

Important Links

<https://www.hackster.io/>

Watch When have time:

<https://www.youtube.com/watch?v=z55nt4qJvdI> --> outubro 2017
<https://www.youtube.com/watch?v=MNypwrbHMgU> --> maio 2018 - placas-montagem - configuracao
<https://www.youtube.com/watch?v=eZ8RlTElkoE> --> junho 2018 - continuacao - montagem - varios video relacionados ao lado
<https://www.youtube.com/watch?v=NsLmnxv4ii8> --> maio 2020 - montagem - placa
<https://www.youtube.com/watch?v=a7bkImtkgUo> --> maio 2020 continuacao
<https://www.youtube.com/watch?v=moCOf6vRQyA> --> INSTALANDO APLICAÇÃO MAGIC MIRROR
<https://www.youtube.com/watch?v=q9OsWBEHDO4> --> abril 2020 - Chromecast - 6
<https://www.youtube.com/watch?v=D6LRa0M4LBI> --> BUILD YOUR OWN GOOGLE HOME 2.0!
<https://www.youtube.com/watch?v=Yfc0dwS402A> --> maio 2020 - automacao residencial
<https://www.youtube.com/watch?v=gbnpmLS0DvQ> --> RaspberryPi

Project Ideas

Umidifier

PhotoResistor when it gets dark it turns on the light in your home

Facial Recognition + Door Opening + Accelerometer (If someone tries to steal, an alarm rings)

Voice Recognition + Call Number + Control Lights + Control Blinds

Robot that follows you

Robot that helps you with luggage

Robot that helps you with garbage

Cleaning Robot that detects shit in the floor and avoids it as well as make sounds to avoid animals coming close

Make a glass that can be transparent and opaque when you want (12:40 building automation event video)

Cooker Robot

Infrared Camera

Measure the Efficiency of a Compressor

Arduino and Raspberry PI communication

<https://www.raspberrypi.org/forums/viewtopic.php?p=1007463#p1007463>

Cost

Raspberry Pi 3 Kit

[Place your order](#)

Order Summary

Items:	CDN\$ 99.99
Shipping & Handling:	CDN\$ 0.00
Total before tax:	CDN\$ 99.99
Estimated GST/HST:	CDN\$ 13.00
Estimated PST/RST/QST:	CDN\$ 0.00

Order Total: CDN\$ 112.99

[How are shipping costs calculated?](#)

Prime Shipping has been applied to the eligible items in your order.

Links to buy Raspberry Pi

[https://www.amazon.ca/Freenove-Raspberry-Processing-Tutorials-Components/dp/B06W54L7B5/ref=sr_1_8?crid=G06RSDBGX9AY&keywords=raspberry+pi&qid=1590850084&suffix=rasp%2Caps%2C200&sr=8-8](https://www.amazon.ca/Freenove-Raspberry-Processing-Tutorials-Components/dp/B06W54L7B5/ref=sr_1_8?crid=G06RSDBGX9AY&keywords=raspberry+pi&qid=1590850084&sprefix=rasp%2Caps%2C200&sr=8-8)

<https://www.buyapi.ca/product/raspberry-pi-4b-budget-bundle-1gb/>

<https://www.canakit.com/raspberry-pi-kit-for-dummies.html>

https://www.amazon.ca/CanaKit-Raspberry-Starter-Premium-Black/dp/B07BCC8PK7/ref=sr_1_3?dchild=1&keywords=raspberry+pi+3&qid=1590852890&sr=8-3

Raspberry PI Cheat Sheet

-Ciro's Folder:
file:///D:/CIRO%20(Estudos%20Compactados)/CENTENNIAL/CENTENNIAL%20(ENERGY%20ENGINEERING)/Mat%C3%A9rias/Python/Raspberry/Raspberry%20Terminal%20Cheat%20Sheet.pdf

Hardware (Pi3 vs Pi4)

Raspberry Pi 3 vs Raspberry Pi 4

Raspberry Pi 3	Raspberry Pi 4
1.2 GHz CPU	1.5 GHz CPU
1 GB RAM	1GB, 2GB, 4GB RAM
100 Base Ethernet	Gigabit Ethernet
4 USB 2.0 Ports	2 USB 2.0 Ports 2 USB 3.0 Ports
1 Full size HDMI	2 Micro HDMI with 4K support
Micro USB Power Support	USB Type -C Power Support

Connecting Raspberry Pi to the PC

https://github.com/leeassam/pi-ultimate-guide/blob/master/setup_headless_mode/instructions.md

Headless Setup Process

- Flash SD card with latest Raspbian
- Create two files (ssh and wpa_supplicant.conf)
- Get IP address of Pi
- Connect via SSH and enable VNC Viewer, Boot to Desktop and Set Screen Resolution in raspi-config settings
- Use VNC Viewer to connect to your Pi

https://github.com/leeassam/pi-ultimate-guide/blob/master/setup_headless_mode/instructions.md

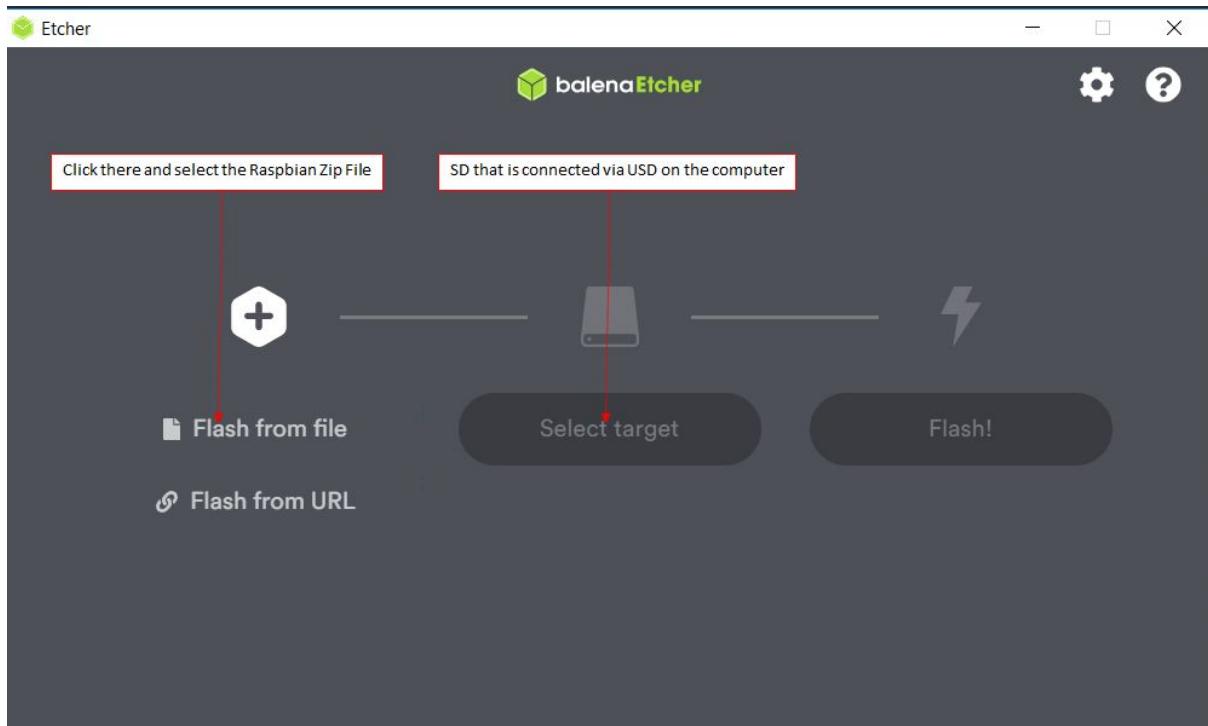
- 1) Download the latest Raspbian version

<https://www.raspberrypi.org/downloads/raspbian/>

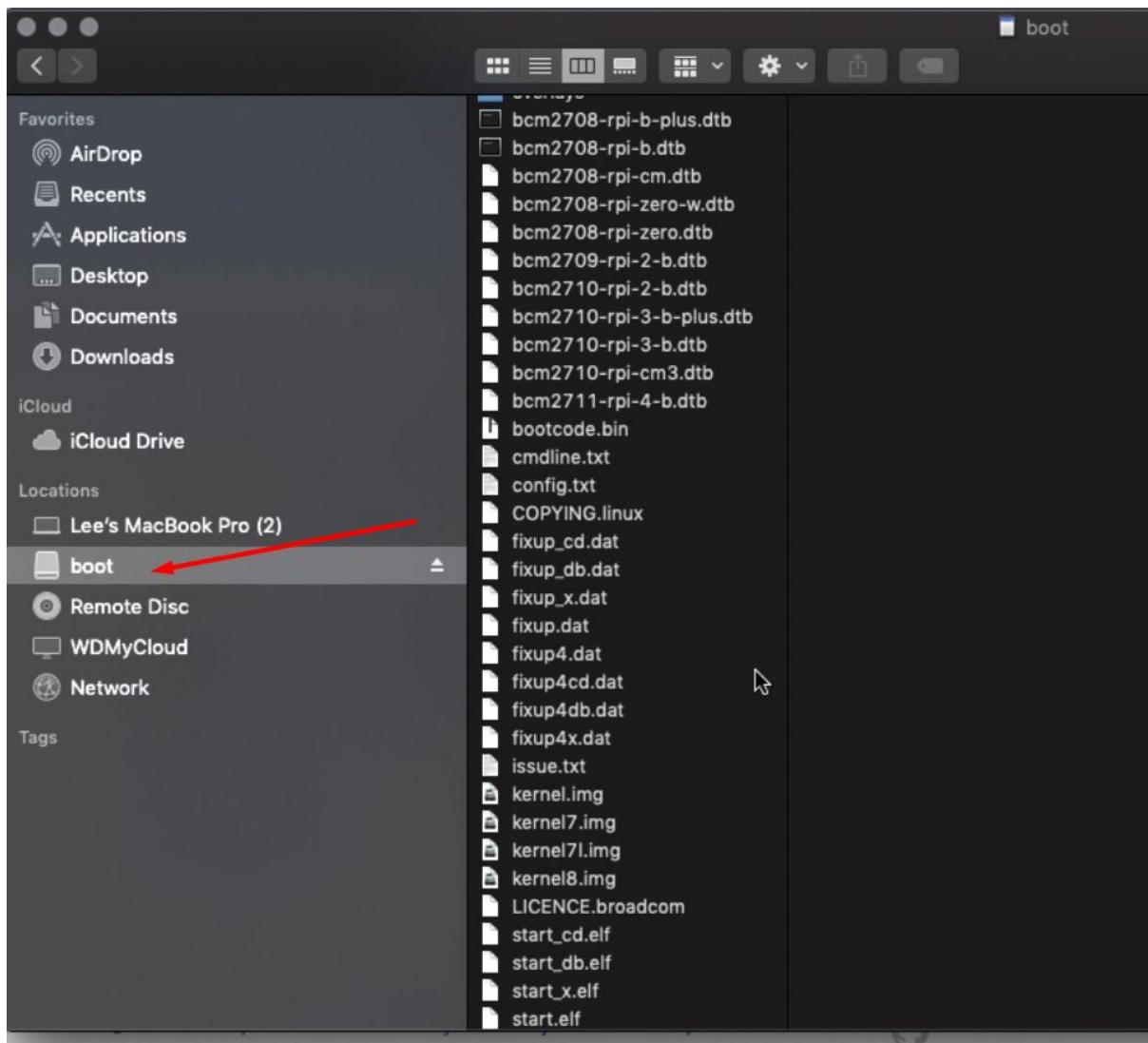
- 2) Download Etcher

<https://www.balena.io/etcher/>

- 3) Open Etcher



- 4) After the Flashing process is over, the SD card is going to be removed from the computer, so just take out the USB reader and insert it again, so the computer will recognize it back.
- 5) The name of the location when you put the SD card back is probably going to be Boot.

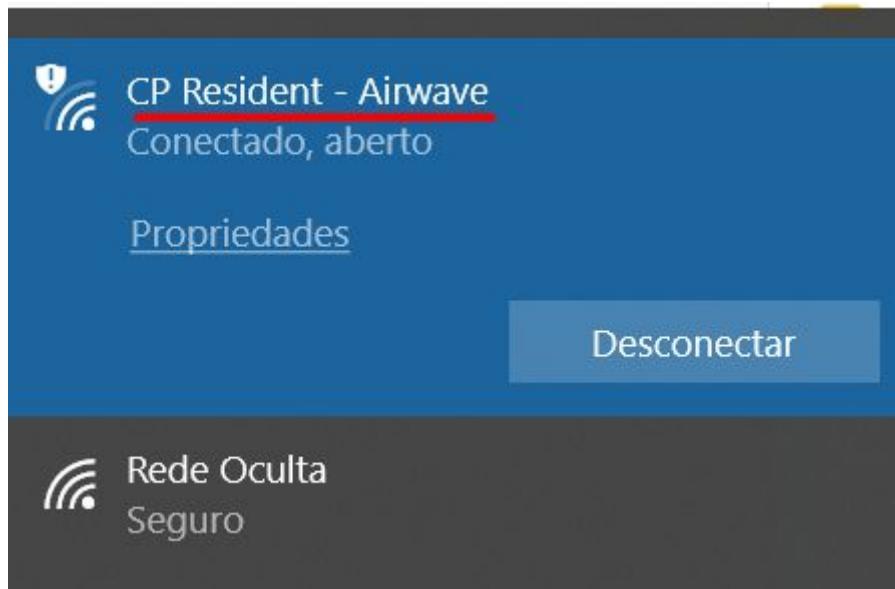


- 6) Create a file WITHOUT EXTENSION named: ssh
- 7) Create another file named: wpa_supplicant.conf and paste the below text there:

```
ctrl_interface=DIR=/var/run/wpa_supplicant  
GROUP=netdev  
update_config=1  
  
country=CA  
  
network={  
  
    ssid="CP Resident - Airwave"  
    psk=""  
}
```

- 8) In the country part on the code above, change it for the country code, in this case CA for Canada. If you don't know just search:
<https://www.nationsonline.org/oneworld/canada.htm>

- 9) In the SSID part on the code above, enter the name of your network and in the PSK, enter the password.



- 10) Remove the SD card and put in the Raspberry Pi

- 11) Get the IP address from your computer:

<https://www.howtogeek.com/233952/how-to-find-your-routers-ip-address-on-any-computer-smartphone-or-tablet/>

A screenshot of a Windows Command Prompt window titled 'Prompt de Comando'. The user has typed 'C:\Users\ciro_>ipconfig' and pressed Enter. The output shows the configuration for several network adapters:

- Adaptador Ethernet Ethernet 2: Estado da mídia... : mídia desconectada
- Adaptador de Rede sem Fio Local Area Connection* 2: Estado da mídia... : mídia desconectada
- Adaptador de Rede sem Fio Local Area Connection* 1: Estado da mídia... : mídia desconectada
- Adaptador de Rede sem Fio Wi-Fi:
 - Sufixo DNS específico de conexão... :
 - Endereço IPv6 de link local... : fe80::45ea:cb96:dac1:47cd%24
 - Endereço IPv4... : 172.16.121.156
 - Máscara de Sub-rede... : 255.255.255.0
 - Gateway Padrão... : 172.16.121.1

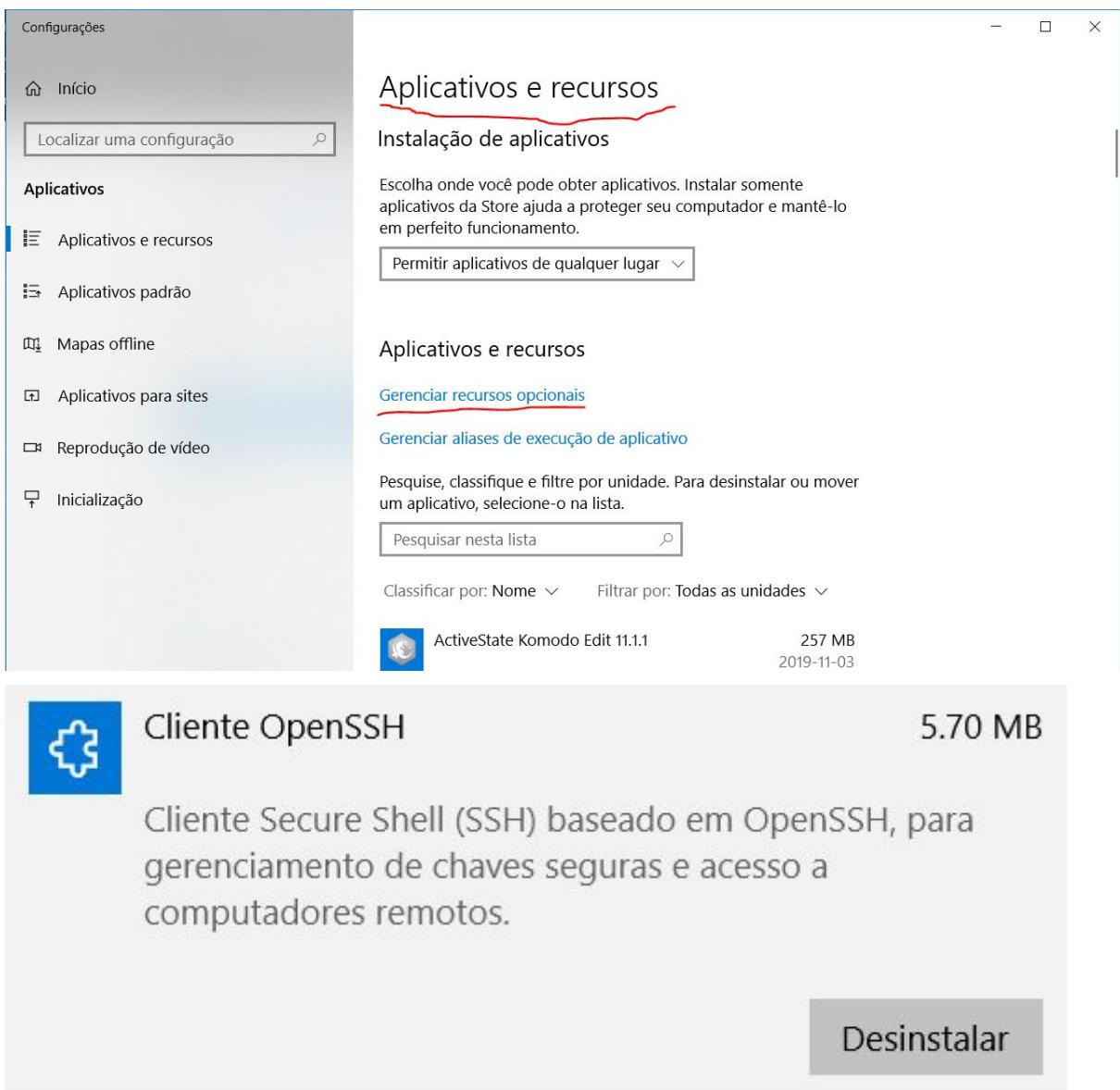
- 12) Download this software to get the IP address of your Raspberry Pi:

<https://www.advanced-ip-scanner.com/>

- 13) Enable SSH:

<https://www.howtogeek.com/336775/how-to-enable-and-use-windows-10s-built-in-ssh-commands/>

- 14) Go to Apps=> Manage Optional Feature=> Install OpenSSH Client



15) Got to the Terminal and type ssh:

```
Windows PowerShell
Copyright (C) Microsoft Corporation. Todos os direitos reservados.

PS C:\Users\ciro_> ssh
usage: ssh [-46AaCfGgKkMmNnqTtVvXxYy] [-b bind_address] [-c cipher_spec]
           [-D [bind_address:]port] [-E log_file] [-e escape_char]
           [-F configfile] [-I pkcs11] [-i identity_file]
           [-J [user@]host[:port]] [-L address] [-l login_name] [-m mac_spec]
           [-O ctl_cmd] [-o option] [-p port] [-Q query_option] [-R address]
           [-S ctl_path] [-W host:port] [-w local_tun[:remote_tun]]
           destination [command]
PS C:\Users\ciro_>
```

16) In the Terminal type ssh pi@IP address of your Raspberry Pi

17) Type yes

18) Put the password: RASPBERRY

```

Lees-MBP-2284:~ leeassam$ ssh pi@192.168.1.118
The authenticity of host '192.168.1.118 (192.168.1.118)' can't be established.
ECDSA key fingerprint is SHA256:ogdKWBXGILBxQTDhsIY4JKgMxoT0SNwGI/+XanCFFKM.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '192.168.1.118' (ECDSA) to the list of known hosts.
pi@192.168.1.118's password:
Linux raspberrypi 4.19.75-v7l+ #1270 SMP Tue Sep 24 18:51:41 BST 2019 armv7l

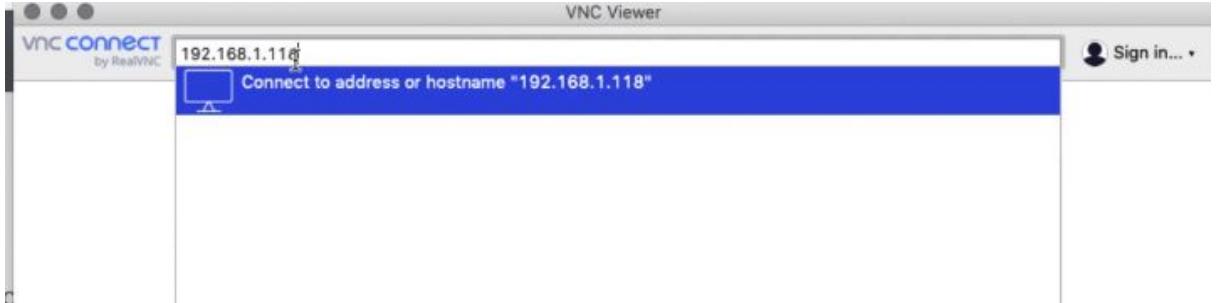
The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
Last login: Thu Sep 26 01:46:17 2019

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.

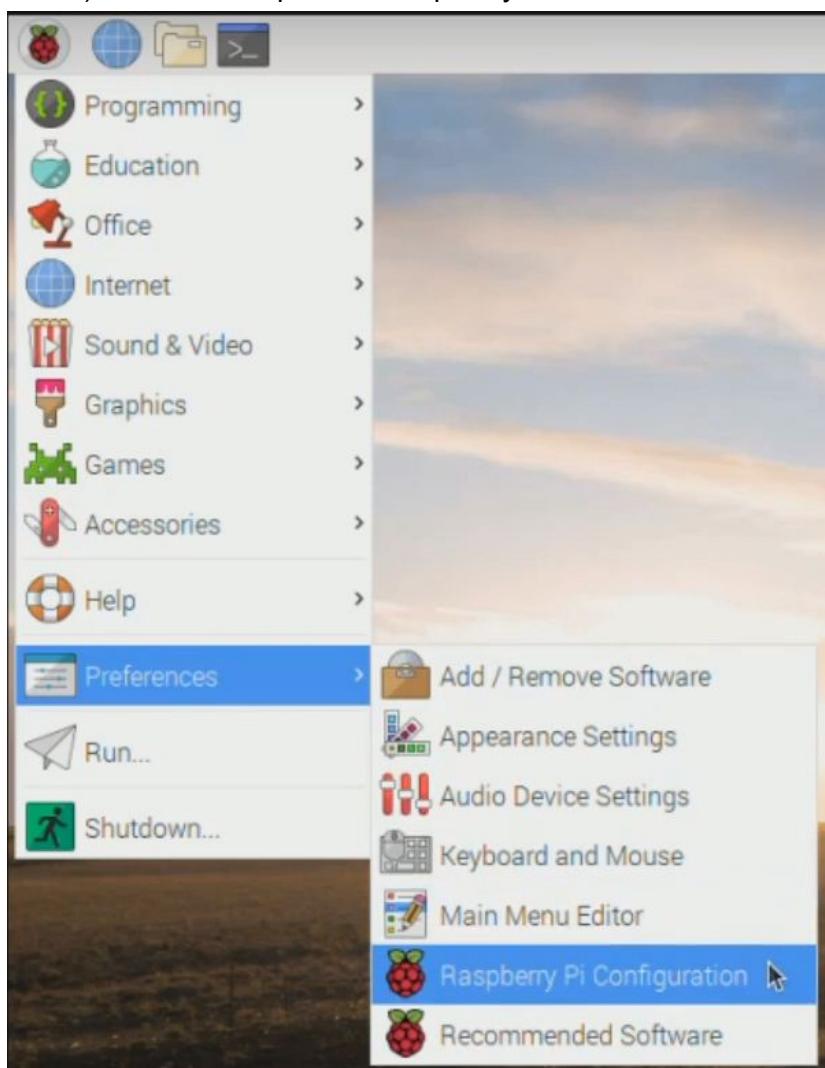
```

