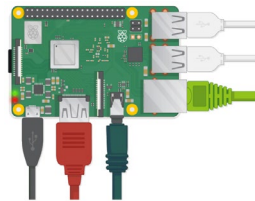# IS4151/IS5451 – AIoT Solutions and Development
AY 2023/24 Semester 2
Setting Up Raspberry Pi

This guide shows you how to set up your **Raspberry Pi (Rpi)** assuming that you have been issued with a new device or a device with a new microSD card. Once you have completed the set up for the first device, you may clone the microSD card of the second device from the first one. Please ensure that you have a built-in microSD card reader on your computer or alternatively you would need to use an external microSD card reader. A microSD card adapter may also be used with a standard SD card reader.

Part 1 – Installing Raspberry Pi OS (f.k.a. Raspian)

1. Extract the microSD card from your Raspberry Pi and format the card as FAT. You can download the SD card formatter tool from this website – https://www.sdcard.org/downloads/formatter/.

2. Download and install the Raspberry Pi Imager from this web page – https://www.raspberrypi.com/software/. The Raspberry Pi Imager would be used to install the Raspberry Pi OS to the microSD card.

3. Start the Raspberry Pi Imager:
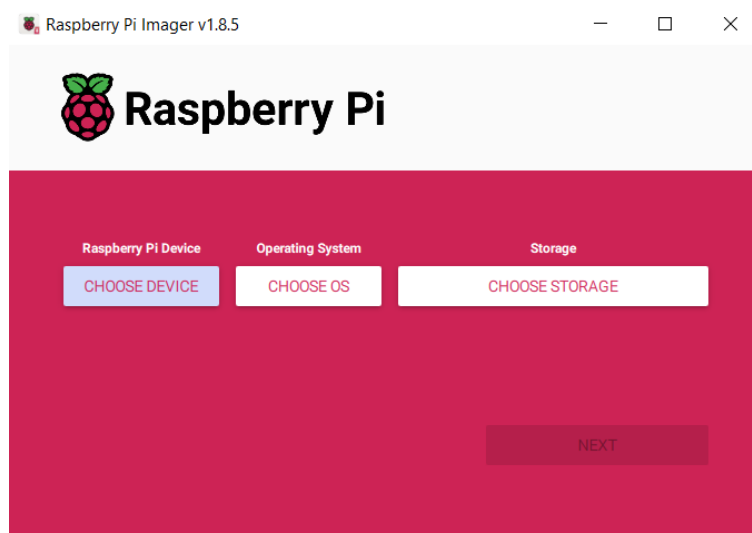
4. Configure the operating system options as follows:

    - Raspberry Pi Device and Operating System:
        - For Raspberry Pi 3 – Choose Raspberry Pi OS (Legacy 32-bit)
        - For Raspberry Pi 4 – Choose Raspberry Pi OS (64-bit)
    - Storage – Select the drive in which your microSD card has been mounted to after the formatting in step (1).
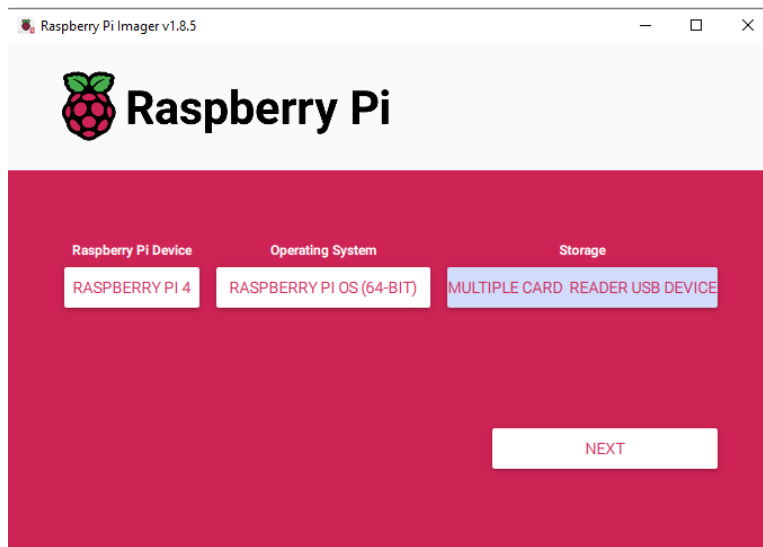
5. Click "NEXT" to continue. When prompted whether to apply OS customisation settings, click "EDIT SETTINGS".

