

# Sistemas Embarcados

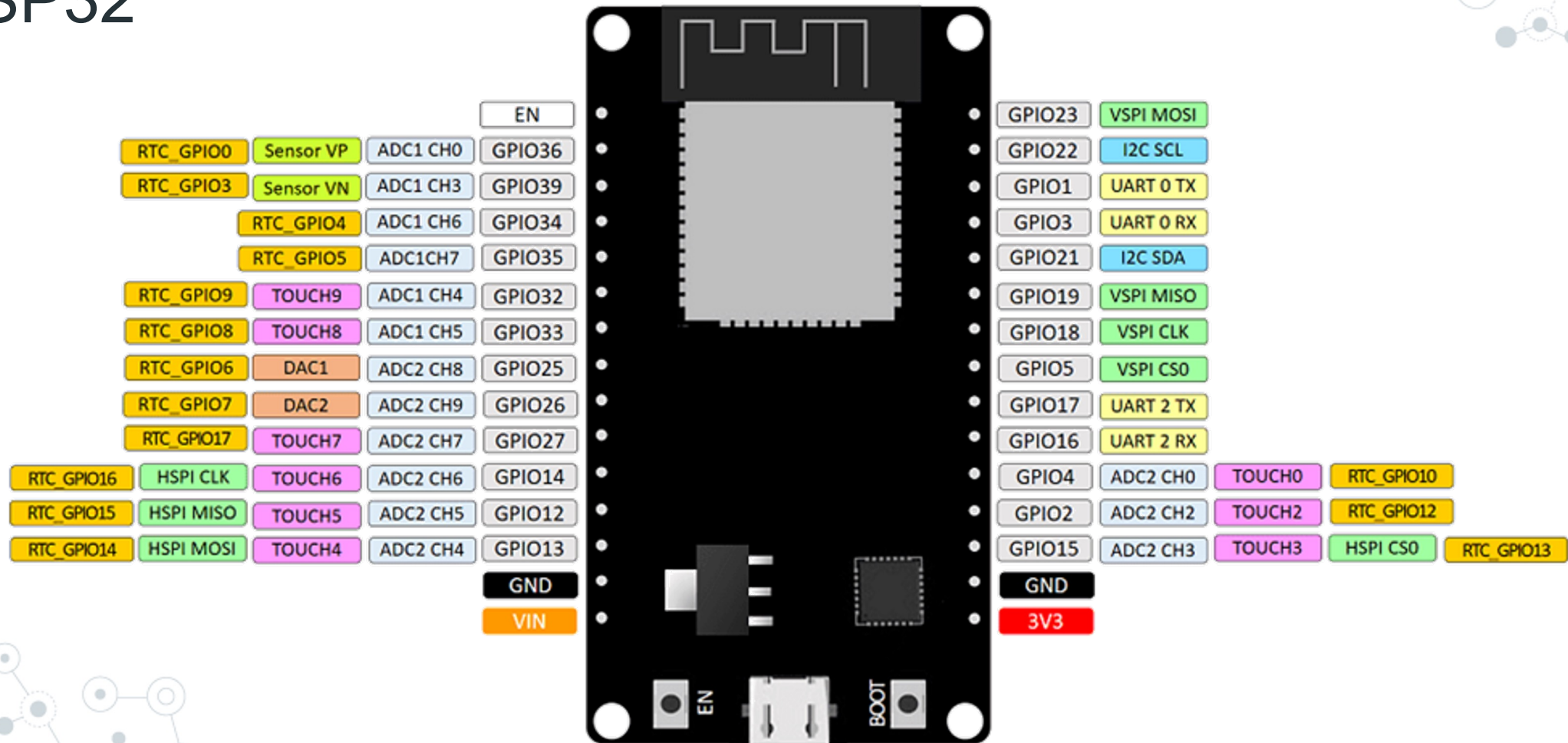
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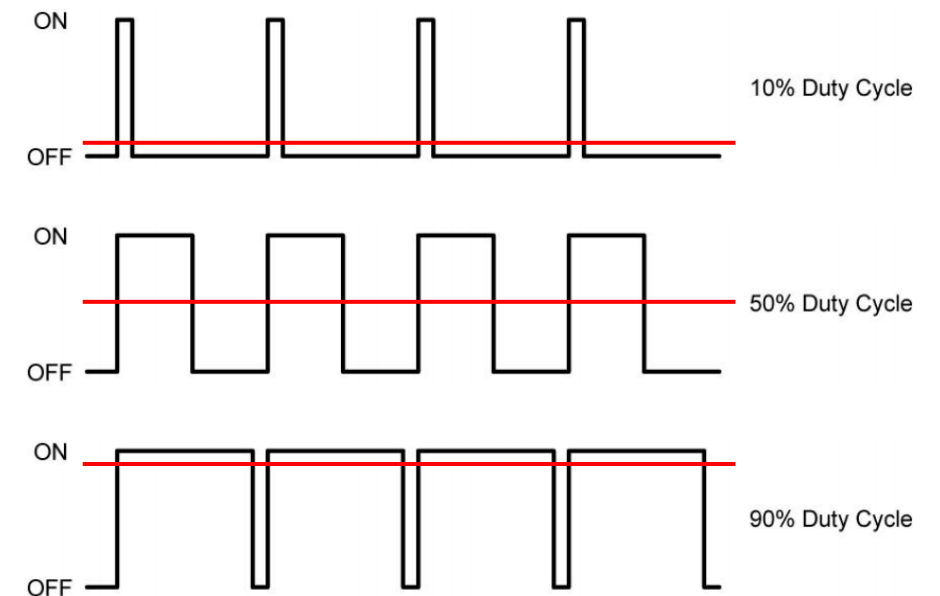
# Sistemas Embarcados

