Python and Raspberry Pi

The Raspberry Pi Foundation

The Raspberry Pi Foundation is a charity that works to put the power of digital making into the hands of people all over the world by making computing accessible to all. More than 15 million Raspberry Pi computers have been sold since the first product launch in 2012, and all sales profits go towards the Foundation’s educational programmes, courses, and resources.

Current Raspberry Pi models

- Raspberry Pi 3
- Raspberry Pi Zero/Zero W

Add-on boards/HATs

Instead of connecting components to GPIO pins, you can use add-on boards which consist of embedded components on a PCB (printed circuit board) and sit on top of the Pi’s GPIO pins. HAT (Hardware Attached on Top) add-on boards are very useful for extending the capabilities of your Raspberry Pi without needing to wire up or solder components. The Foundation has specified a HAT standard to determine which add-on boards can be considered HATs. An ever-growing range of HATs is available from the community of Raspberry Pi accessory retailers.

GPIO pins

These pins (General-Purpose Input/Output pins) allow you to connect electronic components and to program physical devices, e.g. sensors or lights. They are useful for home automation and a diversity of maker projects. You can connect components directly to the pins using jumper wires, or use a breadboard and allow components to share use of some pins. The pins include:

- 3V3 (a constant supply of 3.3 volts)
- 5V (a constant supply of 5 volts)
- GND (ground pins — 0 volts)
- GPIO (general-purpose pins)
- SPI (Serial Peripheral Interface)
- I2C (Inter-Integrated Circuit)
- UART (Universal Asynchronous Receiver/Transmitter)

Camera Module and picamera

You can control the GPIO pins using a wide range of programming languages, but the easiest and most popular one is Python. The GPIO Zero library provides a simple interface to GPIO devices, and includes support for a range of components and add-on boards. With just a few lines of code you can flash an LED.

Camera Module and picamera

In order to make the Astro Pi competition more accessible, we also provide Sense HAT emulators: an online version on trinket.io and a desktop version (just run pip install sense_emu). rpi.io/hats

Sense HAT

The Sense HAT is a Raspberry Pi add-on board made especially for ESA astronaut Tim Peake to take to the International Space Station for our Astro Pi programme. This programme gives young people across Europe the opportunity to run their Python code in space!

The Sense HAT’s Python library provides easy access to the sensors and the display.

Python and GPIO Zero

GPIO Zero works with a selection of low-level GPIO libraries including pigpiod, which supports remote GPIO. This means you can run Python code on one Raspberry Pi to control devices on another Pi, or even multiple Pis, or you can run the code on a PC or Mac. The library also provides a ‘mock pin’ tool which allows you to test your code without Raspberry Pi hardware.

Raspbian operating system

Based on Debian Stretch
Optimised for Raspberry Pi hardware
Custom lightweight desktop theme
Includes Python 3.5 and 2.7

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Multi-paradigm programming

Python is a multi-paradigm programming language, so you can write code in a number of different styles, like procedural, event-driven, object-oriented and functional. For simple tasks, the same outcome can be achieved using one of several styles.

GPIO Zero makes it easy to get started, and enables users to progress along the learning curve towards more advanced programming techniques. For example, if you want to make a push button control an LED, the easiest way to do this is via procedural programming using a while loop:

```python
from gpiozero import LED, Button
led = LED(17)
button = Button(2)
while True:
    if button.is_pressed:
        led.on()
    else:
        led.off()
```

Another way to achieve the same thing is to use events (callbacks):

```python
from gpiozero import LED, Button
led = LED(17)
button = Button(2)
button.when_pressed = led.on
button.when_released = led.off
```

You could even use a declarative approach, and set the LED's behaviour in a single line:

```python
from gpiozero import LED, Button
led = LED(17)
button = Button(2)
led.source = button.values
```

Use your programming skills to become a digital maker, contribute to open-source projects, and volunteer to engage more young people in making things with Python!

Get involved

- Raspberry Jams are family-friendly community events for people of all ages — find your nearest one, or find out how to start your own, at rpf.io/jam
- Code Club is a worldwide network of volunteer-led coding clubs for children aged 9-13. rpf.io/cd
- CodeDogs is a global network for free computer programming clubs for young people. rpf.io/cd
- See the Raspberry Pi website for more of our initiatives and programmes! rpi.io