6. In the "OS Customisation" dialog box, select the "GENERAL" tab.

7. Check "Set hostname" and set it to the default of raspberrypi.local

8. Check "Set username and password" and configure as follows:

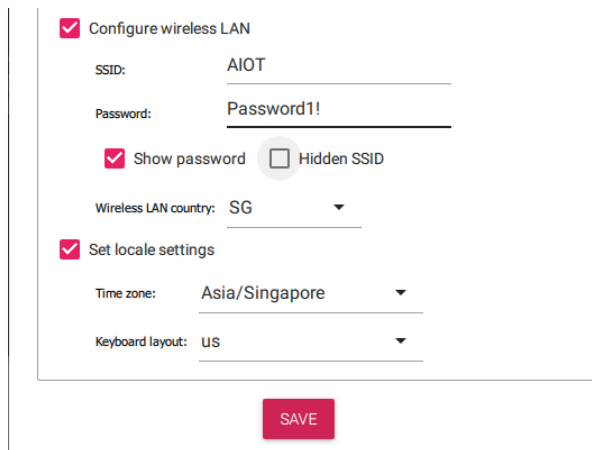   - Username – pi
    - Password – raspberry
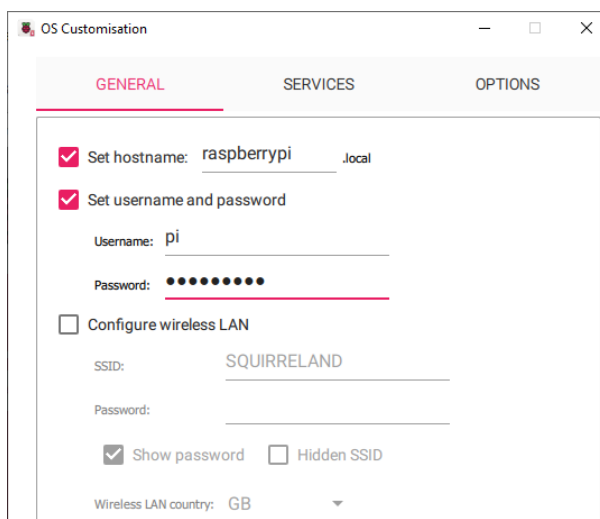
9. Check "Configure the wireless LAN" and configure the settings accordingly, i.e., SSID and password.

For Raspberry Pi 3, you need to use a 2.4 GHz network. Raspberry Pi 4 supports both 2.4 GHz and 5.0 GHz. It is recommended that the SSID should be broadcasted, that is, you should avoid using a hidden SSID.

10. Check "Set locale settings" and configure as follows:

- Time zone – Asia/Singapore
- Keyboard layout – us

11. Switch to the "SERVICES" tab.

12. Check "Enable SSH" and select "Use password authentication"

13. Click "SAVE" to close the dialog box.

14. Back at the "Use OS customisation" dialog box, select "YES" to continue.

15. When prompted that all existing data will be erased, click "YES" to continue.

16. The writing of the Raspberry PI OS image will start.

17. When the image writing has been completed, you would be prompted to remove the microSD card.

18. Insert the microSD card back into your Raspberry Pi. You may optionally connect a USB keyboard and mouse to any of the available USB ports as well as a HDMI monitor. For Raspberry Pi 4, only micro-HDMI is supported.

Please ensure that the WiFi network is available. If you are tethering a hotspot on your computer or mobile phone, you should enable the hotspot first.