- ESP32



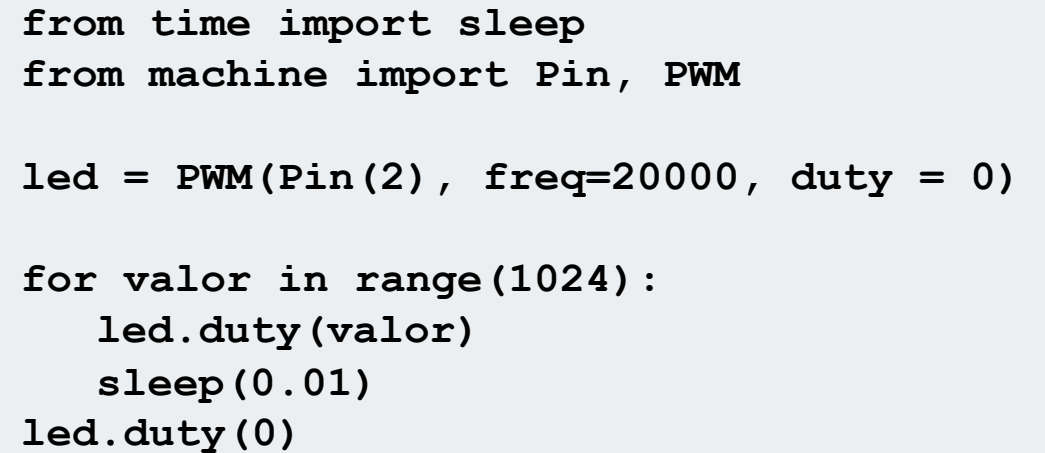
# Sistemas Embarcados

- Node MCU
  - Modulação por Largura de Pulso
    - PWM (Pulse Width Modulation)
    - Este tipo de modulação mantém a amplitude dos pulsos constantes e varia-se a sua largura proporcionalmente aos valores do sinal modulador nos instantes correspondentes.
  - No Node MCU é representada por valores de 0 a 1023.



