CSCI 250 Python Computing: Building a Sensor System
TR 12:30-1:45 and 2:00-3:15 - MZ 026 – Spring 2018
Raspberry Pi 3 Setup
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Corresponding Learning Outcome:

- Install the Raspbian operating system onto the Raspberry Pi Hardware and setup basic configuration parameters.

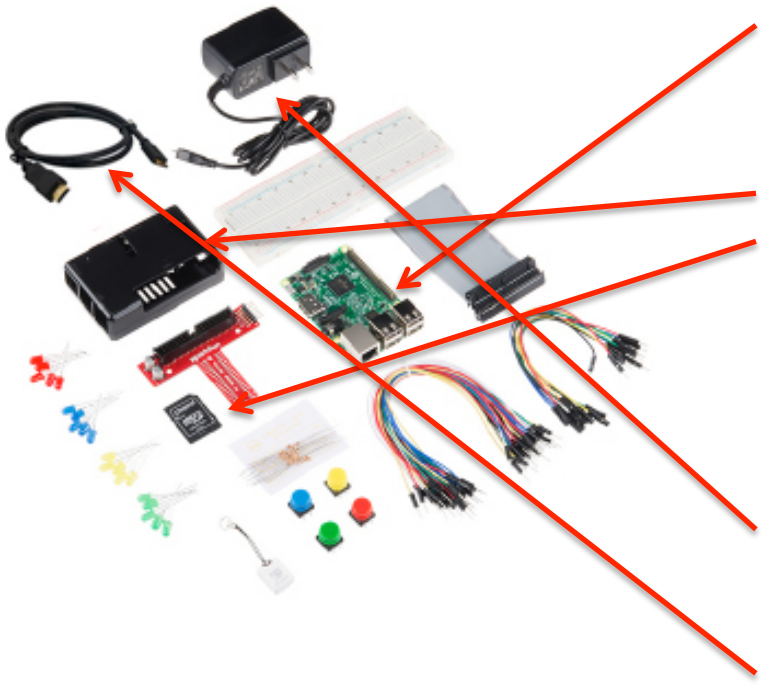
  During this lesson, students will learn how to:
  - Understand the components on the board and their functions
  - Install the Raspbian Operating System
  - Configure Raspbian for the Raspberry Pi
  - Set up boot options for Raspbian

Reference the Sparkfun website Raspberry Pi 3: https://www.sparkfun.com/products/13825

Let's begin:

1. Collect the following equipment from your box, the USB keyboard and mouse, and locate yourself in front of the monitor with HDMI input. This is all you will need for this lesson.

   Note: it is good practice to discharge yourself before handing electronics; you can easily do this by touching a grounded object.



- **Raspberry Pi 3**
- SparkFun Pi Wedge (Preassembled)
- Breadboard - Full-Size (Bare)
- **Pi Tin for the Raspberry Pi - Black**
- **16GB microSD (Preloaded with OS)**
- microSD USB Reader
- Red, Blue, Yellow, Green Buttons
- Red, Blue, Yellow, and Green LEDs
- Resistors 330 Ohm 1/6 Watt PTH
- GPIO Ribbon Cable - 40-pin, 6"
- **Wall Adapter Power Supply**
- Jumper Wires Premium 6" M/F – 10
- Jumper Wires Standard 7" M/M - 30
- **HDMI Cable**

2. Remove the **Raspberry Pi 3** and the **Pi Tin for the Raspberry Pi – Black** (black case) from the packaging and snap the board into the bottom of the case. The board should click in to the case and be fully/evenly seated into the bottom with the **microSD** slot lined up with the empty slat and the Ethernet and USB ports lined up with the shorter end. You will also see the cutouts for HDMI, Power, and Video/Audio jack.

Note: Be careful not to push on the pins or chips on the board, it is best to push on the corners or silver casings for HDMI, Ethernet, and USB.

