

## CamJam EduKit #3 - Assembly Instructions

**Due to the use of power tools and knives, adult assistance is required**

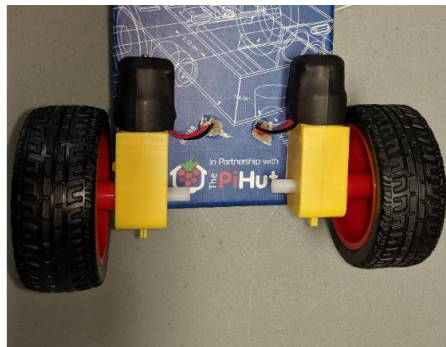
### Materials and Tools Needed

- CamJam EduKit #3
- Raspberry Pi
- Raspberry Pi Power Supply
- 4 AA batteries
- Velcro
- Drill with 1/4" and 7/16" drill bits
- Scissors
- Sharp knife/ box cutter
- Measuring tape/ Ruler
- Small Phillips screwdriver

1. Drill 7/16" hole that is 2 1/8" from the front of the box, centered with the side walls. Trim loose paper and board using a sharp knife to ensure hole is clear. This is for the optical line sensor.



2. Drill two 1/4" holes in the box bottom for the motor wires as shown below. Cut 1 piece of 3M tape into 2 equal pieces and apply to the two motors. Adhere the motors to the box bottom and route the wires through the holes. Press the wheels onto the motor shafts. Ensure the wheels are not rubbing on the box.



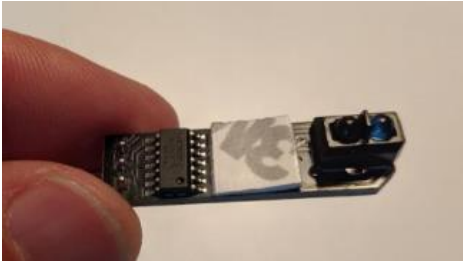
3. Apply 3M adhesive tape to plastic housing for the steel ball. Trim excessive tape.



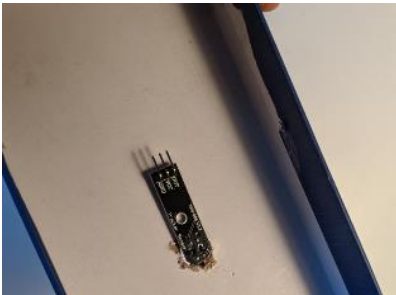
4. Apply steel ball assembly to the box bottom over the 2<sup>nd</sup> “o” in the “Robotics” label. The center of assembly will be approximately 7/8” from front of the box, centered side to side.



5. Cut 3/8” x 3/8” piece of 3M tape and apply to optical sensor over hole in circuit board.



6. Peel and stick optical sensor to box bottom so that sensor is in the hole and circuit board pins point directly to back of box.



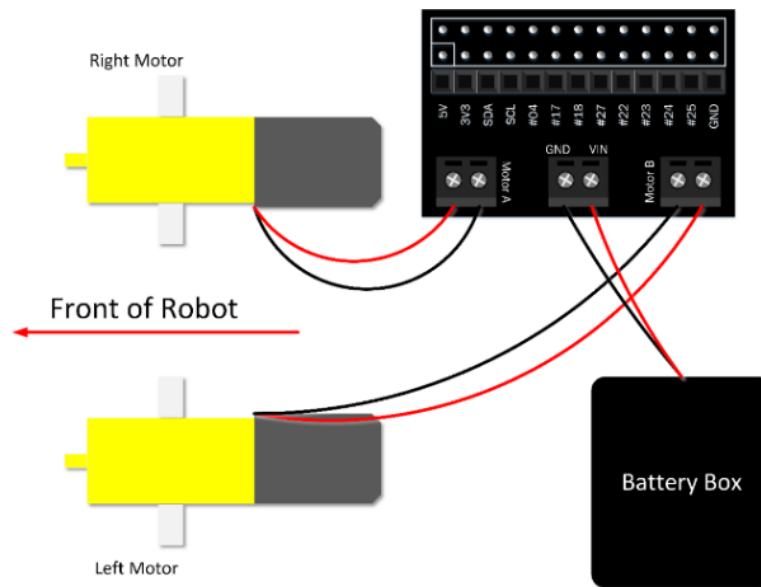
7. Install 4 each of AA batteries in battery box and turn switch “OFF”.
8. Cut 2 each of 1” long mated Velcro.
9. Apply Velcro to battery box on the side which has “OPEN”. Ensure there is at least 1/2” gap between the Velcro pieces.



