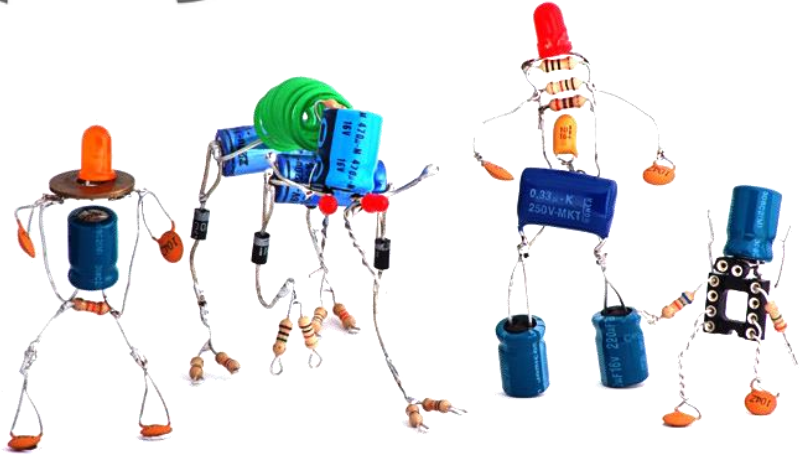




# python

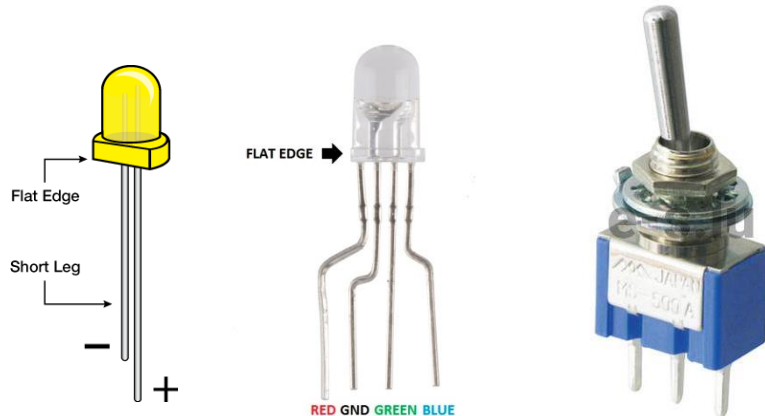


Basic hardware programming with Python & Raspberry PI

# Types of hardware

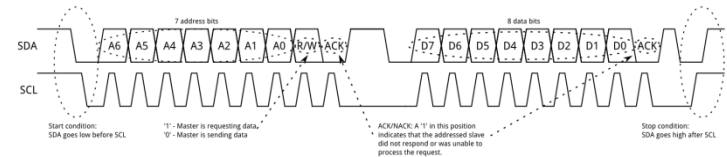
## Electricity based

- GPIO (General Purpose Input/Output)
  - Electricity ON or OFF for input and output
  - Raspberry GPIO is v3.3 tolerant!



