The Raspberry Pi

Get ready to enjoy this session!!

What is a Raspberry Pi?

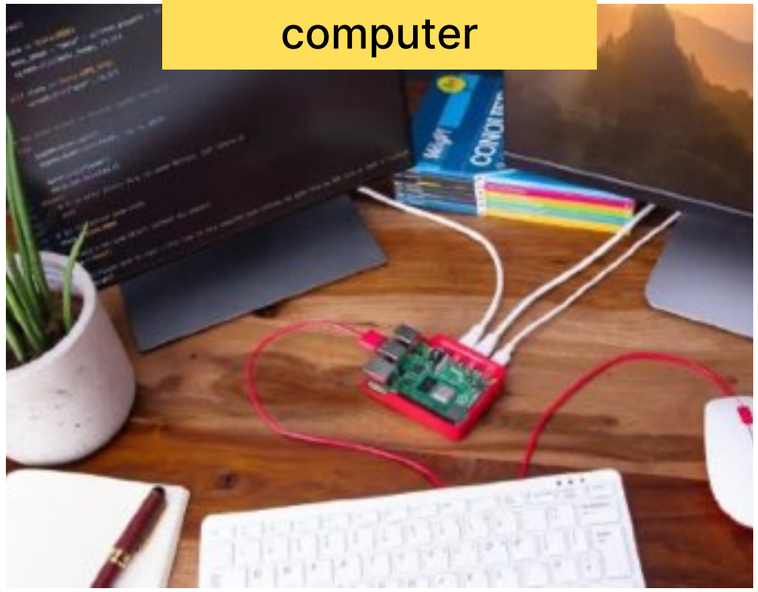
It is a small, affordable, single-board computer developed by the Raspberry Pi Foundation in the UK.

Fun Fact

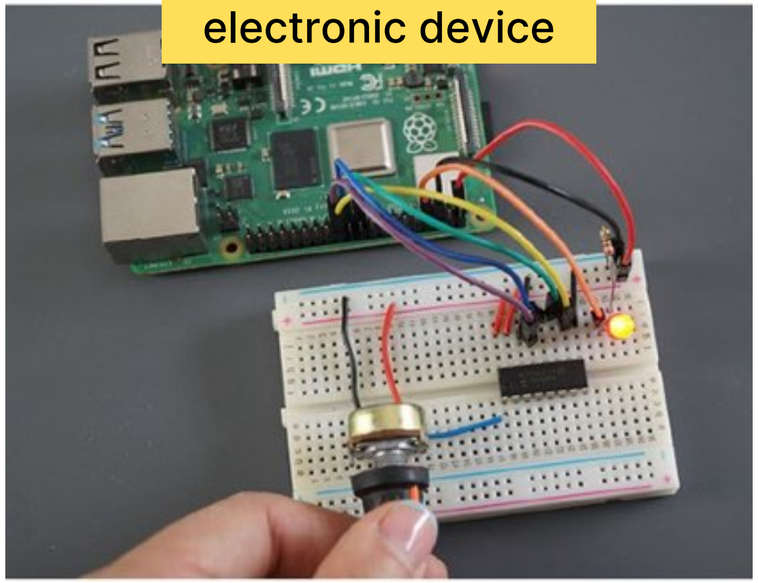
It was originally designed to promote teaching of basic computer science and programming in schools, but over time, it has become a powerful platform used worldwide!!

What can the Raspberry Pi do?

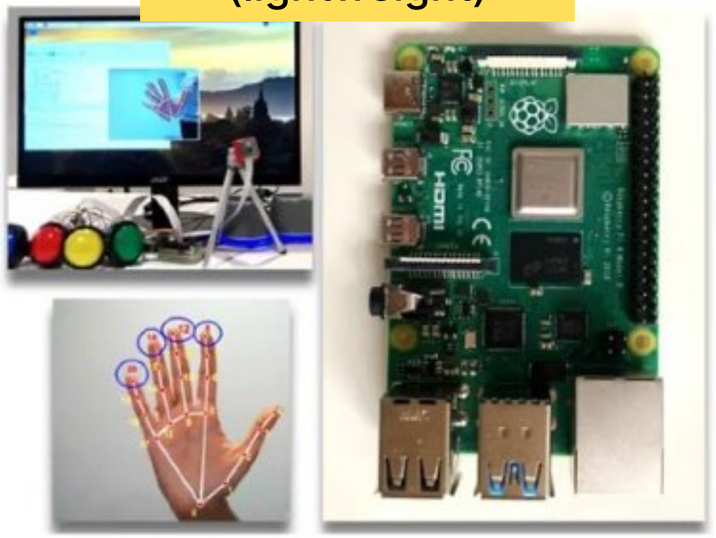
Act as a basic computer



Control electronic device

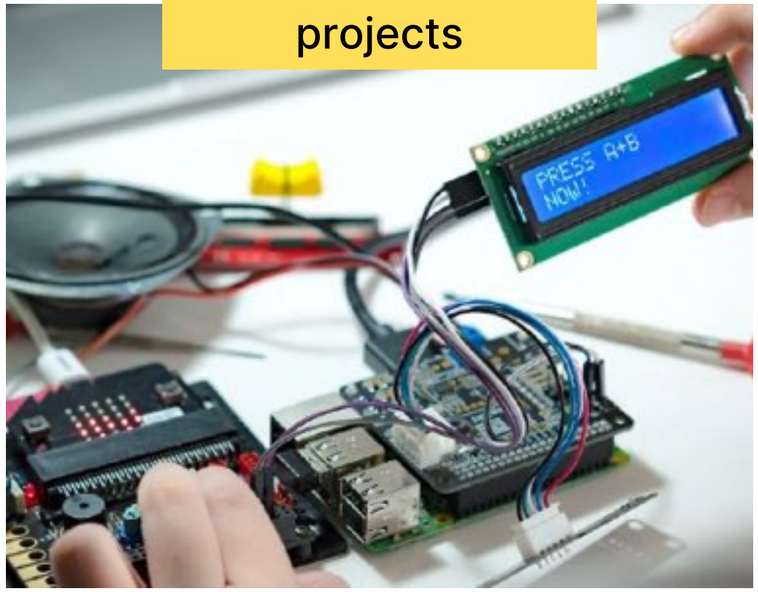


Run AI and ML (lightweight)

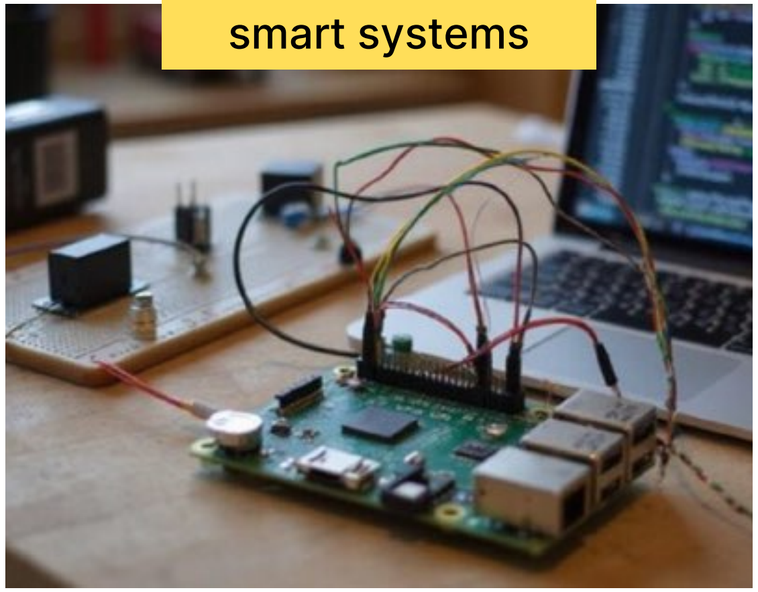


What can the Raspberry Pi do?

