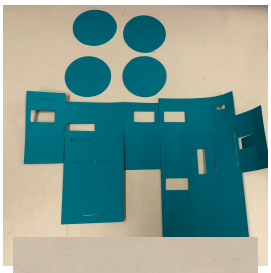
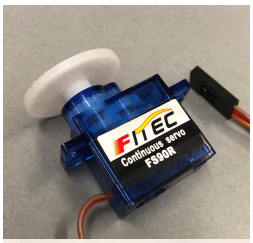
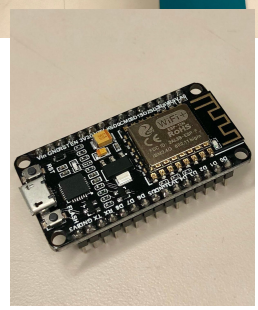
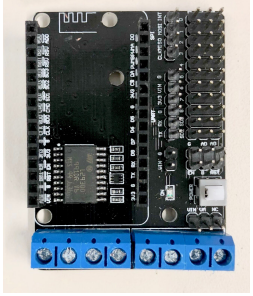
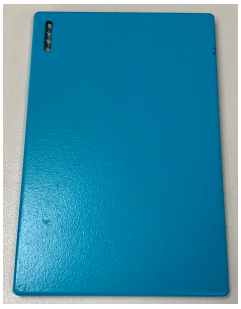
Required Materials

These are all the parts included in this kit to build your robot:

1. 2D paper cutout of robot
2. 4 paper wheels
3. 2 continuous micro servos
4. NodeMCU Amica DevKit board (ESP8266 chip)
5. Motor Shield for NodeMCU
6. Battery
7. Micro USB to Micro USB cable
8. USB to Micro USB cable

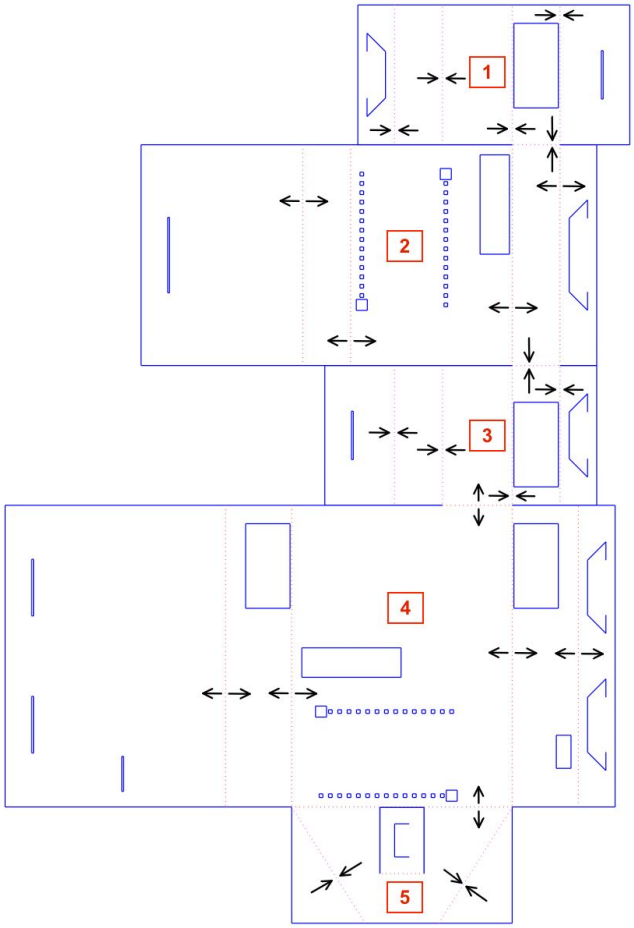

These are the tools you will need to build this robot:

1. Glue stick
2. Screw driver
3. Tape (optional but helps with sturdiness)

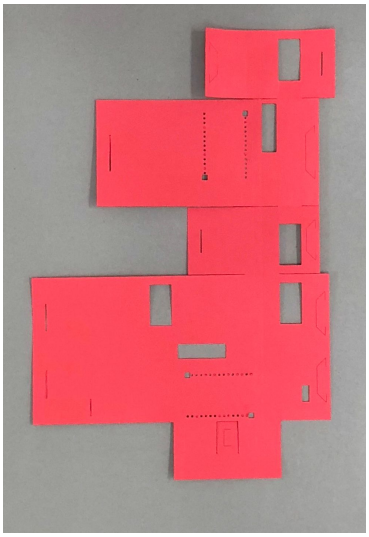
Instructions for building the paper robot car

Guide for Folding

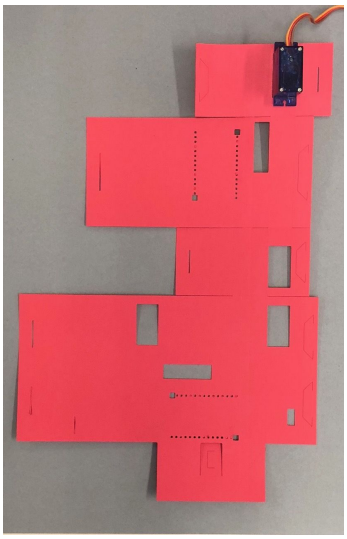
If the arrows on a dotted line point towards each other, fold the paper upwards, bringing both sides of the paper toward you. In origami, this is called a “valley fold” because from your view, the paper should be making a valley. Likewise, If the arrows are pointing away from each other, fold downwards pulling the two pieces of paper further away from you. In origami, this is called a mountain fold because from your view, the paper should look like the peak of a mountain. Below is are step by step instructions on how to build this paper car, but if at any point you get confused about which way to make a fold, refer back to this image to know the right fold.