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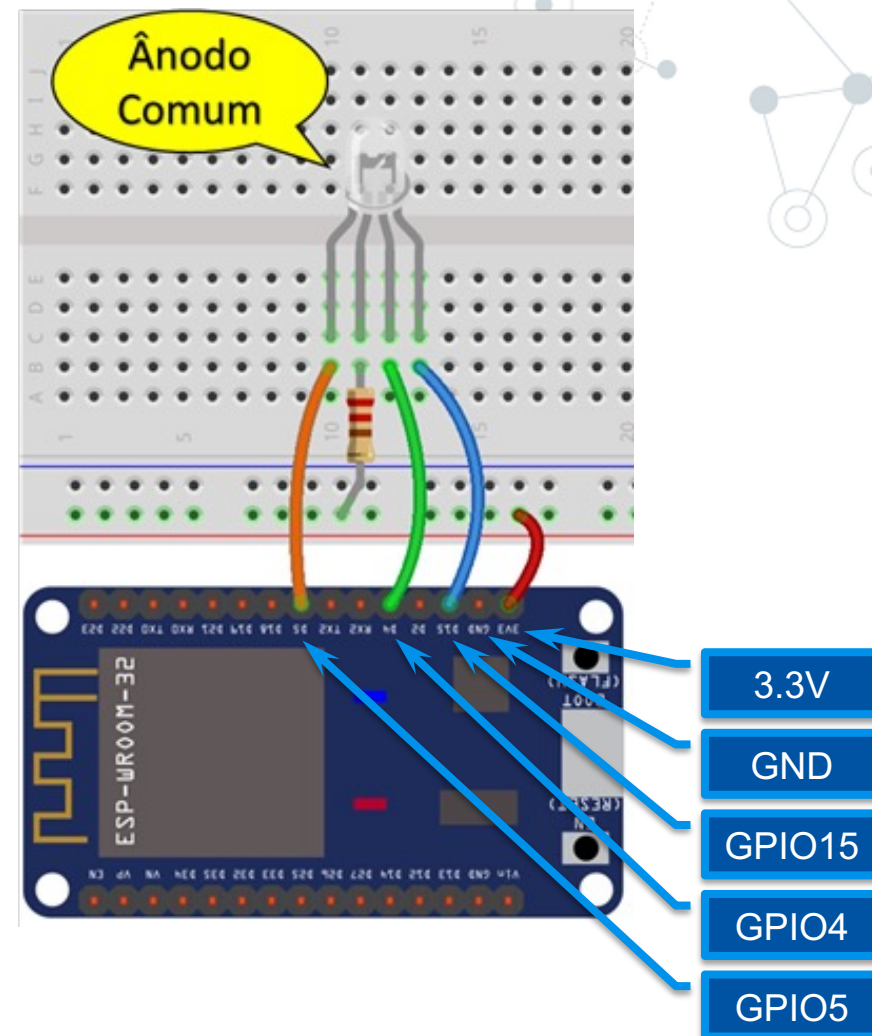
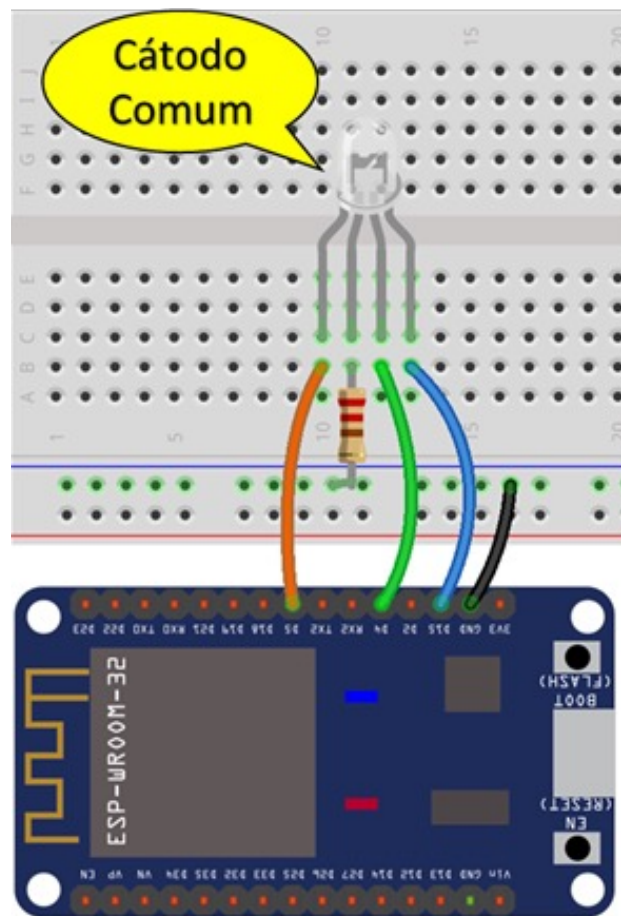
- Node MCU
  - Modulação por Largura de Pulso