- 19) After this you are connected with the Raspberry
 - 20) To configure the raspberry py type in the Terminal: sudo raspi-config
 - 21) Use the keyboard arrows to go to Interfacing Options=>VNC=> Yes
 - 22) Press Enter
 - 23) Go to Boot Options=> Desktop/CLI=> Desktop Autologin
 - 24) Advanced Options=> Resolution=> 1920x1080=> OK
 - 25) Finish
 - 26) Yes
 - 27) Download the VNC

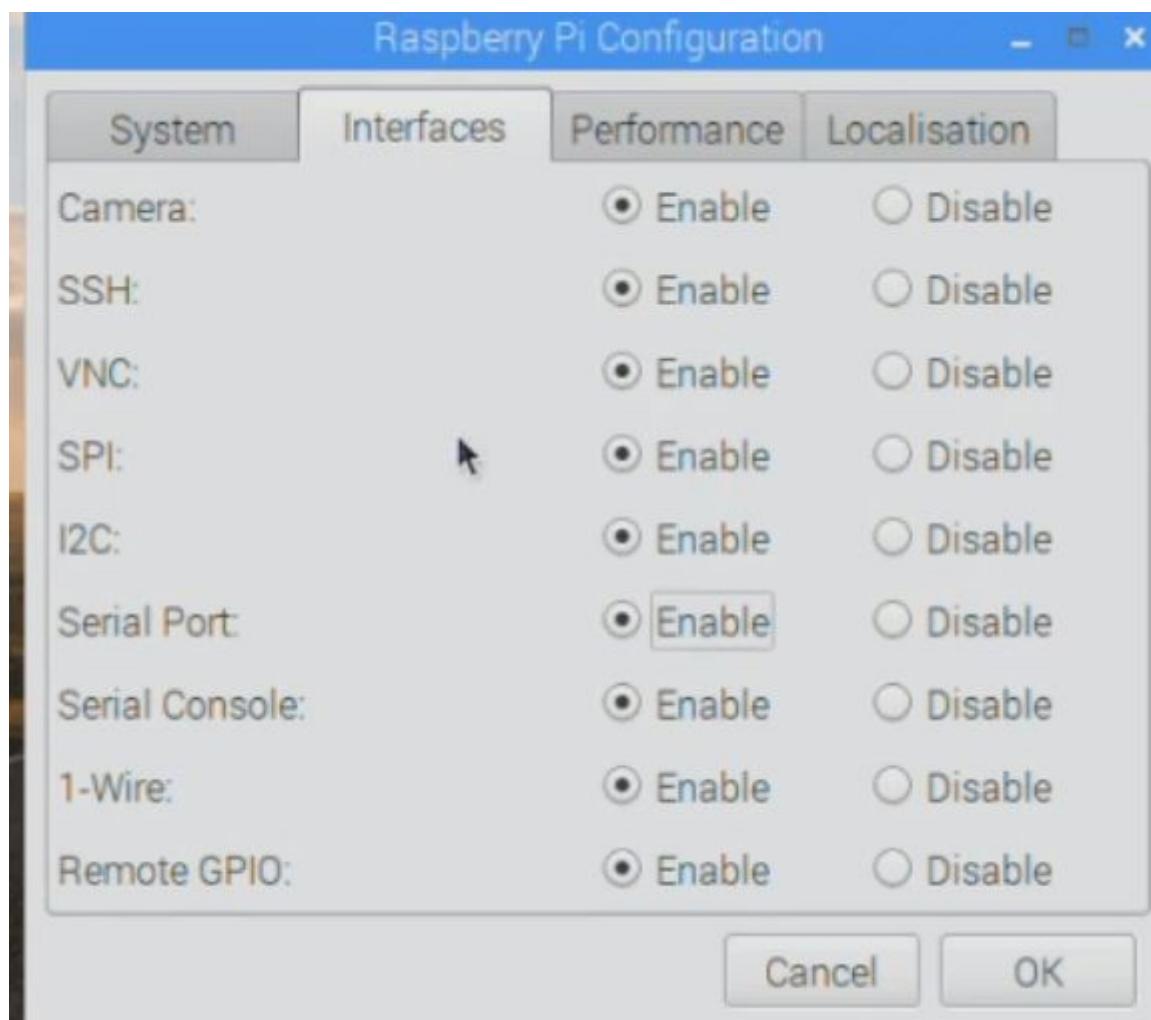
<https://www.realvnc.com/en/connect/download/viewer/>
 - 28) Enter the Raspberry Pi IP Address
- 
- 29) Continue
- 30) Log in information:
- Username: pi
 - Password: raspberry
- 31) Remember the Password
- 32) After pressing next and setting the language,you can change the default password:



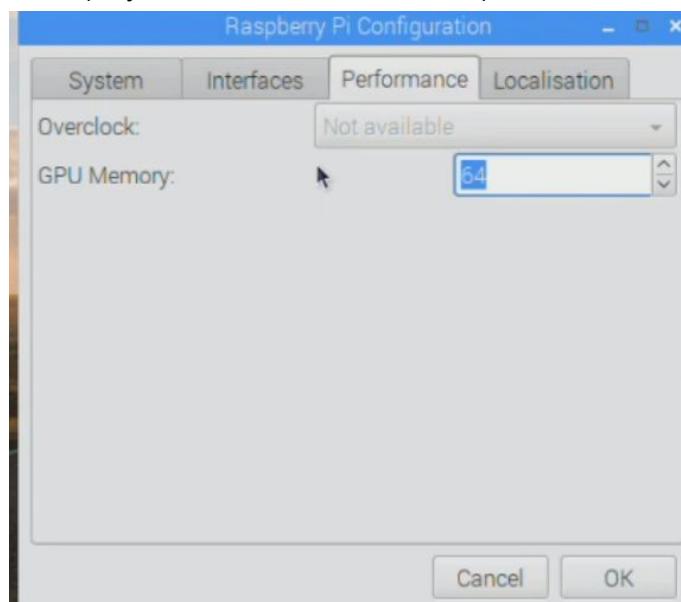
- 33) Select the Wifi network and put the password
- 34) Click NEXT
- 35) REBOOT
- 36) Click at the top in the Raspberry Pi=> Preferences=> Raspberry PI Configuration



- 37) Go to Interfaces and Enable everything



38) If you want to OVERCLOCK (AVOID DOING THAT), go to performance:

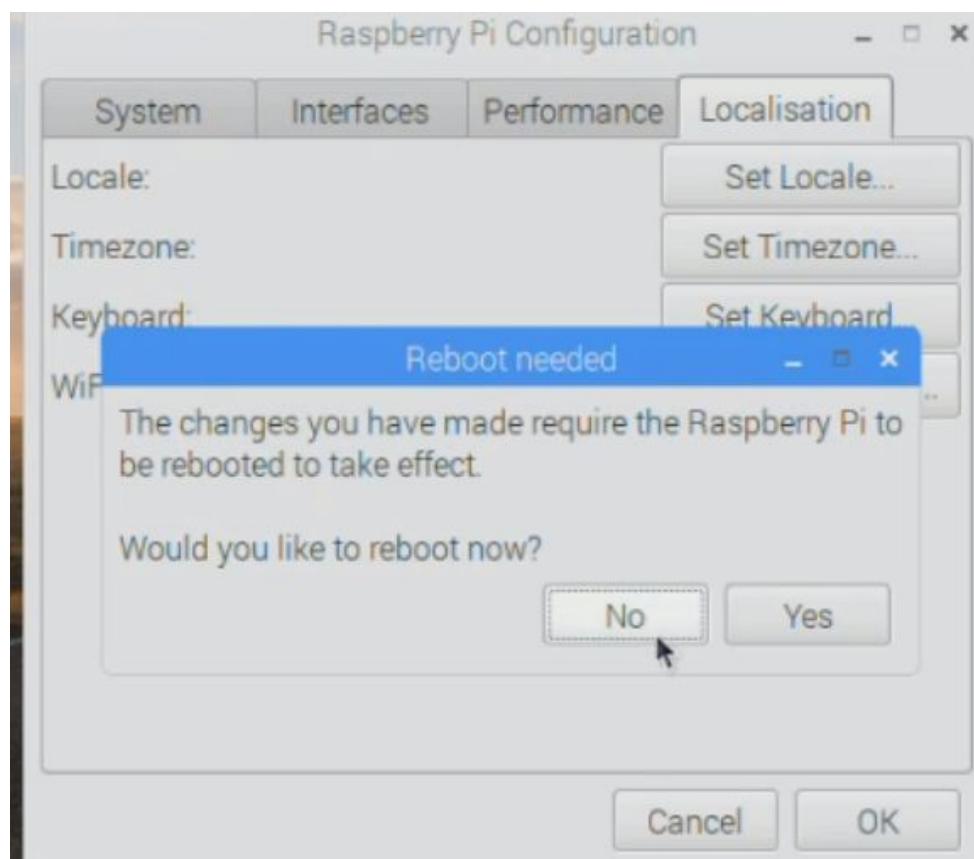


39) Click OK

40) Click Yes (**reboot**), so the changes will take effect.

You can also go at the top in the Raspberry Pi=> Shutdown=> Reboot

Or type in the terminal: **sudo reboot now**



41)s

Connecting Remotely with Raspberry Pi

SSH

For Windows

- 1) Go to the Putty website:

<https://www.chiark.greenend.org.uk/~sgtatham/putty/latest.html>

- 2) Select this one to download:

This page contains download links for the latest released version of PuTTY. Currently this is 0.73, released on 2019-09-29.

When new releases come out, this page will update to contain the latest, so this is a good page to bookmark or link to. Alternatively, here is a [permanent link to the 0.73 release](#).

Release versions of PuTTY are versions we think are reasonably likely to work well. However, they are often not the most up-to-date version of the code available. If you have a bug, see the [development snapshots](#), to see if the problem has already been fixed in those versions.

Package files

You probably want one of these. They include versions of all the PuTTY utilities.
(Not sure whether you want the 32-bit or the 64-bit version? Read the [FAQ entry](#).)

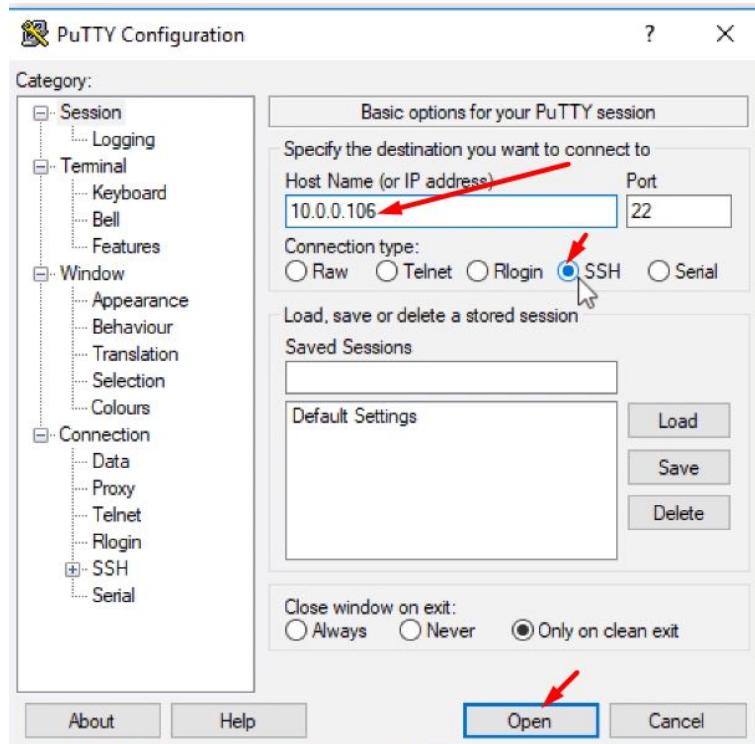
MSI ('Windows Installer')

32-bit:	putty-0.73-installer.msi	(or by FTP)	(signature)
64-bit:	putty-64bit-0.73-installer.msi	(or by FTP)	(signature)

Unix source archive

.tar.gz:	putty-0.73.tar.gz	(or by FTP)	(signature)
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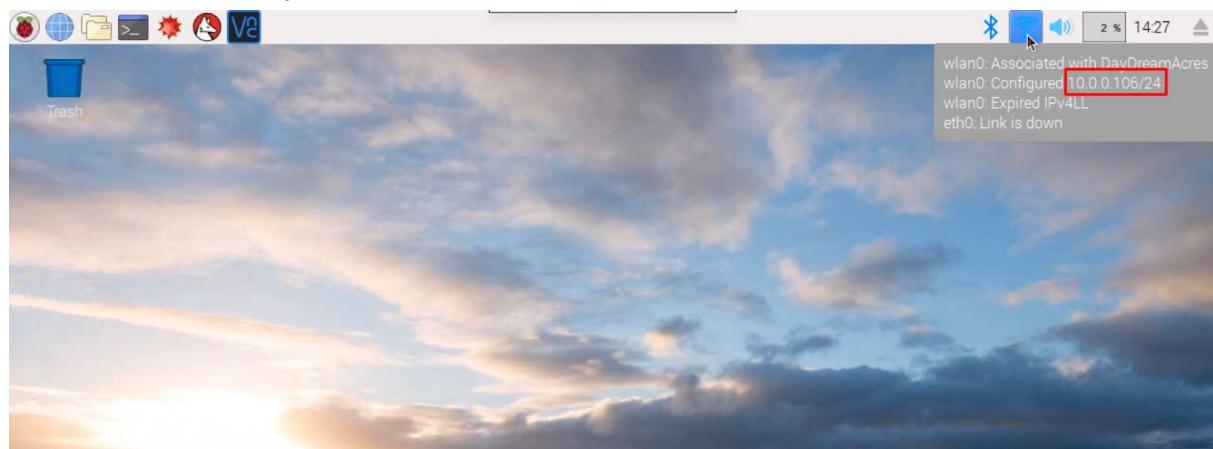
- 3) Install it
- 4) Open the software
- 5) Type your Raspberry PI IP address
- 6) Make sure the SSH is selected
- 7) Press Open



- 8) Select Yes
- 9) Put your username (pi) and password (raspberry)
- 10) To check all the files=> Type: **ls**
- 11) To check folder location=> Type: **pwd**

For MAC

- 1) Check the IP address assigning to the Raspberry Pi:
 - a) Hover your mouse at the top:



- b) Go to the Terminal and type: **ifconfig**

```
pi@raspberrypi: ~
File Edit Tabs Help
RX packets 0 bytes 0 (0.0 B)
RX errors 0 dropped 0 overruns 0 frame 0
TX packets 0 bytes 0 (0.0 B)
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

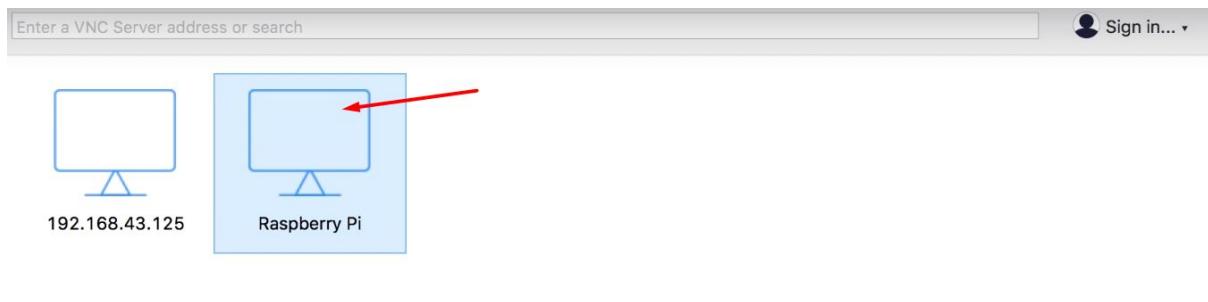
lo: flags=73<UP,LOOPBACK,RUNNING> mtu 65536
    inet 127.0.0.1 netmask 255.0.0.0
    inet6 ::1 prefixlen 128 scopeid 0x10<host>
        loop txqueuelen 1 (Local Loopback)
        RX packets 50 bytes 3202 (3.1 KiB)
        RX errors 0 dropped 0 overruns 0 frame 0
        TX packets 50 bytes 3202 (3.1 KiB)
        TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

wlan0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 10.0.0.106 netmask 255.255.255.0 broadcast 10.0.0.255
        ether b8:27:eb:c8:b0:c5 txqueuelen 1000 (Ethernet)
        RX packets 26282 bytes 12627823 (12.0 MiB)
        RX errors 0 dropped 3 overruns 0 frame 0
        TX packets 32141 bytes 26992675 (25.7 MiB)
        TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
pi@raspberrypi: ~ $
```

- 2) Raspberry PI must be connected in the same network with the remote machine
- 3) Go to the Terminal and type: **ssh@IPADDRESS**
The IP address is the one got from before WITHOUT THE DIGITS AFTER THE BAR.
In this case: it would be **ssh@10.0.0.106**
- 4) Type yes
- 5) Put your new password (the reset one or the old one if you didn't reset)
- 6) To check all the files=> Type: **ls**
- 7) To check folder location=> Type: **pwd**

VNC

- 1) Download the VNC:
<https://www.realvnc.com/en/connect/download/viewer/>
- 2) Install
- 3) Open the software
- 4) Go to File=> New
- 5) The computer MUST be in the same network as your Raspberry
- 6) VNC Server=> Put the IP address of the Raspberry PI
- 7) Name=> Up to you, but choose an easy name
- 8) Click OK
- 9) Double click in the recent created VNC:



10) Put the login and remember password

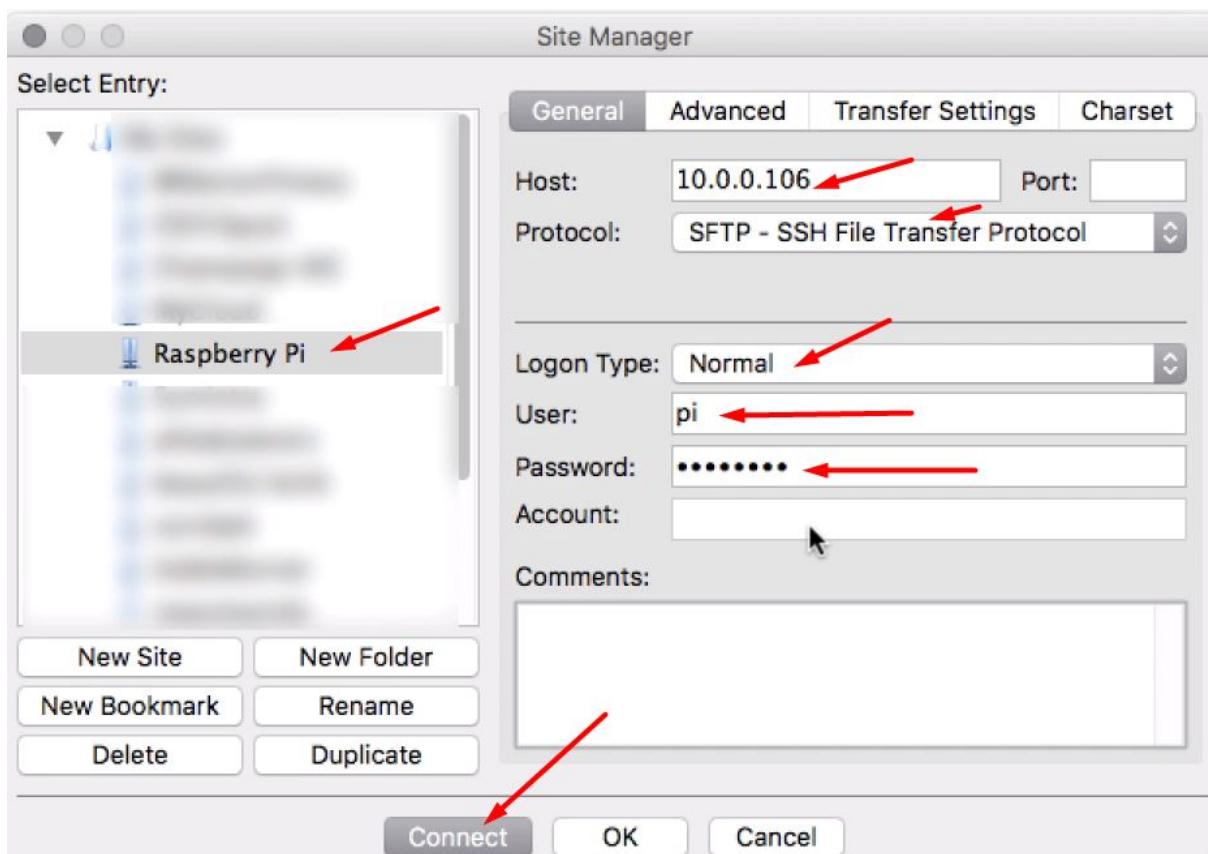
SFTP (file transfer)

Used to transfer files between different computers or the Raspberry Pi to the Computer

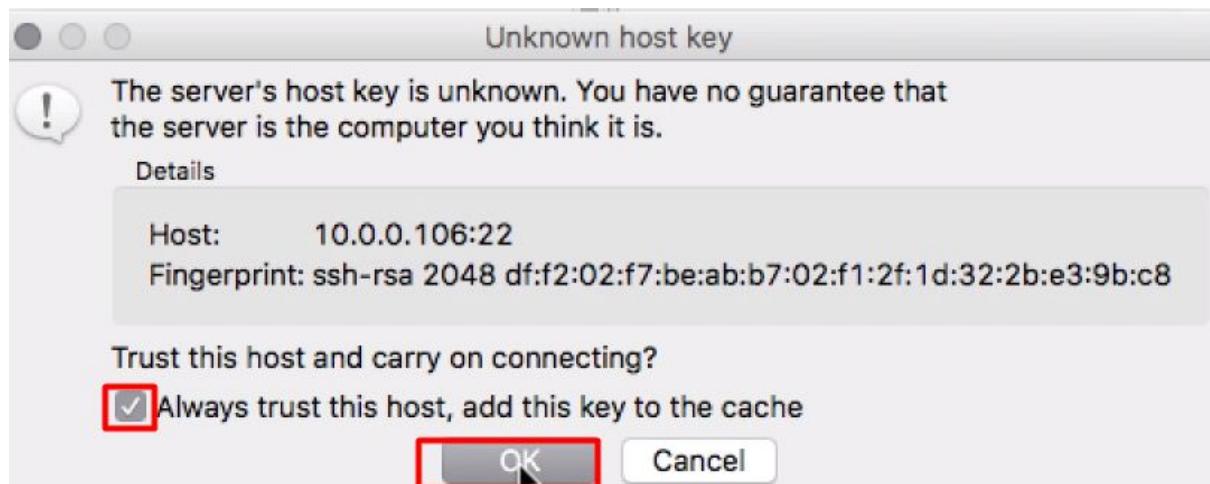
1) Go to Filezilla:

<https://filezilla-project.org/>

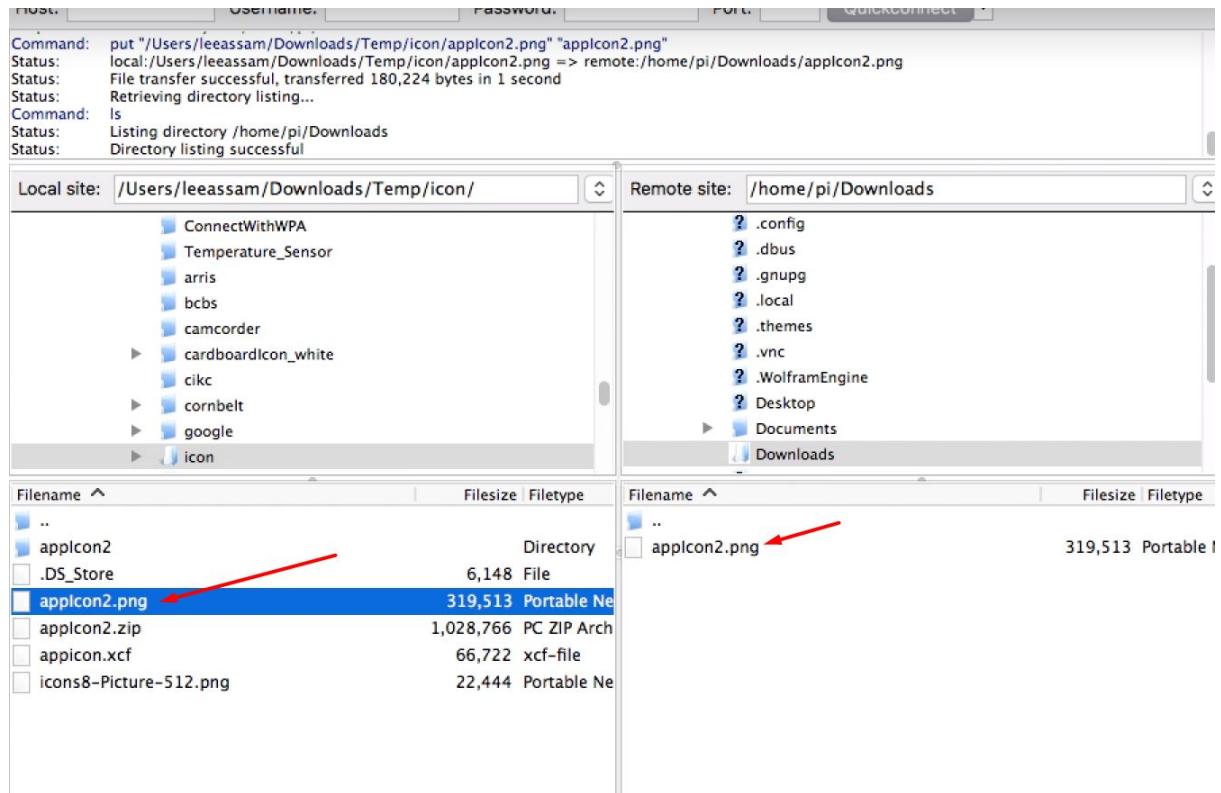
- 2) File=> Site Manager=> New Site=> Rename to Raspberry PI
- 3) Host=> Raspberry PI IP Address
- 4) Protocol=> SFTP
- 5) Logon Type=> Normal
- 6) User=> pi
- 7) Password=> password set for the account
- 8) Connect



9) Check the box and press okay

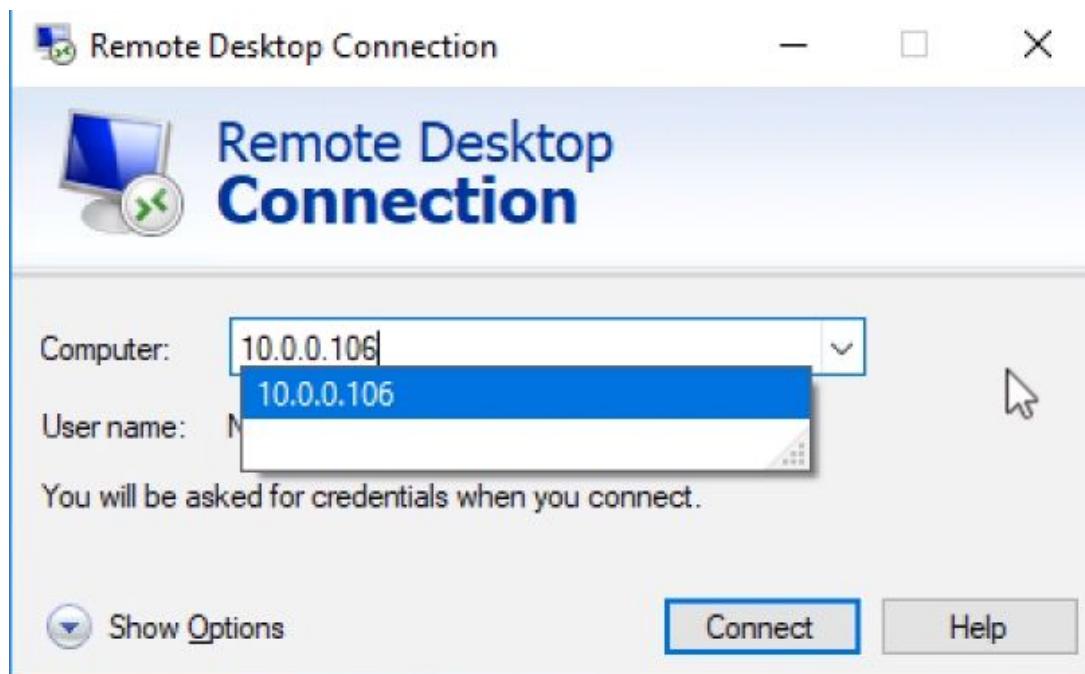


- 10) Now you can double click in one file from the LEFT SIDE and it will go to the right side. So, files are being transferred from the Computer to the Raspberry Pi

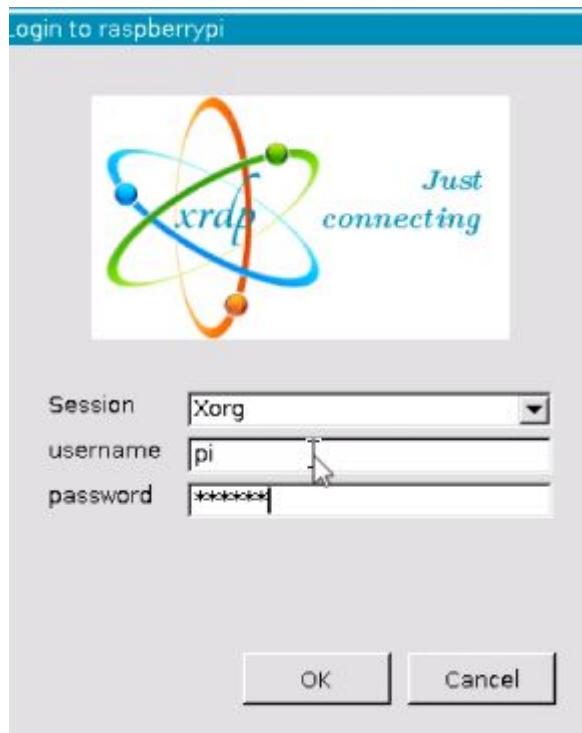


RDP (Remote Desktop Connection)

- 1) Search in the Windows Remote Desktop Connection
- 2) The machine must be connected in the same network as the raspberry PI
- 3) Use the Raspberry PI IP address



- 4) Connect and Yes
- 5) Put the login info



SSDs and Raspberry Pi

Choosing a SSD Card

Avoid SSD card problems by:

- 1) Using genuine SSD cards

- 2) Using a good quality power supply
- 3) Using a good quality USB cable
- 4) BEFORE SHUTTING DOWN YOUR RASPBERRY PI=> TYPE **sudo halt**
- 5) Overclocking is BAD

https://elinux.org/RPi_SD_cards

SSD Card Physical Size

Model	Size
Raspberry Pi Model A Raspberry Pi Model B	 Full-Size SD Card
Raspberry Pi Model A+ Raspberry Pi Model B+ Raspberry Pi 2 Model B Raspberry Pi Zero Raspberry Pi 3 Model B	 Micro SD Card

SSD Card Sizes

Recommendation: 16 GB

OS SD card size requirements

OS Distribution	Size
 NOOBS	 RASPBIAN 8GB Recommended
 UBUNTU MATE	 WINDOWS 10 IOT CORE
 RASPBIAN Lite	4GB
 OSMC	 LIBREELEC < 1 GB

SSD Card Class or Speed

- 1) Recommendation: Class 10
- 2) The number of the class equals the Writing Speed. Example: Class 4: 4 Mb/s
- 3) The higher the writing speed, the lower the reading speed and then slower performance.

Keyboard Commands

Up and down=> go back and forth through the commands you typed before

Tab=> Autocomplete

CTRL+C=>Stop a ongoing process

Basic Coding (Files, Folder, Configuration)

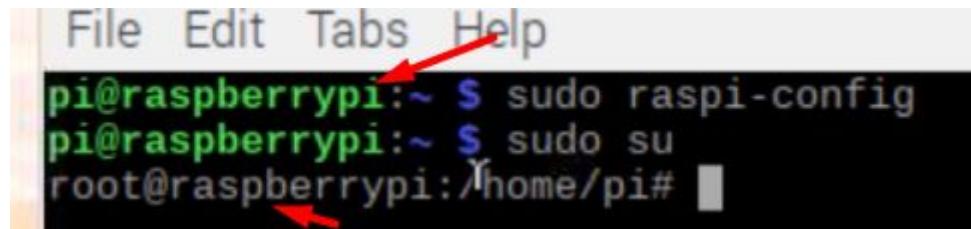
Super User

sudo=> runs a command as a super user (user with advanced privileges)

Type before each command: **sudo**

Or type to change to Super User: **sudo su**

Super user is names as root@raspberrypi and not pi@raspberrypi



A screenshot of a terminal window. The title bar says "File Edit Tabs Help". The main area shows a Super User session:

```
pi@raspberrypi:~ $ sudo raspi-config
pi@raspberrypi:~ $ sudo su
root@raspberrypi:/home/pi#
```

Two red arrows point to the text "pi@raspberrypi:" in the first line and "root@raspberrypi:" in the second line.

Go back to Normal User

exit

Checking Raspberry PI Configuration (Must be in super user)

raspi-config

Check the date

date

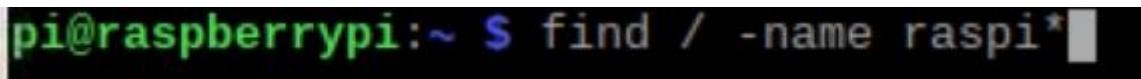
Locate a File

find /FOLDER -name NAME OF THE FILE

The folder is where you want to start looking for the file

You can use * to look for anything after or before the name

Example:



```
pi@raspberrypi:~ $ find / -name raspi*
```

Find in the root folder the file that starts with the name raspi

Create or Open a File

nano NAME OF THE FILE.EXTENSION

Example: **nano test.txt**

Create a file in blank

touch new.txt

Delete a file

`rm new.txt`

Files in the Folder and When Lastly Modified

`ls -l`

Go to another folder

`cd NAME OF THE FOLDER`

`cd Downloads`

Go back to the previous level: `cd ..`

Go to Home: `cd ~`

Create a folder or directory

`mkdir NAME OF THE FOLDER`

`mkdir new_folder`

Remove a folder

`rm -rf new_folder/`

Moving Files

`mv NAME OF THE FILE NAME OF THE DIRECTORY/`

`mv test.txt new_folder/`

Copying Files

`cp NAME OF THE FILE NAME OF THE COPY`

Example: `cp test.txt test2.txt`

This example would create another text file with the name test2

Shutdown Raspberry PI

Shutdown now: `shutdown -h now`

Shutdown 1:30AM: `shutdown -h 01:30`

Network Coding

IP Address

`hostname -I`

Network Configuration

`ifconfig`

Wireless Configuration

`iwconfig`

Check if the machine is running in the Network

`ping IP_ADDRESS` (It doesn't need to be from the Raspberry PI)

`ping 10.0.0.102`

TO STOP THE PROCESS PRESS `CTRL+C`

OR

`ping HOSTNAME` (It doesn't need to be from the Raspberry PI)

Getting a File from the Internet

`wget URL LINK`

```
pi@raspberrypi:~/Downloads $ wget https://www.raspberrypi.org/app/themes/mind-control/images/home-products-cta__image.png
```

System Commands Coding

Check Memory

`cat /proc/meminfo`

Check SSD Card Utilization

`df -h`

Or

`df /`

Check All Packages that were installed

`dpkg --get-selections`

Check if a Specific Package was installed

`dpkg --get-selections | grep NAME OF THE PACKAGE`

Example: `dpkg --get-selections | grep python`

Installing a Software in Raspberry

Update packages

`sudo apt-get update`

AND

`sudo apt-get upgrade`

OR

`sudo apt-get dist-upgrade`

Install Software

`sudo apt-get install NAME OF THE PACKAGE`

Example: `sudo apt-get install ssh`

Remove Package or Software (Use all the commands below)

`sudo apt-get remove NAME OF THE PACKAGE`

`sudo apt-get purge NAME OF THE PACKAGE`

Example: `sudo apt-get remove ssh`

`sudo apt-get purge ssh`

`sudo apt autoremove`

`sudo apt-get clean`

Fix Broken Dependencies

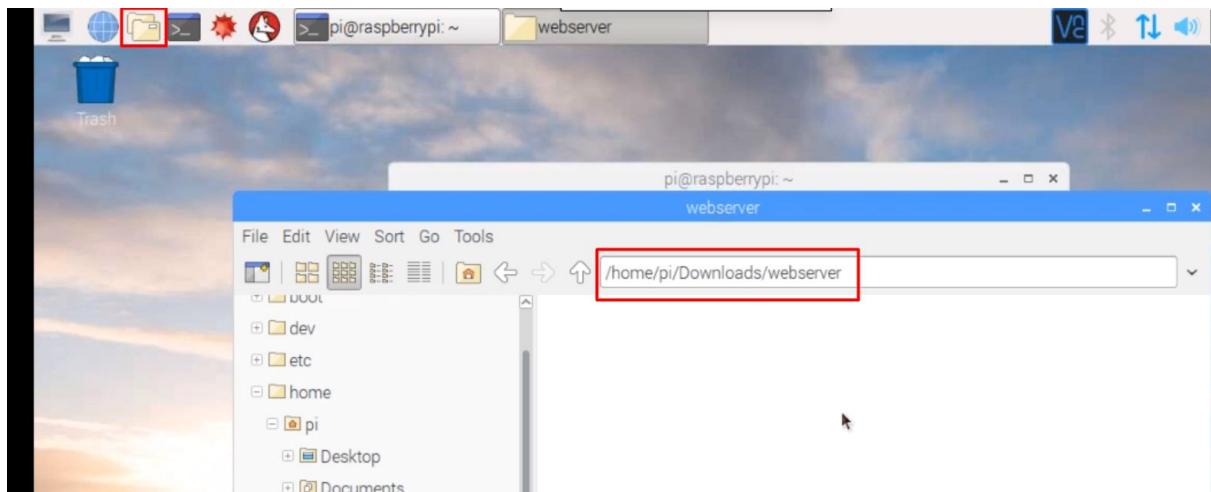
`sudo apt-get -f install`

Free up Space from downloads

`sudo apt-get clean`

Creating a Web Server

- 1) Create a folder:



- 2) Go to the terminal and find the folder:

```
cd ~  
cd NEW FOLDER
```

- 3) Create a html file:

```
nano index.html
```

- 4) Type something or just exit the file (Press Y)

- 5) Run the server:

```
python -m SimpleHTTPServer
```

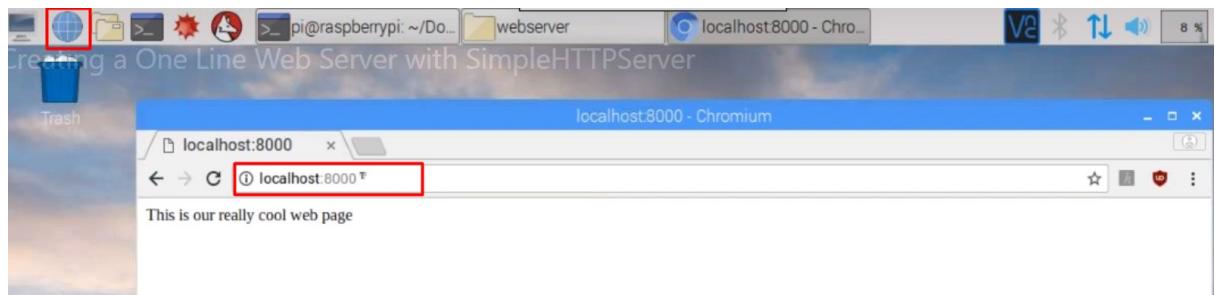
COPY THE PORT NUMBER

```
pi@raspberrypi:~/Downloads/webserver $ python -m SimpleHTTPServer  
Serving HTTP on 0.0.0.0 port 8000 ...
```

- 6) Open the browser and type:

localhost:PORT NUMBER

Example: localhost:8000



- 7) Any device that is connected to this network can access the page. So, type the:
IP Address:Port Number
Example: **10.0.0.117:8000**
- 8) If you want to stop the server from running press **CTRL+C**

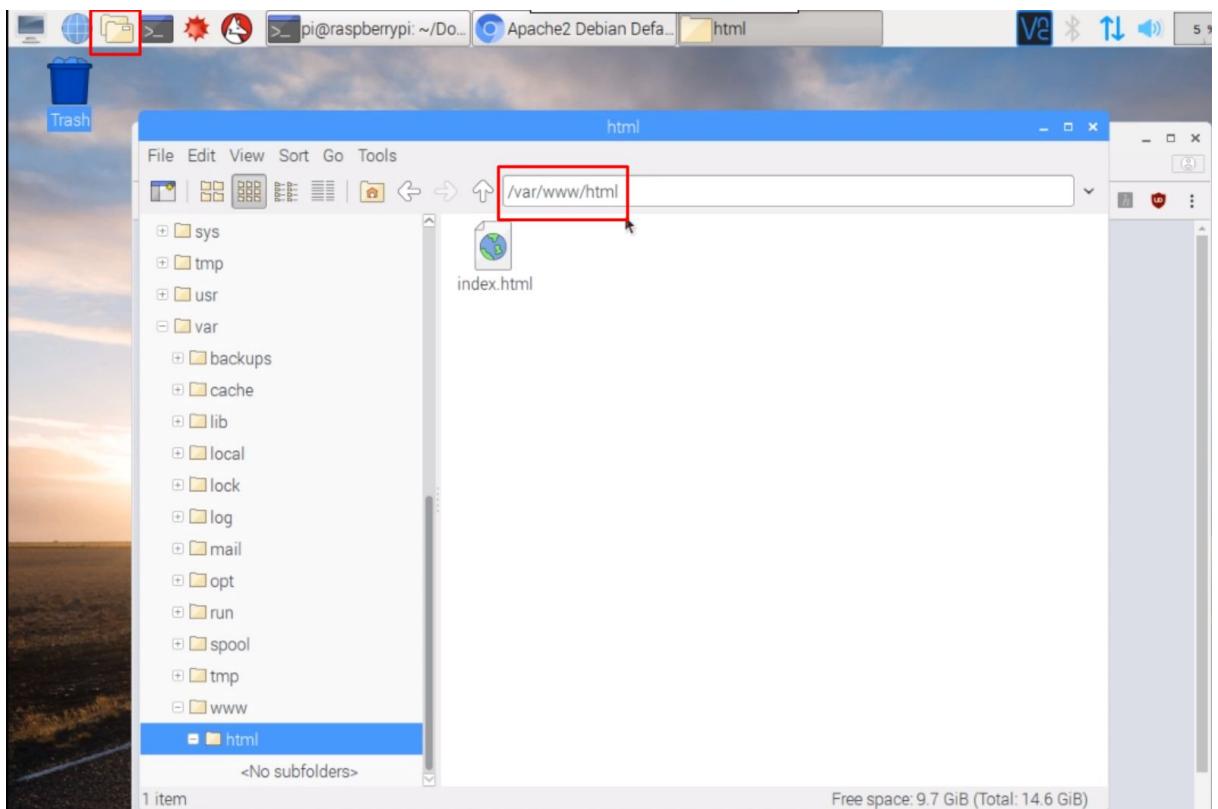
Creating a Apache Web Server

- 1) Install Apache:
`sudo apt-get install apache2 - y`
- 2) The Apache Web Server Root is placed in:
`var/www/html`

You can also go to the folder in the Terminal:

`cd /var/www/html`

JUST THE ROOT (SUDO) USER CAN CHANGE THIS FILE



- 3) To create a file (**IT MUST BE IN THE ROOT LOCATION: var/www/html**):

```
sudo leafpad NAMEOFTHEFILE.html
```

Example: **sudo leafpad hello.html**

- 4) Open the browser and type:

```
localhost/NAMEOFTHEFILE.html
```

Example: **localhost/hello.html**

- 5) Any device that is connected to this network can access the page. So, type the:

```
IP Address/NAMEOFTHEFILE.html
```