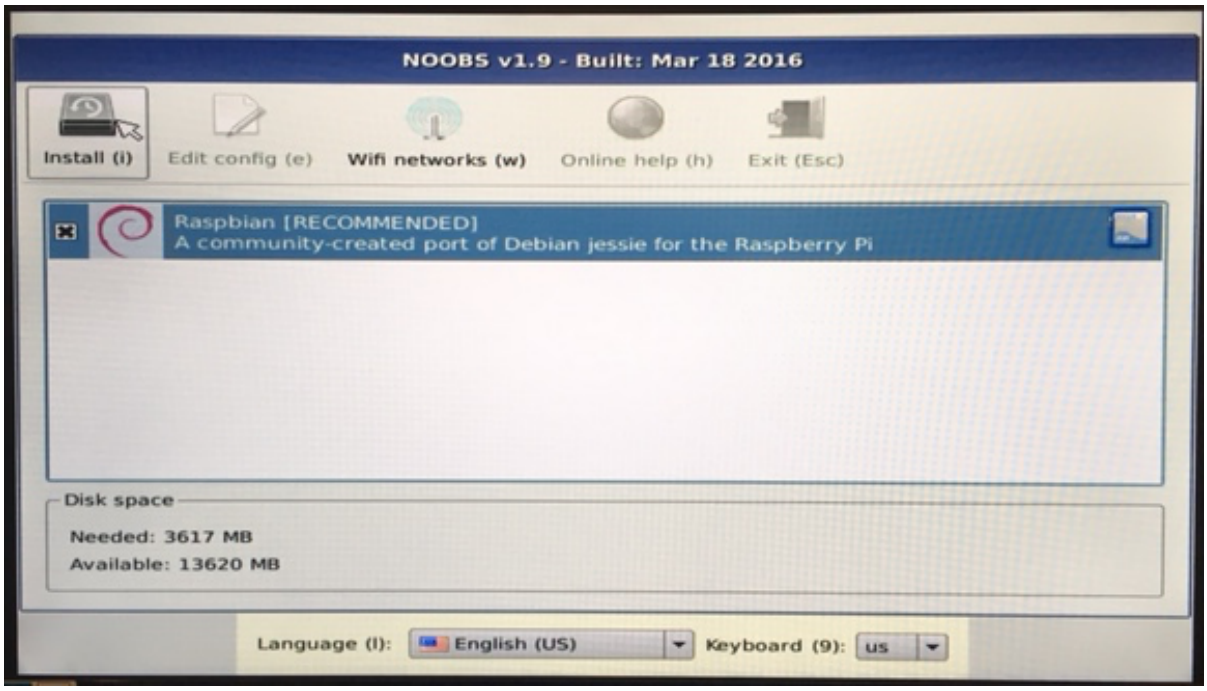
3. Snap the top of the case onto the board; it should snap down evenly if lined up correctly (we will remove the top when we begin connecting the sensors).

4. Remove the **16GB microSD** card from the microSD adapter and insert into the slot on the RPi. The card will only insert one way (the words will be facing out) and when inserted correctly, it will line up with the outside of the case.

5. Plug in USB Keyboard and Mouse.

6. Connect the HDMI cable to the RPi and the available input on the back of the monitor (you will have to change the monitor to use the proper input).

7. Plug in the power supply cable to the power slot on the RPi and plug into an available outlet. The very 1st time the RPi is powered up, you should see the RPi starting up and you should be presented with the following New Out Of the Box Software (Noobs) installer menu.



***** Note: It is important to never simply unplug the RPi, it has to be shutdown properly via the command line (sudo shutdown) or Graphical User Interface (GUI) – menu option (we will cover this in the next section). This will ensure that the RPi has a clean exit and loads correctly the next time it is booted up.***

8. Next, on the Noobs installer screen, check the box to select the Raspbian Operating System (OS), choose your language/keyboard – typically English (US) layout (this setting can also be changed later), and press the **Install (i)** button at the top.

9. When presented with a confirmation window, press the **Yes** button to overwrite the data on the card and then the install will begin. This will take about 25 minutes (you will see a progress bar along the bottom of the screen).

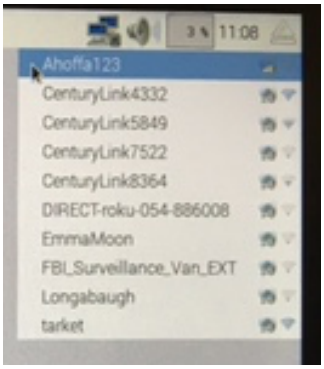
10. Once the install completes, you will receive a message that the OS(es) Installed Successfully, press the **OK** button.

11. The RPi will reboot, you will see a red and blinking green light now inside the RPi case, scrolling text in the console, and then the RPi will boot into the GUI. You will see a grey screen with the raspberry logo.

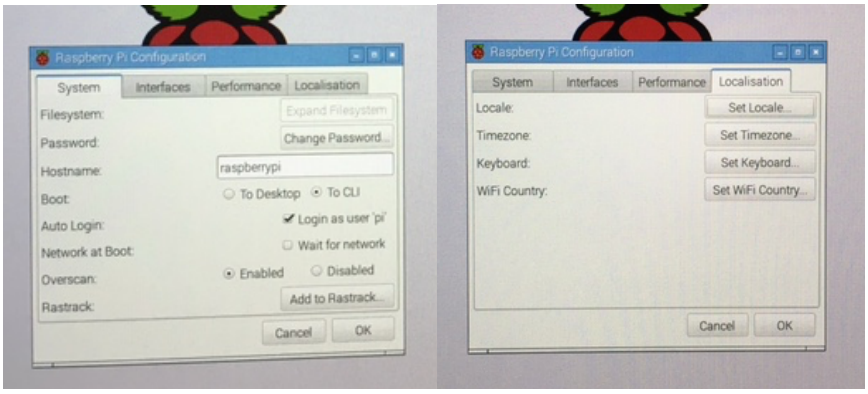
Configuring the Raspberry Pi 3:

Once the Raspberry Pi boots up, you will want to setup some basic configuration properties to begin with (you can adjust these at any time). You can do more; this is the list to get us going!

