Fundamental of Cognitive Interaction with Robots

Lecture 3

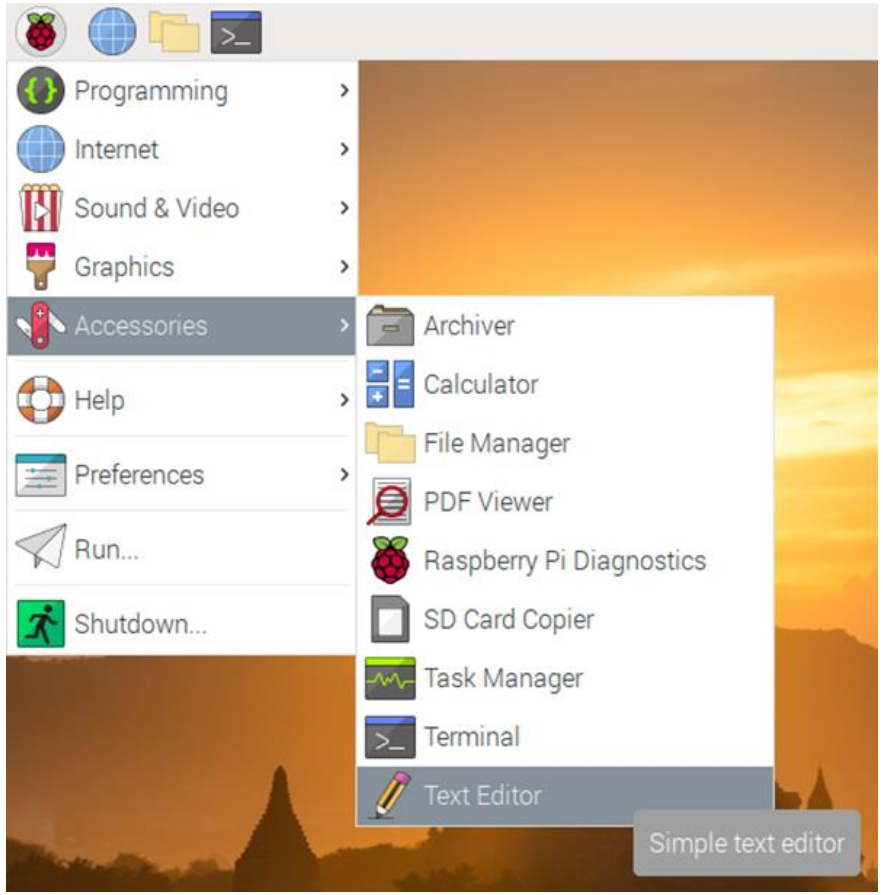
Raspberry Pi Desktop

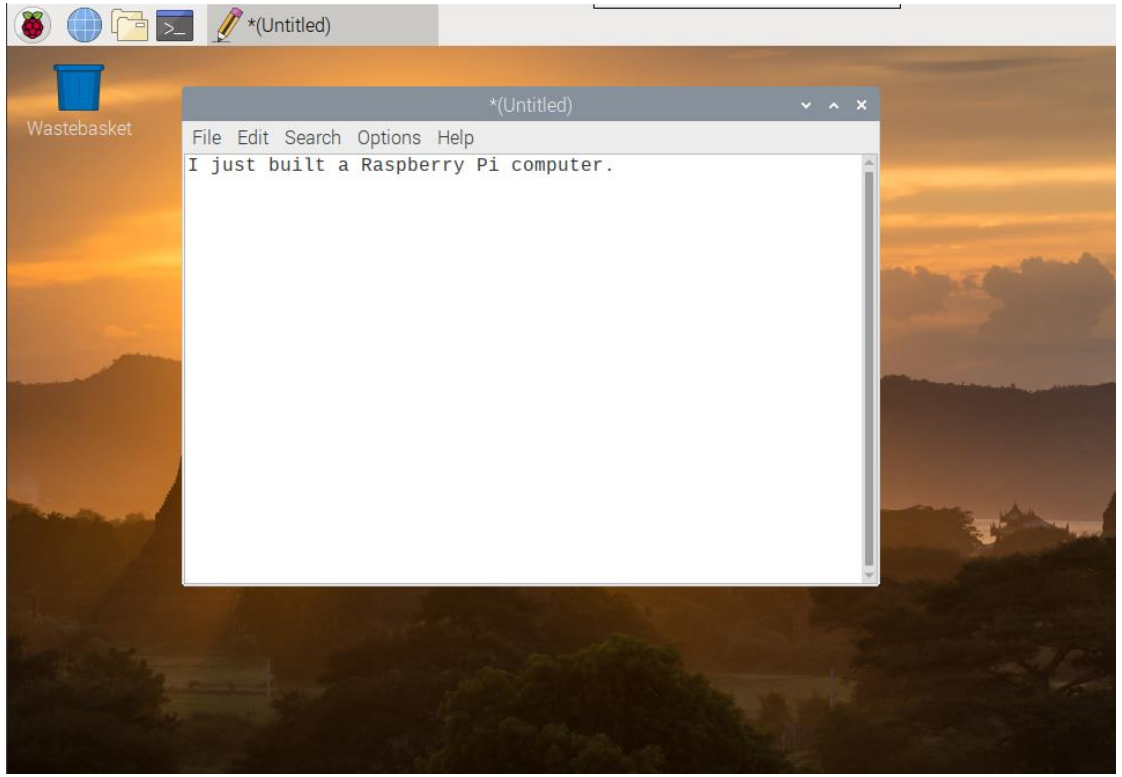
- After Raspberry Pi OS starts up, you will see the Desktop appear.

  - The Raspberry Pi icon in the top left-hand corner is where you access the menu.
  - Click on it to find lots of applications, including Programming applications.

Raspberry Pi Desktop

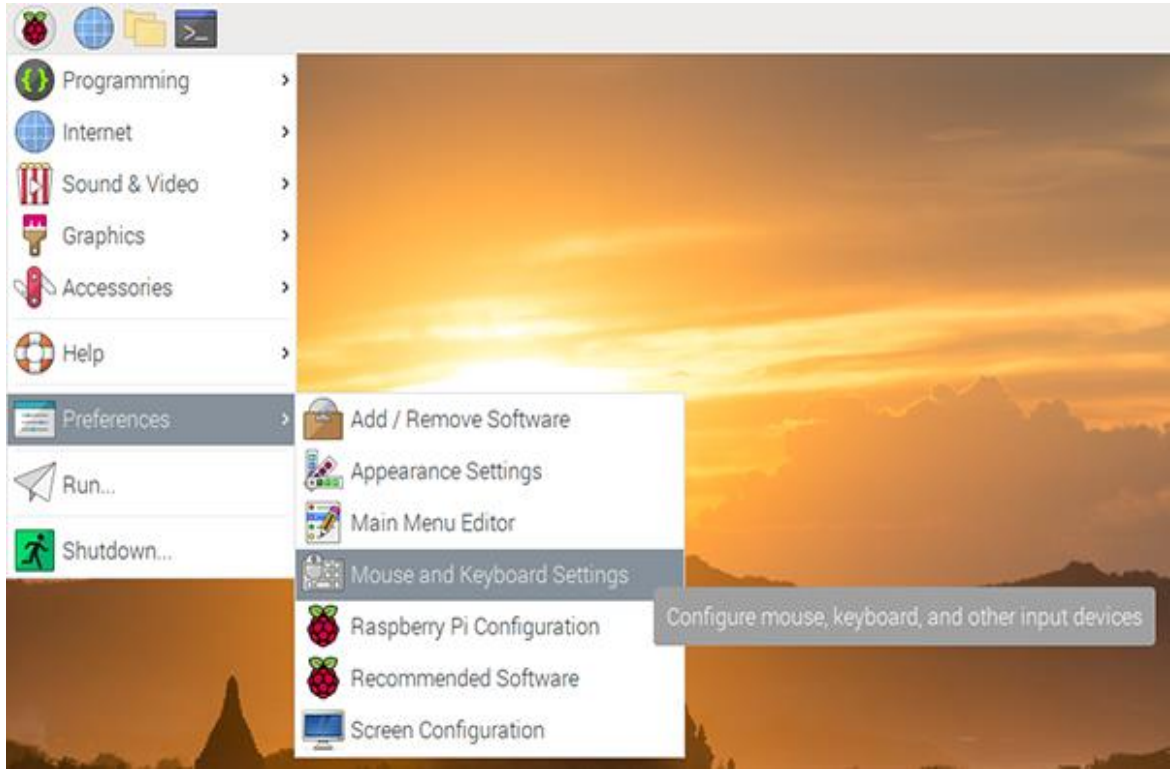
- To open a text editor, click on Accessories and choose Text Editor.

