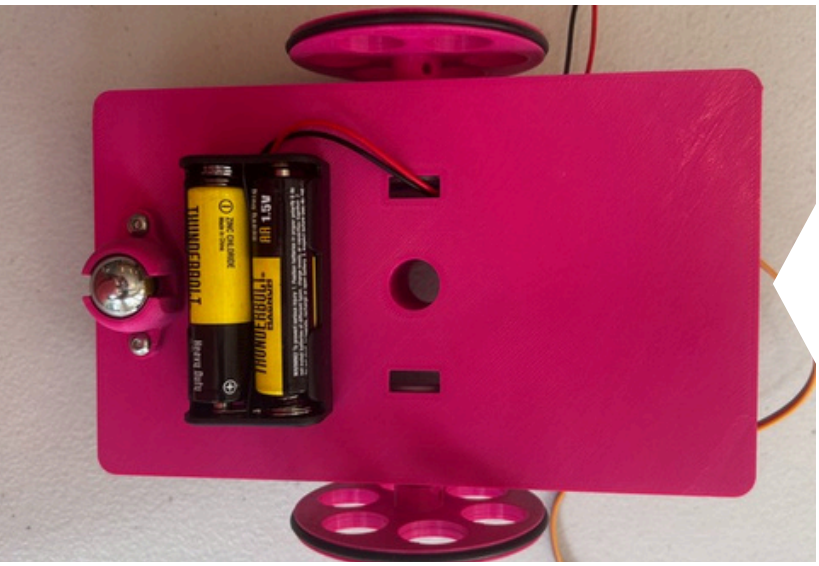


Connect the Arduino Nano, capicator, and switch into the breadboard as shown in the picture.



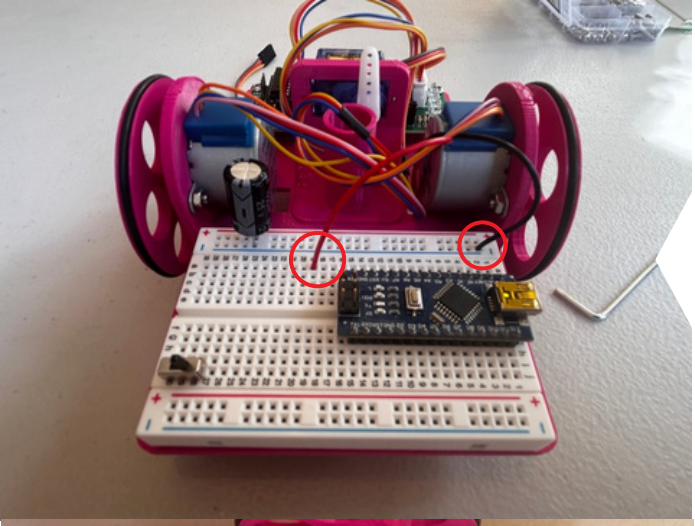


Collect the battery holders. Remove the green and white protective backing off the adhesive foam on the battery holders



Stick one of the battery packs onto the bottom of the robot chassis as pictured.

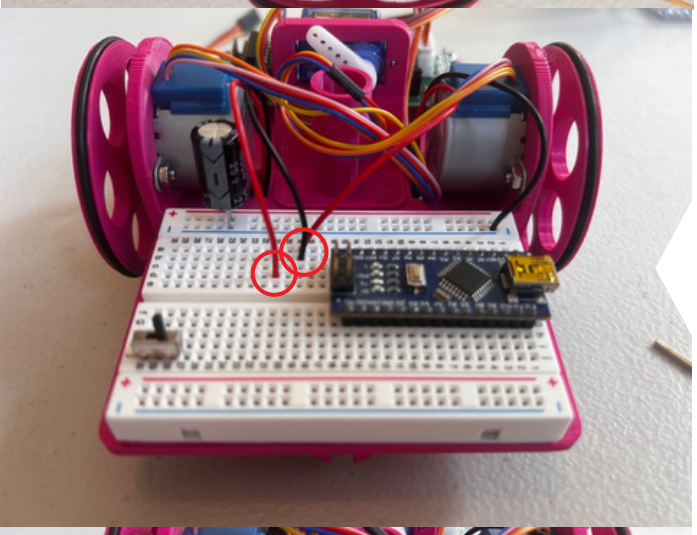
Push the red and black battery holder wires through the top rectangular hole.



