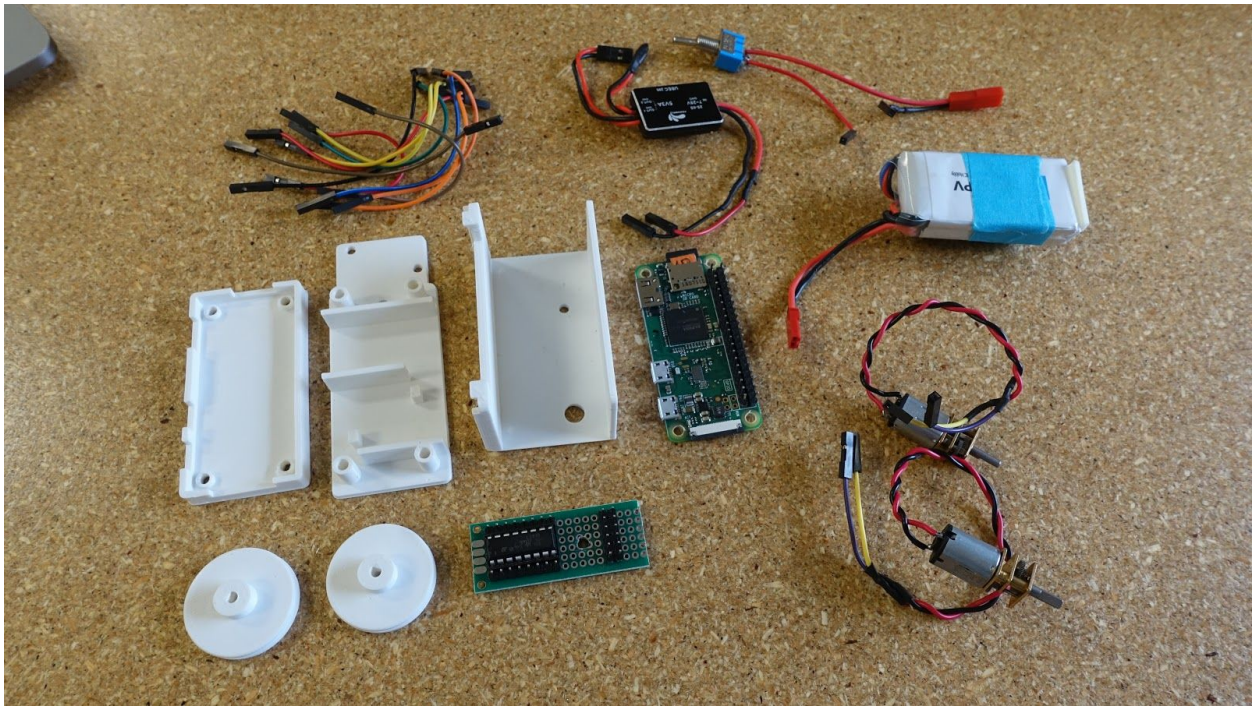
LoisLab

MiniBot assembly guide

Here's a quick run-through of the assembly process for the MiniBot (aka 'Bob'). This isn't a exhaustive step-by-step guide, but it should provide you with the details you need to put one together. As always, you can reach us at jeff@loislab.org or michael@loislab.org if you get stuck.

Here are the parts:



Bill of Materials

Item	**Source**
3D printed plastic parts (see below)	print them!
A Raspberry Pi Zero W	Adafruit, Micro Center
A 5v battery elimination circuit (BEC) from an RC vehicle	Amazon ~ $5
An assortment of short female-to-female dupont wires	Amazon
Two N20-size DC motors, 12v/200rpm or so	Amazon, Aliexpress
A small (250-1000 mAH) 2-cell 7.4v lipo battery	Amazon, Hobbyking
M3 hardware (4) M3x25mm bolts (1) M3x14mm bolt (1) M3x8mm bolt (7) M3 nuts	Amazon, local hardware store
Toggle switch for a 6mm mounting hole	Amazon