Power creative projects



Build IoT and smart systems



Acts as a server

Models of the Raspberry Pi

Now lets go through some of the models of the Raspberry Pi .....

Let’s hear some guesses 🙂

The Flagship series

It consists of the "standard" Raspberry Pi models (e.g., Raspberry Pi 3, 4, and 5)

- Purpose: General computing, learning, and projects.
- Features:
  - Full Linux operating system
  - USB ports, HDMI, audio jack, Ethernet, Wi-Fi, Bluetooth
  - 40-pin GPIO header for electronics
- Size: Credit card-sized board

Raspberry Pi 3 Model B

Difference between Model A and B

Raspberry Pi 3 Model B+

Raspberry Pi 3 Model A+

Difference between Model A and B

Raspberry Pi 3 Model B+

Model B indicates the presence of an Ethernet port.
Model A indicates a lower-cost model in a smaller form factor with no Ethernet port, reduced RAM, and fewer USB ports to limit board height.

There are also models **A+ and B+**, both are part of the flagship family, and the “+” in the name means they are **improved versions** of earlier Model A and B boards

The Keyboard series

It is like a Flagship Pi, but built into a keyboard.

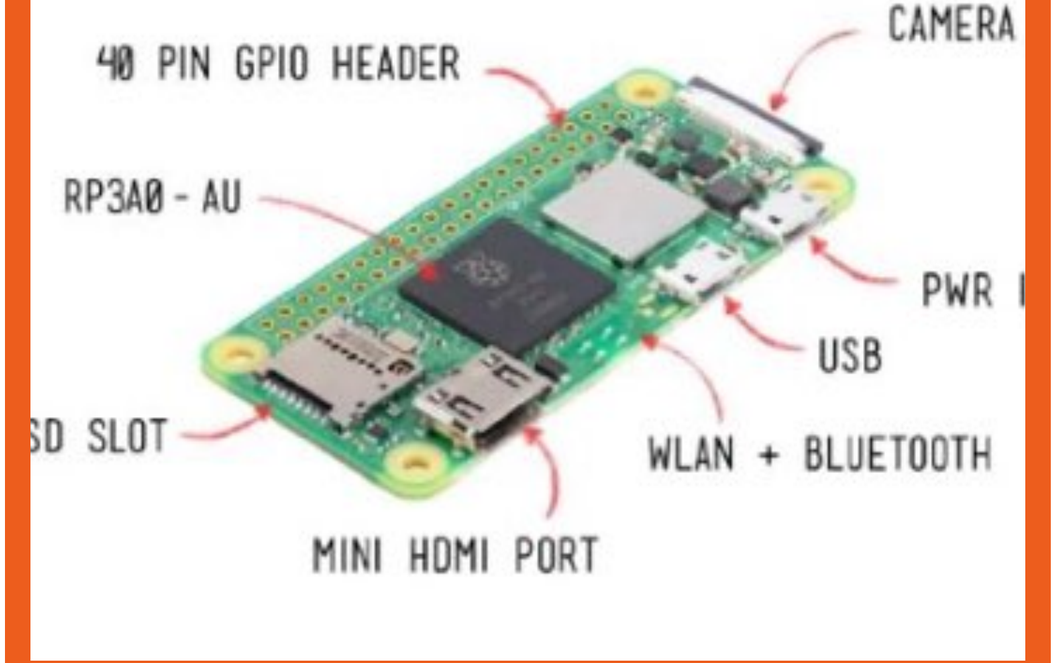
- Purpose: All-in-one beginner computer
- Features:
  - Same internals as the Raspberry Pi 4
  - Built-in keyboard (no separate case needed)
  - Pre-installed Linux OS (Raspberry Pi OS)
- Use Cases: Teaching computing in classrooms, basic desktop use, coding, learning Linux

Raspberry Pi 400

The Zero series

It is a smaller, cheaper, and lower-power version of the flagship models

- Purpose: Cost-effective, portable projects
- Features:
  - Minimal ports (micro-USB, mini-HDMI, etc.)
  - No Ethernet port (though some models have Wi-Fi)
  - Runs Linux
- Size: Tiny — about a third of a flagship Pi
- Use Cases: Wearables, compact robots, DIY sensors, lightweight IoT devices



Raspberry Pi Zero 2W

The Compute Module series

Designed for industrial and embedded systems

- Purpose: Custom products and embedded designs
- Features:
  - Same CPU and RAM as flagship models
  - No ports (no USB, HDMI, GPIO directly on board)
  - Connects to a custom carrier board (like a motherboard) that provides needed ports/pins
- Use Cases: Commercial products, smart devices, embedded controllers, industrial systems

