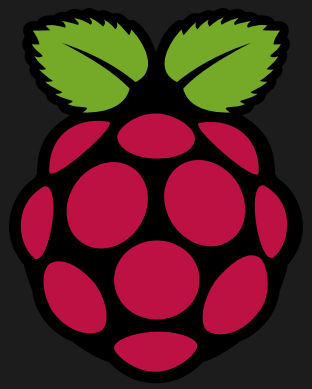
# Raspberry Pi & GPIO Zero



# Topics

What is the Raspberry Pi?

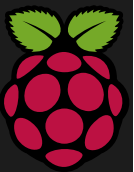
What are GPIOs?

Physical computing starter kits

What is GPIO Zero?

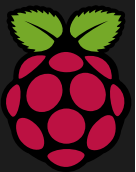
GPIO Zero documentation and tutorials

GPIO Zero examples



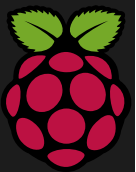
# Martin Wimpress

1972 Vintage Human Meatbag



Software Engineer

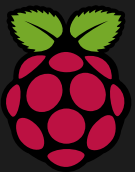
CANONICAL



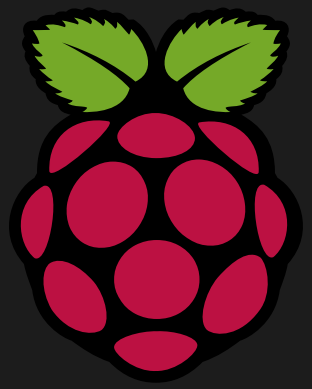
# Ubuntu Desktop Team

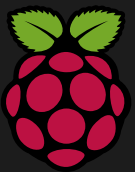
ubuntu

by Canonical and friends



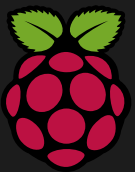
# Raspberry Pi Insider



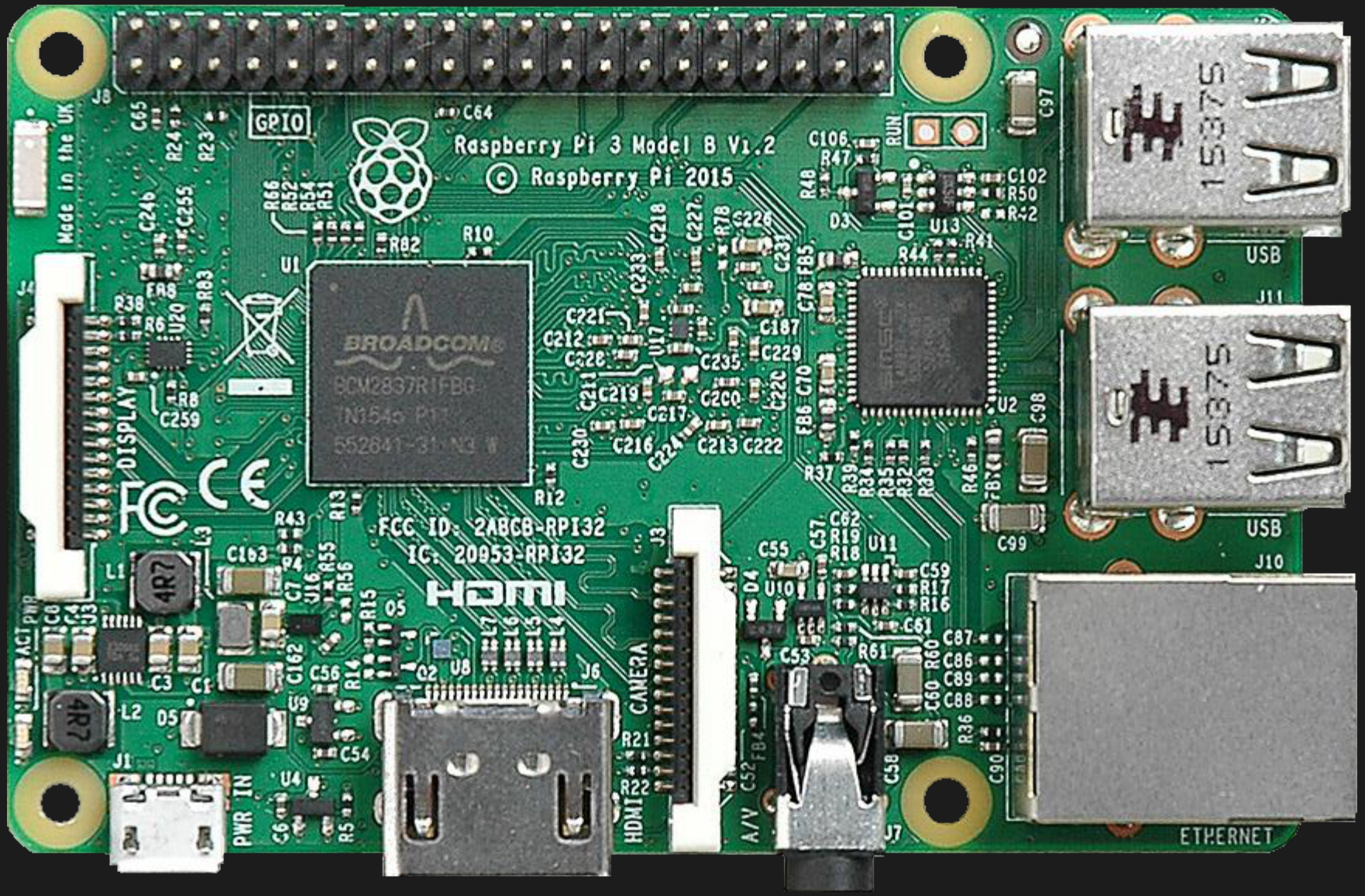


# A complete GPIO newbie!

Absolutely the worst person to give this talk!



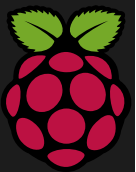
# What is the Raspberry Pi?



# What is the Raspberry Pi?

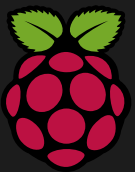
*“The Raspberry Pi is a series of credit card-sized single-board computers developed in the United Kingdom by the Raspberry Pi Foundation to promote the teaching of basic computer science in schools and in developing countries.”*

