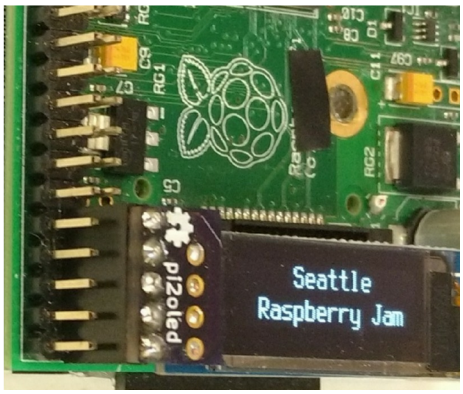
Seattle Raspberry Jam
A Raspberry Pi Meetup for Beginners to Experts

RASPBERRY JAM

Hardware Project #1: OLED Display

Assembly



First, make sure the Raspberry Pi is not powered. Plug the circuit board into a Raspberry Pi on pins 1, 3, 5, 7 and 9 (see the picture to the right). **WARNING! Incorrectly installing the display could damage both the display and the Raspberry Pi. Please have one of the organisers check that the display is plugged in correctly before applying power.**

Software Setup

Before writing data to the display, several software changes need to be made on the Raspberry Pi. First, a device tree overlay and parameter need to be setup in /boot/config.txt. We will be using the ssd1306 overlay for this project. (*Note: this will only work for a version of Raspbian from after 8 May 2019. See our version 1 tutorial for instructions for earlier versions of Raspbian.*) This overlay sets up some parameters for the display, sets up I2C (used to communicate with the display) and creates a frame buffer for the display data. We need to edit /boot/config.txt to include the overlay. To do this, open the nano text editor with the following command:

> **Tip**: The following commands require root permissions to run. Sudo runs a command with root permissions. Instead of typing sudo before every command, you can type sudo su to enter root mode before entering the commands that require root permissions. Type exit to return to regular permissions.

```
sudo nano /boot/config.txt
```

Add the following lines to the bottom of the file:

```
dtoverlay=ssd1306,inverted,sequential,height=32
dtparam=i2c_arm=on,i2c_baudrate=1000000
```

The first line enables the overlay we copied into /boot/config.txt, while the second line sets up I2C. To exit out of the editor, type Ctrl-X, then type y and finally press Enter. The software setup is now complete. Reboot the Raspberry Pi for the changes to take effect.

Continued overleaf

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Display Control

We need to run some commands before we can output text to the OLED screen. All of the following commands require root priveleges; see the Tip box on the previous page for information on how to do this.The following command sets the font we want to use for the display:

```
setfont Lat7-Terminus16
```

Now we are going to map the display's frame buffer to the terminal tty8. There are normally seven consoles numbered from tty1 through tty7 on a Raspberry Pi. The first six are used as command-line interfaces (CLIs) and the seventh is used for a graphical user interface (GUI). The following command maps frame buffer number 1 to console number 8 (tty8).

```
con2fbmap 8 1
```

Tip: For more information on a command, type `man COMMAND`. This opens a page of information about the command and about how to use the command. Use the up and down arrow keys to move through the file and type q to exit. Most commands have a man pages.

Now we can display text on the OLED screen. The following command will print "Testing 1 2 3..." on the screen. The `echo` command prints text to a console. The -n flag removes the trailing newline character to prevent the display from scrolling and the -e flag executes escape sequences (such as \ec, which resets the screen's text, or \n, which prints a newline character). The > symbol pipes the output of the command into a file, which in this case is console tty8. The last two commands, `chvt 8` and `chvt 7`, flush the virtual terminal to make sure that the text appears on the OLED both when we use a local terminal and a remote terminal.

```
echo -n -e "\ecTesting 1 2 3... " > /dev/tty8;chvt 8;chvt 7
```

The words "Testing 1 2 3..." should appear on the OLED screen. If they do not, notify one of the organisers. For a more interesting example, we can print the Raspberry Pi's IP address. The following command has the same configuration as the command above, but now with `` `hostname -I` `` instead of the "Testing 1 2 3..." text. The command `hostname -I` prints the IP address of the Raspberry Pi. Note: the symbols before and after `hostname -I` in the `echo` command are not single quotes but rather back quotes (the key for the back quote is found in the upper-left corner of the keyboard). The back quotes make `echo` execute the `hostname -I` command rather than just printing "hostname -I" to the screen.

Text2fb1 – An Easier Method

We have created a program to make outputting text to the OLED screen easier. This program removes the need for `setfont` and `chvt`. You can download the source code from https://sites.google.com/site/mincepi/pi2oled/files (download the *text2fb1.c* file). This code will need to be compiled before you can run it – you can use `gcc -lz -o text2fb1 text2fb1.c`. To run the program, run the `con2fbmap` command first as before. Next, run `echo -n "Testing 123..." | ./text2fb1`. The text "Testing 123..." should appear on the OLED screen as before!

```
echo -n -e "\ec`hostname -I`" > /dev/tty8;chvt 8;chvt 7
```

The IP address of the Raspberry Pi should now appear on the screen. Congratulations! You have completed the OLED screen tutorial.

Bonus: See if you can figure out how to get the display to show the Pi's processor speed and temperature.
Hint: the processor speed is in the file /sys/devices/system/cpu/cpu0/cpufreq/scaling_cur_freq and the command `cat` prints the contents of a file. The command `vcgencmd measure_temp` prints the processor temperature.

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