## Communication based

- I2C
- SPI
- One Wire
- Serial

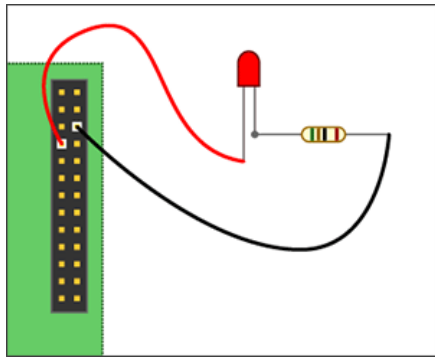


# Raspberry PinOut



		Physical Pins			
GPIO#	2nd func	pin#	pin#	2nd func	GPIO#
N/A	+3V3	1	2	+5V	N/A
GPIO2	SDA1 (I2C)	3	4	+5V	N/A
GPIO3	SCL1 (I2C)	5	6	GND	N/A
GPIO4	GCLK	7	8	TXD0 (UART)	GPIO14
N/A	GND	9	10	RXD0 (UART)	GPIO15
GPIO17	GEN0	11	12	GEN1	GPIO18
GPIO27	GEN2	13	14	GND	N/A
GPIO22	GEN3	15	16	GEN4	GPIO23
N/A	+3V3	17	18	GEN5	GPIO24
GPIO10	MOSI (SPI)	19	20	GND	N/A
GPIO9	MISO (SPI)	21	22	GEN6	GPIO25
GPIO11	SCLK (SPI)	23	24	CE0_N (SPI)	GPIO8
N/A	GND	25	26	CE1_N (SPI)	GPIO7
EEPROM	ID_SD	27	28	ID_SC	EEPROM
GPIO5	N/A	29	30	GND	N/A
GPIO6	N/A	31	32	-	GPIO12
GPIO13	N/A	33	34	GND	N/A
GPIO19	N/A	35	36	N/A	GPIO16
GPIO26	N/A	37	38	N/A	GPIO20
N/A	GND	39	40	N/A	GPIO21

# Switching - Output



```
#!/bin/python

# import the GPIO library
import RPi.GPIO as GPIO

ledPin = 4

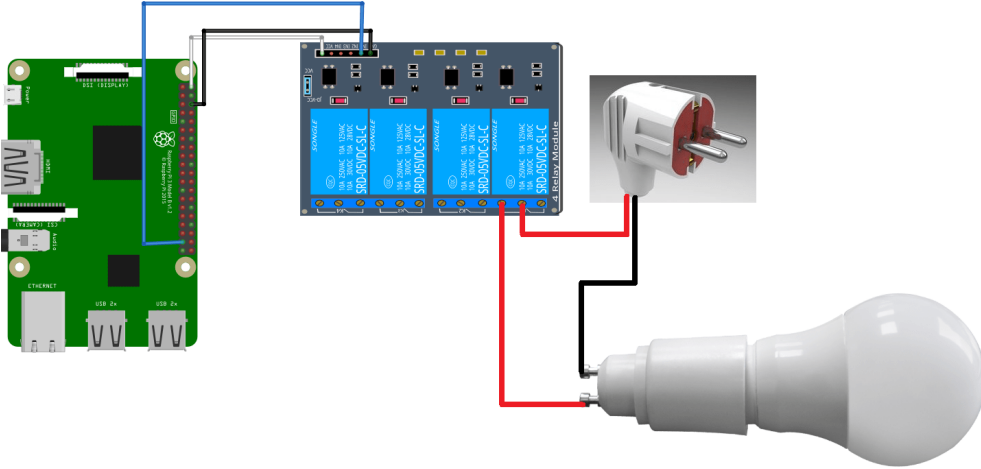
# Set pinmode to Broadcom SOC.
GPIO.setmode(GPIO.BCM)

# Turn off warning messages.
GPIO.setwarnings(False)

# Set GPIO port to Output.
GPIO.setup(ledPin, GPIO.OUT)

# Turn on LED.
GPIO.output(ledPin, True)
```

# Switching – Output



Switching “Big Power” devices

- Relay switch
- Transistor
- Mosfet (high power transistor)
- Solid State

# Switching – Input (Basic)

Momentary Switch



**NOTE:**

GPIO2 pull-down resistor must be enabled to prevent the pin state from floating.

Raspberry Pi P1 Header					
PIN #	NAME		NAME	PIN #	
			5.0 VDC Power		
8	SDA0 (I2C)	3	DNC		
9	SCL0 (I2C)	5	0V (Ground)		
7	GPIO 7	7			
	DNC	9			
0	GPIO 0	11			
2	GPIO2	13			
3	GPIO3	15			
	DNC	17			
12	MOSI	19			
13	MISO	21			
14	SCLK	23			
	DNC	25			

http://www.pi4j.com

```
#!/bin/python
```

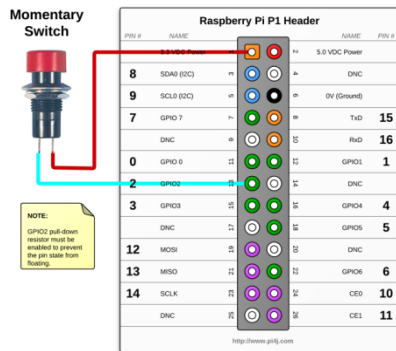
```
import RPi.GPIO as GPIO  
from time import sleep
```

```
GPIO.setmode(GPIO.BCM)  
GPIO.setwarnings(False)
```

```
GPIO.setup(5, GPIO.IN, pull_up_down = GPIO.PUD_DOWN)
```

```
while True:  
    print (GPIO.input(5))  
    time.sleep(1)
```

