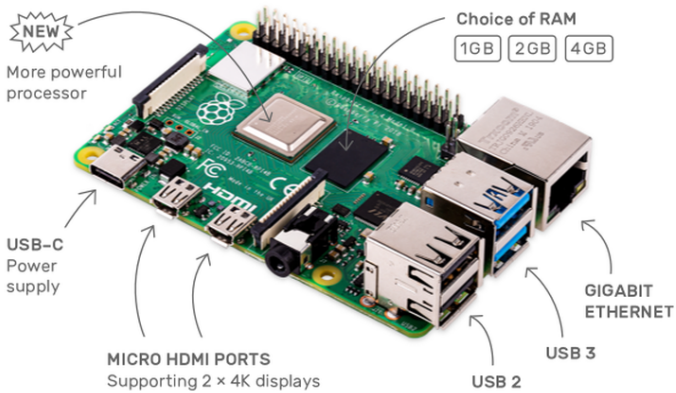
Raspberry Pi

Internet of Things

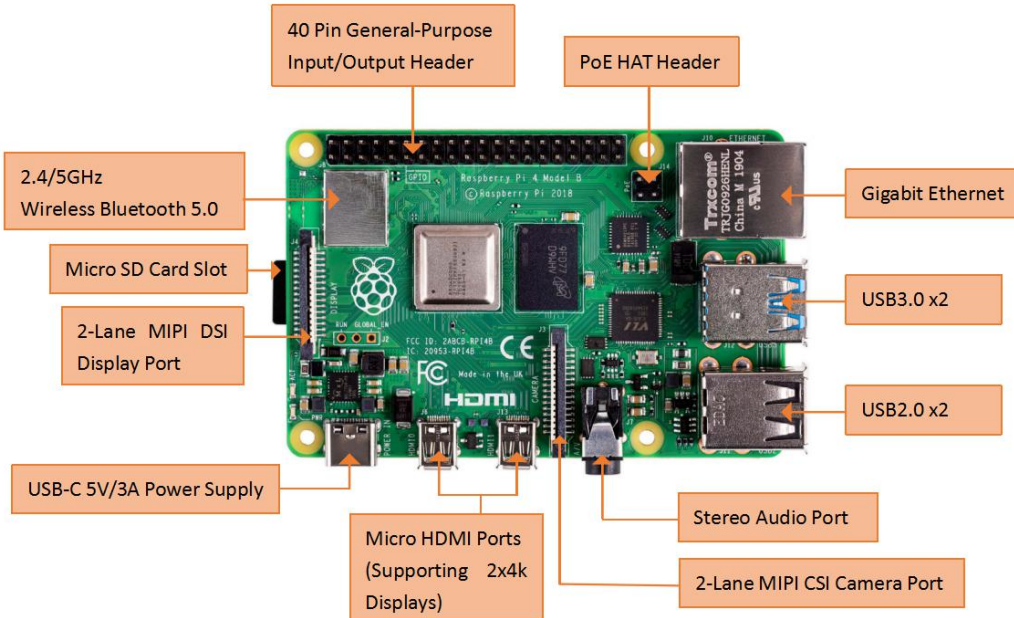
Rahul Shandilya

Raspberry pi

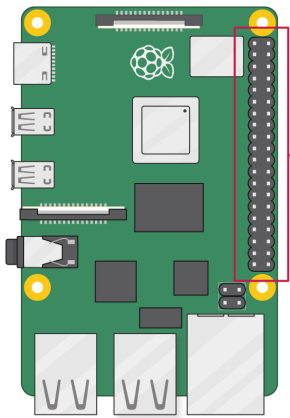
The Raspberry Pi is a very cheap computer that runs Linux, but it also provides a set of GPIO (general purpose input/output) pins that allow you to control electronic components for physical computing and explore the Internet of Things (IoT). Raspberry Pi is used to learn programming skills, build hardware projects, do home automation, and industrial applications.