- Wikipedia



# The Raspberry Pi line-up?

- Raspberry Pi Model A 1 & 1+
  - Old and crusty
  - $20 - $25
- Raspberry Pi Model B 1, 1+, 2 & 3
  - New hotness!
  - $25 - $35
- Raspberry Pi Compute Module 1 & 3
  - Specialist
- Raspberry Pi  Zero
  - Adorable
  - $5



# Which Raspberry Pi to buy?

- Raspberry Pi Model A 1 & 1+
  - Old and crusty
  - $20 - $25
- Raspberry Pi Model B 1, 1+, 2 & **3**
  - New hotness!
  - $25 - $35
- Raspberry Pi Compute Module 1 & 3
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- Raspberry Pi  Zero
  - Adorable
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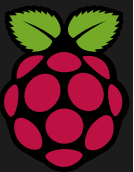
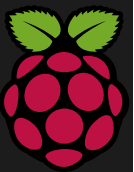


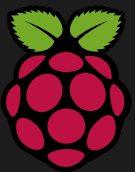
# What do you get for $35?

- Broadcom BCM2837 ARMv8-A (64/32-bit)
  - 1.2 GHz 64-bit quad-core ARM Cortex-A53
  - 1 GB RAM (shared with GPU)
- Broadcom VideoCore IV GPU
  - OpenGL ES 2.0
  - H.264/MPEG-4 decoder and encoder
  - HDMI 1.3
- 4× USB 2.0 ports & 1× 10/100 Ethernet port
- 2.4 GHz WiFi 802.11n & Bluetooth 4.1
- 15-pin MIPI **camera interface** (CSI) connector
- **17× GPIO**

