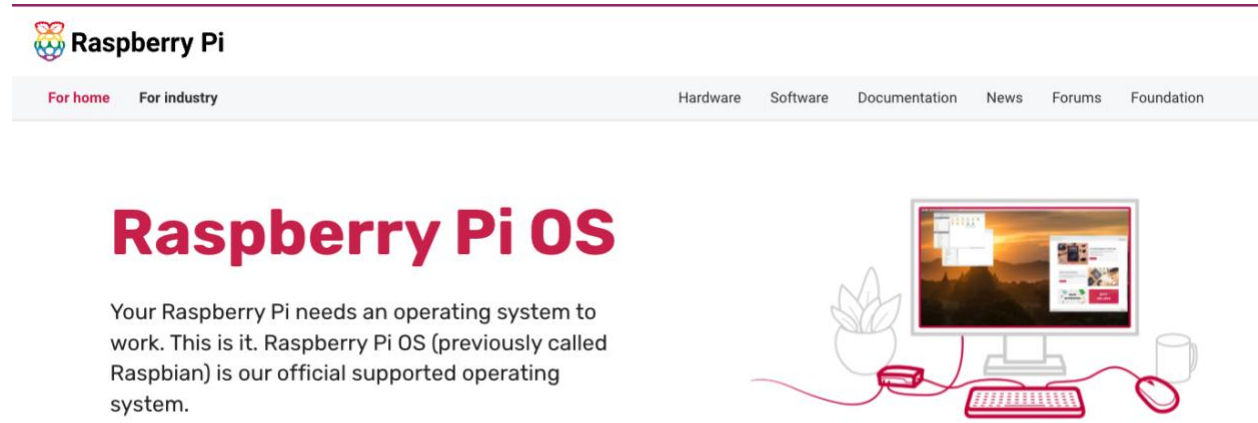Raspberry Pi Imager is free to install from the official Raspberry Pi website. It is under the download page section of the website. It's available for MacOS, Windows, Linux and Ubuntu systems.

Visit Raspberry Pi Software section (https://www.raspberrypi.com/software/)

Download the latest version of Raspberry Pi Imager installer for your Operating System.

Click on Download for macOS and it will download the imager.dmg file. Open the file.
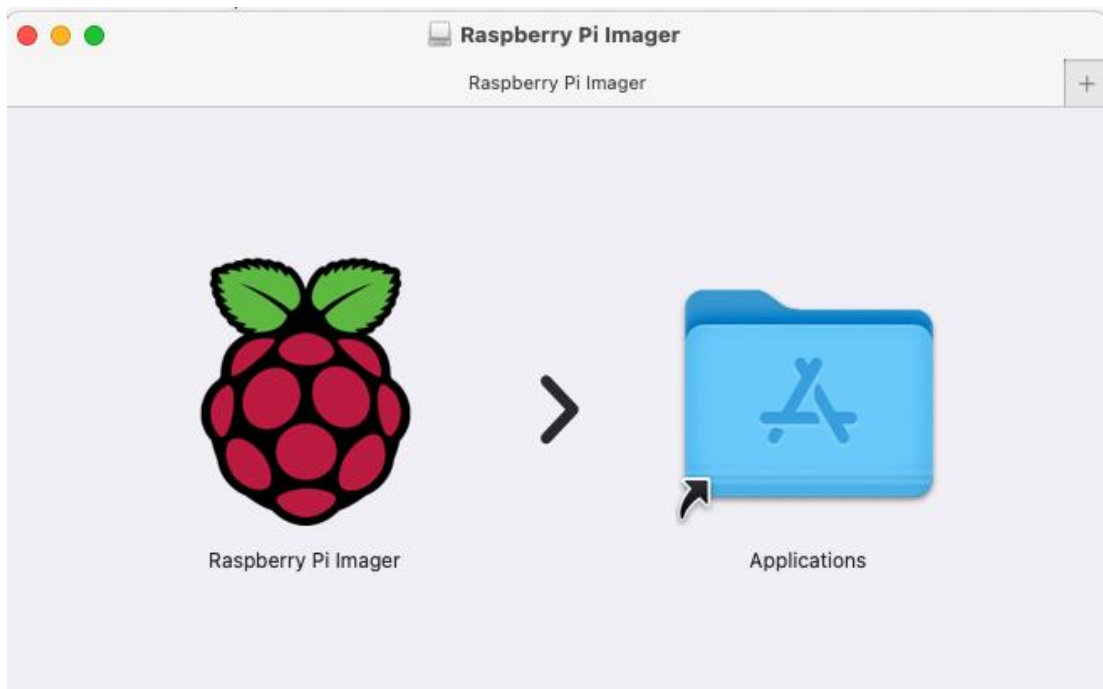
Once the file is open simply drag and drop Raspberry Pi Imager into the Applications folder and the program should be installed.
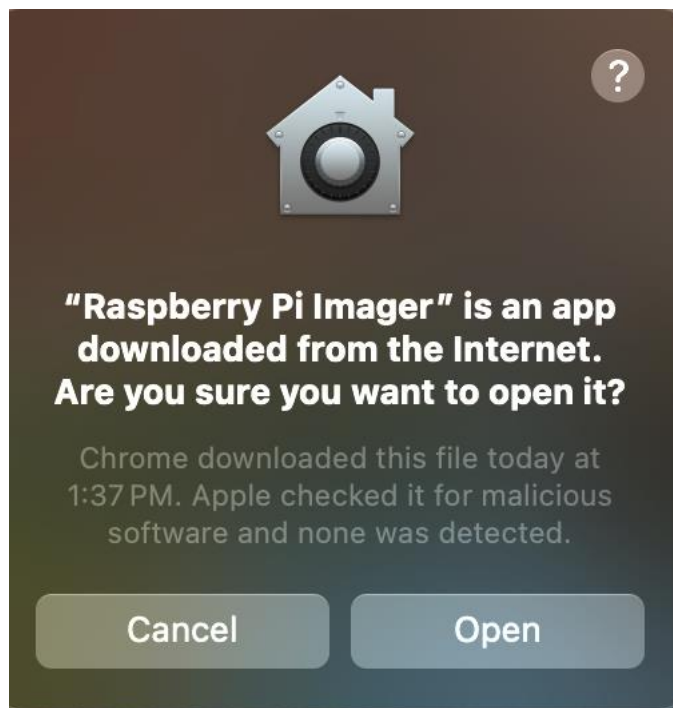
Now open Raspberry Pi Imager from the launchpad and the above prompt will appear. Click on Open. The program should open.
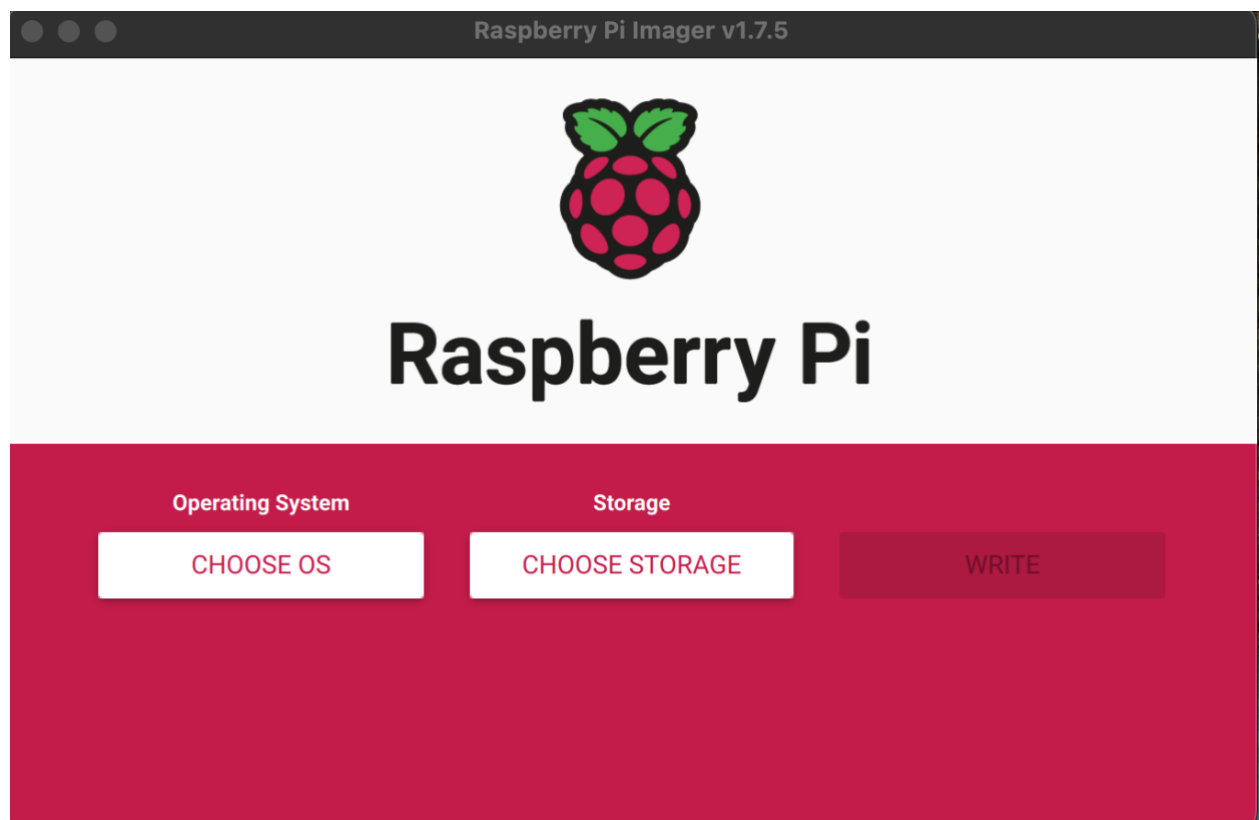
Now click on CHOOSE OS.
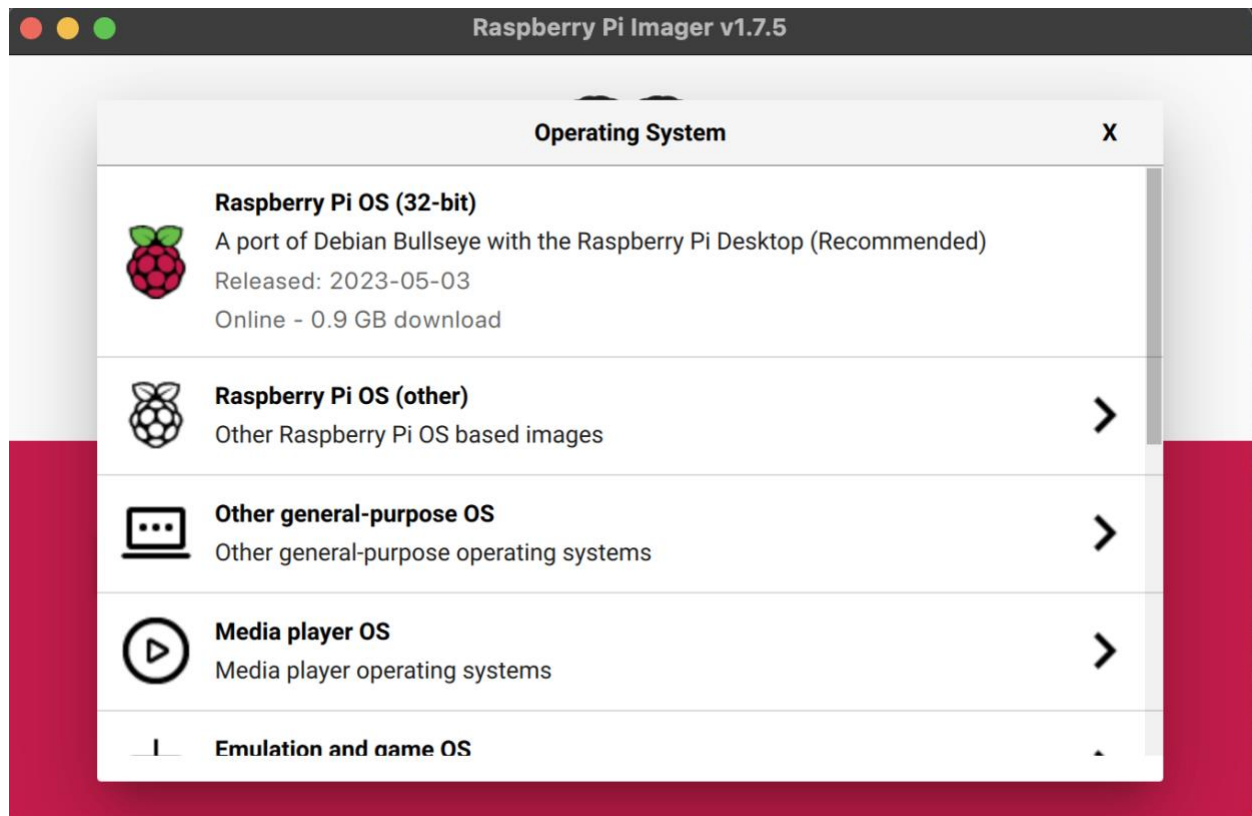
Operating System pop up will open. Click on Raspberry Pi OS (other). We need 64 bit OS for this development.

Scroll a bit down and choose Raspberry Pi OS (64-bit). Keep an eye on the size, this should be 0.8 GB as we need Desktop version of Debian Bullseye.

It will take you back once you select the OS. Insert the SD card into the mac. Now click on CHOOSE STORAGE.
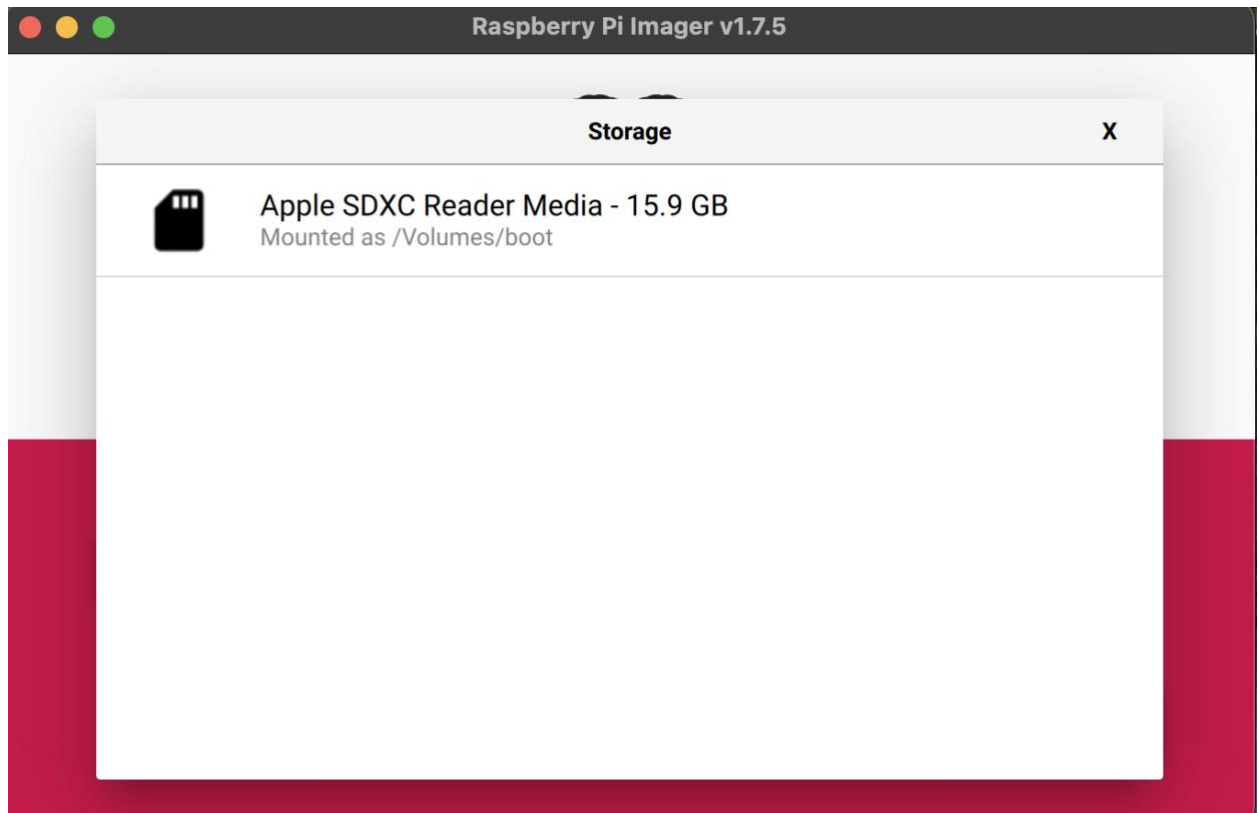
Select the SD card.