10. Peel and stick battery box Velcro so the box's front is against the front of the robot box, approximately centered. Peel stick red breadboard onto battery box so it is against the front of the robot box, centered. Ensure longest dimension of the breadboard is against the robot box.



11. Insert the wires from the right motor into the "A" terminals and the wires from the left motor into the "B" terminals on the motor controller board. It is not important which motor wire goes into a specific terminal at this point since the red/ black colors do not guarantee a motor direction. This will be fixed later. Using a Phillips screw driver, tighten the screws onto the wires. See diagram on next page for layout.

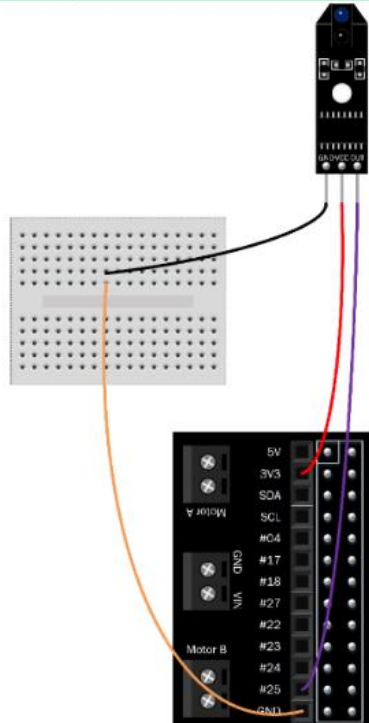


*Connecting the Motors and Battery Box to the EduKit Motor Controller Board (looking from the top)*

12. Insert the battery box red wire into the "+" terminal and the black wire into the "-" terminal on the motor block. (diagram above is from another generation, and it shows "GND" & "VIN", instead of "-" & "+", respectively). Tighten screws.

13. Connect optical line sensor per diagram. As a note, breadboard is red, not gray and wires will not be the same colors as shown.

**Note:** Please be very careful when you connect up your line sensor as connecting it up incorrectly can damage the sensor.



Use the three female-male jumper wires for all of the connections between the line follower and the motor controller board and breadboard. The male-male jumper connects between the ground of the controller board and the breadboard.

Connect the 'GND' (meaning ground) pin of the line sensor to the breadboard, and the breadboard to the ground of the EduKit Controller Board.

Connect the 'VCC' (meaning voltage+) pin on the line sensor to 3V3 (3.3 volts) on the EduKit Controller Board.

Lastly, connect the 'OUT' pin of the line sensor to GPIO pin 25. This pin will be used as an input pin and will get a reading from the line follower.

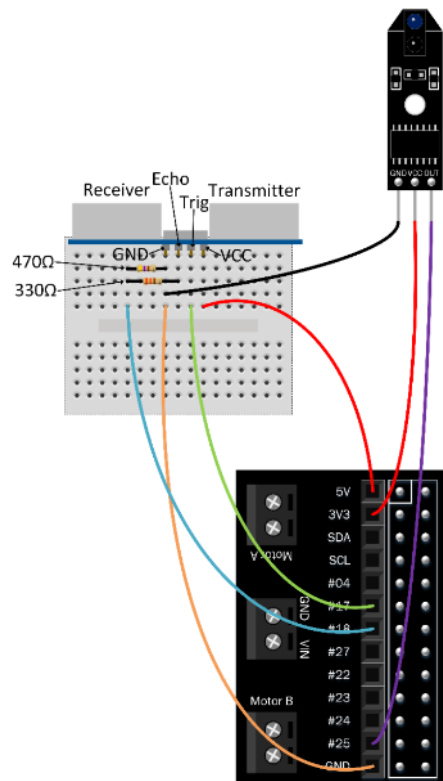
#### 14. Connect ultrasonic distance sensor.

##### HR-SC04 Ultrasonic Module



The HR-SC04 Ultrasonic Sensor module is used to detect the distance from the sensor to a surface.

The diagram below shows the HR-SC04 sensor plugged into the board, as well as the line follower on the right.



Push the ultrasonic sensor into the holes on the breadboard, with the pin marked GND in the same column as the jumper wire that goes to the ground of the EduKit Controller Board.

Bend the legs of the two resistors and place them in the breadboard as on the diagram. Ensure that the correct resistors are placed in the right position. The 330Ω resistor (orange-orange-brown) goes between the Echo pin of the sensor and an unused column of the breadboard. The 470Ω resistor (yellow-purple-brown) goes between that same column and the ground (GND) pin. Then connect the breadboard column to socket 18 of the EduKit Controller Board.