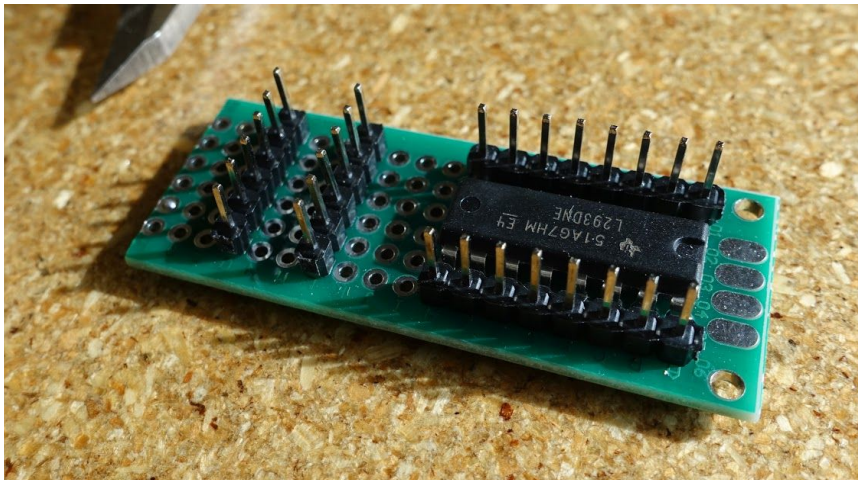
Motor controller board, made from:

2cmx8cm protoboard	Amazon
L293D H-bridge chip	Adafruit, Amazon
Header pins	
8-pin DIP chip socket	
Assorted wires, solder, soldering iron, drill	Beg, borrow, don't steal

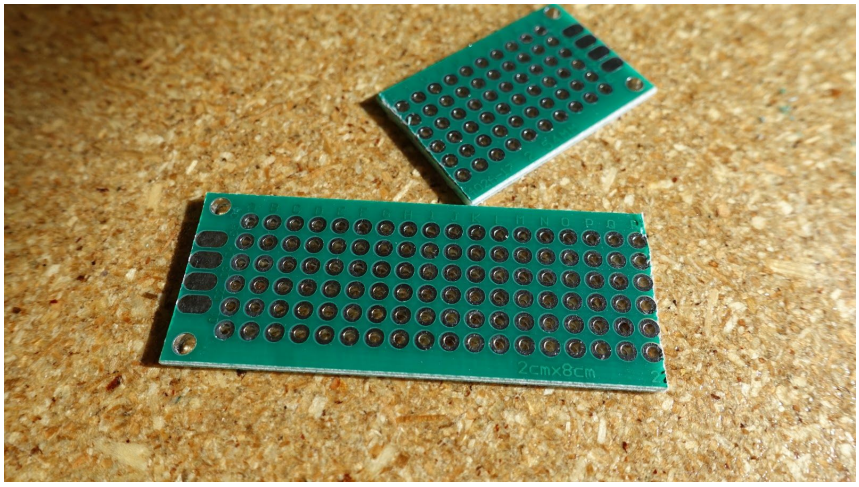
Download and print the white plastic parts - you can find them on our github as part of the MiniBot repo. They're in the STLs folder and are all printable without support material.

The Motor Controller

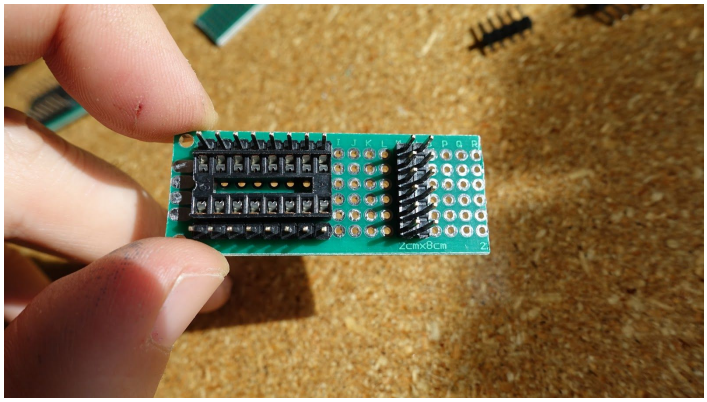
Before we assemble the robot, we need to construct the circuit board that holds the motor controller chip.