We can use Raspberry Pi Imager to setup a raspberry pi in the headless mode without the need for additional peripherals such as monitor, keyboard and mouse. By configuring our Wi-fi credentials and locale settings into the OS we can use this imaging tool to write the OS onto the SD card. So, we click on the setting logo.
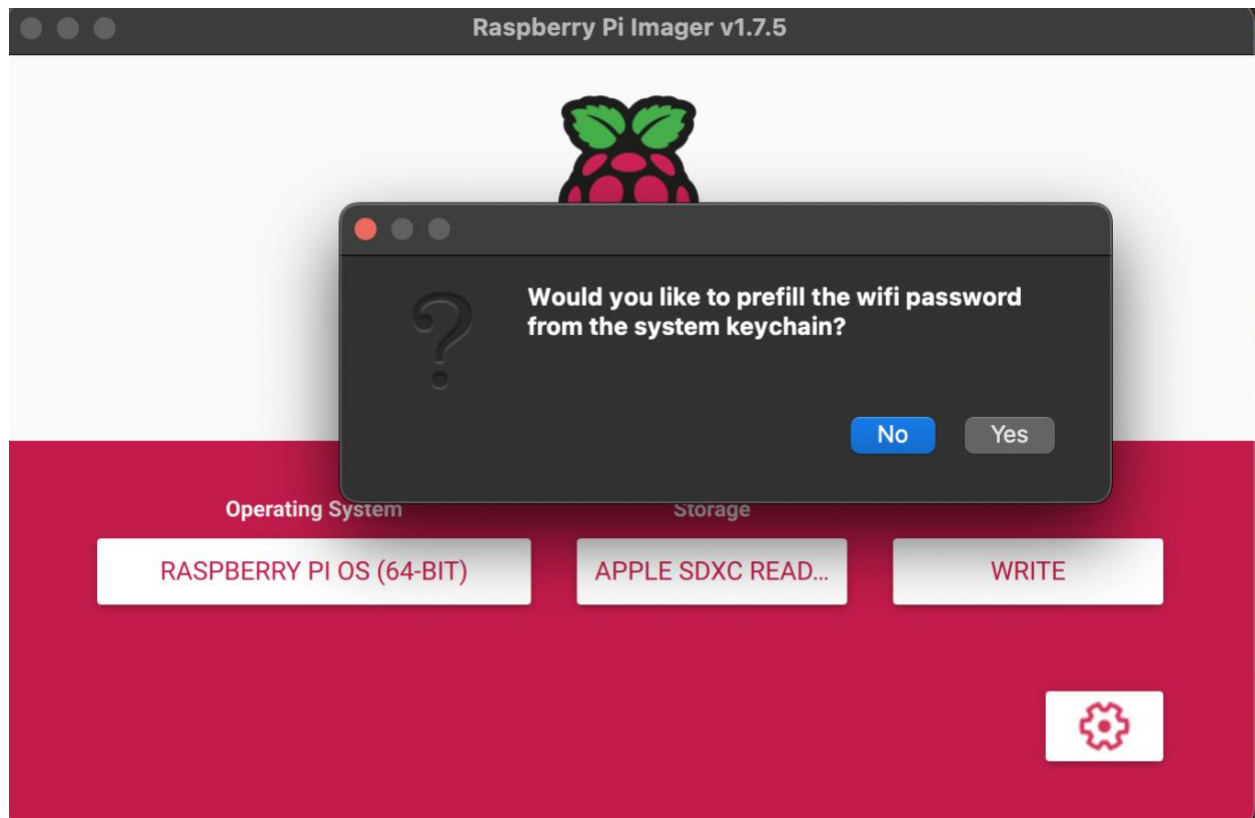
A prompt would ask saying Would you like to prefill the wifi password from the system keychain? For easier access we can select Yes.
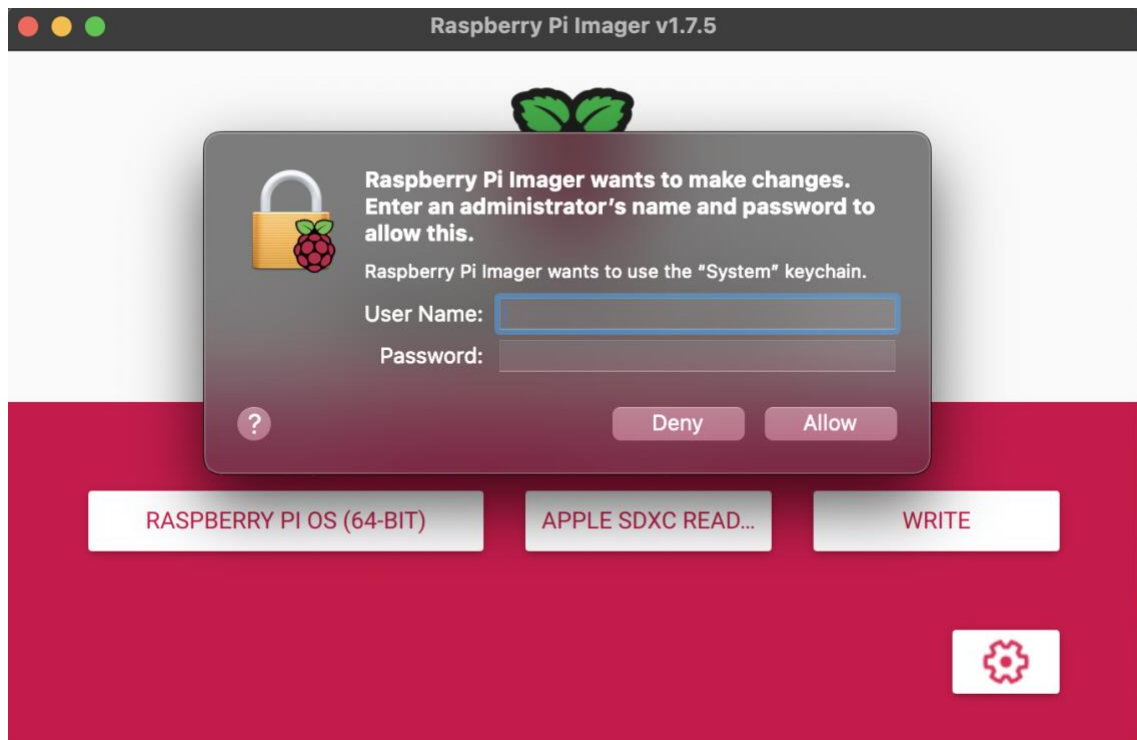
It will ask for system credentials. Please provide the credentials and click on Allow.
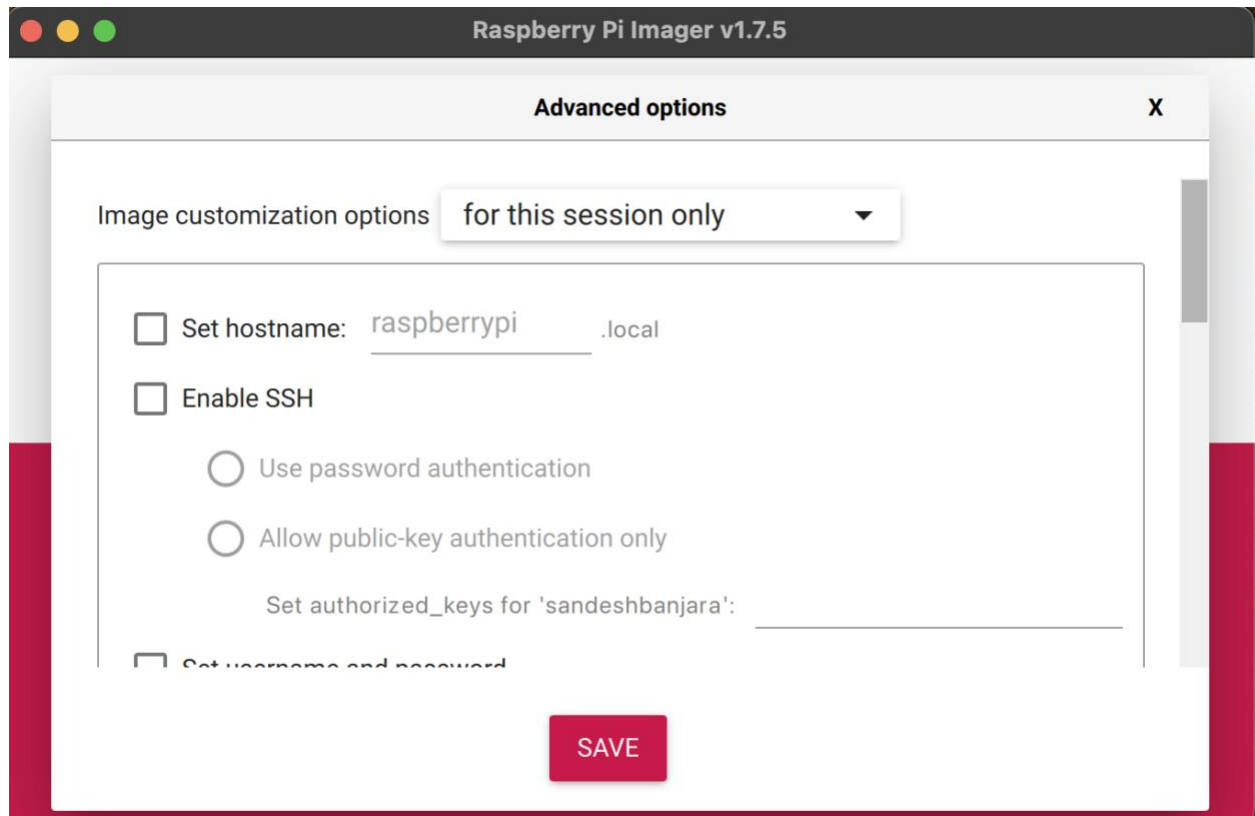
You can select Image customization options to "to always use". Select Enable SSH.
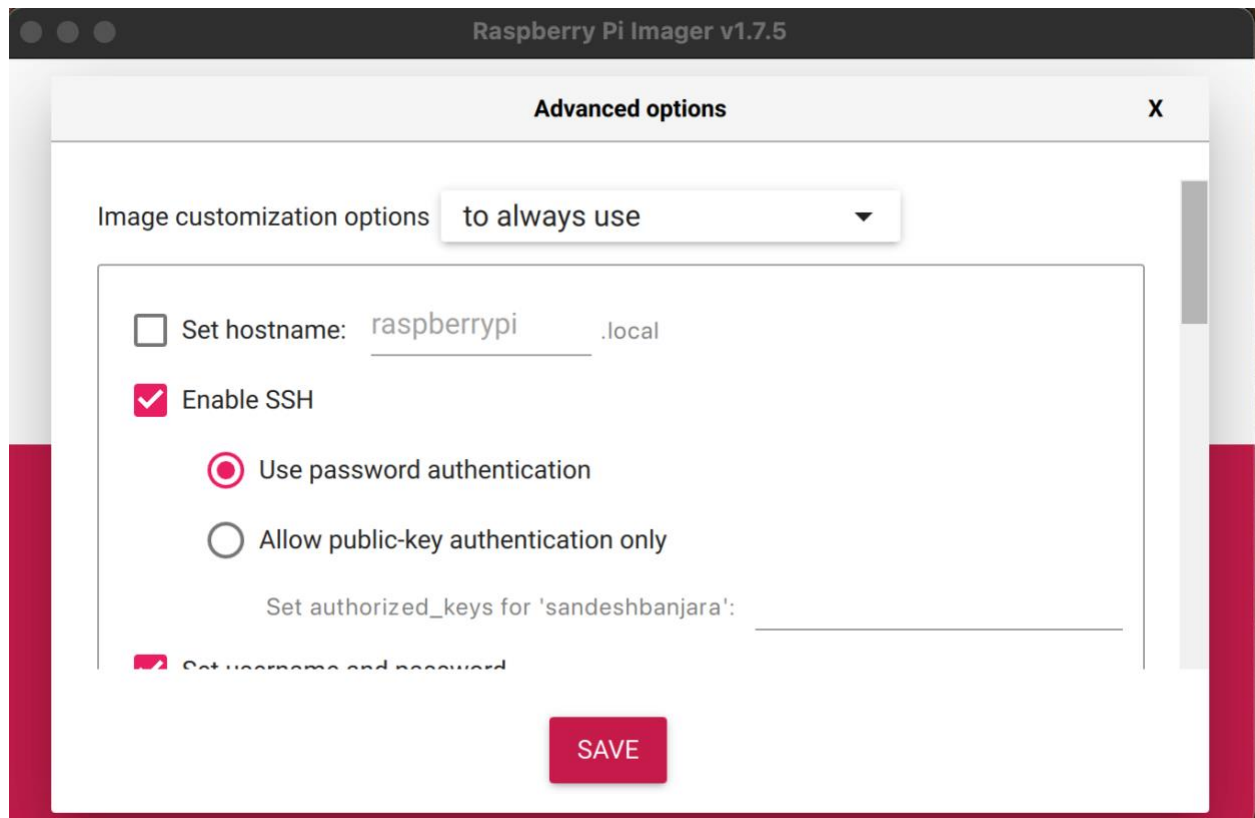
Then scroll down a bit.
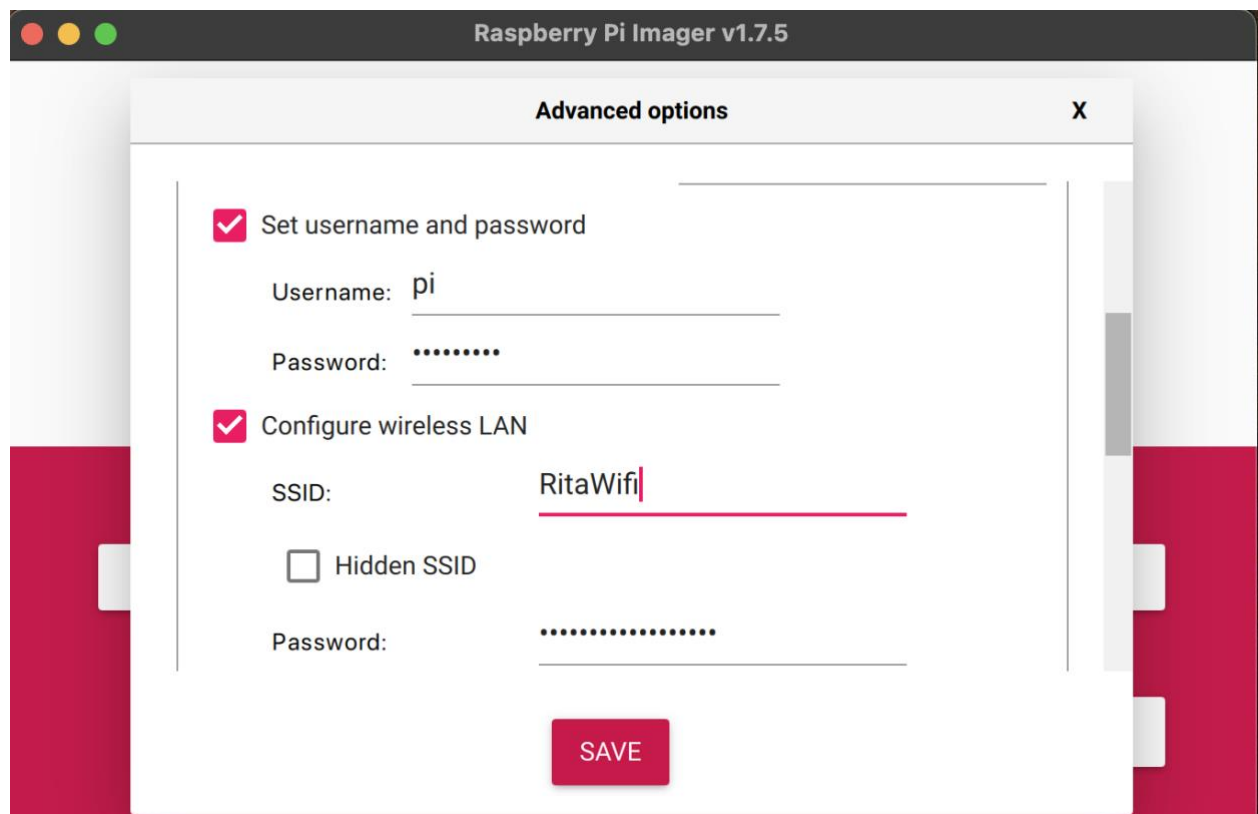
The set Username as "pi" and password as "raspberry". And also provide your wifi credentials. Then scroll again.
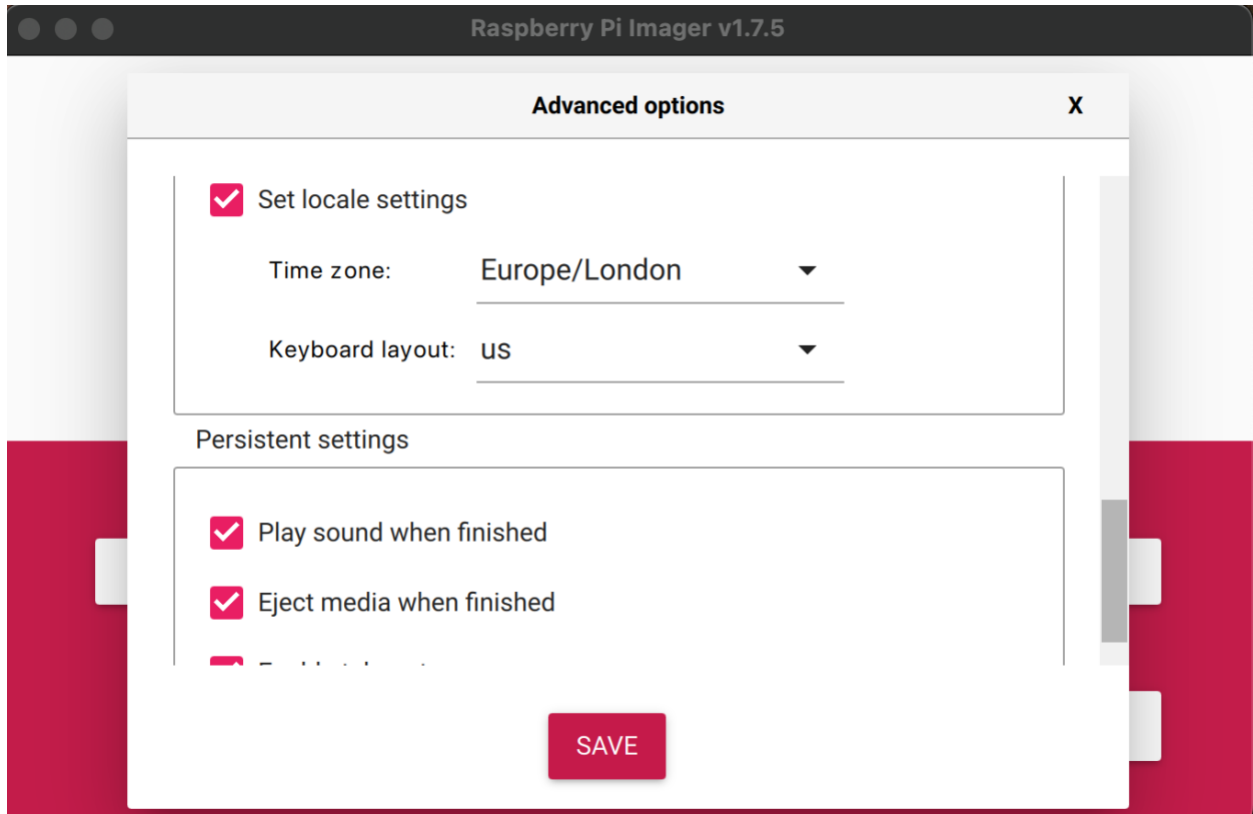
and select on set locale settings and choose your desired Time zone and Keyboard layout. Click on SAVE.