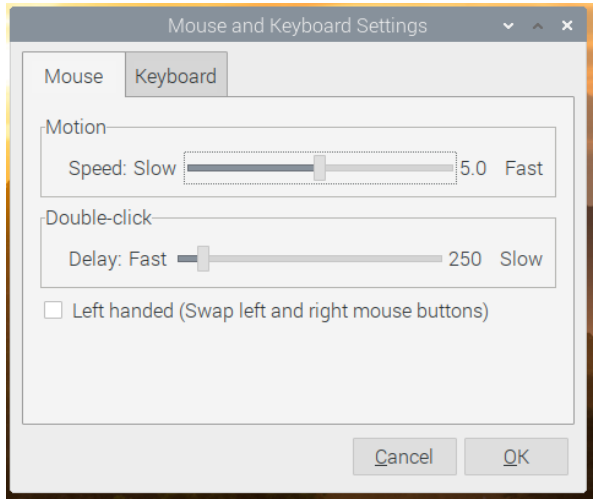


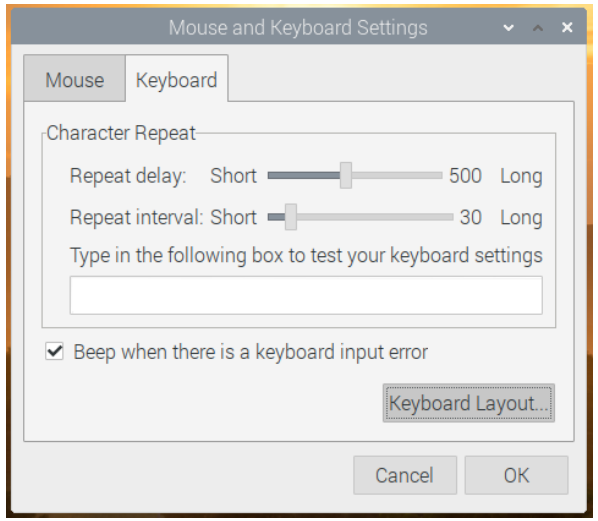


Keyboard and mouse settings

- Select Preferences and then Mouse and Keyboard Settings from the menu.

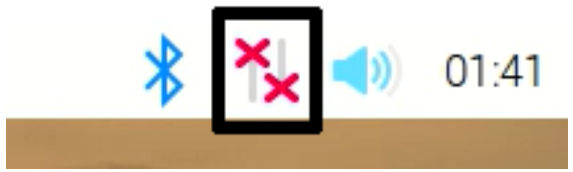






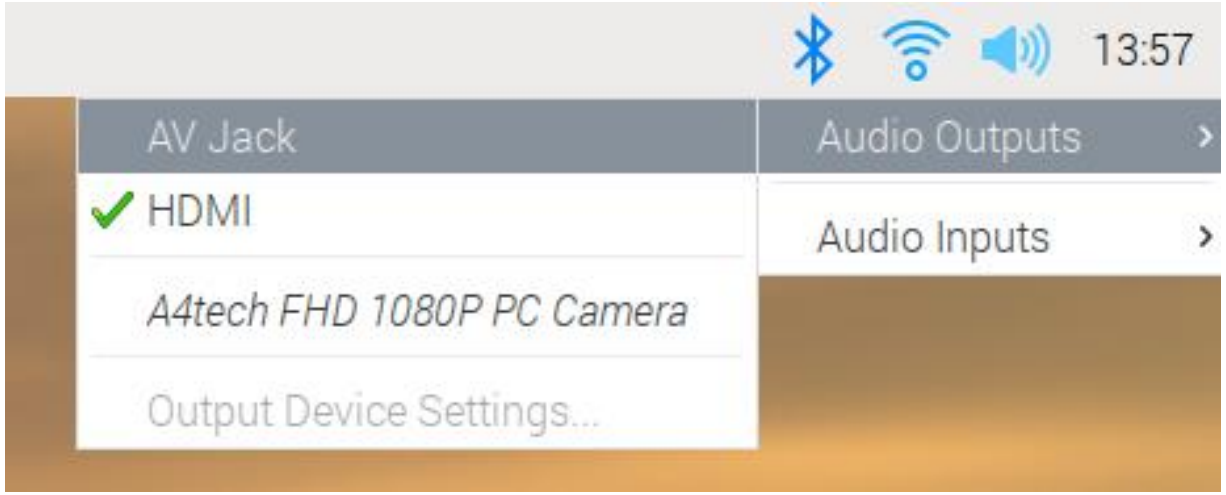
Connecting to the internet

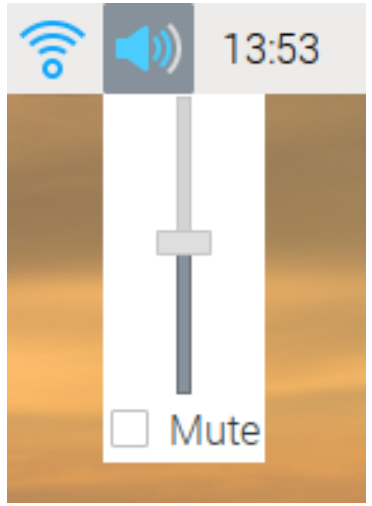
- You can plug an Ethernet cable into RP (if you have a Raspberry Pi Zero, you'll need a USB-to-Ethernet adapter as well).
- If your model is a Raspberry Pi 4, Raspberry Pi 3, or Raspberry Pi Zero W, you can also connect to a wireless network.
- Click on the wireless network icon in the top right-hand corner of the screen, and select your network from the drop-down menu.
- Type in the password for your wireless network, then click on OK.
- Once your Raspberry Pi is connected to the internet, you will see a wireless LAN symbol instead of the red crosses.



Setting up the sound

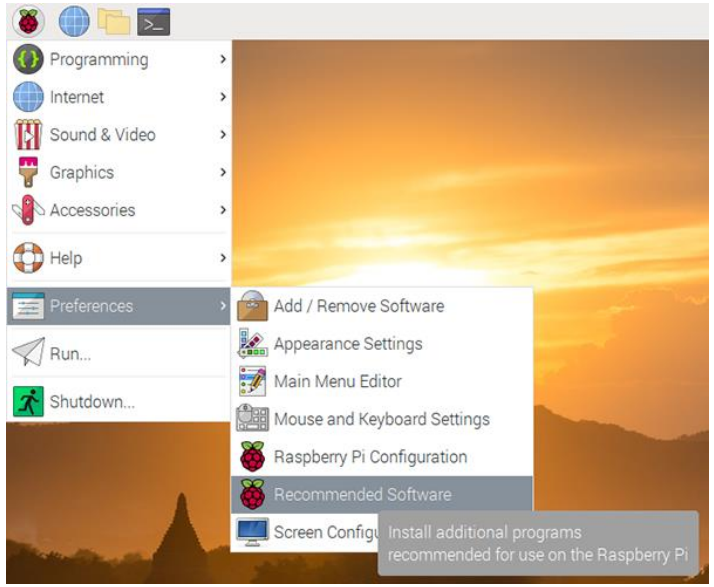
- The Raspberry Pi can either send sound to the screen's built-in speakers through the HDMI connection (if your screen has speakers), or to the analogue headphone jack.
- Right-click on the speaker icon in the top right-hand corner, and select Audio Outputs, to choose whether your Raspberry Pi should use the HDMI or the AV Jack connection for sound.
- Click on the speaker icon to adjust the volume by moving the slider up or down.

