

Line Following Bot V2 - Assembly Instructions

Needed Parts

You will need the following parts to build the bot:



1. 3D printed body
2. Small OLED display and STEMMA QT to tinned wires cable
3. TOF distance sensor
4. STEMMA QT cable for distance sensor
5. 2X Reflectance sensors and 5 pin cables
6. LF Bot I/O board
7. 2X Continuous rotation servos
8. 2X Wheels
9. UM FeatherS3 board
10. LiPo battery
11. Small ball castor

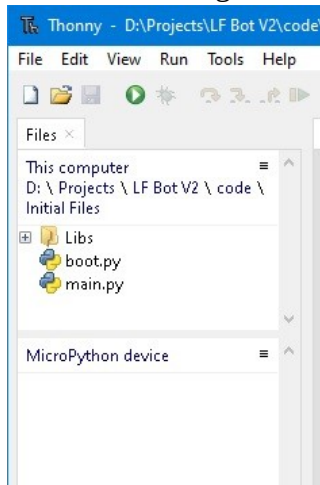
Line Following Bot V2 - Assembly Instructions

Software install

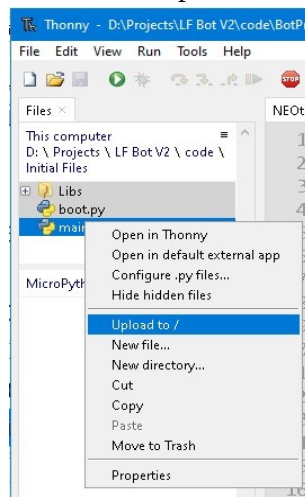
Before building the bot we need to install software on the FeatherS3 board. Insure your board has the latest version of MicroPython and that you have Thonny installed on your PC.

Go to <https://www.jsconsulting.com/explorers/LFV2/> and download the InitialFiles.zip and BotProgs.zip files. Unzip the archives onto your computer. Run Thonny and connect the FeatherS3. Open the “files” tab, (View → Files) and if there are files in the “MicroPython device” frame, delete them. In the “This Computer” section go to the unzipped Initial files folder.

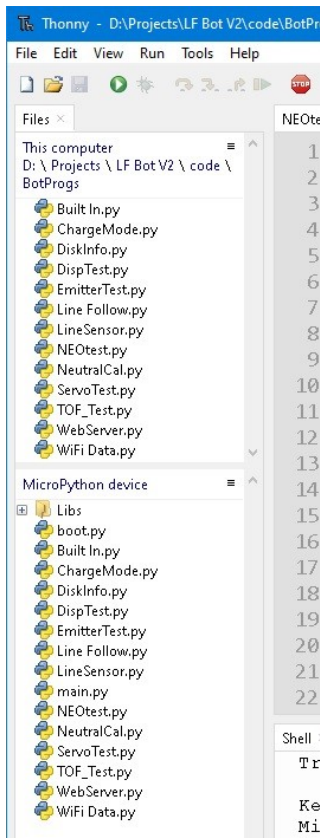
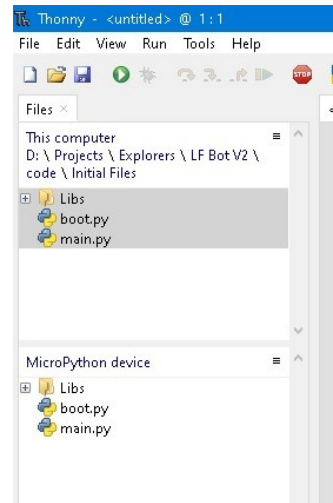
You should see something similar to the below image:



Select all the files from the InitialFiles and select “Upload to /”



After the upload you should see the following:



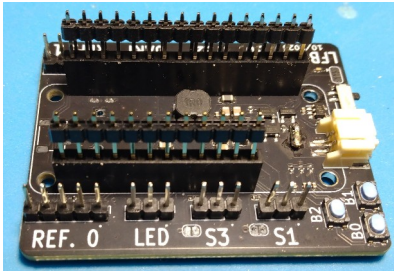
In the “This Computer” section go to the unzipped BatProgs.zip folder and upload all the files to the board.

Your “MicroPython device” should look like the one on the left.

