# EduMiP Assembly

Included in your EduMiP kit are all of the components necessary to make your BeagleBone balance. Open your kit and inspect the following components. For component name clarification, please refer to the exploded view in the technical document in the product GitHub repository here.

1. Drivetrain unit with motors and wheels attached (1)
2. Optical encoder boards (2)
3. Robotics Cape (1)
4. 2-Pin JST ZH Pigtails (2)
5. 4-Pin JST SH Pigtails (2)
6. 2-Cell LiPo Battery (1)
7. 12v 1A DC Power Supply (1)
8. Barrel Jack Plug (1)
9. Lower Bulkhead (1)
10. 4-40 x 3/8" Screws (4)
11. 4-40 x 1/4" Screws (6)
12. Lower Front Bumper (1)
13. Top Skid Right (1)
14. Top Skid Left (1)
15. Battery Retainer (1)

Step 1: Disassemble the powertrain unit by removing the 8 screws holding the gearboxes in. You may keep the wheels attached to the gearbox output shafts.
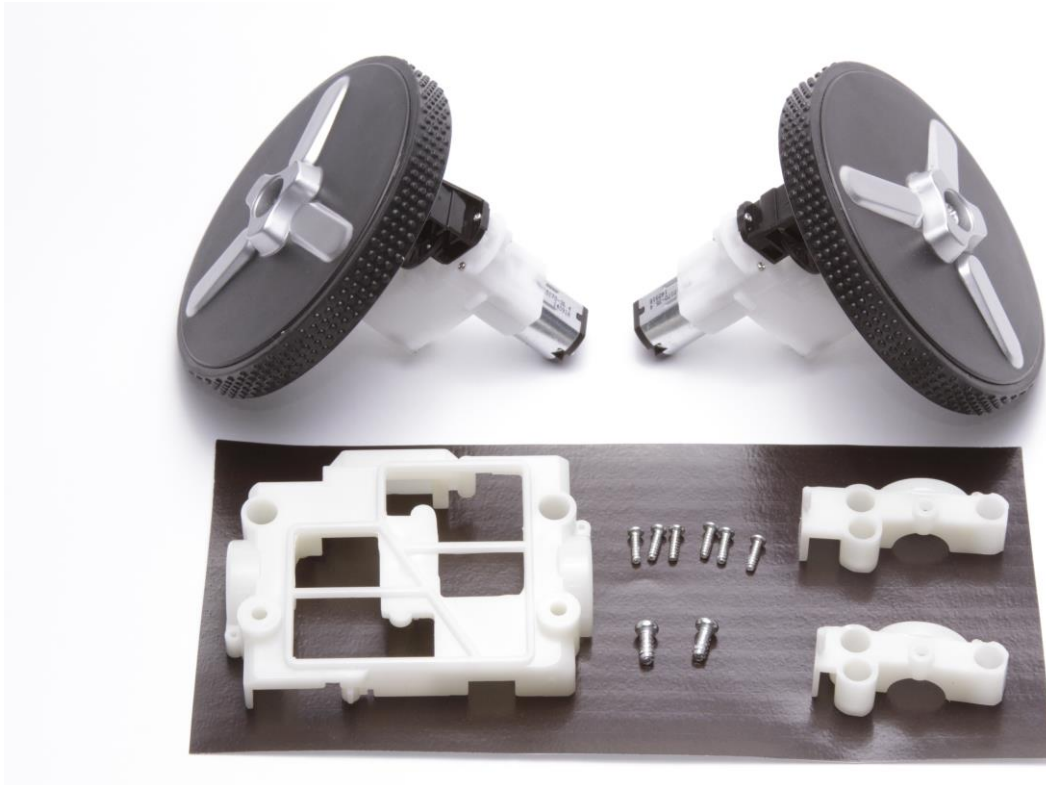
Step 2: Now that you have access to the motor terminals, trim one of the 2-pin pigtails and one of the 4-pin pigtails to roughly 50mm for the front motor and encoder. Then trim, without stripping yet, the remaining two pigtails to roughly 100mm for the rear motor and encoder. If you are new to stripping wires, you may want to leave yourself an extra centimeter or two as it is easy to cut straight through the wire.
