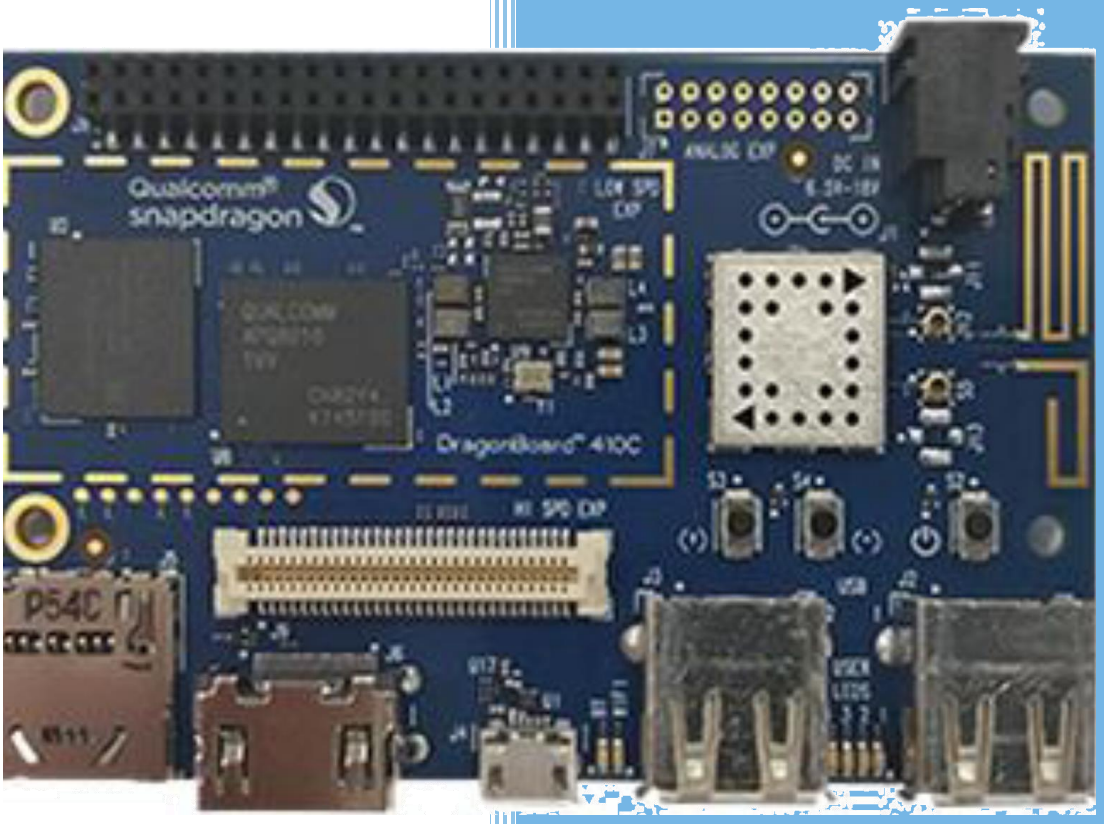
Sensor Demo Project

DragonBoard™ 410c



PROJECT OVERVIEW

This project uses the DragonBoard™ 410c from Arrow Electronics, which has the same Qualcomm® Snapdragon™ processor found in many of today's most popular smartphones. With the simple connection of some wires and sensors, you'll be able to control virtual 3D objects by having them change and move at your command in real-time. These instructions show how easy and fun it can be to build with the heart of a dragon!

Qualcomm Snapdragon is a product of Qualcomm Technologies, Inc.

WHAT YOU'LL NEED

Inventory check! Make sure you have all the items in the charts below.

DRAGONBOARD AND SENSORS

		
DRAGONBOARD 410C	12V WALL ADAPTER	96BOARDS SENSORS BOARD
		
GROVE GESTURE SENSOR	GROVE DIGITAL LIGHT SENSOR	GROVE COLOR SENSOR
		
DOUBLE-SIDED FOAM TAPE *(OPTIONAL)*	COLOR PAPER OR OTHER COLORED-OBJECTS	LIGHT SOURCE (FLASHLIGHT OR PHONE APP)