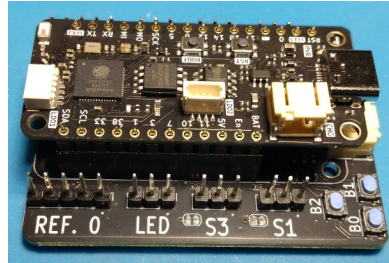
Line Following Bot V2 - Assembly Instructions

Bot Assembly 1. Headers

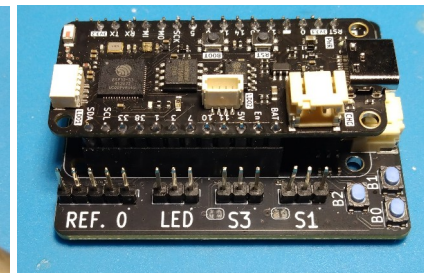
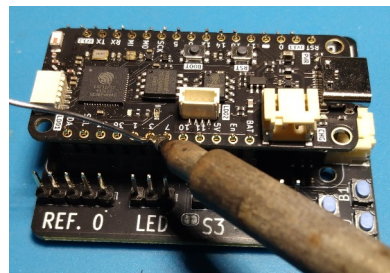
Place the headers that came with the FeatherS3 board into the connectors in the I/O board as shown:



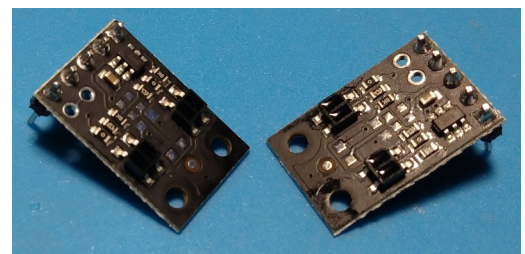
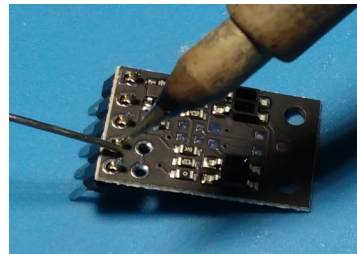
Place the Feather board on top of the headers and push down to seat the headers fully into the sockets:



Solder the headers to the FeatherS3 Board:



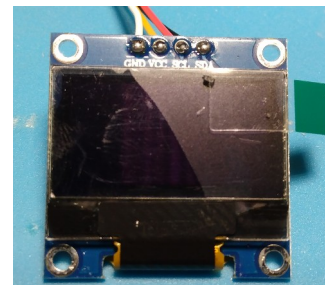
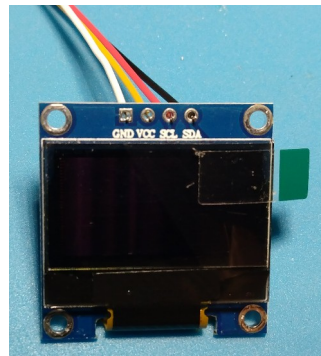
Solder 5 pin headers onto both reflectance sensor boards. Make sure the headers are on the side opposite to the sensors as shown:



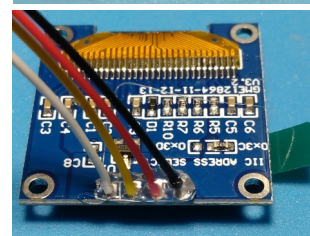
2. Display

Solder the STEMMA QT to tinned wires cable to the display. Be sure to match the wire colors to the image on the left.

Wire	Signal
White	GND
Orange	VCC
Red	SCL
Black	SDA



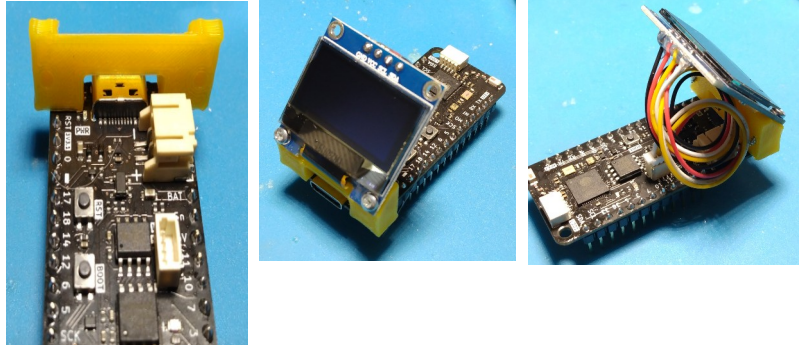
On the back of the display use a small amount of hot glue to secure the wires as shown:



Line Following Bot V2 - Assembly Instructions

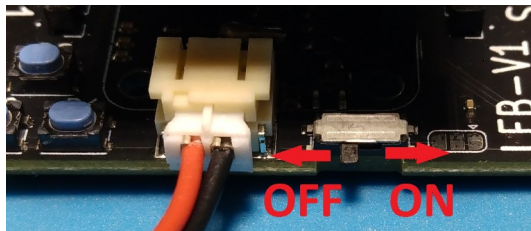
Attach the display mount to the FeatherS3 board with 2 screws. Attach the display to the mount with 2 screws.

Plug the STEMMA QT cable into the vertical connector on the FeatherS3 board. Coil the cable to keep it from interfering with the BOOT and RST buttons on the FeatherS3.



3. Initial Testing

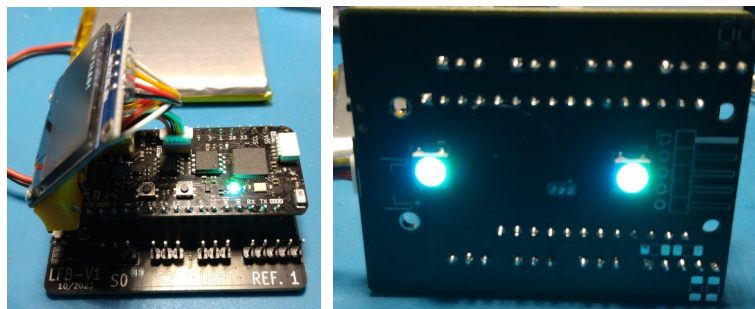
Connect the battery to the FeatherS3 board after making sure the power switch is in the 'OFF' position as shown:



Move the power switch to the On position and after a couple of seconds you should see the screen shown on the right, followed by a list of programs on the board.



Verify that the on board NEO-Pixel LED and the two on the bottom of the I/O board are cycling thru various colors and that the on board blue LED is slowly toggling on/off.



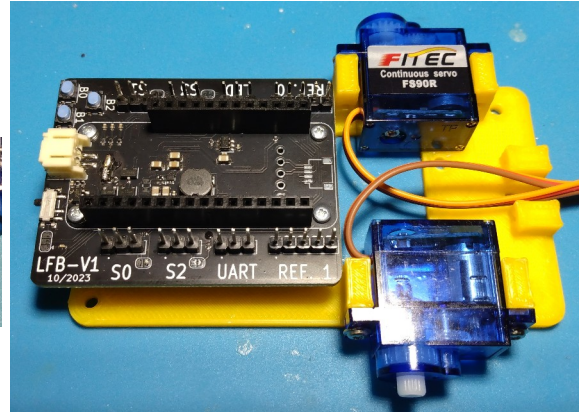
Turn the power switch off, disconnect the battery and unplug the FeatherS3 board from the I/O board.

Line Following Bot V2 - Assembly Instructions

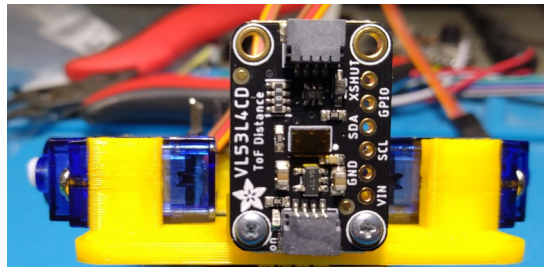
4. Main Assembly

Attach the I/O Board to the main body using 4 #1 screws as shown.

Attach the 2 servos to the main body facing as shown. Use the two larger screws that came with the servos. The smaller screw and the control horns are not used for this build.



Attach the TOF distance sensor to the front of the bot using 2 #1 screws as shown.