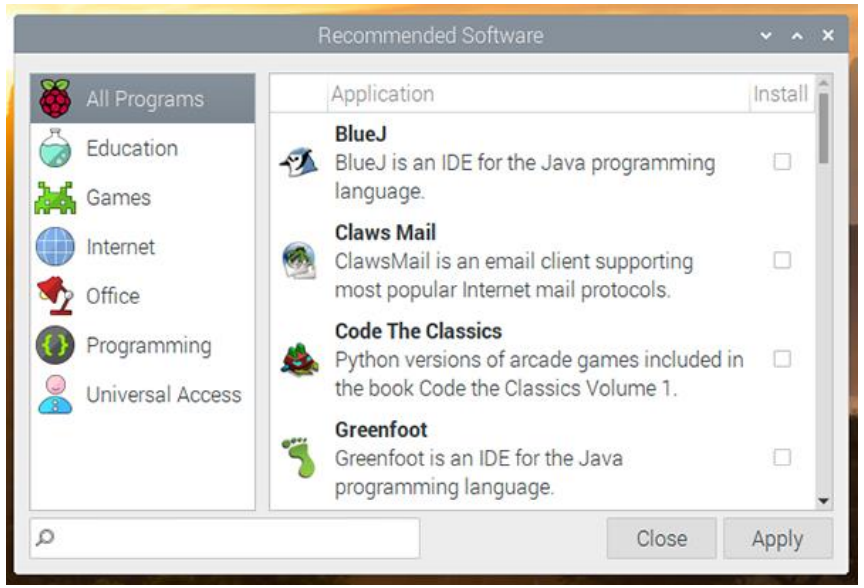




Installing software

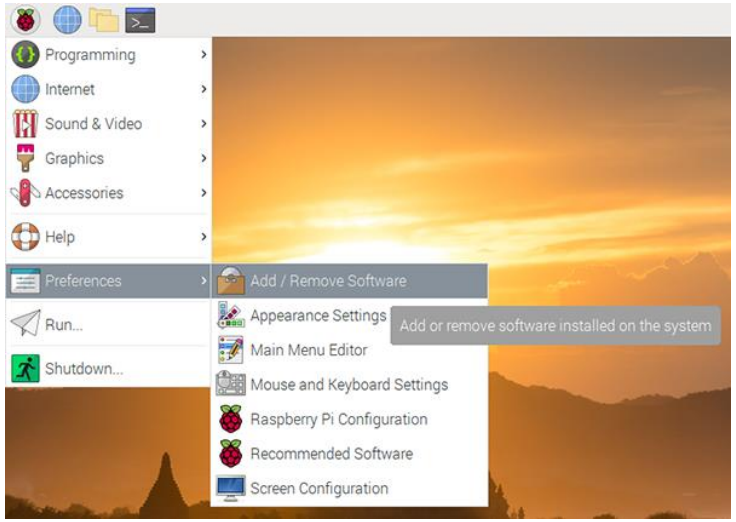
- There are many software programs and applications you can download and install on Raspberry Pi.
- Note: Raspberry Pi has to be connected to the internet before you can install software.
- In the menu, click on Preferences and then on Recommended Software.
- You can browse all the recommended software, or filter it by category.
- To install a software, click to mark the checkbox to its right, then click on OK .

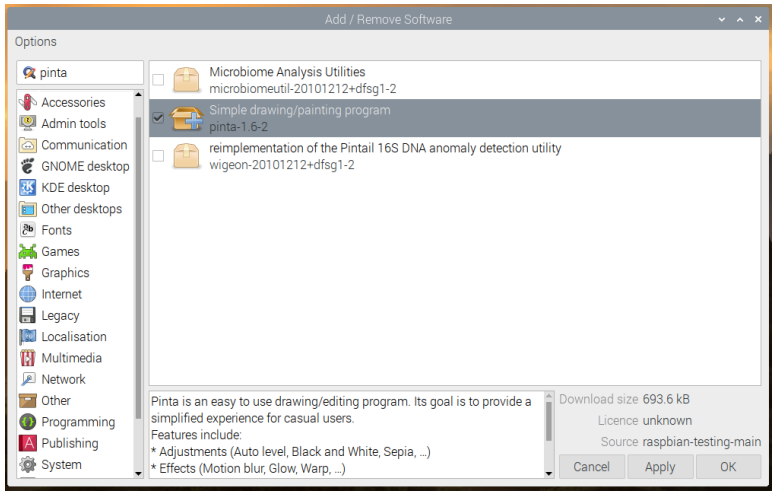


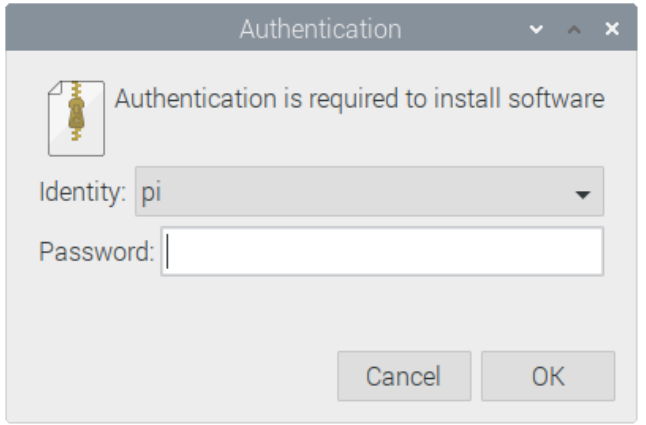


Installing software

- In addition to the Raspberry Pi's recommended software, there's a huge library of other available programs and applications.
- Click on Preferences and then on Add / Remove Software in the menu.
- You can search for software, or browse by selecting a category from the menu on the left.
- Select the program in the list that appears, then click on OK .
- Enter your password; if you haven't changed the password, it will be 'raspberry'.