It will take you back to the home screen. Now simply press WRITE button. The process will start.
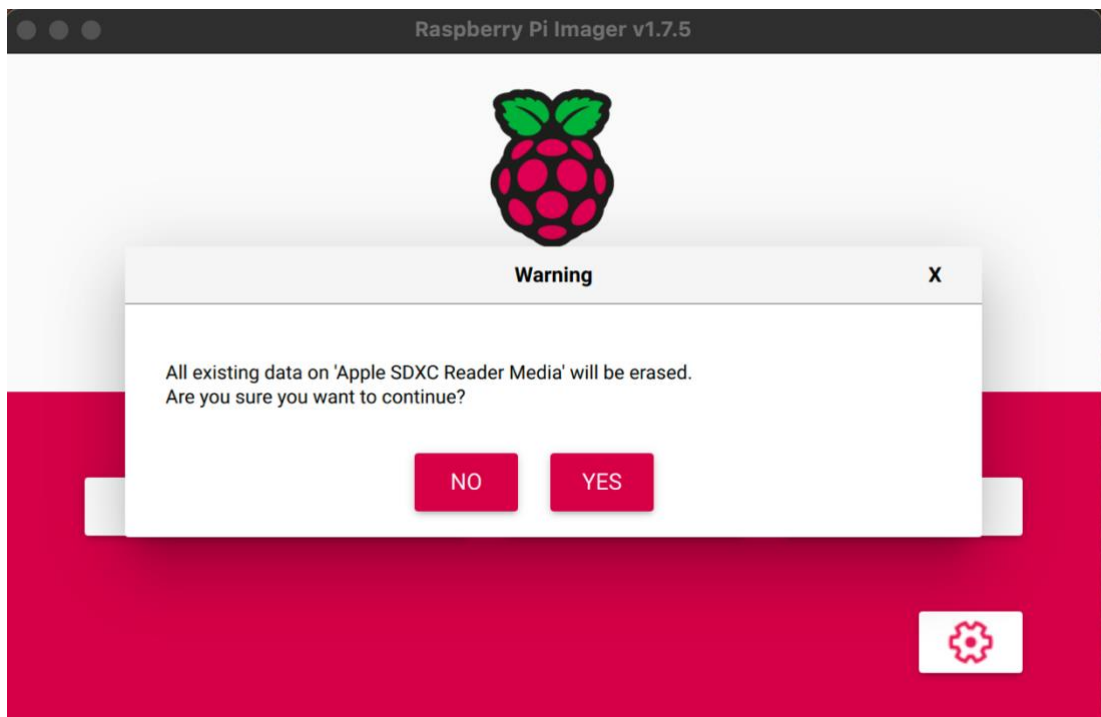
Click on YES.
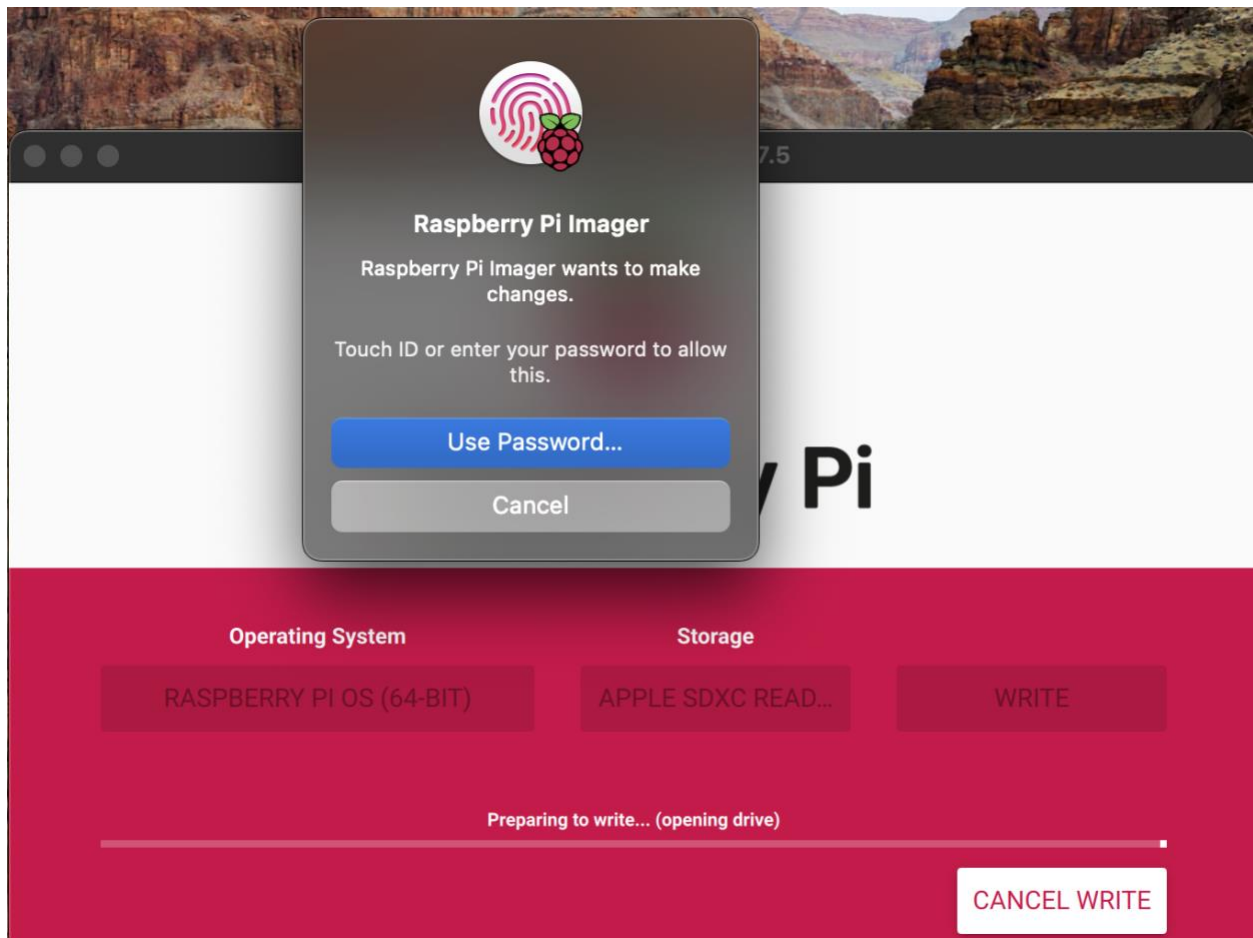
Please verify either using fingerprint or password and the process will start writing the OS into the SD card.
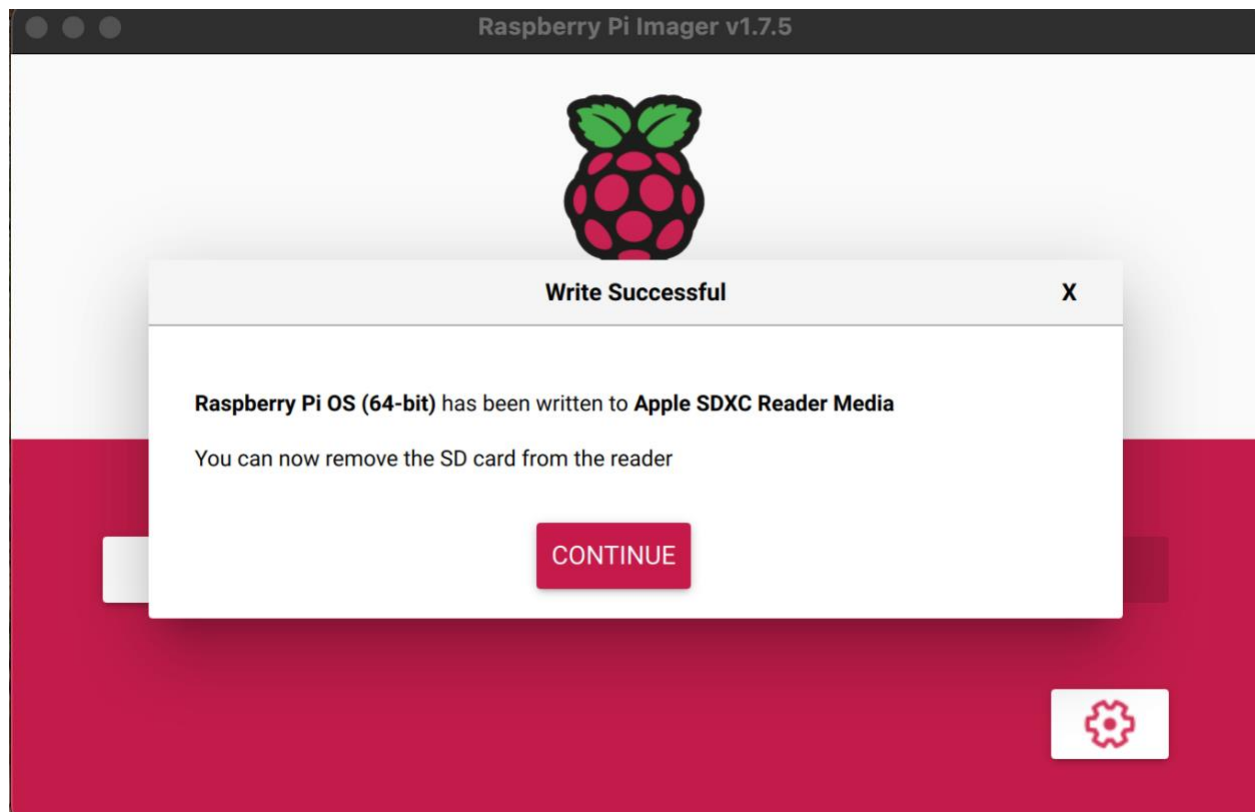
Once the writing process is complete it will prompt a message with Write Successful message. Click on CONTINUE. Remove the SD card from the laptop.

General-purpose input/output pins for connecting electronic components

Micro SD card (underneath)

Ethernet port

USB ports

Micro USB power

HDMI ports

Camera Module port

Audio jack
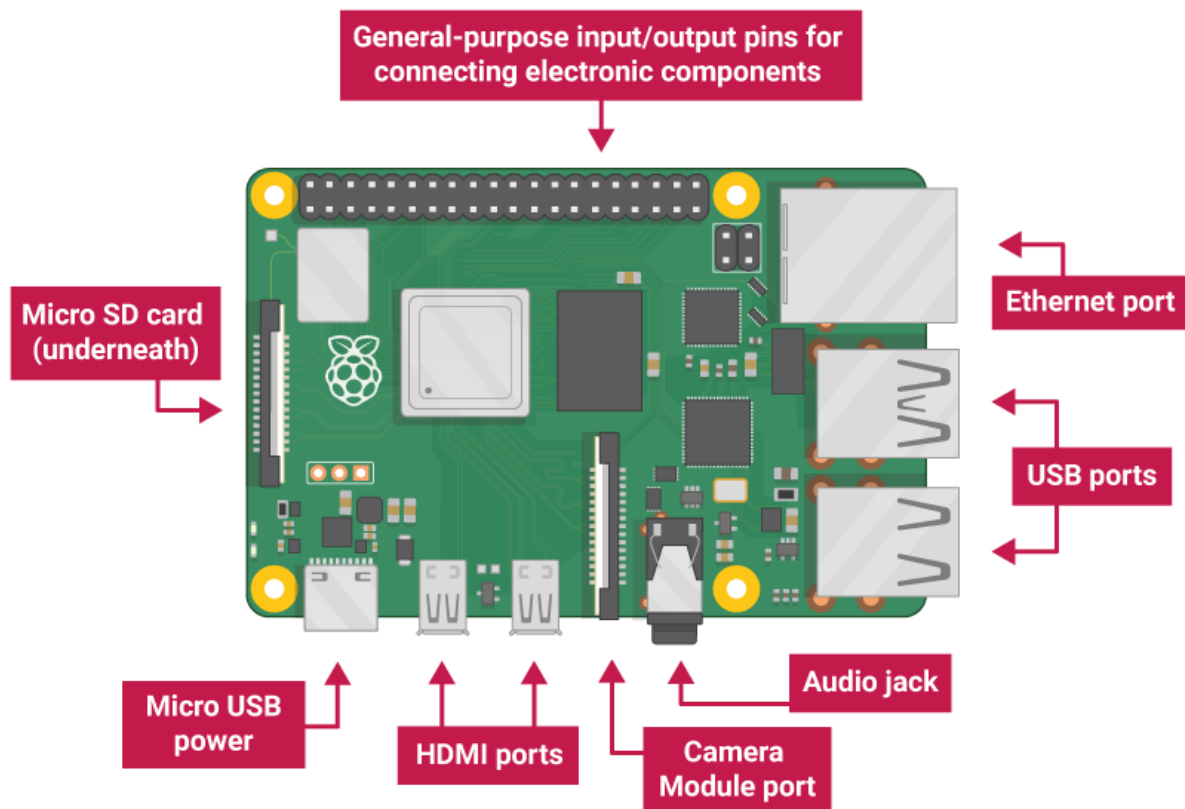
Insert the SD card in the raspberry pi. Connect the Micro USB power using raspberry pi 4 official power supply. The red and green status LED on the side of the Micro USB power will start to blink.