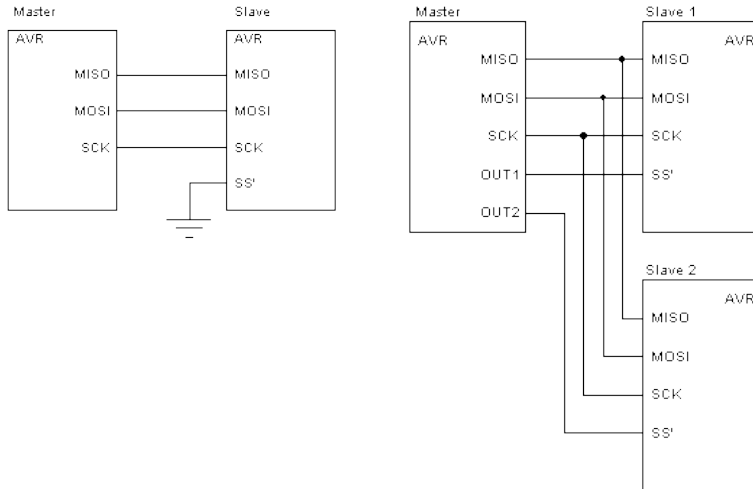
# Switching – Input (Adv)



# I2C vs SPI

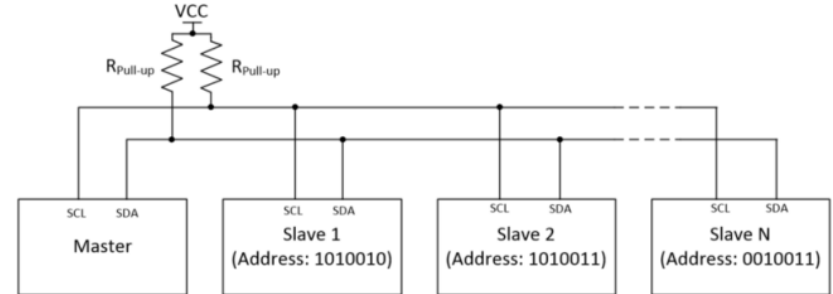
- **SPI**

- Mainly single device (max 2)



- **I2C**

- Network of devices (127)



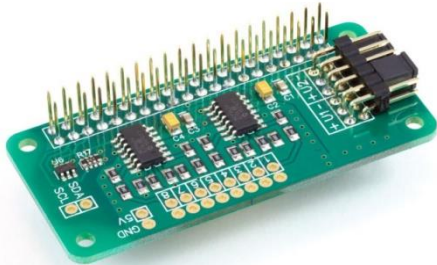


# Analog and PWM

## ADC

### Analog to Digital Converter

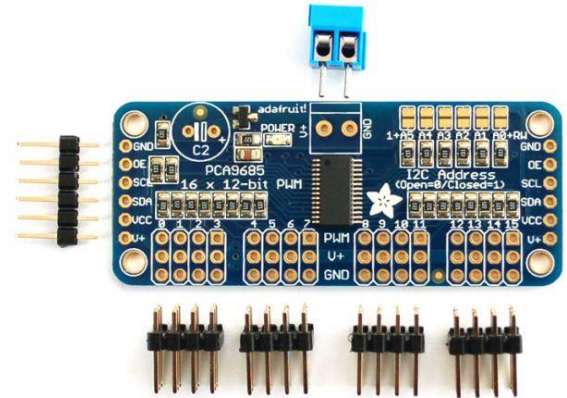
- Microchip MCP3424 A/D based
- 8 x 17-bit 0 to 5V Single Ended Inputs
- Control via the Raspberry Pi I2C port
- input voltage range 0 - 5.06V



## PWM

### Pulse With Modulation

- Mainly used for LED Dimming and Servo Control
- PCA9685 – 16 Channel 12-bit PWM I2C Interface



# Getting sensors / devices

Netherlands

<https://www.kiwi-electronics.nl>

<https://www.sossolutions.nl/>

UK

<https://coolcomponents.co.uk/>

<https://www.modmypi.com/>

US

<https://www.adafruit.com/>