

Setting up a BeagleBone Blue for robotics using Cloud9 and Python

- A [BeagleBone Blue](#) is an amazing tiny robotics-oriented computer
- [Cloud9](#) is a browser-based integrated development environment
- [Python](#) is a programming language that's good for robotics

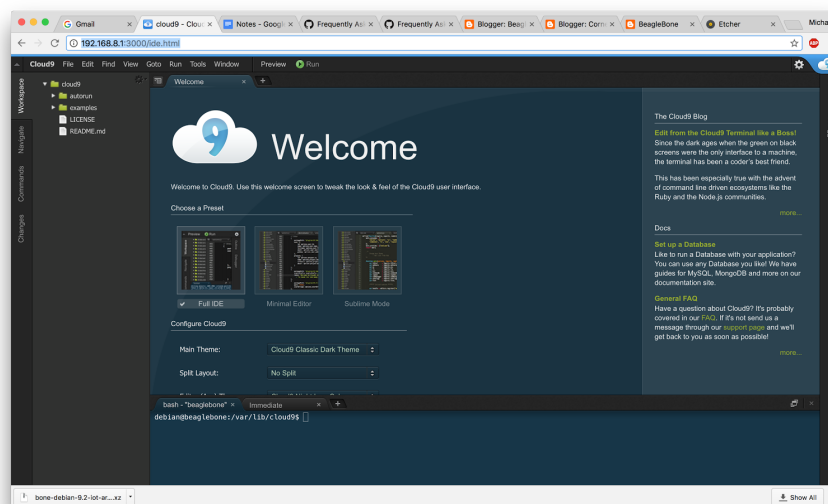
Make a bootable microSD card using the [debian](#) (linux) operating system

1. Go to <http://beagleboard.org/latest-images>
2. Choose: *Stretch IoT (non-GUI) for BeagleBone and PocketBeagle via microSD card* ("Stretch" refers to the major version of debian and IoT (non-GUI) omits user interface components that are not needed)
 - 2.1. Install [Etcher](#)
 - 2.2. Use Etcher to move the downloaded image to a microSD card
 - 2.3. Etcher is ridiculously easy to use – but the process takes a while
 - 2.4. Install the microSD card into the BeagleBone

Power up the BeagleBone and connect to Cloud9, by using either (1) or (2):

1. using a USB cable: browse to either <http://192.168.6.2:3000> or <http://192.168.7.2:3000>, depending on the USB networking drivers provided by your operating system.
2. using an external power supply: connect to the BeagleBoard wifi access point (SSID: *BeagleBone-XXXX*, where XXXX is a unique ID; Password: *BeagleBone*) and browse to <http://192.168.8.1:3000>.

Either way, Cloud9 should appear in the browser. Notice that the lower right pane is actually a terminal (shell) session giving command-line access:



Alternative way to gain command-line access

1. As an alternative to gain command-line access, connect using a USB cable and use:
`ssh debian@192.168.7.2` (password = temppwd)

Connect the BeagleBone to the internet by configuring its wifi adapter

Note that the token **highlighted in yellow** is an example; use a choice listed by “services”:

```
debian@beaglebone:~$ sudo -s (become superuser/root)
[sudo] password for debian: temppwd (use the default debian password)
root@beaglebone:/home/debian# connmanctl (starts the connmanctl program)
connmanctl> tether wifi off (not really necessary on latest images)
connmanctl> enable wifi (not really necessary)
connmanctl> scan wifi (scans for available network access points)
connmanctl> services (lists services in a strange technical format)
connmanctl> agent on
connmanctl> connect wifi_f45eab2f1ee1_6372797774616c_managed_psk
connmanctl> quit
```

Install any pending software updates for debian & roboticscape

```
debian@beaglebone:~$ sudo apt-get update
[sudo] password for debian: temppwd

debian@beaglebone:~$ sudo apt-get upgrade roboticscape
[sudo] password for debian: temppwd
```

If prompted to choose a program to run when roboticscape starts, choose “existing”.