Flip the robot over again. Connect the red and black battery pack wires into the breadboard as pictured.

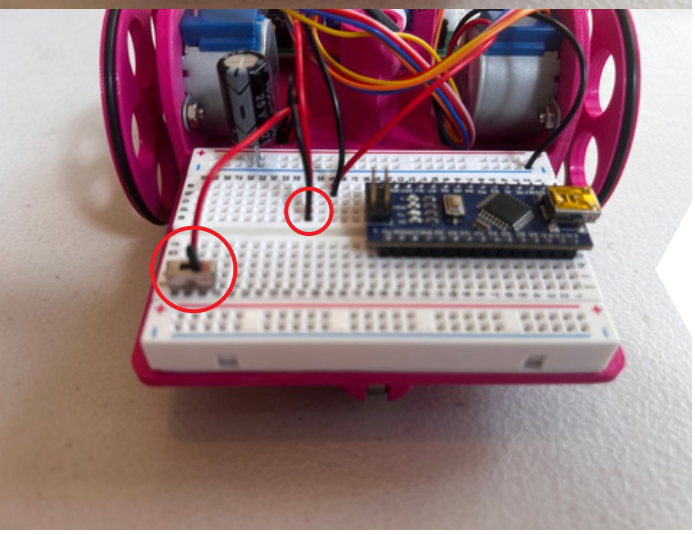
Tip: If your breadboard is not oriented the same way as the picture fix the rotation now before it gets stuck!

Attach the next battery pack onto the chassis as pictured. Thread the red and black wires through the bottom slot of the chassis.



Connect the red and black wires from the battery pack into the breadboard as pictured. Ensure the black wire is connected to the same row as the red wire from the first battery pack.

Attach the final battery pack to the right side of the previous one. Make sure the wires are pointing in the same direction (towards the bottom). Then, thread the wires through the slot at the bottom of the chassis.



Connect the battery pack wires into the breadboard as pictured. The black wire should be connected to the same row as the red wire from the second batter pack. The red wire should be connected to the middle of the switch.

Wiring

Step 5

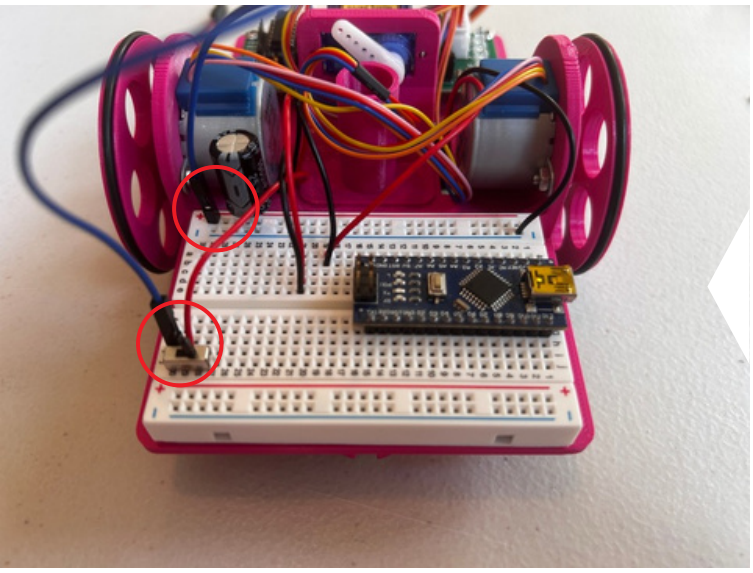
The last step to a completed robot is wiring everything together. Prepare your jumper wires and lets get wiring!

Male-to-Male Wires

Male-to-male wires have metal pins on both ends and are used to connect two things that have holes (sockets).