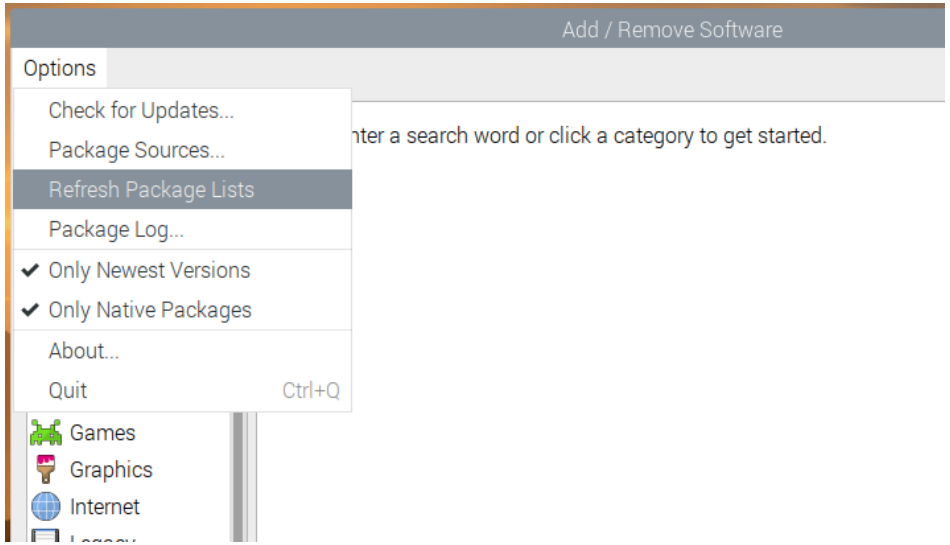


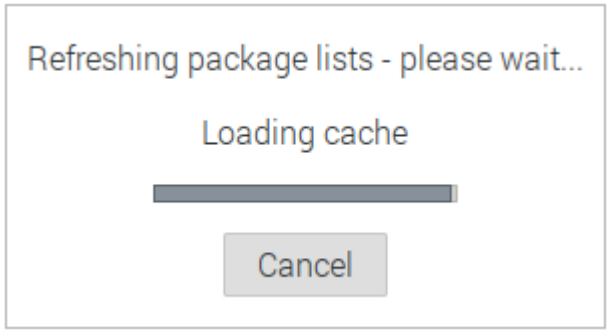




Updating your Raspberry Pi

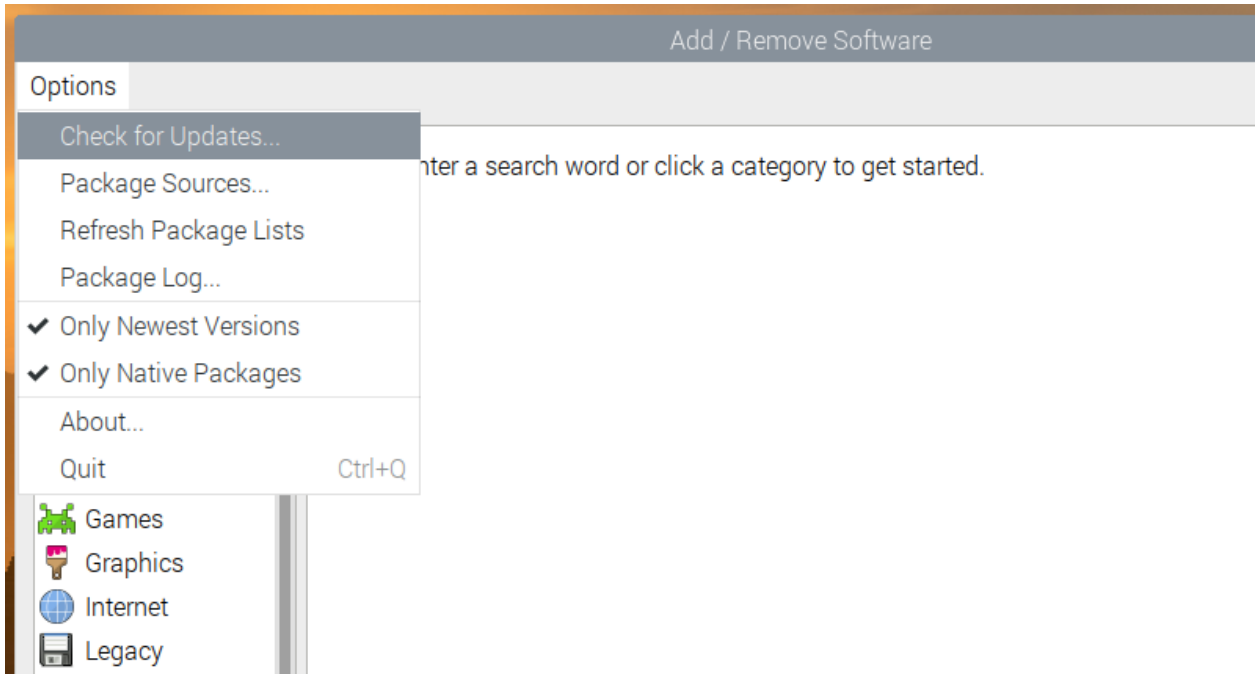
- It’s a good idea to regularly update the software on your Raspberry Pi with the latest features and fixes.
- You can update your Raspberry Pi using the Add / Remove Software application: open it by selecting it from the Preferences section of the menu.
- Before you check and install any updates, you should refresh the software package lists on your Raspberry Pi.
- Click on Options in the top left-hand corner, and select Refresh Package Lists.
- Your Raspberry Pi will then update all lists of packages.





Updating your Raspberry Pi

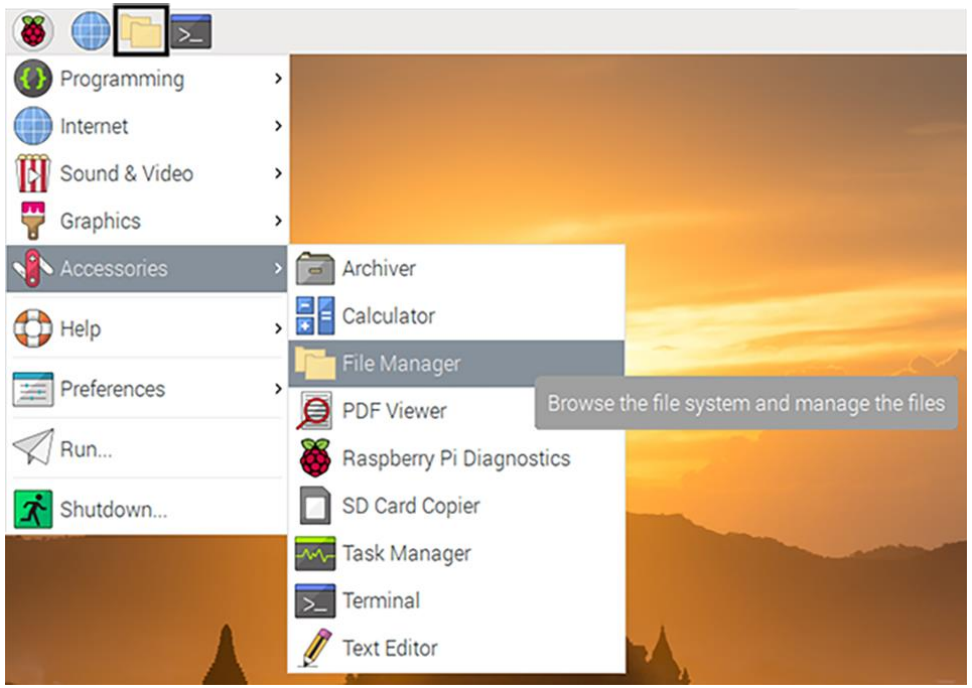
- When this is done, click on Options and select Check for Updates.

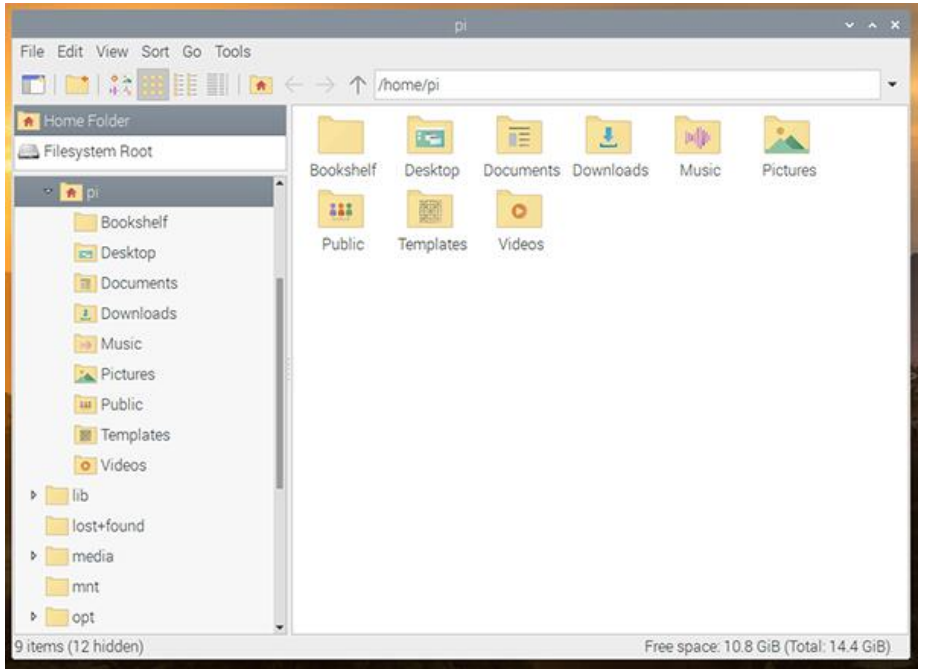


- Click on Install Updates to install all the available updates.
- When prompted, enter your password; if you haven't changed the password, it will be 'raspberry'. After that, the updates will then be downloaded and installed.

