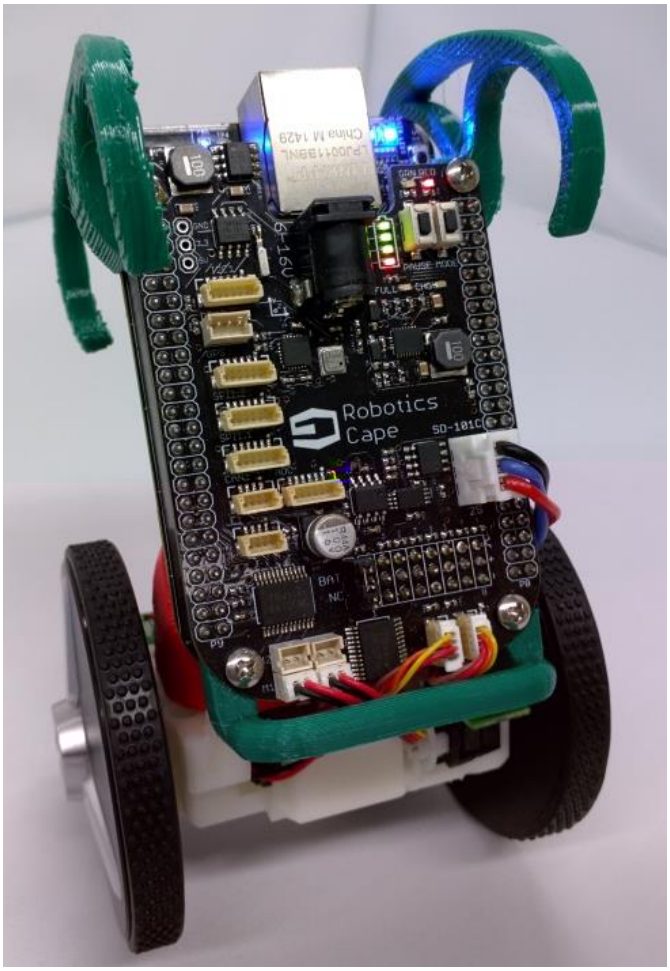
# Getting Started with BeagleMiP

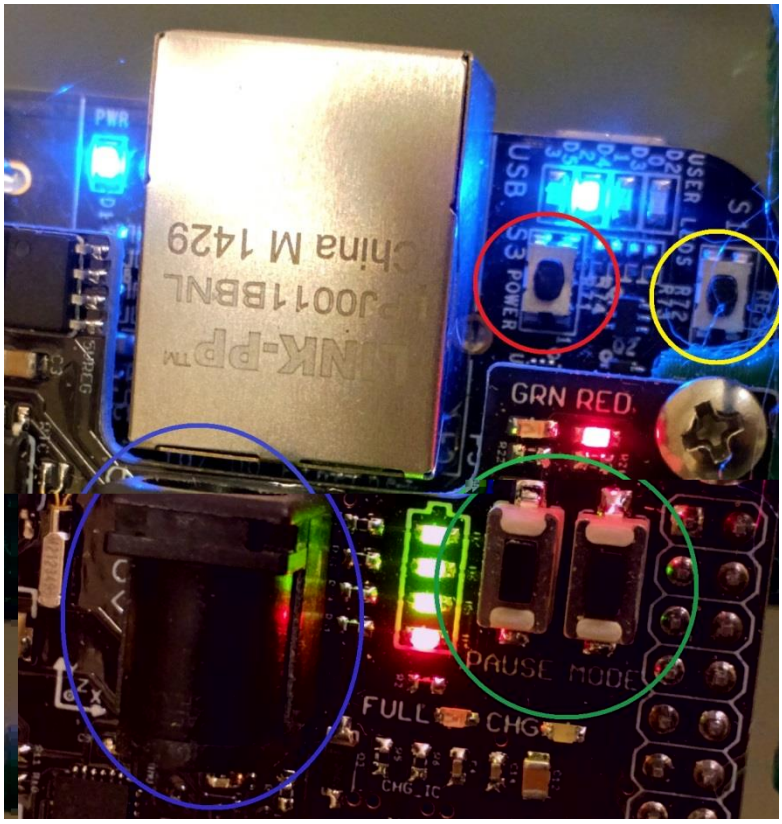
Congratulations on receiving your pre-built BeagleMiP kit. You now have everything you need to start developing small scale robots on an embedded Linux platform. Let's get started!