Compute Module 4

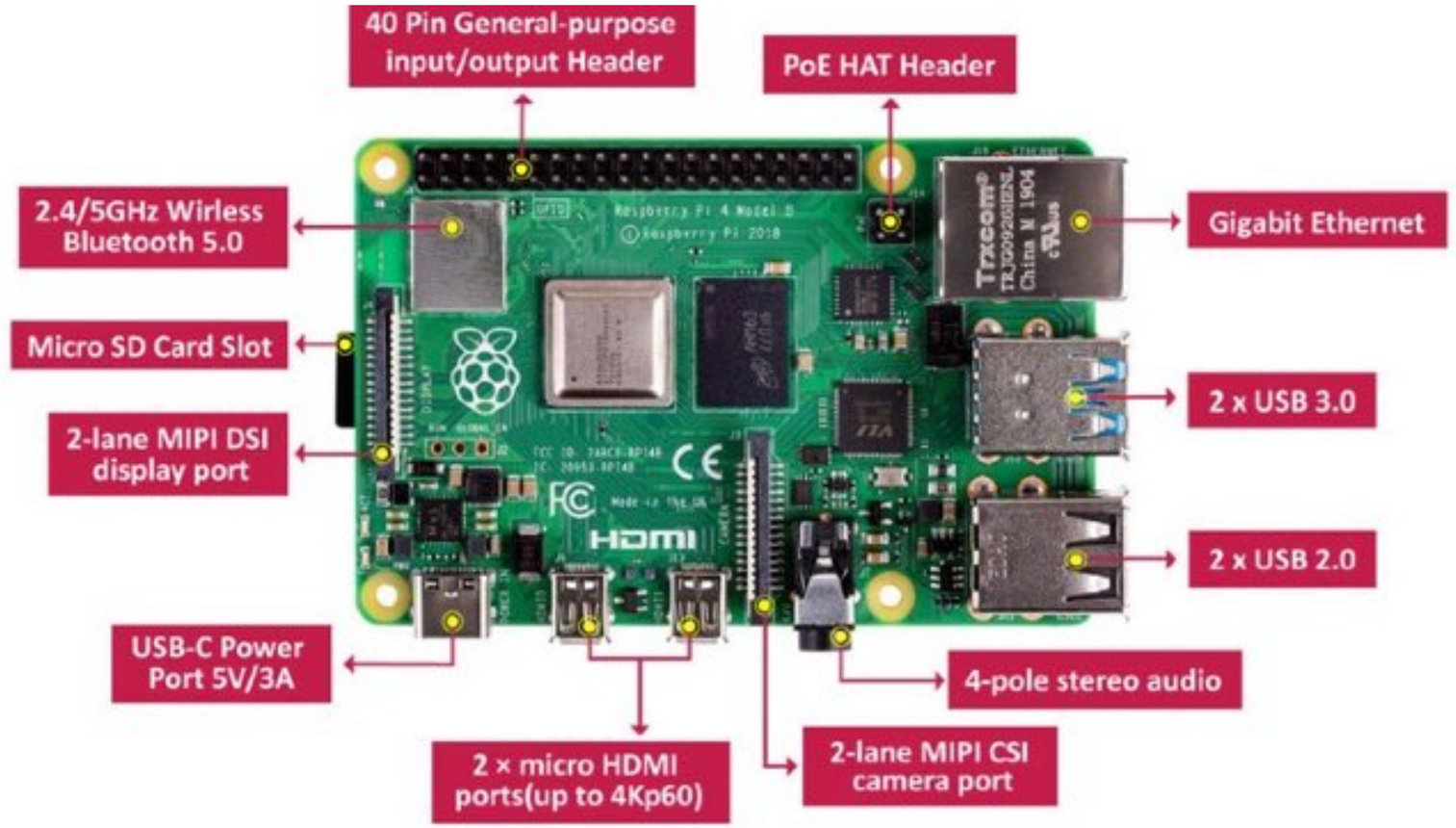
Pico series

It is a microcontroller, like an Arduino. (hence not a computer like the rest)

- Purpose: Real-time control, simple embedded tasks
- Features:
  - No Linux OS
  - Programs written in C or MicroPython
  - No Ethernet, Wi-Fi (unless added separately)
  - Flash binary code directly to onboard storage
- Use Cases: Controlling motors, reading sensors, fast real-time logic (e.g., smart lights, timers)

Raspberry Pi Pico W

Raspberry Pi 4 Model B



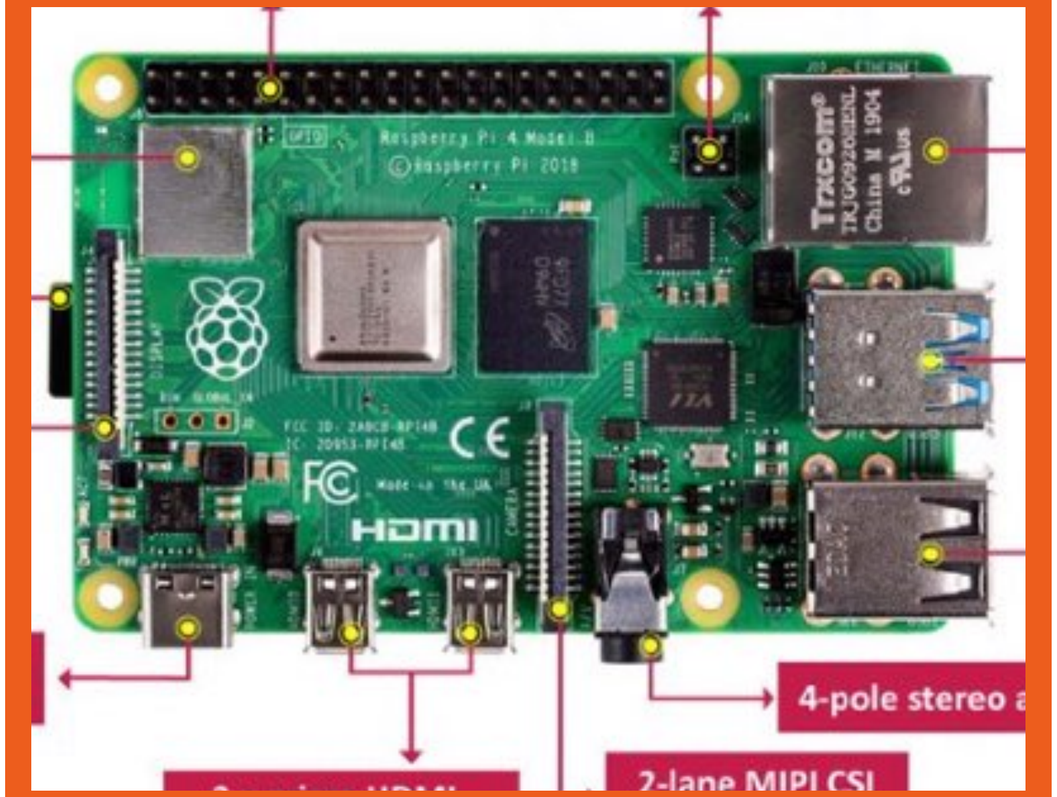
Architecture of a Raspberry Pi 4 Model B

1. Broadcom BCM2711 Processor (CPU + GPU)

- Quad-core Cortex-A72 (ARM v8, 64-bit), clocked at 1.5GHz
- Integrated VideoCore VI GPU for graphics and video processing
- Acts as the brain of the Pi, executing code and managing all system functions
-

2. RAM (Memory)

- Comes in variants: 2GB, 4GB, or 8GB LPDDR4-3200 SDRAM
- Memory is shared between CPU and GPU
- Temporarily stores data, running programs, and processes



