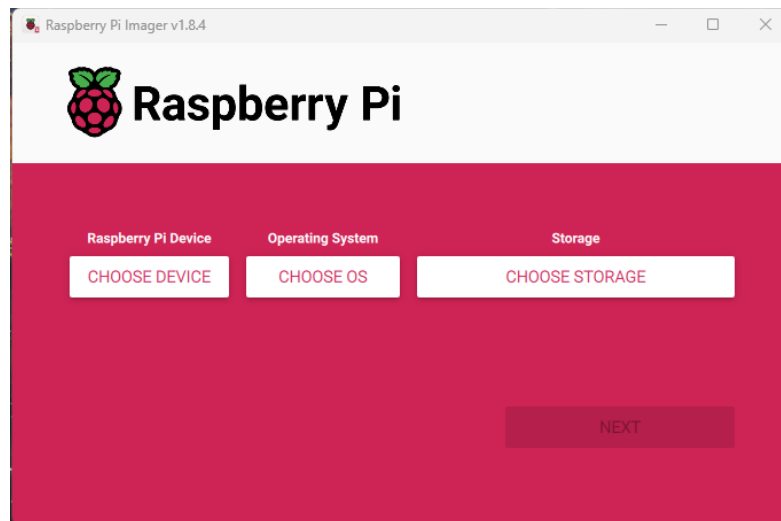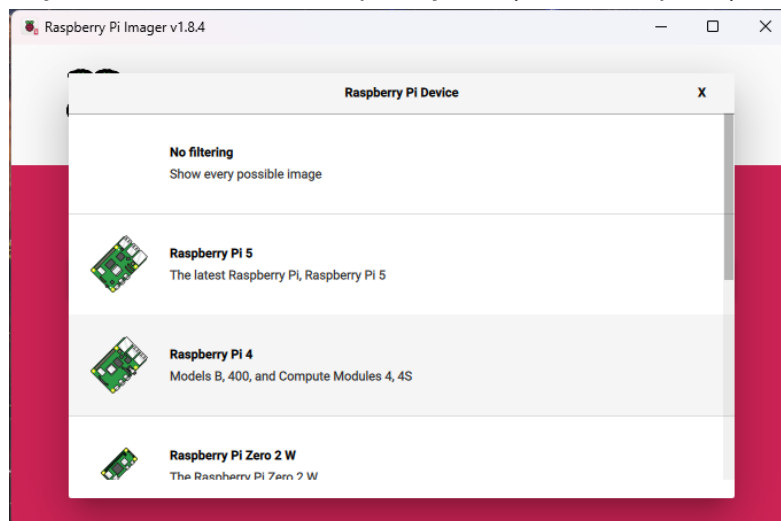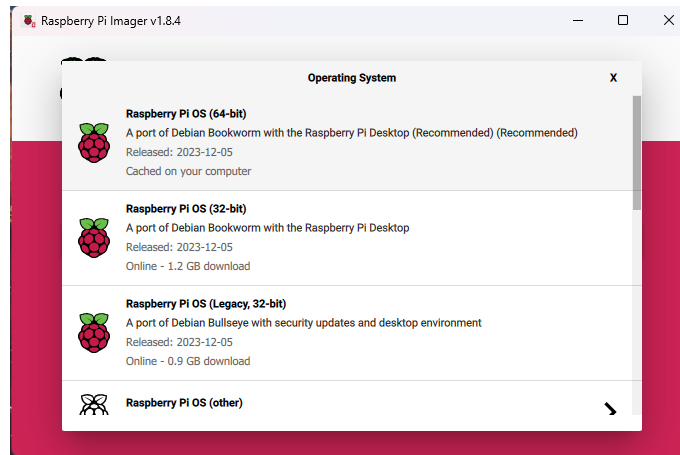# Raspberry Pi Setup

Getting Started

1. Download and installer the Raspberry Pi Imager from this link
2. Put your SD card into your computer and run the Raspberry Pi Imager, you should be greeted with this screen:
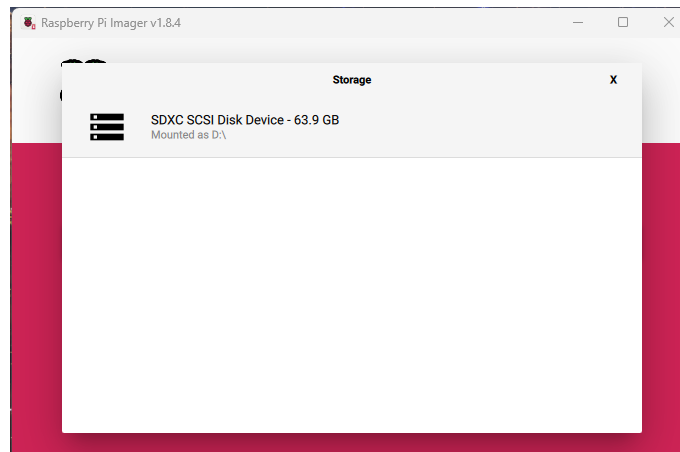