Now once the pi boots up it will connect to the wifi we provided credentials in the setup section. In order to connect to the Pi, we need to know the IP address of the raspberry pi. For that purpose, we can use a software called angry ip scanner. It's available for MacOS, Windows, Linux and Ubuntu systems.
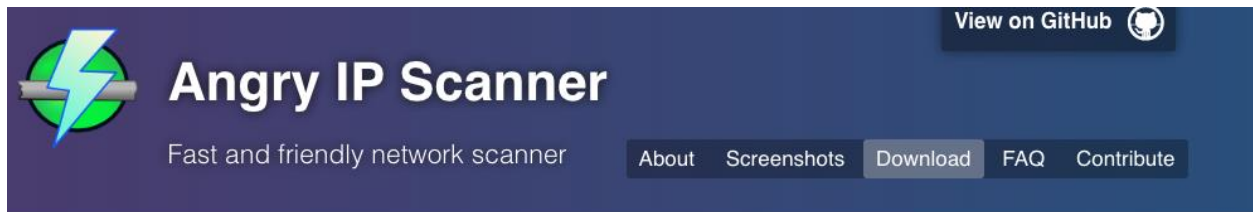
Visit (https://angryip.org/download/#mac)

Select the mac type and download the file. Once the file is downloaded.
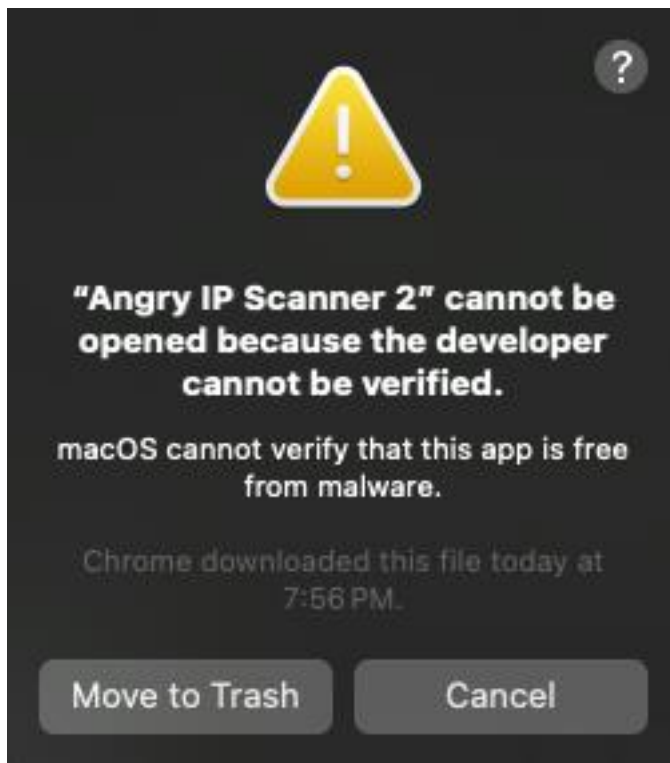
macOS will prompt with this message. You will have to Cancel this. Developer mode has to be enabled in the system. After that go to mac's Settings, then Privacy and Security then scroll until you see this.

Sensitive Content Warning   Off >

Analytics & Improvements   >

Apple Advertising   >

Security

Allow applications downloaded from
- App Store
- App Store and identified developers

"Angry IP Scanner 2" was blocked from use because it is not from an identified developer.

Open Anyway

Allow accessories to connect   Ask for New Accessories ⇕
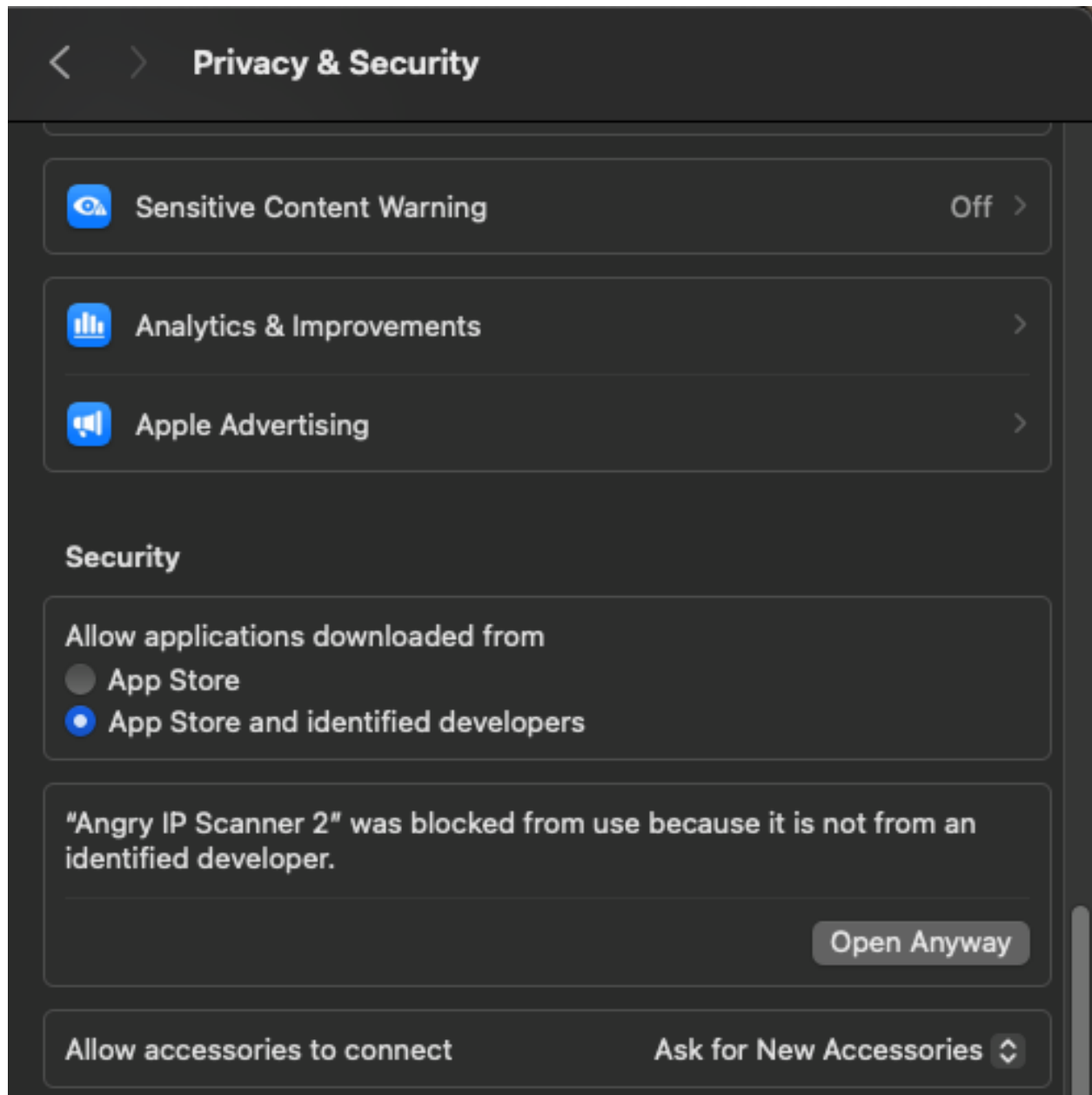
Click on Open Anyway. It will prompt for password provide the password.
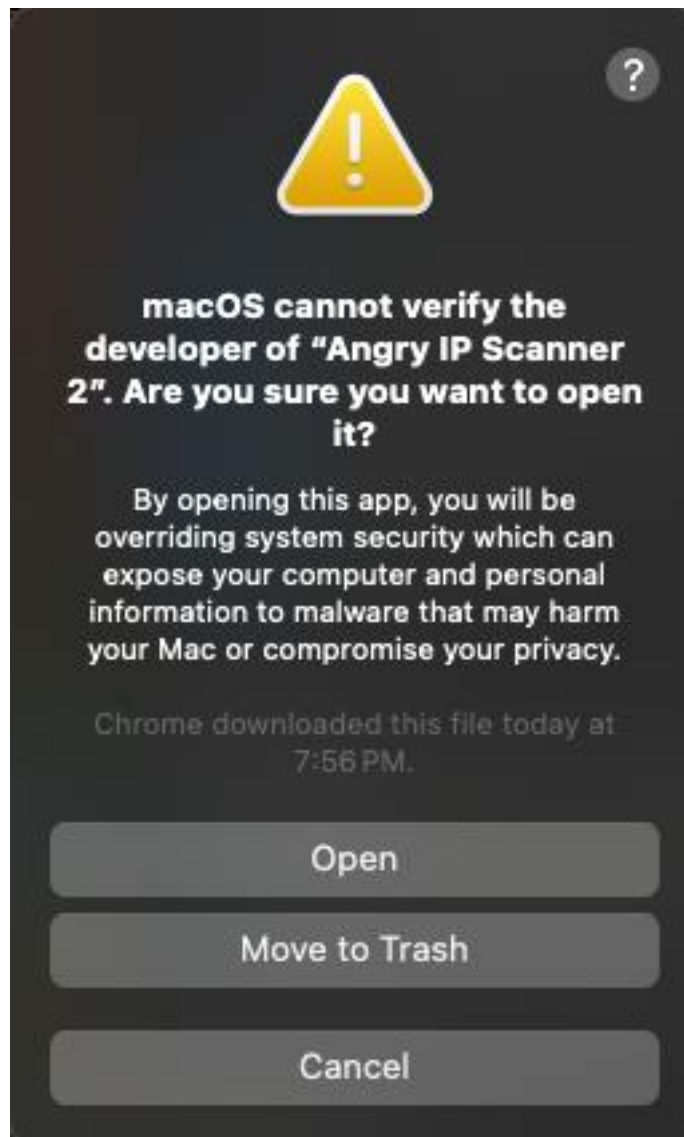
Click on Open. The application will open. Click on Start.
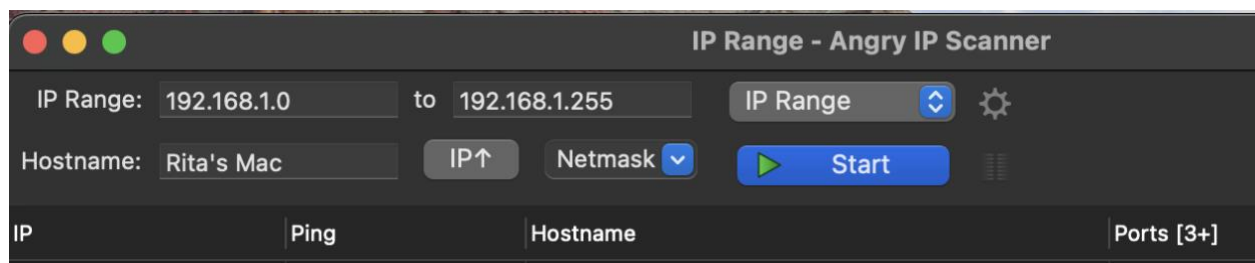
Once the process is complete. Close the prompt. Select anyone of the IP address. Press CMD+H until you see raspberrypi.local on the host name. Sometimes raspberry pi will not be able to connect to the wifi. In that case an ethernet cable can be connected directly from router to the pi. And also keep in mind that the macbook has to be on the same network.

🔴 192.168.1.92	[n/a]	[n/s]		[n/s]
🔴 192.168.1.93	[n/a]	[n/s]		[n/s]
🔵 192.168.1.94	2 ms	raspberrypi.local		[n/a]
🔴 192.168.1.95	[n/a]	[n/s]		[n/s]
🔴 192.168.1.96	[n/a]	[n/s]		[n/s]

Now we have our IP address of the Pi. We can use mac's terminal to SSH into the PI. Open terminal and enter the command
ssh pi@192.168.94

```
tys000
 % ssh pi@192.168.1.94
```

Now press enter.

```
The authenticity of host '192.168.1.94 (192.168.1.94)' can't be established.
ED25519 key fingerprint is SHA256:2iA/IPb6kutYiuXHQQWE9IFGaGmFQay1mJzhZ7vqki0.
This key is not known by any other names.
Are you sure you want to continue connecting (yes/no/[fingerprint])?
```

Types yes and press enter.

```
The authenticity of host '192.168.1.94 (192.168.1.94)' can't be established.
ED25519 key fingerprint is SHA256:2iA/IPb6kutYiuXHQQWE9IFGaGmFQay1mJzhZ7vqki0.
This key is not known by any other names.
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added '192.168.1.94' (ED25519) to the list of known hosts.
pi@192.168.1.94's password: 🔑
```

The password was set to "raspberry". As you type in the password you will see no characters. Once the password is completed press enter and you will be logged into raspberry pi console.

```
pi@192.168.1.94's password:
Linux raspberrypi 6.1.21-v8+ #1642 SMP PREEMPT Mon Apr  3 17:24:16 BST 2023 aarc
h64

The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
Last login: Wed May  3 04:23:56 2023

SSH is enabled and the default password for the 'pi' user has not been changed.
This is a security risk - please login as the 'pi' user and type 'passwd' to set
 a new password.

pi@raspberrypi:~ $
```