3. MicroSD Card Slot

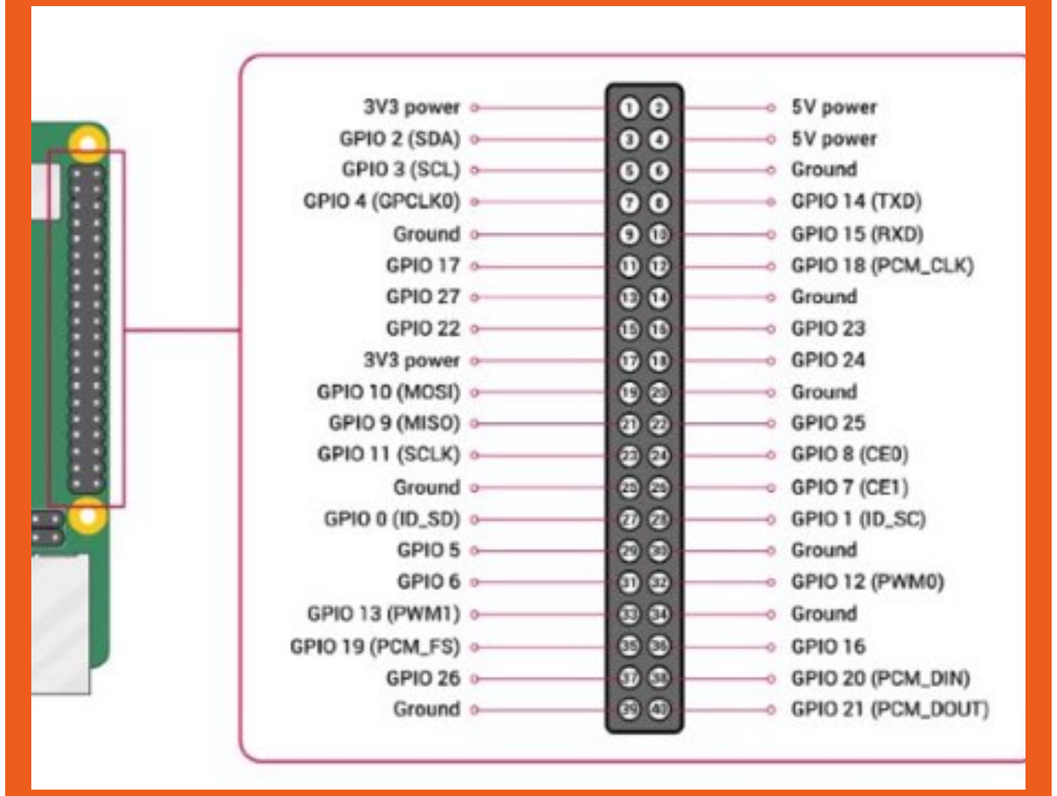
- Main storage location for operating system and user files
- Replaceable and bootable
- Acts like a hard drive, but smaller and solid-state

4. Networking Functionality

- Gigabit Ethernet: For fast, wired internet connection
- 2.4GHz / 5GHz Wi-Fi : Dual-band wireless connectivity
- Bluetooth 5.0: For connecting peripherals like headphones, keyboards, and sensors

5. USB Ports

- 2 × USB 3.0 ports: High-speed data transfer (e.g. external SSDs, USB cameras)
- 2 × USB 2.0 ports: For standard USB devices like mice, keyboards, and flash drives



6. GPIO Header (40-pin General Purpose I/O)

- Lets you interface with electronics: LEDs, motors, sensors, etc.
- Includes power (3.3V/5V), ground, and multiple GPIO pins (digital I/O)
- Supports protocols like I2C, SPI, UART

7. USB-C Power Port (5V / 3A)

- Powers the Pi
- Supplies enough current for the board and any connected USB peripherals
- Important: Needs a good-quality 5V/3A power supply for stability

8. MIPI CSI Camera Port (2-lane)

- Connects to the Raspberry Pi Camera Module
- High-speed video/image capture directly into the GPU for processing

9. MIPI DSI Display Port (2-lane)

- For connecting the official Pi touchscreen display
- Supports high-speed data communication to LCD displays

10. 2 × Micro HDMI Ports

- Supports dual 4K monitors (up to 4Kp60 and 1080p60 simultaneously)
- Allows full graphical desktop experience and multimedia applications

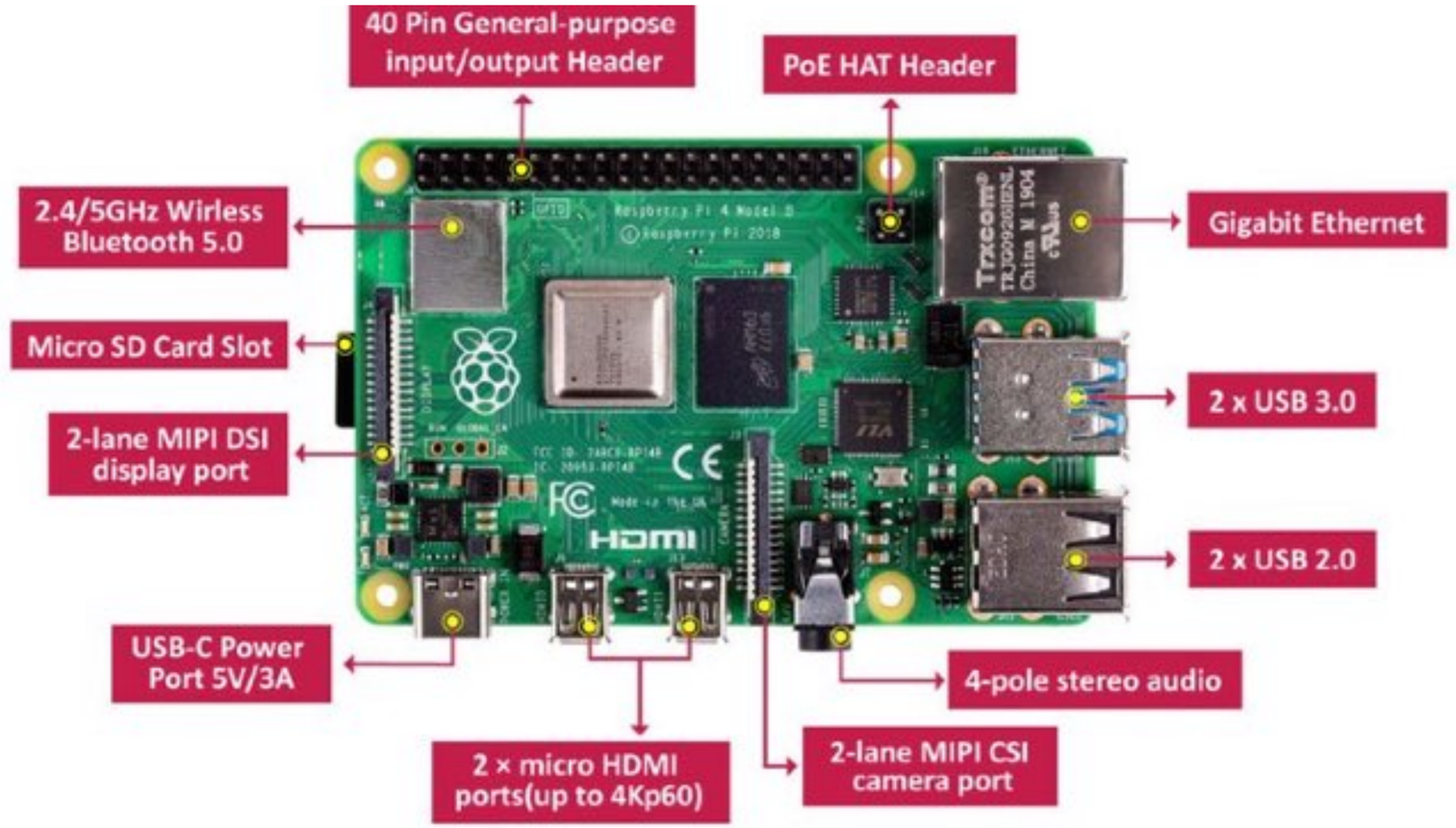
11. 4-Pole Stereo Audio and Composite Video Jack