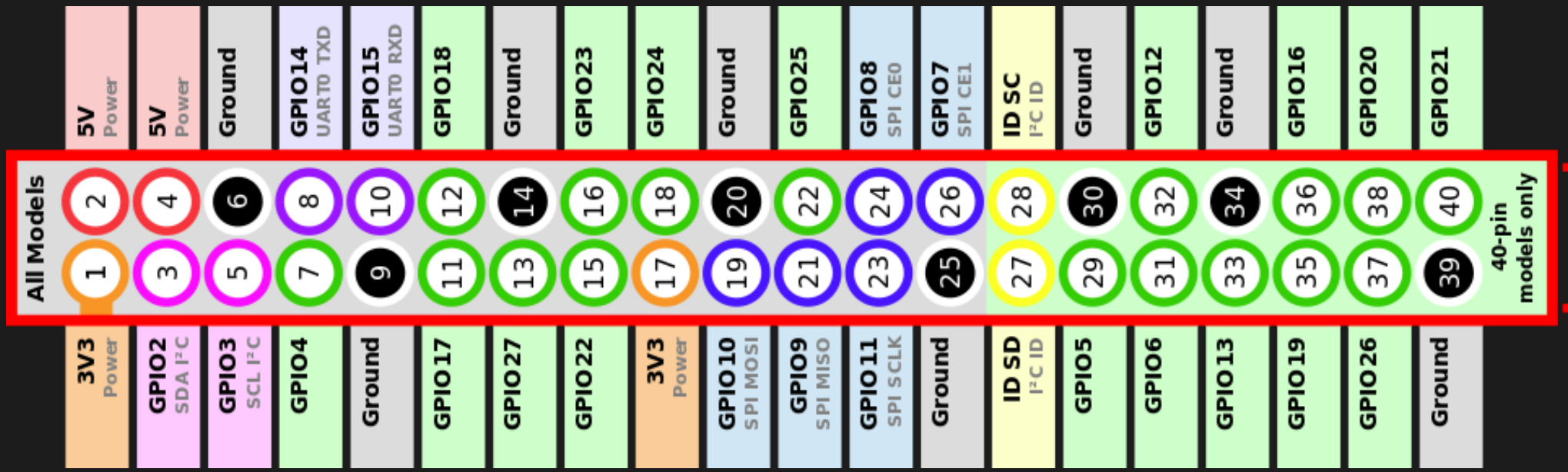


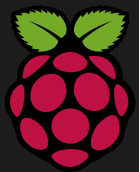
# What are GPIOs?

- **G**eneral **P**urpose **I**nput-**O**utput connector
  - 40-pin GPIO header on the Raspberry Pi
  - Enables the connection and control of electronic components with a program.



# 40-pin GPIO header

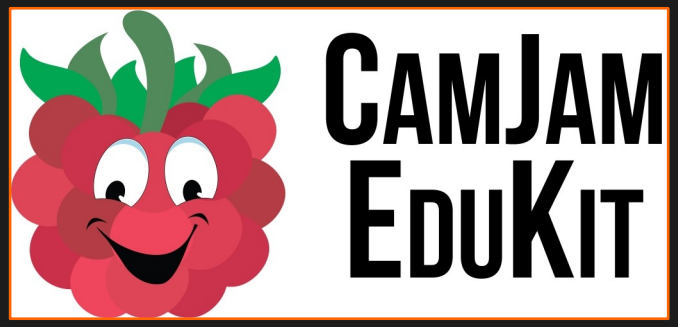


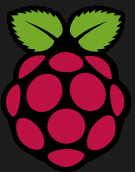



# Physical computing kits

- Ben Nuttal recommends CamJam Edu Kits
  - Joint venture between The Pi Hut and the Cambridge Raspberry Jam
  - https://thepihut.com/collections/camjam-edukit

*"Low-cost way to introduce kids (and adults!) to the world of electronics and programming."*

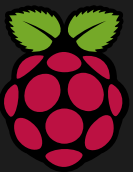


# What is GPIO Zero?

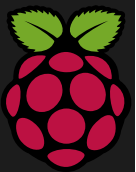
*“A simple interface to everyday GPIO components used with Raspberry Pi.”*

- Ben Nuttal



# Why GPIO Zero?

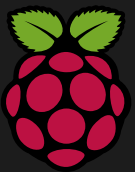
- Python
  - The preferred language of the Raspberry Pi Foundation
- GPIO was complex
  - Connecting electronics required lots of code just to get set up
- GPIO Zero handles the boilerplate for you
  - You focus on controlling the physical devices
  - Fewer lines of code
  - Easier for newcomers to understand
- GPIO Zero uses Broadcom (BCM) pin numbering
  - As opposed to physical (BOARD) numbering



