Executive Summary
Learn how to properly install, update, and use one of the many Python GPIO libraries, Adafruit_BBIO. This library will allow the typical user with basic programming knowledge be able to develop a program that will create full interaction between the BeagleBone Black microcontroller and any circuit of their choosing that requires a toggling or high and low input.
Introduction

Microcontrollers can be and are used for many different applications today. One of the many sought after uses of the BeagleBone Black is to interface a circuit which contains various multiplexers and selection chips with an easy to use computer-based graphical user interface. In order for all of this to happen, a main concern is to have the proper libraries installed and accessible so that a user can SSH into the board and make the appropriate changes to the program and change the outcome of the different user inputs.

Overview

Step one is going to go through the initial startup instructions of connecting the BeagleBone Black for the first time and installing the appropriate drivers to the host PC. Step two will explain how to use the board’s web interface to open an SSH connection through the GateOne SSH client. Step three gives the commands for logging in to the BeagleBone the first time. The actual installation instructions for Adafruit_BBIO are listed in step four, and a testing procedure is given in step five.

Step One: Connecting the BeagleBone Black

The BeagleBone Black ships with an Angstrom distribution operating system preinstalled that will work for the purposes of this guide. After plugging the board via USB in for the first time, go to beagleboard.org/GettingStarted to download and install the necessary drivers needed to be able to open an SSH connection.
Install the drivers for your operating system to give you network-over-USB access to your Beagle. Additional drivers give you serial access to your board.

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<th>Operating System</th>
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<td>Windows (64-bit)</td>
<td>64-bit installer</td>
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| Windows (32-bit) | 32-bit installer | - Note 1: Windows Driver Certificate warning may pop up two or three times. Click “Ignore”, “Install” or “Run”
- Note 2: To check if you’re running 32 or 64-bit Windows see this: http://support.microsoft.com/kb/892715.
- Note 3: On systems without the latest service released, you may get an error (0x80001005). In that case, please install the following and retry: http://www.microsoft.com/en-us/download/confirmation.aspx?id=13933.
- Note 4: You may need to reboot Windows. |
| Mac OS X | Network Serial | Install both sets of drivers. |
| Linux | mladevusb.sh | Driver installation isn’t required, but you might find a few usbv rules helpful. |

Note: Additional FTDI USB to serial/UTAG information and drivers are available from http://www.ftdichip.com/Drivers/VCP.htm.

Note: Additional USB to virtual Ethernet information and drivers are available from http://www.linux-usb.org/gadget/ and http://joshua.se/commisc.

Continue following the steps to update to the newest version of Angstrom, and then proceed to Step 2: Connecting via SSH.

**Step 2: Connecting via SSH**

If not already done so, open a new tab in a browser (not Internet Explorer!) and connect to the board: 192.168.7.2.

On the left hand side of the screen, click on the GateOne SSH link, and then click on the “GateOne SSH client” to launch the SSH connection client.
If the browser complains of certificate errors, it is safe to proceed anyway. NOTE: If Google Chrome errors out saying “The webpage has a redirect loop”, go back to the previous page and click “Set Date” to set the date on the BeagleBone Black.

**Step 3: Signing in For the First Time**

After connecting through SSH, there is no need to fill in the fields for Host/IP or Port. The values that are in the “[ ]” brackets represent the default values. For the User field, enter “root”. Leave the password blank.
NOTE: From this point forward in the tutorial, the board must have an internet connection to be able to download the proper packages. The internet connection will only be necessary when new or existing packages would like to be installed or updated.

**Step 4: Installing and Updating Adafruit_BBIO GPIO Library**

Execute the following lines of code one line at a time:

```bash
opkg update && opkg install python-pip python-setuptools python-smbus
pip install Adafruit_BBIO
```

This will initiate the update and installation process for this GPIO library. The terminal will return to the `root@beaglebone:~#` prompt. If the installation path or package names are desired, scroll back through the terminal to see what directory everything is being unpacked.

**Step 5: Validate Installation**

To validate the installation, type `python` at the prompt to run the Python interpreter that came with the BeagleBone Black. Once Python loads, type:
import Adafruit_BBIO.GPIO as GPIO

This should not return any errors. If it does, go back and repeat step 4 and be sure the internet connection to the BeagleBone is operating correctly.

A simple test program is written below. This program can be ran line by line in the Python shell and will configure pin 11 on rail P8 (P8_11) as an output and toggle it high then back low again (the ‘>>’ represents the command line in the Python shell). The rail numbers, P8 and P9, are numbered on the board as are the two starting and two ending pins for both rails. To be able to see this pin toggle, use a Digital Multimeter to test the voltage at pin P8_11. Any ground pin will work, pins 1 and 2 on rail P8 are easy to reach.

>> import Adafruit_BBIO.GPIO as GPIO
>> GPIO.setup("P8_11", GPIO.OUT)
>> GPIO.output("P8_11", GPIO.HIGH)
>> GPIO.output("P8_11", GPIO.LOW)

The last two lines can be continuously repeated as many times as desired to test the functionality of this specific pin.