

# ENGR 3421: Robotics I

Raspberry Pi

09/01/2022

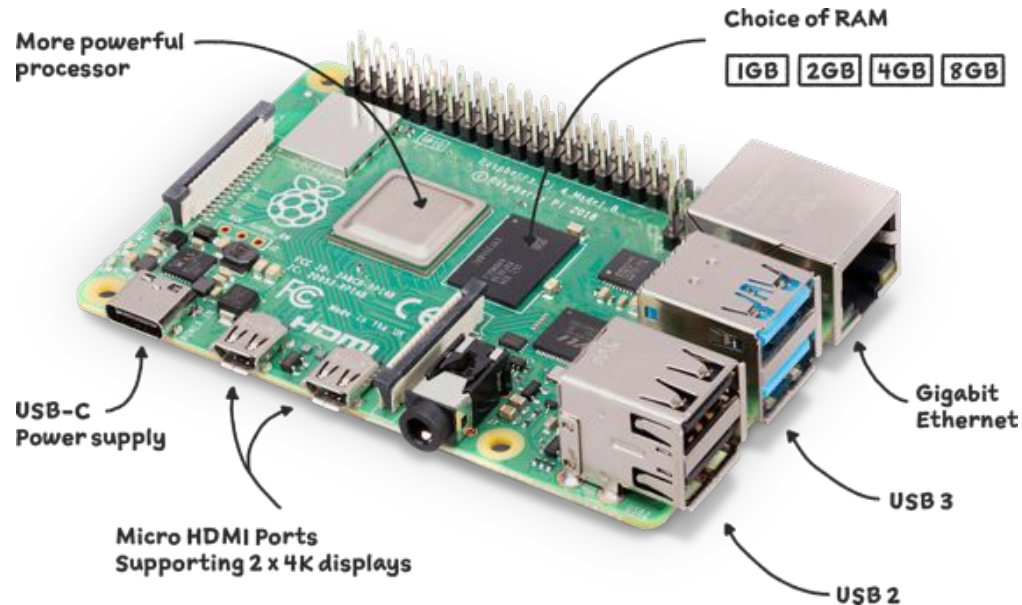


# Outline

- Raspberry Pi Get Started
- GPIO Pins
- gpiozero

# Raspberry Pi Overview

Raspberry Pi is a low cost, credit-card sized computer (single-board computer). It's capable of doing everything you'd expect a desktop computer to do.



# Raspberry Pi Projects

- [NAS Server](#)
- [Retro Gaming](#)
- [Plant Watering](#)
- [Magic Mirror](#)
- [Smart Home](#)
- [Router](#)
- [3D Printer](#)
- [Robot](#)
- [Home Security](#)

# Raspberry Pi vs Arduino

## Raspberry Pi



## Features

- Raspberry Pi is a Microcomputer
- Operating System on MicroSD Card
- USB, Video, Camera, Display & Audio
- I2C & SPI Buses
- Digital I/O
- 5v USB power
- Commercial patented product

## Arduino



- Arduino is a Microcontroller
- Bootloader on chip
- USB
- I2C & SPI Buses
- Digital I/O and Analog Inputs
- 5v USB & 8-20v DC power
- Open source design

[DroneBotWorkshop.com](http://DroneBotWorkshop.com)



# Raspberry Pi vs Arduino

## Raspberry Pi



## Specs

- Up to 1.5 GHz 64-bit quad-core CPU
- 512 Mb - 4 Gb RAM
- 26 Digital I/O pins
- No Analog inputs
- Bluetooth & WiFi (some models)
- Ethernet (some models)
- Expand with HATs

## Arduino



- 16 MHz 8-bit single-core MCU
- 2 Kb - 8 Kb SRAM
- 14 - 54 Digital I/O pins
- 6 - 16 Analog inputs
- No Bluetooth or Wifi
- No Ethernet
- Expand with Shields