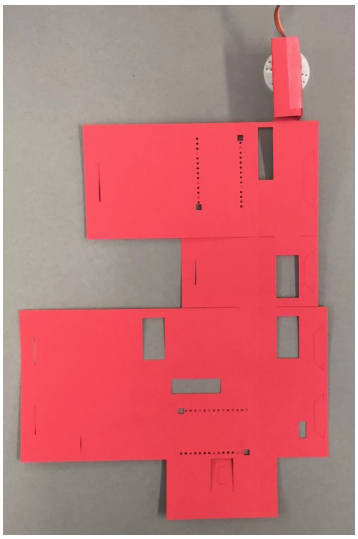


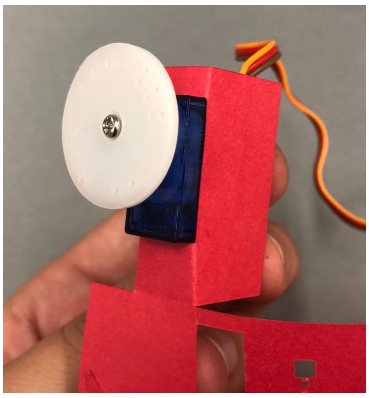
Wheel Motors



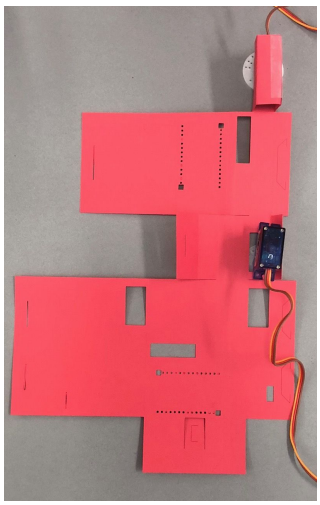
1. Orient the blueprint as shown
2. Remove the plastic wheel from the micro servo so you are less likely to rip the paper cut out throughout building this robot.
3. Place a micro servo through the rectangular hole cut out of box 1. Make sure the micro servo is placed so the wires go up, away from the paper cutout.
4. Fold box 1 around the micro servo inserting the tab into the slit to hold it all together. At any point during this process, use tape to hold the folds together even better.

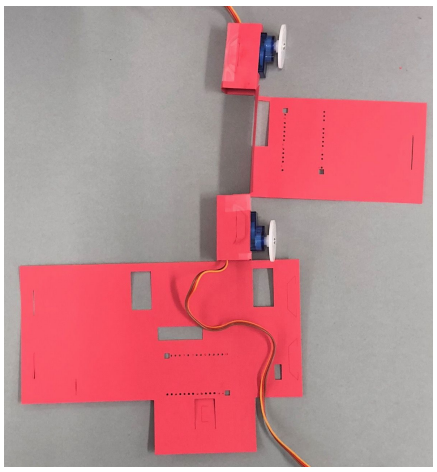






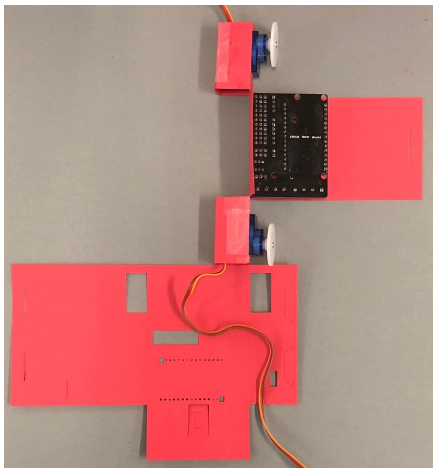
5. Repeat this process for the second micro servo that goes in box 3. Make sure the wires go down, opposite from the first micro servo, like in the picture.

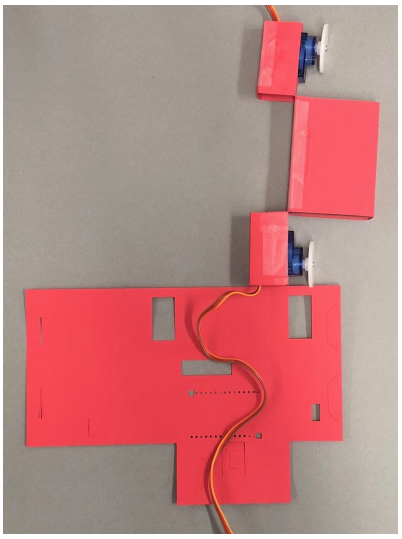




Motor Shield

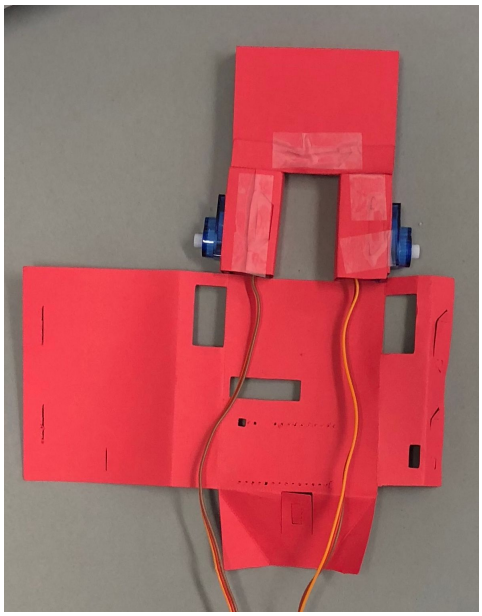
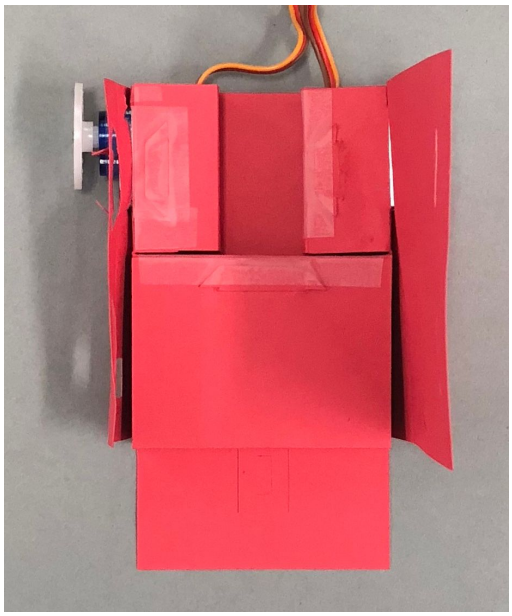
1. Bring box 2 around to the right hand side if you haven't already.
2. Place the motor shield so that the part with row of pins 3 pins wide and 11 pins long lines up with the hole cut out.
3. Fold box 2 around the motor shield, folding the tab into the slit.



