

Setting up a TFT Display with Touchscreen for the BeagleBone (Black/Green)

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Components needed:

- 7.0" 40-pin TFT Display - 800x480 with Touchscreen
<https://www.adafruit.com/product/2354>
- RA8875 Driver Board for 40-pin TFT Touch Displays - 800x480 Max
<https://www.adafruit.com/product/1590>

This document guides the user through:

1. Setting up the wiring of the RA8875 Driver Board and TFT Display Touchscreen with the BeagleBone.
2. Setting up the device tree.
3. Using a C program to initialize the LCD to get a head start with programming with it.

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Formatting:

1. Host (desktop) commands starting with \$ are Linux console commands:
\$ echo "Hello world"
2. Target (board) commands start with #:
echo "On embedded board"
3. Almost all commands are case sensitive.

1. Soldering the pins to the RA8875 Driver Board

1. When you receive the RA8875, you'll need to solder the provided pin headers onto the RA8875 driver board.
2. Ensure when soldering the pins, the longer end points down and the shorter end points up. With this orientation, place the pin headers underneath the driver board.
3. The resulting board after soldering should look like:



Figure 1 - RA8875 with the pins soldered

4. This orientation minimizes wiring and allows easier prototyping because it can be directly placed onto a breadboard.

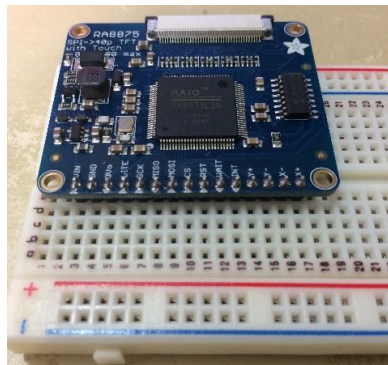


Figure 2 - RA8875 placed onto a breadboard

5. To connect the ribbon cable from the LCD to the driver board, pull the black plastic slot to release the clamp on the driver board (shown below):

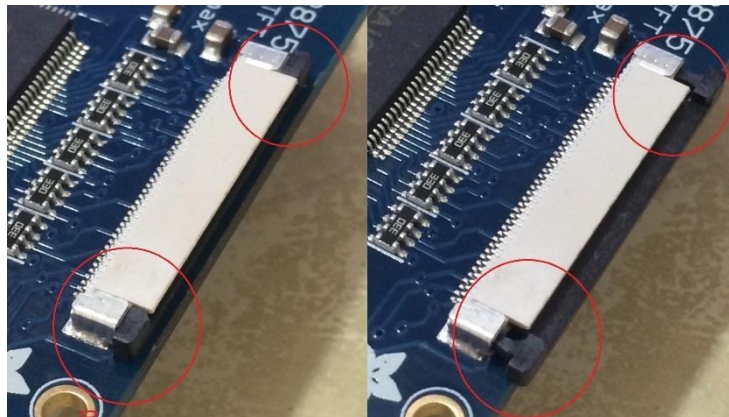


Figure 3 - Ribbon cable clamp on the RA8875

6. Insert the LCD ribbon cable onto the slot and push back the black plastic slot to secure the ribbon cable onto the board.