Raspi Board

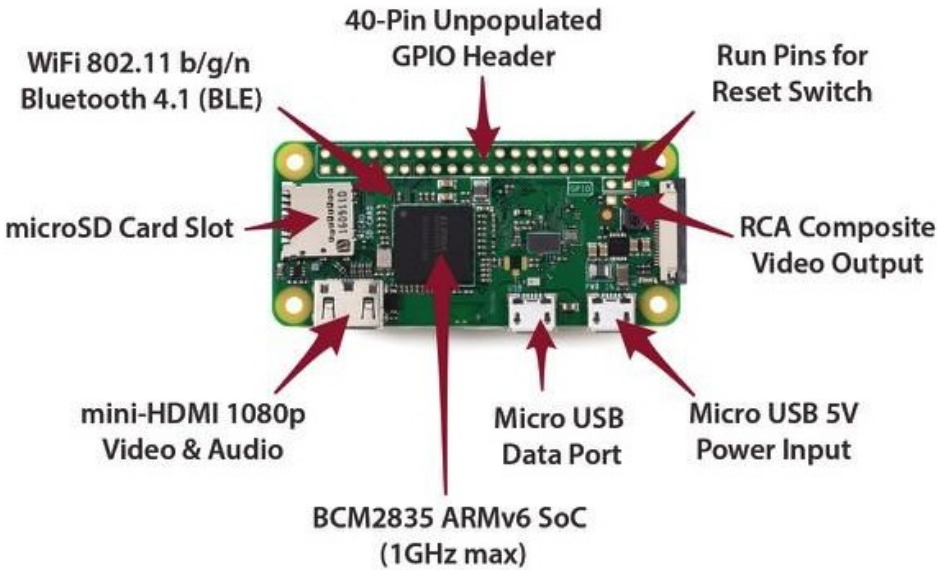

40 Pin General-Purpose Input/Output Header
PoE HAT Header
2.4/5GHz Wireless Bluetooth 5.0
Gigabit Ethernet
Micro SD Card Slot
USB3.0 x2
2-Lane MIPI DSI Display Port
USB2.0 x2
USB-C 5V/3A Power Supply
Stereo Audio Port
Micro HDMI Ports (Supporting 2x4k Displays)
2-Lane MIPI CSI Camera Port

Pin Diagram



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)

Raspi Zero


40-Pin Unpopulated
GPIO Header
WiFi 802.11 b/g/n
Bluetooth 4.1 (BLE)
Run Pins for
Reset Switch
microSD Card Slot
RCA Composite
Video Output
mini-HDMI 1080p
Video & Audio
Micro USB
Data Port
Micro USB 5V
Power Input
BCM2835 ARMv6 SoC
(1GHz max)

Raspi Features

	Raspberry Pi 3 Model B	Raspberry Pi Zero	Raspberry Pi 2 Model B	Raspberry Pi Model B+
Introduction Date	2/29/2016	11/25/2015	2/2/2015	7/14/2014
SoC	BCM2837	BCM2835	BCM2836	BCM2835
CPU	Quad Cortex A53 @ 1.2GHz	ARM11 @ 1GHz	Quad Cortex A7 @ 900MHz	ARM11 @ 700MHz
Instruction set	ARMv8-A	ARMv6	ARMv7-A	ARMv6
GPU	400MHz VideoCore IV	250MHz VideoCore IV	250MHz VideoCore IV	250MHz VideoCore IV
RAM	1GB SDRAM	512 MB SDRAM	1GB SDRAM	512MB SDRAM
Storage	micro-SD	micro-SD	micro-SD	micro-SD
Ethernet	10/100	none	10/100	10/100
Wireless	802.11n / Bluetooth 4.0	none	none	none
Video Output	HDMI / Composite	HDMI / Composite	HDMI / Composite	HDMI / Composite
Audio Output	HDMI / Headphone	HDMI	HDMI / Headphone	HDMI / Headphone
GPIO	40	40	40	40
Price	$35	$5	$35	$35

Raspi important connectors

GPIO header

GPIO stands for General Purpose Input Output, which has been brought out to pin connectors present on the board. We can read values from any other peripherals, such as sensors, and compute the received values in your own programs. Apart from reading the values, we can show the result of the program by connecting LEDs or embedded LCD displays to the board. Depending on the decision taken in the code, we can drive a motor connected on GPIO through a motor driver circuit

RCA video out

It carries the video signal, which is the type output on the RasPi. The RCA connector or composite video signal is merged with a 3.5 mm audio jack on RasPi 1 model A+ and model B+ and RasPi 2 model B.

3.5 mm audio out jack

If you are not using the HDMI connection the audio can be played through speakers or headphones using a standard 3.5 mm jack. In RasPi 1 model B+ or RasPi 2 model B, audio jack being the combination of composite and audio has all the functionalities of composite video and audio out.

USB

his is the most common connector, widely used in the modern computers, and hence called the Universal Serial Bus. You can connect your flash drives, keyboard, Wi-Fi dongles, and mouse to play around with the RasPi. You can also connect the externally powered USB hub with RasPi to connect more USB-based peripherals on it.