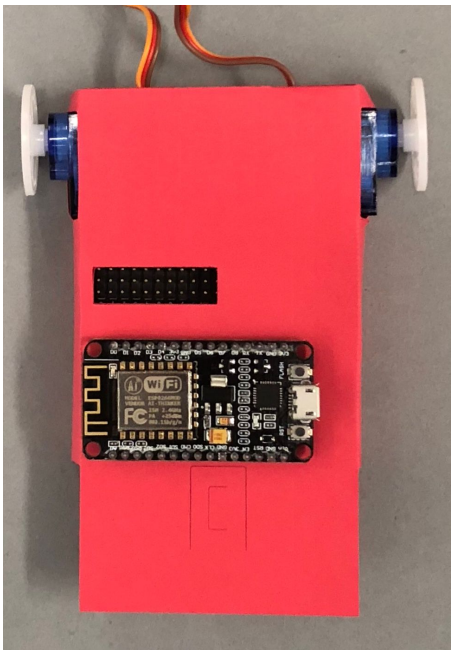


Putting it All Together

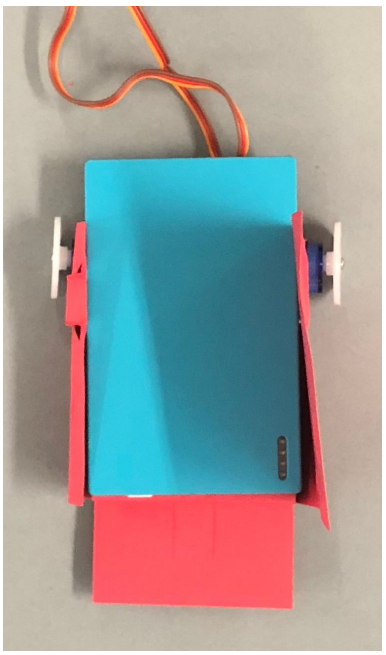
1. Curl the micro servos and motor shield to the left so the micro servos are both touching the edge of box 5 and the wires are going downwards in the same direction.
2. Bring the micro servos and motor shield under box 5 and put the micro servos through the rectangular holes on box 5. (The image show in the bottom side of the robot)

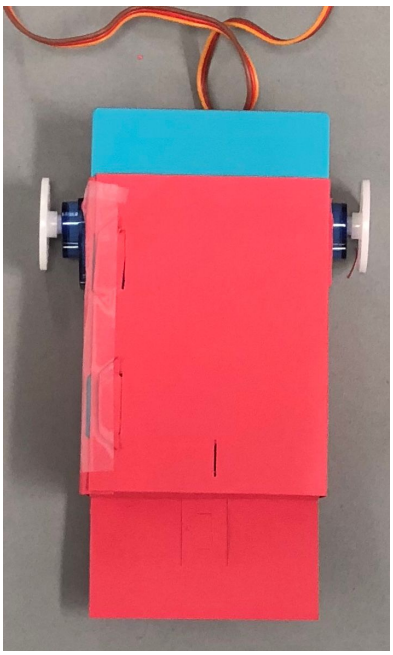



3. The microcontroller can be put in the motor shield at any point now, but it is easiest to put it in at this point because you can see where the pins need to go in on the motor shield. Put the micro controller in so the power input is further from the edge.

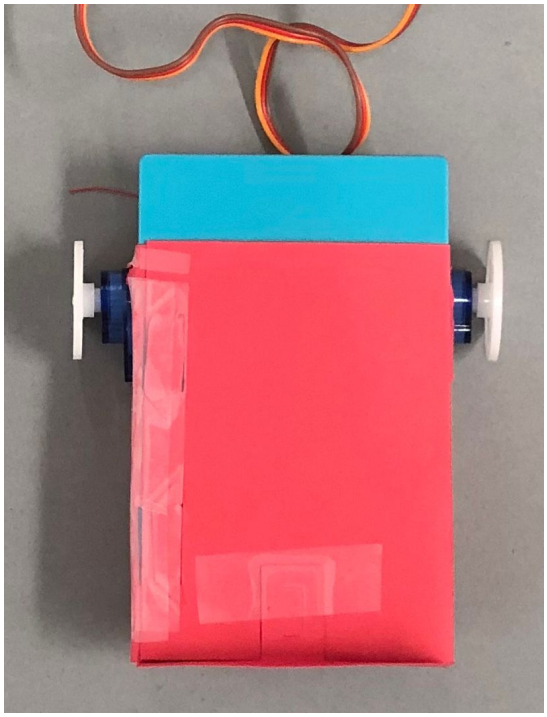


4. Flip the car over fold, put the battery in, and fold the flap down, inserting the tabs into the slits. This is easiest done without the battery inserted, but also use caution when sliding in the battery later. Make sure the power port is on the side of the robot opposite the micro servos, on the same end as the microcontroller.