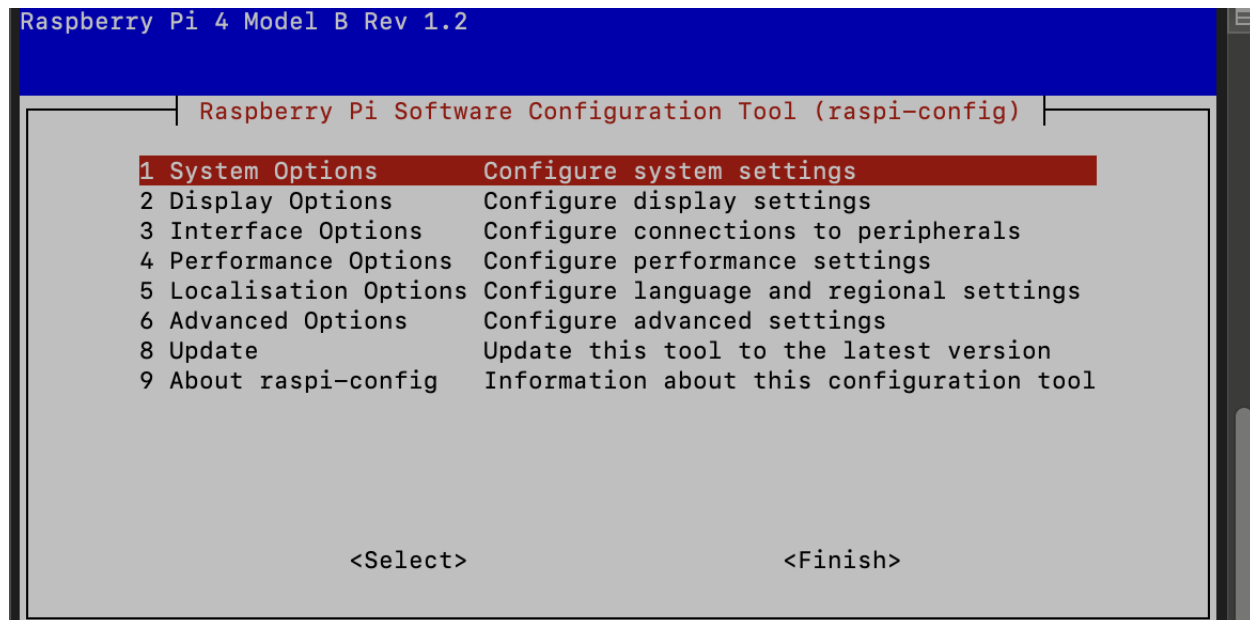Now we can enable VNC viewer to have Desktop GUI access.

```
SSH is enabled and the default password for the 'pi' user has not been changed.
This is a security risk - please login as the 'pi' user and type 'passwd' to set
 a new password.

pi@raspberrypi:~ $ sudo raspi-config
```
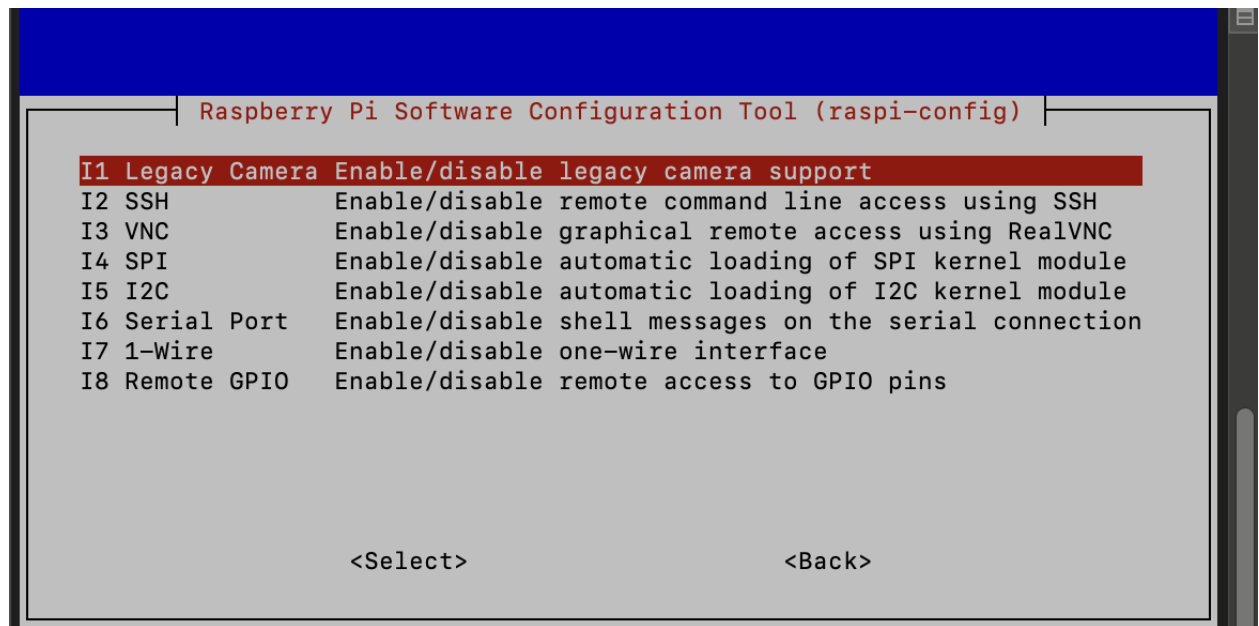
Type the command
sudo raspi-config
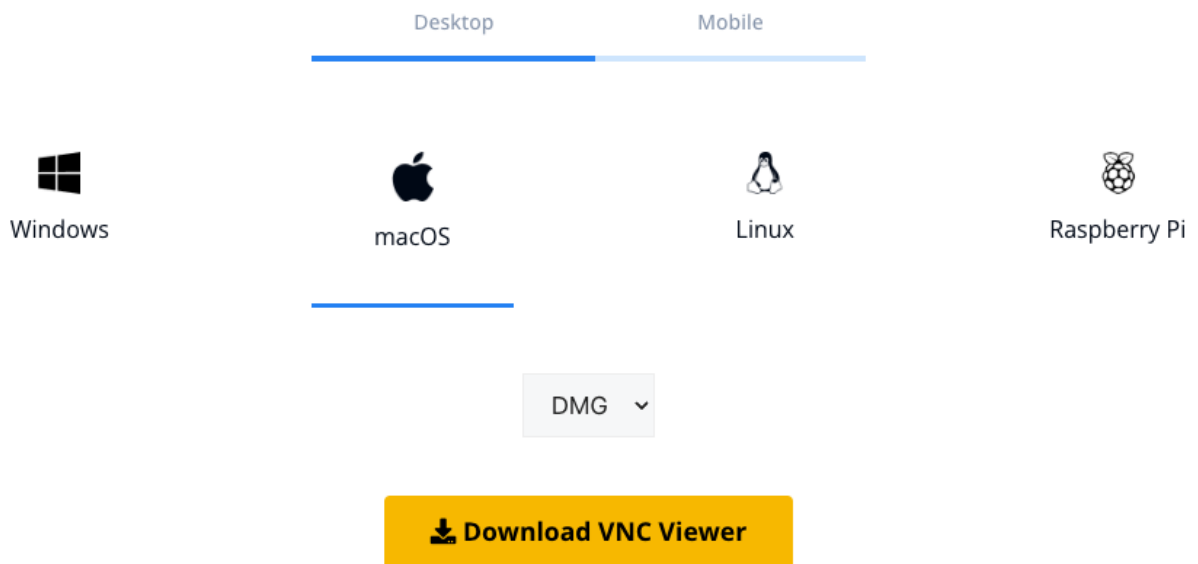And press enter this will direct to raspberry pi configuration.

```
Raspberry Pi 4 Model B Rev 1.2


        ┌───────┤ Raspberry Pi Software Configuration Tool (raspi-config) ├───────┐
        │                                                                          │
        │    1 System Options       Configure system settings                      │
        │    2 Display Options       Configure display settings                    │
        │    3 Interface Options     Configure connections to peripherals          │
        │    4 Performance Options   Configure performance settings                │
        │    5 Localisation Options  Configure language and regional settings      │
        │    6 Advanced Options      Configure advanced settings                   │
        │    8 Update                Update this tool to the latest version         │
        │    9 About raspi-config    Information about this configuration tool      │
        │                                                                          │
        │                                                                          │
        │                                                                          │
        │              <Select>                          <Finish>                  │
        │                                                                          │
        └──────────────────────────────────────────────────────────────────────────┘
```

Go to interface options

```
┌─────────── Raspberry Pi Software Configuration Tool (raspi-config) ───────────┐

  I1 Legacy Camera  Enable/disable legacy camera support
  I2 SSH            Enable/disable remote command line access using SSH
  I3 VNC            Enable/disable graphical remote access using RealVNC
  I4 SPI            Enable/disable automatic loading of SPI kernel module
  I5 I2C            Enable/disable automatic loading of I2C kernel module
  I6 Serial Port    Enable/disable shell messages on the serial connection
  I7 1-Wire         Enable/disable one-wire interface
  I8 Remote GPIO    Enable/disable remote access to GPIO pins




              <Select>                          <Back>
```

go to VNC, enable the VNC Server by choosing Yes. Then go to Display options. Then VNC
Resolution and select 1280x720. Once that is done, click on tab and finish it, when asked for
reboot select yes.

After this the SSH session will end on Terminal. Now let's install VNC viewer. Go to
(https://www.realvnc.com/en/connect/download/viewer/)

Desktop   Mobile

Windows   macOS   Linux   Raspberry Pi

DMG ⌄

⬇ Download VNC Viewer

Click on Download VNC Viewer. Once the DMG file is downloaded open it.

Just drag and drop to install. Once the installation is complete, open the VNC Viewer from the launchpad and click on open when prompt appears.
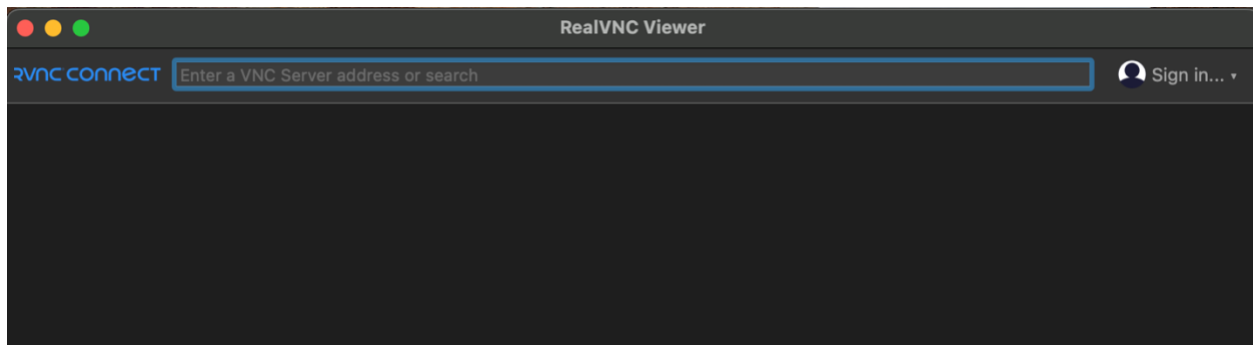
You will see the application like this. Right click on the body section and select new connection.

Properties

General | Options | Expert

VNC Server: [IP address or hostname]

Name: [Friendly identifier]

Labels

To nest labels, separate names with a forward slash (/)

[Enter a label name, or press Down to apply existing labels]

Security

Encryption: Let VNC Server choose ⇕

☑ Authenticate using single sign-on (SSO) if possible

☑ Authenticate using a smartcard or certificate store if possible
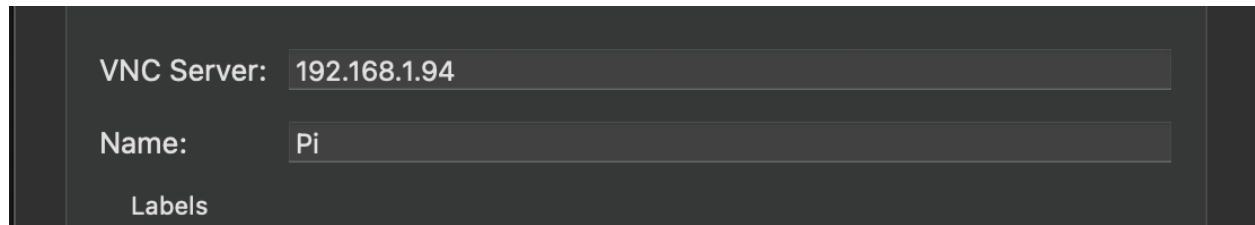
Privacy

☑ Update desktop preview automatically

Cancel | OK

In VNC Server we have to input the ip address of the Pi. (192.168.1.94) and the name can be anything (Pi).
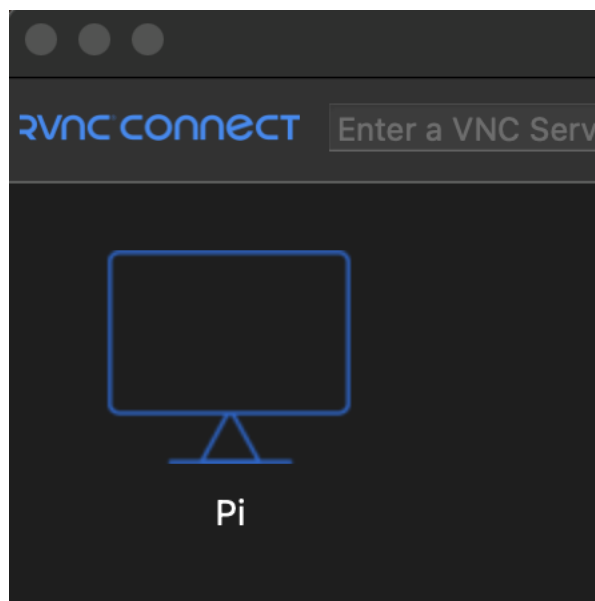
Click on Ok.

This icon will appear, double click on it.
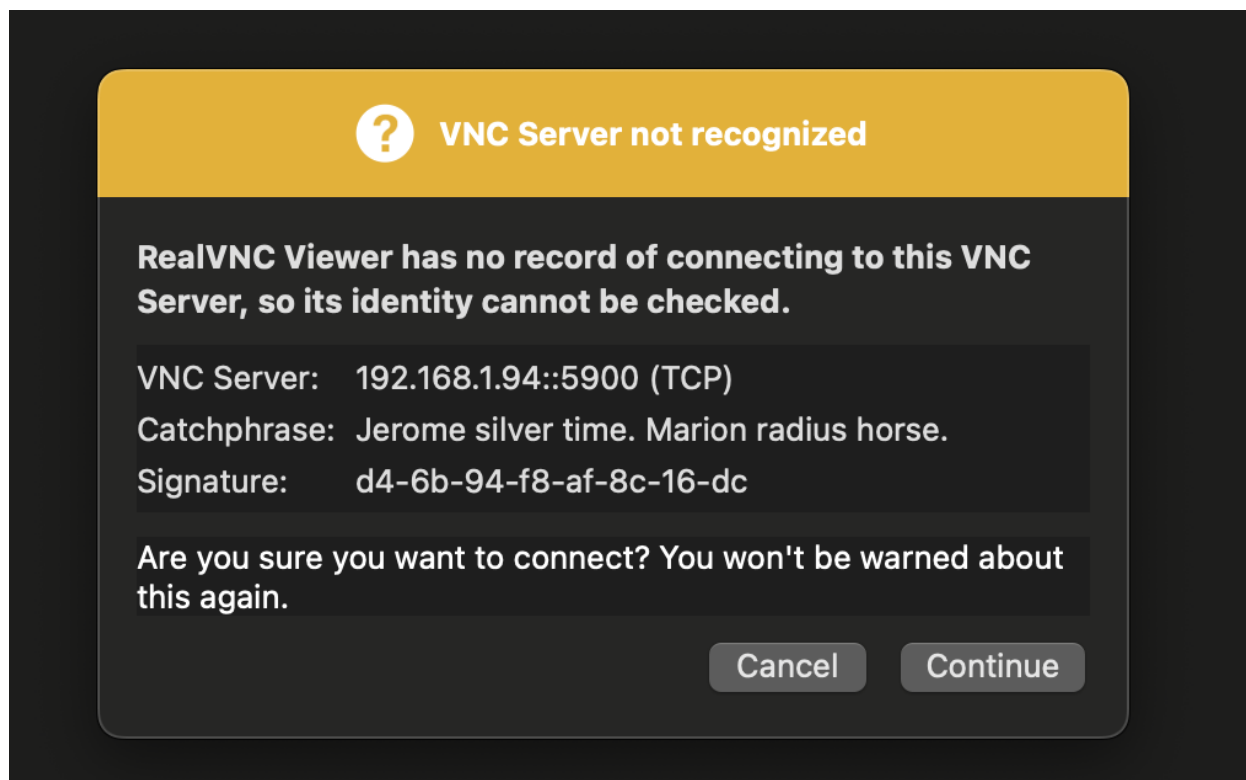
A prompt will appear, click on Continue.
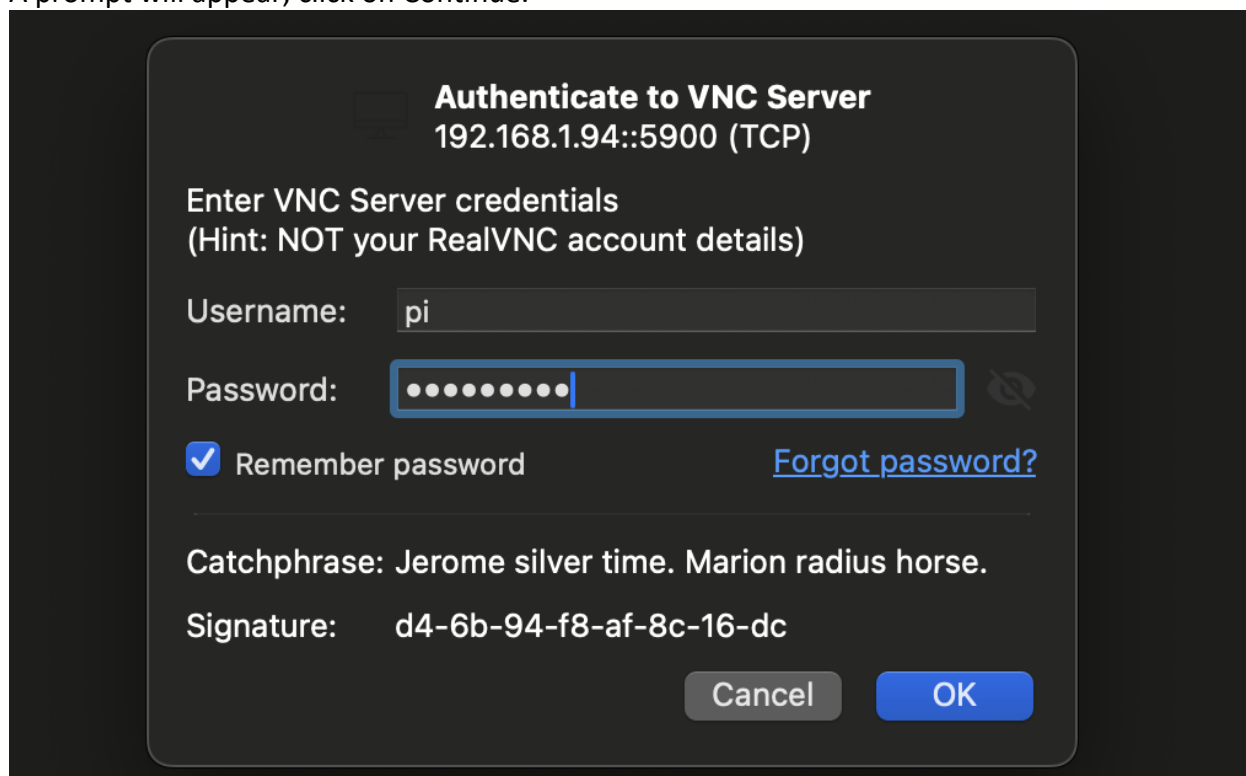
Username is "pi" and the password is "raspberry". Check the remember password box and click ok.
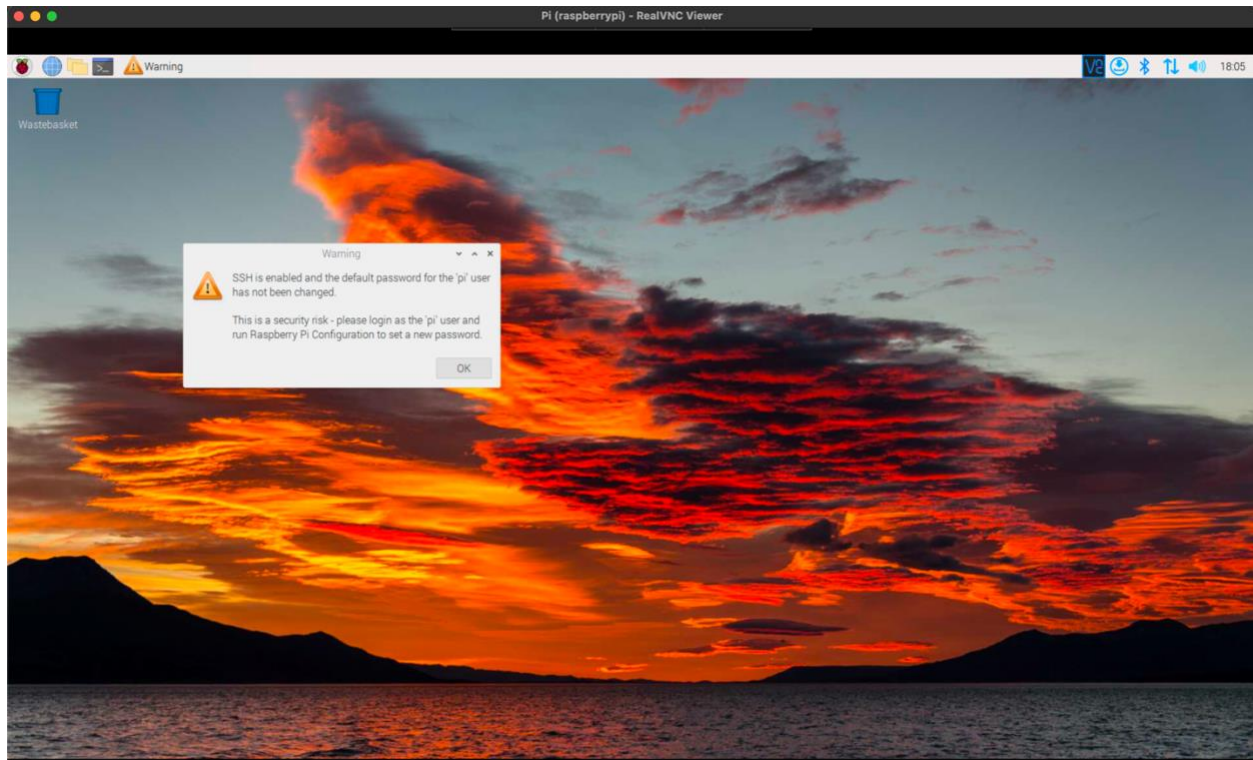
The Raspberry pi desktop will appear and we can use raspberry pi now. The warning can be closed by clicking on ok.