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# Raspberry Pi vs Arduino

Raspberry Pi



Extras

- MicroSD card
- USB (or USB-C) power supply
- Keyboard
- Mouse
- HDMI Monitor
- Adapter cables as required

Arduino



- USB Cable
- Computer

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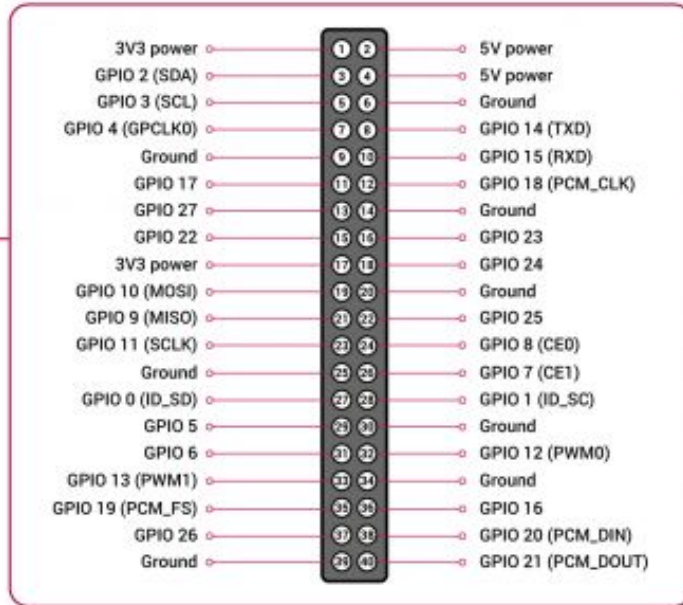
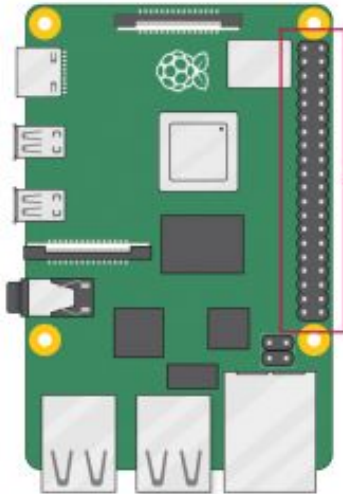


# Raspberry Pi Setup

- Download [Raspberry Pi Imager](#).
- Flash Raspberry Pi OS to micro SD card.
- **Insert micro SD card.**
- Connect Monitor.
- Connect keyboard and mouse.
- (Optional) Connect ethernet cable.
- Plug in power.



# Pinout



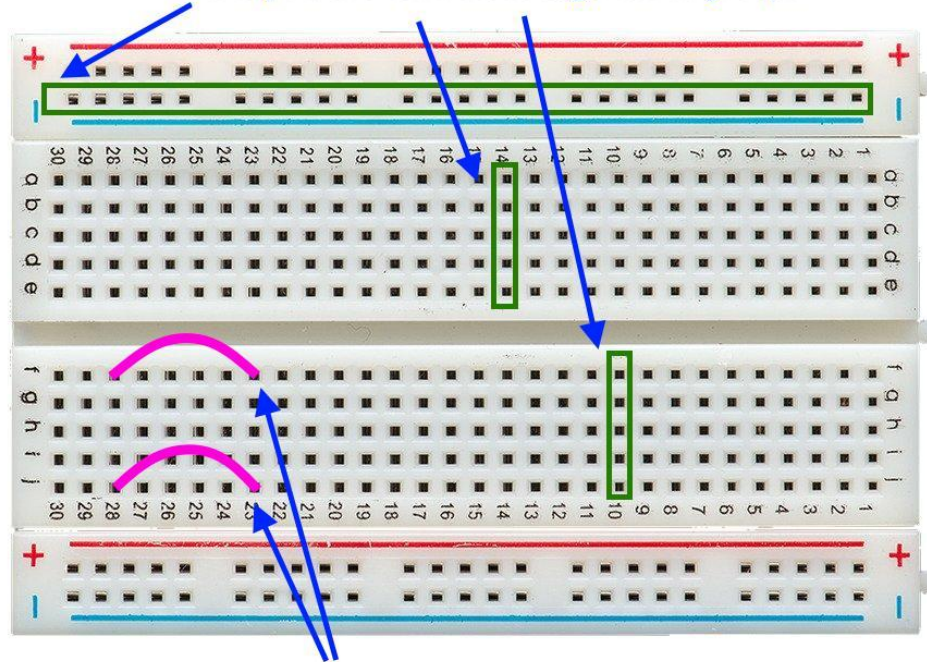
- Power pins: 3.3V, 5V
- Ground pins
- Input/Output pins
- Communication pins
- PWM pins