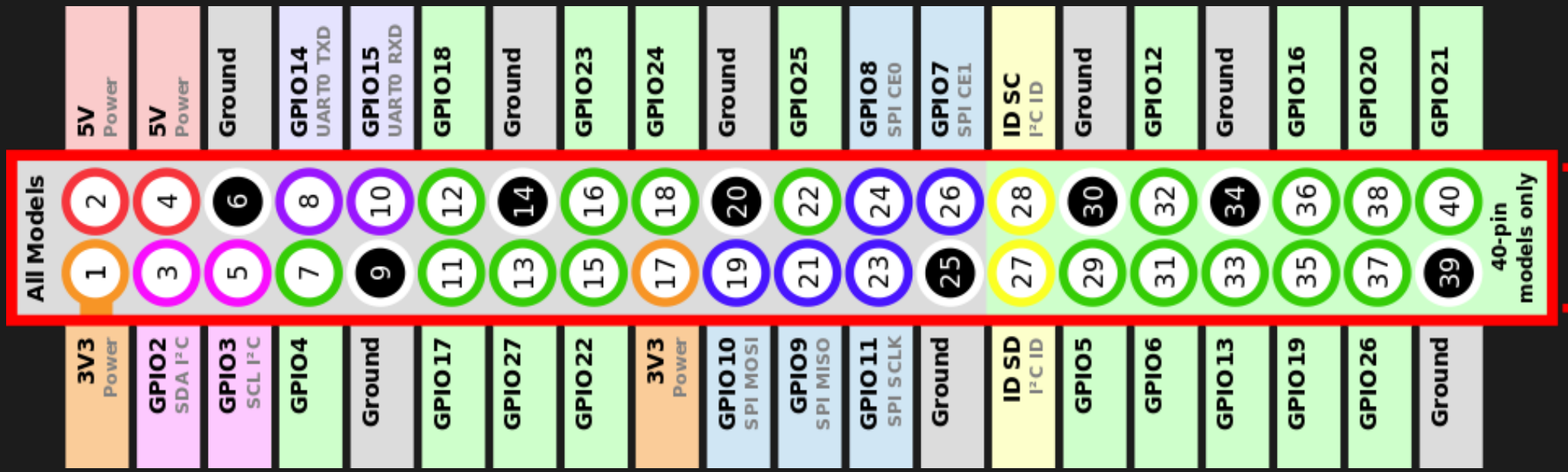
# BCM vs BOARD numbering

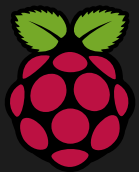
*“The BCM numbering bears no relation to their actual position on the Raspberry Pi GPIO header!”*