Accessing the Files

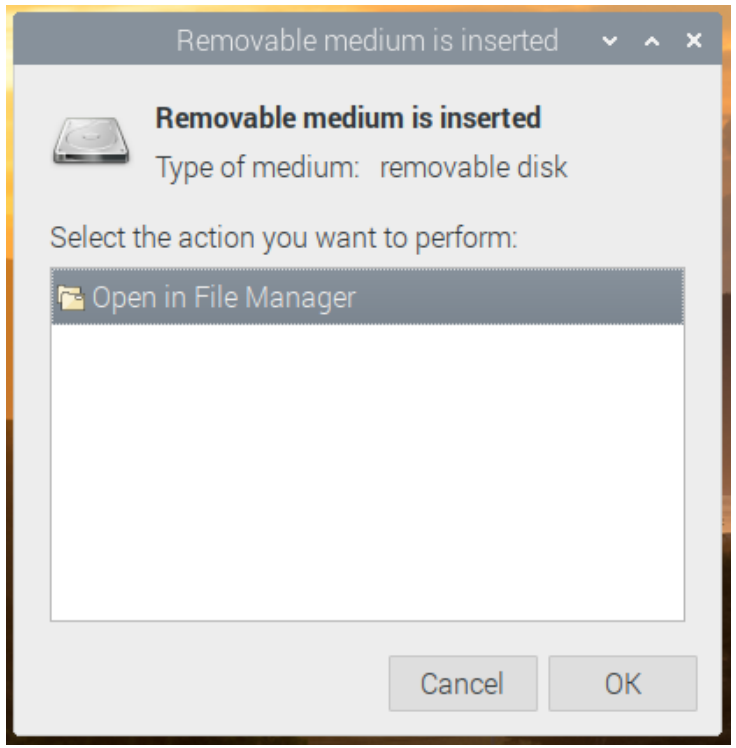
- All the files on your Raspberry Pi, including the ones you create yourself, are stored on the SD card. You can access your files using the File Manager application.
- Click on Accessories and then on File Manager in the menu, or select the File Manager icon on the menu bar.
- When the File Manager opens, you will be shown the **pi** directory — this is where you can store your files and create new subfolders.

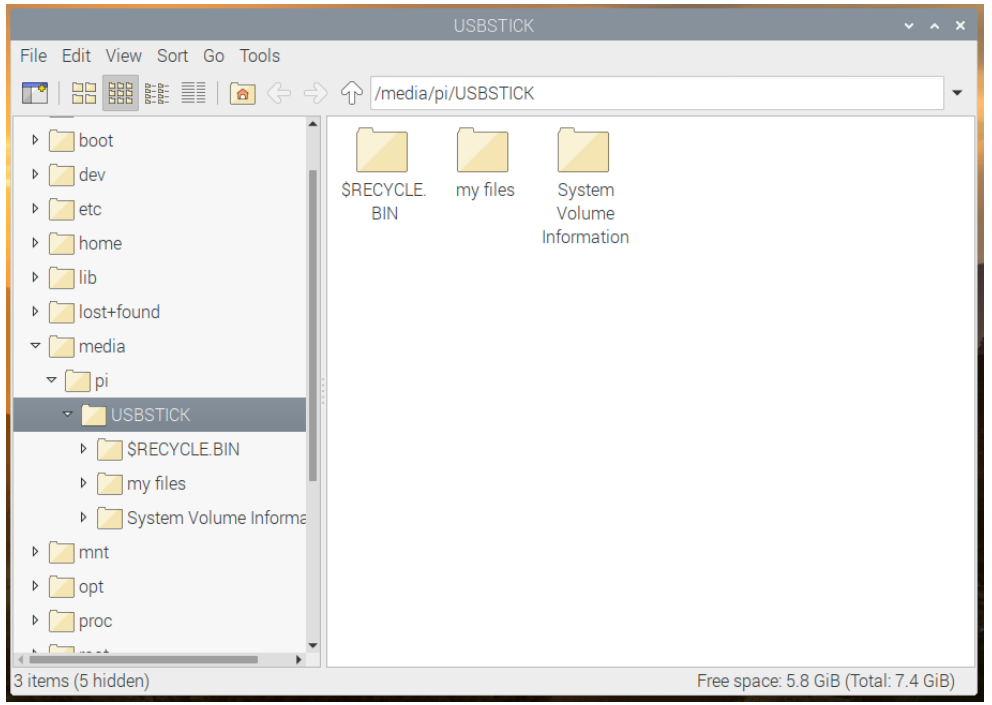




Accessing the Files

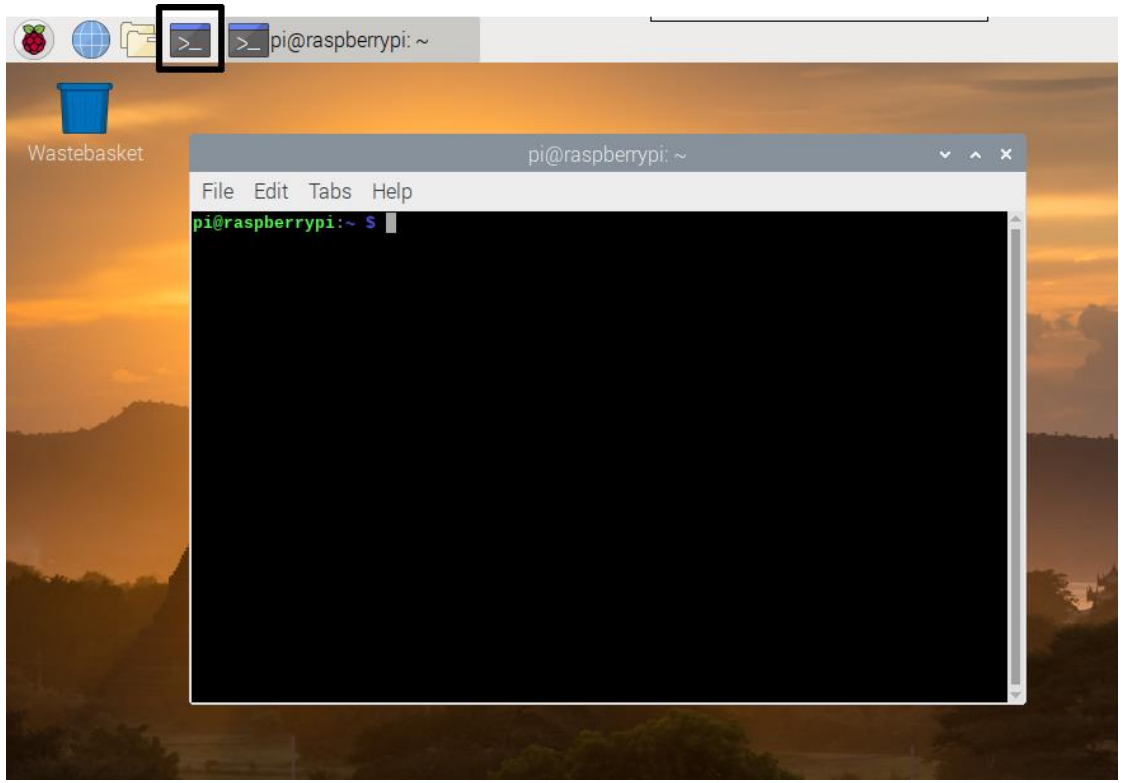
- You can use USB drives and sticks with your Raspberry Pi. This is a convenient way of backing up your files and copying them to other computers.
- Insert a USB stick into your Raspberry Pi. A window will pop up, asking what action you want to perform.
- Click on OK to Open in File Manager.