Connect the power cable and switch on the power supply. You need to use a power source with an output rating of 5V DC (minimum 3A). A high-quality mobile phone charger or power bank that supports fast charging should meet this requirement. Some

chargers might be 5V DC but 2A or 2.5A. You can verify the output rating physically labelled on the power source. For Raspberry Pi 3, you need to use USB-B and for Raspberry Pi 4, you need to use USB-C cable.
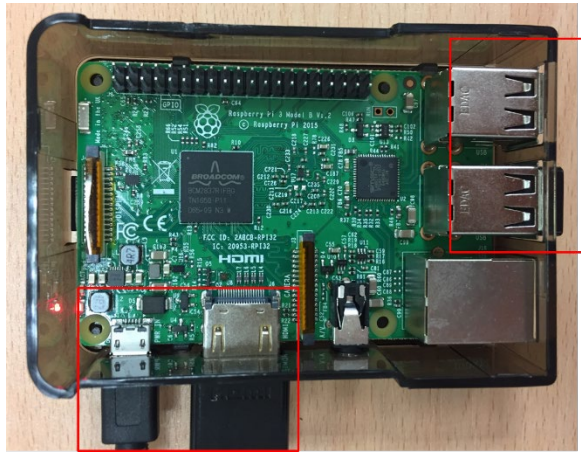
19. **IMPORTANT**: Do ensure that the microSD card has been inserted into your Raspberry Pi before you connect the power supply.

20. If you have connected a HDMI monitor, you should be able to see the Raspberry Pi Desktop after the Raspberry Pi has booted up. Otherwise, follow the instructions in Part 2.

Part 2 – Connecting to Raspberry Pi (Headless over WiFi)

1. The Raspberry Pi boots up immediately after you have switched on the power and connect to the configured WiFi network. Check your WiFi router or hotspot device for the IP address of the Raspberry Pi:

2. Alternative, start command prompt (Windows) or terminal (macOS) and run the following command:

```
ping -4 raspberrypi.local
```

Ensure that you receive the ping reply together with the IP address.

3. Then connect to Raspberry Pi via ssh using the following command with login name set to pi

    ```
    ssh <IP_ADDRESS> -l pi
    ```

4. When prompted for password, use "raspberry". After successful login, you should see the following:

    ```
    pi@raspberrypi: ~

    C:\>ssh 192.168.137.108 -l pi
    pi@192.168.137.108's password:
    Linux raspberrypi 5.15.84-v7l+ #1613 SMP Thu Jan 5 12:01:26 GMT 2023 armv7l

    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: Tue Feb 21 09:34:47 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:~ $
    ```
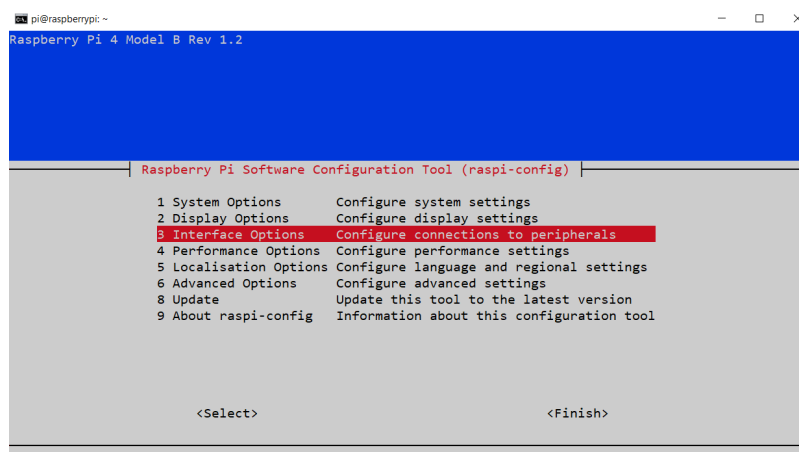
5. Run the following command to install VNC. You can also refer to this webpage for more information – https://www.raspberrypi.com/documentation/computers/remote-access.html#installing-vnc-on-raspberry-pi

    ```
    sudo apt update
    sudo apt install realvnc-vnc-server realvnc-vnc-viewer
    ```

6. Enable VNC Server at the command line using raspi-config:

    ```
    sudo raspi-config
    ```

    Navigate to "Interfacing Options", scroll down and select VNC › Yes. You might also want to use this opportunity to enable the SPI and I2C interfaces. Select "Finish" to exit.