SSH and VNC only works locally and are often time consuming because whenever the IP changes then the whole thing has to be reconfigured. So we can use third party application like anydesk, teamviewer for easy access. Whenever the device is connected to the internet, no matter from where, they can be configured once to be logged in using the same credentials.

Since this OS is 64 bit, anydesk on 64 bit Raspbian OS is not supported yet. Lets install teamviewer and set it up.
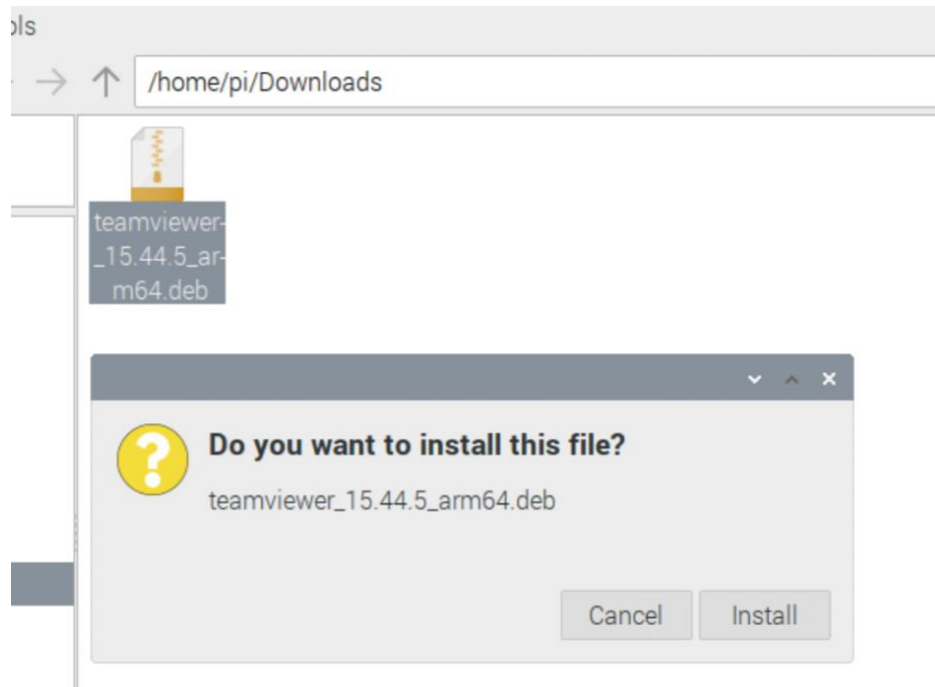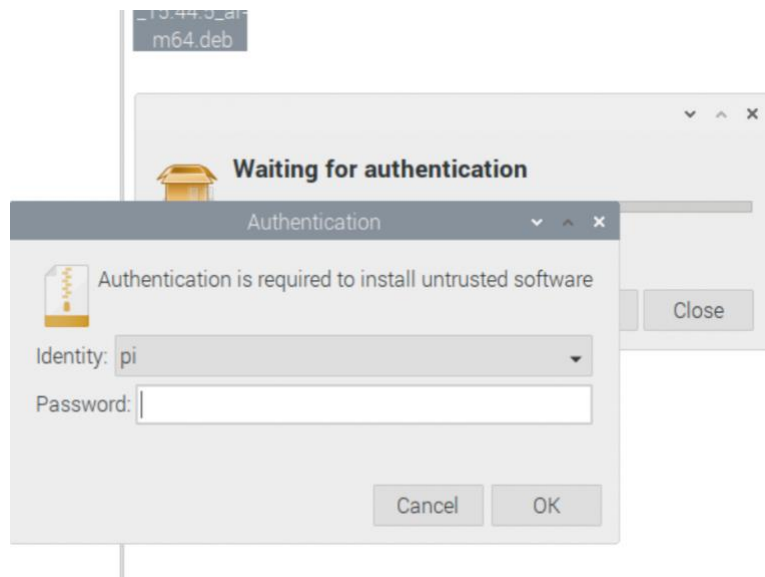
Open up chromium web browser on raspberry pi.

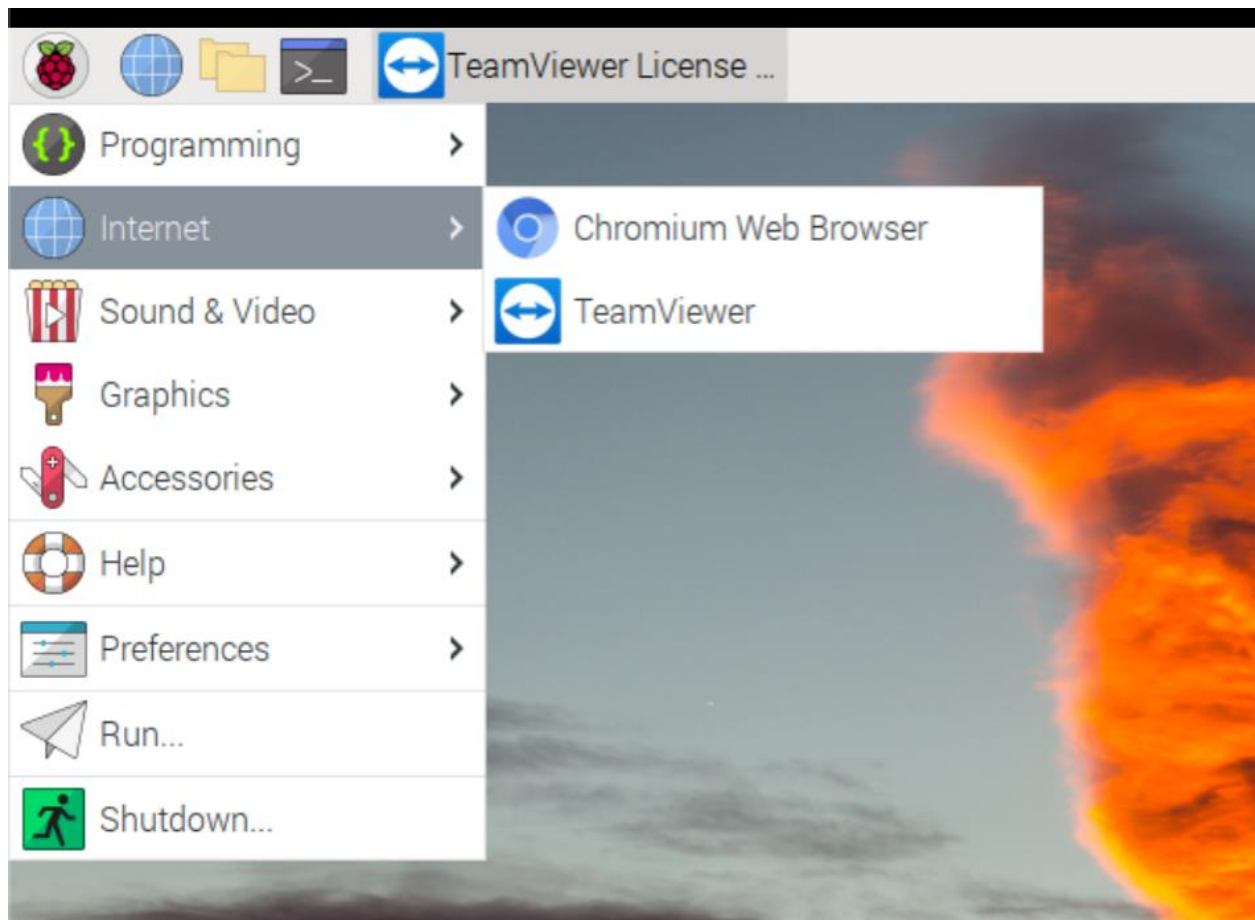now go to (https://www.teamviewer.com/apac/download/raspberry-pi/)
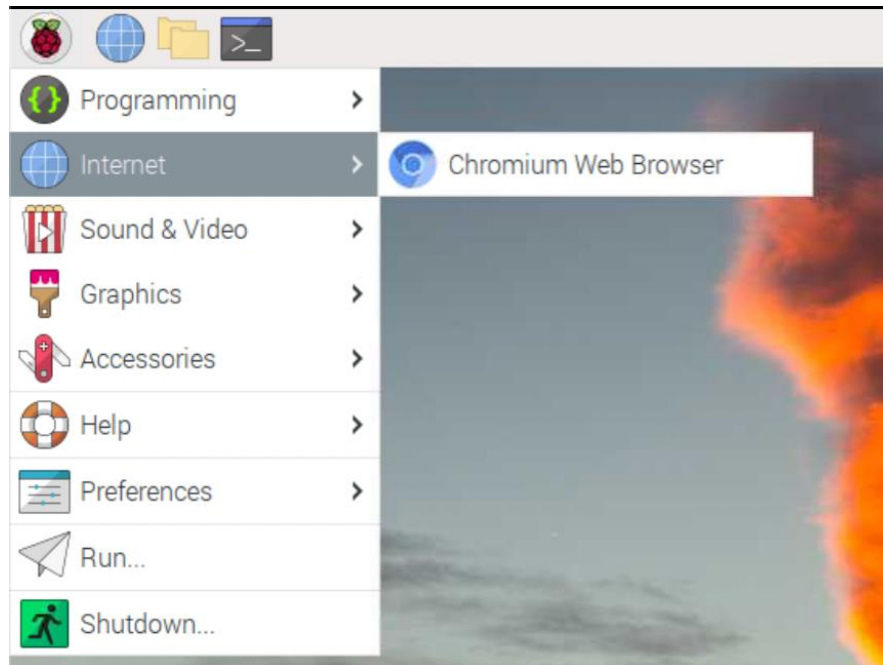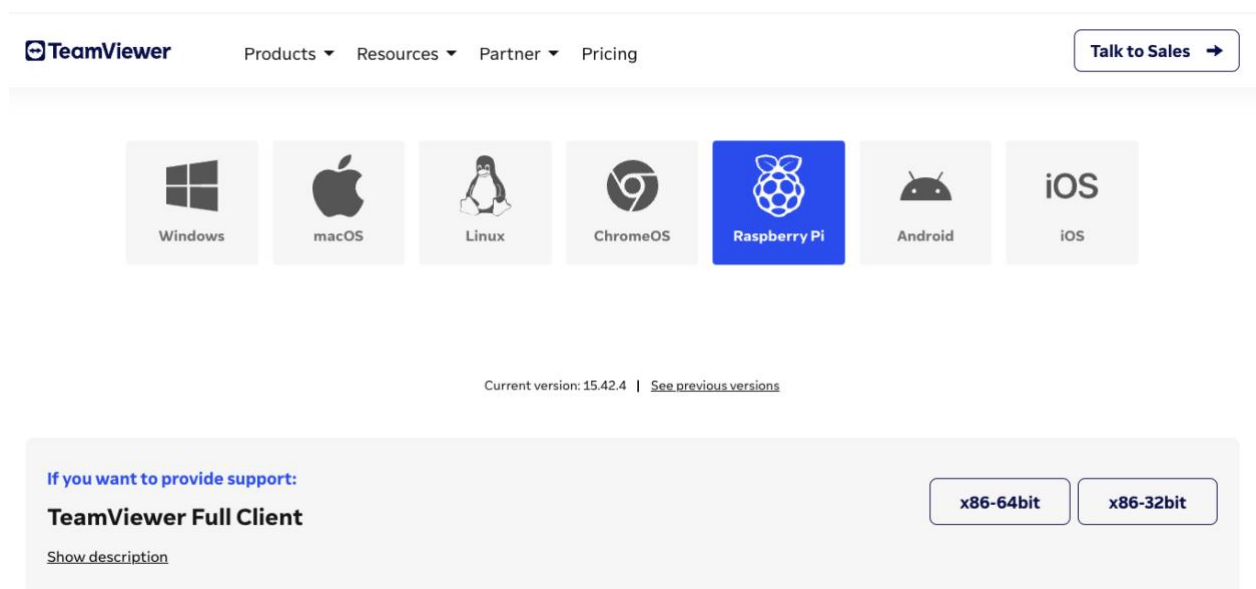
click on x86-64 bit. It will download the Debian package. Now close the browser. Go to Downloads folder and double click on the teamviewer Debian package.
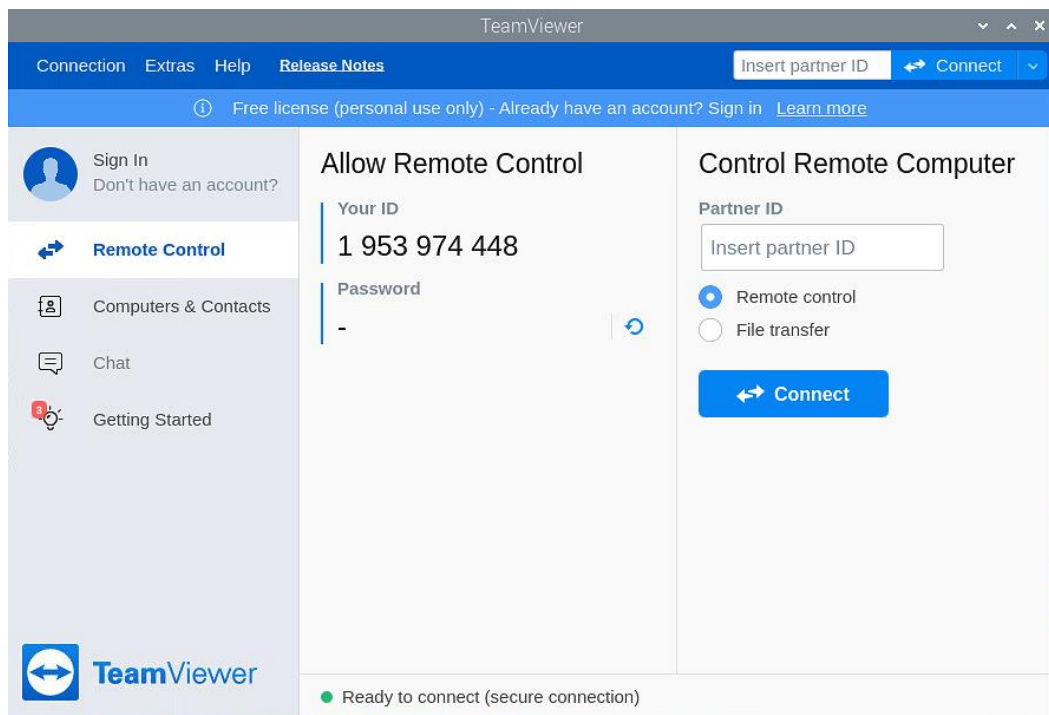
Click on install. A prompt will appear for password.