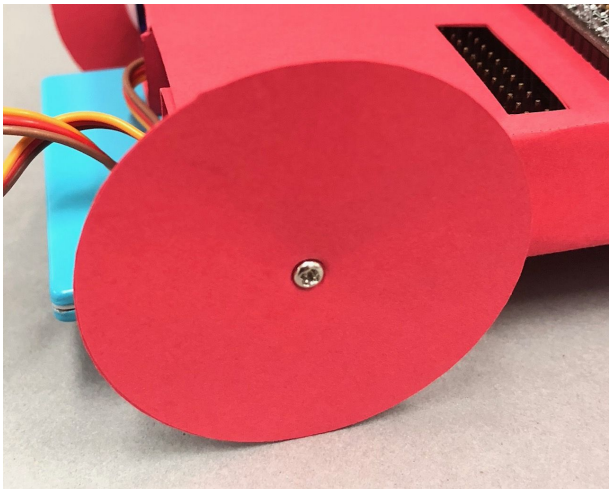


5. Fold the flap last flap on the end and tape the tab down.



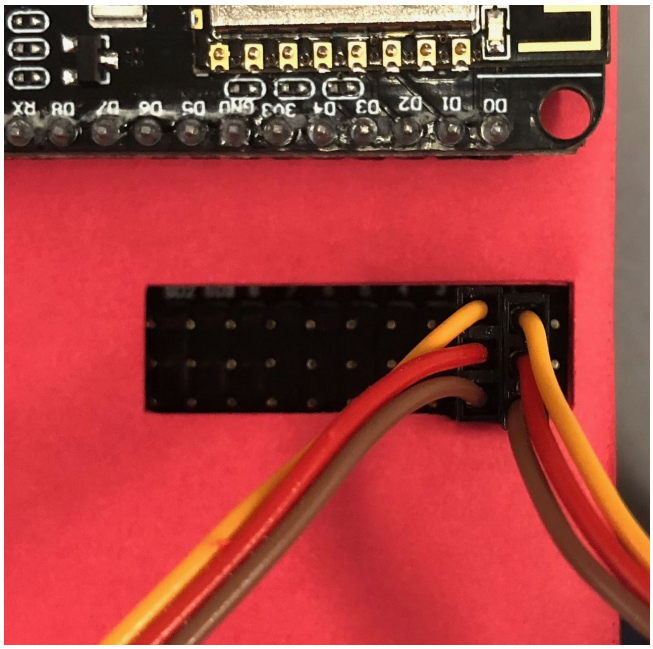
The Wheels

1. Make two wheels by gluing two of the paper circles together.
2. Make the hole at the center larger so the screw from the micro servo can fit in it.
3. Put the screw through the hole of the paper wheel and using a phillips head screwdriver, screw the paper wheel onto the micro servo.

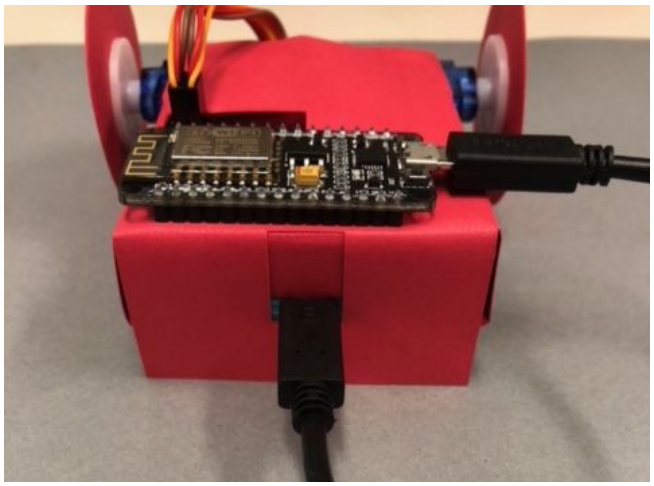


The Electronics

1. Attach the cable coming from the left micro servo to the pins corresponding with D1 (The pins are numbered starting with D0, so this is the second row of pins from the right). Attach the cable from the right micro servo to the row of pins corresponding with D2. The yellow wire should be closest to the microcontroller. The cables should be crossed so that the left motor connects to the right of the right motor's cable on the motor shield.



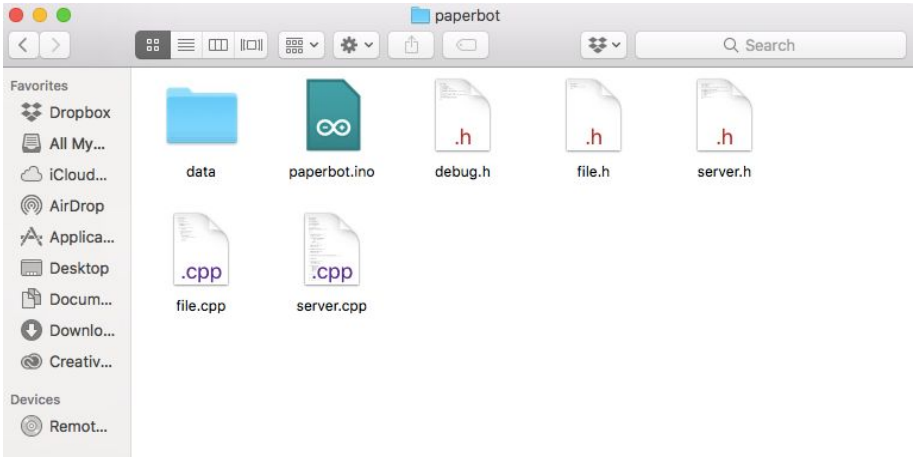
2. Use a micro USB to micro USB to power up the two wheeled car by connecting the battery to the microcontroller.