Example: **10.0.0.117/hello.html**

Creating a PHP Application

- 6) Install PHP:

```
sudo apt-get install php libapache2-mod-php -y
```

- 7) Restart Apache

```
sudo apachectl restart
```

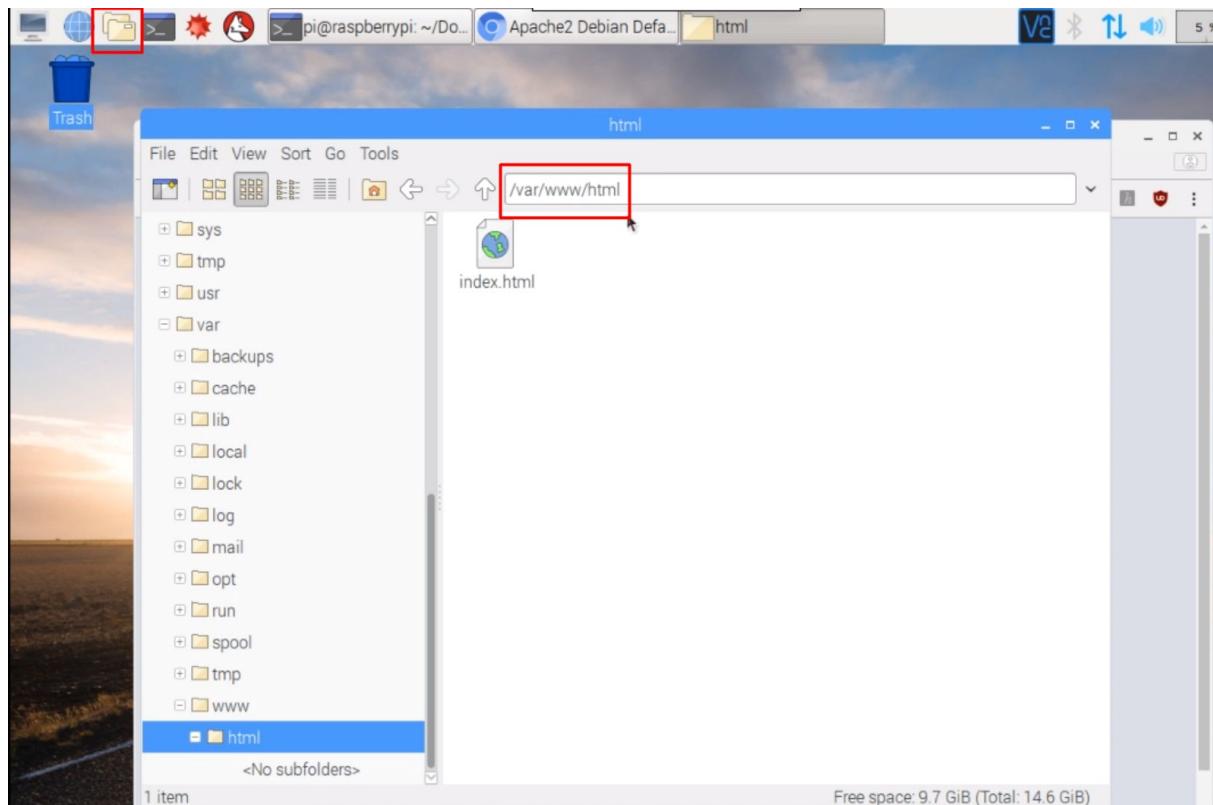
- 8) The Apache Web Server Root is placed in:

```
var/www/html
```

You can also go to the folder in the Terminal:

```
cd /var/www/html
```

JUST THE ROOT (SUNDO) USER CAN CHANGE THIS FILE



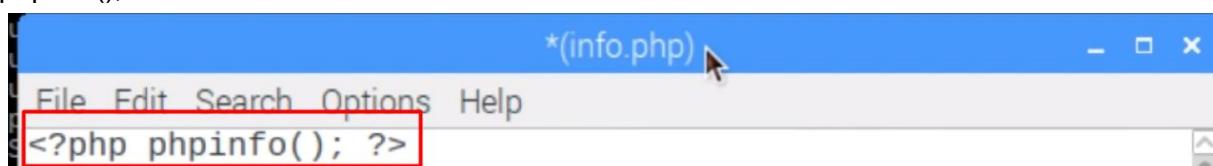
9) To create a file (**IT MUST BE IN THE ROOT LOCATION: var/www/html**):

```
sudo leafpad NAMEOFTHEFILE.php
```

Example: **sudo leafpad info.php**

10) Type (<? php indicates a php block and phpinfo get the information php is going to display):

```
<?php phpinfo(); ?>
```



11) Save and close

12) Open the browser and type:

```
localhost/NAMEOFTHEFILE.php
```

Example: **localhost/info.php**

13) Any device that is connected to this network can access the page. So, type the:

```
IP Address/NAMEOFTHEFILE.php
```

Example: **10.0.0.117/info.php**

Raspberry PI pins



Raspberry Pi 3 GPIO Header		
Pin#	NAME	NAME
01	3.3v DC Power	02
03	GPIO02 (SDA1 , I ² C)	DC Power 5v
05	GPIO03 (SCL1 , I ² C)	04
07	GPIO04 (GPIO_GCLK)	Ground
09	Ground	06
11	GPIO17 (GPIO_GEN0)	(TXD0) GPIO14
13	GPIO27 (GPIO_GEN2)	(RXD0) GPIO15
15	GPIO22 (GPIO_GEN3)	10
17	3.3v DC Power	(GPIO_GEN1) GPIO18
19	GPIO10 (SPI_MOSI)	12
21	GPIO09 (SPI_MISO)	Ground
23	GPIO11 (SPI_CLK)	(GPIO_GEN4) GPIO23
25	Ground	14
27	ID_SD (I ² C ID EEPROM)	(GPIO_GEN5) GPIO24
29	GPIO05	Ground
31	GPIO06	20
33	GPIO13	(GPIO_GEN6) GPIO25
35	GPIO19	22
37	GPIO26	(SPI_CE0_N) GPIO08
39	Ground	(SPI_CE1_N) GPIO07
		(I ² C ID EEPROM) ID_SC
		28
		Ground
		30
		GPIO12
		Ground
		32
		34
		GPIO16
		36
		GPIO20
		38
		GPIO21
		40

Acronyms for the Pins

No analog Pins, so in order to process analog readings, an external analog to digital converter must be used.

GPIO=> General Purpose Input Output Pins (operates with 3.3V)

SDA=> Serial Sata

SCL=> Serial Clock

MOSI=> Master of Slave In

MISO=> Master of Slave Out

Reducing Damage to the Board

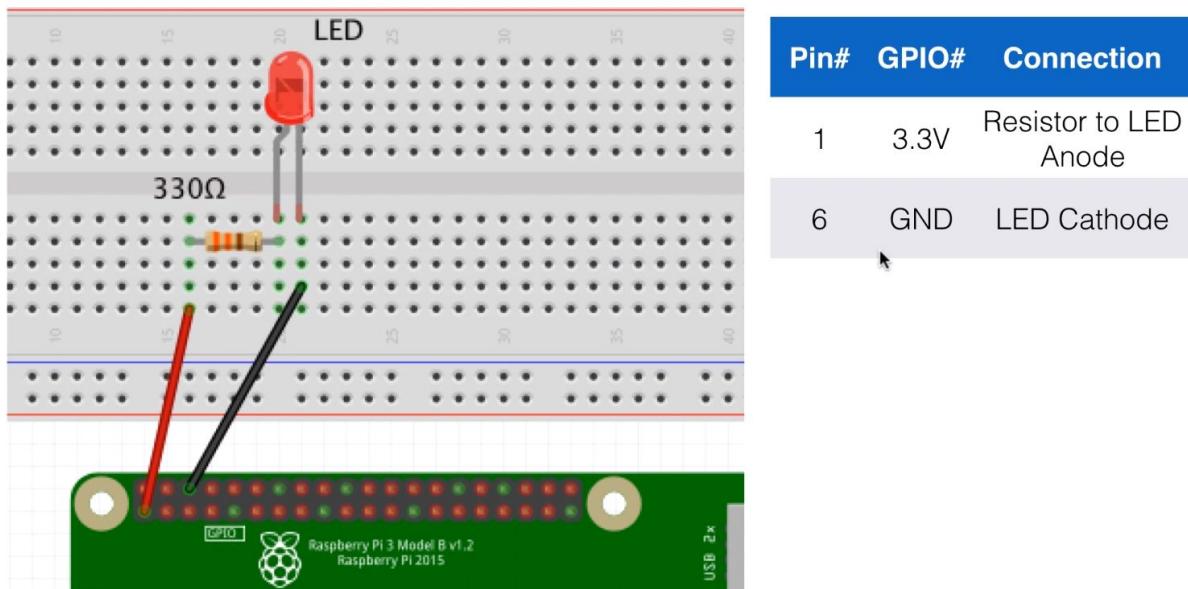
Tips for reducing the risk of damage to your Raspberry Pi

- Ensure your Pi is powered off when connecting circuitry
- Do not put more than 3.3 V on any GPIO pin
- Do not draw more than 3 mA per output.
- Do not poke at the GPIO connector with a screwdriver or metal object when the Pi is powered on
- Do not power the Pi with more than 5V
- Do not draw more than a total of 50 mA from the 3.3 V supply pins
- Do not draw more than a total of 250 mA from the 5V supply pins

Completed Projects

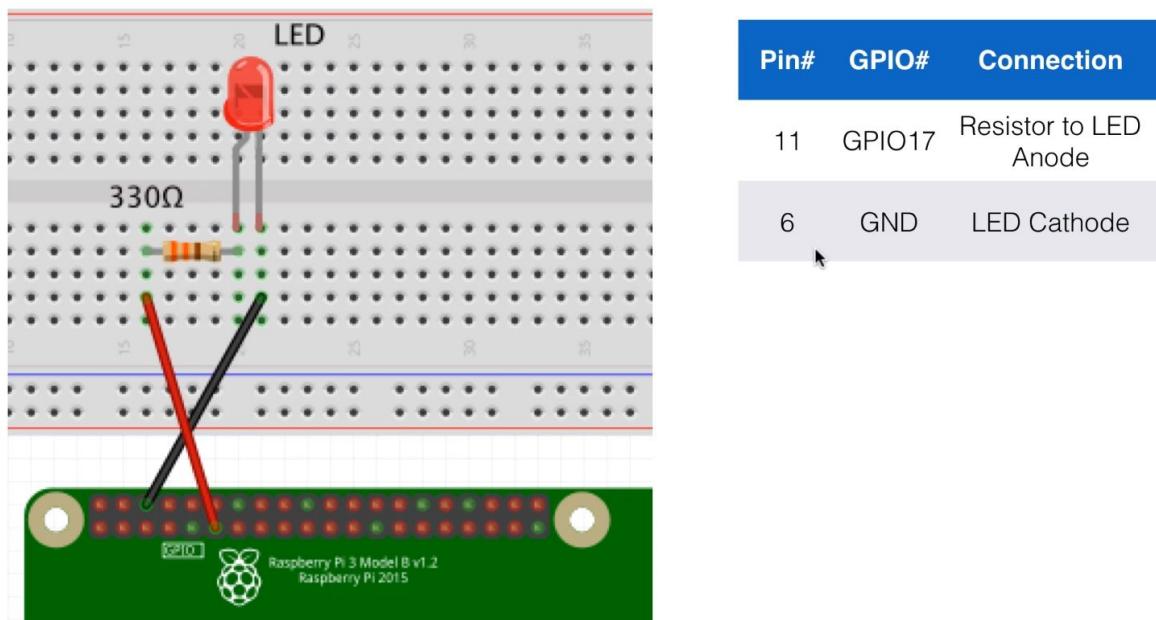
LED connection

Power an LED

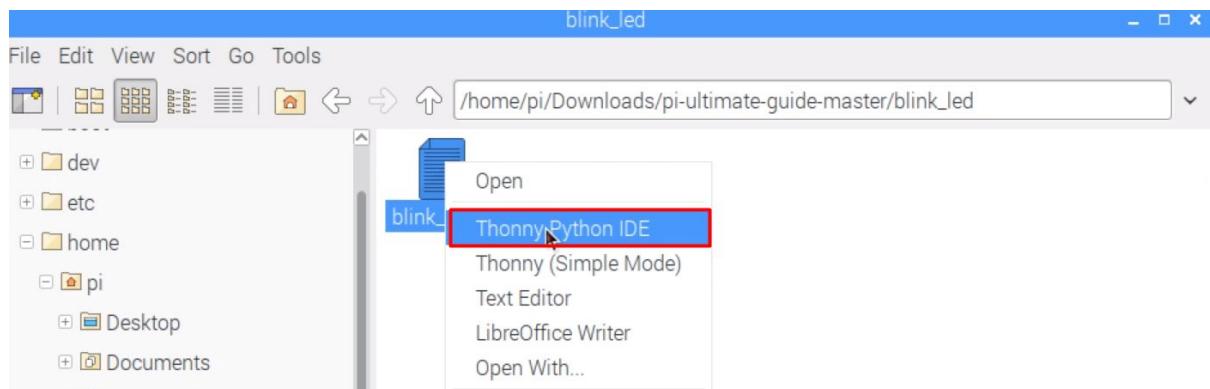


LED Blinking Connection

Blink an LED



14) Open the Program by selecting Thonny Python IDE:



15) Code:

```
import RPi.GPIO as GPIO #Use GPIO library
import time #Use time library

GPIO.setwarnings(False) #Disable any warnings that may appear

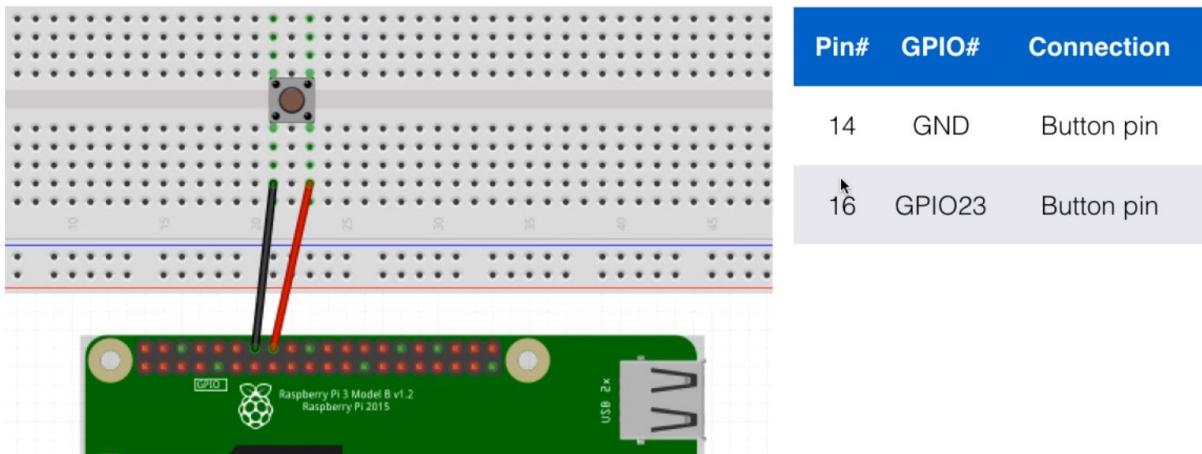
ledPin = 11 # pin11 is connected to the led anode (+ve pin)
GPIO.setmode(GPIO.BOARD) # Numbers GPIOs by physical location
GPIO.setup(ledPin, GPIO.OUT) # Set ledPin's mode as output
GPIO.output(ledPin, GPIO.HIGH) # Set ledPin high(+3.3V) to turn on led

while True: # Continue looping indefinitely
    GPIO.output(ledPin, GPIO.HIGH) # Turn led on
    time.sleep(1) # Pause for 1 second
    GPIO.output(ledPin, GPIO.LOW) # Turn led off
    time.sleep(1) # Pause for 1 second

GPIO.cleanup(); #Clean up when exiting the program
```

Push Button Connection

Detecting a button press



Code:

```
import RPi.GPIO as GPIO #Use GPIO library
import time #Use time library

buttonPin = 16 # pin 16 is connected to the button - other button pin is connected to GND -
pin 14
GPIO.setmode(GPIO.BOARD) # Numbers GPIOs by physical location

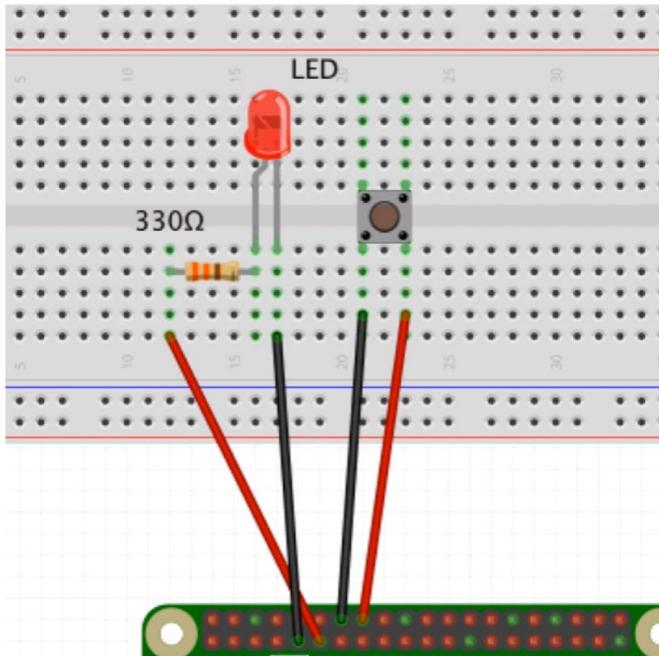
GPIO.setup(buttonPin, GPIO.IN, pull_up_down=GPIO.PUD_UP) #Set buttonPin as input
and enable pullup resistor. This pullup resistor avoids short circuit when the button is
pressed by using an internal pullup resistor in Raspberry Pi

while True: #Loop indefinitely
    input_state = GPIO.input(buttonPin) #Retrieve the state of the button pin
    if input_state == False: #If reading is LOW, button has been pressed
        print('Button Pressed') #Display button pressed
        time.sleep(0.3) #Wait for 0.3 seconds for debouncing

GPIO.cleanup(); #Clean up when exiting the program
```

LED Blinking and Push Button Connection

Using a button to control an LED



Pin#	GPIO#	Connection
14	GND	Button pin
16	GPIO23	Button pin
11	GPIO17	Resistor to LED Anode
9	GND	LED Cathode

Code:

```
import RPi.GPIO as GPIO #Use GPIO library
import time #Use time library

GPIO.setwarnings(False)

ledPin = 11 # pin11 is connected to the led anode (+ve pin), cathode(-ve pin) connected to
pin9 GND
buttonPin = 16 # pin 16 is connected to the button - other button pin is connected to gnd -
pin 14
GPIO.setmode(GPIO.BOARD) # Numbers GPIOs by physical location

GPIO.setup(ledPin, GPIO.OUT) #set ledPin's mode as output
GPIO.output(ledPin, GPIO.LOW) #initially turn off the led

GPIO.setup(buttonPin, GPIO.IN, pull_up_down=GPIO.PUD_UP) #Set buttonPin as input
and enable pullup resistor

while True: #Loop indefinitely
    GPIO.wait_for_edge(buttonPin, GPIO.FALLING) #Button was pressed (When the button is
not pressed it is HIGH, when it is pressed, it turns into low)
    print('Button Pressed') #Display button pressed
    GPIO.output(ledPin, GPIO.HIGH) # Turn led on
```

```

GPIO.wait_for_edge(buttonPin, GPIO.RISING) #Button was released
GPIO.output(ledPin, GPIO.LOW) # Turn led off

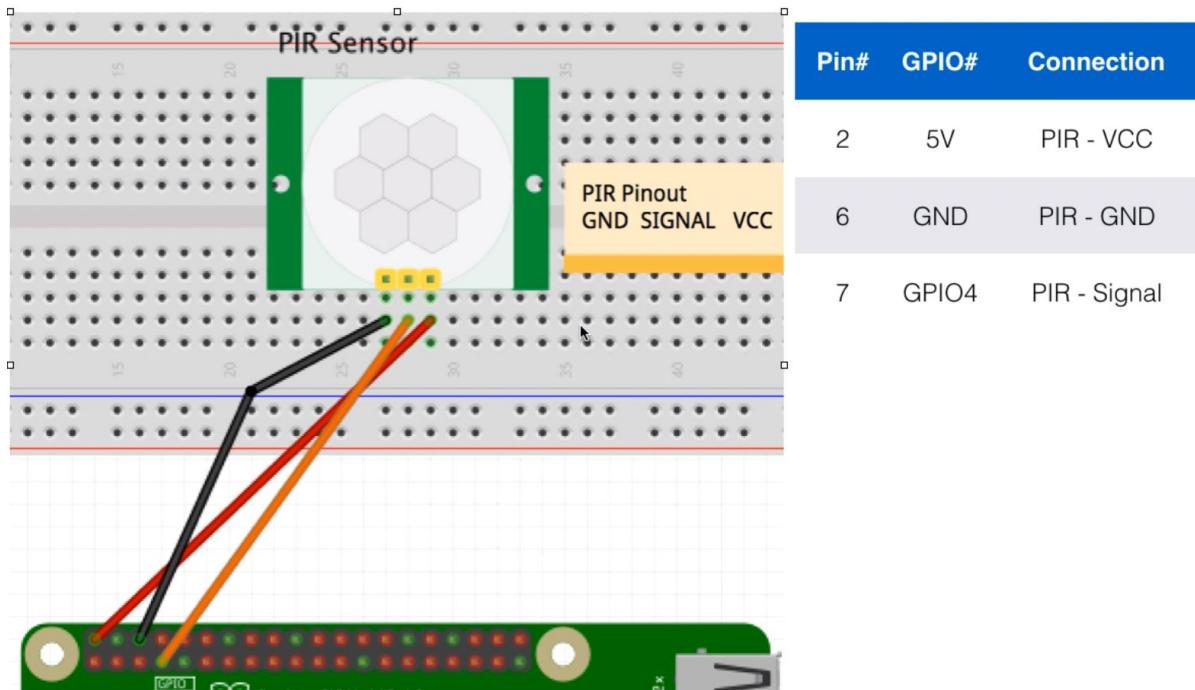
GPIO.cleanup(); #Clean up when exiting the program

```

PIR (Passive Infrared) Sensor

This sensor detects the change in its voltage when a heat body passes through its range, so it can detect movement

PIR sensor



Code:

```

import RPi.GPIO as GPIO #Use GPIO library
import time #Use time library

```

```

pirPin = 7 # pin 7 is connected to output from the PIR motion sensor
GPIO.setmode(GPIO.BOARD) # Numbers GPIOs by physical location
GPIO.setup(pirPin, GPIO.IN) #set the pirPin as an input
count = 0; #number used as a reference to detect motion

```

```

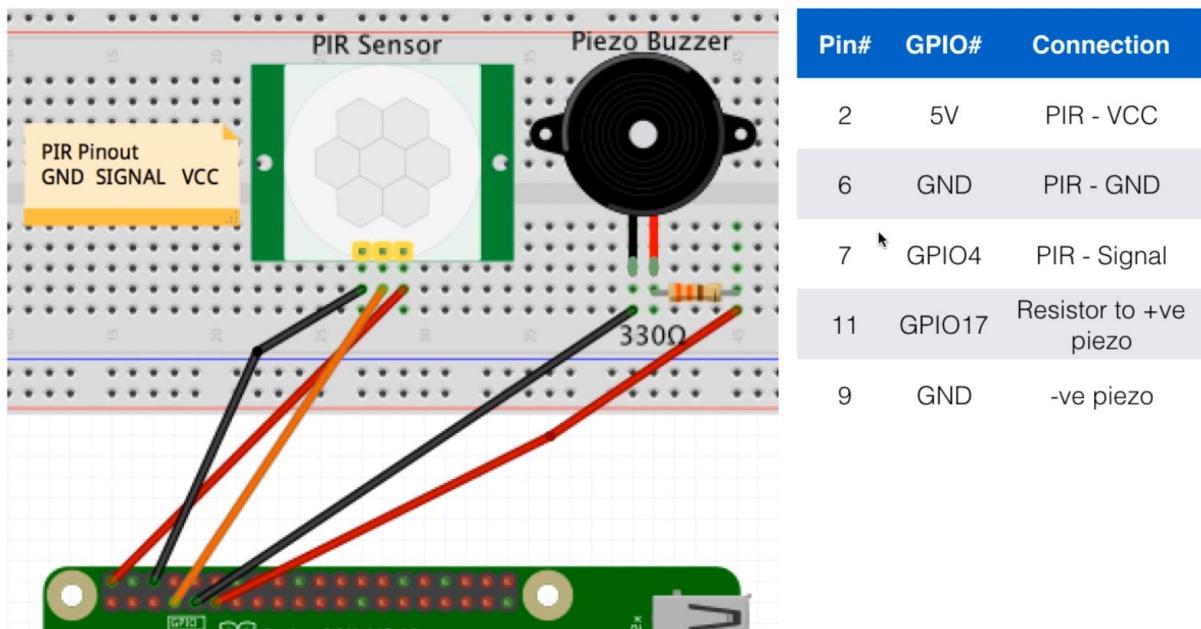
while True: #Loop indefinitely
    input_state = GPIO.input(pirPin) #Retrieve the state of the button pin
    if input_state == True: #If reading is HIGH, there is output from the motion sensor
        print("Motion Detected -- " + str(count)) #Motion was detected
        count+=1 #increment the count
    time.sleep(0.3) #Wait for 0.3 sec