Reboot the BeagleBone

```
debian@beaglebone:~$ sudo reboot
(reconnect using Cloud9 or ssh)
```

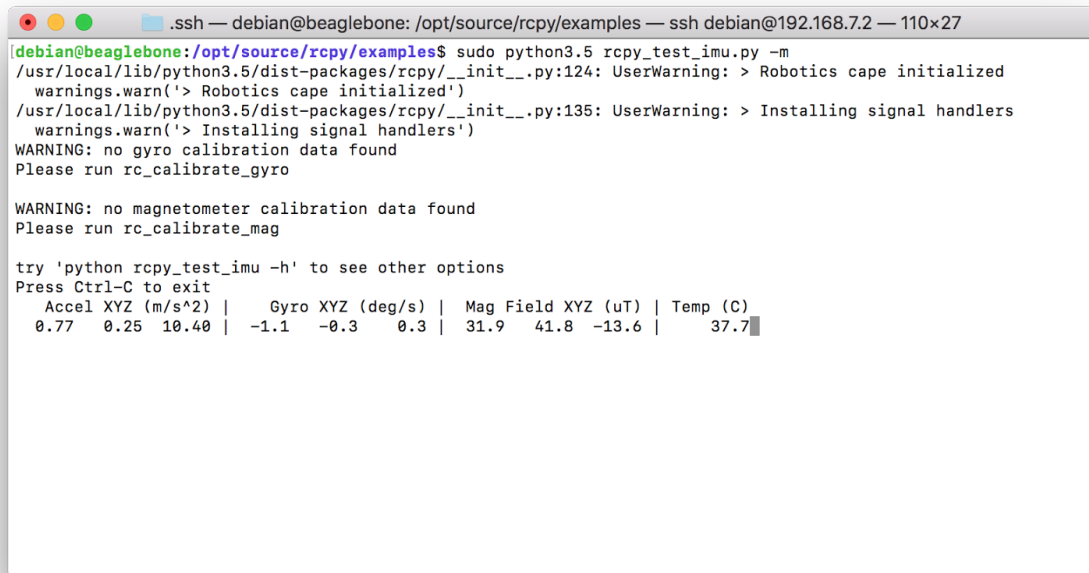
Install Python3.x, pip, and rcpy

```
debian@beaglebone:~$ sudo apt install python3 python3-pip
debian@beaglebone:~$ sudo pip3 install rcpy
```

Try running some of the rcpy examples... note: roboticscape only runs as root user

```
debian@beaglebone:~$ cd /opt/source/rcpy/examples
```

```
debian@beaglebone:/opt/source/rcpy/examples$ sudo python3.5 rcpy_test_imu.py -m
```



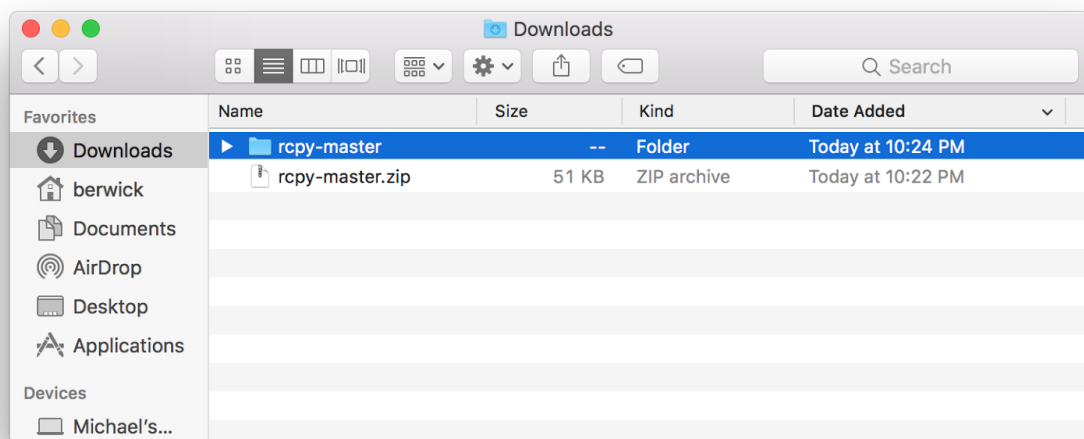
```
ssh — debian@beaglebone: /opt/source/rcpy/examples — ssh debian@192.168.7.2 — 110x27
[debian@beaglebone:/opt/source/rcpy/examples$ sudo python3.5 rcpy_test_imu.py -m
/usr/local/lib/python3.5/dist-packages/rcpy/__init__.py:124: UserWarning: > Robotics cape initialized
warnings.warn('> Robotics cape initialized')
/usr/local/lib/python3.5/dist-packages/rcpy/__init__.py:135: UserWarning: > Installing signal handlers
warnings.warn('> Installing signal handlers')
WARNING: no gyro calibration data found
Please run rc_calibrate_gyro

WARNING: no magnetometer calibration data found
Please run rc_calibrate_mag

try 'python rcpy_test_imu -h' to see other options
Press Ctrl-C to exit
  Accel XYZ (m/s^2) |   Gyro XYZ (deg/s) |  Mag Field XYZ (uT) | Temp (C)
    0.77   0.25  10.40 |   -1.1   -0.3    0.3 |  31.9  41.8  -13.6 |   37.7
```