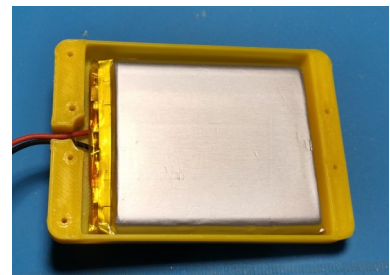
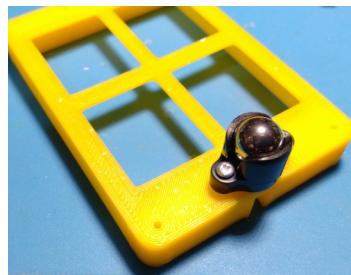


For the next step we need the ball castor and the thicker of the two spacers that came with it. Remove the brown paper from both sides of the spacer. The thinner spacer and the mounting bolts that came with the ball castor are not used in this build.

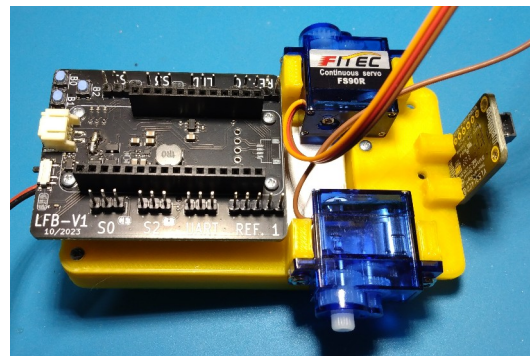


Attach the ball castor to the bottom of the battery holder using 2 #1 screws as shown.

Turn the battery holder right side up and place the battery inside as shown. Make sure the wires go thru the slot in the back.

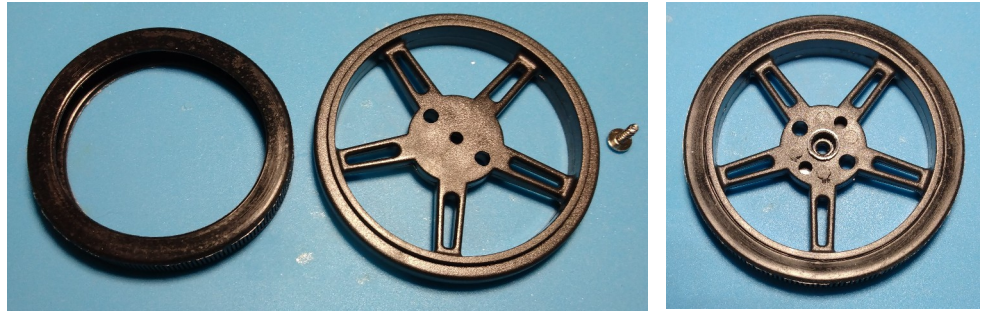


Attach the main bot body to the battery holder using 4 #1 screws as shown. Be very careful not to pinch the battery wires or damage the battery with the screws.



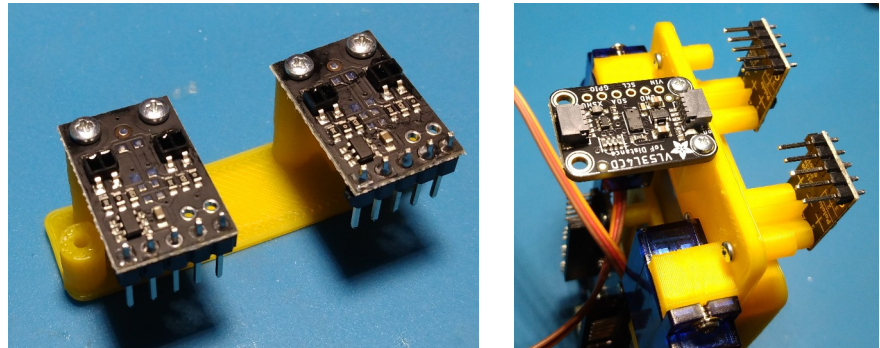
Line Following Bot V2 - Assembly Instructions

Take a rubber tire and wrap it around the plastic wheel. Do this for both wheels. The screws that come with the wheels will be used to mount them to the servos. Don't lose em.



Mount the two reflectance sensors to the sensor mounting bracket using 4 #1 screws as shown.