- Tim Cox



# 40-pin GPIO header

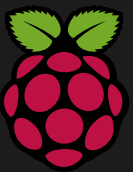


# Raspberry Pi Pinout

*“The comprehensive GPIO Pinout guide for the Raspberry Pi.”*

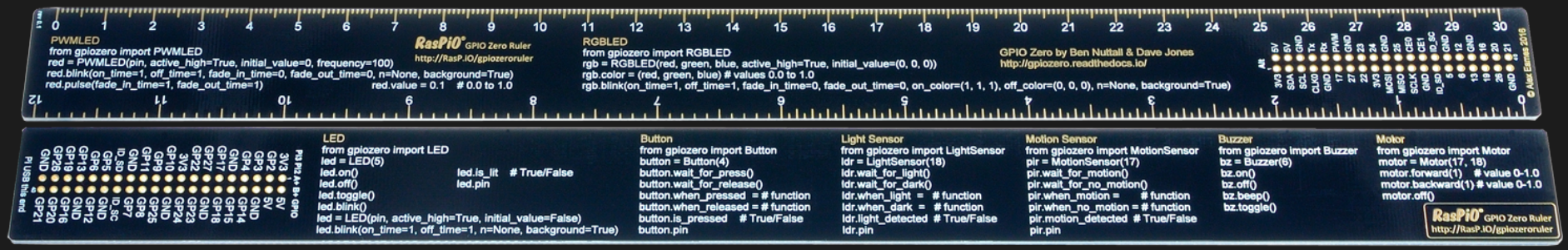
- https://pinout.xyz/



# GPIO Ruler

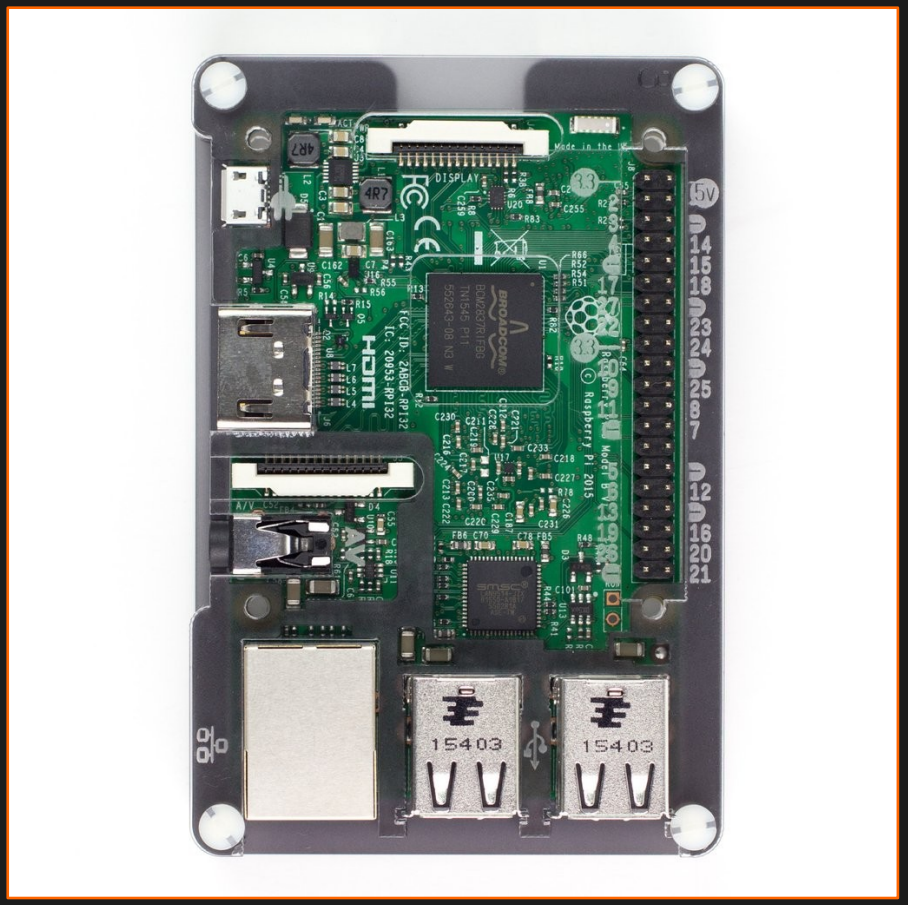
*"Quick reference for GPIO hacking on the Raspberry Pi in Python"*

- http://rasp.io/gpioruler/



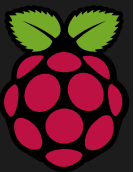
# Pibow 3 Coupé

https://shop.pimoroni.com/collections/raspberry-pi/products/pibow-coupe-for-raspberry-pi-3



# GPIO Documentation & Tutorials

- The Documentation
  - http://gpiozero.readthedocs.io/
  - https://github.com/RPi-Distro/python-gpiozero
- The Book
  - http://bennuttall.com/simple-electronics-gpio-zero-book/
  - https://www.raspberrypi.org/magpi/gpio-zero-essentials/
  - https://www.raspberrypi.org/magpi-issues/Essentials_GPIOZero_v1.pdf
- Physical Computing with Python
  - https://www.raspberrypi.org/learning/physical-computing-with-python/



# The MagPi

- The Official Raspberry Pi Magazine
  - Free to download or purchase the print copy
  - https://www.raspberrypi.org/magpi/