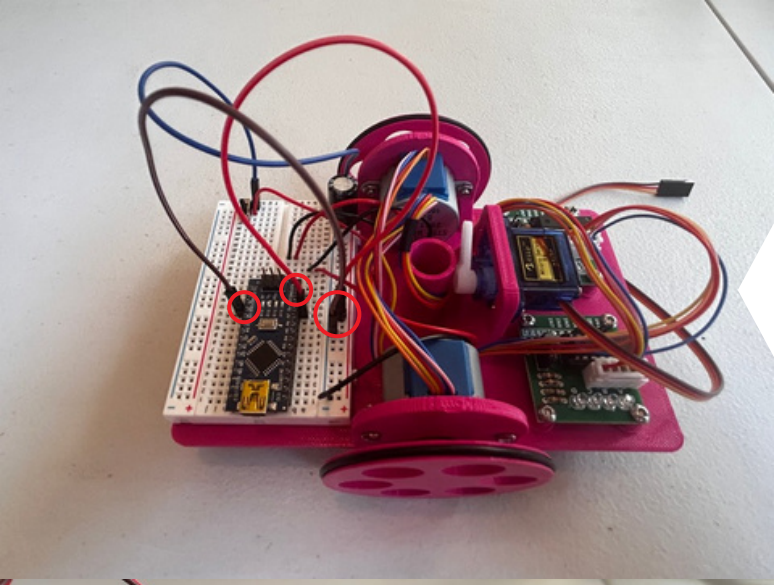
Male-to-Female Wires

Female-to-male wires have a hole on one end and a pin on the other, used to connect something with a pin to something with a socket.



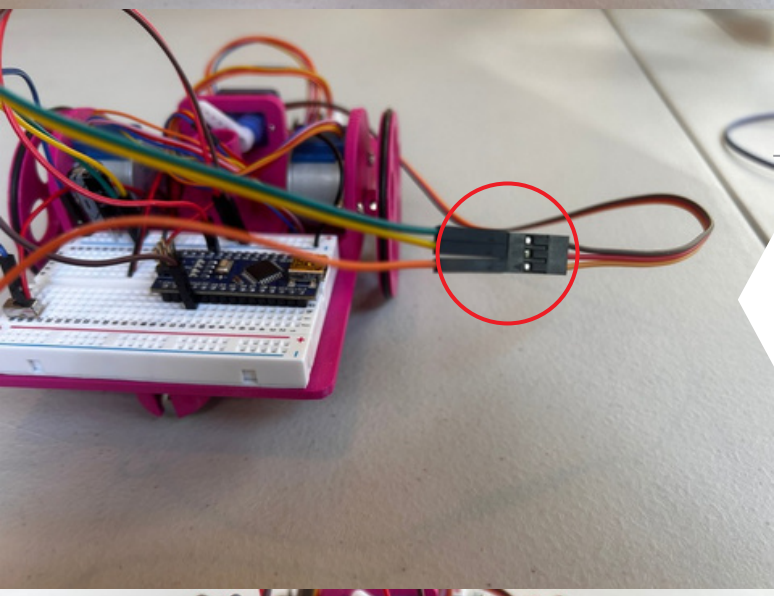
Grab a male-to-male wire. Connect one end to the left side of the switch. Connect the other end to the top power rail of the breadboard.

Tip: Your wiring does not have to look exactly the same as ours! Breadboards can work in many different ways. If you are struggling to connect a wire see if you can connect it somewhere else.