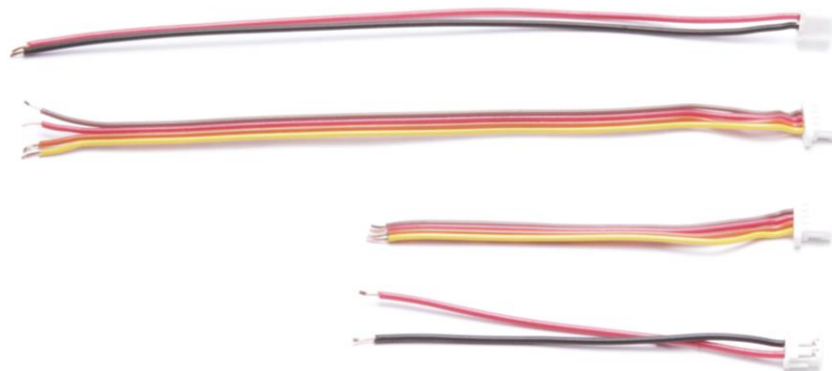
Step 3: Strip and tin the pigtail ends to prepare them for soldering. Also tin the motor terminals. There are plenty of tutorials online for learning the basics of soldering, including tinning. When you strip the wires, make sure not to strip off more than 1.5mm of insulation as the insulation will shrink to expose more wire under heat. Carefully solder the motor wires to match the orientation shown below. The wires do not need to go through the holes in the terminals. Double check that the red wires go to the positive(+) terminals of the motors.
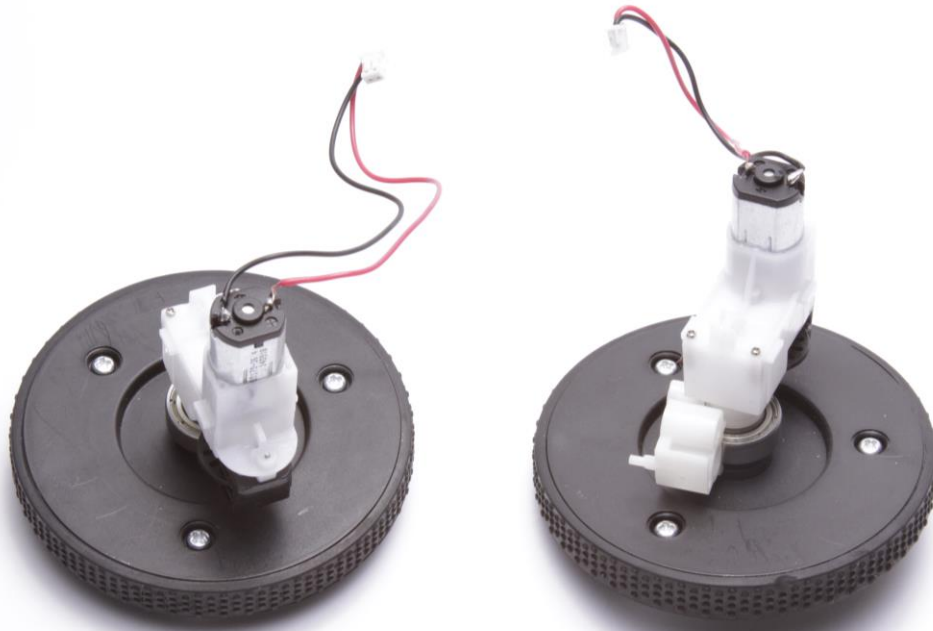

Step 4: With the soldering iron still hot, solder the encoder boards. This time thread the wires through the holes. It is not necessary to tin the wires here since the board is already tinned for you. You'll want to heat the tinned portion of the board and then apply solder rather than attempting to heat the wires themselves. The brown wire should go to the terminal labeled GND, the rest follow in order.

Step 5: Put the powertrain unit back together with the motor wires and press the encoder boards in to match the orientation in the following picture.