The default password is "raspberry". Then click on OK and the packages will install.
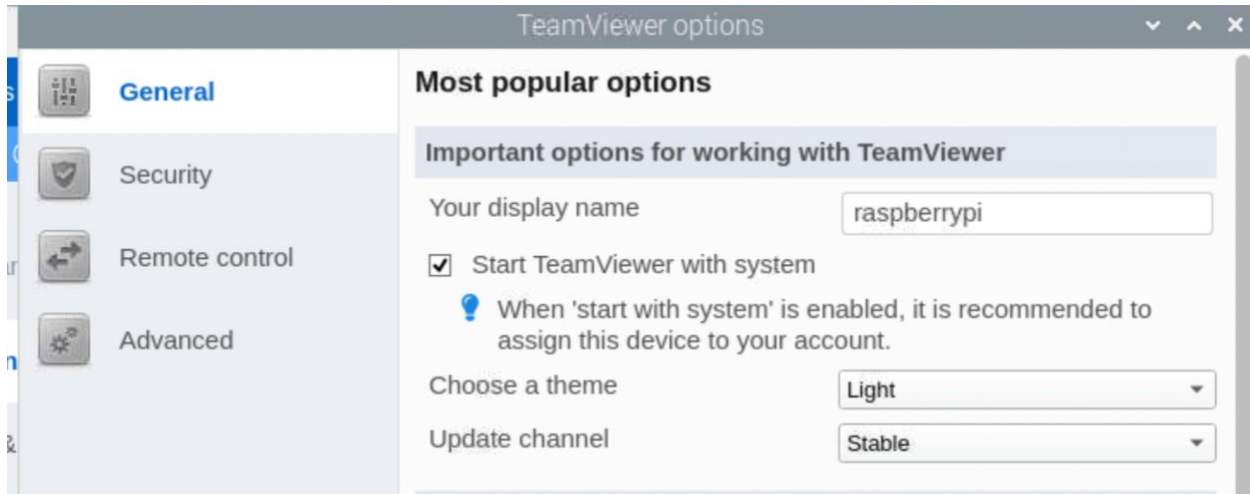
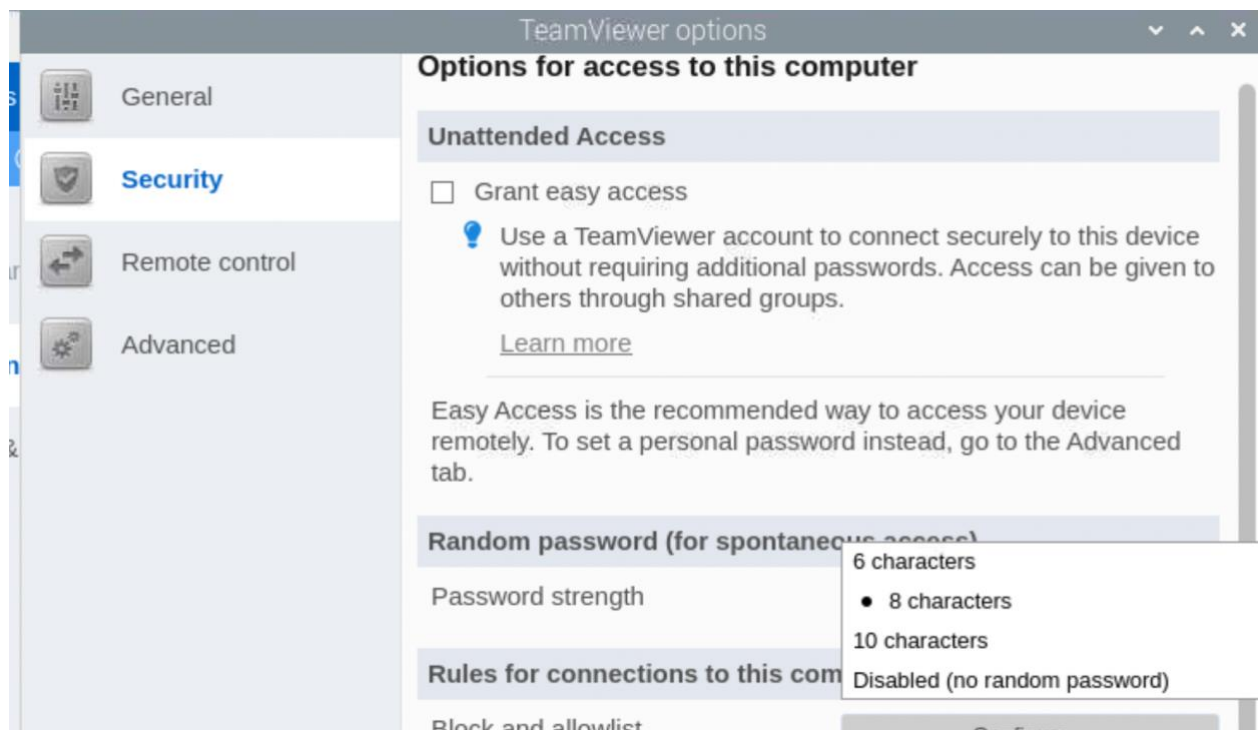Open team viewer. If prompt appears then check I accept and click on continue.

This screen will appear.

Let's setup it in such a way that the password remains the same and TeamViewer always runs at boot.
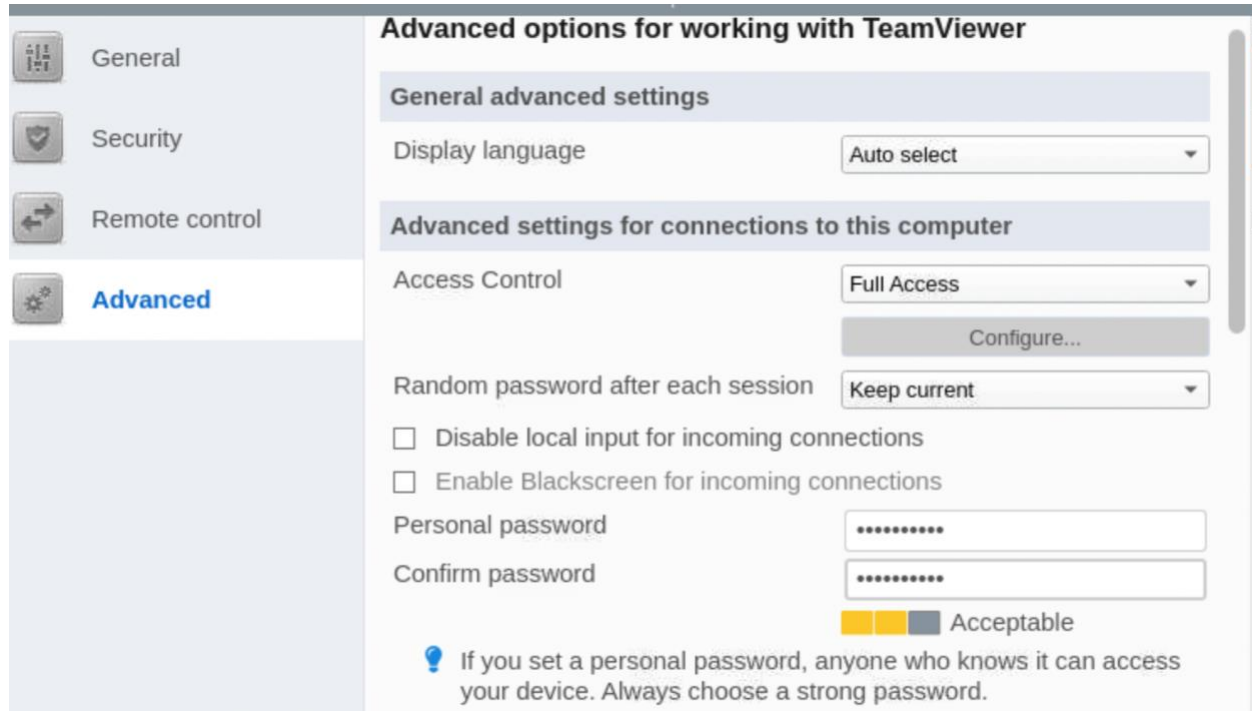Go to extras then options. In general check the start TeamViewer with system.

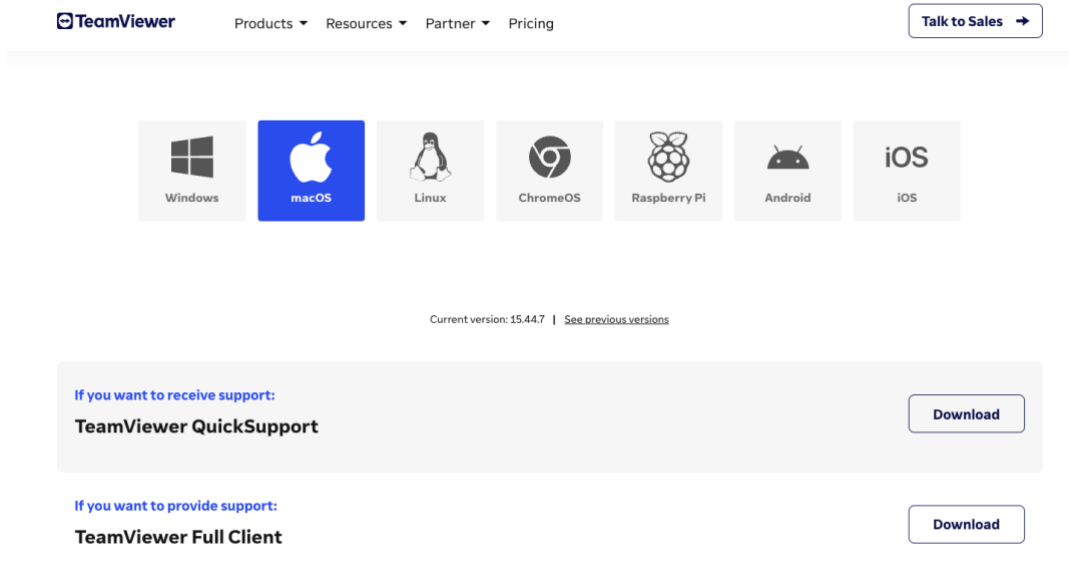Go to Security tab and disable random password.

Go to advanced and then under Personal password, keep a password of your choice.

Click on Apply and Ok.

Now we can install team viewer in the mac and try to access the pi using the id and password we got from above steps.
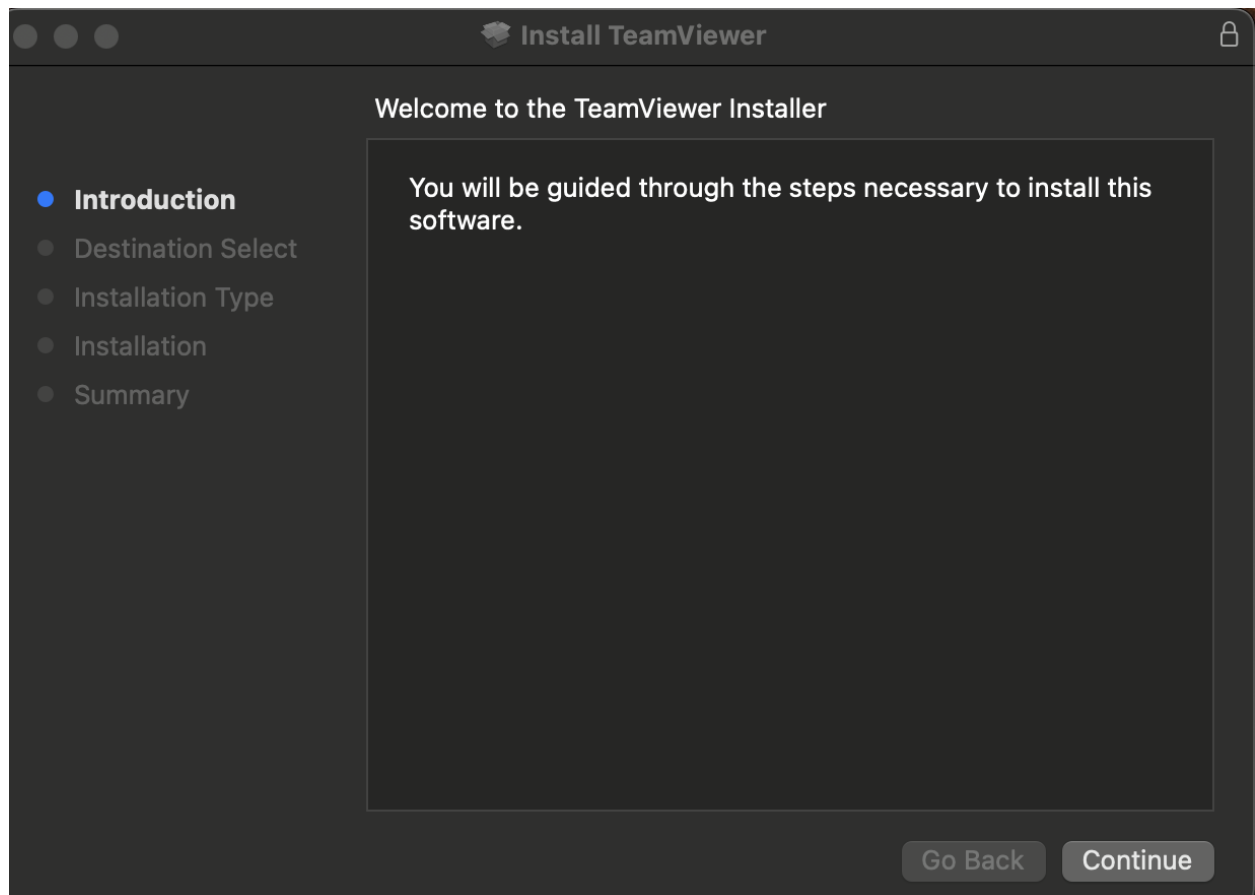
Go to (https://www.teamviewer.com/apac/download/macos/) from browser in mac.