MONITOR, KEYBOARD, AND MOUSE

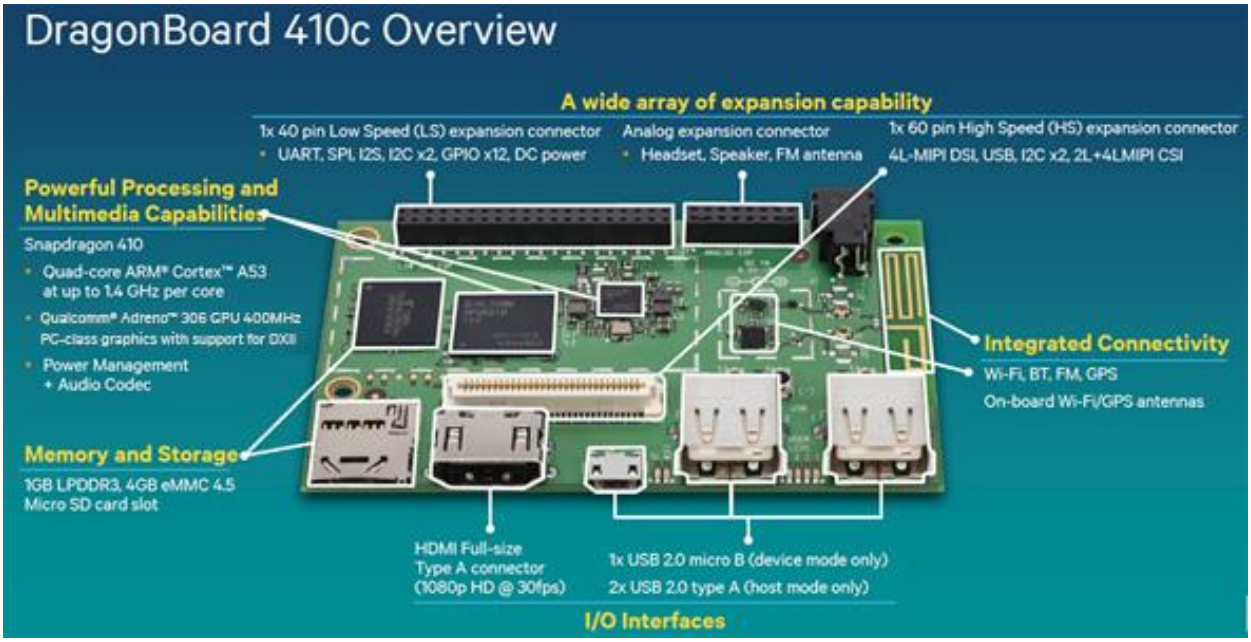
		
1080P HDMI MONITOR, HDMI CABLE, POWER CORD	USB KEYBOARD	USB MOUSE
		
COMPUTER	CONSOLE CABLE MICRO USB TO USB CABLE	

OVERVIEW OF THE DRAGONBOARD 410C

What is a DragonBoard? It's a powerful single board computer (SBC) with a Snapdragon™ 400 series processor on board. It also has Wi-Fi, Bluetooth connectivity and GPS, all packed into a board the size of a credit card! It's helping to enable embedded computing and Internet of Things (IoT) products in many areas including robotics, medical, entertainment and much more.

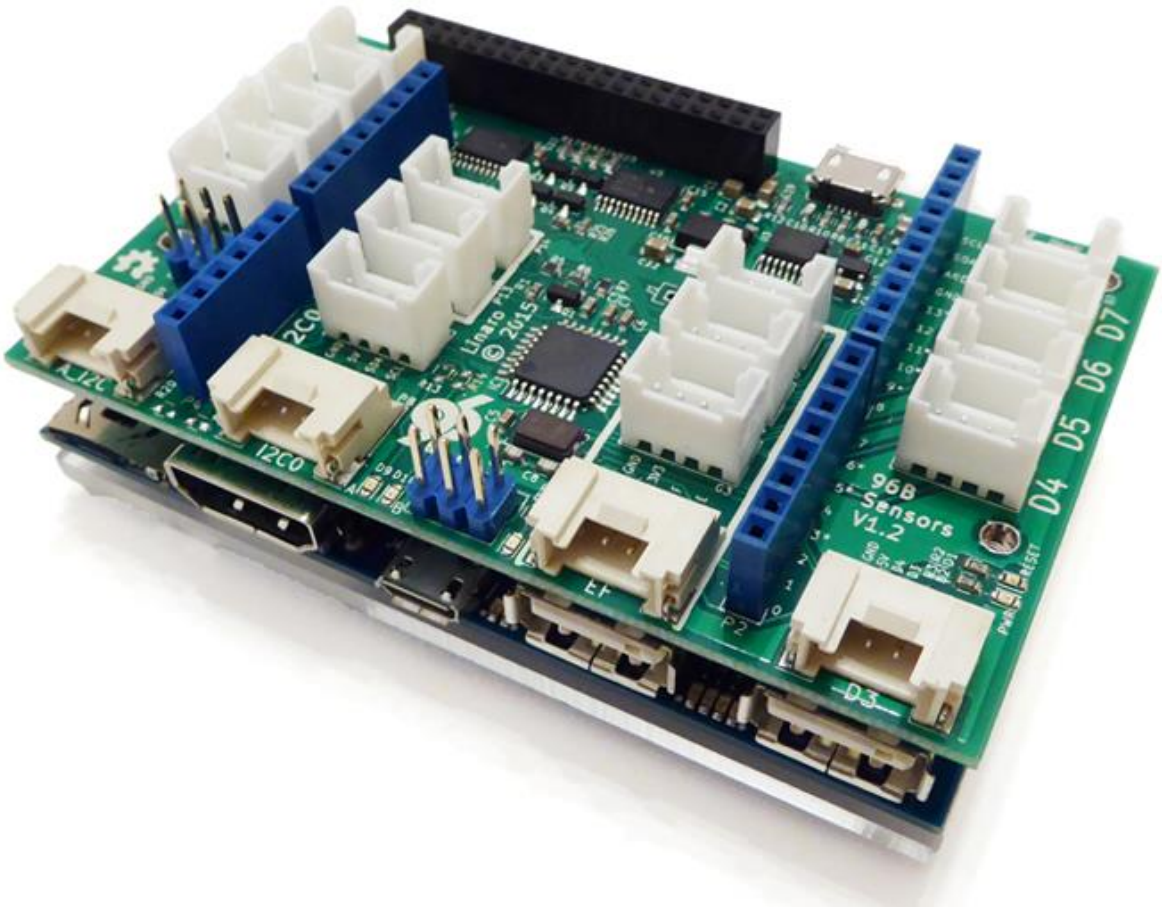
The DragonBoard 410c is also designed to support education and prototyping. We'll be using it to demonstrate using three sensors (light, gesture and color) to manipulate objects on the screen.

