CamJam EduKit Worksheet Five

Project Push button for physical input.

Description In this project, you will learn how to wire and program a push button for physical input.

Equipment Required

The circuit built in CamJam EduKit Worksheet Two, plus the following:

- Push button
- 2 x M/F Jumper Wires
- 1 x M/M Jumper Wires
- 4.7k Ω Resistor

Additional Parts

You will be adding a switch to the LED circuit that you made in CamJam EduKit Worksheet Two. Here are the additional components. You may skip this section if you already know about these components.

Push Button

A push button will complete a circuit when the button is pressed. What that means is that a current will not flow across the button until it is pressed. When it is released, the circuit will be 'broken'.

4.7kΩ Resistor

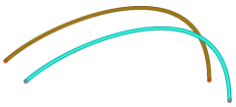
The resistor in this circuit has a special purpose.

You are going to use one of the GPIO pins as an input pin, meaning that it will react to the outside world. If you try to detect the state of one of the GPIO input pins it will randomly be either on or off, so you must have a way to ensure that it is on or off in a reliable way.

For this, you are going to use what is called a 'pull-up resistor'. When the button is not pressed, there will be a current flowing from the 3.3v power supplied by the Pi to the input pin of the Pi. When read, the input pin will be seen as being 'on'.

When you press the switch, another circuit is made which will make the current 'flow to ground', which means that the input pin will be seen as being 'off'. This is how you will detect the switch.

Jumpers

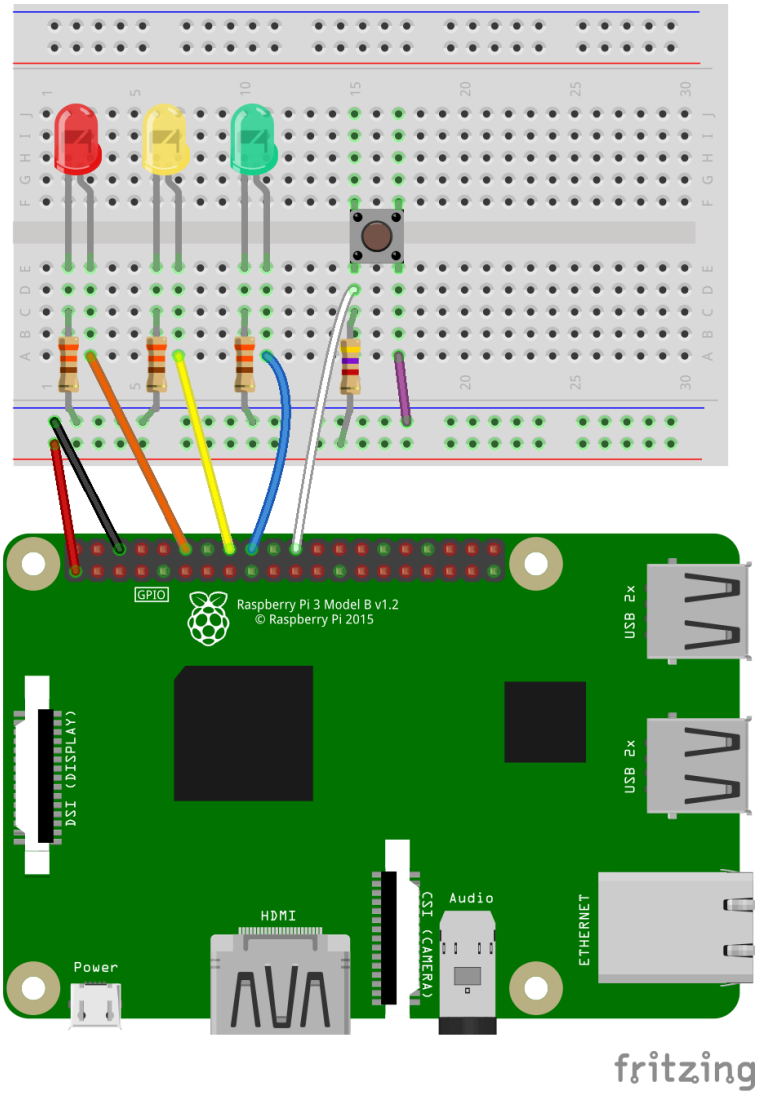


You will be adding two more Male/Female jumper wires and one Male/Male (M/M) jumper, which has a pin on each end. The M/M jumper will be used for joining two rows or columns on the breadboard together.