```

```
GPIO.cleanup(); #Clean up when exiting the program
```

PIR (Passive Infrared) Sensor + Alarm

PIR sensor alarm



Code:

```
import RPi.GPIO as GPIO #Use GPIO library
import time #Use time library

pirPin = 7 # pin 7 is connected to output from the PIR motion sensor, 5V to pin 2, GND to pin 6
buzzerPin = 11 # pin 11 is connected to the +ve buzzer pin; -ve connected to pin 9 GND
GPIO.setmode(GPIO.BOARD) # Numbers GPIOs by physical location

GPIO.setup(pirPin, GPIO.IN); #set the pirPin as input
GPIO.setup(buzzerPin, GPIO.OUT); #set the buzzer pin as output
GPIO.output(buzzerPin, GPIO.LOW) #initially turn off the buzzer

#define alarm events
def soundAlarm(pirPin):
    #sound alarm (for 2 seconds )
    print("Sound Alarm")
    GPIO.output(buzzerPin, GPIO.HIGH) # Turn buzzer on
    time.sleep(2) # Pause for 2 seconds
    turnOffAlarm() # Turn buzzer off

def turnOffAlarm():
```

```

#turn off alarm
GPIO.output(buzzerPin, GPIO.LOW) # Turn buzzer off

#adding a callback function when the pir sensor output rises when motion is detected
GPIO.add_event_detect(pirPin, GPIO.RISING, callback=soundAlarm);

#try catch block to perform GPIO cleanup
try:
    while True:
        pass
except KeyboardInterrupt:
    print("You ended the program")
finally:
    #clean up the GPIO pins
    GPIO.cleanup()

```

Camera with Motion Package (Just put in the Web Browser)

- 1) It is easier to get a camera with USB connection
- 2) IF YOU HAVE THE ANY OTHER CAMERA PACKAGE INSTALLED, YOU HAVE TO UNINSTALL IT (Go to this part - [link](#))
- 3) Go to the Raspberry PI terminal and install the webcam package by typing:
sudo apt-get install motion
- 4) Type: **y**
- 5) Check if the camera is shown as connected:
lsusb

```

pi@raspberrypi:~ $ lsusb
Bus 001 Device 005: ID 046d:c52b Logitech, Inc. Unifying Receiver
Bus 001 Device 004: ID 046d:082d Logitech, Inc. HD Pro Webcam C920
Bus 001 Device 003: ID 0424:ec00 Standard Microsystems Corp. SMSC9512/9514 Fast
Ethernet Adapter
Bus 001 Device 002: ID 0424:9514 Standard Microsystems Corp. SMC9514 Hub
Bus 001 Device 001: ID 1d6b:0002 Linux Foundation 2.0 root hub

```

- 6) **sudo nano / etc/motion//motion.config**
- 7) **CTRL+W**
- 8) Search for: **daemon**
- 9) Change from OFF to ON

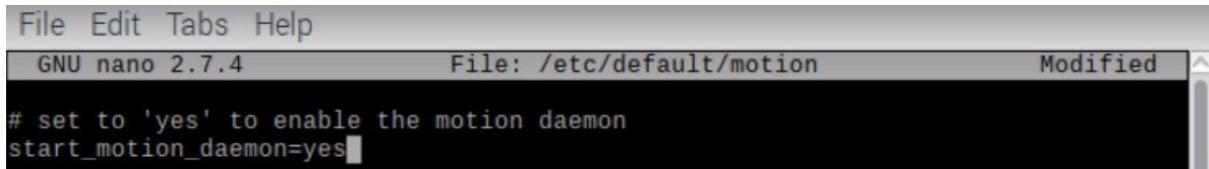
```

# Daemon
#####
# Start in daemon (background) mode and release terminal (default: off)
daemon on

```

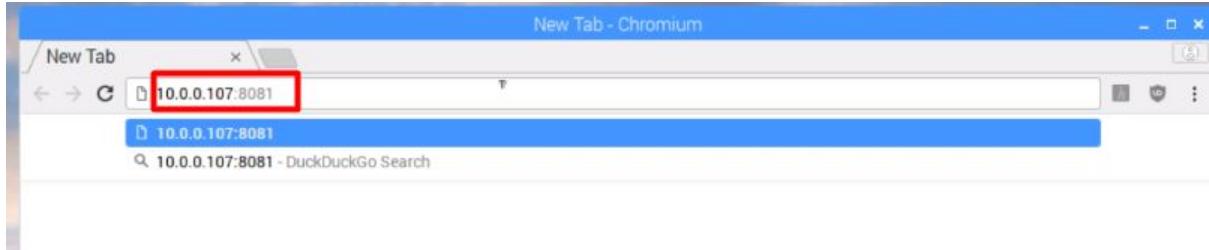
- 10) **CTRL+W**
- 11) Search for: **localhost**
- 12) Change from ON to OFF
- 13) **CTRL+W**
- 14) Search for: **webcontrol_localhost**

- 15) Change from ON to OFF
- 16) **CTRL+X**
- 17) **Y**
- 18) Enter
- 19) **sudo nano / etc/default/motion**
- 20) Change from NO to YES



```
File Edit Tabs Help
GNU nano 2.7.4          File: /etc/default/motion          Modified
# set to 'yes' to enable the motion daemon
start_motion_daemon=yes
```

- 21) **CTRL+X**
- 22) **Y**
- 23) Enter
- 24) **sudo service motion start**
- 25) If you want to stop the program: **sudo service motion stop**
- 26) Open Chromium in the Raspberry Pi
- 27) Get the Network IP Address
- 28) Type in the browser:
IP Address:8081
Example: **10.0.0.107:8081**
Since the camera is connected to the Raspberry PI, you can also use: **localhost:8081**



29) s

Camera with FSwebcam Package (Allows you to Take Pics and Record Video)

- 1) It is easier to get a camera with USB connection
- 2) IF YOU HAVE THE OTHER CAMERA PACKAGE INSTALLED (MOTION), YOU HAVE TO UNINSTALL IT (Go to this part - [link](#), typing MOTION at the end)
- 3) Create a folder:
mkdir ~/Downloads/photos/
- 4) **cd ~/Downloads/photos/**
- 5) Go to the Raspberry PI terminal and install the webcam package by typing:
sudo apt-get install fswebcam
- 6) Choosing the image resolution:
fswebcam -r 1280x720
- 7) Take a photo with the webcam:
fswebcam image.jpg

- 8) You can change the resolution and take a picture
`fswebcam -r 1280x720 image2.jpg`
- 9) Removing the banner of the image:
`fswebcam -r 1280x720 --no banner image3.jpg`

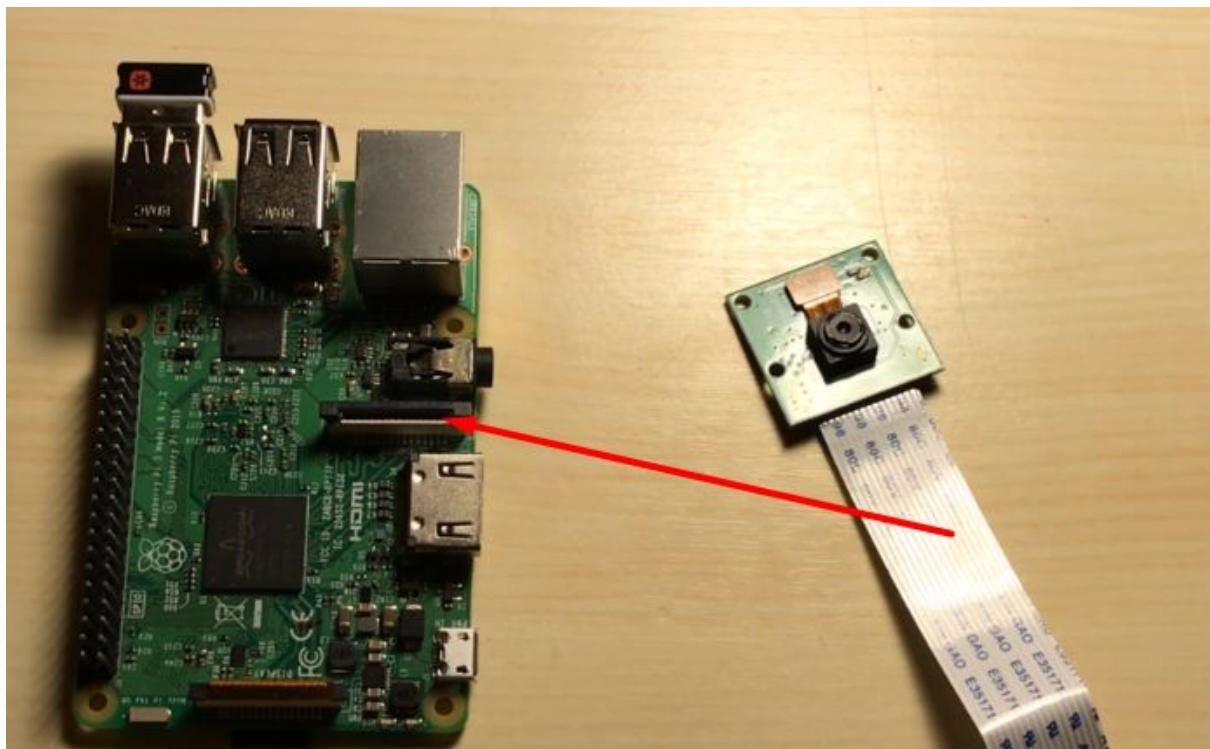
Script to Take Pictures

<https://www.udemy.com/course/pi-ultimate-guide/learn/lecture/9385984#questions>

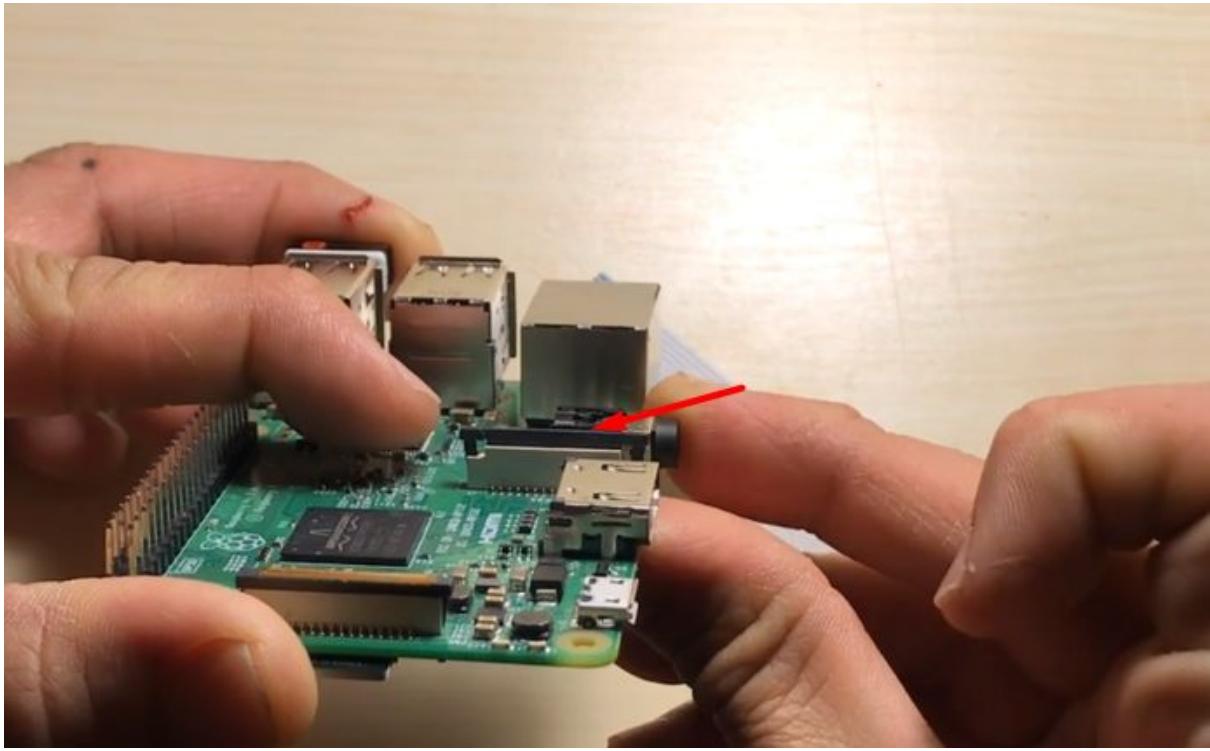
Camera Module

The Camera Module is specific for Raspberry PI

- 1) The camera module goes to that section



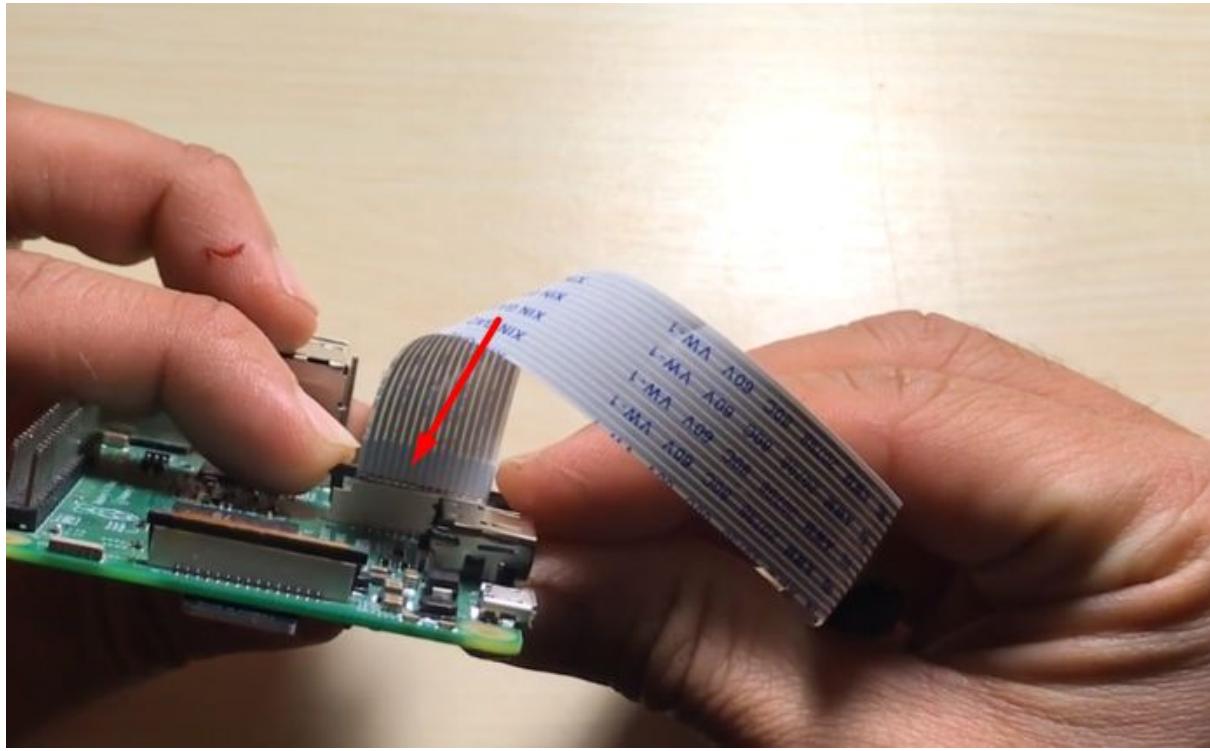
- 2) Lift the black compartment



3) Put the tape there:



4) Push the black part down:



Adjusting the Brightness

```
camera.brightness = 70
```

Put Text in the Image

```
camera.annotate_text = "Brightness: %s" % i
```

Resolution

```
camera.resolution = (2592, 1944)
```

Frame Rate

```
camera.framerate = 15
```

Camera Effects

```
from picamera import PiCamera
from time import sleep

camera = PiCamera()

camera.start_preview()
for effect in camera.IMAGE_EFFECTS:
    camera.image_effect = effect
```

```
camera.annotate_text = "Effect: %s" % effect
sleep(5)
camera.stop_preview()
```

Showing a Live Video

```
from picamera import PiCamera
from time import sleep

camera = PiCamera()

camera.start_preview()
sleep(10) # Live for 10 seconds
camera.stop_preview()
```

Capture an Image

```
from picamera import PiCamera
from time import sleep

camera = PiCamera()

camera.start_preview()
sleep(5)
camera.capture('/home/pi/Downloads/photos/image.jpg')
camera.stop_preview()
```

Capture Multiple Images

```
from picamera import PiCamera
from time import sleep

camera = PiCamera()

camera.start_preview()
for i in range(5):
    sleep(5)
    camera.capture('/home/pi/Downloads/photos/image%s.jpg' % i)
camera.stop_preview()
```

Record a Video

- 1) Code:
from picamera import PiCamera

```

from time import sleep

camera = PiCamera()

camera.start_preview()
camera.start_recording('/home/pi/Downloads/photos/video.h264')
sleep(10)
camera.stop_recording()
camera.stop_preview()

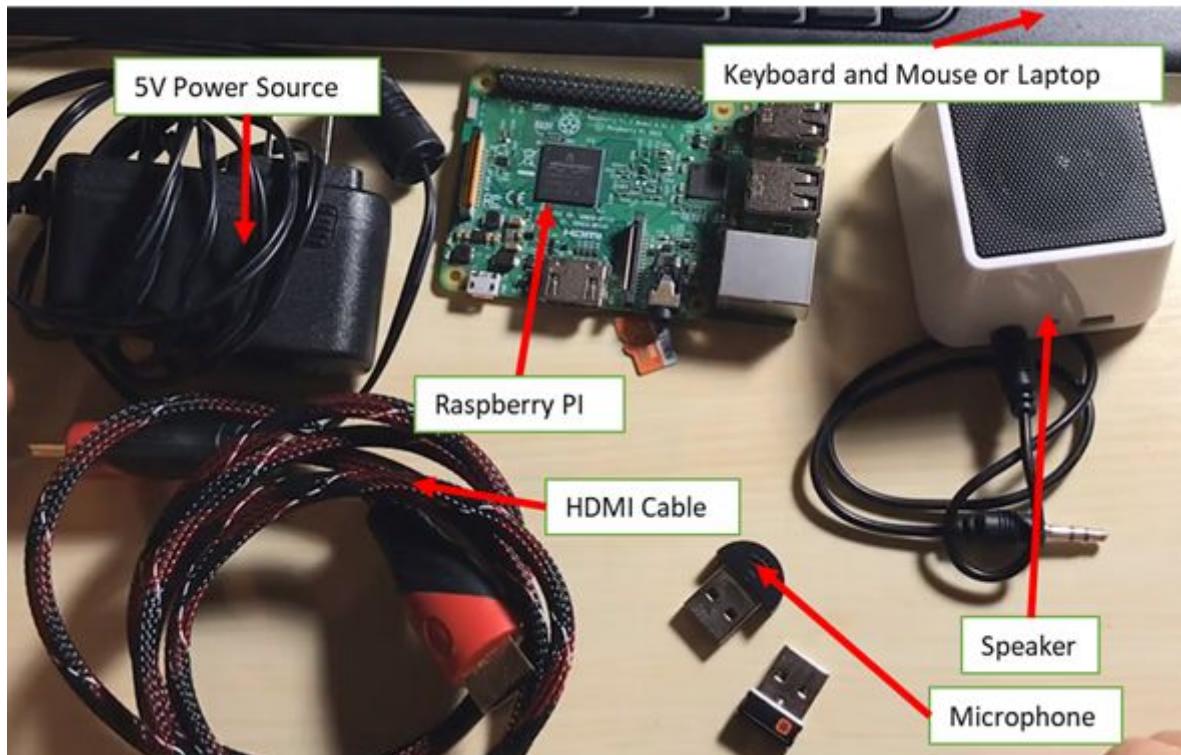
#view image
#omxplayer video.h264

```

- 2) Play the Video using OMXPLAYER. Type in the terminal:
omxplayer ~PATH/NAMEOFTHEFILE
Example: **omxplayer ~ /Downloads/photos/video.h264**
- 3) s

Amazon Alexa with Raspberry PI

- 1) Material:



- 2) Go to the website: developer.amazon.com
- 3) Log in
- 4) Go dashboard=> Alexa Voice Service

The screenshot shows the Amazon Developer Dashboard with the 'Dashboard' tab selected. In the Alexa section, there is a red box around the 'Alexa Skills Kit' link. Below it, another red box surrounds the 'Alexa Voice Service' link, which is highlighted with a yellow background.

For developers with live apps in the Japanese marketplace. On October 1, 2019, the consumption tax rate will increase from 8% to 10% for content sold to customers living in Japan. Please find more details [here](#).

amazon alexa

Build for voice with Alexa, Amazon's voice service and the brain behind the Amazon Echo

Alexa Skills Kit
A collection of self-service APIs, tools, documentation, and code samples that make it fast and easy for anyone to add skills to Alexa

Alexa Voice Service
Create or manage your Alexa enabled devices

amazon appstore

Build Android apps and games for Amazon Fire TV, Fire tablet, and Amazon's mobile app store

App List
View complete list of all your Apps

Reports
View how your app is performing and download reports

[Add a New App](#) ▾

amazon dash

Dash Replenishment Console; manage existing devices and set new devices

Device List
View complete list of all your devices

App Settings
View and update your Dash Replenishment app settings

[Create a Device](#)

5) Products

6) Add new products

7) Fill up the fields below:

Product name * ⓘ

PI_Echo

Product ID * ⓘ

PI_Echo

Please select your product type. * ⓘ

Application with Alexa built-in

A standalone app. This includes apps on the web, Android, Kindle, iOS, FireTV, AppleTV, etc.

Device with Alexa built-in

Physical product with the potential to have buttons, knobs, a touch screen, etc. Examples are speakers, headsets, televisions, set top boxes, appliances, etc. Includes Alexa Mobile Accessories.

Alexa Gadget

An accessory that connects to a compatible Echo device via Bluetooth. For example, an animatronic that moves a motor in response to sound, or lights up if a notification arrives. [Learn More](#)

Will your device use a companion app? * ⓘ

Yes

No

Product category *

Computing

Brief product description * [?](#)

Raspberry PI test Alexa Device



How will end users interact with your product? *

Touch-initiated

A user's primary way to interact with Alexa is by tapping or holding a button.