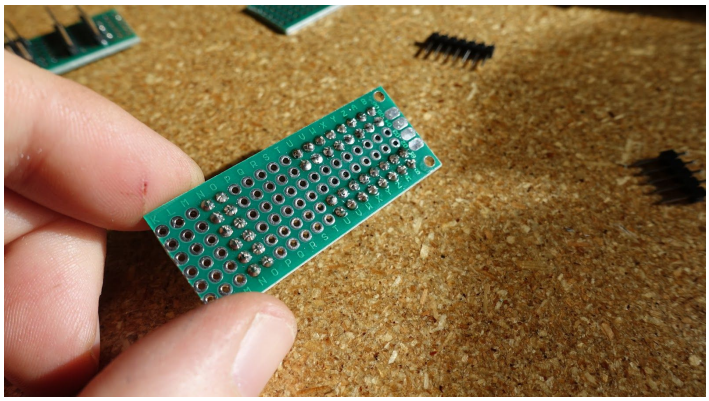


Start by scoring and snapping the protoboard to give you a piece that is 20mm wide and 50mm long:

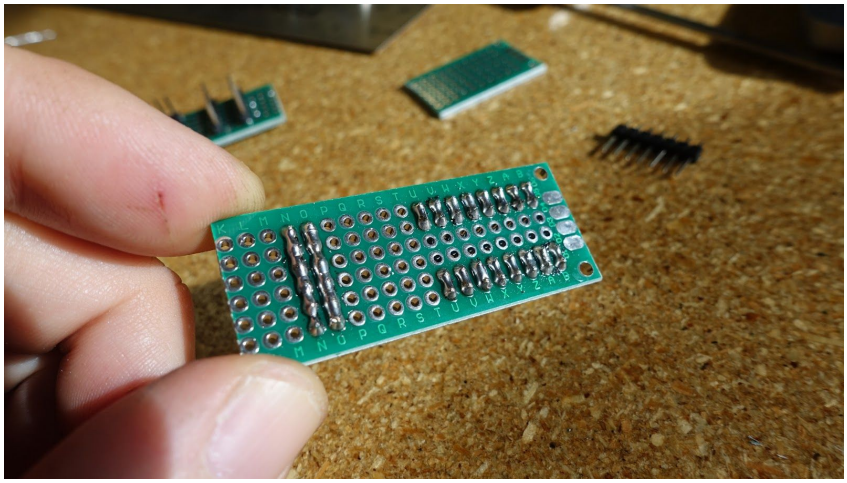


Line up the chip socket and pins, and use a piece of tape or your finger to hold them in place while you solder. Parts get hot, be careful.

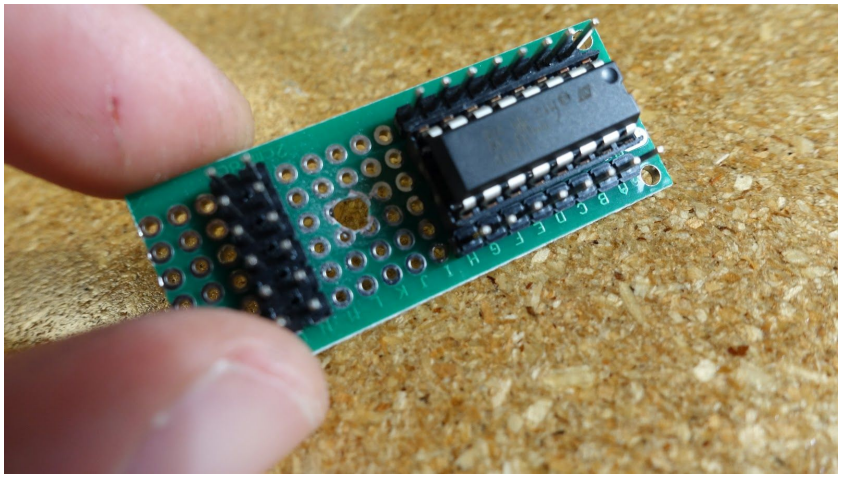




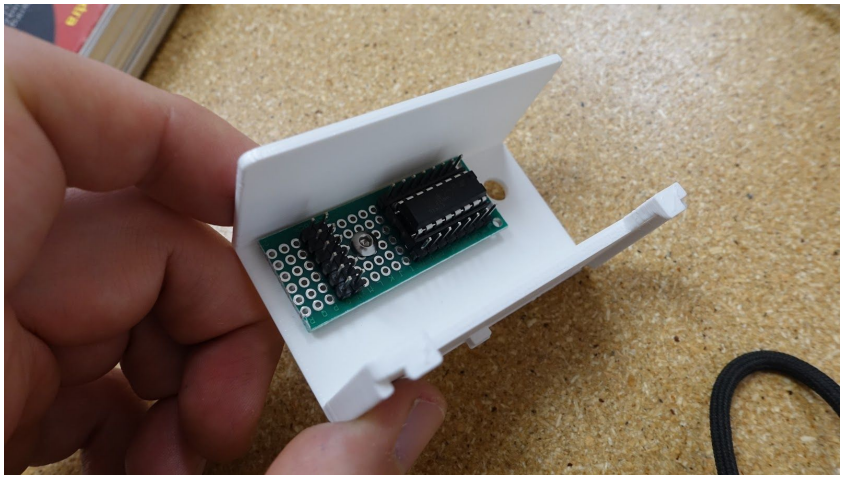
Once the pins are all soldered, carefully bridge each socket pin to the header pin next to it. If you're not a confident solderer, or you have trouble, you can use a little piece of wire to make the connection and then solder that in place.