The jumper wires supplied in the EduKit will vary in colour and are unlikely to match the colours used in the diagrams.

Building the Circuit

Before you connect additional components to your circuit, you should turn off your Pi. Leave the LED circuit from the previous worksheets in place.



Add the button to the breadboard, with the pins straddling the split in the middle of the board. It will only fit one way round. Push down hard to ensure that the pins are inserted fully into the breadboard.

Connect one of the jumpers (shown in red here) from the 3.3v pin of the Raspberry Pi to the horizontal rail just above the red line.

Connect the 4.7kΩ resistor between the same horizontal rail and one side of the button.

Then connect another jumper (shown in white) from the same column of the breadboard as the resistor to the input pin you are going to use on the Raspberry Pi. You are using pin 25.

Finally, connect the 'ground rail' to the other side of the switch, shown here by the purple wire.

So, how does the switch work? When the switch is not being pressed, a current will flow between the 3.3v pin of the Pi, through the red wire, then the resistor and to the input GPIO pin of the Pi through the white wire.

When the switch is pressed, the current takes another route. It also goes from the resistor, through the switch and back to ground (0v). This splits enough of the current off that the voltage across the white wire is much lower, and no longer high enough for the input GPIO pin to be seen as 'on'.

Code

Using the IDLE3 editor, create a new file. Type in the following code:

```
# CamJam Edukit 1 - Basics
# Worksheet 5 - Button

# Import Libraries
import os                 #Gives Python access to Linux commands
import time               #Proves time related commands
import RPi.GPIO as GPIO #Gives Python access to the GPIO pins

GPIO.setmode(GPIO.BCM)  #Set the GPIO pin naming mode
GPIO.setwarnings(False) #Supress warnings
```

```
# Set pin 25 as an input pin
ButtonPin = 25
GPIO.setup(ButtonPin, GPIO.IN)

print("---------------")
print(" Button + GPIO ")
print("---------------")

print(GPIO.input(ButtonPin))

# The commands indented after this 'while' will be repeated
# forever or until 'Ctrl+c' is pressed.
while True:
    # If the button is pressed, ButtonPin will be 'false'
    if GPIO.input(ButtonPin) == False:
        print("Button Pressed")
        print(GPIO.input(ButtonPin))
        time.sleep(1) # Sleep for 1 second
    else:
        os.system('clear') # Clears the screen
        print("Waiting for you to press a button")

    time.sleep(0.5) # Sleep for 0.5 seconds
```

Save the file as `5-blink.py`.

Concepts

What is happening in the code? Let us go through some of the important concepts before looking at the code:

- A 'variable' is a name that contains a value. That value can be changed within your code at any time. It is often easier to use a variable to contain a number because it is easier to remember the name.
- 'Constants' are similar to variables, except that they cannot be changed within your code.
- In Python, there are two special 'constants' called 'True' and 'False'. They have the values '1' and '0'.
- Indentation is very important in Python. It is used to group commands together after certain other commands, like 'if' and 'while'. Everything at the same indentation distance after these commands will be grouped together.

Explanation of the Code

```
#Set pin 25 as an input pin
ButtonPin = 25
GPIO.setup(ButtonPin, GPIO.IN)
```

The code above sets up a 'variable' that holds the pin number (25) and then sets it as an 'input' pin. This means that the status of the pin can be read.

When the pin detects a voltage nearing 3.3v, it is read as 'true', or 'on'. If the voltage nears 0v, then it is 'false', or 'off'.

```
while True:
```

The commands indented after this 'while' will be repeated forever, or until 'CTRL+c' is pressed.

```
    if GPIO.input(ButtonPin) == False:
```

The 'if' statement gets the value of the input pin. The value is either:

- 'True', meaning the button is being pressed, or
- 'False', meaning the button is not being pressed.

If it is 'False', then the button is being pressed. Everything indented after the 'if' statement will be run.

```
    else:
```

If the value of the input button is not 'false', then different code is run.

```
     time.sleep(0.5) # Sleep for 0.5 seconds
```

There is a half-second wait between looking at the state of the button to allow any messages to appear on the screen for long enough to read.

Running the Code

Run the code by selecting the Run Module menu option, under the Run menu item. Alternatively, you can just press the F5 key.

The program will wait for the button to be pressed and report the status to the screen. This will continue until you press 'Ctrl + c' to exit Python.