

ECE471: Embedded Systems – Homework 2

Raspberry Pi and Linux

Due: Thursday, 18 September 2014, 9:30am

This Homework is meant to get you started with the Raspberry Pi so that you will be prepared for future homework assignments.

1. Get Linux Working

- Install some form of Linux onto your Raspberry Pi. I use Raspbian, but others should be fine too. You may have obtained an SD card that already has Linux installed, or you can download images from here: <http://www.raspberrypi.org/downloads/>
- Power up the Pi and ensure you can login. If using Raspbian the default login is `pi` and default password is `raspberrypi`.
- You can change your password with the `passwd` command. You can also add users with the `adduser` command, though you probably need to be root to do that `sudo adduser`
- If you are connecting to your board with a keyboard/display then after logging in you can use `startx` to get a graphics interface.
- If you have trouble with any of these steps and need help, let me know as soon as possible!

2. Copy the Assignment to your Raspberry Pi

- Download the code from:
`http://web.eece.maine.edu/~vweaver/classes/ece471_2014f/ece471_hw2_code.tar.gz`
- Copy it to your Pi. The easiest method might be to put it on a USB key, then copy it.
 - Ideally the USB key would automatically be detected for you, but on my Pi it wasn't. Here's how you do things manually.
 - You need to do these things as root (system administrator). The default `pi` user has `sudo` access; if you are using a different user you created yourself you'll have to add yourself to the `/etc/sudoers` file.
 - Insert the usbkey
 - `sudo mkdir /media/usbkey`
(you only have to do this step the first time, the directory will then be created)
 - `sudo mount /dev/sda1 -o rw /media/usbkey`
 - The files on the key should now appear under `/media/usbkey`
`ls /media/usbkey`
 - To copy `ece471_hw2_code.tar.gz` to your home directory type
`cp /media/usbkey/ece471_hw2_code.tar.gz ~`
 - When you are done with the usbkey, **before** removing it you have to unmount it: `sudo umount /media/usbkey`

3. Unpack the homework files

Uncompress/unpack it with the command

```
tar -xzvf ece471_hw2_code.tar.gz
```

4. Build the C files

- Change into the `ece471_hw2_code` directory
`cd ece471_hw2_code`
- Run `make` to build the code.
- Run `./hello_world` and it should run!

5. Modify the C program (5pts total)

Modify the `hello_world.c` file (4.5 pts)

- Change the file so the output is 20 lines, each line looking something like this:
`1. ECE471 MY_MESSAGE`
Where the number increments each line, and `MY_MESSAGE` is any message you want to print. Full credit requires using some sort of loop (not just cut/paste).
- You can use any text editor you want to do this coding. A simple one that is available on the Pi is `nano`, you can start it by running `nano hello_world.c`
- Once you have updated the code, you can simply run `make` and it should recompile your code. Then test by running `./hello_world`
- Be sure to comment your code!

“Something Cool” (0.5 pts)

- Modify your `hello_world.c` file further to print the lines in different colors.
HINT: Look up “ANSI escape codes”

6. Answer the following questions (5pts total)

Short answers are fine. Put your answers in the `README` file.

- (a) If you want to know more about the `ls` program, what command can you run?
- (b) What does the `-a` option to the `ls` program do?
- (c) In a Linux executable, how does “BSS” data differ from regular data?
- (d) Why does Linux make a distinction between “BSS” data and regular data?
- (e) What method are you using to connect to your pi? (monitor/keyboard, network, serial, etc.?)
How are you copying files back and forth?

7. Submit your work

- Run `make submit` which will create a `hw2_submit.tar.gz` file containing `README`, `Makefile` and `hello_world.c`.
You can verify the contents with `tar -tzvf hw2_submit.tar.gz`
- e-mail the `hw2_submit.tar.gz` file to me by the homework deadline. Be sure to send the proper file!