Gently press the chip in place. The marking for pin 1 (an indentation, on this chip) should be at the end of the board. Hold the board up to the U-shaped board carrier plastic part and mark where you want the mounting hold to go. The exact location isn't critical, but I like to place the hole so the board will rest against one of the overhangs and be held in place as shown in the last photo.



The board installed:

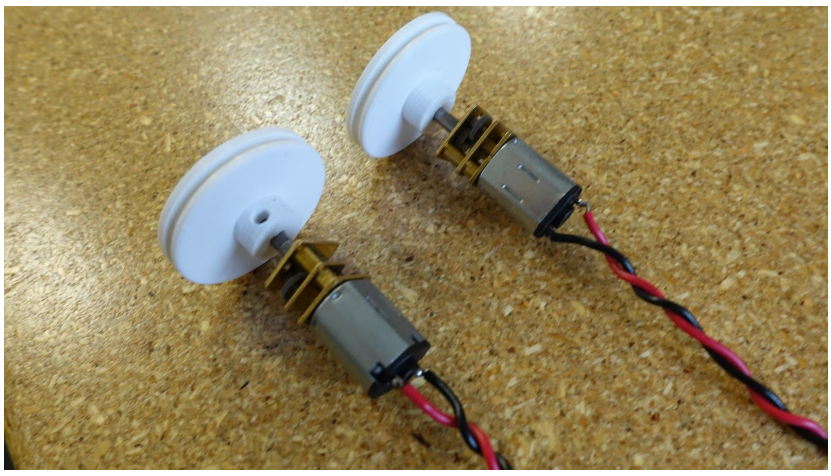


Assembling the MiniBot

The robot is essentially a sandwich of three sections that hold the motors and Raspberry Pi contained together.

Start by pressing the wheels onto the motor shafts. If it is difficult to get them started, make sure the openings are clear using pick or the tip of a hobby knife. You can heat the motor shafts gently with a soldering iron to deform the plastic around the shafts slightly, but be careful as too much heat might result in the wheels sitting off-axis and wobbling.

Cut a couple of the dupont wires and solder them onto the motors so you can plug them into the motor controller board. If the motors are marked with (+) or (-) terminals, you can get the colors to match between the motors when you solder the wires on; it might make your job easier later on.

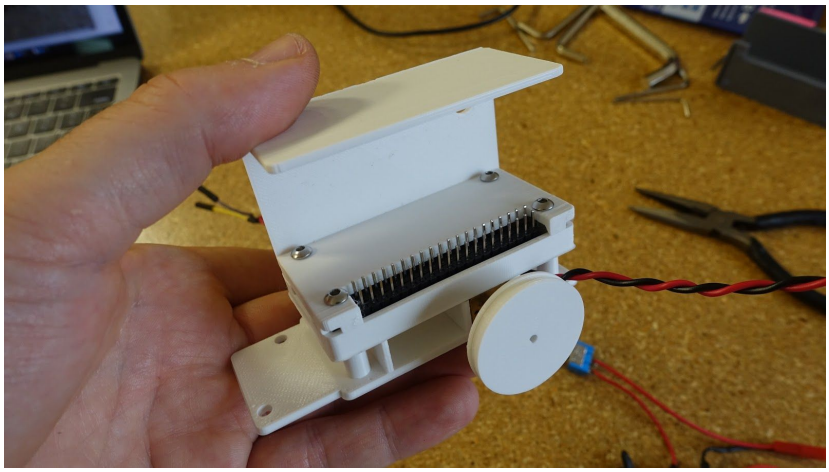


Set the motors in opposing directions in the motor carrier board. Retention pegs will rest against the rear of each motor to locate them properly; the gearbox plates should sit flush with the outer edge of the motor carrier part.

