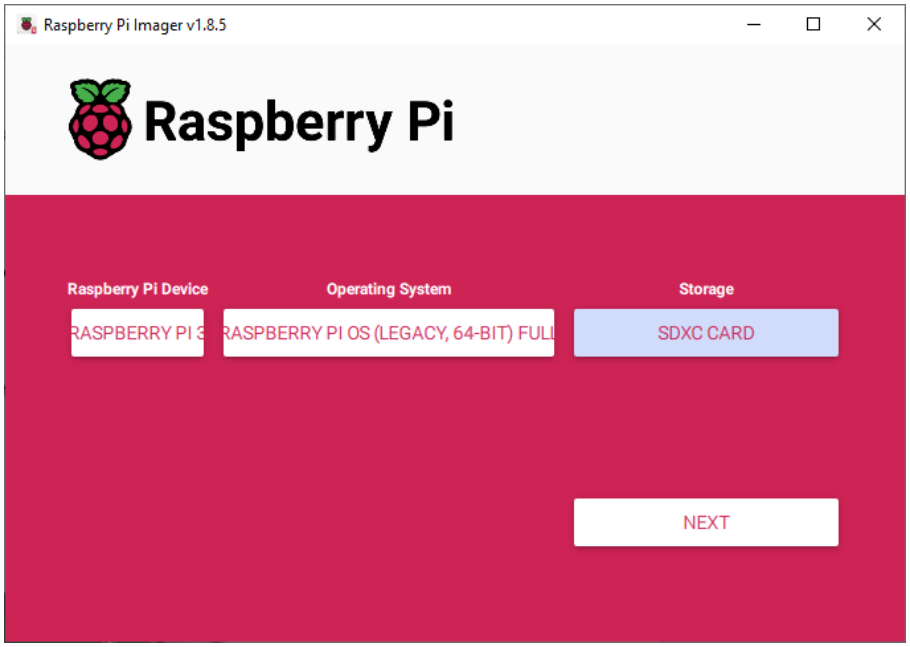
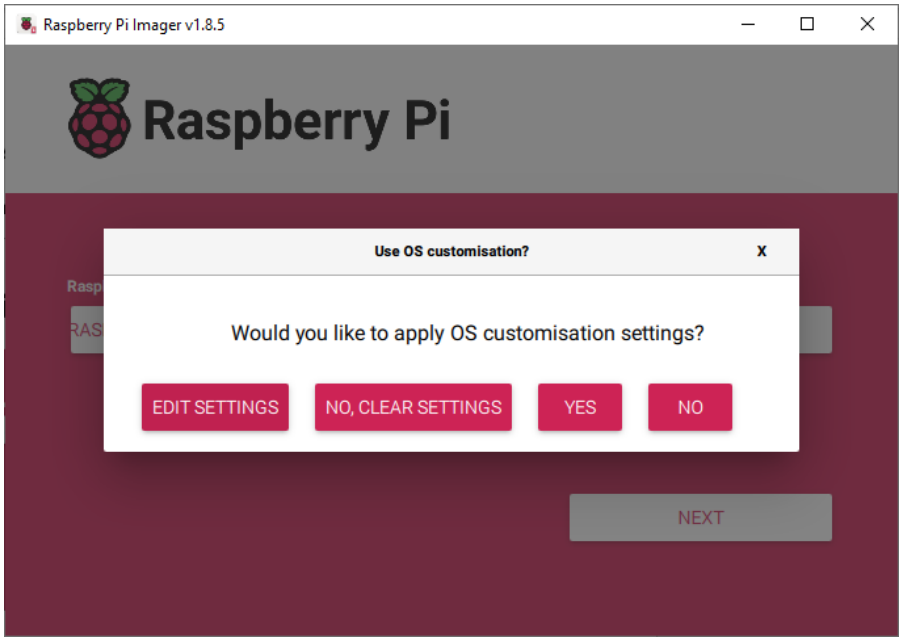
Quick Guide – How to connect and setup the components for Pi 3