Below is an overview of the DragonBoard 410c components. For this workshop, it's not necessary to understand each component, but is helpful to see where things connect up. In the diagram, find the **40 pin Low Speed (LS) expansion connect**, we'll be using that on the next page.



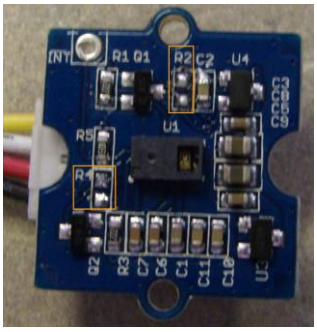
MAKING THE CONNECTIONS

Attach the 96boards sensors board to the DragonBoard 40-pin low speed expansion connector. It will look like a double-stack of boards like this:



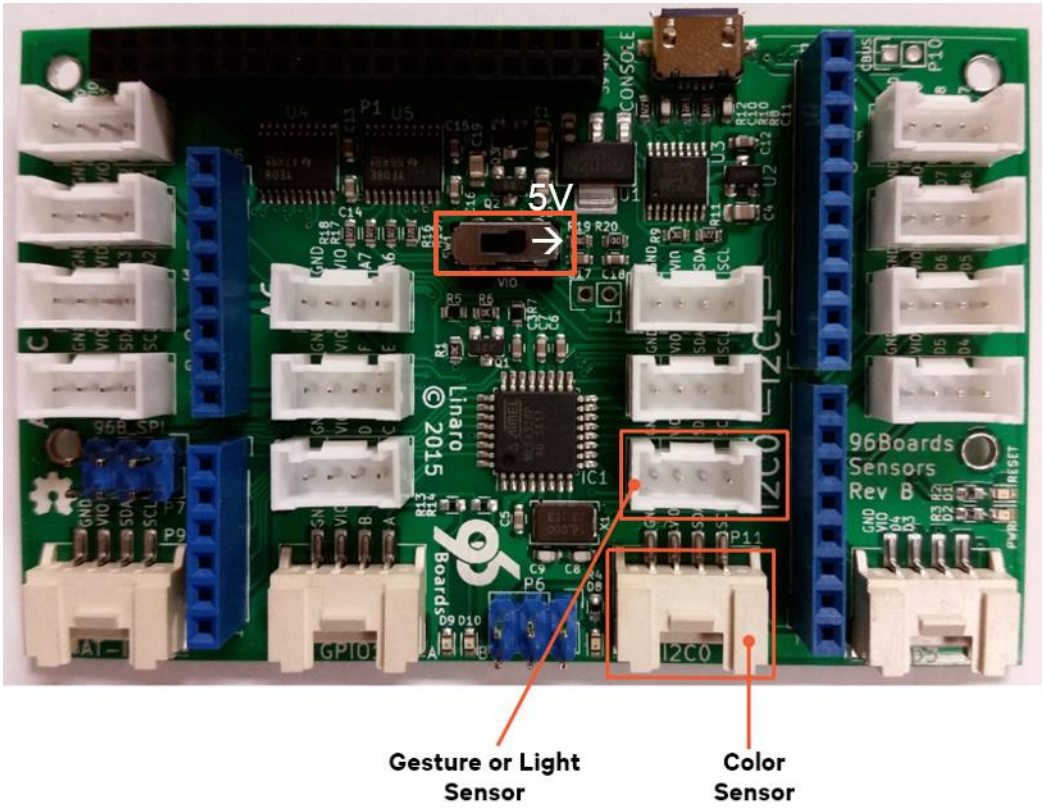
[CONDITIONAL] REMOVING RESISTORS FROM THE GESTURE SENSOR

If you are using Rev. B of the 96boards sensor board, you will need to remove resistors R2 and R4 from the **gesture sensor**, as shown below. If you have version V1.2 or later, you can skip this step ☺.