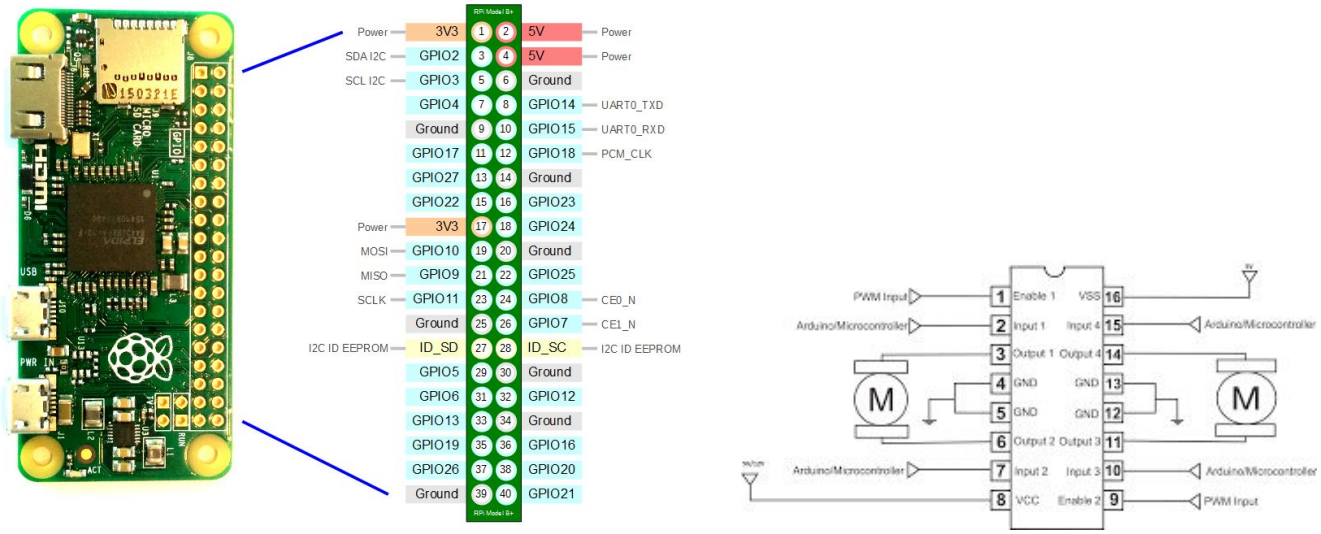
[PIC]

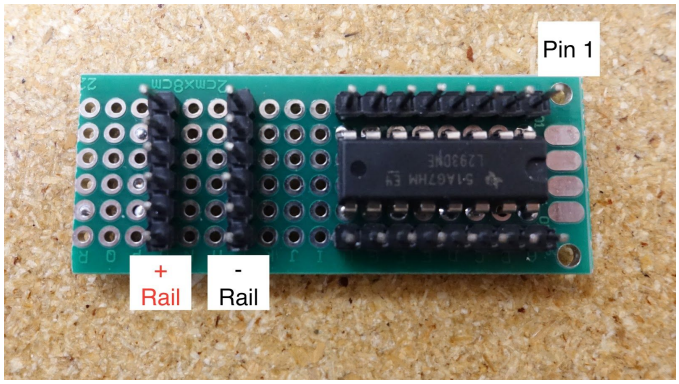
Place the Raspberry Pi in its carrier.

Using the (4) M3x25mm bolts to align the parts, stack the motor carrier, Pi carrier, and motor controller carrier together and tighten nuts under the frame.



Using the following reference pinouts, wire up the connections between the Raspberry Pi and the motor controller.