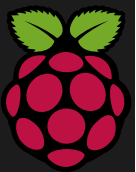
Available on the App Store

GET IT ON Google Play

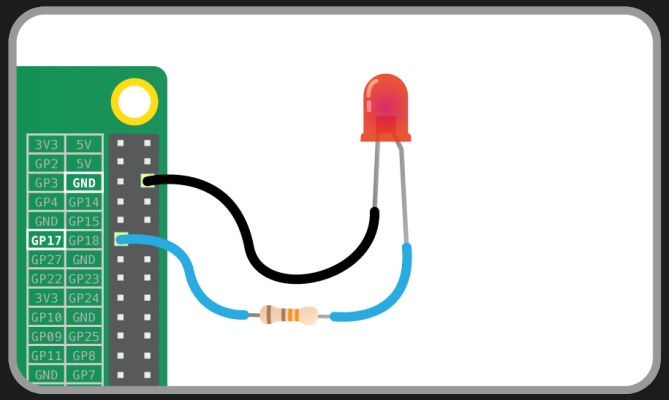
Available at amazon

# GPIO examples

- You will need:
  - A Raspberry Pi
  - SD card of “Raspbian Jessie with PIXEL”
    - https://www.raspberrypi.org/downloads/raspbian/
  - Power supply
  - Monitor
  - A keyboard and mouse
  - Python3

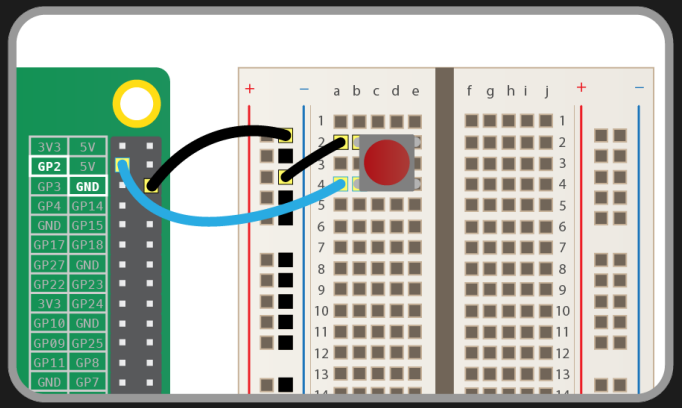


# Turn a LED on and off repeatedly



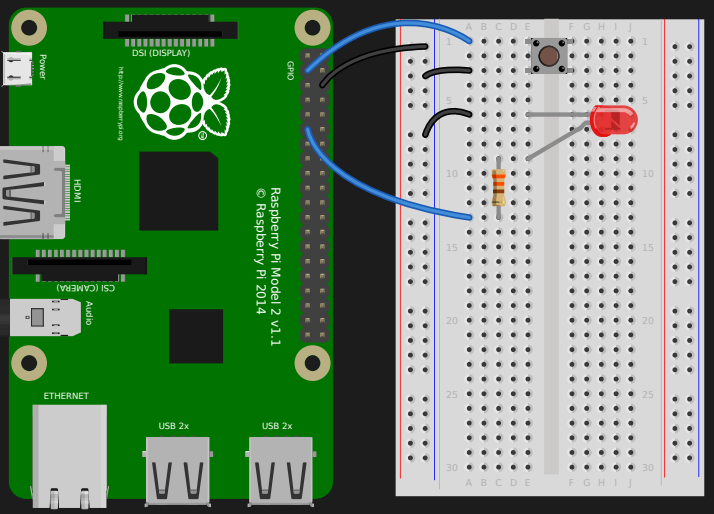

```
from gpiozero import LED
from time import sleep

red = LED(17)

while True:
    red.on()
    sleep(1)
    red.off()
    sleep(1)
```

# Check if a Button is pressed



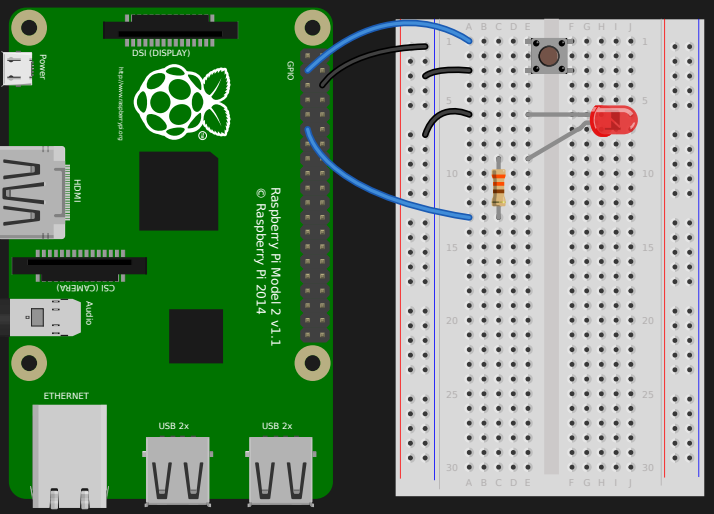

```
from gpiozero import Button

button = Button(2)

while True:
    if button.is_pressed:
        print("Button is pressed")
    else:
        print("Button is not pressed")
```