# Pins Rules

- DO NOT short connect pins.
- GPIO pins use 3.3V logic for input/output. Never input 5V signals to GPIO pins.
- Max current draw is 16mA. Don't try to drive your motor with GPIO pins directly.
- Physical numbers vs. BCM numbers

# Solderless Breadboard

The pins are connected together in groups.



These wires are in parallel

# GPIO Python Libraries

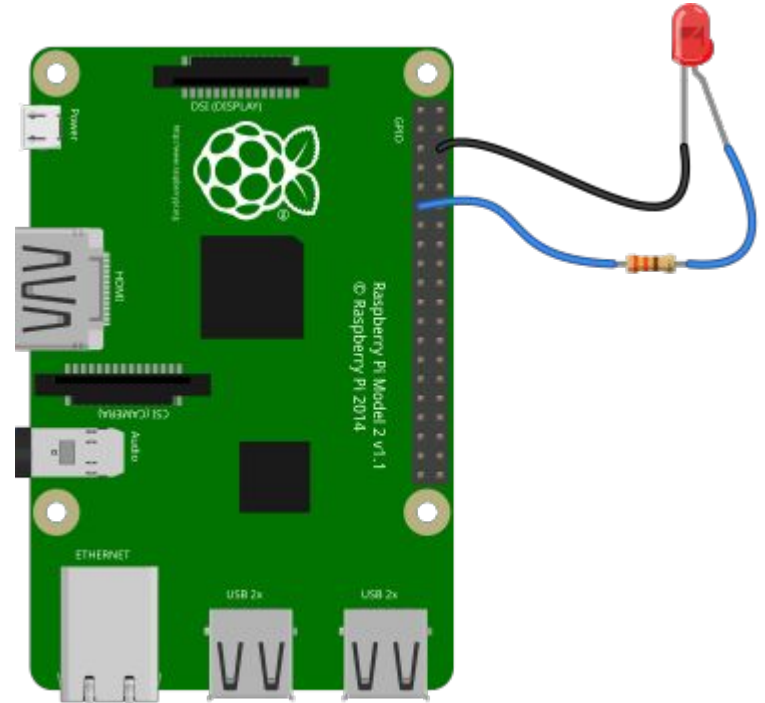
- [gpiozero](#)
- RPi.GPIO
- pigpio
- WiringPi