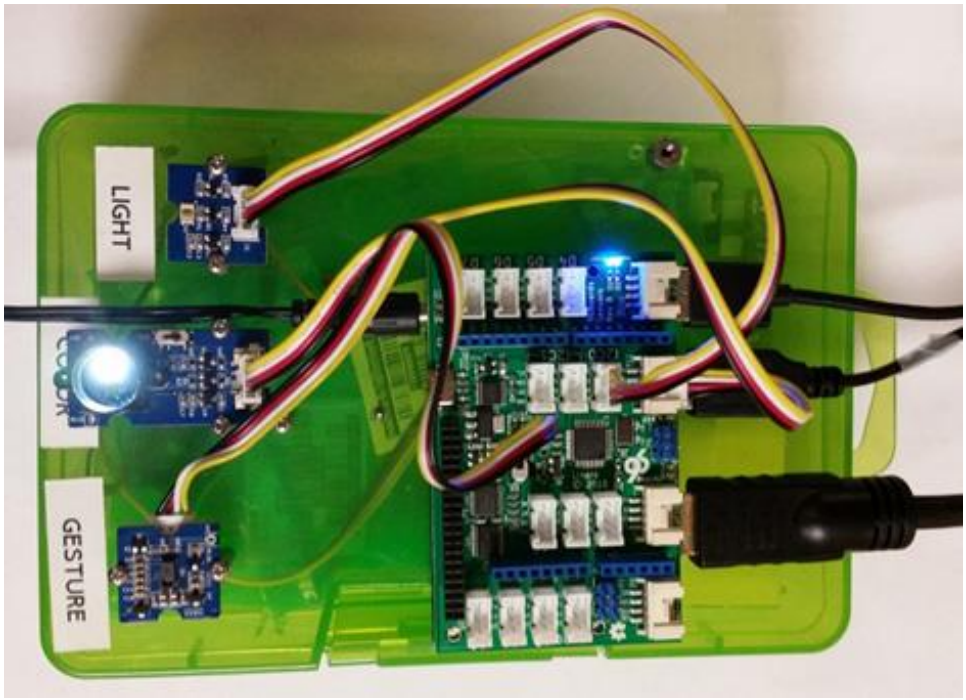


CONNECTING THE SENSORS

If you are using Rev. B of the 96boards sensor board, be sure to set the 3V/5V switch to the 5V position, as shown below. In the project's current configuration, any two sensors can be connected to the I2C0 ports at one time. Connect the sensors to the 96boards sensors board according to the image below:



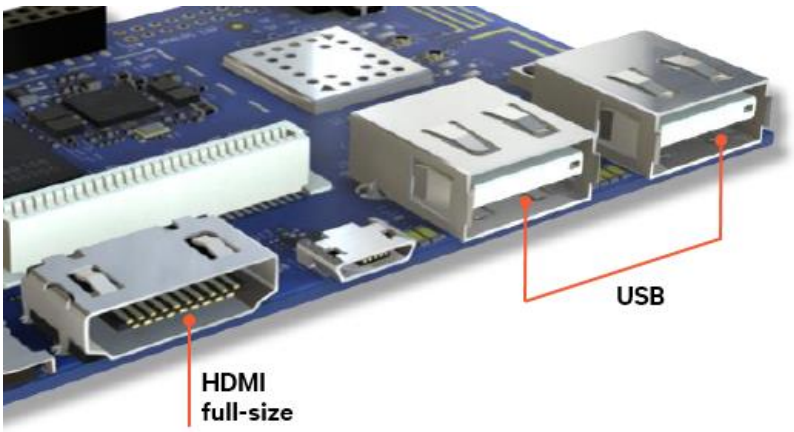
If desired, use the foam tape to firmly stick the sensor modules on a box or table surface.

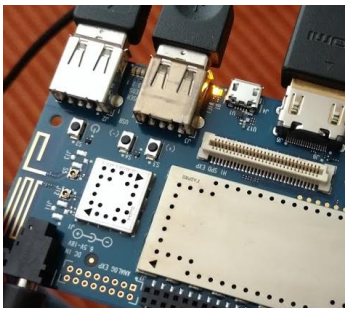


CONNECTING THE MONITOR, KEYBOARD, AND MOUSE

Plug the USB connector for the mouse and keyboard into the DragonBoard 410c USB ports.

Plug the monitor's HDMI cable into the DragonBoard 410c HDMI port. Plug in the monitor's power cord and power on the monitor.