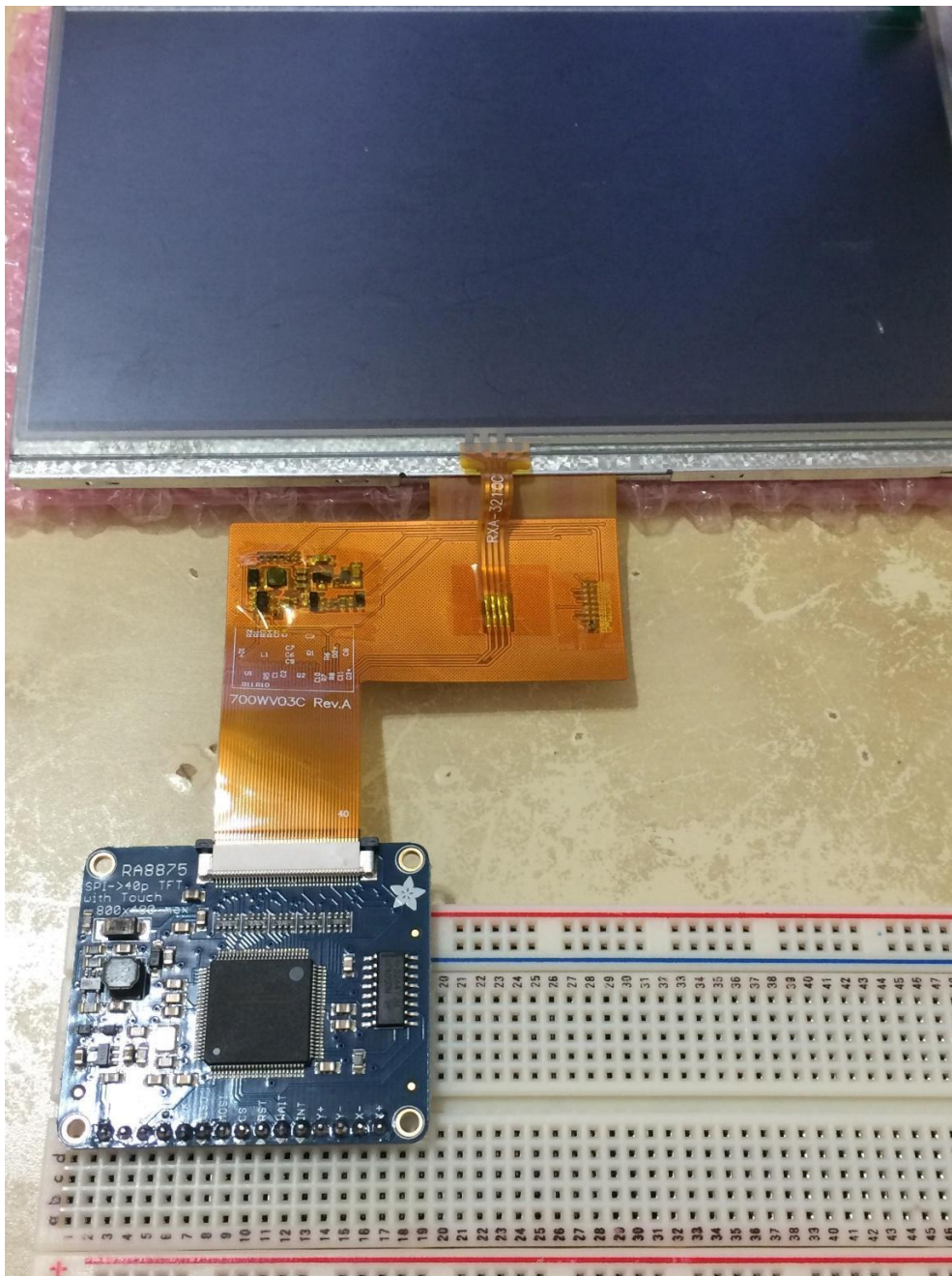


Figure 4 - Setup between RA8875 and LCD

2. Wiring the RA8875 Driver Board to the BeagleBone

1. Some of the necessary pins needed to drive the LCD are in use by the Zencape's I2C. To connect the LCD's driver board onto the BeagleBone, we need to remove the Zencape.
2. Ensure the BeagleBone is powered off.
3. On the LCD driver board, there are 15 pins. We'll use the pins: VIN, GND, SCK, MISO, MOSI, CS, RST, and INT.