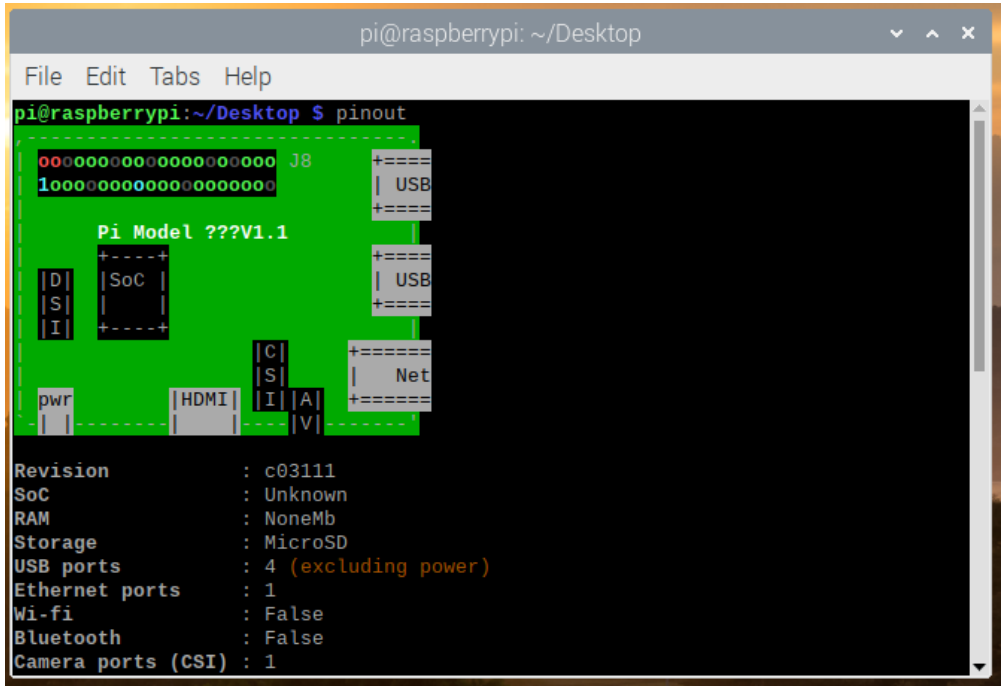
Using the terminal

- The terminal is a very useful application: it allows to navigate file directories and control the RP using typed commands instead of clicking on menu options.
- To open a terminal window, click on the Terminal icon at the top of the screen, or select Accessories and then Terminal in the menu.



Using the terminal

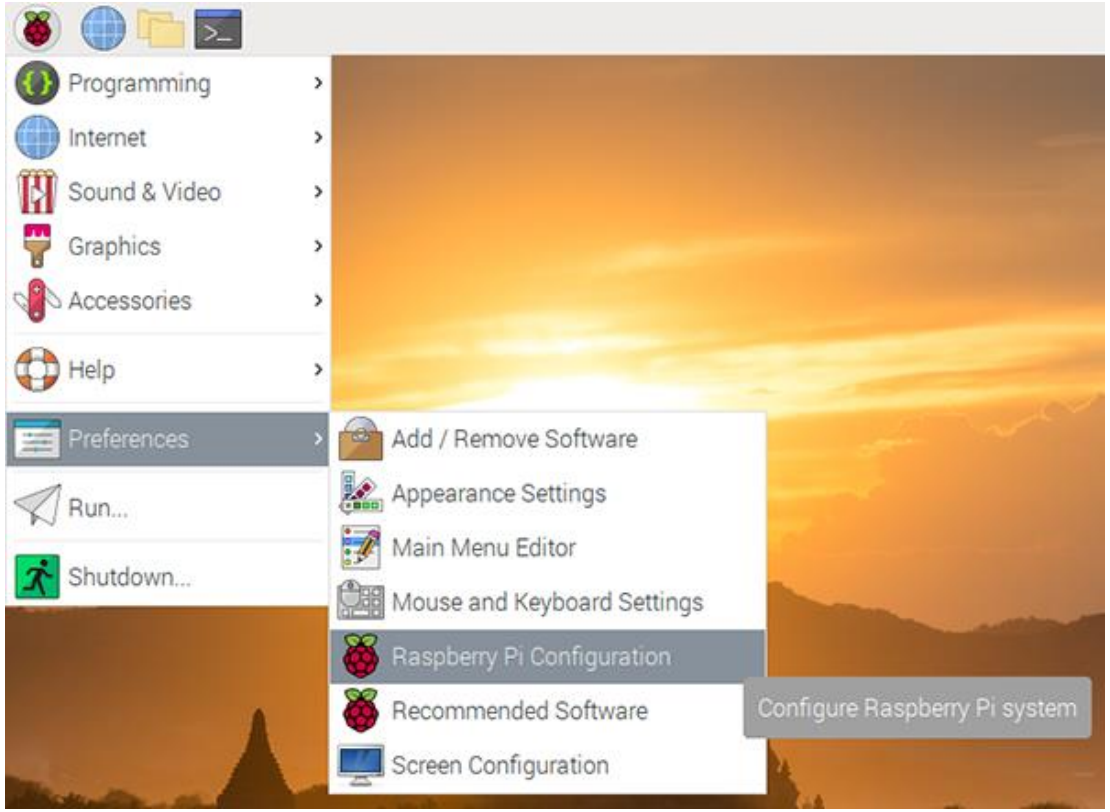
- As just one small example, try the command **`pinout`**.
- This will show a labelled diagram of the GPIO pins, and some other information about the Raspberry Pi.

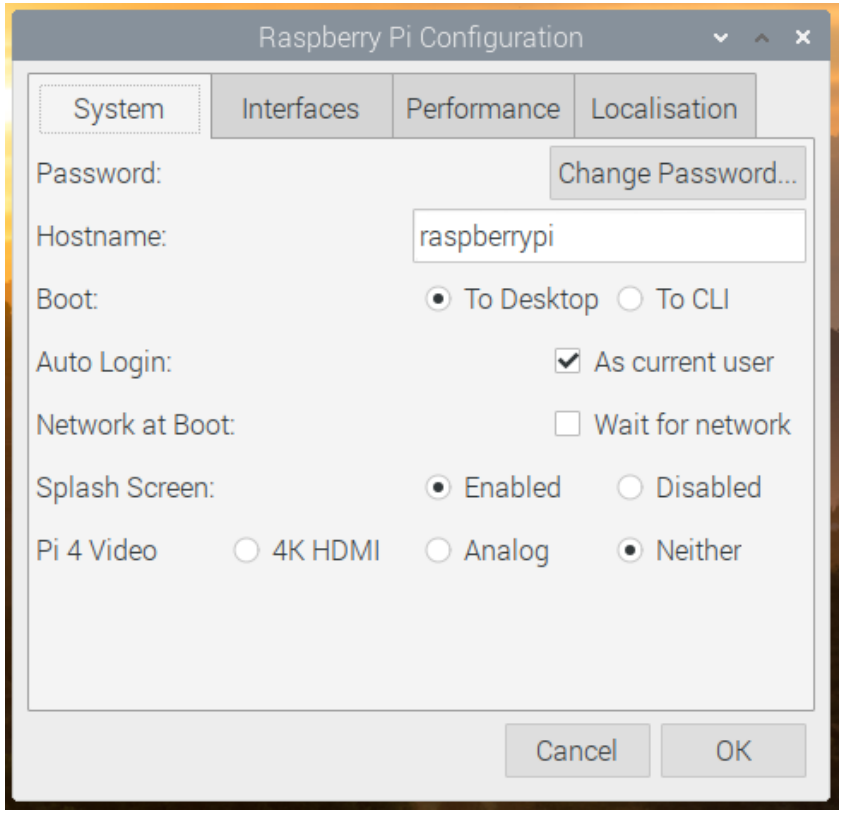


- Close the terminal window by clicking on the x in the top right-hand corner, or using the command **`exit`**.