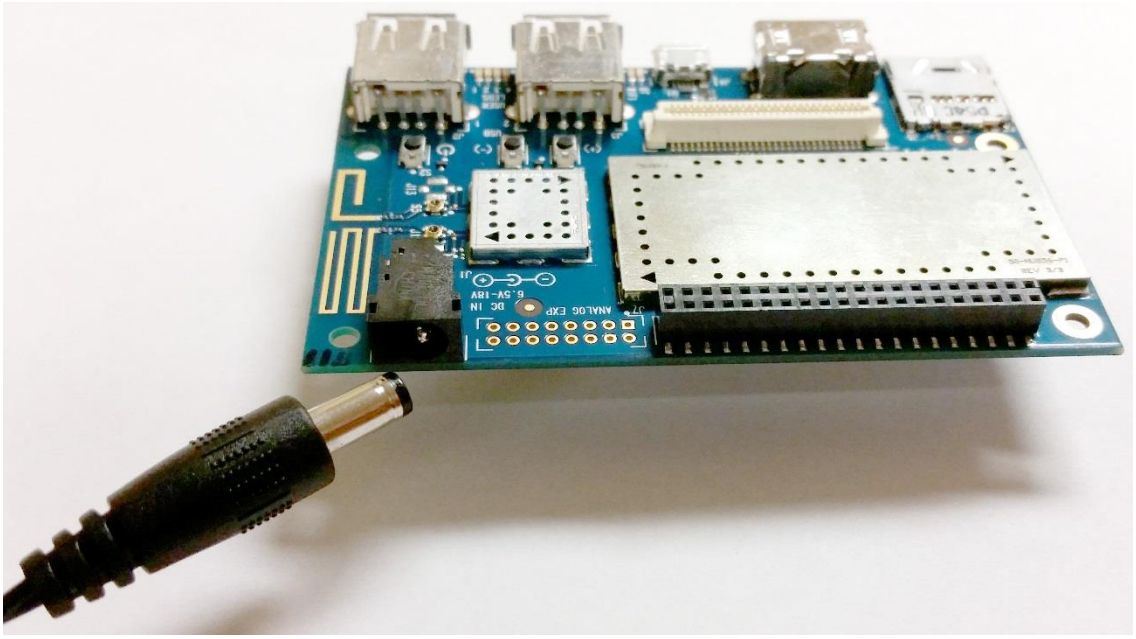




POWERING AND BOOTING UP

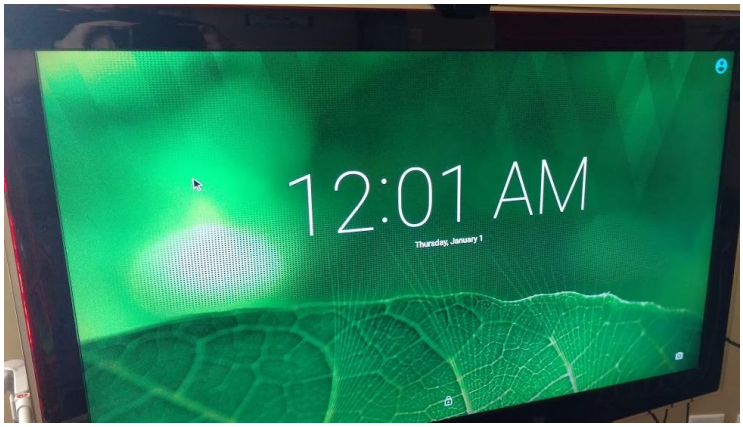
Stop to Review and verify all connections. Before connecting the power, verify that all of the connections have been made.

POWER: Once connections are verified, connect the power cord to the DragonBoard 410c and let Android boot up!



Verify the monitor is ON and display is on the correct HDMI port (use the monitor remote to change if needed).

BOOT: Give the board a few minutes to power up until the Snapdragon logo appears and the Android OS appears on the screen, followed by the Android home screen.



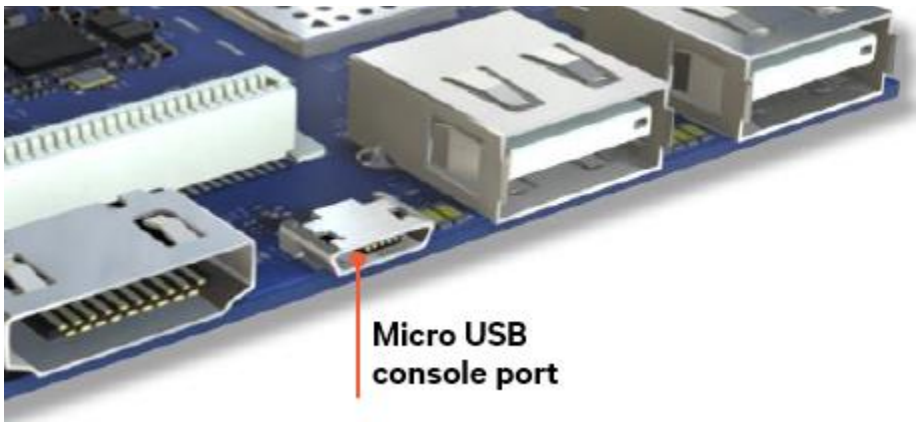
If the screen is locked, press the spacebar on the keyboard

INSTALLING THE SENSOR DEMO APP

Follow these instructions to sideload the Sensor Demo app on the DragonBoard 410c.