Hands-free

Hands-free products allow users to interact with Alexa by using their voice at a close distance.

Far-field

Far-field products allow users to interact with Alexa by using their voice from a long distance.

Upload an image

This image is shown to end users on the [Manage your Content and Devices](#) page.



Do you intend to distribute this product commercially? *

Yes

No

Far-field products allow users to interact with Alexa by using their voice from a long distance.

Upload an image

This image is shown to end users on the [Manage your Content and Devices](#) page.



Do you intend to distribute this product commercially? *

Yes

No

Will your device be used for [Alexa for Business](#) ? *

Yes

No

Is this a children's product or is it otherwise directed to children younger than 13 years old? * [Learn More](#)

Yes

No

NEXT

8) NEXT

9) Create a New profile:

LWA Security Profile

A Login with Amazon security profile is required. It associates Amazon data, including security credentials, with one or more products. [Learn More](#)

Select a Security Profile Security Profile *

A security profile associates user data and security credentials with one or more related products. Please do not use the following words 'Alexa', 'Amazon', 'AWS' and 'Amazon Web Services' in the application name. or [CREATE NEW PROFILE](#)

10) Fill the fields below:

LWA Security Profile

A Login with Amazon security profile is required. It associates Amazon data, including security credentials, with one or more products. [Learn More](#)

Select a Security Profile Security Profile *

A security profile associates user data and security credentials with one or more related products. Please do not use the following words 'Alexa', 'Amazon', 'AWS' and 'Amazon Web Services' in the application name. or [CREATE NEW PROFILE](#)

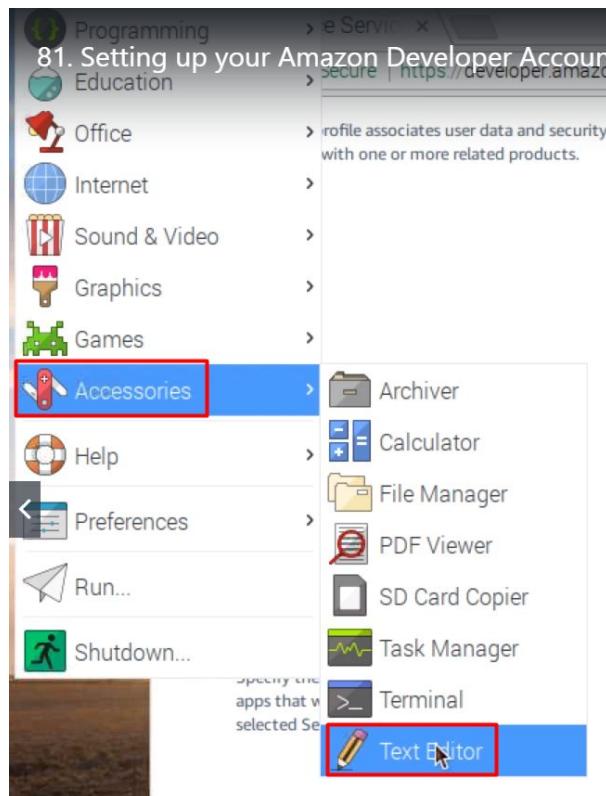
Create a new Security Profile Security Profile Name *

A security profile associates user data and security credentials with one or more related products. Please do not use the following words 'Alexa', 'Amazon', 'AWS' and 'Amazon Web Services' in the application name.

Security Profile Description *

[NEXT](#)

11) Go to the Raspberry Pi Screen=> Accessories=> Text Editor:



12) Copy the information below and paste in the Text Editor:

Select a Security Profile

A security profile associates user data and security credentials with one or more related products. Please do not use the following words 'Alexa', 'Amazon', 'AWS' and 'Amazon Web Services' in the application name.

Security Profile *

PI Echo Profile

Security Profile description

PI Echo Profile

Security Profile ID ⓘ

amzn1.application.2c7ca6f513034db491342b80ca8a1824

COPY

13) Copy the information below and paste in the Text Editor:

Platform information

Web [Android / Kindle](#) [iOS](#) [Other devices and platforms](#)

Specify the settings for the websites or mobile apps that will use Login with Amazon with the selected Security Profile.

Add all possible origin URLs of your LWA implementation to associate with the web Client ID and secret below. [Learn More](#)

Client ID ⓘ

amzn1.application-**oa2-client.1ce5d1609fb440029fbfb1be82a65d1b**

COPY

Client secret ⓘ

a7afe7941cb1e2bb2626d519a476112f9919ac996b156e737e0e6d832cbc228a

COPIED

Allowed origins ⓘ

14) Add in Allowed Origins: **http://localhost:5050**

Allowed origins ⓘ

http://localhost:5050

ADD

15) Add the IP Address of the Raspberry PI (you can check at the top) in the same field:
http://IPADDRESS:5050

Example: **http://192.168.1.89:5050**

Alexa Voice Service - Chromium

wlan0: Associated with ATTutCs9qs
wlan0: Configured 192.168.1.89/24
eth0: Link is down

Secure | https://developer.amazon.com/alexa/console/avs/securityProfile

amzn1.application.ec267c1cf7742adb77ce7590b855737

COPY

Platform information

Web [Android / Kindle](#) [iOS](#) [Other devices and platforms](#)

Specify the settings for the websites or mobile apps that will use Login with Amazon with the selected Security Profile.

Add all possible origin URLs of your LWA implementation to associate with the web Client ID and secret below. [Learn More](#)

Client ID ⓘ

amzn1.application-**oa2-client.1ce5d1609fb440029fbfb1be82a65d1b**

COPY

Client secret ⓘ

a7afe7941cb1e2bb2626d519a476112f9919ac996b156e737e0e6d832cbc228a

COPY

Allowed origins ⓘ

https://www.example.com

ADD

http://localhost:5050

Allowed origins

https://www.example.com

ADD

http://192.168.1.89:5050

http://localhost:5050

X

X

16) Add in the Allowed return URLs: http://localhost:5050/code

17) Add the IP Address of the Raspberry PI (you can check at the top) in the same field:
http://IPADDRESS:5050/code

Example: http://192.168.1.89:5050/code

Allowed return URLs

http://192.168.1.89:5050/code

ADD

18) Go to the Raspberry Terminal and type: sudo apt-get update

19) sudo apt-get dist upgrade

20) sudo apt-get install git

21) sudo pip install CherryPy==17.4.0

22) cd /opt

23) sudo git clone https://github.com/alexa-pi/AlexaPi.git

24) sudo ./AlexaPi/src/scripts/setup.sh

25) Keep hitting ENTER

26) Airplay Support=> Type: n

27) Enter your Device Type ID=> Pi_Echo

28) Security Profile Description=> Code from Step 12

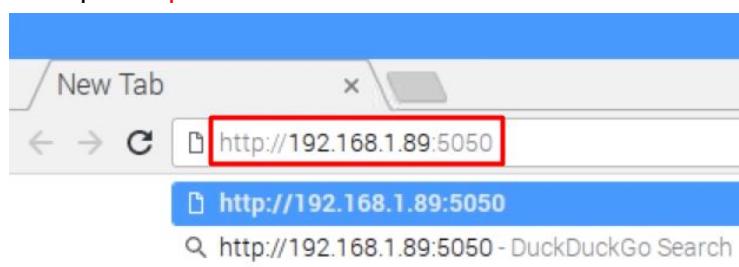
29) Client ID=> Code from Step 13

30) Client Secret=> Code from Step 13

31) Go to the Raspberry Browser:

http://IPADDRESS:5050

Example: http://192.168.1.89:5050



32) Login in your account

33) After the Success Message, close your browser

34) Go back to the terminal and press: CTRL+C

- 35) **sudo systemctl start AlexaPi.service**
- 36) s
- 37)

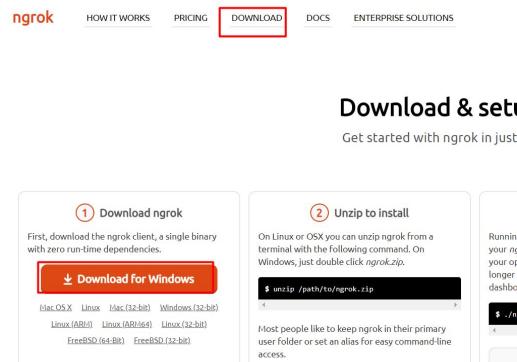
Custom Skill

You need four things: Intents, Utterances, Slots, Dialog and a Skill Handler

- 1) Intent: Fulfill something the user want to do. Example: book a trip
- 2) Utterances: spoken phrases of the user to give orders and execute the intents
- 3) Slot: Values to fulfill the intent. Example: toppings of the pizza
- 4) Dialog: multi-turn conversation
- 5) Skill Handler: code to process the intent

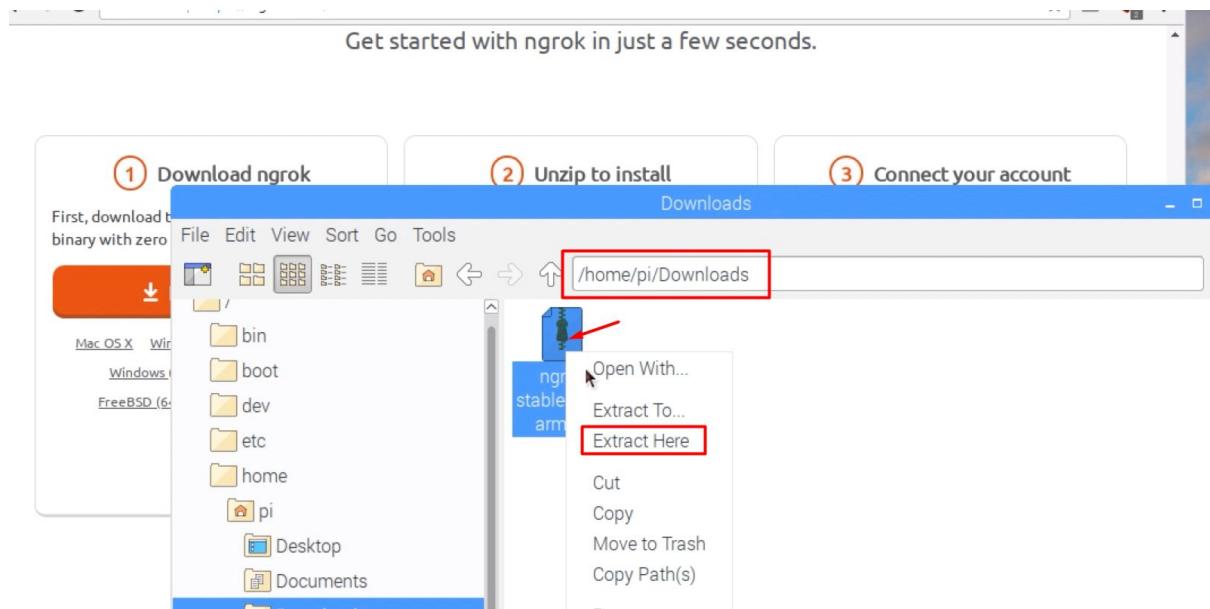
Flash Disk (Library to create Alexa Skills) and Ngrok (Public Availability)

- 1) Update the Raspberry PI: [Click on this link](#)
- 2) Update pip:
`sudo -H pip3 install --upgrade pip`
- 3) `sudo pip3 install flask-ask`
- 4) Go to the Raspberry PI Chromium: [ngrok.com](#)
This website allows to expose a public URL to the Raspberry Pi. This is how the skill is going to be available in Alexa
- 5) Go to download:



The screenshot shows the 'Download & seti' section of the ngrok website. It includes two numbered steps: 1. Download ngrok (with a 'Download for Windows' button highlighted with a red box) and 2. Unzip to install (with a terminal command shown: \$ unzip /path/to/ngrok.zip).

- 6) Go to the folder where you downloaded and click Extract Here



Optional: Get the Code from Git hub

- 7) `cd /Downloads`
- 8) For the Relay: `sudo git clone https://github.com/leeassam/alexa-rpi-skills.git`
- 9) For the TV: `sudo git clone https://github.com/leeassam/alexa-rpi-tv-control.git`

Creating a New Skill

- 1) Go to: <https://developer.amazon.com/dashboard>
- 2) Click in Skills

Project Overview

Hello World Project

- Amazon Developer Portal Skill Setup
 - Intent
 - HelloWorldIntent
 - Slots
 - firstname
 - Utterances
 - say hello
 - say hi to firstname
 - say hello to firstname
- Skill Handler Code
 - hello-world.py
 - templates.yaml

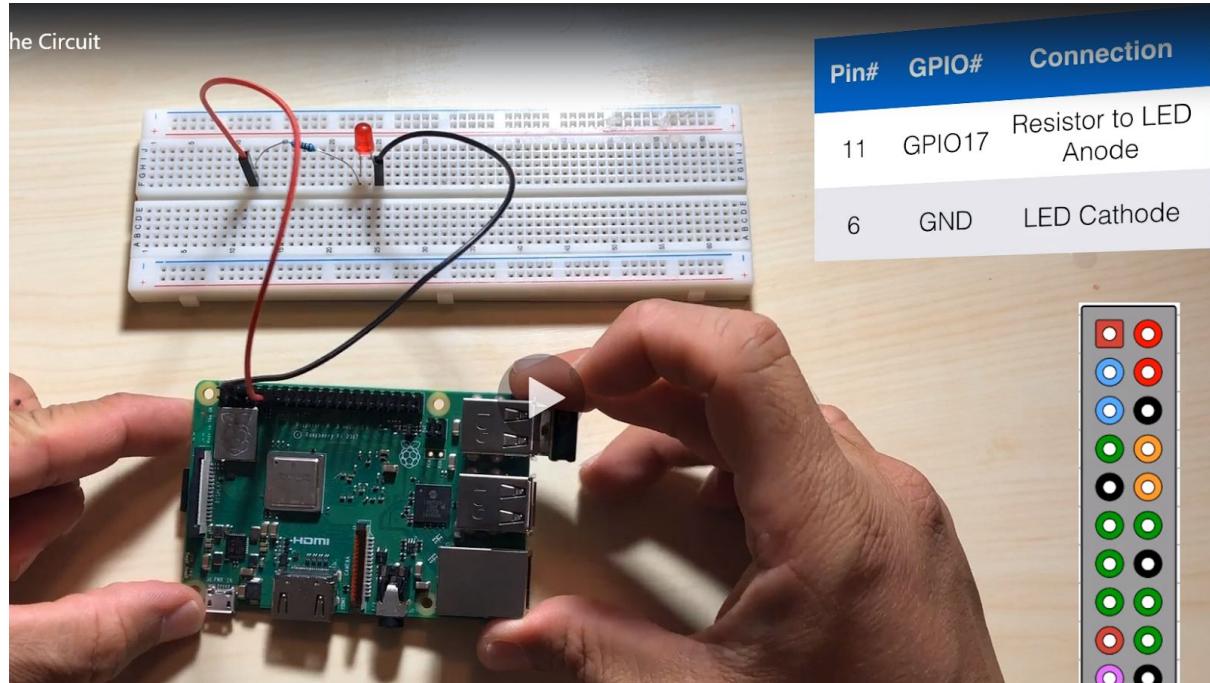


LED turning ON and OFF Project

Overview of the MyLED Skill

- Amazon Developer Portal Skill Setup
 - Intent
 - OnOffIntent
 - Slots
 - OnOff
 - Utterances
 - switch on/off
 - turn on/off
- Skill Handler Code
 - led-control.py
 - templates.yaml





Relay Control Project

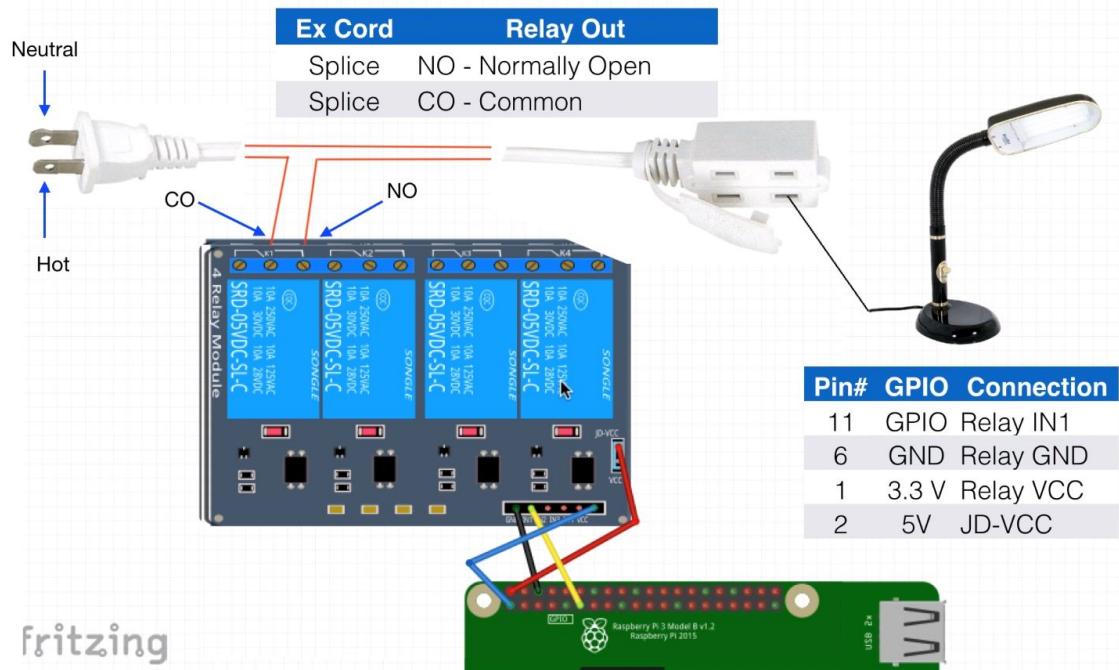
Overview of the MyDevice Skill

- Amazon Developer Portal Skill Setup
 - Intent
 - OnOffIntent
 - Slots
 - OnOff
 - Utterances
 - switch on/off
 - turn on/off
- Skill Handler Code
 - relay-control.py
 - templates.yaml

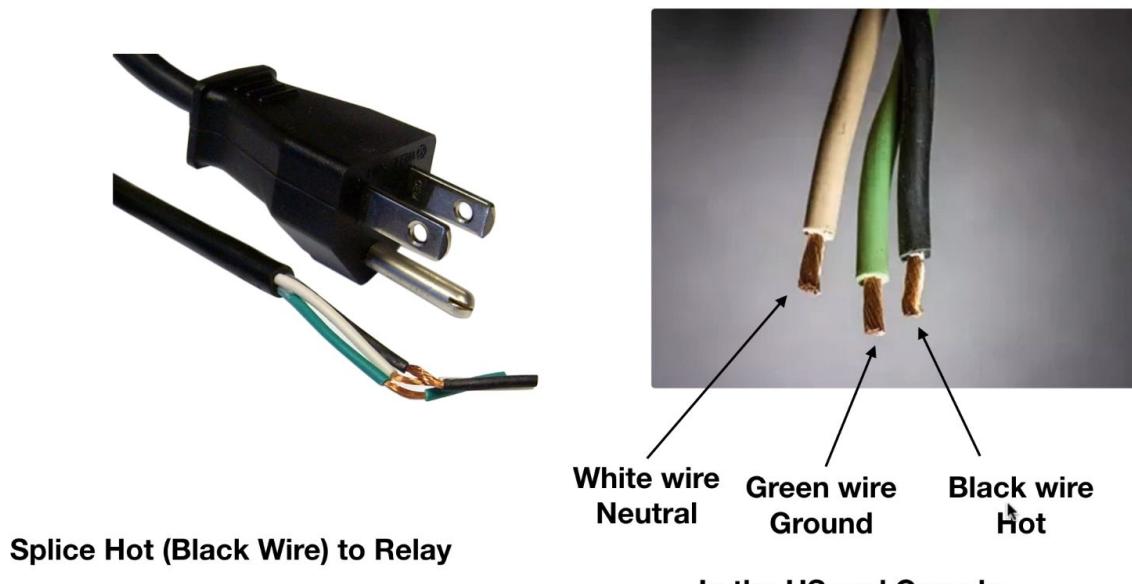


“Alexa, tell my device to turn on”

Relay Circuit



Three prong plug



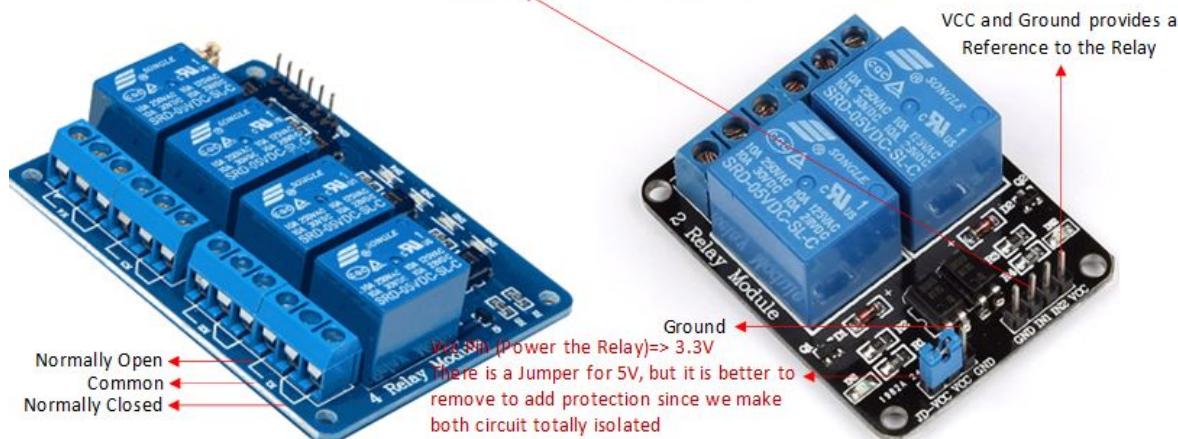
Relay Modules

IN1=> Control Relay 1

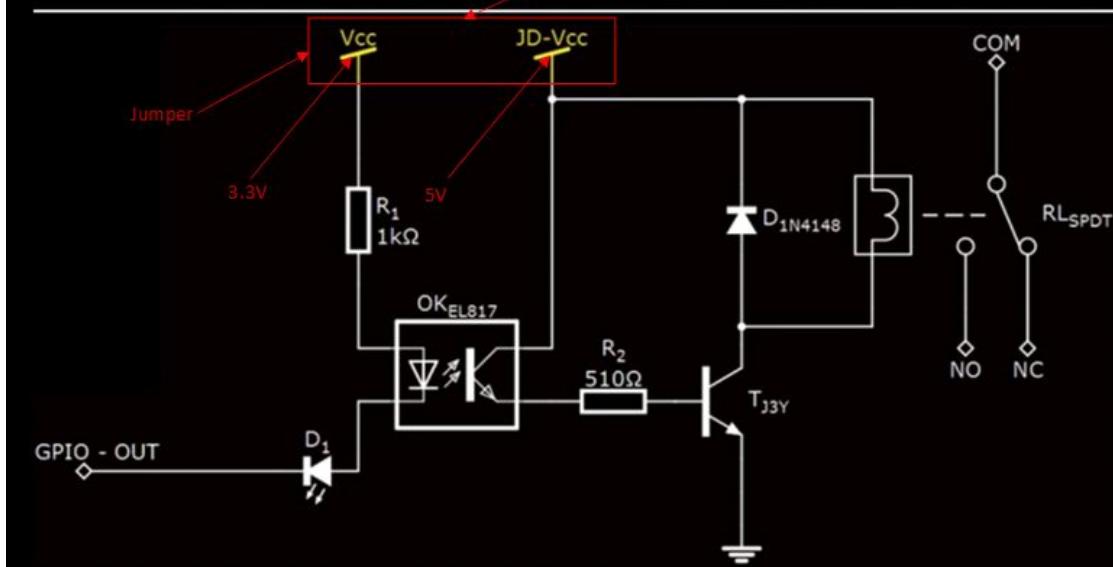
IN2=> Control Relay 2

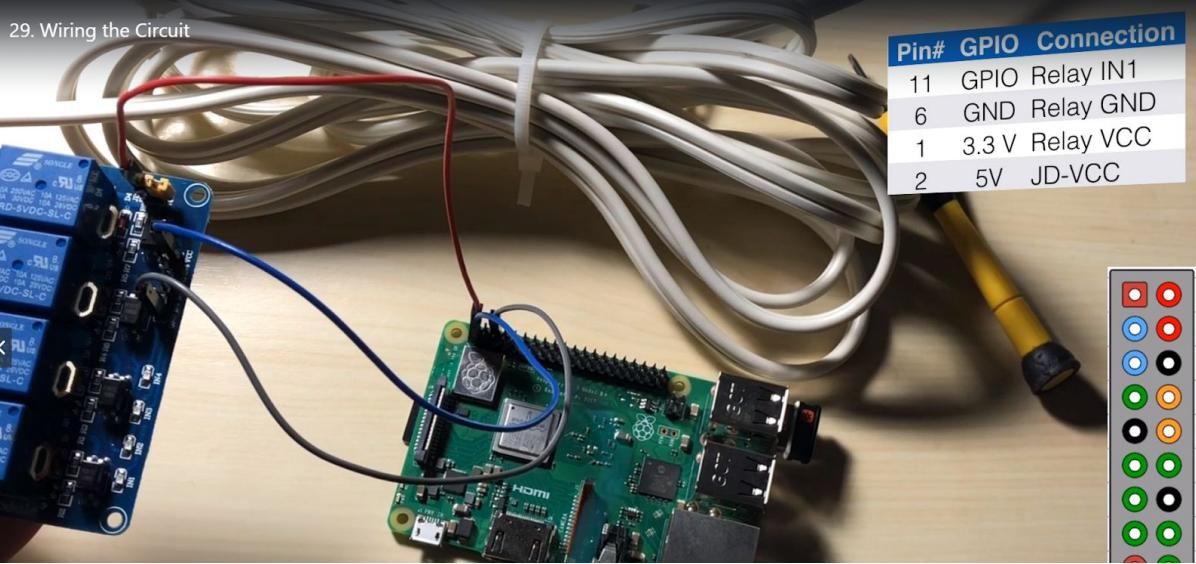
Relays are Active Low=>

- When you apply a Low Signal IN1 or IN2=> You energize the Relays and change the Switch position, NO switches to close while NC switches to Open