# Button controlled LED



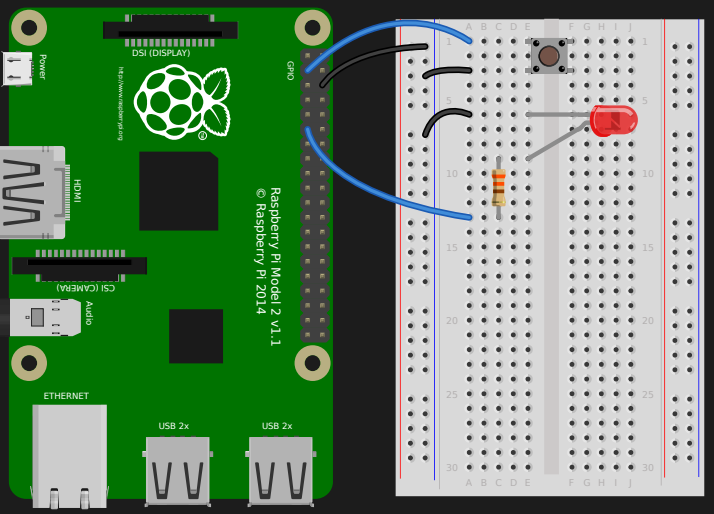

```
from gpiozero import LED, Button
from signal import pause

led = LED(17)
button = Button(2)

button.when_pressed = led.on
button.when_released = led.off

pause()
```

# Button controlled LED




```
from gpiozero import LED, Button
from signal import pause

led = LED(17)
button = Button(2)

led.source = button.values

pause()
```

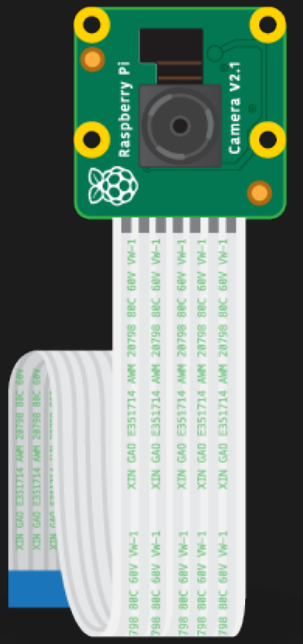
# Button controlled LED

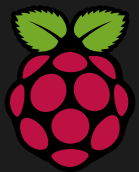



```
from gpiozero import LED, Button
from signal import pause

led = LED(17)
button = Button(2)

led.source = button.values

pause()
```

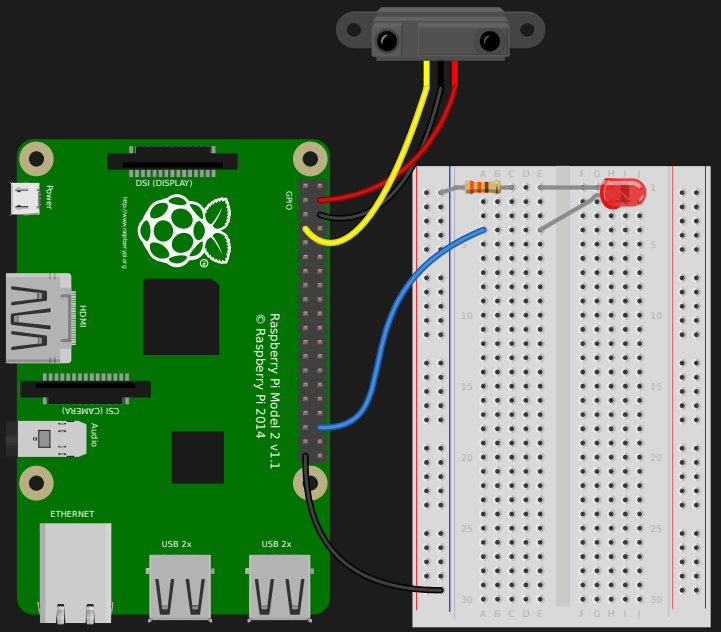
# Button controlled camera

```
from gpiozero import Button
from picamera import PiCamera
from datetime import datetime
from signal import pause

button = Button(2)
camera = PiCamera()

def capture():
    datetime = datetime.now().isoformat()
    camera.capture('/home/pi/%s.jpg' % datetime)

button.when_pressed = capture

pause()
```