1. You'll need to access the board with ADB. If you have not used ADB yet, please see the Appendix for first time setup instructions.

2. Once you have these ADB installed on your computer and the corresponding device library for the DragonBoard 410c, connect the console cable to the DragonBoard Micro USB port, and to a standard USB connector on your computer.

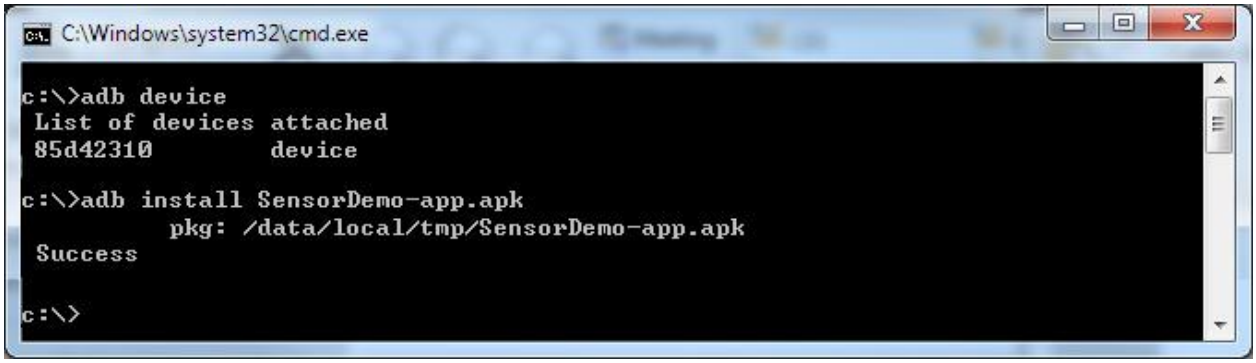


3. Your computer should then recognize the DragonBoard 410c as an Android device, which you can verify with the command:

   "**adb device**"

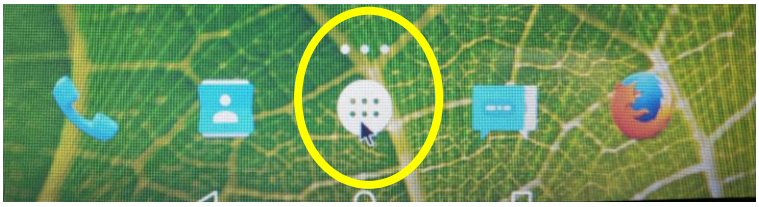
4. Install the Sensor Demo app using the command:

   "**adb install SensorDemo-app.apk**"



5. Unplug console cable.

6. On the HDMI monitor, click on the app icon (icon with the dots), and then double-click on the "**DB Workshop**" icon to run the Sensor Demo app



Congratulations –

Now try out the sensors!

USING THE SENSORS

Below are steps to use the various sensors. Have fun!

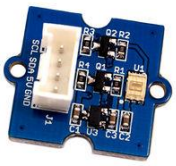
USING THE GESTURE SENSOR

Try moving your hand over the sensor in the following ways:

- Up
- Down
- Left
- Right
- Forward (zoom-in)
- Backward (zoom-out)
- Clockwise
- Counter Clockwise
- Wave (re-centers)

Each action will move the 3D object on the monitor in the direction of the gesture. Waving hand quickly will (re)center the object.