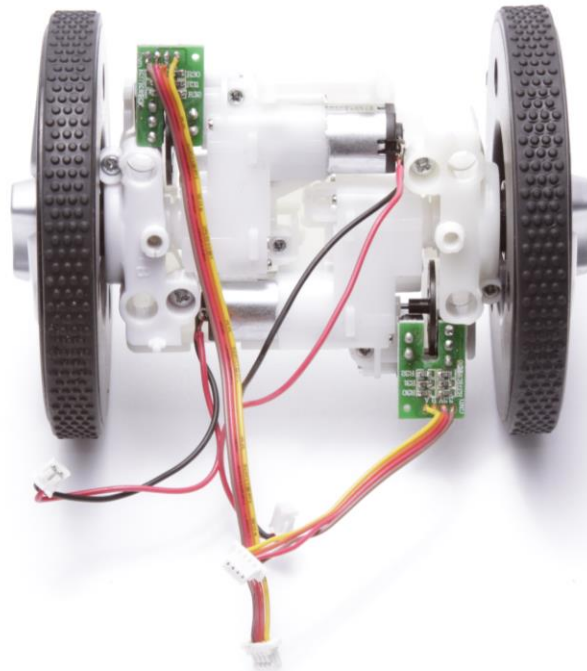

Step 6: Use two of the 4-40 3/8" screws to mount the Lower Bulkhead to the top of the powertrain unit. Be careful not to pinch any of the wires before tightening the screws fully. This is a good time to check that the wheels and encoders can move freely without obstructions.
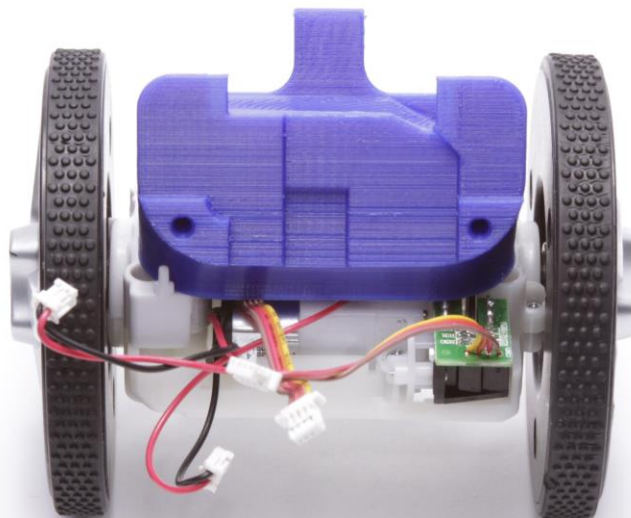
Step 7: Now install your BeagleBone Black onto the Lower Bulkhead with two 4-40 x ¼" screws. Also insert the plastic barrel jack plug cover into the BeagleBone's 5V DC input Jack.
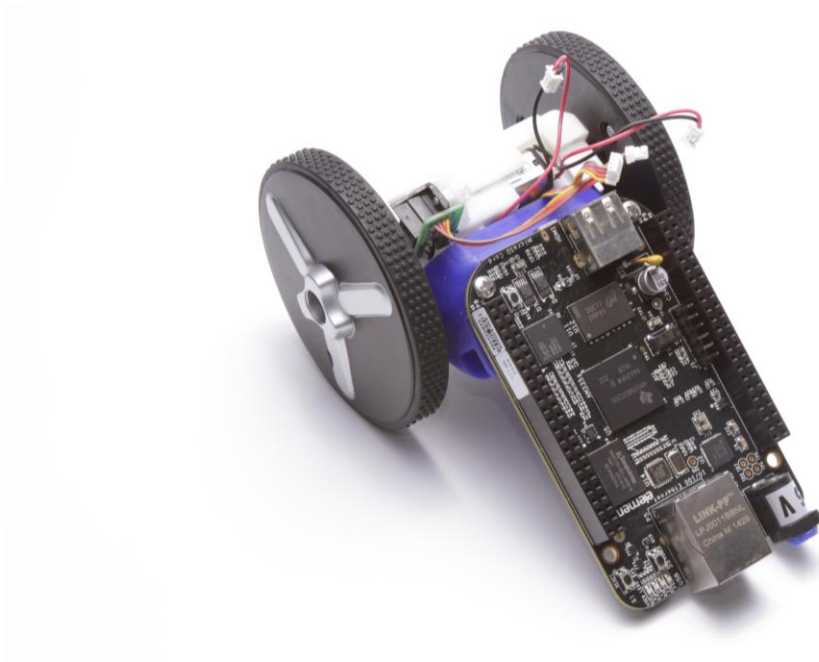

Step 8: Install the Robotics Cape onto the BeagleBone Black paying careful attention not to bend any pins and make sure both connectors are completely inserted. Now install the Top Left Skid using only one 4-40x1/4" screw from the front side of the cape as shown below. We will install the second screw later.