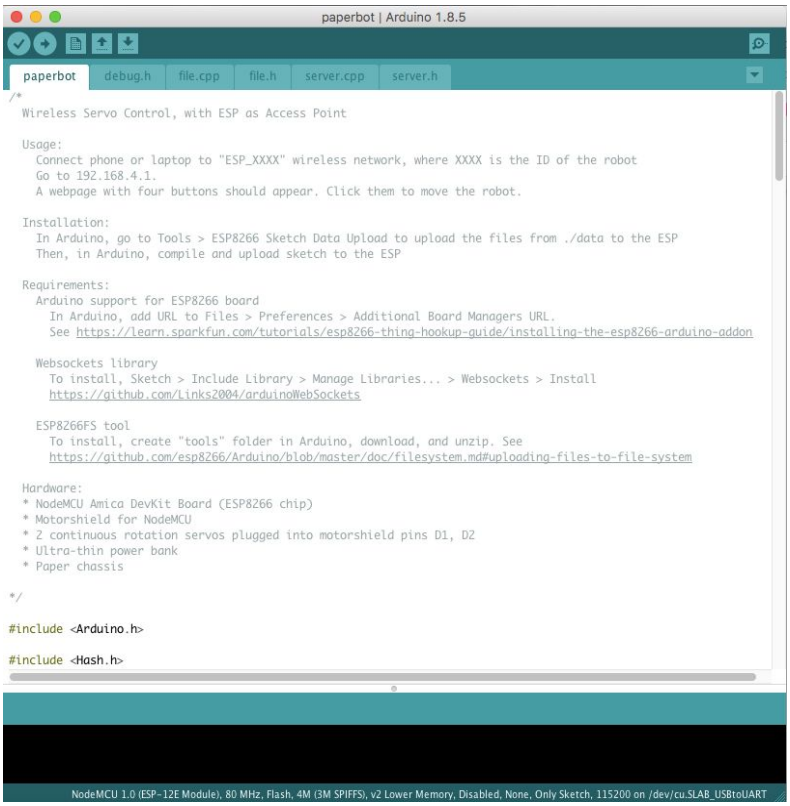


The Software

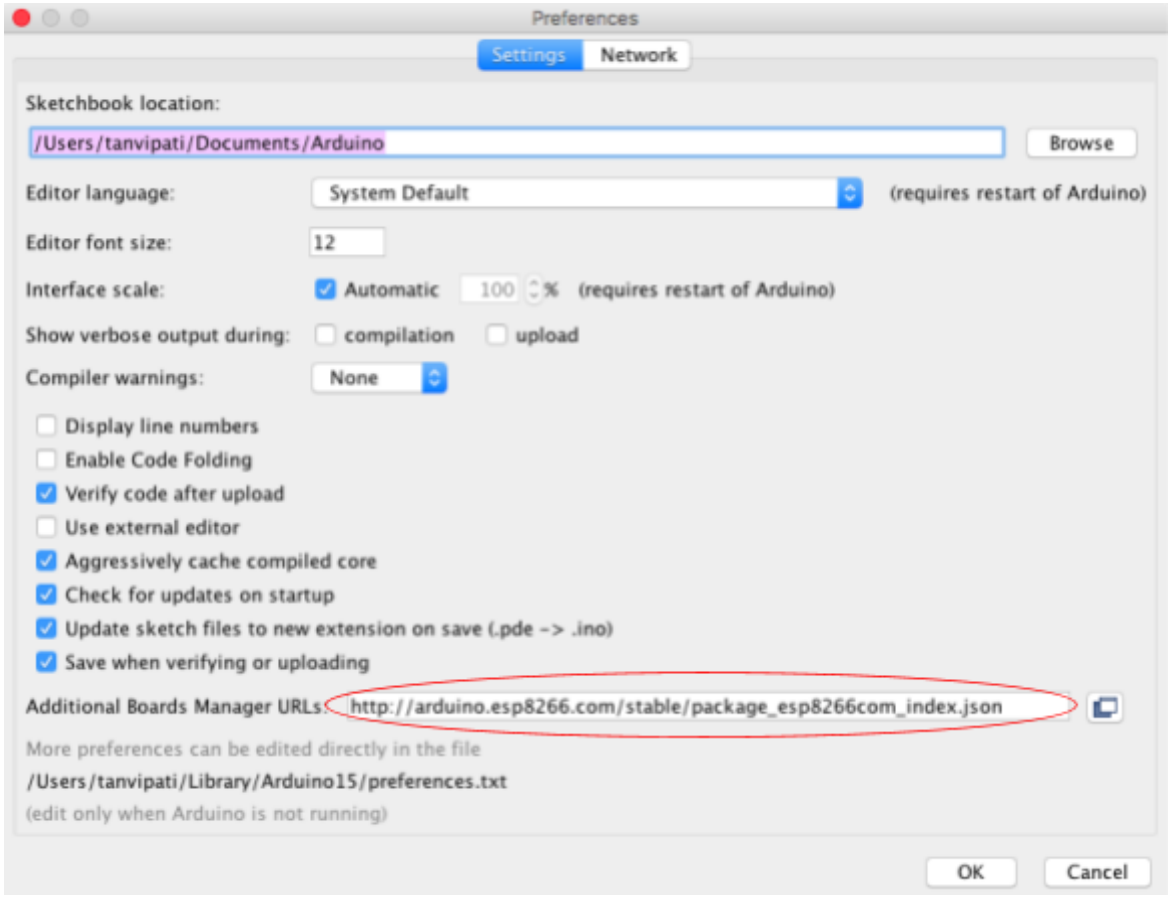
(These instructions are for Mac users, but you can follow a similar procedure for other operating systems as well.)

1. Install the latest version of Arduino on your computer. You can do so at: https://www.arduino.cc/en/Main/Software
2. Connect the NodeMCU to the computer using the USB to Micro USB cable.
3. Plug in the USB given to you. You will find a folder named “paperbot”. When you open the folder, click on the file named “paperbot.ino”.