1. Internet – click on the network icon in the upper right-hand corner to bring up the list of available WiFi networks. Select the CSM Wireless network and follow instructions for logon OR from home or another location, select the appropriate network and enter your password.

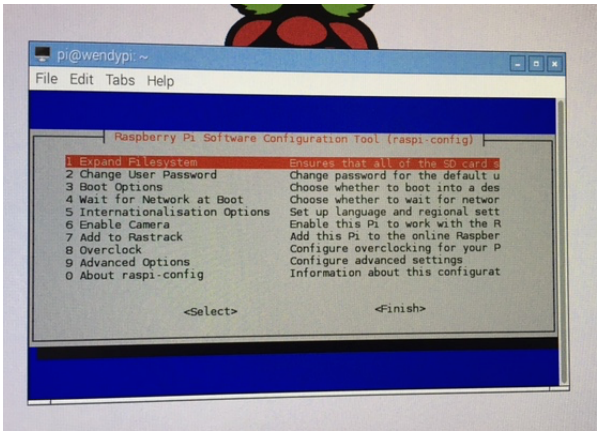


2. To get to the setup options, you can use the GUI or the Terminal window:
    a. GUI: Menu->Preferences->Raspberry Pi Configuration (GUI version will be used in class).



b. Terminal/console/CLI: sudo raspi-config

Note: the sudo command tells the system you want to run as the root user



3. From the GUI Configuration Window, System Tab:
    a. Filesystem: Sometimes when you install the operating system to the microSD card, it just uses up enough space for the operating system plus a little more. The **Expand Filesystem**, reformats the microSD card so you can use all the – our system does not allow this, the root filesystem is already expanded.
    b. Password: The system is set up with a default user name (username: pi) and password (password: raspberry). You will want to press **Change Password** to create your own.
    c. Hostname – this is the name that is visible on the network. It can be letters a-z and is case sensitive, numbers 0-9, and a hyphen (cannot start or end with a hyphen).
    d. Boot – this is where you want the raspberry pi to launch into upon startup. The choices are: **To Desktop** (GUI) or **To CLI** (terminal/console) – If you select To CLI and want to get back to the GUI, simply type **startx** at the command prompt.
    e. Auto Login – default is on (checked) – you can uncheck **Login as user 'pi'** if you want to enter your username and password at boot up.

f. Network at Boot – detault is off (unchecked) - check the **Wait for network** if you want the system to wait until it has a network connection before completing the boot up.
g. Overscan – **Enable** or **Disable** (hide) the black outline on the screen (usefulness of this command depends on your monitor).
h. Rastrack - this is just a service that allows Raspberry Pi users to find other Raspberry Pi users. It's completely optional; I did not select it, but that's your choice.

4. From the GUI Configuration Window, Localisation Tab:
    a. Locale – this is where you set the language – I selected **(en (English))** and country **(US (USA))**.
    b. Timezone – this is where you set the local timezone – I selected **US** and **Mountain**.
    c. Keyboard – we set this up when we installed the Operating System – you can change it here anytime … should be **US** (or whatever matches your keyboard).
    d. WiFi Country code – should be US.

Once you are done setting configuration parameters, press OK and the system will ask you to reboot.

5. Date – click on the time to bring up calendar and change if needed.

6. Time – the default is to display a 24-hour clock, to change this format, right click on the time and select **Digital Clock Settings** – the **Clock Format** string can be used as follows:

%r will give you a 12 hour clock with am/pm	*%d will give you the day in number format*
%R will give you a 24 hour clock	*%D will give you the date in MM/DD/YY*
%X will give you a 24 hour clock with seconds	*%a will give you the abbreviated day name*
%x will give you the date in DD/MM/YY	*%A will give you the full day name*

7. Shutdown and reboot options - it is important to never simply unplug the RPi, it has to be shutdown properly to ensure that the RPi has a clean exit (the system schedules a shutdown approximately 1 minute after you type the command, which gives the system time to tell all the other processes to stop) and loads correctly the next time it is booted up.
    a. Graphical User Interface (GUI) – select the **Menu->Shutdown** option.
    b. Terminal: type the command **sudo shutdown**.

    When the screen turns black and you see the red and green lights stay on (no flashing green), it is now safe to unplug the raspberry pi.