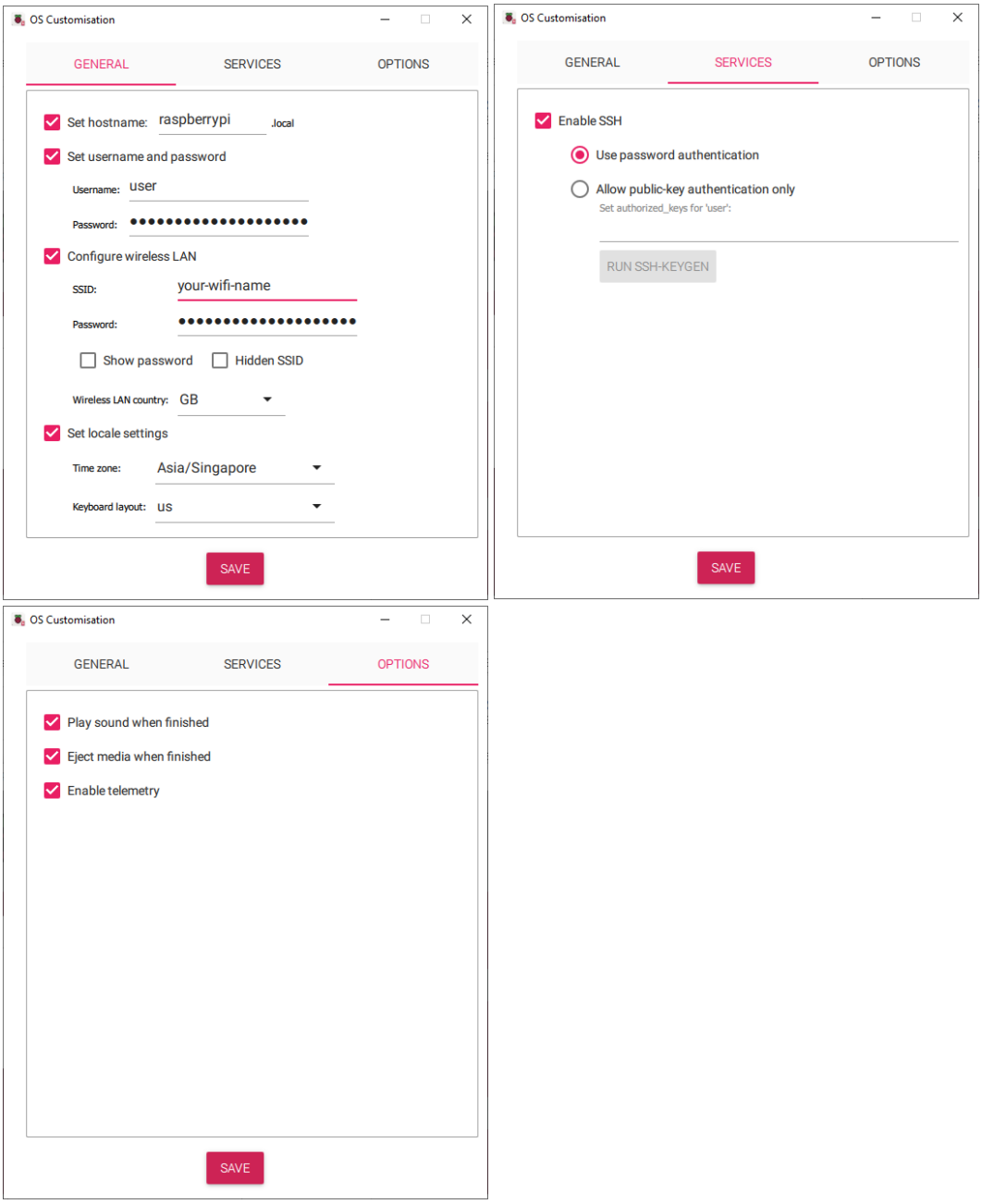
Boards and Sensors

1. **Raspberry Pi 3 B+ Board**
   a. Obtain the SD Card from your instructor. Although you can use USB Drive for the OS, SDXC is faster and safer.
   b. Download Raspberry Pi Imager to your PC and select the following settings:

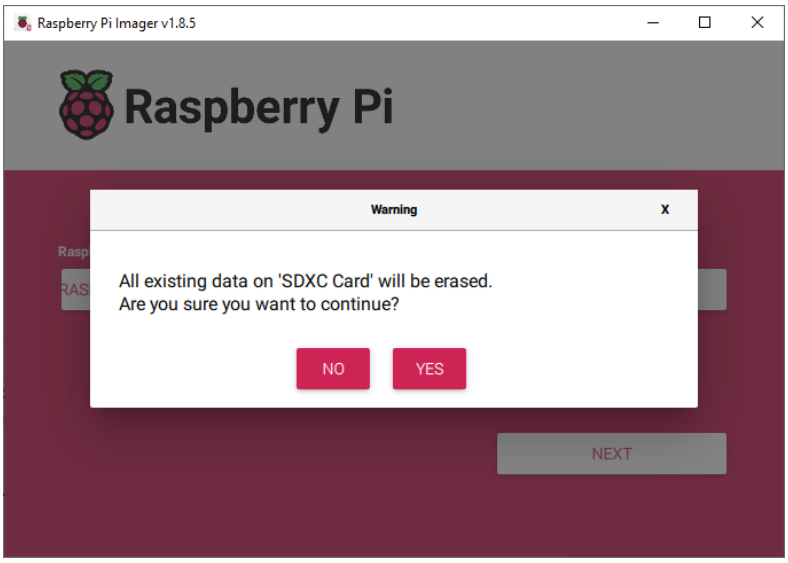


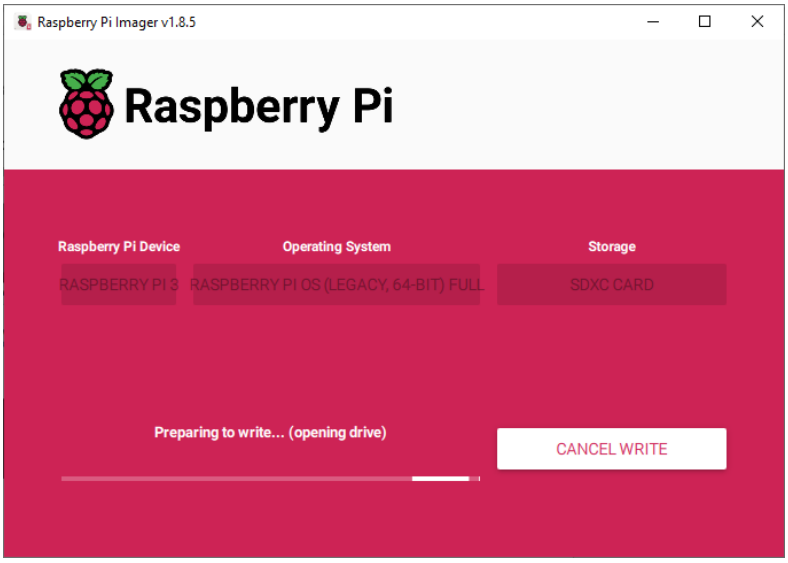


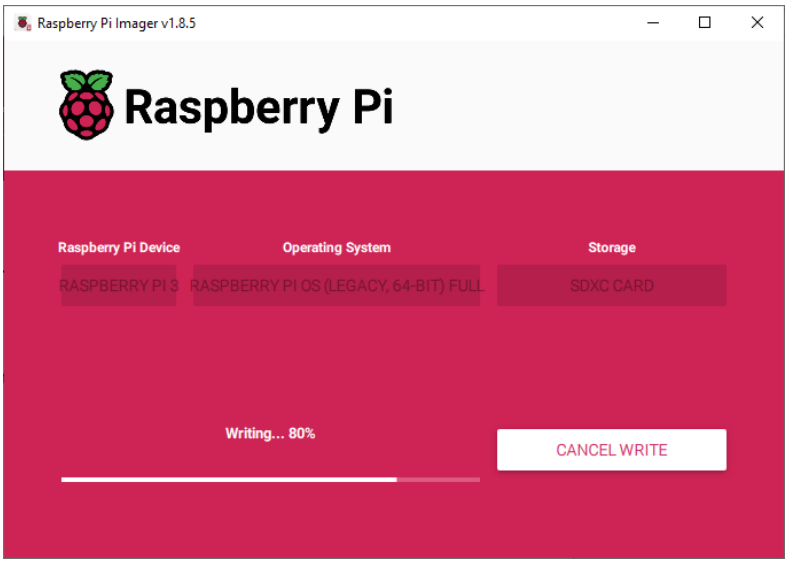
   c. Select edit settings. For the username and password, we will set it as **user** for easy access. For services, we need to enable SSH using user password authentication.