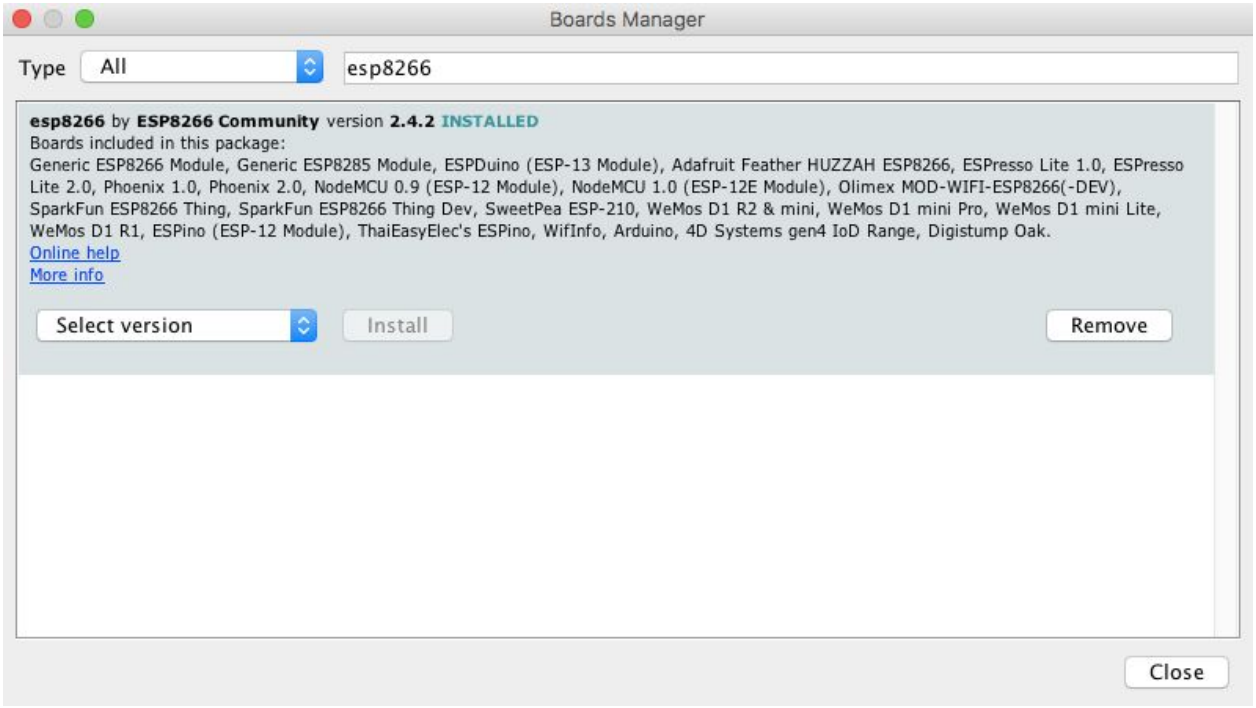




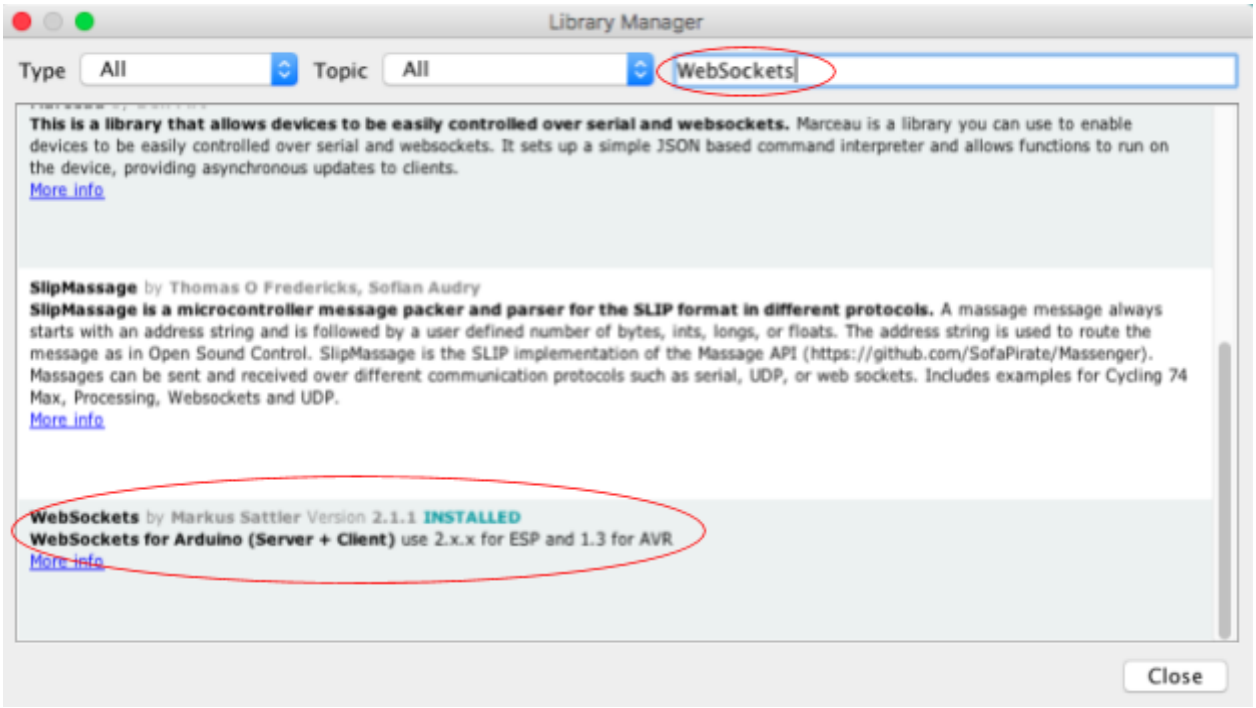
4. You need to set up the Arduino to support the ESP8266 board. To do so, open up Arduino and go to “Files” in the menu bar. In the drop-down menu, select “Preferences” and then “Additional Board Managers URL”.
5. Copy this URL http://arduino.esp8266.com/stable/package_esp8266com_index.json into the “Additional Board Managers URLs” text box at the bottom of the pop-up window. If you have another URL already in the textbox, add a comma after it and copy the given URL after the comma. Hit “OK”.



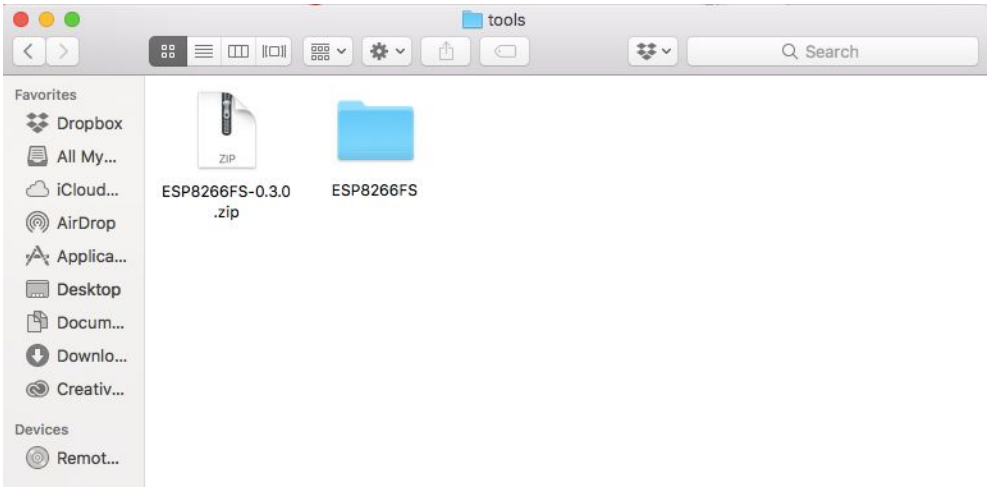
6. Go to “Tools” and select “Boards”. From the drop-down menu, select “Boards Manager...”. In the pop-up window, filter your search by typing “esp8266” and click “Install” on the option that shows up.