3. Under Raspberry Pi Device choose Raspberry Pi 4 (the third option)

4. Under Operating System choose Raspberry Pi OS 64-bit (the first option)


5. Under Storage choose your SD card (you should only have one option here). Since flashing the OS will wipe the drive, make sure you have selected the correct drive so you don't accidentally erase the wrong storage.


6. Your final screen should look something like this:
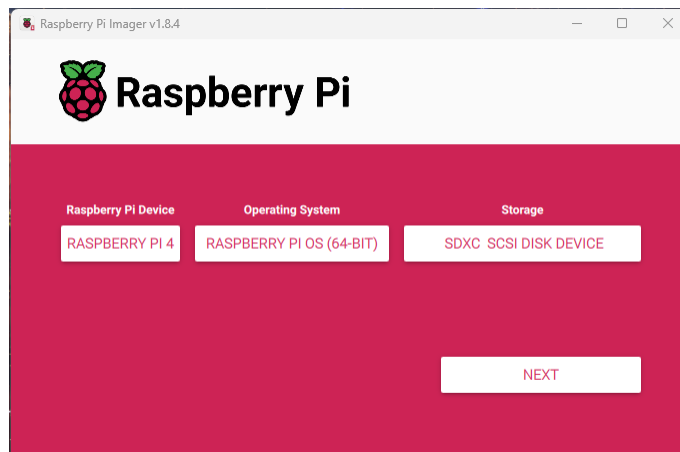
7. Click Next, then click Edit Settings, and you should get this screen. This page will allow us to configure some settings before flashing the OS. Let's start on the general tab.
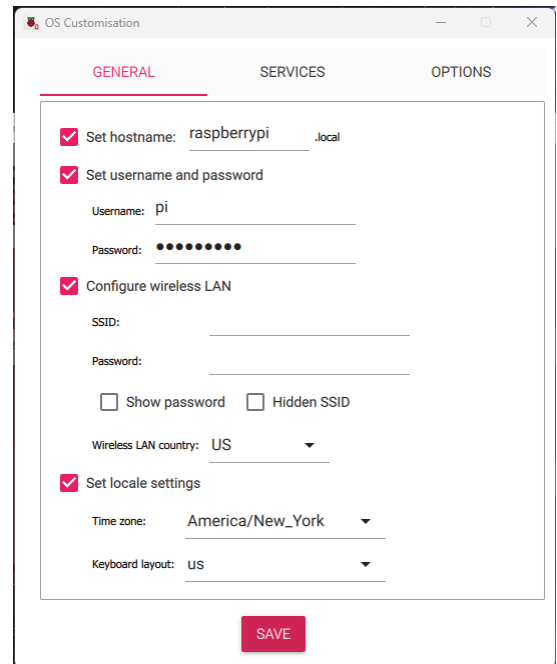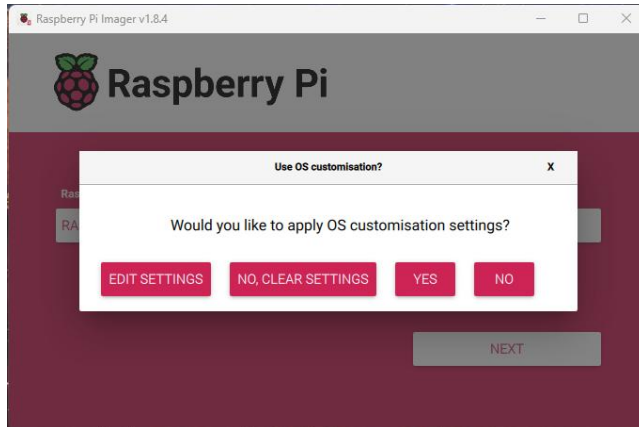
8. Click the **Set locale settings** checkbox and set your time zone and keyboard layout (US)
9. If you want to change your password, click the **Set username and password** checkbox and type your new password into the Password field. If you change this, make sure everyone on your team knows what the new password is!
10. Click the **Configure wireless LAN** checkbox. The SSID and password fields should be replaced with the name and password of the network you would like to connect to. You may need to ask a school administrator to get the password for your school's WiFi network,
11. Go to the Services tab and click the Enable SSH checkbox and choose the Use password authentication option. The screen should look like this once configured.
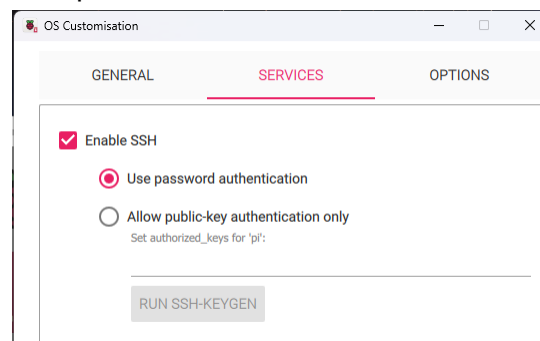
12. Click Save at the bottom of the customization window, then click Yes.
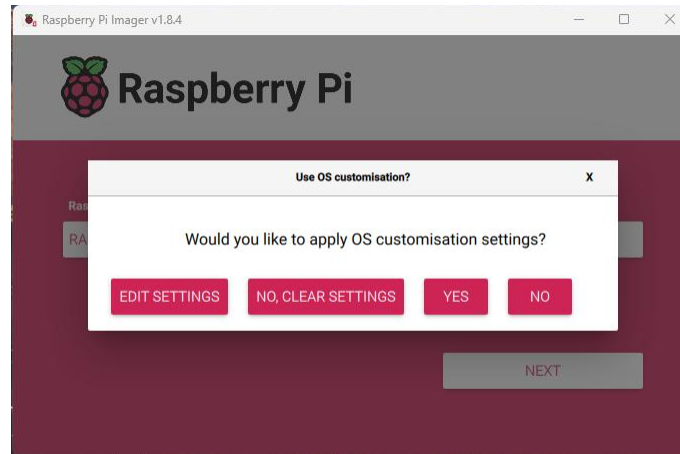
13. Click Yes on the following prompt and wait for the flashing process to complete.
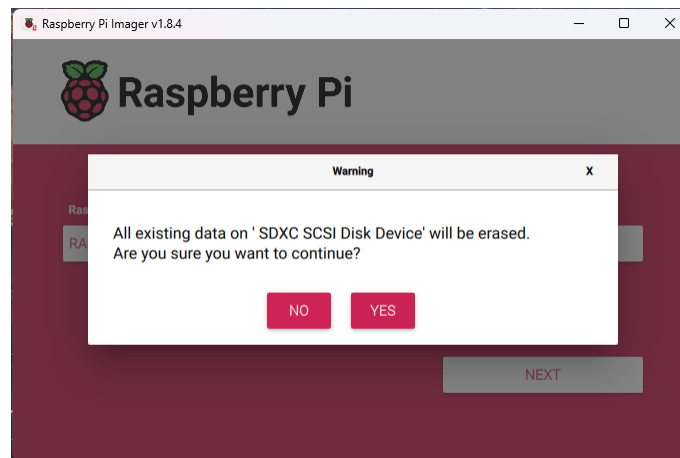
Some Setup for Windows Users