    ```
    pi@raspberrypi: ~                                              –  □  ×
    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>
    ```
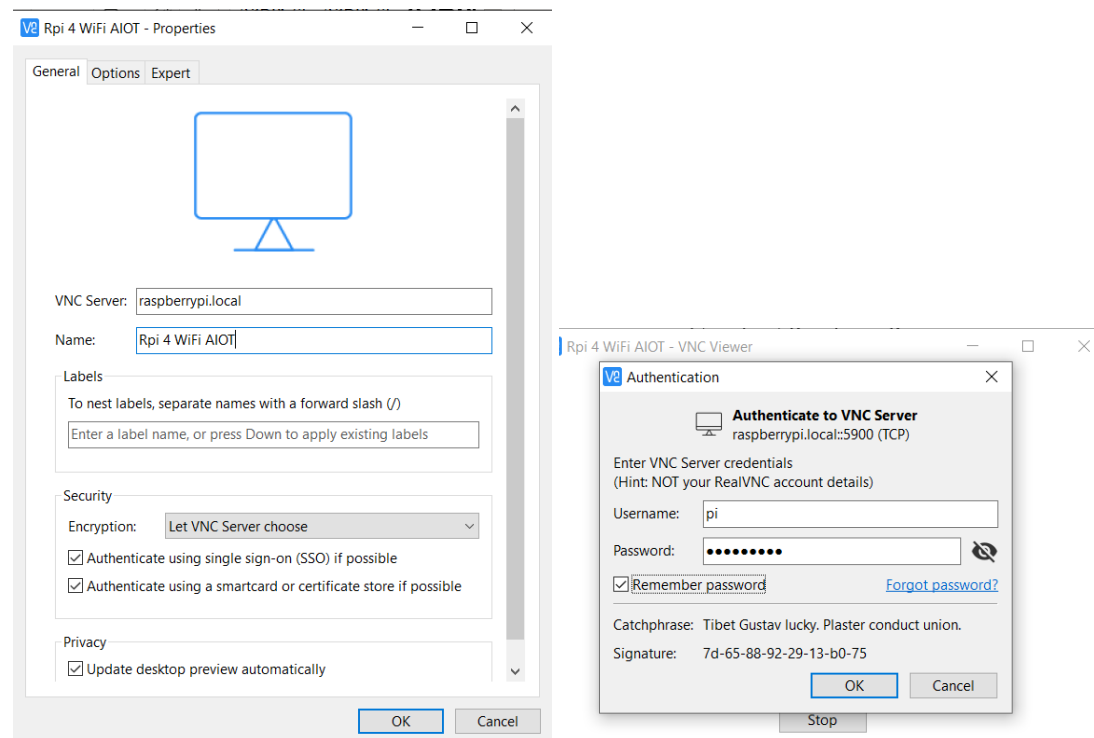
7. Run the following command to reboot Raspberry Pi:

```
sudo reboot
```

8. After Raspberry Pi has rebooted, download VCN Viewer from here – https://www.realvnc.com/en/connect/download/viewer/ – and then connect to Raspberry Pi using the same IP address or the hostname raspberrypi.local

   When prompted to login, use the following credential:

   - Username – pi
   - Password – raspberry

9. You should now be able to see the Raspberry Pi Desktop:
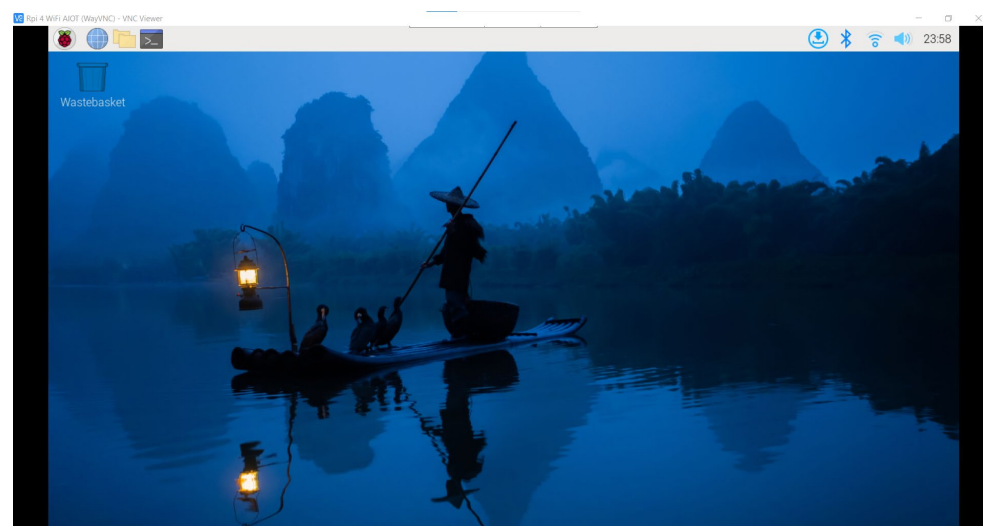
Part 3 – Post-installation Configuration