Circuit Diagram (Relay Board)

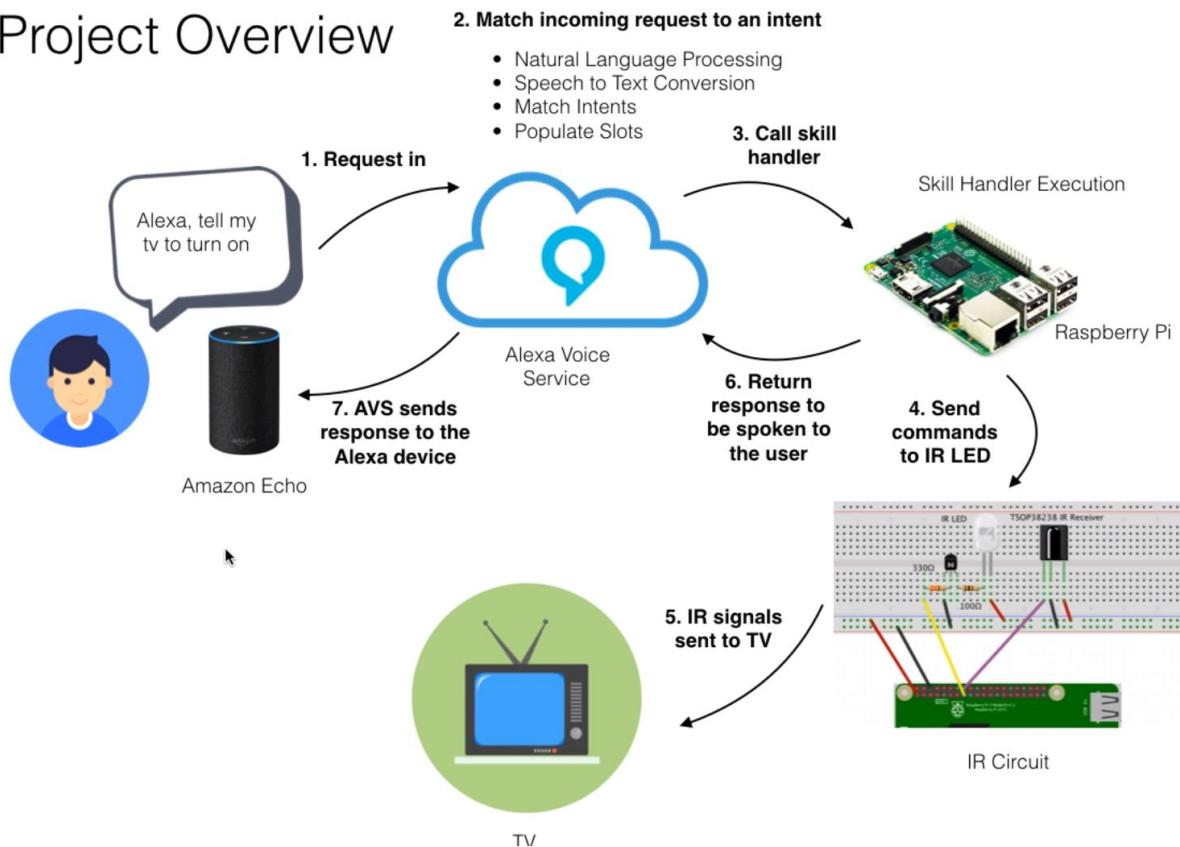




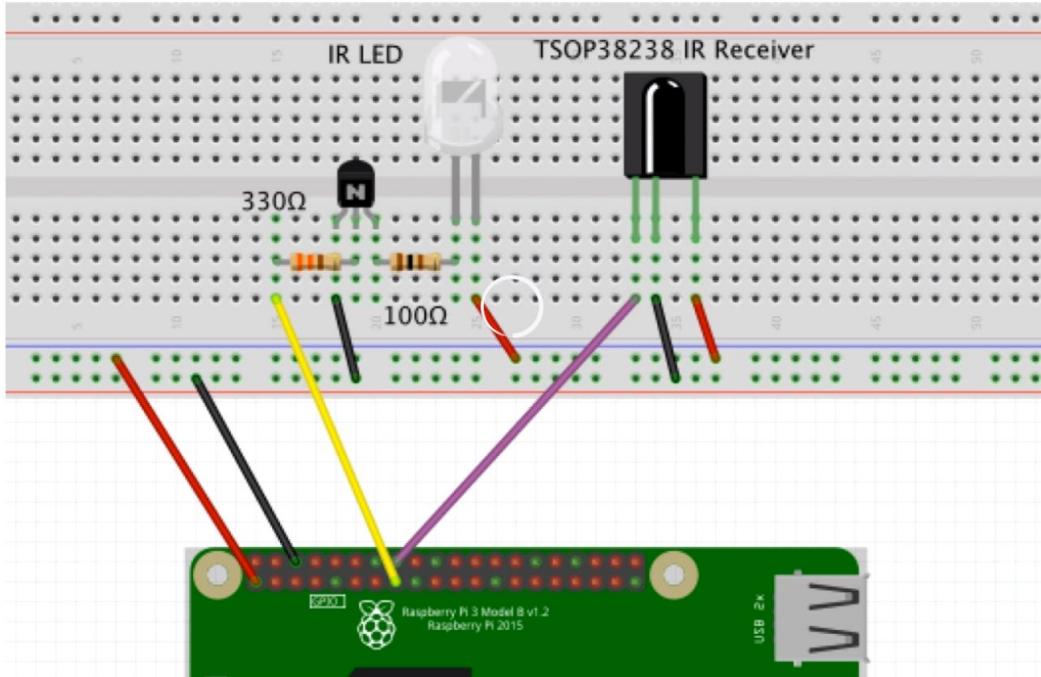
TV Voice Control Project

Material: Breadboard, Infrared LED, Infrared Receiver, NPN Transistor, Connecting Wires, Raspberry Pi and its associated peripherals (SD card, Power Adapter, HDMI cable etc.)

Project Overview



Circuit Diagram



NPN Transistor

Pin	Connection
Base	Resistor to GPIO22
Collector	Resistor to Cathode IR LED
Emitter	GND

Raspberry Pi

Pin#	GPIO#	Connection
1	3.3V	Power Rail
6	GND	Ground Rail
15	GPIO22	Resistor to NPN Base
16	GPIO23	OUT IR Receiver

IR Receiver

Pin	Connection
Vs	3.3V
GND	GND
OUT	GPIO23

IR LED

Pin	Connection
Anode	3.3V
Cathode	Resistor to NPN Collector

- 1) For the TV Voice Control, the LIRC (Linux Infrared Remote Control) library is going to be needed:

<https://www.lirc.org/>

- 2) Go to the Terminal and update everything [Click on this link](#))
- 3) **sudo apt-get install lirc**
- 4) Y
- 5) Open a Chrome Browser:
- 6) s

Creating a Skill

3) Create Skill=> Put the Skill Name and choose Custom=>Start from Scratch

For Hello World: HelloWorld

For LED: myLED

For Relay:: myDevice

Create a new skill



- 4) Go to Invocation

The screenshot shows the Alexa developer console interface. The top navigation bar includes 'Your Skills' (selected), 'HelloWorld' (the skill being edited), and 'Build'. The left sidebar has sections for 'CUSTOM' (selected), 'Interaction Model', 'Utterance Conflicts (0)', and 'Invocation' (which is highlighted with a red box). Under 'Invocation', there are sections for 'Intents (5)' and 'Built-In Intents (5)'. At the bottom of the sidebar, it says 'AMAZON.FallbackIntent'.

- 5) The invocation is how we will tell Alexa to get the skill. Choose a Name:

For Hello World: hello world

For LED: my project

For Relay:: my device

English (US) ▾

Save Model Build Model

CUSTOM

Interaction Model

Invocation

Intents (5) Add

Built-In Intents (5)

AMAZON.FallbackIntent
AMAZON.CancelIntent
AMAZON.HelpIntent
AMAZON.StopIntent
AMAZON.NavigateHomeIntent

User: Alexa, ask daily horoscopes for the horoscope for Gemini

Skill Invocation Name ?

hello world

6) Go to Intents (The Description of the Intents are shown below)

Intents

+ Add Intent Filter intents

NAME	UTTERANCES	SLOTS	TYPE	ACTIONS
AMAZON.FallbackIntent	If Alexa doesn't understand what you said, it is going to run the Fallback intent		Built-In	Edit Delete
AMAZON.CancelIntent	If the User says Cancel, it is going to Cancel the Skill or maybe Clean up a database		Required	Edit
AMAZON.HelpIntent	If the User says Help, it is going to Help the User how to use the skill		Required	Edit
AMAZON.StopIntent	If the User says Stop, it is going to Stop the Skill from being Executed		Required	Edit
AMAZON.NavigateHomeIntent	If the User wants to go back to the Home Menu		Required	Edit

7) Add Intent

8) Put the name of the intent.

For Hello World: HelloWorldIntent

For LED and Relay: OnOffIntent

○ Create custom intent ?

HelloWorldIntent

Create custom intent

Creating a Slot Type (Some projects don't need like Hello World that already has a built-in firstname Slot Type)

9) Create the Slot Type name:

For LED and Relay: OnOffValue

The screenshot shows the Alexa Skills Kit Developer Console interface. On the left, there's a sidebar with 'Invocation' and 'Intents (6)' sections. Under 'Intents (6)', 'OnOffIntent' is selected. Below it are 'Built-In Intents (5)': AMAZON.FallbackIntent, AMAZON.CancelIntent, AMAZON.HelpIntent, AMAZON.StopIntent, and AMAZON.NavigateHomeIntent. At the bottom of the sidebar is a 'Slot Types (0)' section with a '+ Add' button. The main area shows instructions about slot types, a radio button for 'Create custom slot type' (which is selected), a text input field containing 'OnOffValue' (with a red box around it), and a blue 'Create custom slot type' button with a red arrow pointing to it. Another radio button for 'Use an existing slot type from Alexa's built-in' is also shown.

10) Create the Slot Values:

For LED and Relay: On / Off

The screenshot shows the 'Slot Values' section of the Alexa Skills Kit Developer Console. It displays 'Slot Values (1)' with a value of 'off'. There are buttons for 'Bulk Edit' and 'Export', and a search bar. Below the list is a table with columns: VALUE, ID (OPTIONAL), and SYNONYMS (OPTIONAL). A new row is being added, indicated by a red box around the 'on' value and a red arrow pointing to the '+' button. The table rows are as follows:

VALUE	ID (OPTIONAL)	SYNONYMS (OPTIONAL)
off		
on	Enter ID	Add synonym

11) Go back to the Intent

The screenshot shows the AWS Lambda Interaction Model interface. Under 'Invocation', there is a section for 'Intents' with 6 items. One item, 'OnOffIntent', is highlighted with a red border. Below it is a section for 'Built-In Intents' with 5 items: AMAZON.FallbackIntent, AMAZON.CancelIntent, AMAZON.HelpIntent, AMAZON.StopIntent, and AMAZON.NavigateHomeIntent. Under 'Slot Types', there is one item: 'OnOffValue', which is also highlighted with a red border.

12) Scroll down and Create the Slots

Intent Slots (0)

ORDER	NAME	SLOT TYPE	ACTIONS
1	firstname	+ Select a slot type	Edit Dialog Delete

Linking the Slots with the Intent

13) Put a Name / Slot Type:

For Hello World: firstname / AMAZON.US_FIRST_NAME

For LED and Relay: OnOff / OnOffValue

ORDER	NAME	SLOT TYPE	ACTIONS
1	firstname	first AMAZON.US_FIRST_NAME	Edit Dialog Delete
2	Create a new slot	+ AMAZON.DE_FIRST_NAME	Edit Dialog Delete

14) Click in the Name:

ORDER	NAME	SLOT TYPE	ACTIONS
1	firstname	CLICK HERE AMAZON.US_FIRST_NAME	Edit Dialog Delete
2	Create a new slot	+ Select a slot type	Edit Dialog Delete

15) Turn on the Slot Requirement if, that slot is required for the Skill

Slot Filling

Is this slot required to fulfill the intent? 



Slot Confirmation

Does this slot require confirmation? 



16) Put multiple ways that Alexa can ask for that information:

For Hello World: What is your name?

For LED: Do you want to turn your LED on or off?

For Relay: Do you want to turn your device on or off?

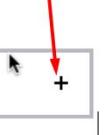
Slot Filling

Is this slot required to fulfill the intent? 



Alexa speech prompts 

What is your name?



17) You can add multiple ways.

Slot Filling

Is this slot required to fulfill the intent? 



Alexa speech prompts 

What will Alexa say to prompt the user to fill this slot?



Who should I say hello to?



Tell me who to say hello to



What is your name?



18) Scroll down and go to Utterances=> Type { so you will have access to the Slot Name

The Utterance is mentioning to Alexa that the user response is going to be the

For Hello World: {firstname}

For LED and Relay: {OnOff}

User utterances ?

The screenshot shows a modal dialog titled "Select an Existing Slot". Inside the dialog, there is a list item with a blue circular icon and the text "firstname". A red arrow points from this item to a red box around the same text "firstname" in the main "User utterances" list below.

User utterances ?

The screenshot shows a list of user utterances. At the top, there is a red box around the placeholder text "{firstname} |". To the right of the list is a red arrow pointing towards a red "+" button at the bottom right corner of the list area.

< 0 – 0 of 0 >

19) Go back to the previous Screen:

[Intents](#) / [HelloWorldIntent](#) / firstname

20) Go Sample Utterances:

Configure in Alexa how the User is going to request to use the Skill

For Hello World: say hi to {firstname} / say hi

For LED and Relay: switch {OnOff} / {OnOff} / turn {OnOff}

[Intents](#) / HelloWorldIntent

Sample Utterances (3) ?

Bulk Edit Export

What might a user say to invoke this intent? +

say hi to {firstname}



say hi



how are you



< 1 – 3 of 3 >

21) Save the Model

 Save Model

 Build Model

Intents / HelloWorldIntent

Sample Utterances (5)

What might a user say to invoke this intent?

22) Build the Model

 Save Model

 Build Model

Intents / HelloWorldIntent

Sample Utterances (5)

What might a user say to invoke this intent?

23) The JSON gives all the code for this Skill. So the only thing the person needs to do is to copy the skill there. To copy: CTRL+A and CTRL+C

The screenshot shows the AWS Lambda JSON Editor. On the left, there's a sidebar with sections for 'Intents (6)', 'Slot Types (1)', and a 'JSON Editor' tab which is highlighted with a red arrow. The main area displays a JSON configuration for an Alexa skill intent. The code is as follows:

```

1  {
2      "interactionModel": {
3          "languageModel": {
4              "invocationName": "hello world",
5              "intents": [
6                  {
7                      "name": "AMAZON.FallbackIntent",
8                      "samples": []
9                  },
10                 {
11                     "name": "AMAZON.CancelIntent",
12                     "samples": []
13                 },
14                 {
15                     "name": "AMAZON.HelpIntent",
16                     "samples": []
17                 },
18                 {
19                     "name": "AMAZON.StopIntent",
20                     "samples": []
21                 },
22                 {
23                     "name": "AMAZON.NavigateHomeIntent",
24                     "samples": []
25                 }
26             ]
27         }
28     }

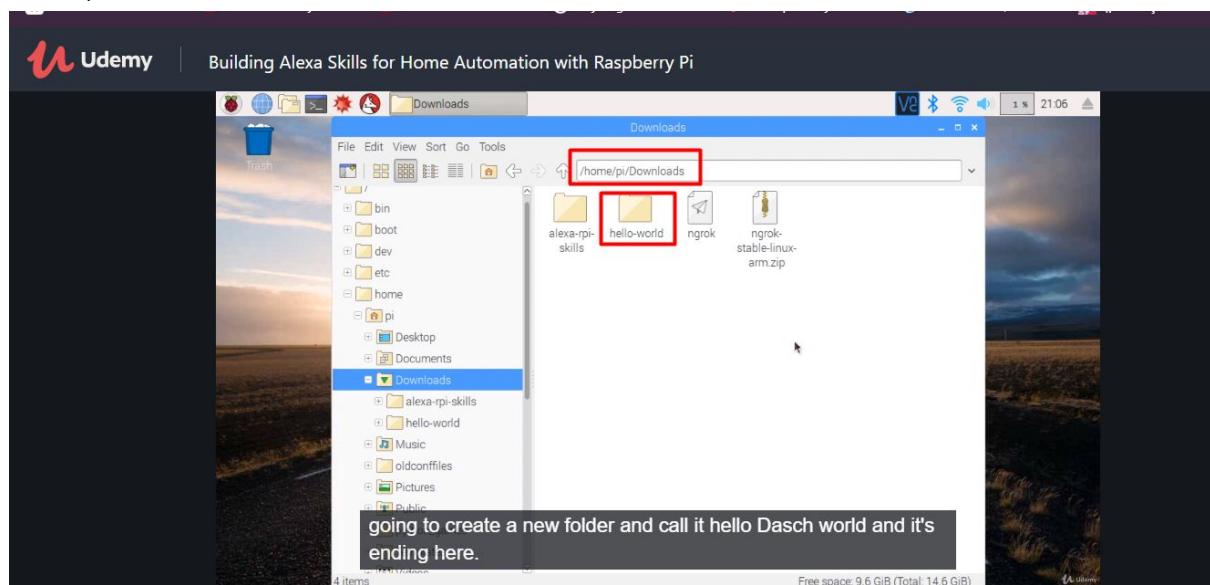
```

24) Go to the Terminal

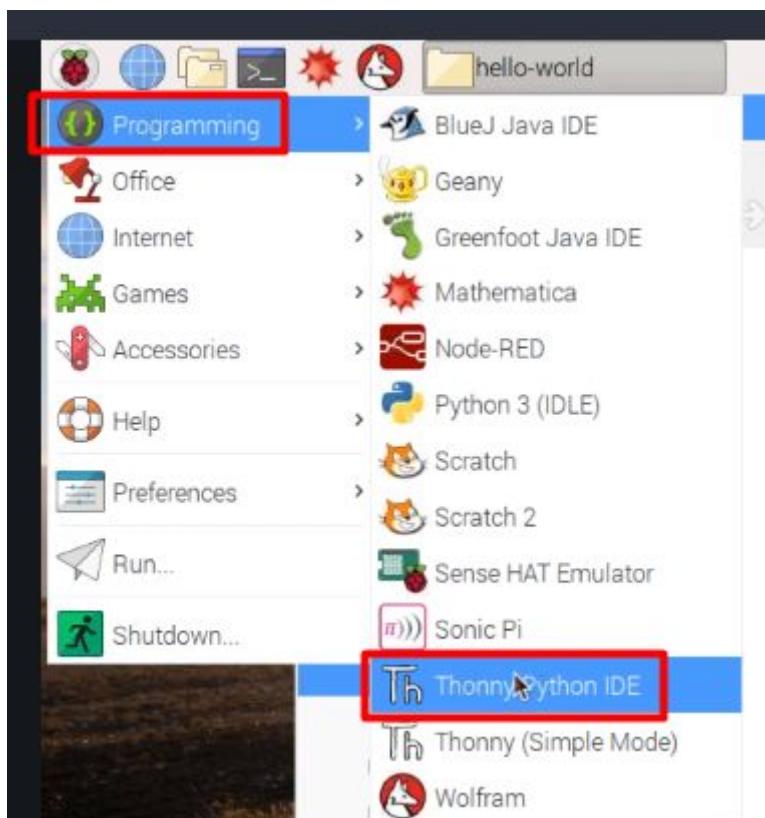
25) Go to Downloads

- a) Two files are going to be created one for when the user calls the skill and the python file is going to map the skill in Alexa
- b) Then Alexa is going to call the end point which would be the Python program in the Raspberry PI
- c) First File: The Raspberry PI is going to receive the message and send a response back to the user
- d) Second File: It is going to store all the strings that Python uses when interacting with the User