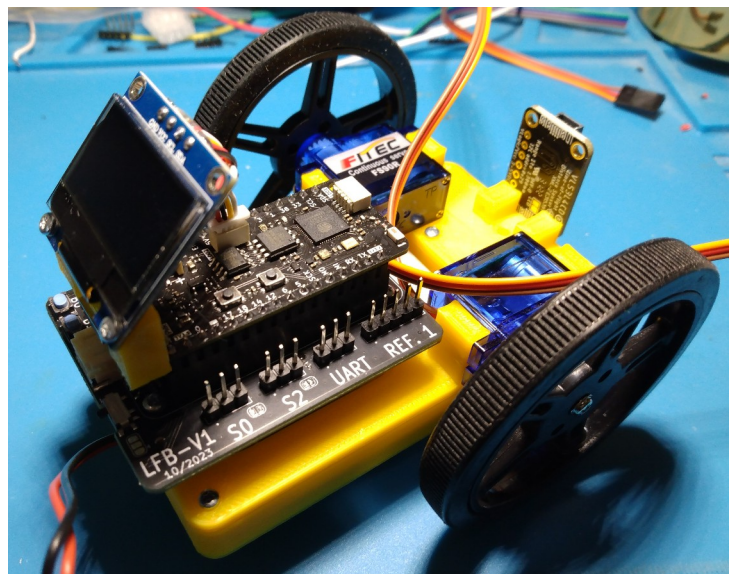
Attach the mounting bracket to the front of the bot as shown using 2 #1 screws.



Carefully push the wheels onto the servo shafts making sure to first align the splines. Attach both wheels to the servos using the screws that came with the wheels.



Your bot should now look like the image to the left.

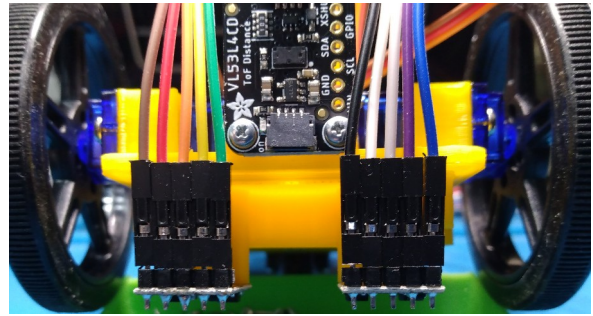


Line Following Bot V2 - Assembly Instructions

5. Cables/Wiring

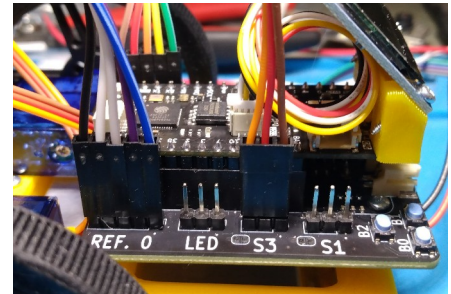
Plug a 5 pin M-M jumper cable onto each reflectance sensor board on the front of the bot. Make sure to keep the wires in same order as they are in the cable. (Don't cross the wires!)

Take note of the color of the wire on the right hand side of each board, i.e. in the picture on the right that would be the green and blue wires.



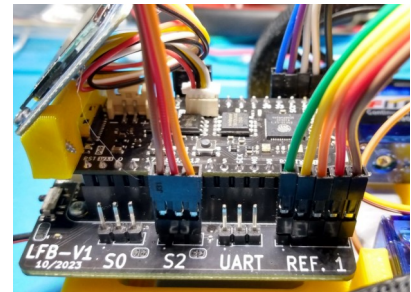
Place the left hand sensor cable onto the REF. 0 connector on the left side of the I/O board. The wire that is on the right side of the sensor goes towards the rear of the bot. Make sure to keep the wires in same order as they are in the cable. (Don't cross the wires!)

The left hand servo cable goes onto connector S3 with the brown wire towards the back.



Place the right hand sensor cable onto the REF. 1 connector on the right side of the I/O board. The wire that is on the right side of the sensor goes towards the rear of the bot. Make sure to keep the wires in same order as they are in the cable. (Don't cross the wires!)

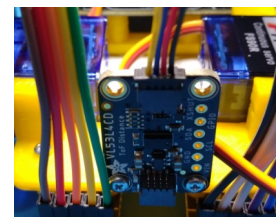
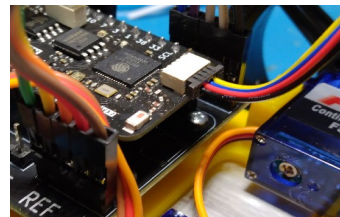
The right hand servo cable goes onto connector S2 with the brown wire towards the back.



