What is the Raspberry Pi?

•   Affordable credit-card sized computer
•   Plugs into a computer monitor or TV
•   Uses standard keyboard and mouse
•   Can browse the internet and play HD video
•   Can also interact with the outside world!

Raspberry Pi
Raspberry Pi is a tiny (about 9x6cm), low-cost ($35+), single-board computer that supports embedded Linux operating systems
The recommended
Operating System is called
Raspberry Pi OS (Linux based)

Commonly used sensors
•   Light Sensor
•   Temperature Sensor
•   Proximity Sensor
•   Pressure Sensor
•   GAS Sensor
•   Current Sensor
•   Bio-Medical Sensor
•   Sound Sensor
•   Tilt Sensor
•   Hall effect Sensor
•   Accelerometer Sensol
•   Compass Sensor
•   Flow Sensor
•   Humidity Sensor
•   Level Sensor
•   Motion Sensor
•   Speed Sensor
•   RPM Sensor
•   Force Sensor

Actuators

•   An actuator is a component of a machine that is responsible for moving or controlling a mechanism or system.

- An actuator requires a control signal and a source of energy. The control signal is relatively low energy and may be electric voltage or current, pneumatic or hydraulic pressure, or even human power.
- When the control signal is received, the actuator responds by converting the energy into mechanical. motion.

Gather Necessary Hardware: Before you can start working with a Raspberry Pi, you need the following hardware components:

Raspberry Pi board: This is the main computing unit. Different models are available, such as Raspberry Pi 4, 3B+, or Zero W. Choose the model based on your project needs.

MicroSD card (16GB recommended): The MicroSD[**secure digital-** memory card]card acts as the storage for the operating system and your files. A 16GB card is recommended for most applications, but larger storage might be better for intensive tasks.

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- **Power supply**: It is used to provide power to the kit.
- **HDMI cable and monitor**: HDMI[High Definition Multimedia Interface] and is the most frequently used HD signal for transferring both high definition audio and video over a single cable.
- The HDMI cable connects the Raspberry Pi to a monitor or TV, allowing you to view and interact with the operating system.
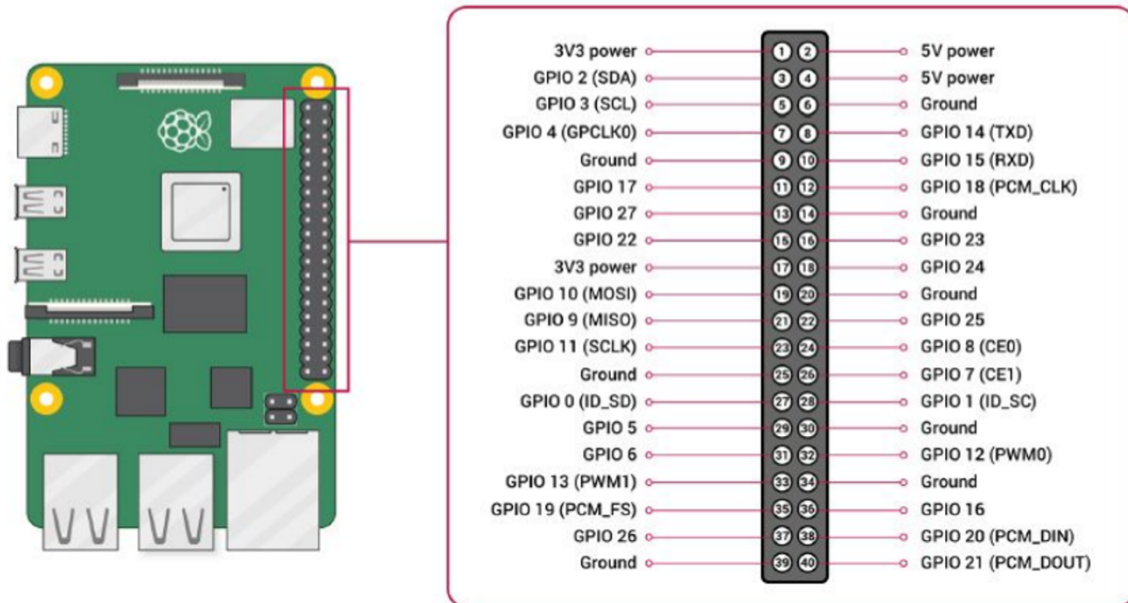- **Keyboard and mouse**: These peripherals are essential for setup and interaction if you're not using a headless configuration (without a monitor).
- **Internet connection**: The Raspberry Pi can connect to the internet via an Ethernet cable or built-in Wi-Fi, depending on the model.
- **GPIO (General-Purpose Input/Output)** refers to the physical pins on a Raspberry Pi (or similar devices) that allow you to interact with external hardware. These pins are used to send or receive digital signals, making them essential for connecting sensors, actuators, and other components to the Raspberry Pi for various projects.
- **Input Mode:** Read signals from sensors, switches, or other devices.**Output Mode:** Send signals to control LEDs, motors, or relays.