## Step 1: Familiarizing Yourself with the Hardware.

Your BeagleMip consists of two PCBs and a pair of driven wheels to let it balance and move. The control software is done on the bottom PCB, a BeagleBone Black (BBB) Linux development board. This is the board you will communicate with and run your software on. If you do not already know about the BeagleBone Black I suggest stopping here and briefly visiting BeagleBoard.org. The second PCB is called the Robotics Cape which provides sensors, power management, and a long list of features designed to empower the BBB for use in robotics applications. In the case of BeagleMiP, you will see 5 of the Robotics Cape connectors used: two for the pair of motors, two for the pair of quadrature encoder boards, and a 3-pin connector for the LiPo battery.

Your BeagleMiP kit also includes a 12v 1A DC power supply to charge the 2-Cell LiPo battery. The DC barrel jack on the Robotics Cape circled on the next page in blue will power the BBB and sensors with 6-16V DC input. However you should use at least 9V to charge the LiPo battery. Note that the LiPo battery is connected with a standard 3-Pin plug, this is because the Robotics Cape provides individual over and under voltage protection on each of the cells. When the power supply is connected, either the green FULL led or the yellow GHG LED will illuminate to indicate the charging circuity is operating regardless of if the BBB if booted or not. If the battery fully discharges or becomes disconnected from the Robotics Cape, you will have to plug the charger in momentarily to arm the protection circuit before it will supply current to the BBB.




Since your BealgeBone Black runs Debian Linux just like a desktop PC can, it should be booted and shut down correctly just like a personal computer with the power button circled above in red. A single momentary press will boot your BBB in about 15 seconds, you do not need to hold the button down. After it is booted, another single momentary press will trigger the shutdown sequence. This shutdown sequence will take 5-15 seconds depending on what processes must be shut down. Do not simply disconnect power from the BBB as this can cause damage to the file system and may require flashing the BBB back to stock. If something does crash or go wrong, you can press the hard-reset button on the BBB circled above in yellow, but this is not commonly necessary.

Now connect your DC power supply to start the battery charging and momentarily press the power button to boot the BBB while your BBB rests on its back. After about 15 seconds, the LEDs on the Robotics Cape should illuminate. The line of 4 LEDs next to the DC barrel jack form the battery indicator. These are driven by the battery_monitor example program which automatically loads on boot. The two LEDs on the Robotics Cape labeled GRN and RED can be controlled by your robot program. The built in example balance program will illuminate the red LED if paused and the green LED otherwise.

The Robotics Cape also has two buttons: pause and mode. These can be programmed to do whatever you want in your robotics project. In the included balance example program, the pause button will toggle whether or not to drive the wheels and the mode button will swap between the default hold-position mode and angle mode where the MiP will stay upright but you can push it around.

Your pre-built BeagleMiP kit comes with the Robotics Cape library pre-installed and the BeagleMiP balance.c program set to automatically run on boot. If your BBB successfully booted and the battery indicator LEDs show that some battery charge is present then you can remove the DC charger from the Robotics Cape and lift your BeagleMiP to the upright position to start balancing. Tip it on its back or press the pause button to stop it. Hold the pause button for 3 seconds until the red LED flashes to exit the balance program completely.

## Step 2: Familiarizing Yourself with the Software

You will treat your BBB like a headless Linux computer by communicating with SSH and transferring files with SFTP. I suggest using the convenient mini-usb port on the BBB to gain network access. Head on over to the BeagleBoard website to download the USB drivers here: http://beagleboard.org/getting-started

Once you have gained shell access to the BBB through SSH, you can try some of the other included sample programs designed to test and demonstrate Robotics Cape features. Executing any program made with the Robotics Cape library will cleanly exit the previously running program to prevent conflicting use of resources. Here is a list of some of the pre-installed programs that you should try. There are many more examples included in the installer package located in /root/Robotics_Cape_RevC_Installer/examples and available on the installer github page linked below.

| | |
|---|---|
| battery_monitor | calibrate_gyro |
| test_imu | blink |
| test_encoders | test_motors |
| test_dsm2 | balance |

Your example balance program has a configuration file located in /root/robot_config/balance_config.txt which is loaded every time BeagleMiP starts balancing, allowing you to rapidly change control parameters and settings.

To make your own programs run automatically on boot, edit the /root/Auto_Run_Script.sh file to include your own program or to stop the default balance program from running automatically.

## Further References

For more information on using the Robotics Cape development environment please download BeagleBone Robotics from the github documentation page. This is also where you will find the Robotics Cape schematic and header pin table describing how the BeagleBone Black header pins are configured.
https://github.com/StrawsonDesign/Robotics_Cape_RevC_Documentation

The installer package that includes all libraries and examples is open source and available on github here:
https://github.com/StrawsonDesign/Robotics_Cape_RevC_Installer

Also consult http://strawsondesign.com/#!manual-install for a quick API reference.

The BeagleBone Black itself is an open source platform with widespread community support. Use beagleboard.org and http://beagleboard.org/community/forums for BeagleBone specific issues.