Place the STEMMA QT cable into the connector on the end of the FeatherS3 board.

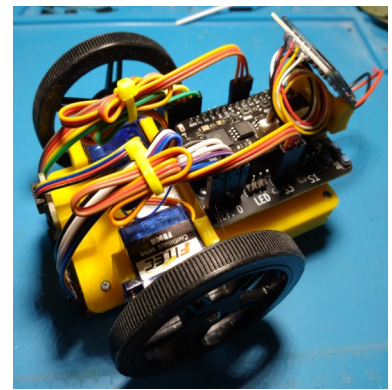
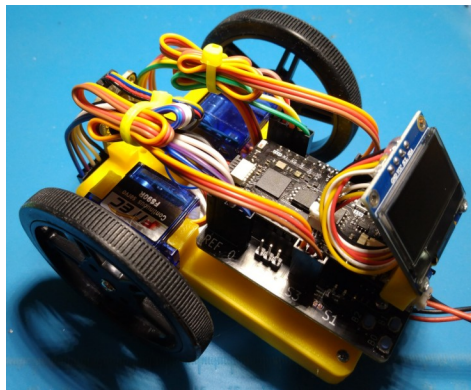
The other end of the cable goes into the connector on the top of the TOF sensor board on the front of the bot.

Carefully check the connector alignment on both boards.



Make sure the power switch is in the off position and then plug the battery cable into the back of the I/O board. You can coil it up a bit so it doesn't stick out too much.

Using a couple of cable ties gather up the extra cable lengths.



Congrats! You're done with the assembly!

Line Following Bot V2 - Assembly Instructions

6. Final Testing

Switch on the power to the bot. The servos may twitch a bit, this is normal.

After a few seconds you should see a list of all the programs on the bot as seen on the left.

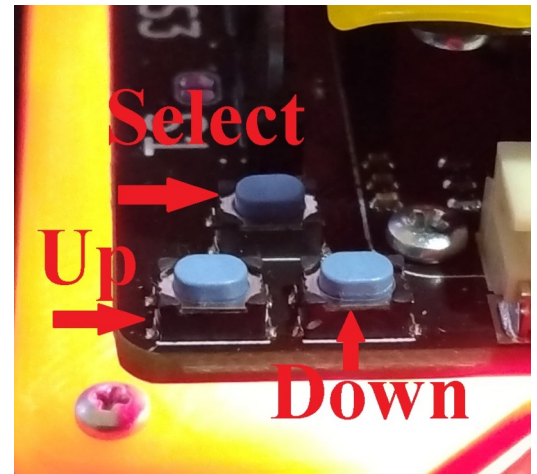


To navigate the list we use the three buttons on the back left corner of the I/O board.

As seen on the left, the button on the lower left moves up the list and the lower right button moves down the list.

The button on the top is used to select the currently highlighted program to run.

After running a program you can hit the RST button on the FeatherS3 board or turn the bot off and on again to get back to the program list.



Select and run the Built_in.py program. This will display the battery voltage, the level of the ambient light sensor (place your hand over the bot to see it change) and the state of the USB Vbus connection.

The DispTest.py program will draw text and various shapes and lines on the display.

The LineSensor.py program draws four bars across the screen showing the reading from the 4 reflectance sensors. When placed over a piece of 1" wide black tape, or over a test track printout you can see the sensors change as they move over the tape. When the bot is centered over the tape the middle two sensors should both be partway up and the outside sensors should both be all the way down.

The NeutralCal.py program allows you to set the neutral positions for the servos. Use a short press on the select button to chose which servo to adjust, and the up down buttons to change the neutral point. When your happy with the settings a long press on select will save the values. (S2 is the RH wheel, and S3 is the left. S0 and S1 are not currently used.)

The ServoTest.py Program will run the bot forward, backward, rotate clockwise/counter clockwise for about 2 seconds each with short stops in between. Note that until you calibrate the neutral positions of your servos one or both wheels may rotate slowly when the bot is "stopped". This is normal.

The TOF_Test.py program displays the distance from the front of the bot to objects placed in front of it in cm. The range is about 2cm to almost 2M.