USING THE LIGHT SENSOR



Use a phone's flashlight app or other light source in front of the sensor

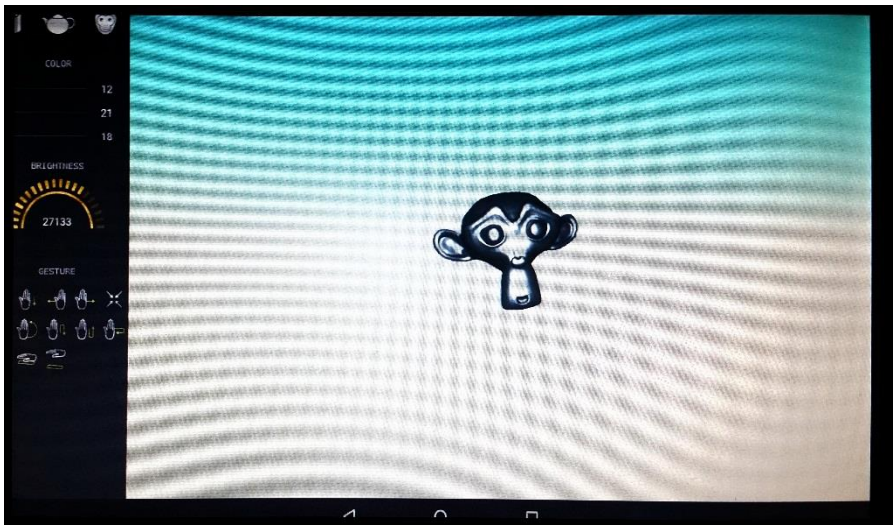
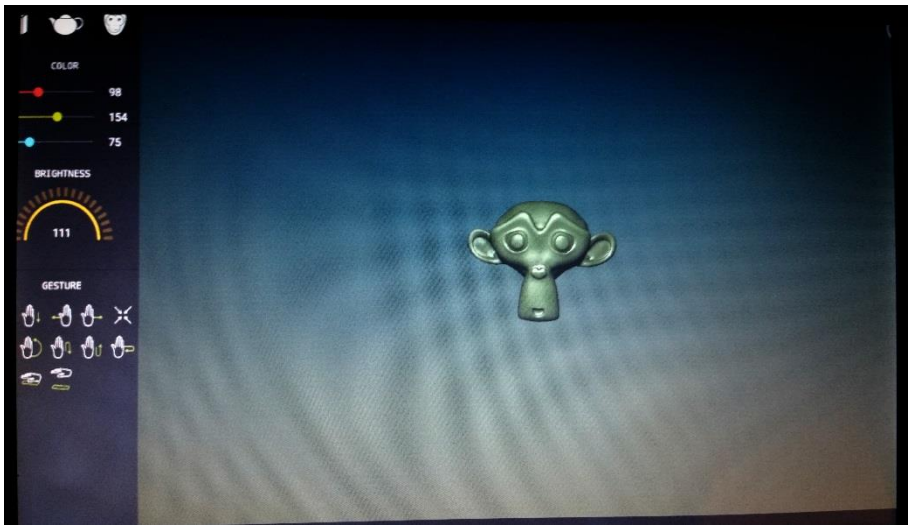
The light will control the background lighting on the screen. Note the changes in the light level indicator on the left side of the screen.

USING THE COLOR SENSOR

Place different colored objects over the color sensor

The color of the 3D objects will change. Note also the changes in the color sliders on the left side of the screen.

EXAMPLE SENSOR RESULTS

No Sensors Activated	
Light Sensor Activated	
Color Sensor Activated (green)	

NEXT STEPS

Now that you have begun working with the DragonBoard 410c, there are many things you can do from here. Below are a few suggestions:

- Visit developer.qualcomm.com for some new projects or post a blog about your experiences
- Take a class on IOT concepts, one to try might be: https://www.coursera.org/learn/internet-of-things-dragonboard
- Investigate and work to better understand the components and wiring on the boards
- Try using other sensors and modifying the application to include those new sensors
- Modify the application to add other objects or perform other functions

You are only limited by your imagination – have fun and all the best with your next projects!

APPENDIX: USB DRIVER INSTALL AND ADB ACCESS (WINDOWS)

Before You Begin:

1. Ensure the 410c has the 3rd switch on the bottom in the off position (S6[PIN3] == OFF)
    a. This enables accessing the board via adb using the micro USB port
2. Follow the steps below in order, BEFORE connecting the 410c to your computer via the USB cable (for easier setup)
    a. If you plugged it in already, that's OK, we'll show you how to fix it below

Step-by-Step Guide:

1. **Install the Android SDK and USB driver**
    a. The SDK Tools can be installed by themselves (stand-alone), or bundled with Android Studio
        i. Download whichever makes sense for you (Android Studio may be useful if you plan to write apps)
        ii. Here's the link: http://developer.android.com/sdk/installing/index.html
        iii. Remember where you install the SDK Tools, as we'll need the installation path later
    b. Download the Android USB Driver using the SDK Manager
        i. Refer to this link: http://developer.android.com/sdk/win-usb.html

2. **Plug in the 410c wall power adapter to supply power to the board**
    a. Wait a few seconds for the board to power up

3. **Add the SDK Tools directory to your computer's path variable**
    a. This tells your computer where the 'adb' command is located
    b. Right-click on My Computer, select Properties -> Advanced system settings -> Environment Variables (lower right-hand corner)
    c. Open notepad (Start -> type 'notepad' -> press enter)
    d. Double-click on the 'Path' entry in the 'System variables' list
    e. Copy the existing text into notepad, add ';' followed by C:\<path to SDK tools>\platform-tools
    f. Copy the text out of notepad and back into the 'Variable value' text box, click OK (3 times to close the 3 windows)

4. **Tell the Android USB Driver how to recognize the 410c**
    a. Open the android_winusb.inf file using notepad
        i. The file is located here: <path to SDK tools>\extras\google\usb_driver\android_winusb.inf
        ii. Search your home directory for 'android_winusb.inf' if you can't find it
        iii. Note: If you installed the SDK in a directory requiring administrator access (ex. C:\Program Files)