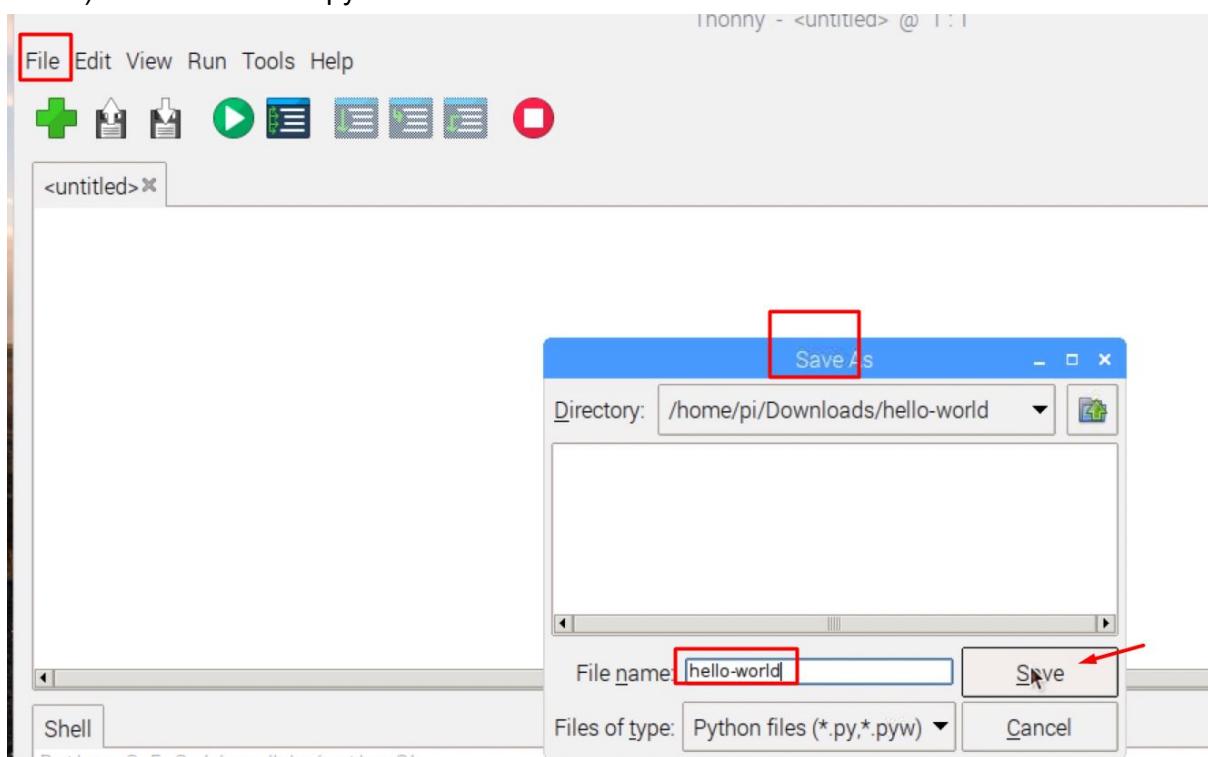
26) Create a folder



27) Go to programming=> ThonnyPython IDE

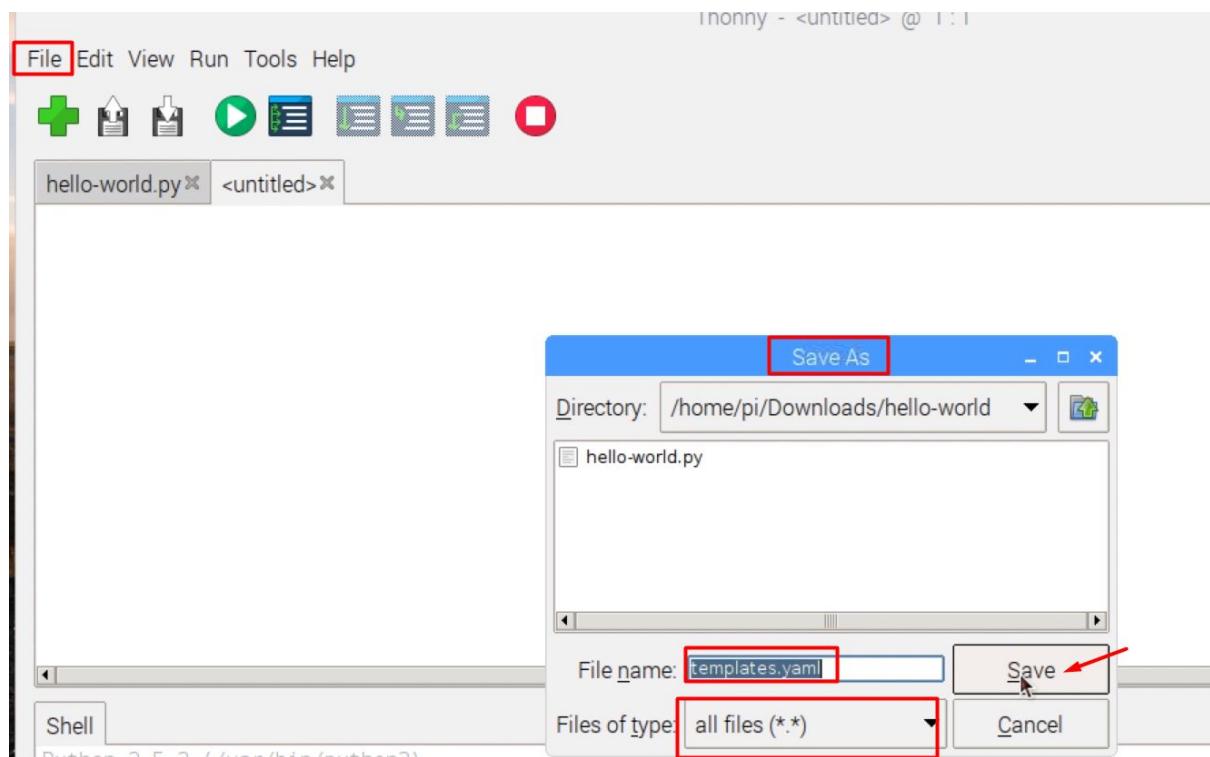


28) Save one File as py



29) Create another file: File=> New

30) The second file WILL NOT BE A PYTHON ONE. The name of it will be templates.yaml



31) Open the templates.yaml file and edit it with the strings:

a) *Hello World Example:*

welcome_text: Welcome to the Hello World Alexa Skill. You can say your name , or, how are you

hello: Hello {{ firstname }}. Great job on running your first Alexa skill.

ask_name: What is your name

ask_name_reprompt: Can you tell me your name

b) *LED Example:*

This is for the LED Example:

welcome_text: Welcome to the LED control skill. You can say, tell my project to turn on, or, tell my project to turn off

command: Turning your LED {{ onOffCommand }}

command_reprompt: Do you want to turn your LED on, or, off

c) *Relay Controlling Device Example:*

welcome_text: Welcome to the Device control skill. You can say, tell my device to turn on, or, tell my device to turn off

command: Turning your device {{ onOffCommand }}

command_reprompt: Do you want to turn your device on, or, off

d) s

32) Open the hello-world.py

Hello World Example

```
#This is for the Hello World Example:  
from flask import Flask, render_template #The render_template is going to be used  
to connect with the templates.yaml file  
from flask_ask import Ask, statement, question #Statement closes the interaction  
with the user while the question keep the conversation going for example in the case  
of alexa not understanding the question  
  
app= Flask(__name__)  
ask= Ask(app, '/')  
  
@ask.launch #Decorator to map the intent to the function  
def launch():  
    welcome_text=render_template('welcome_text') #The welcome_text is a  
string from template.yaml  
    return question(welcome_text)  
  
@ask.intent('AMAZON.FallbackIntent') #This name has to be exactly the name in  
comparison to the skill created in Amazon Developer. This is used when Alexa didn't  
understand what was asked for  
def fallback():  
    reprompt_text = render_template('ask_name_reprompt') #The  
ask_name_reprompt is a string from template.yaml  
    return question(reprompt_text)  
  
@ask.intent('HelloWorldIntent')#This name has to be exactly the name in  
comparison to the skill created in Amazon Developer.  
def hello(firstname):  
    if firstname is None: #Checks if the User gave the First Name or not  
        ask_name_text = render_template('ask_name') #The ask_name is a  
string from template.yaml  
        return question(ask_name_text) #Alexa asks for the name if it was not  
given  
        response_text = render_template('hello',firstname=firstname) #Alexa is going  
to run the hello string if a name was given from the User  
#firstname = firstname is the sentence that links the firstname that was given by the  
user to the Alexa skill  
        return statement(response_text).simple_card('Hello', response_text) #Returns  
the response_text with voice and shows in Amazon Echo screen the simple_card of  
Hello  
  
if __name__ == '__main__':  
    app.run(debug=True) #If there is a bug, we will be able to see in the terminal
```

LED On and Off Example

```
#This is for the LED Example:  
from flask import Flask, render_template  
from flask_ask import Ask, statement, question #Statement closes the interaction  
with the user while the question keep the conversation going for example in the case  
of alexa not understanding the question  
import RPi.GPIO as GPIO #use GPIO library  
  
#initializing GPIO  
GPIO.setwarnings(False)  
ledPin = 11 #pin 11 is connected to the led anode (+ve pin)  
GPIO.setmode(GPIO.BOARD)      # Numbers GPIOs by physical location  
GPIO.setup(ledPin, GPIO.OUT)  # Set ledPin's mode as output  
GPIO.output(ledPin, GPIO.LOW) # Set ledPin low to turn off the led  
  
#initializing flask ask  
app = Flask(__name__)  
ask = Ask(app, '/')  
  
@ask.launch  
def launch():  
    welcome_text = render_template('welcome_text')  
    return question(welcome_text)  
  
@ask.intent('AMAZON.FallbackIntent')  
def fallback():  
    reprompt_text = render_template('command_reprompt')  
    return question(reprompt_text)  
  
@ask.intent('OnOffIntent')  
def control(OnOff):  
    command = OnOff  
    if command is None:  
        #no command was given  
        reprompt_text = render_template('command_reprompt')  
        return question(reprompt_text)  
    elif command == "on" or command == "off":  
        if command == "off":  
            #turn OFF  
            GPIO.output(ledPin, GPIO.LOW)  
        else:  
            #turn ON  
            GPIO.output(ledPin, GPIO.HIGH)
```

```

        response_text = render_template('command', onOffCommand=command)
#onOffCommand is in the template.yaml and allows alexa to say what she is doing
with the LED
        return statement(response_text).simple_card('Command', response_text)
#Returns the response_text with voice and shows in Amazon Echo screen the
simple_card of Led ON or Off
    else:
        #a valid command was not given. In case the user says something that it is not
On or Off
        reprompt_text = render_template('command_reprompt')
        return question(reprompt_text)

if __name__ == '__main__':
    app.run(debug=True)

```

Relay Switching On and Off Example

```

#Testing the Relay Switching On and Off
import RPi.GPIO as GPIO #use GPIO library
import time #use time library

GPIO.setwarnings(False)
outputPin = 11 #pin 11 is connected to the relay board
GPIO.setmode(GPIO.BOARD)      # Numbers GPIOs by physical location
GPIO.setup(outputPin, GPIO.OUT) # Set pin's mode as output
GPIO.output(outputPin, GPIO.HIGH) # Set outputPin high to turn off the device

while True: # Continue looping indefinitely
    GPIO.output(outputPin, GPIO.LOW) # Turn device on
    time.sleep(2) # Pause for 2 seconds
    GPIO.output(outputPin, GPIO.HIGH) # Turn device off
    time.sleep(2) # Pause for 2 seconds

```

Relay Controlling Device Example

```

#Relay Control System (WHOLE PROGRAM)
from flask import Flask, render_template
from flask_ask import Ask, statement, question
import RPi.GPIO as GPIO #use GPIO library

#initializing GPIO
GPIO.setwarnings(False)
outputPin = 11 #pin 11 is connected to the relay board
GPIO.setmode(GPIO.BOARD)      # Numbers GPIOs by physical location
GPIO.setup(outputPin, GPIO.OUT) # Set pin's mode as output
GPIO.output(outputPin, GPIO.HIGH) # Set outputPin high to turn off the device

```

```

#initializing flask ask
app = Flask(__name__)
ask = Ask(app, '/')

@ask.launch
def launch():
    welcome_text = render_template('welcome_text')
    return question(welcome_text)

@ask.intent('AMAZON.FallbackIntent')
def fallback():
    reprompt_text = render_template('command_reprompt')
    return question(reprompt_text)

@ask.intent('OnOffIntent')
def control(OnOff):
    command = OnOff
    if command is None:
        #no command was given
        reprompt_text = render_template('command_reprompt')
        return question(reprompt_text)
    elif command == "on" or command == "off":
        if command == "off":
            #turn OFF
            GPIO.output(outputPin, GPIO.HIGH)
        else:
            #turn ON
            GPIO.output(outputPin, GPIO.LOW)
        response_text = render_template('command', onOffCommand=command)
        return statement(response_text).simple_card('Command', response_text)
    else:
        #a valid command was not given
        reprompt_text = render_template('command_reprompt')
        return question(reprompt_text)

if __name__ == '__main__':
    app.run(debug=True)

```

33) Go to the Terminal and then go to the folder the files are.

Example:

cd "Downloads/hello-world"

34) Type: python3 nameofthefile.py

Example:

python3 hello-world.py

35) The above will run in localhost, so you have to: [Open another Terminal](#)

36) Go to the folder you put the ngrok: `cd "Downloads"`

37) The ngrok will make the hello-world public:

This is going to create a https endpoint

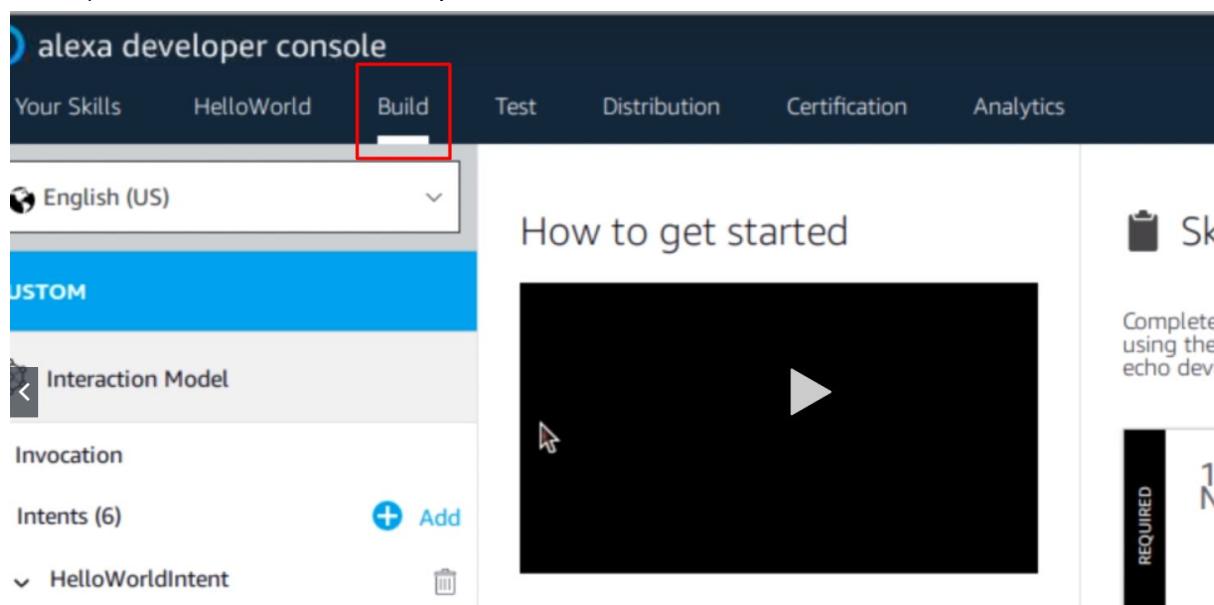
`./ngrok http 5000`

```
pi@raspberr... ✘ pi@raspberr... ✘ |  
pi@raspberrypi:~/Downloads/hello-world $ cd ..  
pi@raspberrypi:~/Downloads $ cd ~/Downloads/  
pi@raspberrypi:~/Downloads $ ls  
alexa-rpi-skills  hello-world  ngrok  ngrok-stable-linux-arm.zip  
pi@raspberrypi:~/Downloads $ ./ngrok http 5000
```

38) Copy the url below:

```
pi@raspberr... ✘ pi@raspberr... ✘ |  
ngrok by @inconshreveable (Ctrl+C to quit)  
  
Session Status          online  
Session Expires        7 hours, 58 minutes  
Version                2.2.8  
Region                 United States (us)  
Web Interface          http://127.0.0.1:4040  
Forwarding             http://6f772ed0.ngrok.io -> localhost:5000  
Forwarding             https://6f772ed0.ngrok.io -> localhost:5000  
  
Connections            ttl     opn      rt1      rt5      p50      p90  
                         0       0       0.00    0.00    0.00    0.00
```

39) Go to the Amazon Developer Website=> Skills=> Click in the Skill Created=> Build



The screenshot shows the Alexa Developer Console interface. At the top, there is a navigation bar with tabs: Your Skills, HelloWorld, **Build**, Test, Distribution, Certification, and Analytics. The 'Build' tab is highlighted with a red box. Below the navigation bar, there is a dropdown menu set to 'English (US)'. On the left side, there is a sidebar with sections for 'CUSTOM' (Interaction Model, Invocation, Intents), 'HelloWorldIntent' (with an 'Add' button and a delete icon), and a 'REQUIRED' section. In the center, there is a large black rectangular area with a play button icon and a cursor arrow pointing towards it. To the right of this area, there is some text: 'How to get started' at the top, followed by 'Complete using the echo devi' and '1'.

40) Endpoint=> HTTPS

The screenshot shows the AWS Lambda function configuration interface. On the left, there's a sidebar with various intent names: *AMAZON.FallbackIntent*, *AMAZON.CancelIntent*, *AMAZON.HelpIntent*, *AMAZON.StopIntent*, and *AMAZON.NavigateHomeIntent*. Below this is a section for **Slot Types (1)** with *AMAZON.US_FIRST_NAME* listed. To the right, under **Service Endpoint Type**, it says "Select how you will host your skill's service endpoint." There are two options: **AWS Lambda ARN** (Recommended) and **HTTPS**. The **HTTPS** option is highlighted with a red box. At the bottom of the sidebar, the **Endpoint** tab is selected, also highlighted with a red box.

41) Put the link collected in step 35) in Default Region and the Second Option in SSL

This screenshot shows the configuration of the *AMAZON.NavigateHomeIntent* endpoint. In the sidebar, the **Endpoint** tab is selected. On the right, the **Default Region** dropdown is set to "North America (Optional)". Below it, the **Select SSL certificate type** dropdown is open, showing the message: "My development endpoint has a certificate from a trusted certificate authority". A red box highlights this message. Another red box highlights the input field where the URL `https://6f772ed0.ngrok.io` is entered.

42) Save the Endpoint

This screenshot shows the **Endpoint** configuration screen again. The sidebar includes tabs for **Interaction Model**, **Invocation**, and **Intents (6)**. In the main area, there's a **Save Endpoints** button highlighted with a red box. Below it, a note states: "The Endpoint will receive POST requests when a user inter request body contains parameters that your service can us a JSON-formatted response. Learn more about AWS Lamb your own HTTPS web service endpoint as long as the servi described here."

43)

44) If there is a Cryptography Error when you run the Skill Handler. Just install the following package: `pip install 'cryptography<2.2'`

Testing the New Skill

45) Go to the Amazon Developer Website=> Skills=> Click in the Skill Created=> Test

A screenshot of the Alexa Skills Kit Developer Console. The top navigation bar includes 'Your Skills', 'HelloWorld', 'Build', 'Test' (which is highlighted with a red box), 'Distribution', 'Certification', and 'Analytics'. Below the navigation bar, there's a dropdown menu set to 'English (US)'. A blue bar labeled 'CUSTOM' is visible. On the right, the text 'How to get started' and 'Alexa Skills Kit Developer Console: Build' are displayed.

46) Enable the testing of this skill

17. Testing our Skill

A screenshot of the Alexa Skills Kit Developer Console. The top navigation bar includes 'Your Skills', 'HelloWorld', 'Build', 'Test' (which is highlighted with a red box), 'Distribution', 'Certification', and 'Analytics'. A message box contains the text 'Test is disabled for this skill.' with a magnifying glass icon. Below the message, a note says 'When test is enabled, you can interact with the development version of your skill in the Alexa Skills Kit developer console.' A large blue circular button is visible on the right.

47) Type or Speak (hold)

A screenshot of the Alexa Skills Kit Developer Console. The top navigation bar includes 'Your Skills', 'HelloWorld', 'Build', 'Test' (which is highlighted with a red box), 'Distribution', 'Certification', and 'Analytics'. A toggle switch on the left is turned on, with the text 'Test is enabled for this skill'. To its right are checkboxes for 'Skill I/O' and 'Echo'. Below the toggle, there are three tabs: 'Alexa Simulator' (underlined), 'Manual JSON', and 'Voice & Tone'. The 'Alexa Simulator' tab has a dropdown for 'English (US)' and a text input field with the placeholder 'Type or click and hold the mic'. A red arrow points from the word 'TYPE' to this input field. To the right of the input field is a microphone icon with a hand cursor, and another red arrow points from the word 'SPEAK' to this icon. On the far right, there's a panel titled 'Skill I/O' with a 'JSON Input' section.

48) If speaking: ask skill to say skill to variable
For Hello World: ask hello world to say hello to Lee
For LED: Tell my project to turn on
For Relay: Tell my device to turn on

49) If typing: open skill
For Hello World: open hello world
For LED: open myLed
For Relay: Tell my device to turn on

Alexa Skills Kit Developer Console

alexa developer console

Your Skills HelloWorld Build Test Distribution Certification Analy

Test is enabled for this skill

Skill I/O Echo

Alexa Simulator Manual JSON Voice & Tone

English (US)

open hello world

Skill I/O

JSON Input

Testing the New Skill in Alexa

- 1) Go to: <https://alexa.amazon.ca/spa/index.html>
- 2) Skills=> Your Skills

All Skills

Now Playing

CATEGORIES

Search all skills

Get highlights from this week's football games.

“Alexa, open Westwood One Sports.”

Westwood One SPORTS

Get started

- 3) DEV Skills
- 4) Click on the Skill
- 5) Enable

Debugging the code

1) Check the Device Log=> Scroll Down=> Select the Capture Debug

The screenshot shows the Alexa Skills Kit developer console interface. At the top, there's a toggle switch labeled "Test is enabled for this skill". Below it are three tabs: "Alexa Simulator", "Manual JSON", and "Voice & Tone". The "Alexa Simulator" tab is currently selected. On the left, there's a dropdown for "English (US)" and a microphone icon for audio input. In the center, a button says "open hello world". To the right, a large text area displays a log of events. The "Device Log" checkbox at the top of the log section is checked. The log entries are as follows:

- [22:41:17:236] - Directive: SkillDebugger.CaptureDebug...
- [22:41:17:294] - Directive: SpeechSynthesizer.Speak
- [22:41:17:298] - Directive: ListRenderer.RenderDetail
- [22:41:17:306] - Directive: SpeechRecognizer.ExpectSp...
- [22:41:17:308] - Directive: SpeechRecognizer.RequestPr...
- [22:41:17:355] - Event: SpeechSynthesizer.SpeechStarted
- [22:41:23:466] - Event: SpeechSynthesizer.SpeechFinis...
- [22:41:29:804] - Event: Text.TextMessage
- [22:41:30:391] - Directive: SkillDebugger.CaptureDebug...
- [22:41:30:826] - Directive: SkillDebugger.CaptureDebug...

The log entries from line 39 to line 41 are highlighted with a red border.

2) s