
Application Note: Connections between a 4D Display Module, the Raspberry Pi, and a Power Supply

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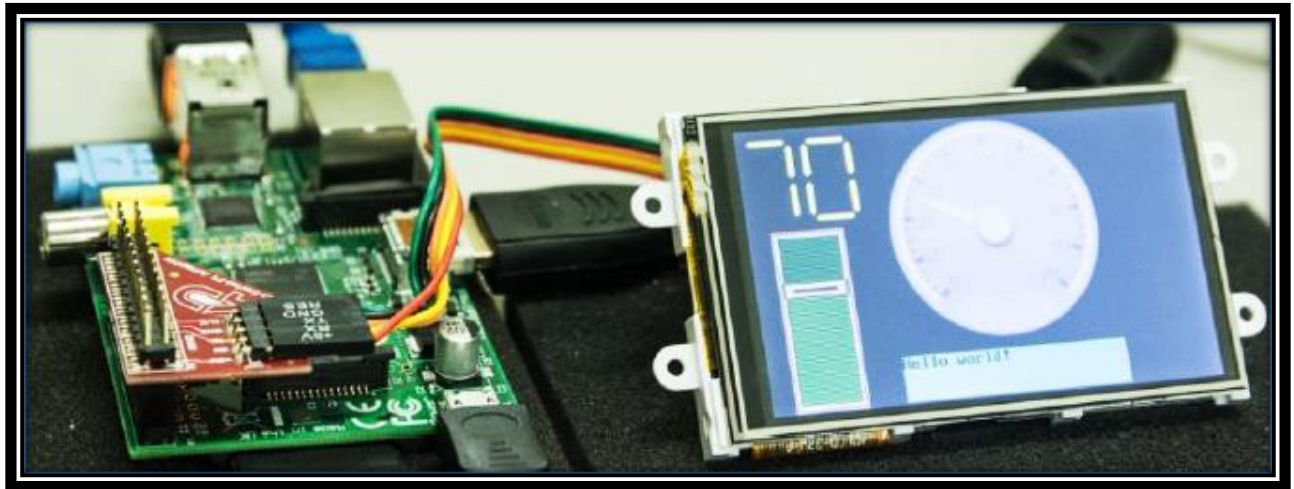


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Executive Summary:

A Raspberry Pi is a minicomputer that is attached in this project to a 4D touch-screen display to be able to extract data from any required source through sensors, and then display this data on a computer via USB cable. The Raspberry Pi must be powered in order to have it functions and will distribute this power to the display screen via connections. This application note is intended to demonstrate the connections between the 4D display module, the Raspberry Pi and the power supply.

Keywords:

Raspberry Pi, 4D Display, Power supply, connect

Introduction:

The Raspberry Pi chip is a credit-card-sized computer that is developed and designed in the UK by the Raspberry Pi Foundation for teaching purposes. [1] This minicomputer was developed to have variety input methods such as regular and micro USB, SD card slot, HDMI and many more. This chip is required in this project to measure hazards from football players' concussions, and save this data in its memory to be displayed later via computer. Thus, our team chose to interact with this device through an attached touch-screen to send commands and save data. For that, a touch-screen display module was chosen with required cables to be connected to the Raspberry Pi.

For this device to be portable, the team insisted of having a power source to assure that the device lasts for as long time as possible. Therefore, a battery was chosen as a power source for the device based on Raspberry Pi specifications so it matches and performs perfectly.

Objective:

To explain how to connect the used parts all together enhanced with figures and pictures, and to go over some details concerning testing the connections and guarantee that they are constructed as required.