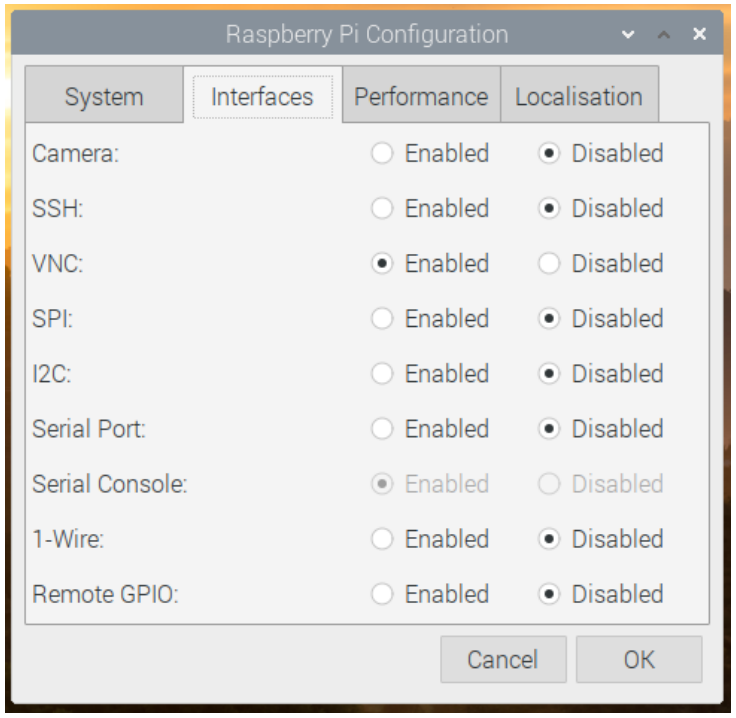
Configuring the Raspberry Pi

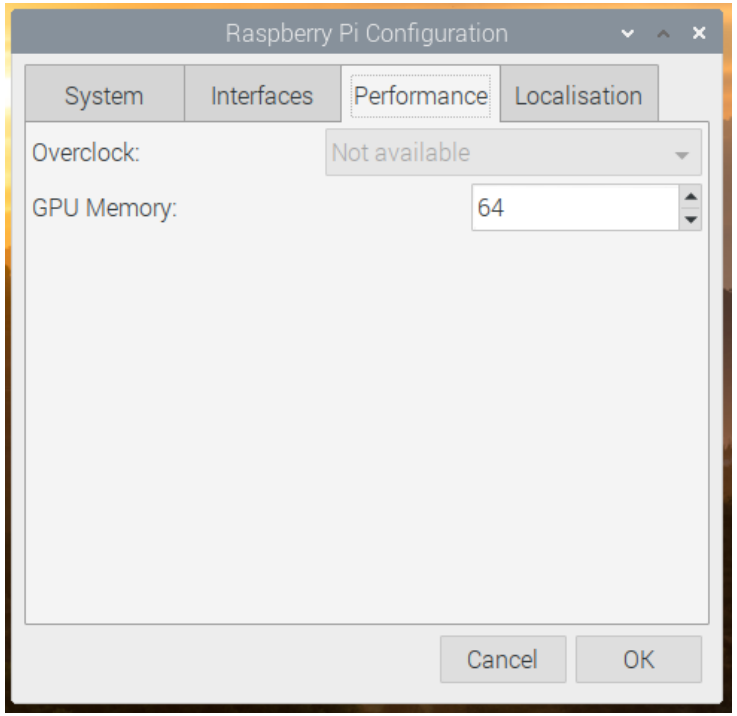
- You can control most of the Raspberry Pi's settings through the Raspberry Pi Configuration application found in Preferences on the menu, , or using the command **`sudo raspi-config`**.
- You can configure System, Interfaces, Performance, and Localisation.





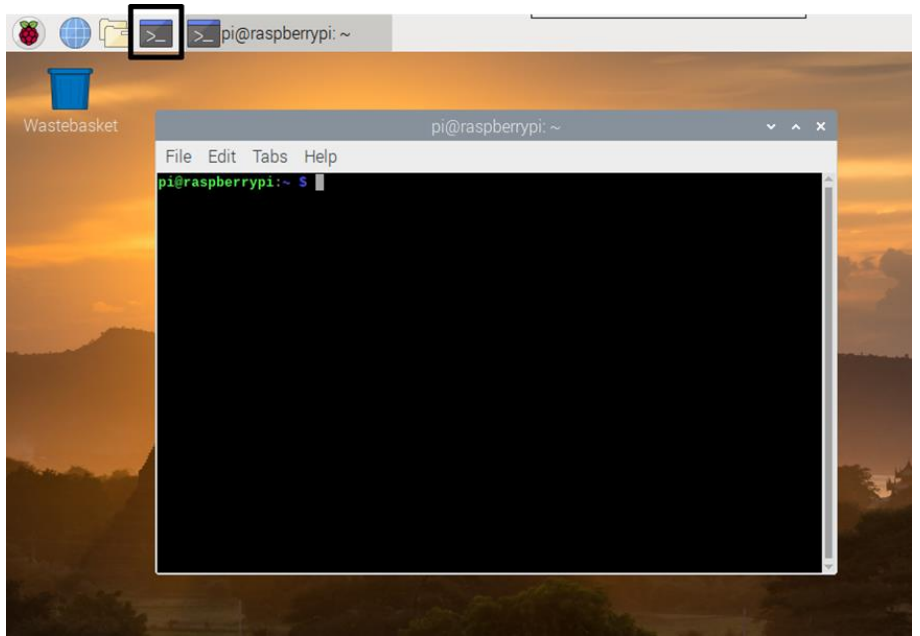
Configuring the Raspberry Pi





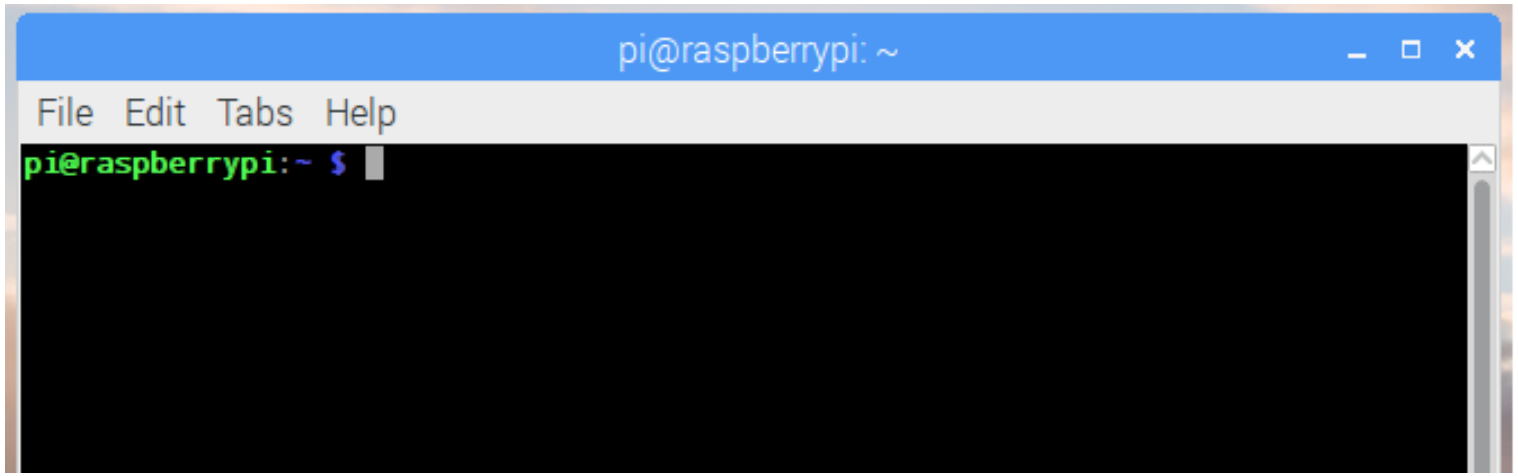
The Terminal

- Raspberry Pi OS has a powerful command line interface (terminal) that gives you a lot more control over the computer than you can get using the GUI.
- Many important tasks are either easier or only possible via commands.
- To open a terminal, either click the Terminal icon or hit CTRL+ ALT + T.
- If you connect to your Pi via SSH or you already booted to the command prompt, you don't need to open terminal, because you're already there.



The Terminal

The Prompt:




```
pi@raspberrypi:~ $
```

- The prompt shows the username and the hostname (machine name) of the Pi.
- Here we are logged in as a user called pi and the machine is called raspberrypi.
- The user pi has permission to edit any file in the home directory, which is /home/pi/.
- But we cannot change the underlying filesystem or modifying outside the home directory as we do not have permission to do so.
- To make wide changes we either need to be a user called “root” which is similar to administrator on Windows, or to use sudo to temporarily give us extra permissions.