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Ethernet

This is one of the most important connections to have a remote login on RasPi and to provide wired internet connection.We cannot always connect RasPi to the dedicated display, so we use the remote login, and we see the entire desktop or Command-line Interface (CLI) of RasPi on our computer screen.

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CSI camera connector

The RasPi board does not come with camera module integrated, but a separately bought camera module can be interfaced using the CSI connector via a 15 cm flex cable. The 5-megapixel Raspberry Pi camera module can be used to record high-definition videos as well as still photographs. This camera module provides improved performance over a USB-connected camera.

HDMI connector

The High-definition Multimedia Interface (HDMI) is a compact audio/video interface used to transfer uncompressed media data.You can connect your modern HDTV to watch full high definition (FHD/ HD) videos through the RasPi. If you plug in the HDMI connector, there is no need to connect the speakers to the audio jack, and if you want to get sounds on both HDMI and the 3.5 mm jack, then you'll have to play with and edit the internal files of Linux.

Micro USB power

The device can be powered by a 5V input voltage, and the current ratings solely depend upon what you have hooked up with RasPi. the RasPi module does not have the power on button, just plugging the micro USB power adapter will boot the RasPi.

SD card slot

The SD card is important because it is where the RasPi keeps its operating system. It is also where you will store your documents, programs, and pictures.

Display connector

Last but not least, the display connector is used to connect a 7-inch finger-touch LCD display to the board for your embedded product development. But usually, the RCA and HDMI are enough.

Application of Raspberry Pi

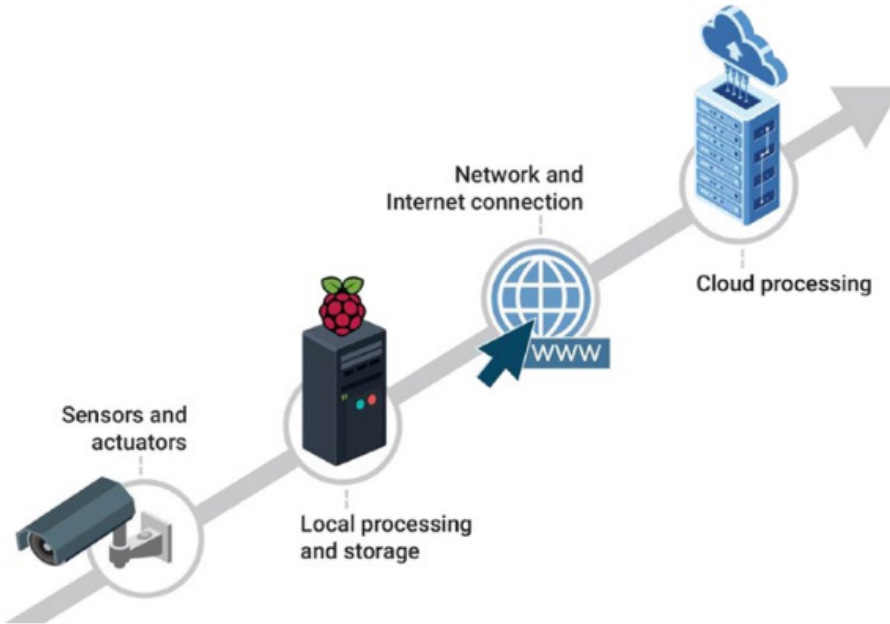
The Raspberry Pi As an Edge Device

The Raspberry Pi is the most used edge device for building IoT solutions.The affordable price and accessibility made it extremely popular. The computing and storage capabilities of the Raspberry Pi enables people to use it as an edge device within the IoT projects they are building. Also, both Raspberry Pi models can be directly connected to sensors and actuators through pins. The devices can support the basic GPIO, SPI, I2C, serial connections, and other more complex types. The Raspberry Pi is widely integrated into commercial and industrial machines.

The Raspberry Pi in Industry

A fundamental characteristic of any industrial system is the need to respond in real time to specific triggers.As already mentioned, industrial devices need to be robust and to work uninterrupted for long periods of time (years) in harsh conditions.If, or when, they fail, IoT devices need to be able to reset and recover automatically or, as in the case of catastrophic failures, send diagnosis information to the main systems. This is why most of the industrial systems are built around PLCs.Today, PLCs which are compatible with the Raspberry exist, enabling the integration of the Raspberry Pi into industrial products.

Raspi in IoT


Network and
Internet connection
Cloud processing
WWW
Sensors and
actuators
Local processing
and storage