Hardware Needed:

- Raspberry Pi Board Module B
<http://www.raspberrypi.org/wp-content/uploads/2012/02/BCM2835-ARM-Peripherals.pdf>
- 4D Display Module uLCD-32-PTU
<http://dlnmh9ip6v2uc.cloudfront.net/datasheets/LCD/Color/uLCD-32-PTU-PI-Datasheet-REV1.1.pdf>
- 4D Serial Adaptor
- 4400mAh Lithium Ion Battery
- Wires

Getting Started:

First, we need to understand the inputs and outputs of our main part of this device, which would be the Raspberry Pi. The system comes in two different designs: Model A and Model B. The main differences between the two designs are that Model B has two USB ports and one Ethernet jack, while model A has only one USB port and no Ethernet jack. The picture below represents the main parts of model B which will be used in this application. The Raspberry Pi has GPIO headers that could be used as true GPIO for turning LEDs on and off, I²C to connect hardware modules with two control pins, serial Rx and Tx for communication with serial peripherals, and some pins that can be used for pulse width modulation (PWM). The USB ports are the only external data connectivity option. The other connections which include RCA and HDMI ports, 3.5mm audio output, SD/MMC/SDIO card slot are all for obtaining and displaying the output data. Remember that a minimum SD card of 2GB is required to run the default operating system, and you will need even more capacity to run different codes without facing difficulties. Later on, you will need an SD card reader/writer to analyze the data, which is probably provided in all laptops nowadays. [2]

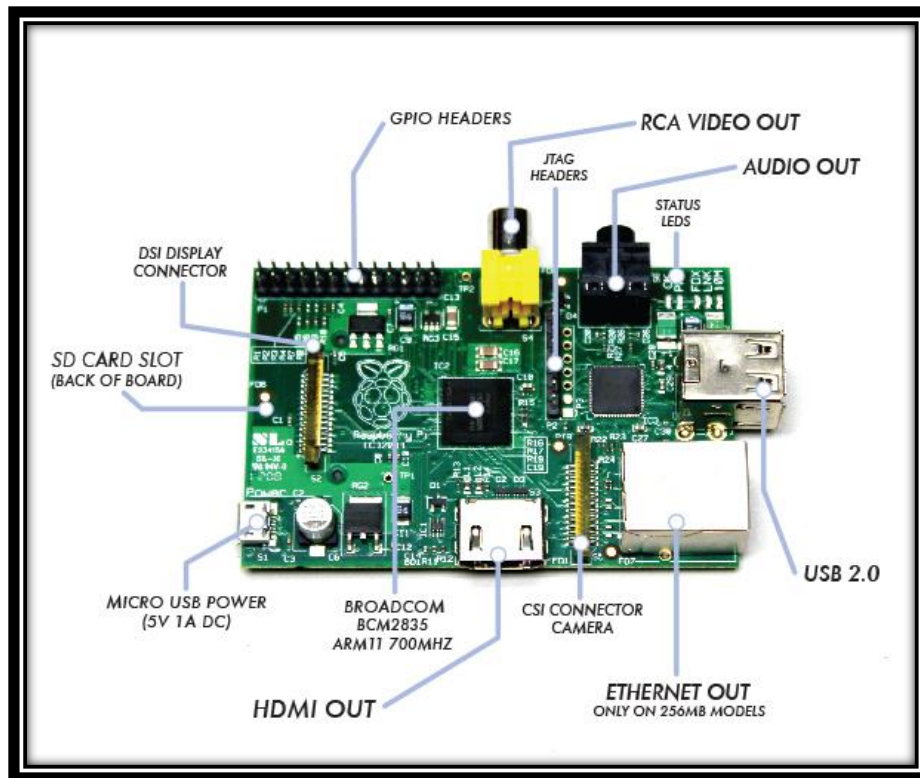


Figure 1: Raspberry Pi Module B with Input/output and Boards Labeled [3]

The Raspberry Pi will be powered through the micro-USB connection. The micro-USB port has a regulator to provide the chip with 5V even if the power supply produces higher than that amount, but in terms of current you must acquire a minimum of 700mA in order to power the Raspberry Pi, and the more current you draw the more peripherals would be powered off the USB port. In our design we will use a 5V lithium ion rechargeable battery that provides up to 1A, and that is sufficient for our usage.