# gpiozero Examples: Blink LED

```
from gpiozero import LED
from time import sleep

red = LED(17)

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

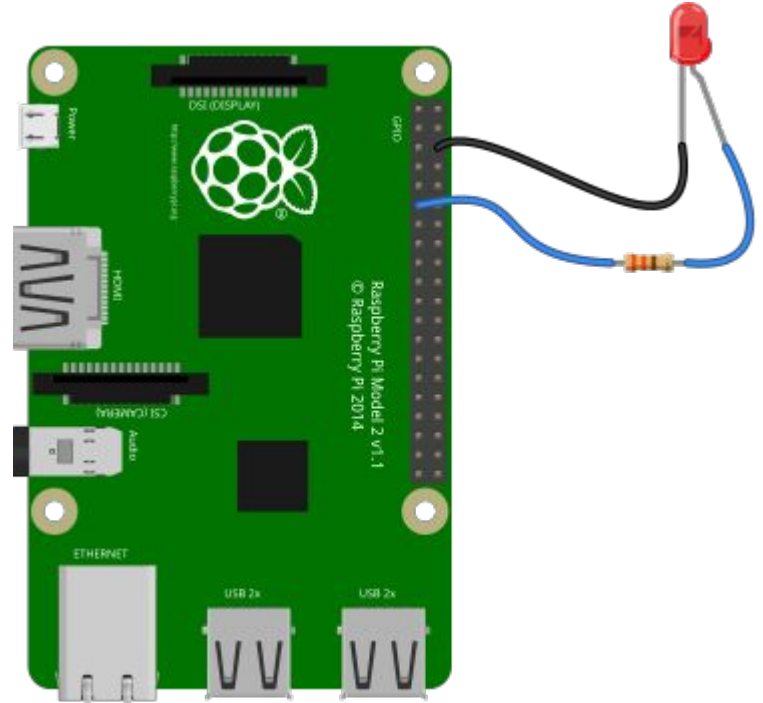


# gpiozero Examples: LED w/ Varied Brightness

```
from gpiozero import PWMLED
from time import sleep

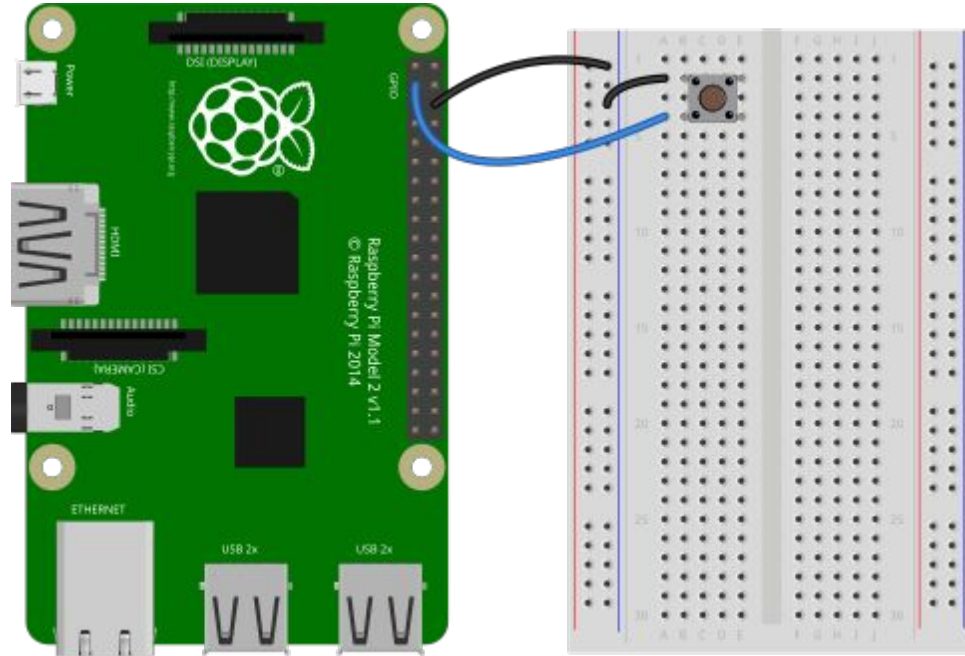
led = PWMLED(17)

while True:
    led.value = 0 # off
    sleep(1)
    led.value = 0.5 # half brightness
    sleep(1)
    led.value = 1 # full brightness
    sleep(1)
```



# gpiozero Examples: Pressed Button

```
from gpiozero import Button  
  
button = Button(2)  
  
while True:  
    if button.is_pressed:  
        print("Button is pressed")  
    else:  
        print("Button is not pressed")
```



# gpiozero Examples: 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()
```