1. You will not, by default, be able to read the Raspberry Pi's filesystem on Windows. You can use Linux Reader to add this compatibility, but it isn't necessary. All the files you will be required to edit for this class are accessible without it, but you may want to have access to the rest of the files on the SD card at some point.
2. To use native Windows SSH, follow this guide to install OpenSSH
3. If you want to see graphical interfaces (such as running PyCharm or viewing images) through SSH, you will need to install PuTTY (installing PuTTY might also help if you're running into errors on Windows). In future steps, where it tells you to SSH via the command line, instead type the hostname into the PuTTY client.
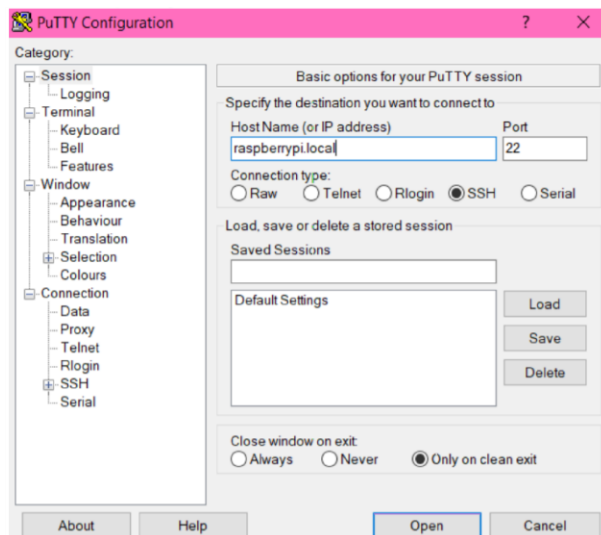
Connecting to the Raspberry Pi

We are going to be doing something called SSHing into the Raspberry Pi. SSH is a way to access the Pi while you are not physically attached to it, which will be useful while you are doing labs. If you have followed the flashing instructions above, SSH should now be enabled and your Pi should be connected to your WiFi network. This setup, with no direct peripherals connected, is called headless and most closely resembles your CubeSat in a flight configuration.