Connection of the 4400mAh Battery and the Raspberry Pi:

The 4400mAh lithium ion battery has a charging circuit inside it and a boost converter that provides 5VDC and up to 1A via USB port. The packet of the battery includes a USB-to-micro-USB cable so that we can make a connection between the battery and the Raspberry Pi. Simply, take out the cable and attach the USB to the battery, and link the micro-USB side to the Raspberry Pi. Once the connection is achieved, the battery will show a blue light, and the Raspberry Pi will have the status red LED on. If not, make sure that the battery is fully charged, and check the connection again.



Figure 2: Connection between the Raspberry Pi and the Battery with Red LED and Blue Lights On
Take the micro-USB connector out of the Raspberry Pi. Now we want to make the connection between the 4D Display and the Raspberry Pi.

Connect the Raspberry Pi to the 4D Display:

The Raspberry Pi display model pack (uLCD-32-PTU-PI) is a 3.2" touch-screen display module designed specifically for Raspberry Pi. The 4D Display model has many features and built-in functions led to choose it other than other screens for this design. For more information about the screen itself, refer to the 4D Systems application notes and the uLCD-32-PTU datasheet. This display will be used in this device to be programmed and then be our command station where users can input instructions through the touch-screen to save and display the desired data based on those inputs. Note that the display module can be used as a display source for the data itself, but that requires extra storage capacity and would consume more time and power, so we will just use it for implementing instructions and store the data to be displayed later on a regular computer. The display comes with a 5 way female-female cable and a 4D Serial Pi Adaptor. The adaptor is required to make the connection between the display and the Raspberry Pi. Hint, not using this adaptor prevents you from utilizing the features provided by the display.

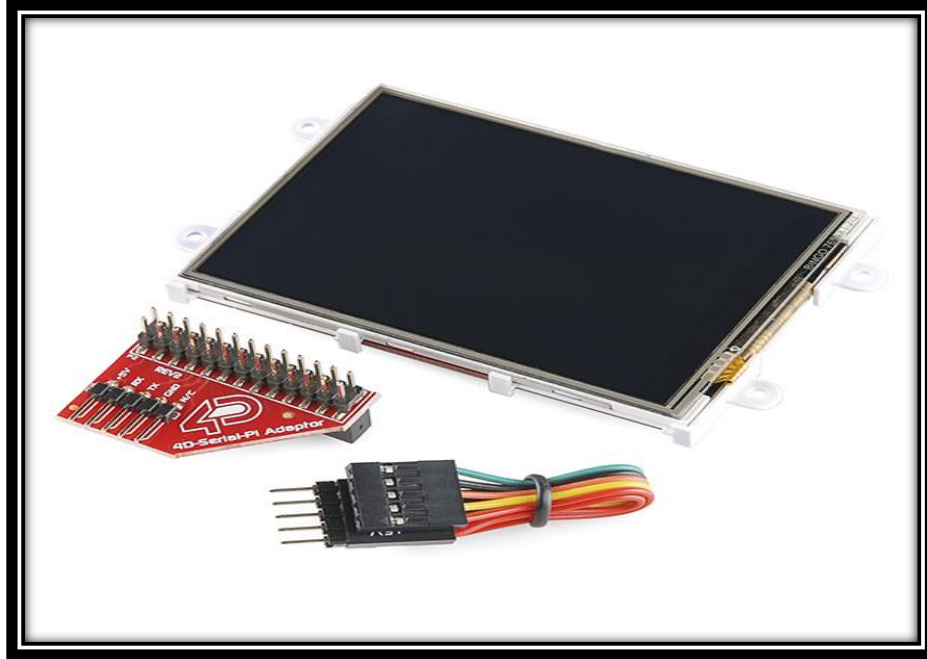


Figure 3: uLCD-32-PTU-PI Pack with 4D Serial Adaptor and 5 Way Female-Female Cable