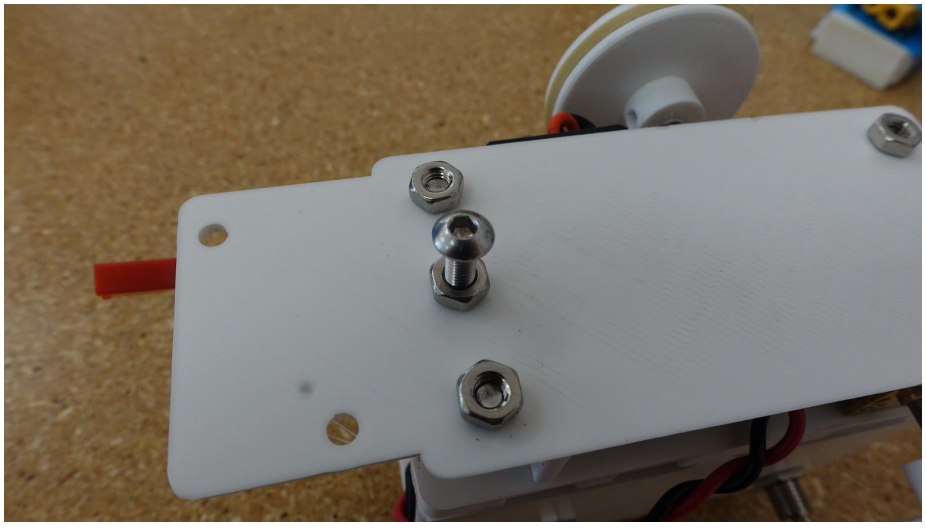
Motor driver pin	Connects to
#1	Pi pin 7
#2	Pi pin 3
#3	motor #1 (+)
#4	- rail
#5	not connected
#6	motor #1 (-)
#7	Pi pin 5
#8	+ rail
#9	Pi pin 15
#10	Pi pin 11
#11	motor #2 (-)
#12	- rail
#13	not connected
#14	motor #2 (+)
#15	Pi pin 13
#16	Pi pin 2

Battery connector	Connects to
7.4v +	+ rail
7.4v -	- rail

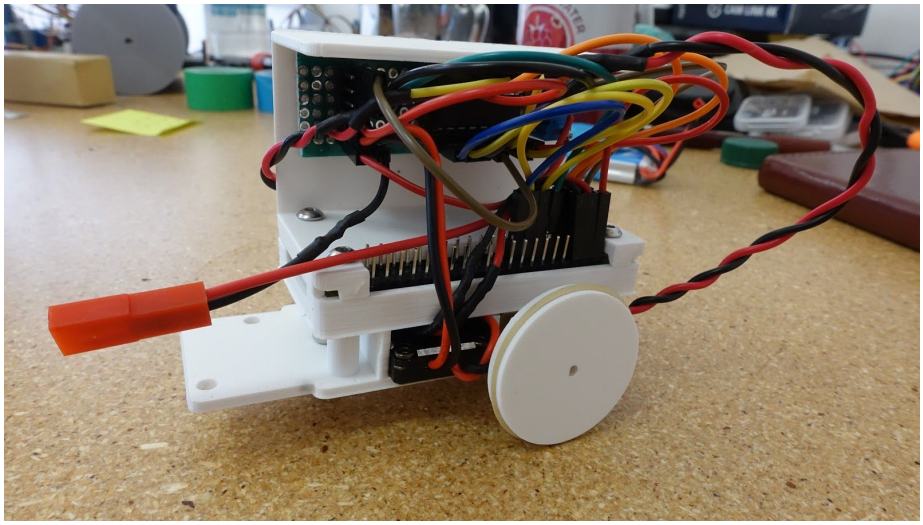
BEC	Connects to
BEC + input	+ rail
BEC - input	- rail
BEC output	Pi pin 4
BEC output	Pi pin 6

Optionally, you can wire the switch so it is between the LiPo + battery connection into the + power rail. This is a nice feature to keep the battery from running down when the robot is not in use.

Use a 14mm M3 bolt as the front ‘skid’ or third wheel. Put one nut on the bolt, slide it into the hole on the bottom of the chassis, and hold it in place with the other nut.



Here is the completed bot.



Configuring the software

Boot the Pi Zero W with the latest Raspbian image.

Clone the MiniBot software repo with the following command:

```
git clone https://github.com/LoisLab/MiniBot.git
```

Trying out the MiniBot

Log in to the Pi.

Go to the directory where you cloned the repo. In our case:

```
cd ~/MiniBot
```

Start up the web service that listens for commands:

```
sudo python3 webbot.py
```

You can now give the little robot commands using a web browser. For example, let's say your robot is joined up to your wireless network and has an IP address of 192.168.0.199, you could make it move by putting the following URL in your browser:

```
http://192.168.0.199/action=0
```

The service accepts eight action commands (0-7). Have fun playing with it.

As always, you can reach us at jeff@loislab.org or michael@loislab.org if you get stuck, or just to tell us stories about how you've been using it.