1) Right click on Notepad in the start menu and click 'Run as administrator'
2) Open the file using File->Open (change 'Text Documents' to 'All Files' in the bottom right corner)

b. Add the following lines in the [Google.NTx86] section:

```
;Dragonboard 410c
%SingleAdbInterface%        = USB_Install, USB\VID_05C6&PID_9091
%CompositeAdbInterface%     = USB_Install, USB\VID_05C6&PID_9091&MI_00
%CompositeAdbInterface%     = USB_Install, USB\VID_05C6&PID_9091&MI_01
%CompositeAdbInterface%     = USB_Install, USB\VID_05C6&PID_9091&MI_02
%CompositeAdbInterface%     = USB_Install, USB\VID_05C6&PID_9091&MI_03
%SingleBootLoaderInterface% = USB_Install, USB\VID_18D1&PID_D00D
```

c. Add the same lines in the [Google.NTamd64] section

d. Make sure the following lines exist in the [Strings] section:

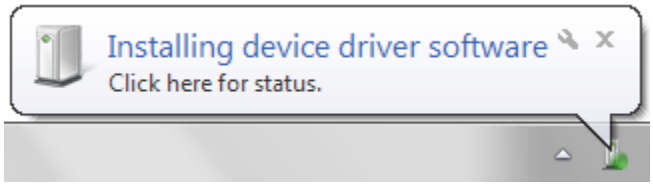
```
SingleAdbInterface          = "Android ADB Interface"
CompositeAdbInterface       = "Android Composite ADB Interface"
SingleBootLoaderInterface   = "Android Bootloader Interface"
```

5. Tell ADB to recognize the 410c

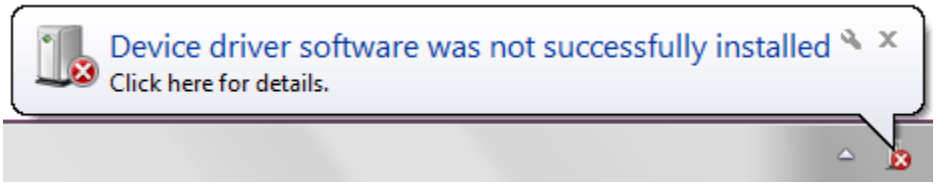
a. Open a new file explorer window, and type %USERPROFILE%, then Enter in the navigation text box
b. If there isn't a '.android' directory, create it (note the dot in the front)
c. Enter the '.android' directory
d. Edit the file 'adb_usb.ini' in notepad, creating it if it doesn't already exist
e. Add the line '0x05C6' to the end of the file, on a new line
f. Do not run 'android update adb' after this point, as the manual update will be overwritten

6. Fixing the USB Driver (if you connected before installing the driver, or if the driver install failed)

a. Skip this step if you performed steps 3-5 prior to connecting the 410c to your computer via USB
b. If you plugged in the USB cable before installing the drivers, you will likely see this:

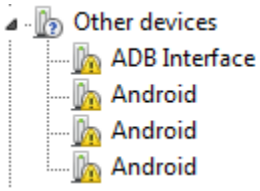


c. Followed shortly by this:



d. Click Start -> Control Panel -> Device Manager (right click and select 'Run as Administrator')

e. You should see the device with yellow exclamation marks next to it:



f. Right click on ADB Interface and select Properties

g. Click Update Driver, and select 'Browse my computer for driver software'

h. Enter the path to the usb_driver directory mentioned above, and check the 'Include subfolders' box, click Next

i. You may get a security warning, which is OK - click Install this driver software anyway

j. Repeat these steps for all 4 problematic drivers shown under 'Other devices'

k. Note: If you see 'Driver Not Found' after performing these steps, check the Hardware ID to ensure it matches

   i. Right click on the problematic driver and select 'Properties'

   ii. Click the 'Details' tab, and select 'Hardware Ids' in the dropdown

   iii. The values after VID_, PID_ and MI_ should all match what's shown above (step 4b)

   iv. If not (maybe the board you're using is a newer model), update the changes made in step 4 with the correct ID

   v. Retry once this is fixed (repeating for each driver that doesn't install properly)

7. Now you're ready to plug in the USB cable

a. Plug the micro USB side into the 410c, and the normal USB side into your computer

b. You should not see any pop-ups saying 'Device driver software was not successfully installed'

   i. Refer to step 6 if this happens

8. Open a new command terminal to launch adb

a. Click Start -> Type 'cmd', and press enter

b. Type 'adb usb' to start adb in USB mode

   i. If you see 'adb' is not recognized as an internal or external command, review step 3 to ensure the path variable is correct (close and re-open the terminal once this is done)

   ii. If you see 'error: device not found', review steps 4-6 to ensure all steps were followed correctly (you can also try restarting your computer after step 6)

   iii. At this point you should see 'restarting in USB mode'

c. Type 'adb devices' to see the device's address
d. If there's only one device connected, you don't need to specify the address for future ADB commands