- Combines analog audio output and composite video output in one 3.5mm jack
- Can be connected to speakers, headphones, or older TVs

12. PoE HAT Header (Power over Ethernet Hardware Attached on Top).

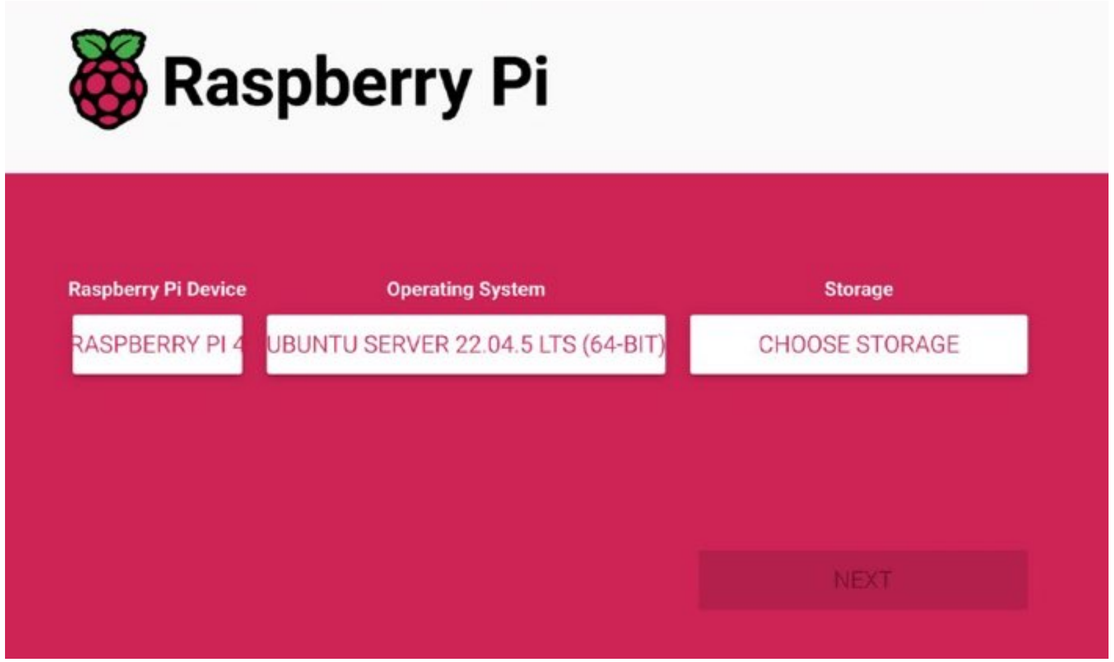
- This setup allows the Pi to receive both electrical power and a network connection through a single Ethernet cable, simplifying wiring in networked or embedded installations.
- Useful for networked setups where power plugs are hard to reach.

Raspberry Pi Setup

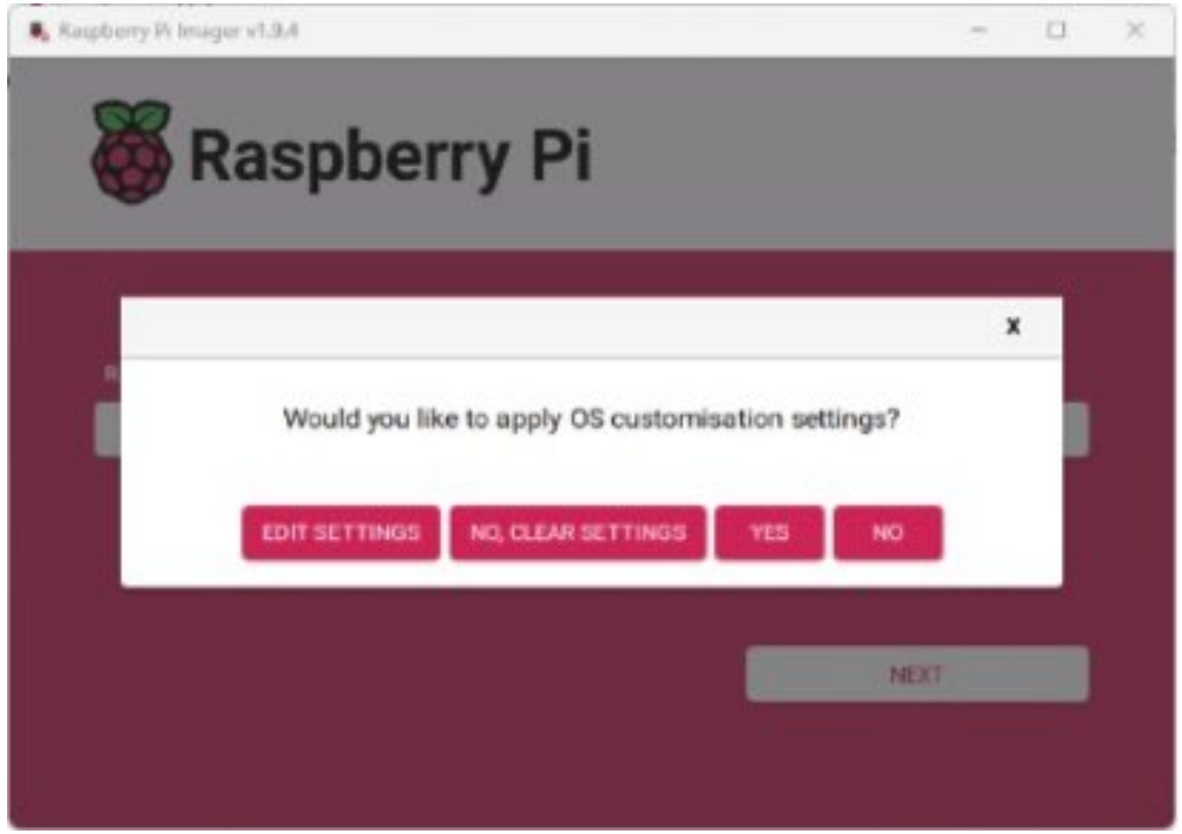


Raspberry Pi Setup

- Download Raspberry Pi Imager from **Raspberry Pi software – Raspberry Pi**
- Insert your microSD card via USB card reader in your PC.
- **In Raspberry Pi Imager:**
- Choose the Raspberry Pi Device: **Raspberry Pi 4**
- Choose OS: **Other general-purpose OS → Ubuntu → Ubuntu Server 22.04.5 LTS (64-bit)**
- Choose storage: **Your microSD card**
- The steps above are as shown:

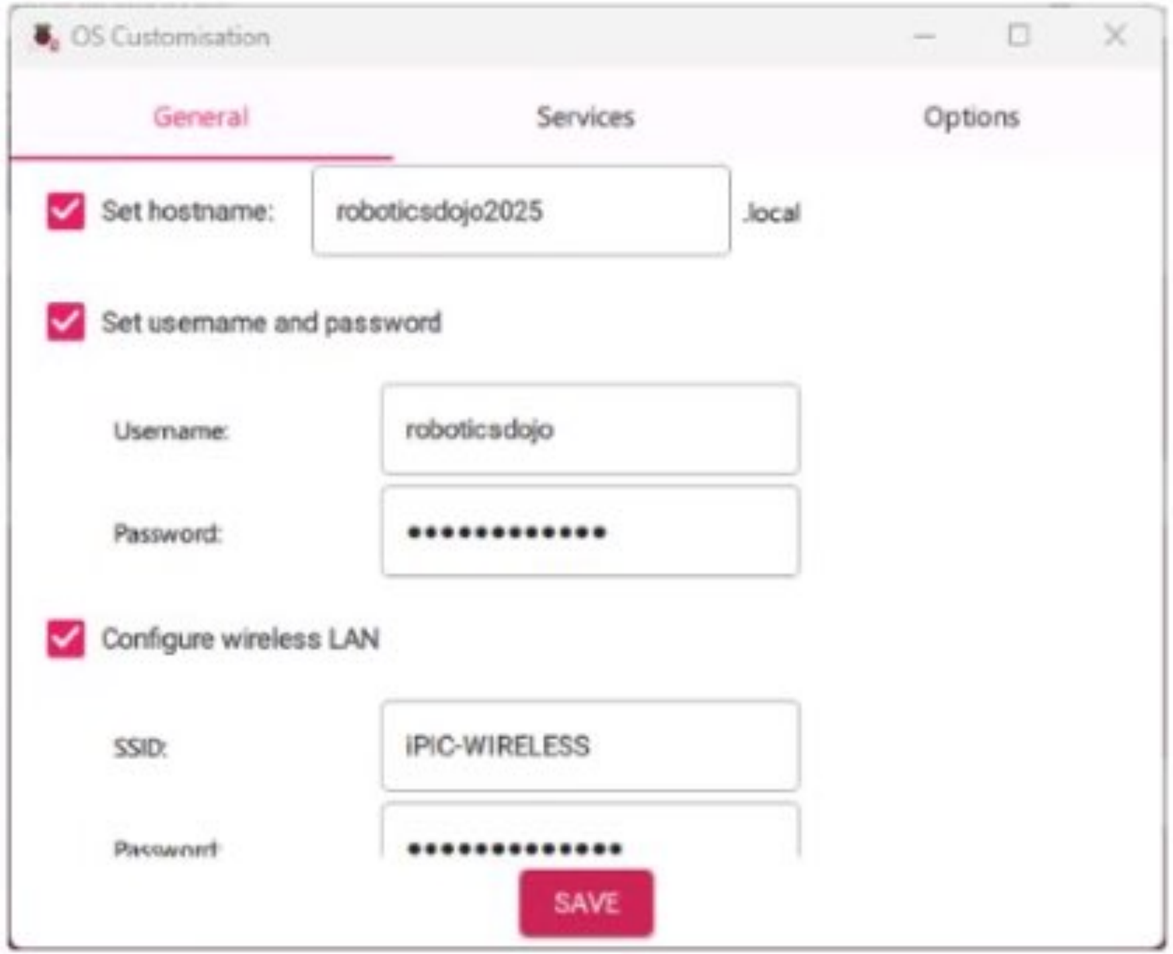


- The following pop up will appear: If not click (CTRL+SHIFT+X)



- **Click on Edit Settings**

The following will appear:



- On **General**:

Check Set hostname and type your hostname as desired.
Check Set username and password

- Enter:

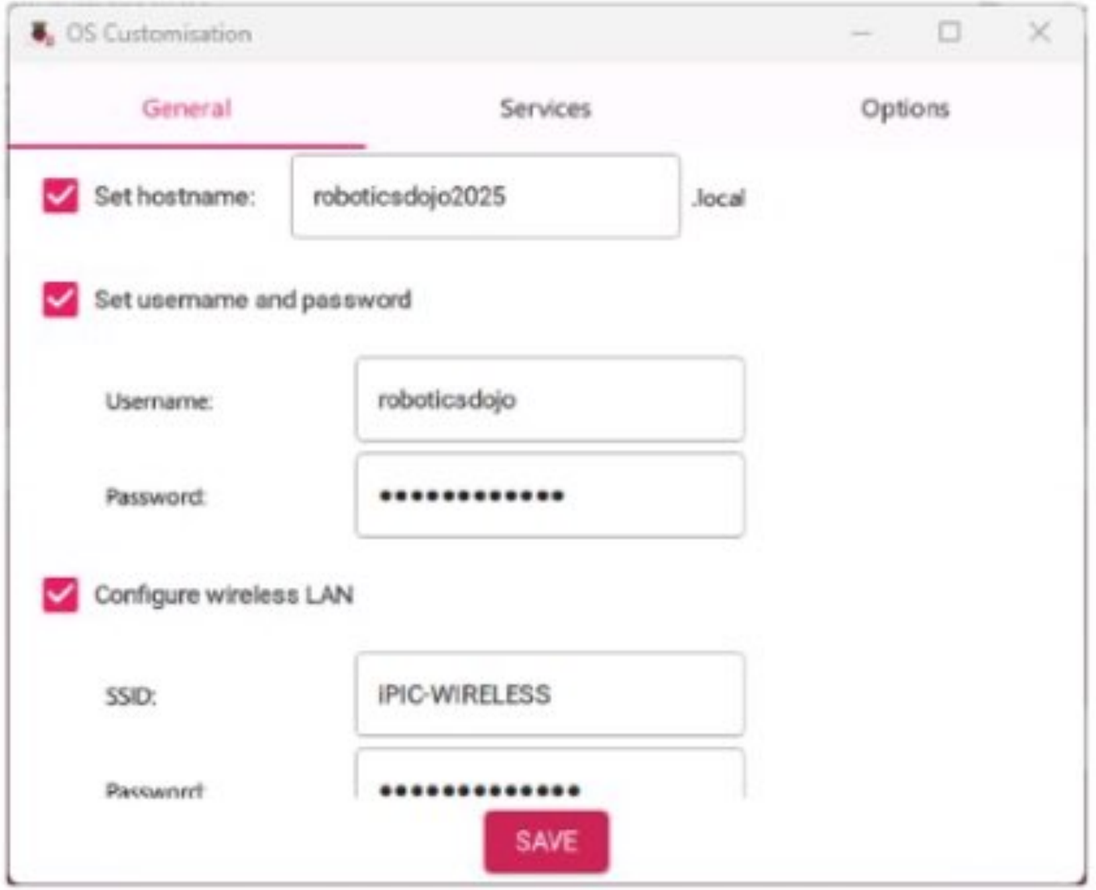
Username: your username
Password: your password