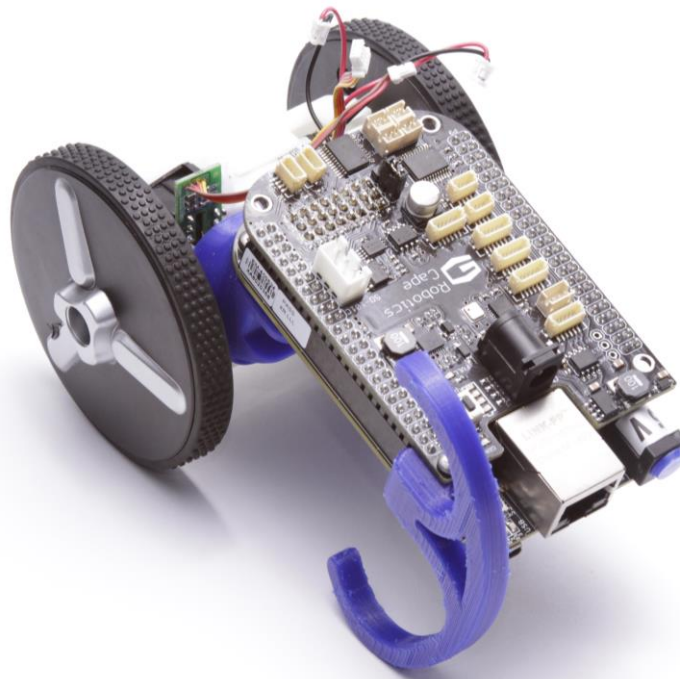
Step 9: Carefully bend the battery leads back with the thicker leads pulled towards the label. Place the battery into the Battery Retaining Clip.
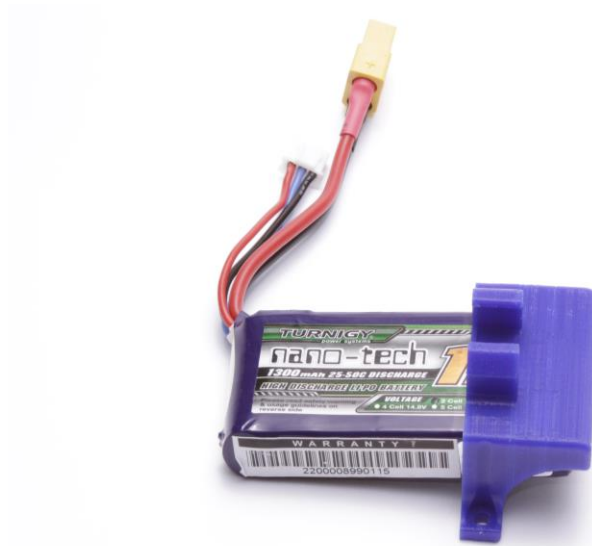

Step 10: Slide the battery and retaining clip into place behind the BeagleBone Black and secure with one 4-40 x 3/8" through the Battery Retaining Clip into the Top Left Skid hold that you left open in Step 8. Now install the Top Skid Right in the same manner with a ¼" screw from the front of the cape and a 3/8" screw from the back side.