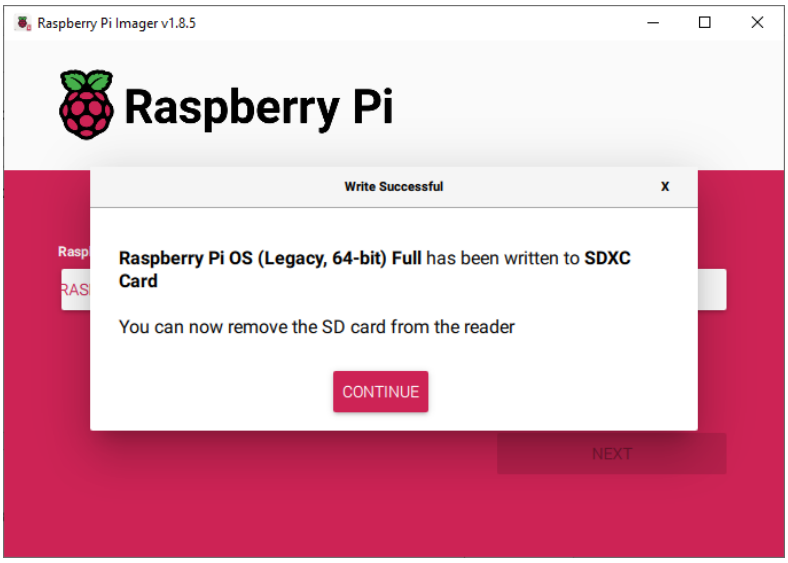


d. After that, select **Yes** to continue creating the OS Image on the SD Card. The SD Card will be ready in several minutes.


Raspberry Pi Imager v1.8.5
Raspberry Pi
Warning
X
All existing data on 'SDXC Card' will be erased.
Are you sure you want to continue?
NO
YES
NEXT


Raspberry Pi Imager v1.8.5
Raspberry Pi
Raspberry Pi Device
Operating System
Storage
RASPBERRY PI 3
RASPBERRY PI OS (LEGACY, 64-BIT) FULL
SDXC CARD
Preparing to write... (opening drive)
CANCEL WRITE

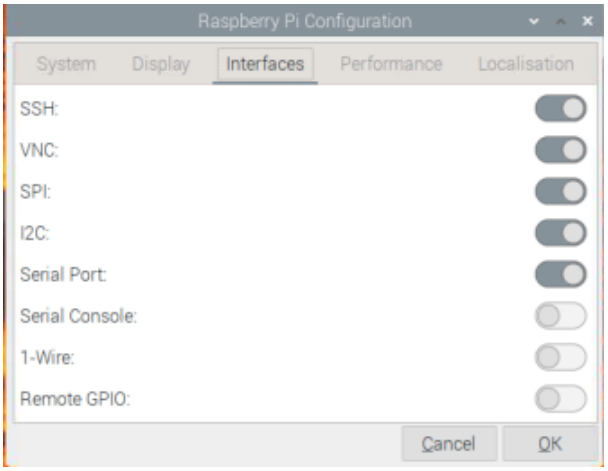

Raspberry Pi Imager v1.8.5
Raspberry Pi
Raspberry Pi Device
Operating System
Storage
RASPBERRY PI 3
RASPBERRY PI OS (LEGACY, 64-BIT) FULL
SDXC CARD
Writing... 80%
CANCEL WRITE

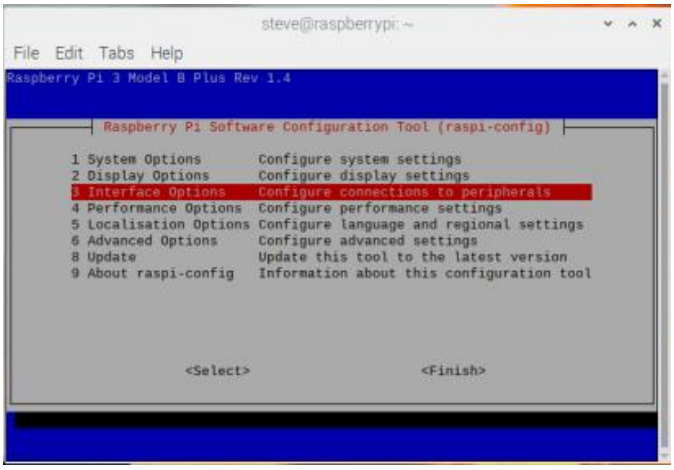


Warning: DO NOT select Format the SD Card from the Windows prompt after the completion. Just select complete from the Raspberry Pi Imager.

e. Insert the SDXC Card and power on the board. You can use the micro-USB port to power up the board using a USB 5V phone charger that provides a minimum of 2.4A.

f. Once power On, go to the Preferences menu and select Raspberry Pi Configuration. Make sure to enable the following Interfaces – **SSH, VNC, SPI, I2C, Serial Port**. You can also use command line **sudo raspi-config** to do the same thing.