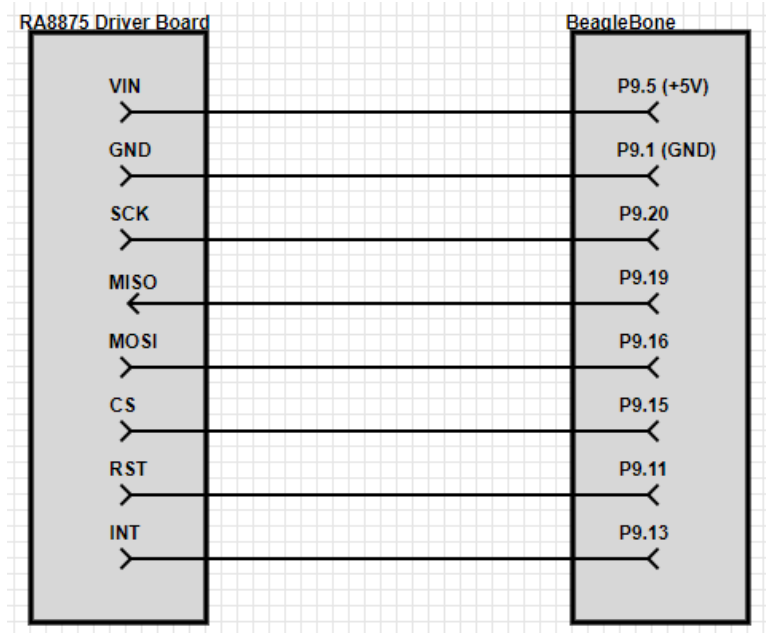


Figure 5 - Wiring between RA8875 and BeagleBone

4. Wire up the circuit as shown in Figure 5.
5. Troubleshooting:
 - Double check your circuit (Ask a friend)
 - Ensure the BeagleBone is oriented the correct way (i.e., using P9 and not P8)

3. Device Tree: Enabling the LCD Touchscreen

(This section requires the .dtbo file that's provided for this guide.) For Linux to control the LCD, we must load a device tree using the cape manager. **The following is done on the target:**

1. Boot the BeagleBone and log into root.
2. Put the .dtbo file into /lib/firmware folder that's provided for this guide.
 - **Note:** When we tried to generate a SPI signal on BBG, we tried to use a similar method as I2C setup, but this did not work. We thought this was a device tree problem, so we tried 3 versions of .dts online and compile them back and forth. Incidentally, we figured out that the problem was not .dts, but a problem with the SPI API. Therefore, we are not sure which .dts is used. Hence, we give a .dtbo file.
3. Using the cape manager, enable Linux support for this cape:

```
# echo BB-SPIDEV0 > /sys/devices/platform/bone_capemgr/slots
```
4. Edit the uEnv.txt file, which configures the hardware that's loaded at startup. Append the following lines to the bottom of the uEnv.txt file (and take caution when editing):

```
cape_enable=bone_capemgr.enable_partno=BB-SPIDEV0
```
5. **(Skip this step if using BeagleBone Green).** If using the BeagleBone Black, you must unload the conflicting HDMI Cape by uncommenting the lines of uEnv.txt:

```
##Disable HDMI
cape_disable=capemgr.disable_partno=BB-BONELT-HDMI,BB-BONELT-HDMIN
```
6. Reboot:

```
# reboot
```

4. C Code

Download the files provided for the guide. It consists of a makefile, spi.c/h, lcd.c/h, gpio.c/h, and main.c.

1. Make an “/lcd” directory in your public folder:
\$ mkdir ~/cmpt433/public/lcd
2. In the directory that contains the files provided for the guide, run make
make
3. Run the executable, called lcdTest
./lcdTest
4. If the executable runs with no error, then you have completed your LCD Setup! You can now explore all the possibilities of programming an LCD Touchscreen.
 - For more information about using the driver board, you can refer to the RA8875 datasheets:
https://cdn-shop.adafruit.com/datasheets/RA8875_DS_V19_Eng.pdf
 - You may also refer to Adafruit’s library made for the RA8875 Driver Board, which was heavily influenced in the writing of the provided guide files:
https://github.com/adafruit/Adafruit_RA8875/blob/master/Adafruit_RA8875.cpp
 - Additionally, you may also refer to TeamChess’ git repository. It contains a working and ported library of the RA8875 Driver Board TFT Display for the BeagleBone
<https://github.com/Hasanchiver/CMPT433-Team-Chess>
5. Troubleshooting:
 - Ensure that the wiring is correct
 - If the executable returns an error relating to the SPI i.e., sys_err: SPI environment setting failure, then the device tree was not properly setup.