GPIO

3V3 power	① ②	5V power
GPIO 2 (SDA)	③ ④	5V power
GPIO 3 (SCL)	⑤ ⑥	Ground
GPIO 4 (GPCLK0)	⑦ ⑧	GPIO 14 (TXD)
Ground	⑨ ⑩	GPIO 15 (RXD)
GPIO 17	⑪ ⑫	GPIO 18 (PCM_CLK)
GPIO 27	⑬ ⑭	Ground
GPIO 22	⑮ ⑯	GPIO 23
3V3 power	⑰ ⑱	GPIO 24
GPIO 10 (MOSI)	⑲ ⑳	Ground
GPIO 9 (MISO)	㉑ ㉒	GPIO 25
GPIO 11 (SCLK)	㉓ ㉔	GPIO 8 (CE0)
Ground	㉕ ㉖	GPIO 7 (CE1)
GPIO 0 (ID_SD)	㉗ ㉘	GPIO 1 (ID_SC)
GPIO 5	㉙ ㉚	Ground
GPIO 6	㉛ ㉜	GPIO 12 (PWM0)
GPIO 13 (PWM1)	㉝ ㉞	Ground
GPIO 19 (PCM_FS)	㉟ ㊱	GPIO 16
GPIO 26	㊲ ㊳	GPIO 20 (PCM_DIN)
Ground	㊴ ㊵	GPIO 21 (PCM_DOUT)

Step 2 -Download the Raspberry Pi OS

The Raspberry Pi OS (previously known as Raspbian) is a Linux-based operating system optimized for Raspberry Pi. Here's how to get it:

Visit the Raspberry Pi website:

Go to the official Raspberry Pi website: raspberrypi.org.

Navigate to the Downloads section:

Click on the **Software** or **Downloads** section to find the operating system options.

Choose the appropriate OS version:

Lite version: A minimal installation suitable for headless servers or lightweight tasks.

Desktop version: Includes a graphical user interface (GUI), making it user-friendly for general tasks.

Full version: Includes the GUI and additional software packages like productivity tools and educational software, suitable for learning and development.

Choose the version based on your project's needs. For beginners or general users, the Desktop version is usually the best choice.

Download the OS:

Use the **Raspberry Pi Imager** tool available on the website to download and install the OS onto your MicroSD card. Alternatively, you can download the OS image directly and use tools like **balenaEtcher** to flash it onto the card.

Step 3: Write Raspberry Pi OS to the MicroSD Card: Once you have downloaded the Raspberry Pi OS image, the next step is to write it onto a MicroSD card so that your Raspberry Pi can boot from it. Here's how to do it:
1.Download and Install a Flashing ToolA popular and user-friendly choice is Balena Etcher, which is compatible with Windows, macOS(**Macintosh)**, and Linux:Go to the official Balena Etcher website.Download the appropriate version for your operating system.Install the application by following the on-screen instructions.
2.Insert the MicroSD CardInsert the MicroSD card into your computer. Use an SD card reader if your computer doesn't have a built-in card slot.Ensure the card has sufficient storage (16GB or more is recommended) and is properly detected by your system.
 3. Open Balena EtcherLaunch the Balena Etcher application.You will see a simple interface with three main options: Flash from file, Select target, and Flash!.
4. Select the Raspberry Pi OS ImageClick "Flash from file" and browse to locate the Raspberry Pi OS image file you downloaded earlier (usually in .img or .zip format).Select the file to load it into Balena Etcher.
5. Choose the MicroSD Card as the TargetClick "Select target" to choose the MicroSD card.Make sure you select the correct card to avoid accidentally overwriting another drive.
6. Start FlashingClick "Flash!" to begin writing the OS image to the MicroSD card.Balena Etcher will first write the image and then validate it to ensure no errors occurred during the process
.7. Wait for CompletionThe process may take a few minutes depending on the image size and your system speed.Once completed, you'll see a confirmation message.
8. Safely Eject the MicroSD CardClose Balena Etcher and safely eject the MicroSD card from your computer.