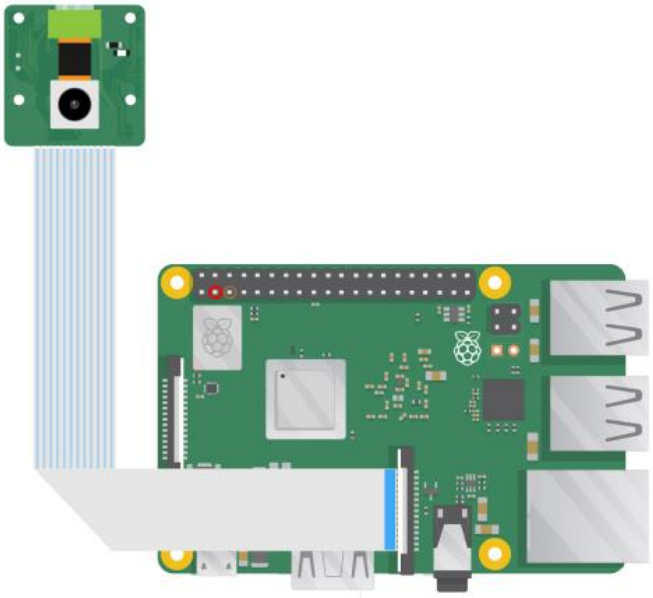




To enable graphics acceleration, navigate to **Advanced Options**, and select **Enable Glamor graphic acceleration**.
In case if you encounter errors when running the *libcamera-vid* tests, navigtate to **Advanced Options**, **GL Driver**, and enable the **GL (Full KMS)**. To be safe, just enable it at this step.

2. Arducam 8MP IMX219

a. Connect the flat cable to the main board like this.

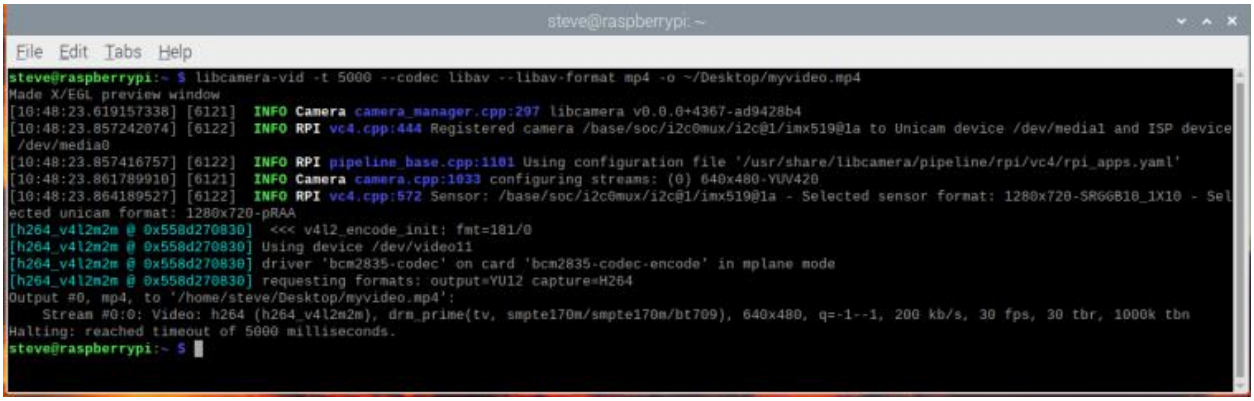


b. Edit the /boot/**config.txt** file

i. Look for **camera_auto_detect** = **1** and change it to 0 (zero)!
camera_auto_detect = 0

j. Add to the last line (after **[all]**)
dtoverlay=imx219,vcm

c. To test the camera, you can use the standard camera library from the Raspbian as follows from the terminal command line:
libcamera-vid it 5000 --codec libav --libav-format mp4 -o ~/Desktop/myvideo.mp4



d. To use the camera in Python, you need to install several libraries. We will use the latest picamera2 library in python for our purpose. You can download the datasheet from the official Raspberry Manual
e. Issue the command in the terminal to install the python components.
sudo apt install -y python3-picamera2
f. To test the camera in Python, open Thonny from Programming menu, and type in the following code:

```
from picamera2 import Picamera2, Preview
import time
picam2 = Picamera2()
camera_config = picam2.create_preview_configuration()
picam2.configure(camera_config)
picam2.start_preview(Preview.QTGL)
picam2.start()
time.sleep(2)
picam2.capture_file("test.jpg")
```