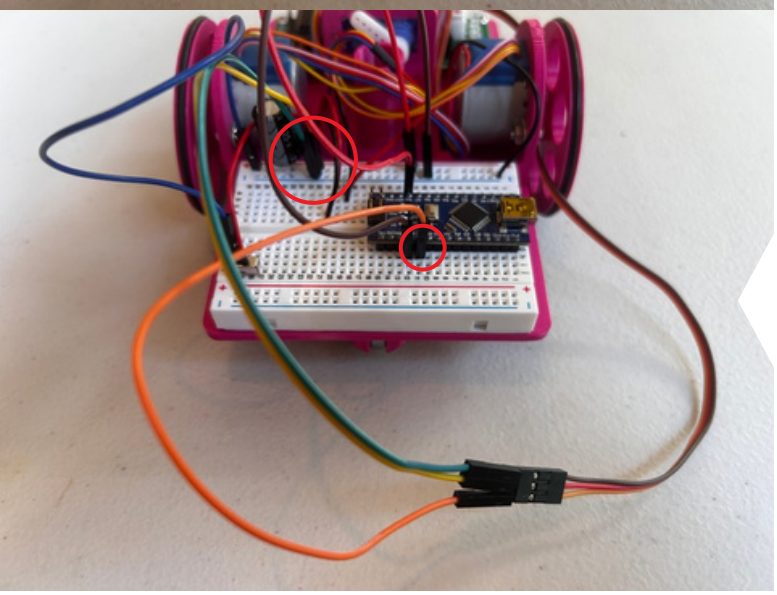


Grab two male-to-male wires. With the first one, connect one end to the ground rail of the breadboard and the other end to the breadboard hole next to where it says GND on the arduino (pictured).

Using the second wire, connect one end to the power rail and the other end to VIN on the arduino. (THE PICTURE IS INACCURATE and has the wire connected to 5v instead of VIN).



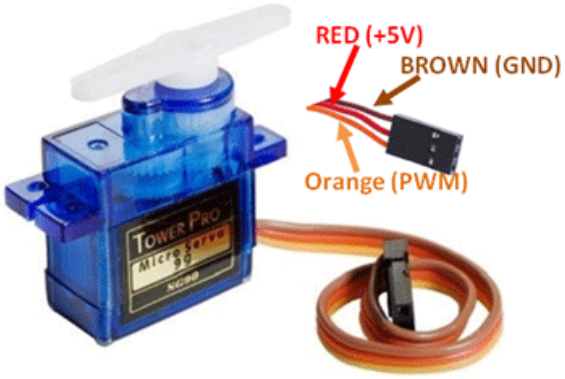
Take three male-to-male wires and connect one end of each wire to the servo wire. Make sure to remember which color wire connects to each servo wire—for example, green wire to brown, yellow wire to red, and so on.



Connect the wire that corresponds to the servo's brown wire to the breadbord ground rail. Connect the wire that corresponds to the red wire to the breadboard power rail. Finally, connect the wire that corresponds to orange to D2 on the arduino.

Servo Wiring Explained

We have now wired the servo but understanding why we connected wires where we did is very important.



“Pinout” of the SG90 Servo Motor

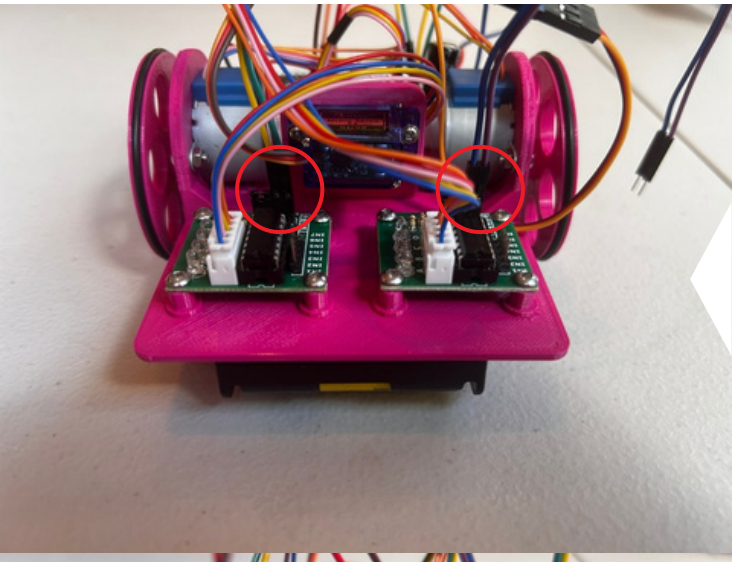
The red wire on the servo supplies power to the motor, and our motor specifically needs 5 volts to run. The brown wire is the ground, which completes the circuit by letting the power flow back. The orange wire controls the motor’s position using PWM (Pulse Width Modulation) — basically this means it sends rapid pulses that tell the motor exactly what angle to move to.