1. Click on the Raspberry Pi main menu and select "Preferences > Raspberry Pi Configuration".

2. Switch to the "Display" tab and look for "Headless Resolution". Select "1280x720" then click "OK" to continue.

3. From the Raspberry Pi main menu, select "Shutdown > Reboot".

4. VNC will reconnect when the Raspberry Pi has rebooted. After the reboot, the new display resolution should take effect.
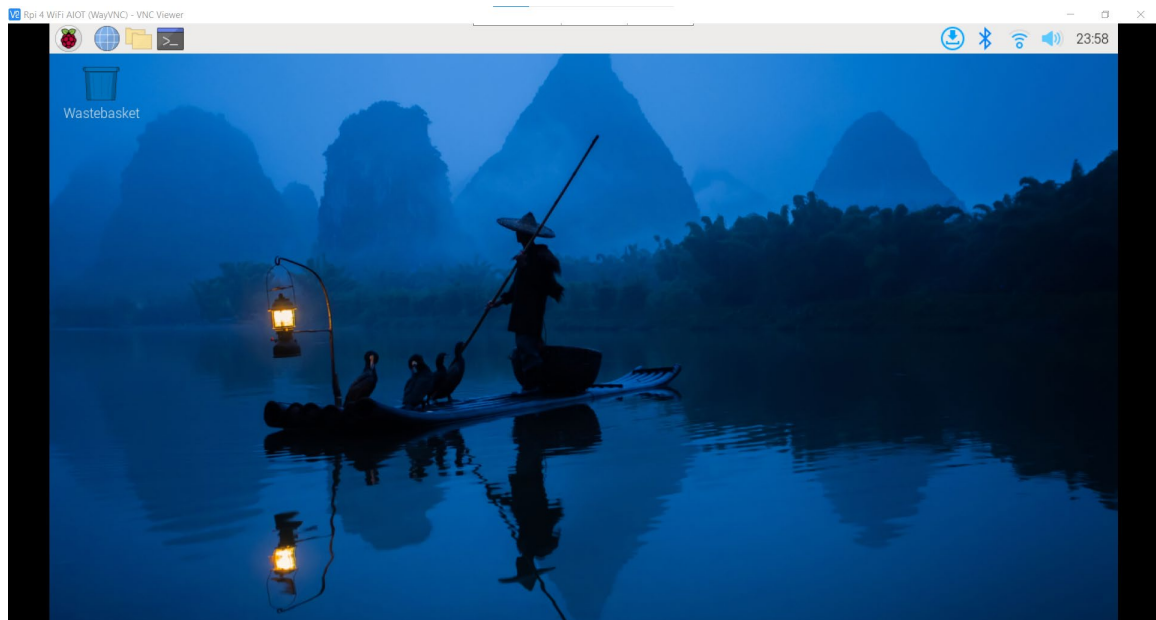
5. If prompted to install any updates, you can proceed to install them.

6. Explore the Raspberry Pi OS environment:

   - Start the terminal and check the version of the default Python installation.
   - Start the web browser and surf the Internet.

7. When you are done, remember to shut down the Raspberry Pi properly by going to the Raspberry Pi main menu and selecting "Shutdown > Shutdown".

8. Wait for the green LED to stop flashing before switching off the power source.

Part 4 – Cloning microSD Card

After you have finished setting up your first microSD card, you can clone it to the other microSD cards to run the remaining Raspberry Pi computers without having to repeat the entire process.

Note: This cloning only works if you are cloning to a similar Raspberry Pi computer. If you have set up a Raspberry Pi 4, do not clone it to a Raspberry Pi 3 as it does not support 64-bit processing.

Download Win32 Disk Imager from here – https://win32diskimager.download/ – and use it to clone an image of your microSD card before writing it to the other cards.