Testing your SSH Connection

1. Now, the Pi should be ready to boot. Put the SD card in your Pi in the MicroSD port on the underside of the board (NOT into the USB ports with the adaptor), then plug in the power supply (the USB-C connector labeled power in). You can now use SSH to connect to the pi. Go into the command line or Windows Terminal. The default user is "pi" and the default hostname is "raspberrypi", so the following command will open an SSH connection with the pi:

```
ssh pi@raspberrypi.local
```

2. On PuTTY, type raspberrypi.local in HostName. It will ask for your username in the popup: type pi and use the password "raspberry" or whatever you changed it to

3. If this connection doesn't work immediately, give the Pi at least 5 minutes to boot up, then try again. You should now have a connection to the Raspberry Pi!

Troubleshooting

There are many reasons why your SSH connection may not be working, if this happens to your team try the solutions below.

1. If the green light on your Pi is flashing for a long time after booting, that means the Pi is in an error state. Check this page to see what the error may be. The main way to fix this problem is to re-flash Raspberry Pi OS onto your SD card. Be sure to delete everything on the card before doing this. Once it has flashed plug it back into your Pi and turn it on. If the flashing has gone away, you can proceed. If it doesn't, there may be a problem with your SD card.
2. If your green lights are okay, your Pi may be failing to connect to your WiFi.
   a. The first method to fix this is to connect a micro HDMI cable, a monitor, a USB mouse, and a USB keyboard to check if your Pi is connected to WiFi using the GUI. If not, try setting up WiFi again from the GUI. You may also want to double-check SSH is enabled by following this guide.
   b. The second method is to plug your Pi into your computer using an Ethernet cable and try SSH again. If it now works, your WiFi was configured incorrectly and you will need to set it up again from the command line following this guide. If you still cannot connect over SSH, try the first method.
3. If you suspect the reason is that your WiFi is too bad for your Raspberry Pi to be set up, you can also use that Ethernet Cable to connect your Pi to your Router. Keep in mind that the whole point of this is remote connection – future things in the class may be more difficult if your Pi is tethered to an Ethernet cable. You should be able to SSH in while it is connected to Ethernet.
4. If you still can't SSH in while it's connected via Ethernet or if you don't have an Ethernet cable, we will try and SSH via the Pi's IP address 10. If you are running the Pi with a monitor, type:

   ```
   hostname -I
   ```

   Into the Raspberry Pi terminal. This should give you the IP address of the Pi.

   a. If you don't have a monitor, try:

   ```
   ping raspberrypi.local
   ```

5. If SSH wasn't working, odds are good this won't either. But if it does, you should get a response like this:

```
PING raspberrypi.local (192.168.1.131): 56 data bytes 64
bytes from 192.168.1.131: icmp_seq=0 ttl=255 time=2.618 ms
```

Where 192.168.1.131 is the example Pi's IP address.

6. If that doesn't work, you're going to need to check your router. Go find your router and find the IP address; it should be printed on a label on the side. In your browser, navigate to it by typing it into the address bar. You should be brought to a page specific to your router. You can log in and see all the things connected to your network. You should be able to figure out which one is your Pi. Note down that IP address. 14. Once you figure out the Pi's IP address, you can try and ssh in using:

```
ssh pi@IPADDRESS
```