The Terminal

Login as root:

- Be aware that some commands executed from root account can harm the filesystem
- The root account is not active by default, you need to do:

```
pi@raspberrypi:~ $ sudo passwd root
```

- Then you are prompted to set the password.
- Then you can change to the root user using

```
pi@raspberrypi:~ $ su root
```

- After that you are logged in as the root user

```
root@raspberrypi:/home/pi#
```

The Terminal

sudo - Super User Do

- To perform any core tasks like installing/removing software from your current “pi” user, you have to write the word “sudo” before any core command.
- By doing so, you have admin rights for that execution.
- To use “sudo” or change from a user account to the “root” account, you have to be in the "sudoers" permission group.
- Fortunately, the default Raspberry Pi user “pi” is already in this group.
- For example,

```
sudo apt update
```

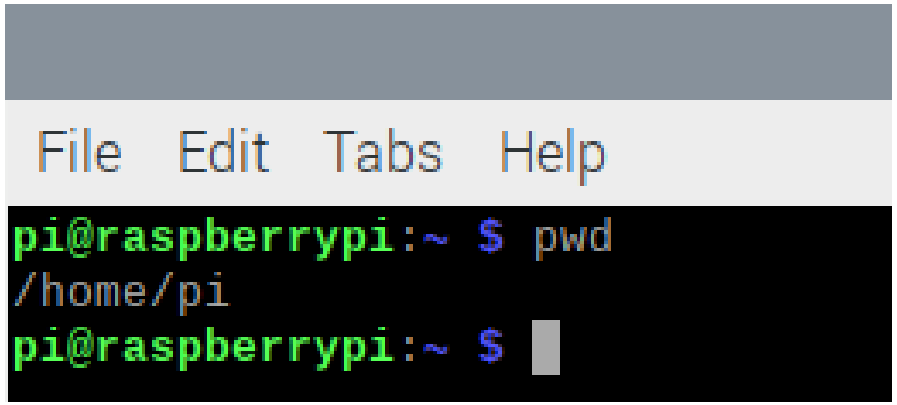
passwd – change the password for the current user

```
passwd
```

Navigating the file system

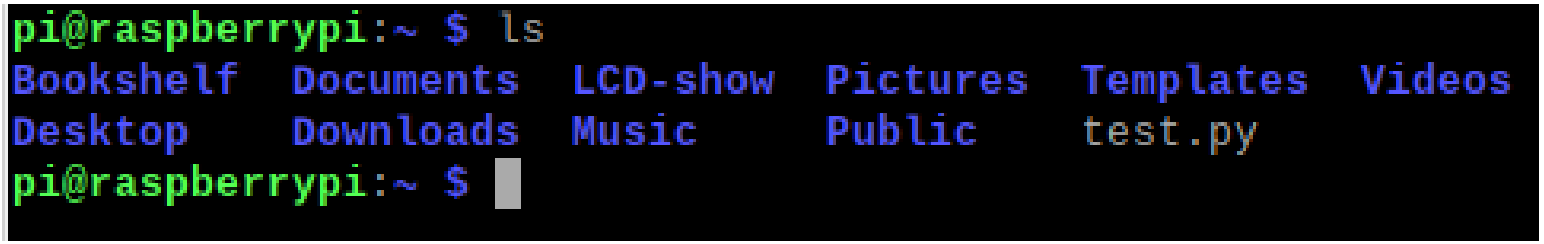
pwd - Print working directory

- This command will show the full path to the directory we are in.



ls - List directory content

- This command is used to list the contents of a directory.



Navigating the file system

cd - Change directory

- This command is used to change the current directory.
- For example, to move from our home directory to Downloads directory:

```
pi@raspberrypi:~ $ cd Downloads
pi@raspberrypi:~/Downloads $
```

- To go back to the previous directory that we were in:

  `cd -`

  or

  `cd ..`

- To go back to our home directory:

  `cd ~`

Working with files

cat – display (concatenate) the lines of a file to the terminal

- Print the contents of a file to the terminal,
- For example, a Python file: **`cat test.py`**

```
pi@raspberrypi:~ $ cat test.py
import numpy as np
import matplotlib.pyplot as plt
xstart = 0
xstop = 2*np.pi
step = 0.1
x = np.arange(xstart, xstop, step)
y = np.sin(x)
plt.plot(x, y)
```

- Print the contents of a file to the terminal with line numbers: **`cat -n test.py`**

```
pi@raspberrypi:~ $ cat -n test.py
     1  import numpy as np
     2  import matplotlib.pyplot as plt
     3  xstart = 0
     4  xstop = 2*np.pi
     5  step = 0.1
     6  x = np.arange(xstart, xstop, step)
     7  y = np.sin(x)
     8  plt.plot(x, y)
```

Edit a file

nano

- Nano is a command-line editor.
- Create a new file, for example newfile.txt.

```
nano newfile.txt
```

- Edit an existing file, for example test.py.

```
nano test.py
```

- Inside nano we navigate using the arrow keys and it works just like a regular text editor.

System Information

lscpu – display cpu information

```
pi@raspberrypi:~ $ lscpu
Architecture:            armv7l
Byte Order:              Little Endian
CPU(s):                  4
On-line CPU(s) list:     0-3
Thread(s) per core:      1
Core(s) per socket:      4
Socket(s):               1
Vendor ID:               ARM
Model:                   3
Model name:              Cortex-A72
Stepping:                r0p3
CPU max MHz:             1500.0000
CPU min MHz:             600.0000
```

free - Show amount of free and used RAM

- Using the -m option we can set the values in MB.

```
pi@raspberrypi:~ $ free -m
               total        used        free      shared  buff/cache   available
Mem:            7898         161        7257          21         479        7490
Swap:             99           0          99
```

File Management

mv - Move / rename a file

- This command offers two functions. We can move a file from one location to another. For example here we move test.py to the Documents directory.

```
mv test.py Documents/
```

- The command can also be used to rename a file or directory. Here we rename test.py to test2.py.

```
mv test.py test2.py
```

rm - Delete a file

- With this command we can delete files and directories. In this example we delete the file test.py.

```
rm test.py
```

File Management

cp - Copy a file

- To copy a file, for example test.py to our Documents directory.

```
cp test.py Documents/
```

- To copy a directory, we need to use the -r option.

```
cp -r test2/ Documents/
```

mkdir - Create a directory

- Create a new directory to store work. For example let's create a directory called Work in our home directory.

```
mkdir Work
```

clear: Clear the Terminal Window

```
clear
```

Software Installation

apt - Install and manage software

- apt, the Advanced Packaging Tool. The app store of Linux. To use apt we will need to use sudo as it will make changes to the operating system.
- First we update the list of installable software.

```
sudo apt update
```

- Then we can install a specific package/application:

```
sudo apt install <package-name>
```

- Or we can upgrade all of the software on our Raspberry Pi. Note that for this command we pass the -y option to automatically agree to install every package. But this is optional.

```
sudo apt upgrade -y
```

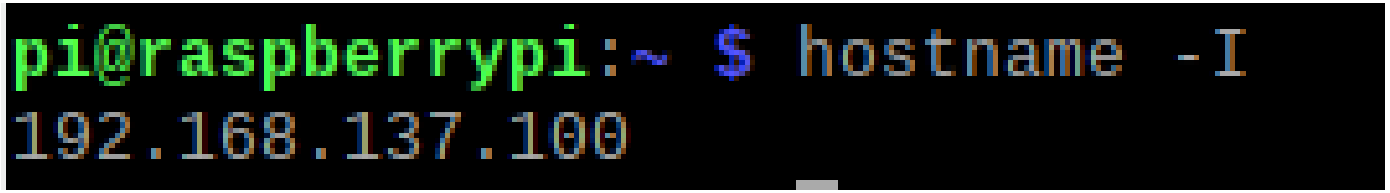
Network Connectivity & Internet

ping - Check that we are connected

- The ping command is used to test that our Raspberry Pi is connected to the Internet/local network.
- Ping a website: **`ping google.com`**
- Ping an IP address: **`ping 8.8.8.8`**
- Ping a local IP: **`ping 192.168.1.1`**

hostname - Get the IP address of the Raspberry Pi

- Use the – I (uppercase i) option to show all IP addresses (WiFi and Ethernet)



- Or you can use **`ifconfig`**


Any Questions