Connect the row with the sensors' VCC connection (red wire in the diagram) to the EduKit Controller Board's 5v socket. The sonar module requires 5v to run.

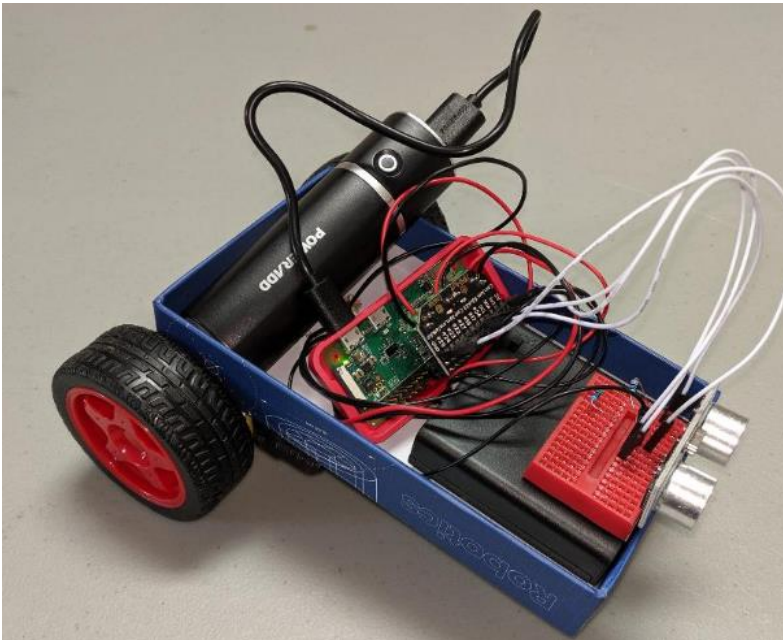
Connect the column with the sensors' trigger (green wire in the diagram) to the EduKit Controller Board's socket marked #17 (The Pi's GPIO pin 17).

**Remember:** the echo pin of the sensor module is connected to the Raspberry Pi GPIO with resistors and ground because the module uses a +5V level for a "high", but this is too high for the inputs on the GPIO header, which only likes 3.3V. In order to ensure the Pi only gets hit with 3.3V you use a basic "voltage divider" formed with the two resistors.

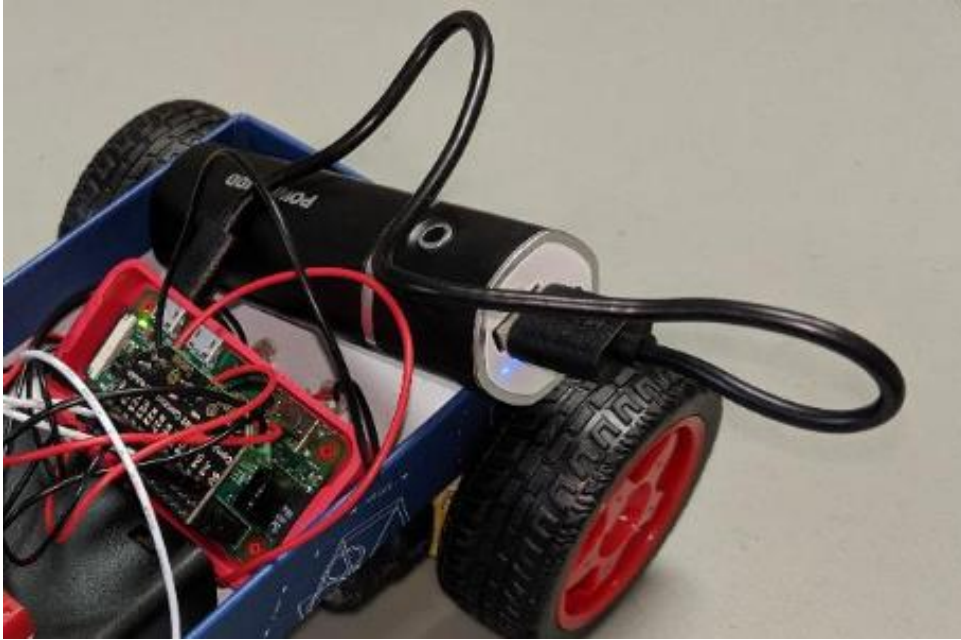
15. Plug Raspberry Pi into the motor controller board.



16. Plug cylindrical power supply into Raspberry Pi.



17. Turn on power supply by pressing small button on the cylinder side until the blue indicators on the top light up.



18. Slide the AA battery box switch to "ON".



The CamJam EduKit #3 is now assembled and powered up!