7. If none of these things are working, there are more options. This page from Raspberry Pi details other methods to find the IP address of your Pi. This page is mostly about other versions of the Pi, but if you skip down to the "Enabling and Connecting over VNC" section, you can look up how to use VNC Viewer to view the Pi Desktop remotely. This worked for some students on a Mac.
8. If none of these things work, contact the staff. Be sure to take note of what OS you're on, what you have tried, and what error messages you've gotten. There's a plethora of other guides online, so feel free to try those things. If you get something to work that isn't in this guide, let us know!
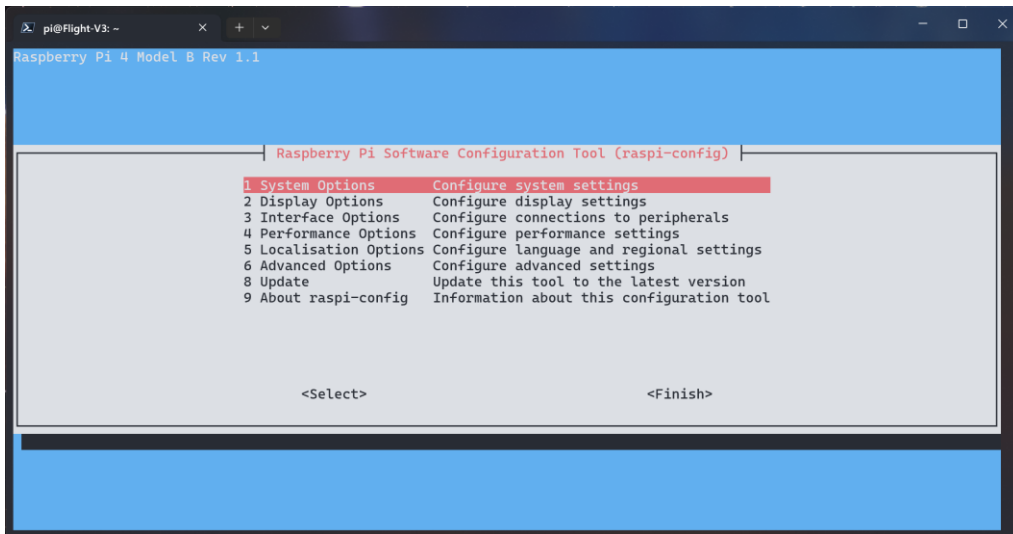
Software/Hardware Setup

1. To make sure all of your software is up to date, run:

```
sudo apt update
sudo apt upgrade
```

2. To interface with your camera and IMU, you will need to enable the camera and I2C interfaces. To access the Raspberry Pi configuration tool, run the following on the Pi's terminal:

```
sudo raspi-config
```

3. You should see something like this in your terminal:

4. From here, you can change a number of settings on the Pi (including changing the hostname and password if you wish). We will need to turn on some hardware interfaces, so select "interfacing options."
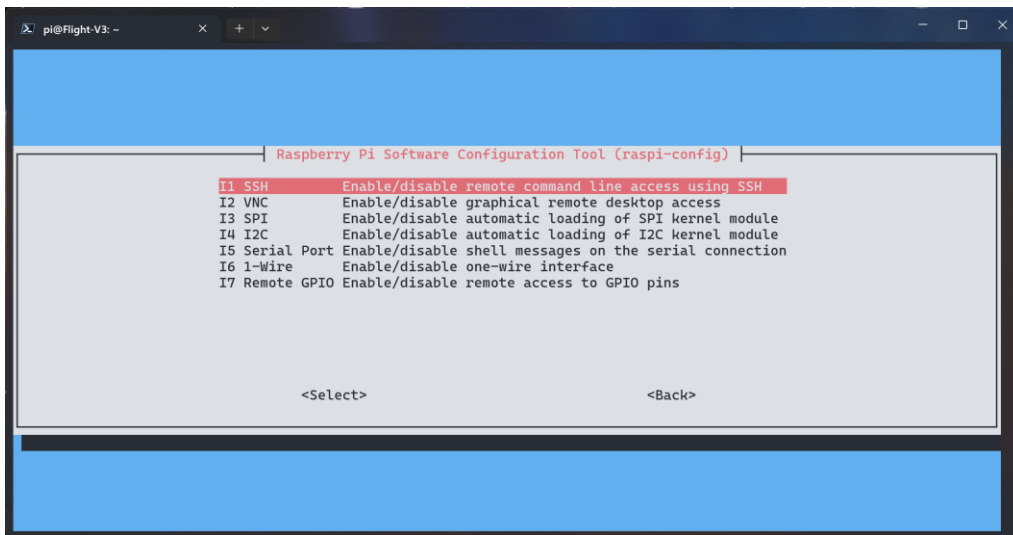
5. Once inside this menu, use the "I2C" tab to enable it.
6. (optional) Sometimes it is useful to work using the Raspberry Pi's GUI, which is possible with VNC viewer. Follow the instructions here to set up VNC viewer so that you can access the Raspberry Pi's desktop and apps through your computer, without having to use the command line for everything.
7. Finally, we will make sure the camera is working as expected by running:

```
libcamera-hello --list-cameras
```