Check Configure wireless LAN

- Enter:

SSID: your Wi-Fi name
Password: your Wi-Fi password
Wireless LAN country: KE for Kenya

- Then **Click Save**



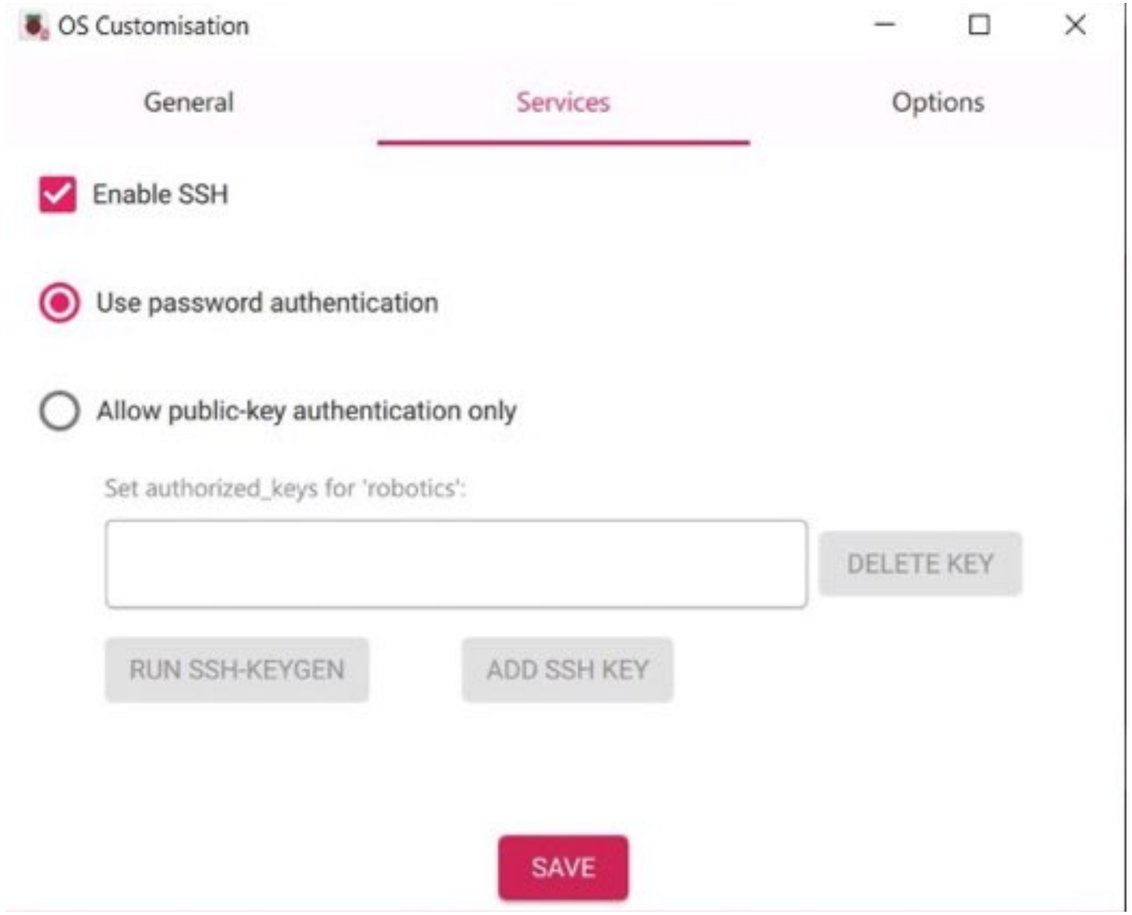
- On **Services:**

Check Enable SSH

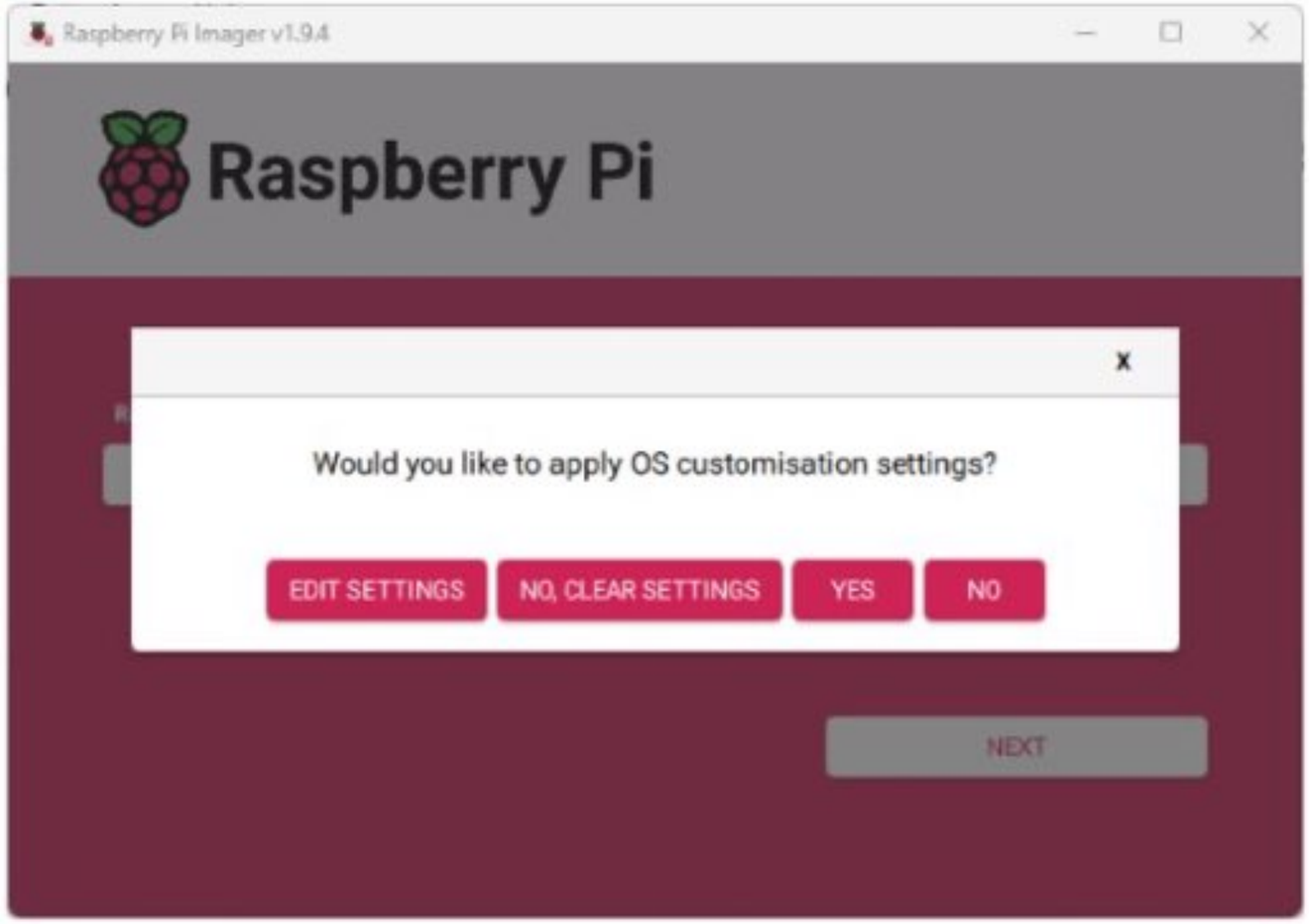
Choose Use password authentication

Then **Click Save**

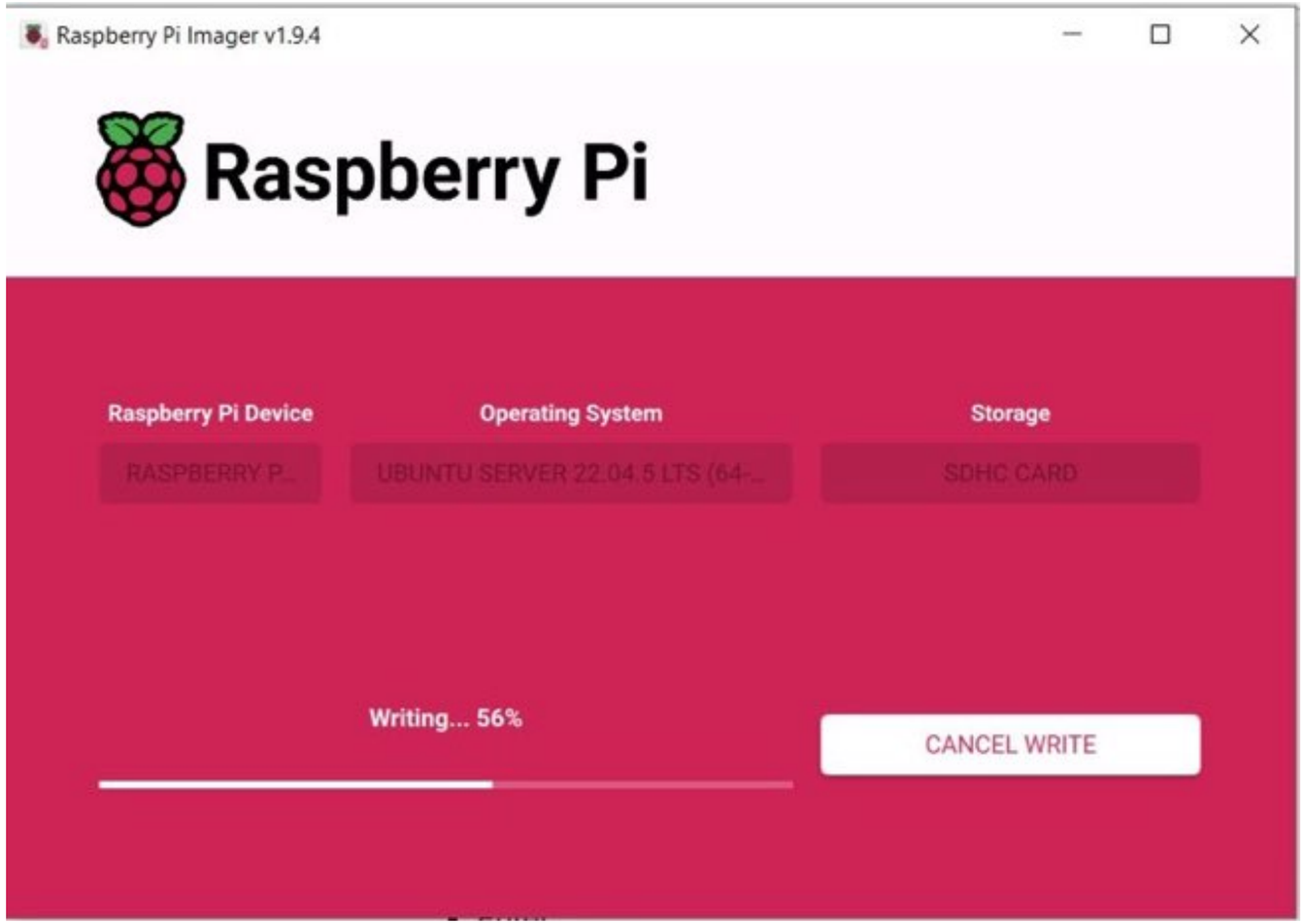
The above process is as shown below:



- **NB:Don’t edit the options section.**
- After the steps above, the following will pop up:



- **Click on yes**, it will begin to write then verify as shown below.