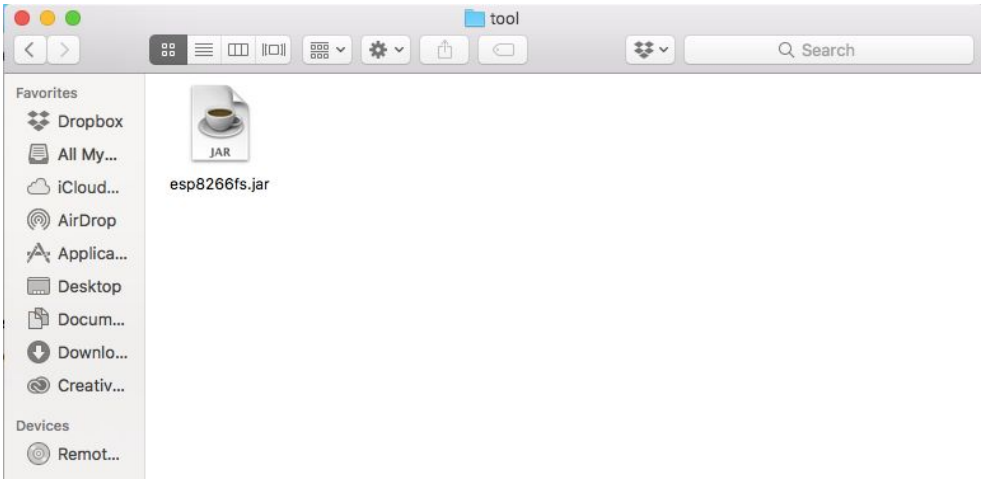
7. Next, your microcontroller needs to able to communicate with the device you will be using to control it over WiFi. To do this, you have to set up the WebSockets library in Arduino. Go to “Sketch” in the menu bar and select “Include Library”. In the drop-down menu, select “Manage Libraries…”. Filter your search by typing “WebSockets”. A few options may appear - find the one titled “WebSockets” and “Install”.



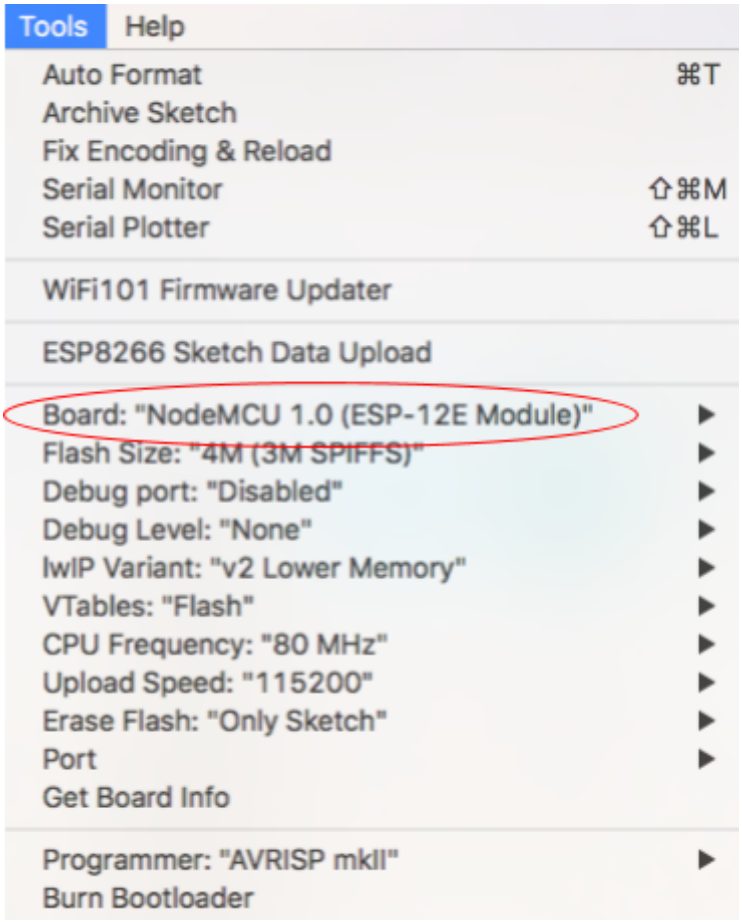
8. Next, you need to download the ESP8266FS tool. To do so, go to your computer's "Arduino" folder. Create a new folder named "tools".
9. Download the first .zip file on this page: https://github.com/esp8266/arduino-esp8266fs-plugin/releases
10. Move this from your "Downloads" folder to the "tools" folder you created. Double click on the file. A new folder named "ESP8266FS" will appear.



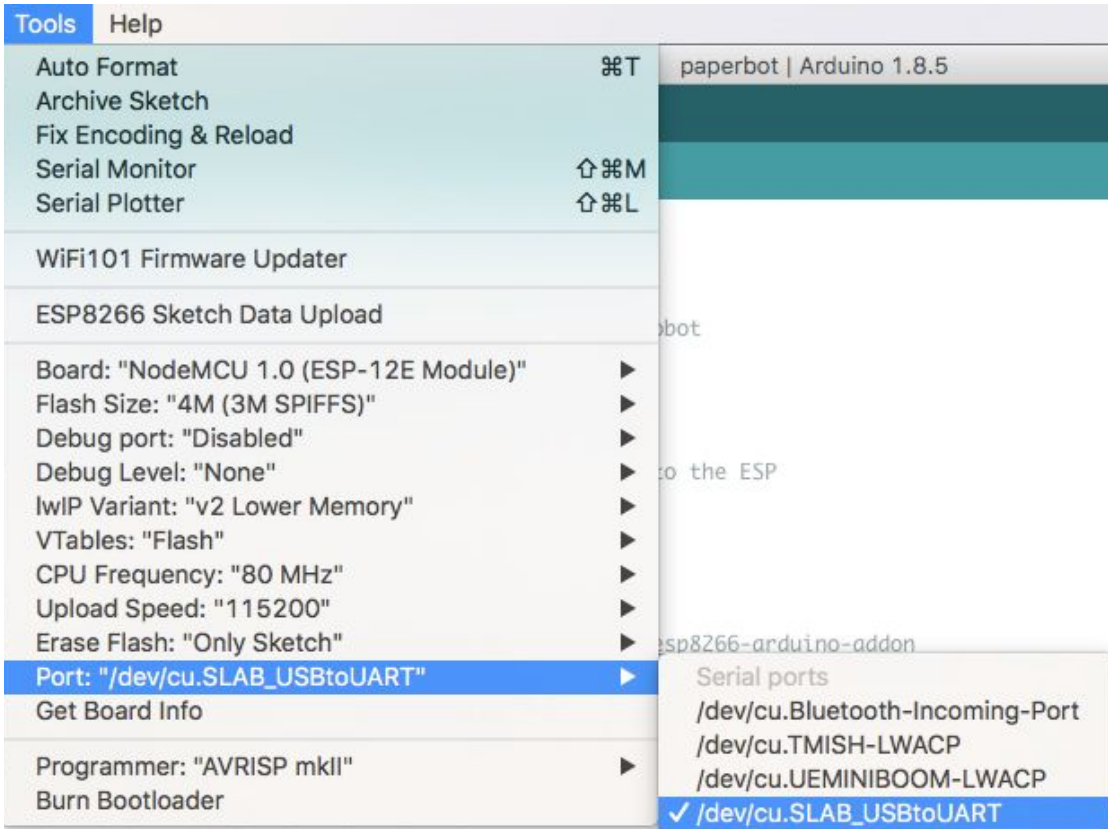
11. If you click on the "ESP8266FS" folder, you will find a folder named "tool". In the "tool" folder, you should find a file named "esp8266fs.jar". You do not need to click on it, but check this to make sure you've downloaded the correct files.