Click on Download in TeamViewer full client. Once download is complete, open the file.
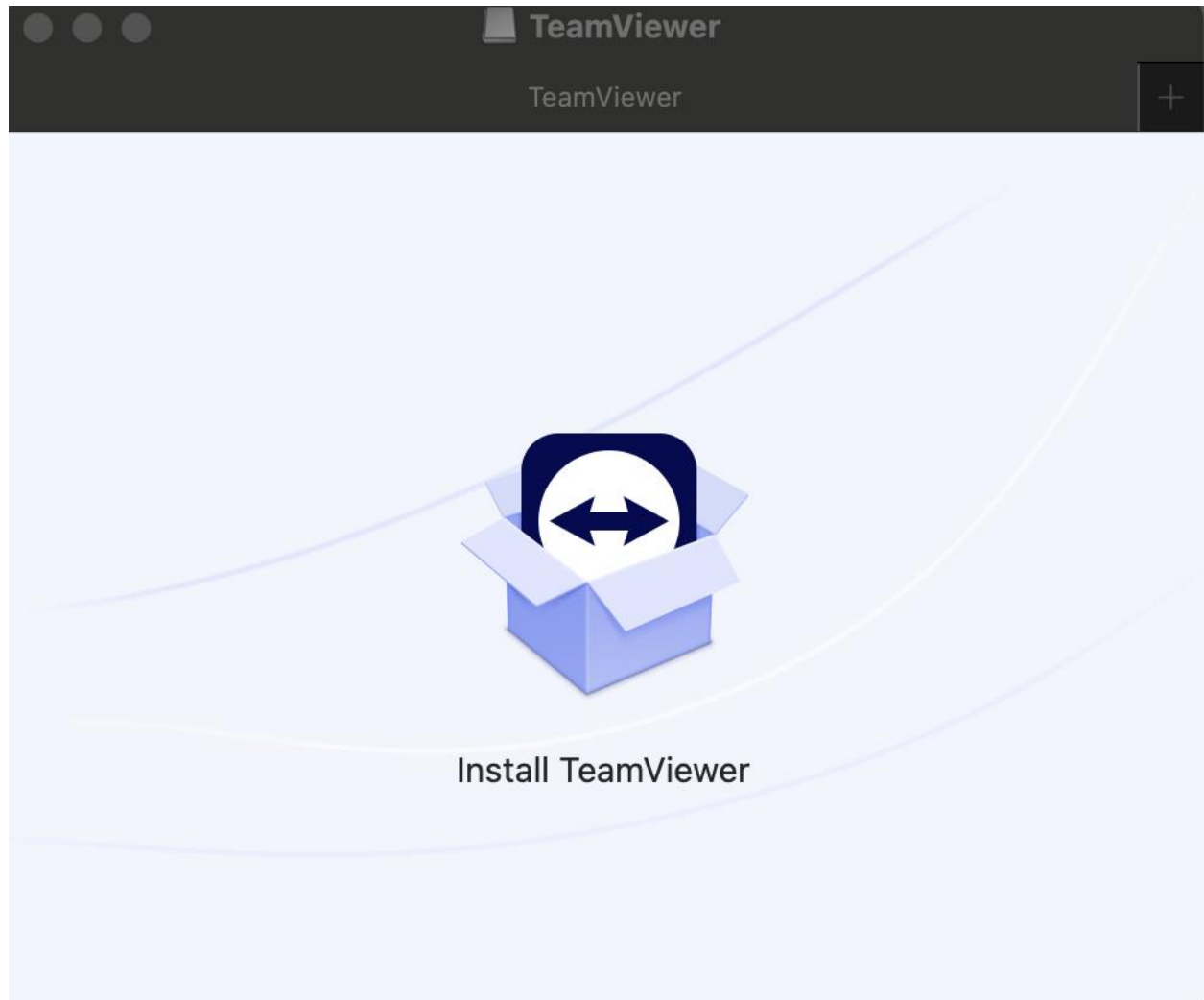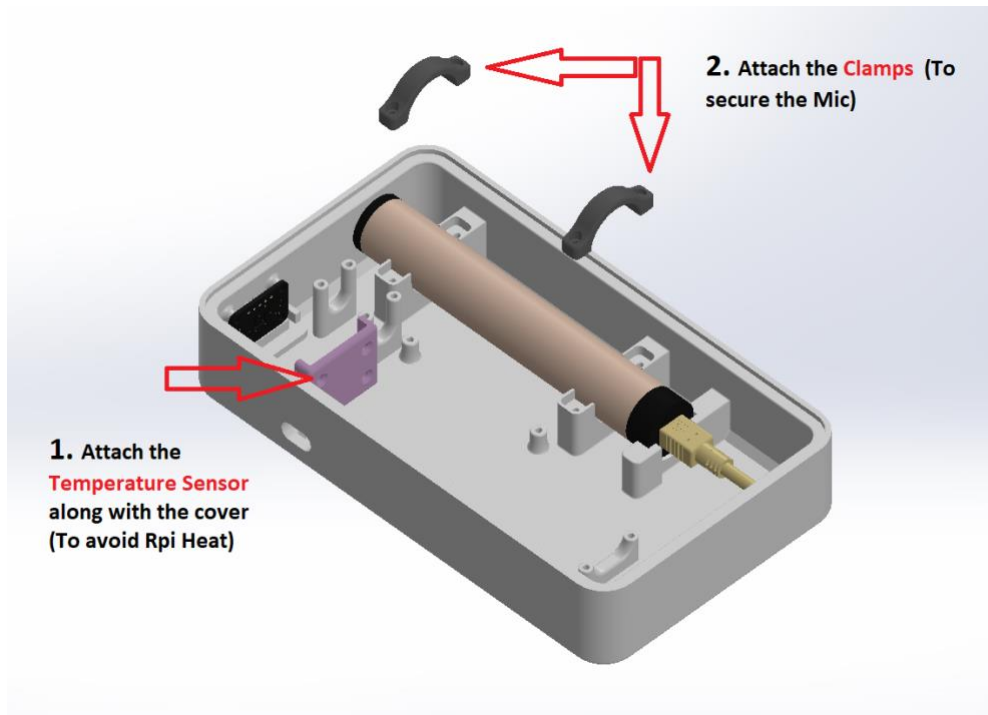

Double click on the icon and a prompt will appear click on Open. Another prompt will appear click on I accept and continue.
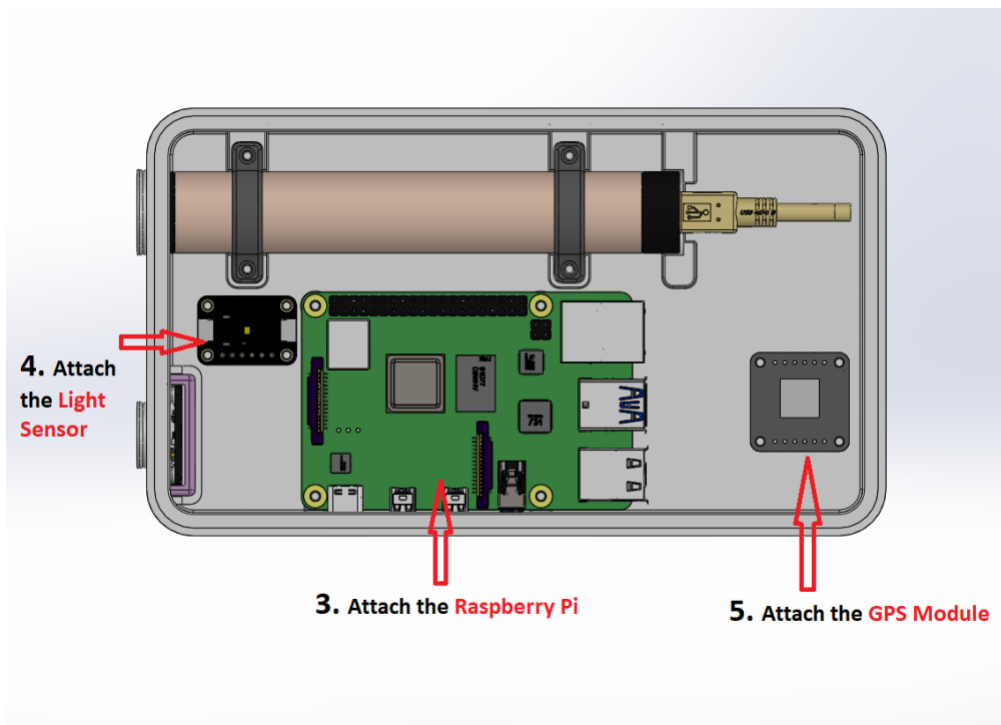
The installation process will begin. Follow the instruction and install team viewer. Once the installation is complete, open TeamViewer from launchpad.

Then you can use the Id and password we set from above steps and we can access our pi easily.

Now lets connect all hardware together.

2. Attach the Clamps (To secure the Mic)

1. Attach the Temperature Sensor along with the cover (To avoid Rpi Heat)

please install temperature sensor and the Microphone as depicted on the image above.

4. Attach the Light Sensor

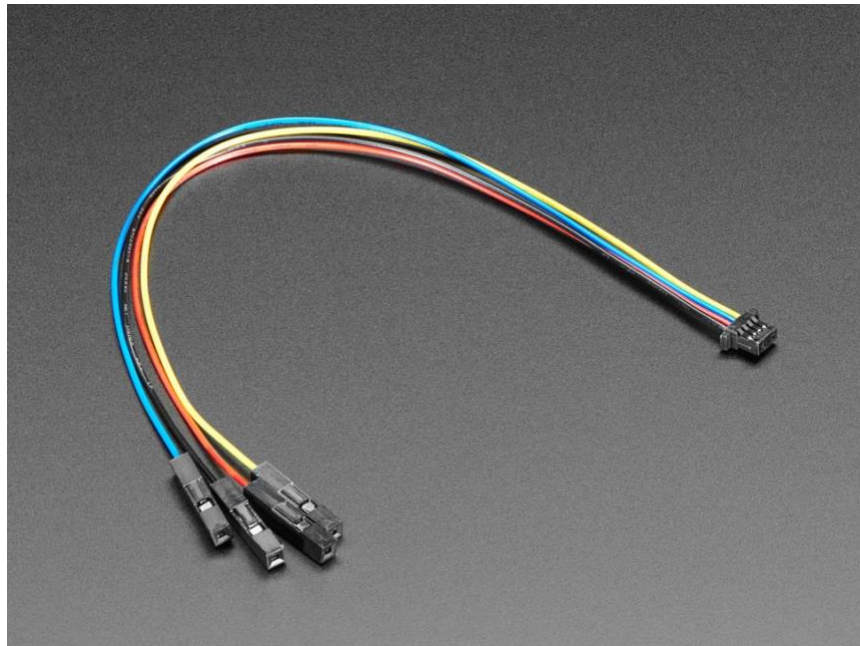**3.** Attach the Raspberry Pi

5. Attach the GPS Module

Then we can place light sensor, GPS module and Raspberry Pi inside the housing. Power supply is connected to Pi via a cut out from the side. The microphone is connected on the USB port.

All three sensors are STEMMA QT / Qwiic compatible. The sensor can be wired from one to another in a daisy chain.
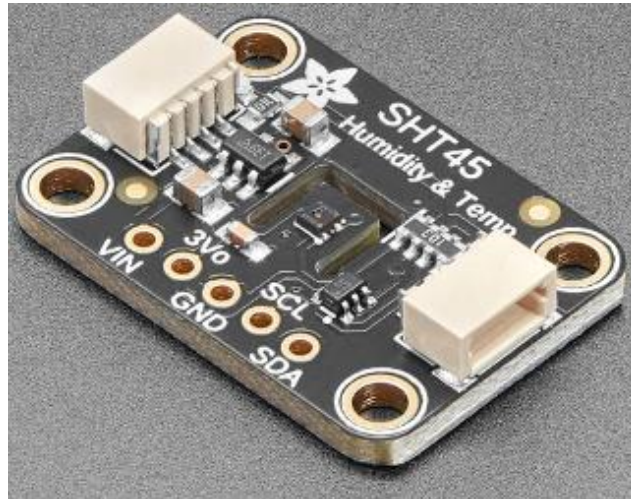
The white connectors on the side in the above SHT45 temperature and humidity sensors are STEMMA QT / Qwiic connectors. Qt cable can be directly connected on those ones. Please use STEMMA QT / Qwiic JST SH 4-pin Cable with Premium Female Sockets as in the pictures below.

The connector side is connected to the sensor and the female sockets are connected to the raspberry pi's GPIO pin.
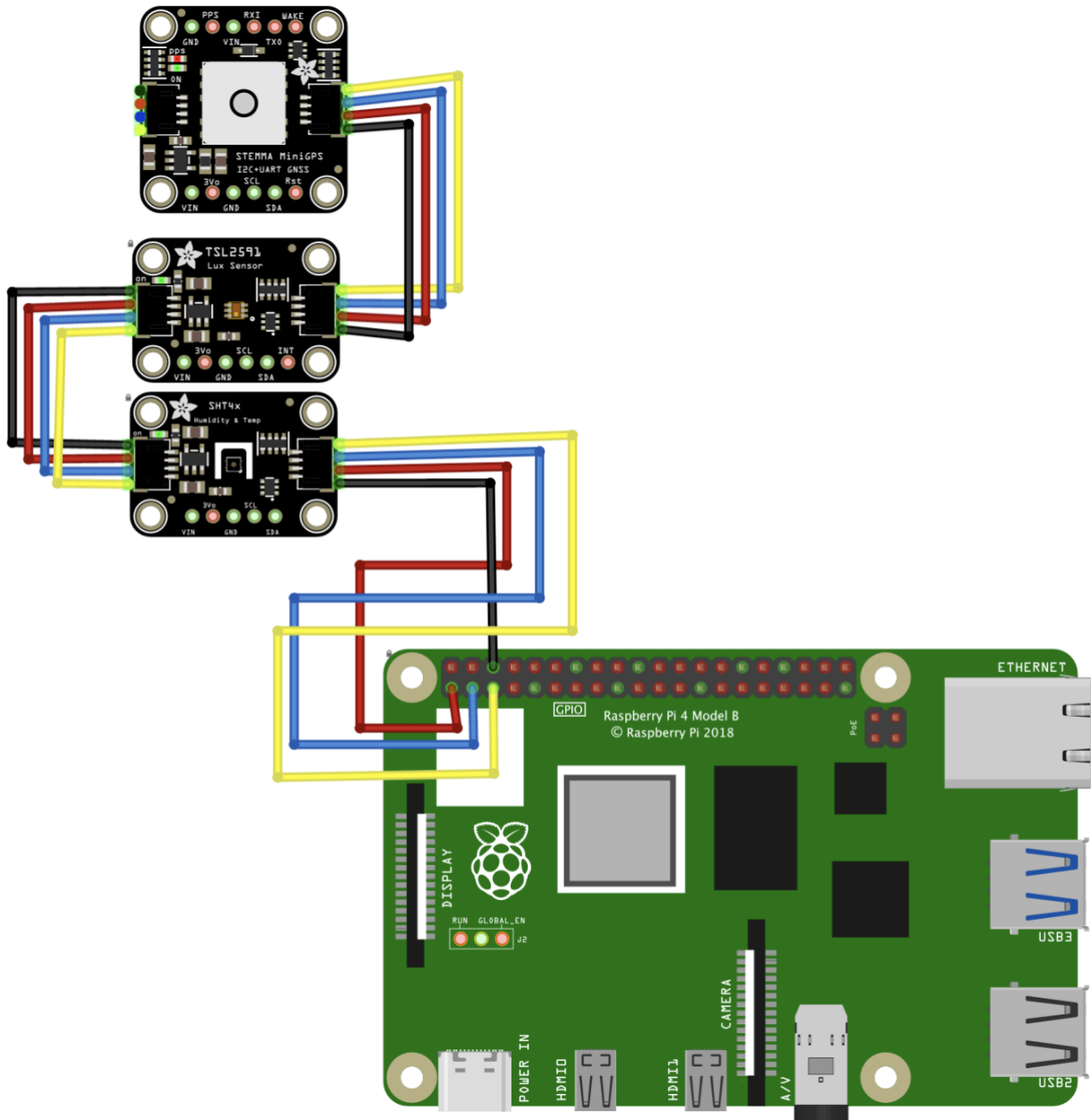
The female socket cables are color coded so they can be easily used. The red wire is VCC, black wire is GND, blue is SDA and yellow is SCL.

Red wire: pin 1 of raspberry pi (3v3)
Black wire: pin 6 of raspberry pi (GND)
Blue wire: pin 3 of raspberry pi (GPIO 2) (SDA)
Yellow wire: pin 5 of raspberry pi (GPIO 3) (SCL)

After that we use QT to QT cable (STEMMA QT / Qwiic JST SH 4-Pin Cable - 200mm Long) to connect between sensors as shown in figure below.

The final result should look like this. The pi
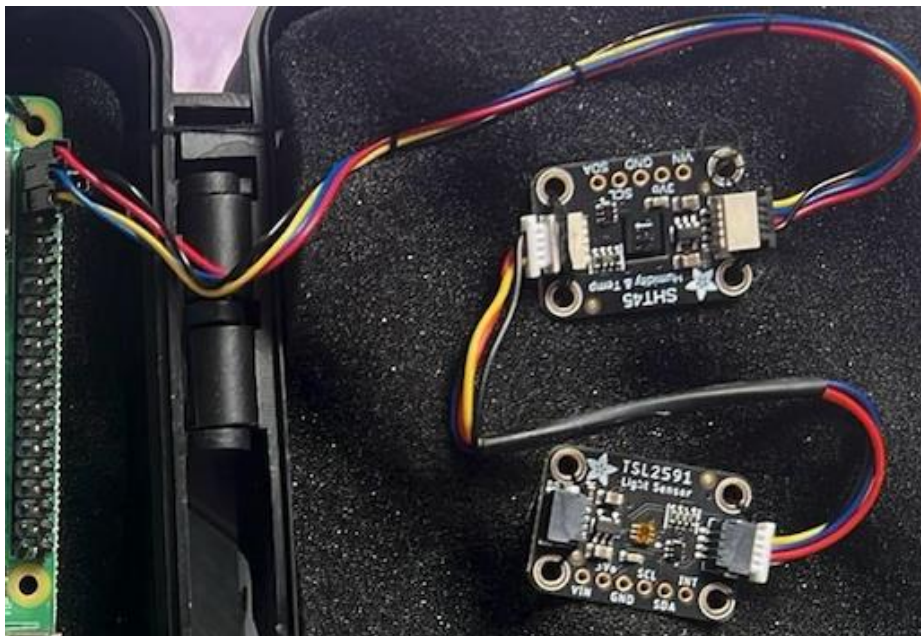
Likewise, GPS module is also connected in similar fashion.

Now all the hardware is connected and assembled. Let's start programming them to test and build it completely.