References:

1. For 8MP IMX219 Motorized Focus Camera - Arducam Wiki
2. https://datasheets.raspberrypi.com/camera/picamera2-manual.pdf
3. https://docs.arducam.com/Raspberry-Pi-Camera/Motorized-Focus-Camera/Quick-Start-Guide/IMX219-Motorized-Focus-Camera/#install-libcamera-from-arducam

g. How to write continuous monitoring Python program called ***picamera2_continuous.py*** ?

```
from picamera2 import Picamera2, MappedArray
from picamera2.outputs import FfmpegOutput
from picamera2.encoders import H264Encoder, Quality
import cv2, time, platform
from time import sleep
from datetime import date, datetime
#create helper function for calculating 10-minute interval
def seconds_till_x_minute(x):
  n = datetime.now()
  v = x * 60 - n.second
  return v
#main function to handle the recording
def main():
  now = datetime.now()
  filename = now.strftime("%Y-%m-%d_%H_%M_%S")
  fmt = '.mp4'
  root = '/home/steve/Desktop/Video/'   #remember to change to an existing folder
  width = 1024 # default 640
  height = 768 # default 480     use main for bigger size e.g. 1024 x 768 instead of lo res
  camera_name = platform.node()
  cam = Picamera2()
  preview_config = cam.create_video_configuration(main={"size": (width, height)}, display="main")
  #lores={"size":(width,height)},display="lores"  #low resolution
  #,transform=libcamera.Transform(vflip=1,hflip=1) #flips the image vertically and horizontally
  colour = (0, 255, 0)
  origin = (0, 30)
  origin_name = (width - len(camera_name)*20, 30)
  font = cv2.FONT_HERSHEY_DUPLEX
  scale = 1
  thickness = 2

  def apply_timestamp(request):
   timestamp = time.strftime("%Y-%m-%d %X")
```

```
    with MappedArray(request, "main") as m:
        cv2.putText(m.array, timestamp, origin, font, scale, colour, thickness)
        cv2.putText(m.array, camera_name, origin_name, font, scale, colour, thickness)
# Settings
cam.configure(preview_config)
# Afmode: 0=manual, 1=single_autofocus, 2=continuous_autofocus
cam.set_controls({"AfMode": 2, "AfTrigger": 0})
# continuous_autofocus - may report errors in the status but the picture is still fine
cam.pre_callback = apply_timestamp
cam.start()
sleep(1)
while True:
    now = datetime.now()
    filename = now.strftime("%Y-%m-%d_%H_%M_%S")
    output = FfmpegOutput(root + filename + fmt) #,audio=True #to record audio
    encoder = H264Encoder()
    quality = Quality.VERY_HIGH
    duration = seconds_till_x_minute(1)  #every 1-minute
    print("record duration=" + str(duration) + " ->" + filename)
    #cam.start_recording(encoder, output, quality)
    cam.start_and_record_video(output, encoder, duration = duration, quality = quality)
main()
```

Once you have created the program, you can then schedule it to run in the operating system services or call it from the shell to run in the background as follows:

1. Create a **record.sh** text file
2. Enter the command into record.sh file ***python picamera2_continuous.py &***
3. Change the text file to executable using the command **chmod 755 record.sh**
4. This will allow you to run the designated python program as a background process. To run it, all you need to do is type **./record.sh** (remember to add the dot slash)
5. If you want to stop the process, you will have to know the process id and kill it. E.g.

```
stevep@bikecam2:~ $ ps
    PID TTY          TIME CMD
   8281 pts/1    00:00:00 bash
   9299 pts/1    00:00:03 python
   9306 pts/1    00:00:01 ffmpeg
   9311 pts/1    00:00:00 ps
stevep@bikecam2:~ $ kill 9299
stevep@bikecam2:~ $ ps
    PID TTY          TIME CMD
   8281 pts/1    00:00:00 bash
   9320 pts/1    00:00:00 ps
stevep@bikecam2:~ $
```