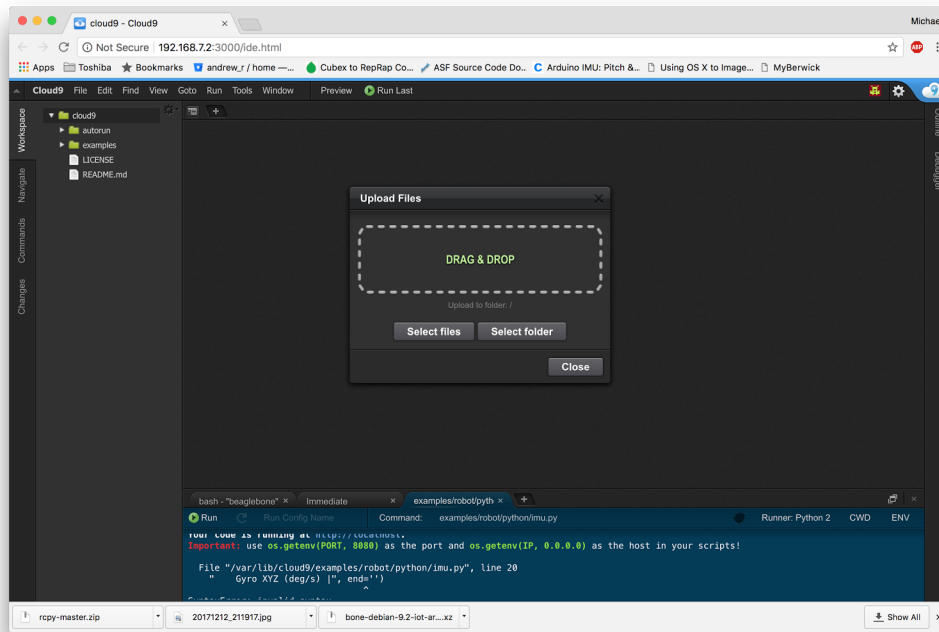
Introduce a copy of rcpy as a Cloud9 project

1. Download a copy from <https://github.com/mcdeoliveira/rcpy> (use “Clone or download” button to download a zip copy of the entire project)
2. Unzip locally:

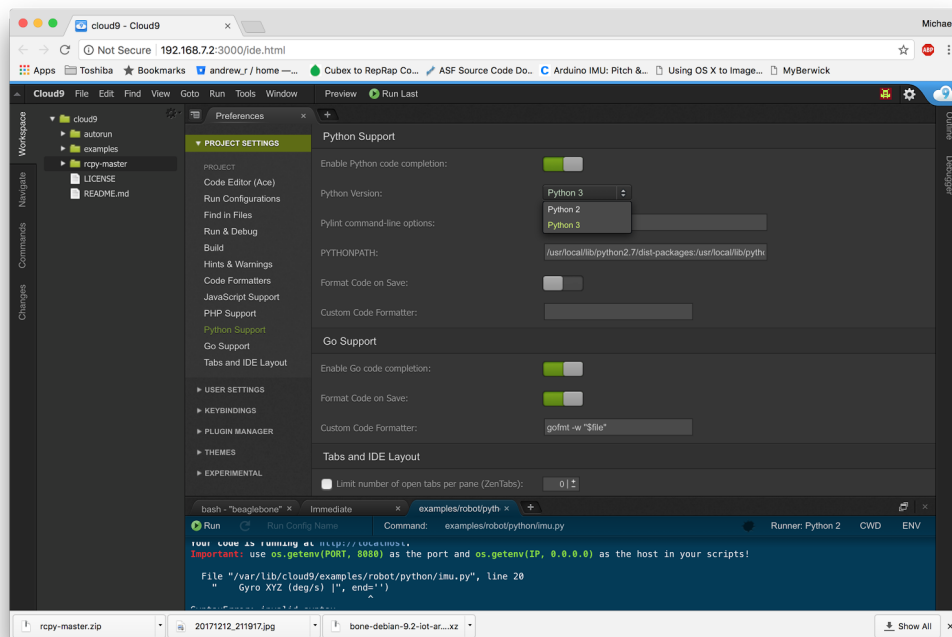


Questions? Contact jeff@jvon.org or michael@jvon.org

3. Use the Cloud9 *File/Upload Local Files...* menu option to upload the unzipped folder:

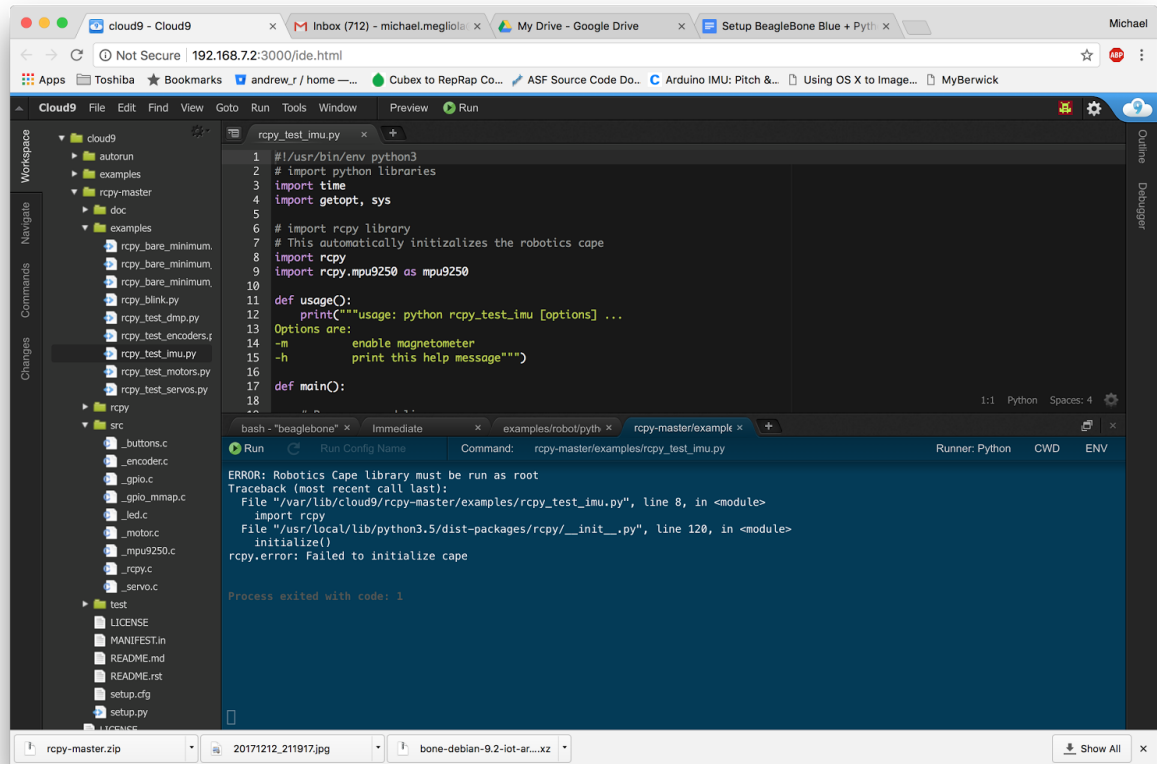


4. Use the Cloud9/Preferences menu option to switch from Python2 to Python3:



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5. Selecting and running `rcpy_test_imu.py` will fail, because Cloud9 does not start as the root user, and the roboticscape software requires root access:



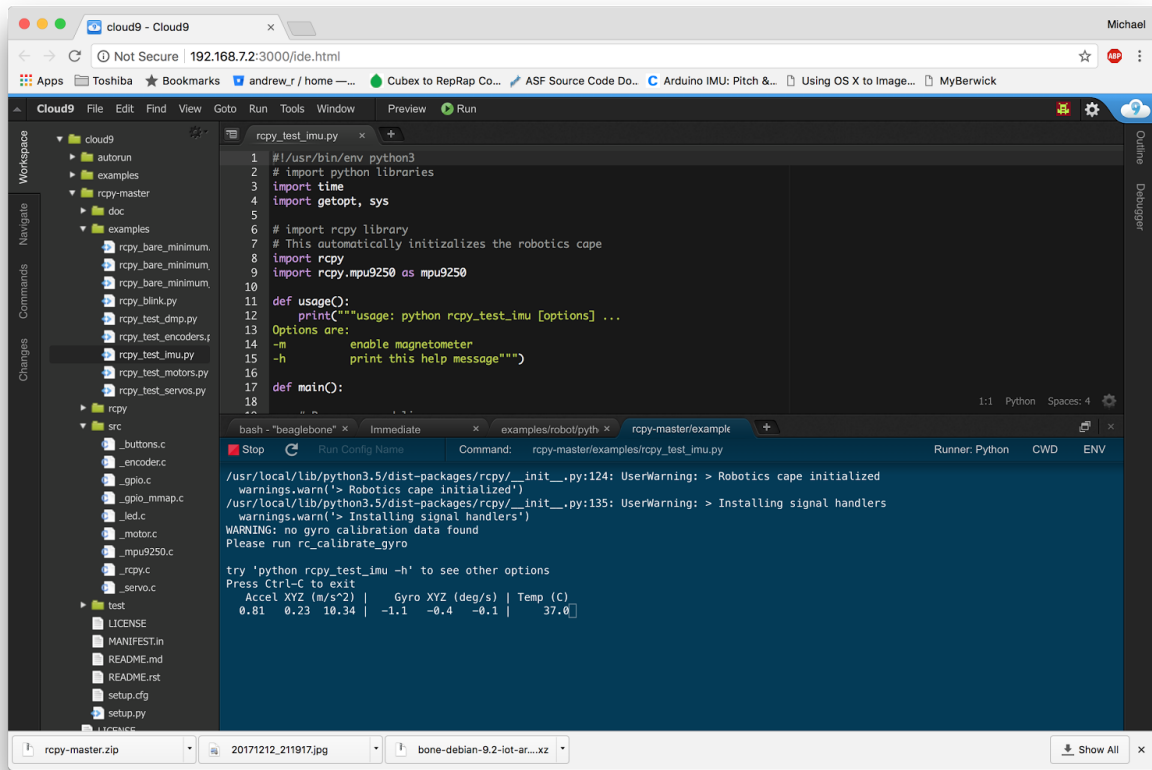
6. To correct this problem: remove the line **User=1000** from `/lib/systemd/system/cloud9.service` (allowing Cloud9 to run as root) and reboot:

`debian@beaglebone:/lib/systemd/system$ sudo vi cloud9.service`



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The BeagleBone Blue should now run rcpy under Python3.x in Cloud9:



```
1#!/usr/bin/env python3
2# import python libraries
3import time
4import getopt, sys
5
6# import rcpy library
7# This automatically initializes the robotics cape
8import rcpy
9import rcpy.mpu9250 as mpu9250
10
11def usage():
12    print("""usage: python rcpy_test_imu [options] ...
13Options are:
14-m enable magnetometer
15-h print this help message""")
16
17def main():
18    ...
19
20if __name__ == '__main__':
21    main()
```

```
bash - "beaglebone" x Immediate x examples/robot/pyth x rcpy-master/example
Stop Run Config Name Command: rcpy-master/examples/rcpy_test_imu.py Runner: Python CWD: ENV
/usr/local/lib/python3.5/dist-packages/rcpy/__init__.py:124: UserWarning: > Robotics cape initialized
warnings.warn('> Robotics cape initialized')
/usr/local/lib/python3.5/dist-packages/rcpy/__init__.py:135: UserWarning: > Installing signal handlers
warnings.warn('> Installing signal handlers')
WARNING: no gyro calibration data found
Please run rc_calibrate_gyro

try 'python rcpy_test_imu -h' to see other options
Press Ctrl-C to exit
Accel XYZ (m/s^2) | Gyro XYZ (deg/s) | Temp. (C)
0.61 0.23 10.34 | -1.1 -0.4 -0.1 | 37.0
```

*Special thanks to Mauricio de Oliveira at UCSD for creating **rcpy** and to Robert Nelson at Digi-Key for helping out with item #6.*