The 4D Serial Adaptor has one face that allows the GPIO headers to be attached to it, and another face that has pins itself. Take the 4D Serial Adaptor and place it on the GPIO headers so that it connects to the Raspberry Pi. Now, we want to use this adaptor to make the connection between the Raspberry Pi and the touch-screen display. The touch-screen display has two headers, H1 and H2, and there are two ways to make connection between it and the adaptor; the first is to connect the +V to Pin 10 and –V to Pin 4 of header H2, or alternatively +V to Pin 14 and –V to Pin 13, 11 of header H1. All these pins have voltage range of 4.0 to 5.5 volts, and that make it simpler for us because we only need to make a connection via wires between the Raspberry Pi and the display screen to power the screen rather than implementing voltage regulators. That shows one advantage of our touch-screen display where it can be powered through the Raspberry Pi using the same power supply, and here comes the power source role where it must be able to provide enough current to both the Raspberry Pi and the display module. For this time, we will use header H2, so grab the 5 way female-female cable provided in the screen kit, and make a connection between the 4D Serial Adaptor and the display screen as shown in the picture.

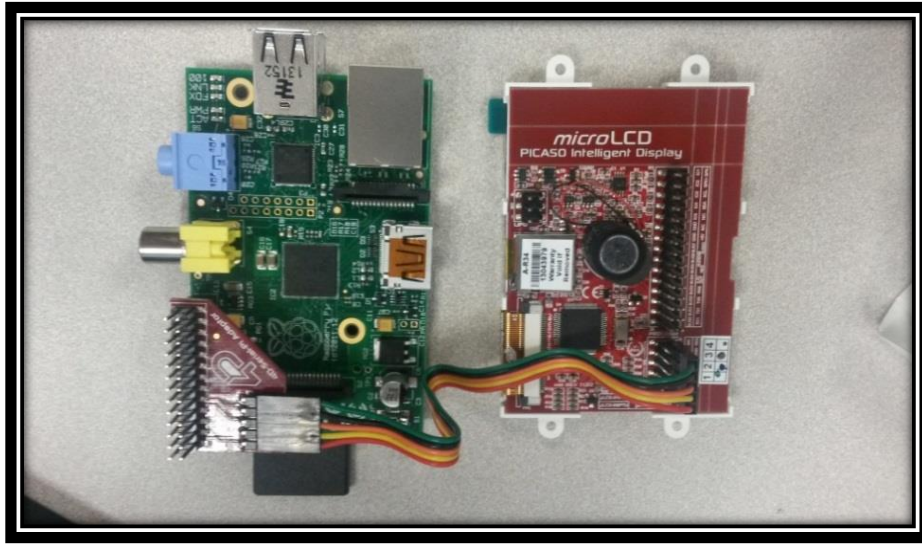


Figure 4: Connection between the Raspberry Pi and the Display Module

Check the orientation of this connection so that the labeled cable matches the labeled header H2 and the 4D serial Adaptor. That is, +5V is connected to +5V, GND to GND and so on. [4] By this connection, the Raspberry Pi is now connected to the display screen and ready to be utilized. Wire the micro-USB of the battery back to the Raspberry Pi and you should see the status red LED back on and the display screen on. If not, check your wiring and make sure you are using the right pins.

Work Cited

- [1] Bush, Steve. "Dongle Computer Lets Kids Discover Programming on a TV." *News. ElectronicsWeekly*, 25 Mar. 2011. Web. 06 Nov. 2013.
- [2] Olive, Kyle. "The Raspberry Pi Primer: Part 1: Introduction and Required Hardware." *Embedded Developer*. EE Web, n.d. Web. 04 Nov. 2013.
- [3] Murray, Matthew. "Raspberry Pi." *PCMAG*. N.p., n.d. Web. 05 Nov. 2013.
- [4] "Application Note: 4D-AN-P4023 ViSi Genie – Connecting a 4D Display to the Raspberry Pi." *4D Systems*, 17 Aug. 2013. Web. 04 Nov. 2013.