- This writes Ubuntu Server to your SD card with Wi-Fi preconfigured.

Step 2: Boot and Connect

1. Insert the microSD into the Pi and power it up.
2. Wait about 1–2 minutes for it to boot and connect to Wi-Fi.

Step 3: Find Your Pi’s IP Address

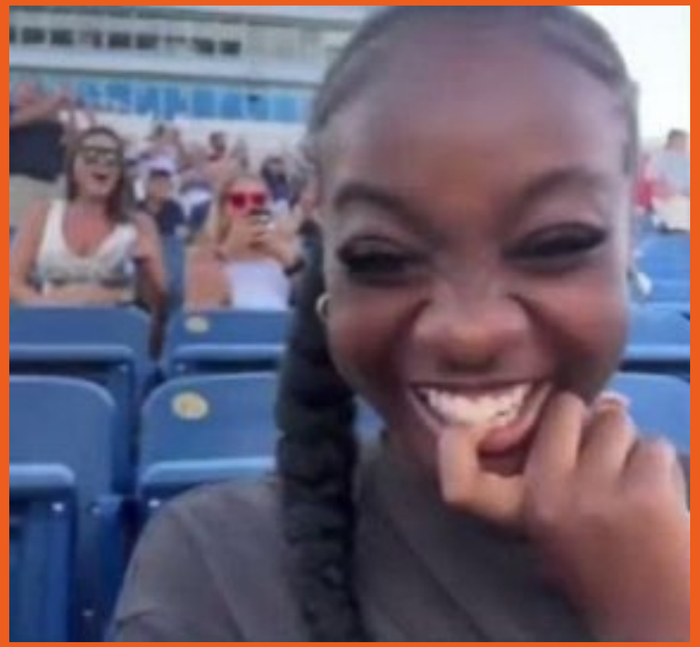
NB:Your Laptop should be connected to the same Wi-Fi or Mobile Hotspot you used to set up Raspberry Pi in Step 1 above.

Try this in **Windows Terminal or VS Code**
ssh username@username.local

- Keep trying until you find the Pi's IP Address

Resources

Raspberry Pi Blog



Thank You!

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