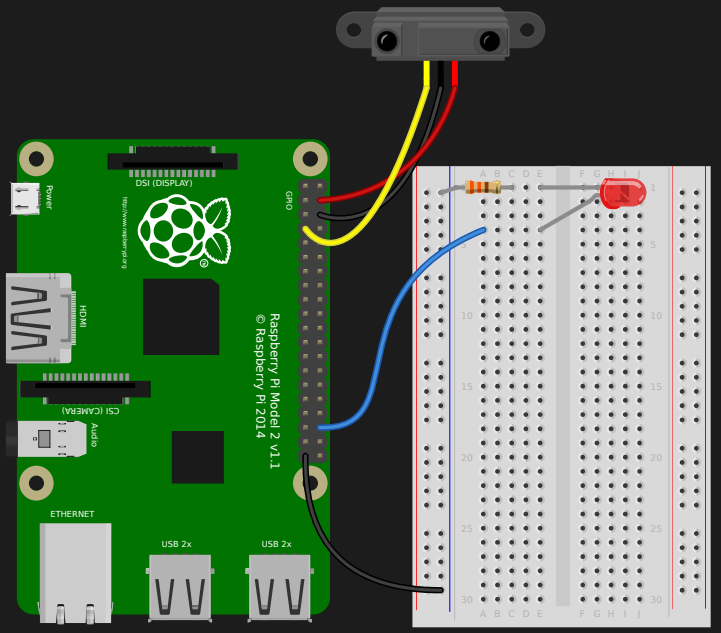



# Motion detector

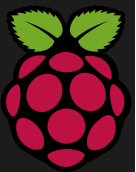



```
from gpiozero import MotionSensor, LED
from signal import pause

pir = MotionSensor(4)
led = LED(16)

pir.when_motion = led.on
pir.when_no_motion = led.off

pause()
```

# Distance detector

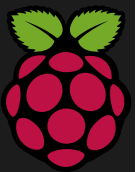



```
from gpiozero import DistanceSensor

from time import sleep


sensor = DistanceSensor(23, 24)


while True:

    print('Distance to nearest object
is', sensor.distance, 'm')

    sleep(1)
```



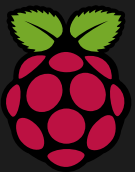
# What can GPIO control?

- Input devices
  - Button
  - Line Sensor (TRCT5000)
  - Motion Sensor (D-SUN PIR)
  - Light Sensor (LDR)
  - Distance Sensor (HC-SR04)
  - DigitalInputDevice
  - SmoothedInputDevice
- Output devices
  - LED
  - PWMLED
  - RGBLED
  - Buzzer
  - Motor
  - Servo
  - AngularServo
  - DigitalOutputDevice
  - PWMOutputDevice



# What can GPIO control?

- LEDBoard
- LEDBarGraph
- ButtonBoard
- TrafficLights
- LedBorg
- PiLITEr
- PiLITEr Bar Graph
- PI-TRAFFIC
- TrafficLightsBuzzer
- Fish Dish
- Traffic HAT
- Robot
- Ryanteck MCB Robot
- CamJam #3 Kit Robot
- Energenie
- SnowPi

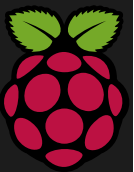
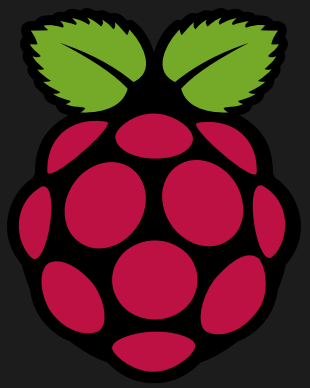


# Summary

The Raspberry Pi 3 is a small inexpensive computer

**G**eneral **P**urpose **I**nput-**O**utput enables the connection and control of electronic components with a program.

CamJam Edu Kits are great for newcomers

GPIO Zero is a simple interface for GPIO components used with Raspberry Pi.

Lots of GPIO Zero documentation and tutorials