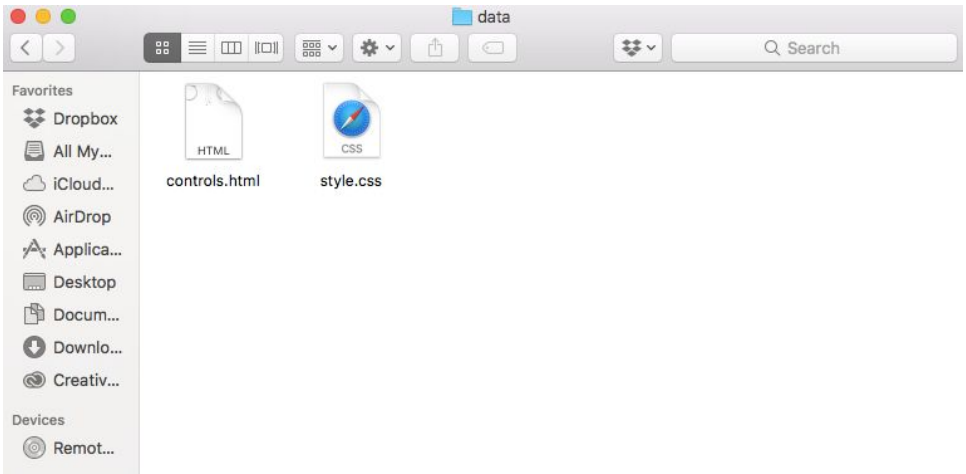
12. Go to "Tools" in the menu bar and select "Board". In the drop-down menu, select "NodeMCU 1.0 (ESP-12E Module)".



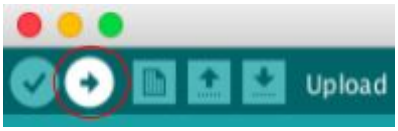
13. Now, you need to make sure your computer can communicate with the NodeMCU through the USB to Micro USB cable. Click on the link and download the suitable driver: https://www.silabs.com/products/development-tools/software/usb-to-uart-bridge-vcp-drivers
14. Open the .zip file from your “Downloads” folder and follow the instructions to install the driver.
15. Restart your computer. Reopen “paperbot.ino” and go to “Tools” in the menu bar. In the drop-down menu, go to “Port” and select “/dev/cu.SLAB_USBtoUART”.



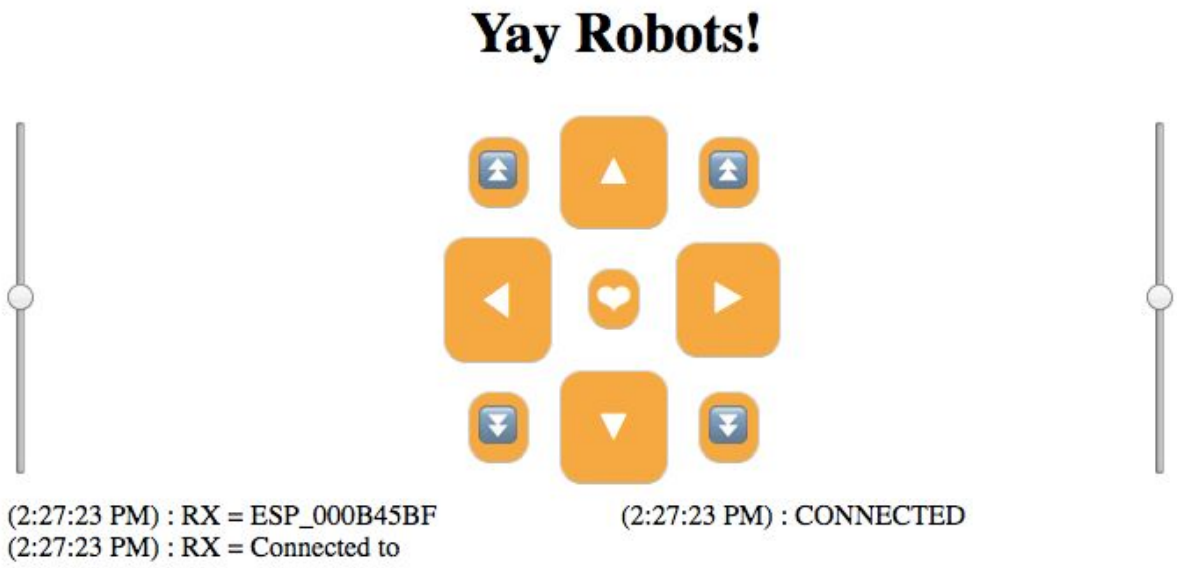
16. Go to “Tools” in the menu bar. In the drop-down menu, go to “Flash Size” and select “4M (3M SPIFFS)”. Go to “CPU Frequency” and select “80 MHz”. GO to “Upload Speed” and select “115200”. You can refer to the picture given above for more clarity.
17. In the menu bar, go to “Sketch” and choose “Show Sketch Folder”. Make sure that there is a folder named “data” with the files “controls.html” and “style.css”. You don’t have to click on them, but make sure that they are there.



18. Select “Tools” and click on “ESP8266 Sketch Data Upload”. Once you are done, the message “SPIFFS Image Uploaded” will appear in the status bar at the bottom of the window.
19. Finally, you can click on the arrow at the top left corner of the window and upload the code onto the NodeMCU.



20. Once you have finished this, you can disconnect the NodeMCU from the computer. The microcontroller outputs a WiFi signal starting with ESP you can connect to using your phone, tablet or laptop device. Then go input the IP address 192.168.4.1 into your device’s web browser to control the car.



21. Drive it around and have some fun!