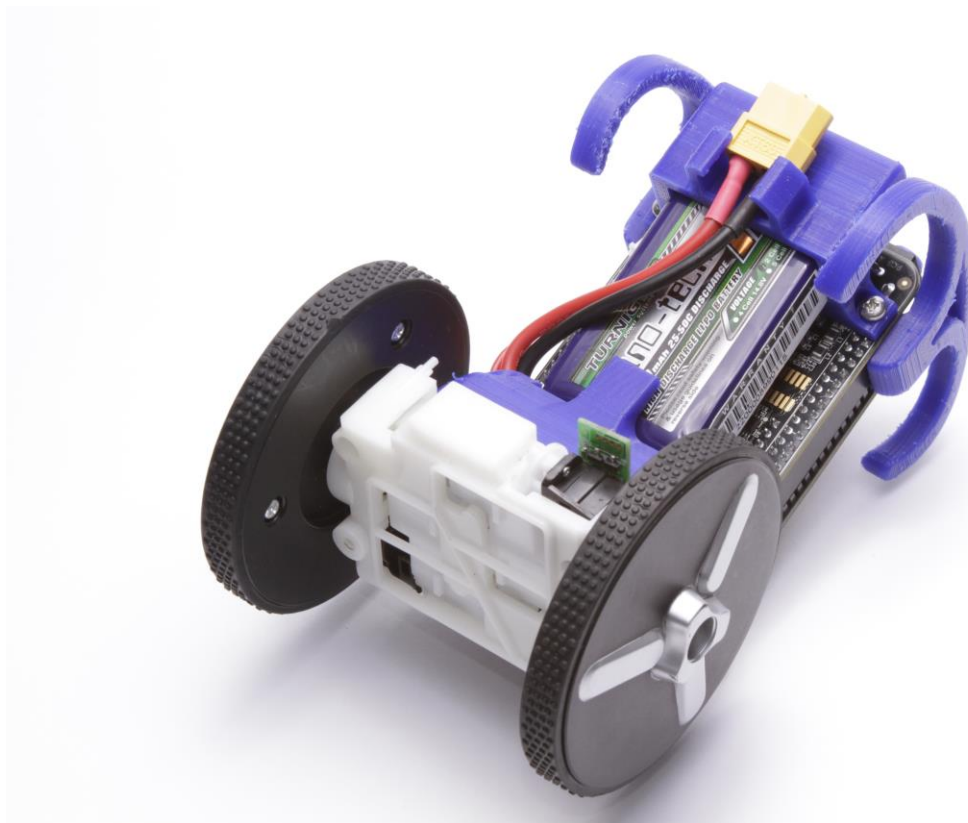
Step 10: Plug in the Robotics Cape and connectors. Note that your BeagleBone will not turn on immediately after connecting the battery if you use a Revision C cape. In this case, you must briefly connect the included 12V DC power supply to the Robotics Cape to arm the battery protection circuit. With your MIP in the orientation depicted below, we suggest connecting the leads coming from the left motor and encoder to the M1 and E2 headers. Then connect the leads from the right motor and encoder to the M4 and E3 headers.
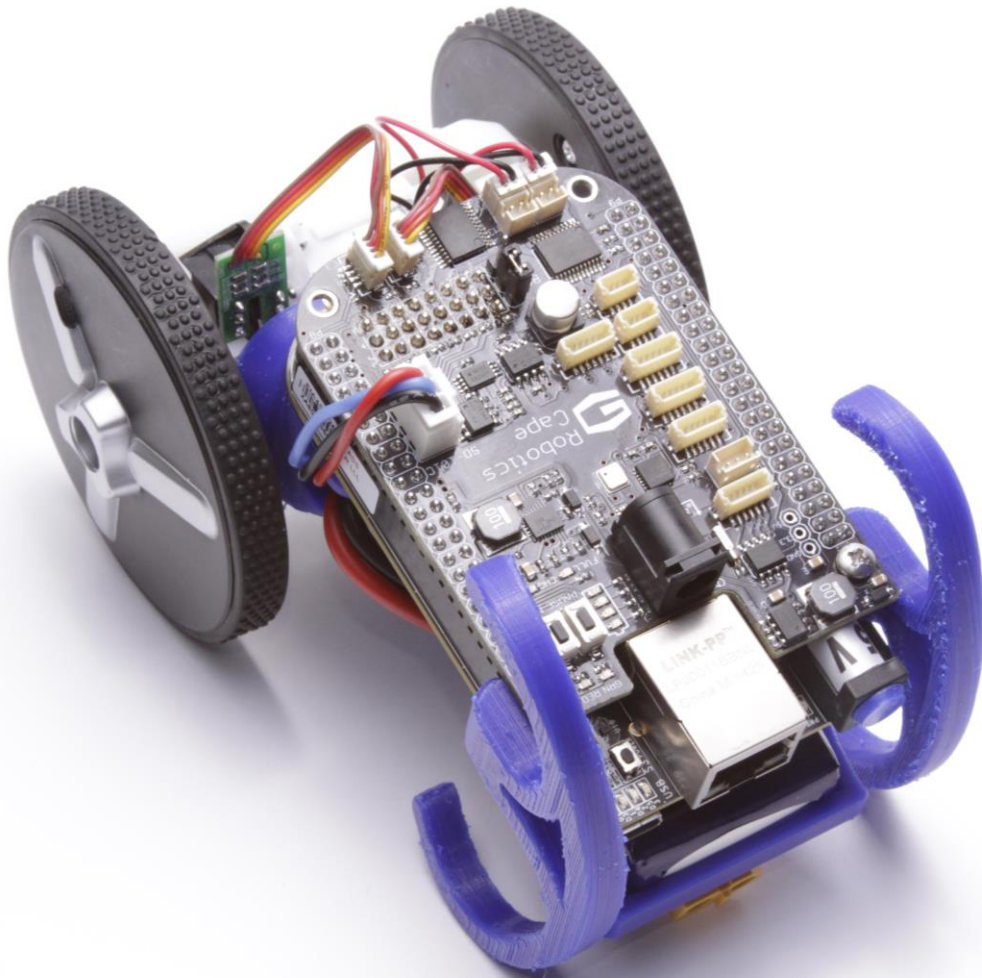
Step 11: Lastly, screw in the Lower Bumper with the remaining 2 4-40x1/4" screws as shown. They should simply slide in from the sides and bottom. Your build is complete!