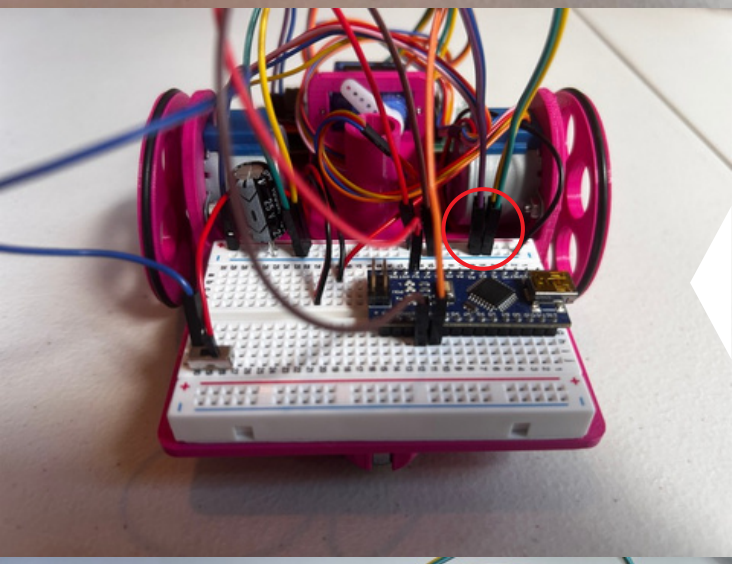
Wiring Check

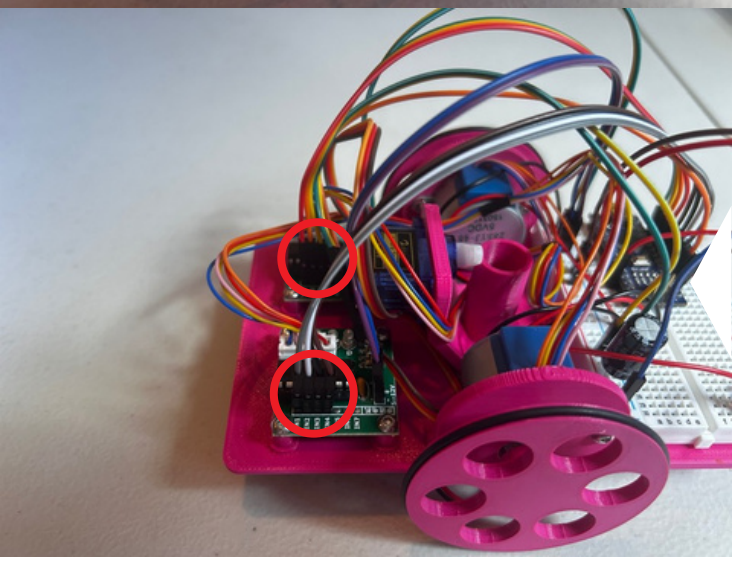
Before we keep going lets make sure your wiring is correct! Hopefully this saves a few headaches.

Coming Soon
(software blocked by it)