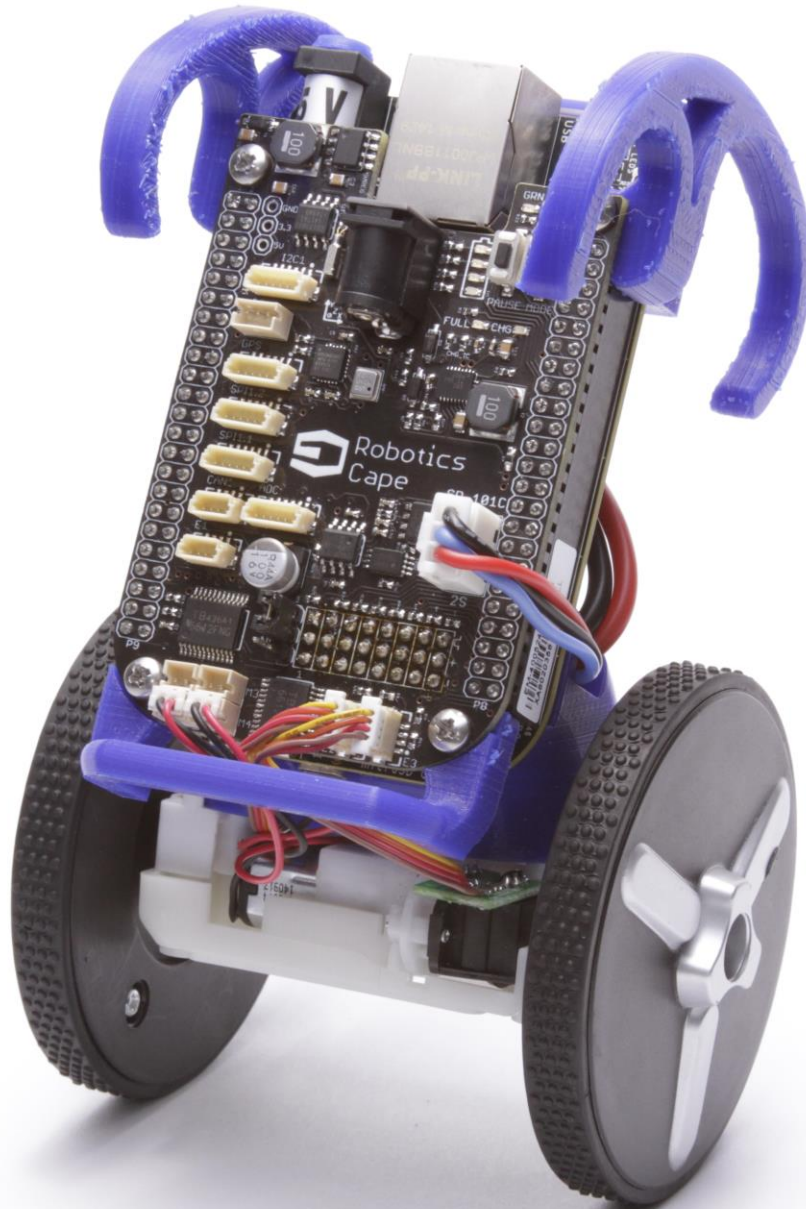
The Robotics Cape installer package comes with an example program to demonstrate EduMiP functionality. Please follow the instructions at http://strawsondesign.com/#!manual-install to install the software and set the 'balance' example to run automatically on boot.