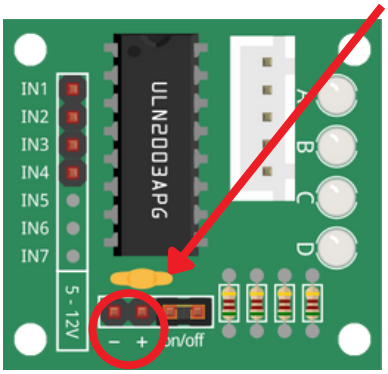
More Wiring





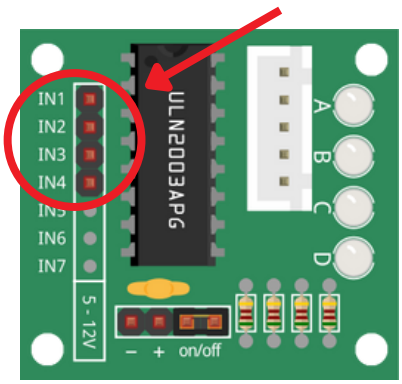


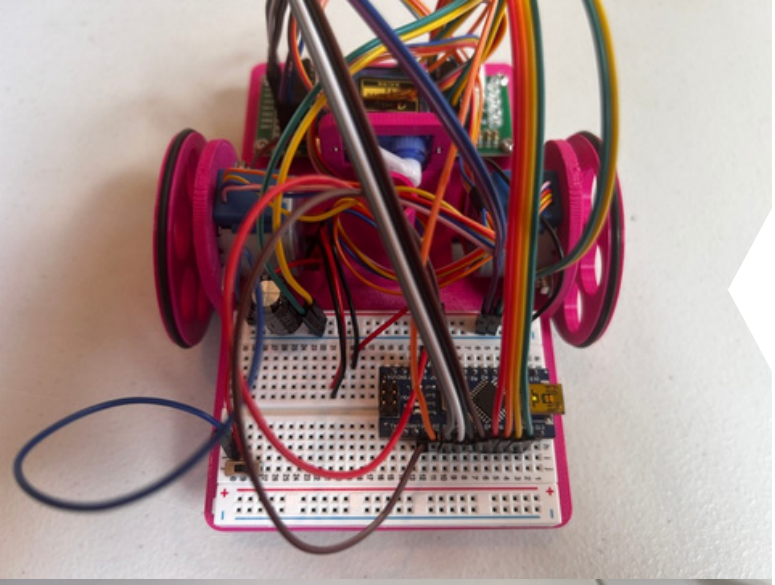
Grab 4 male-to-female wires. Connect the side of each wire with a socket to each one to the pins on the stepper driver boards labled with a “-” or “+”.



Connect the other end of the wires connected to the “-” pins to the ground rail of the breadboard. Connect the other end of the wires connected to the “+” pins to the power rail of the breadboard.

Grab the remaining 8 male-to-female wires. Connect the side of each wire with a socket to the pins onthe stepper driver board labled IN1-4.

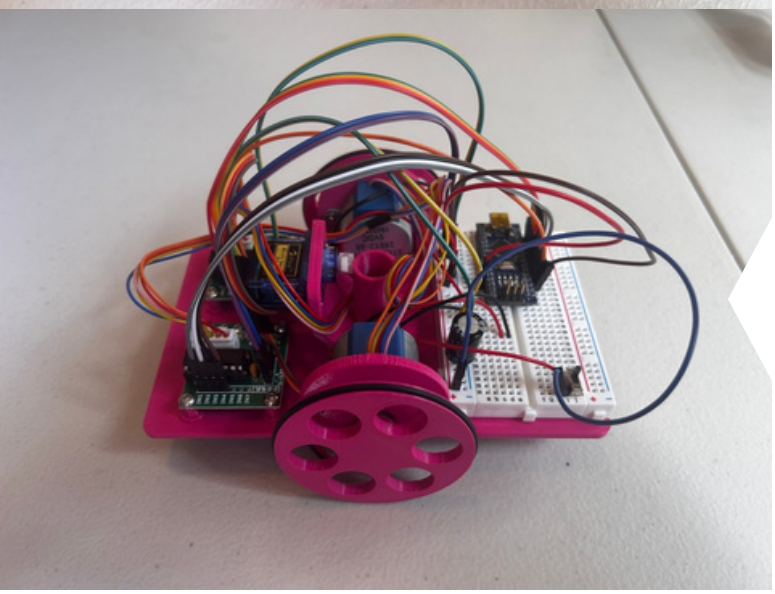




Starting with the left driver board. Connect the wire connected to IN1 to D6 on the arduino, connect IN2 to D5, IN3 to D4, and IN4 to D3.

With the right driver board. Connect IN1 to D7, IN2 to D8, IN3 to D9, IN4 to D10.

Tip: Use the picture to help



You have completed assembling this RISE kit, congratulations!

Check your wiring before proceeding to the next section.

Wiring Check

Before we can start programming lets make sure all the wiring is correct.

Coming Soon
(software blocked by it)

Programming