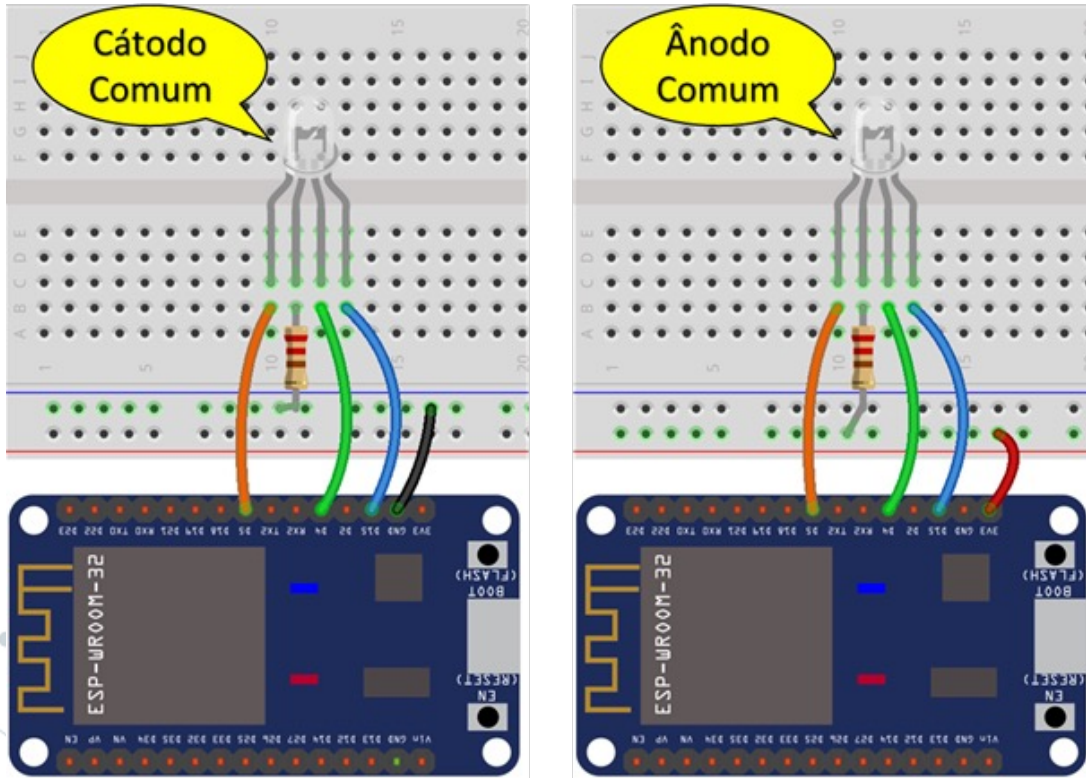
# Sistemas Embarcados

- Node MCU
  - LED RGB
    - Materiais
      - Node MCU
      - 1 Resistor  $220\Omega$
      - 1 Resistor  $10\text{ k}\Omega$
      - 1 LED RGB
      - 1 Protoboard
      - Fios e jumpers



# Sistemas Embarcados

- Node MCU
- LED RGB



```
from time import sleep
from machine import Pin, PWM
from random import getrandbits
```

```
#Indicar o tipo do LED RGB
tipo = "ANODO_COMUM"
if tipo == "CATODO_COMUM":
    MIN = 0
    MAX = 1023
else:
    MIN = 1023
    MAX = 0
```

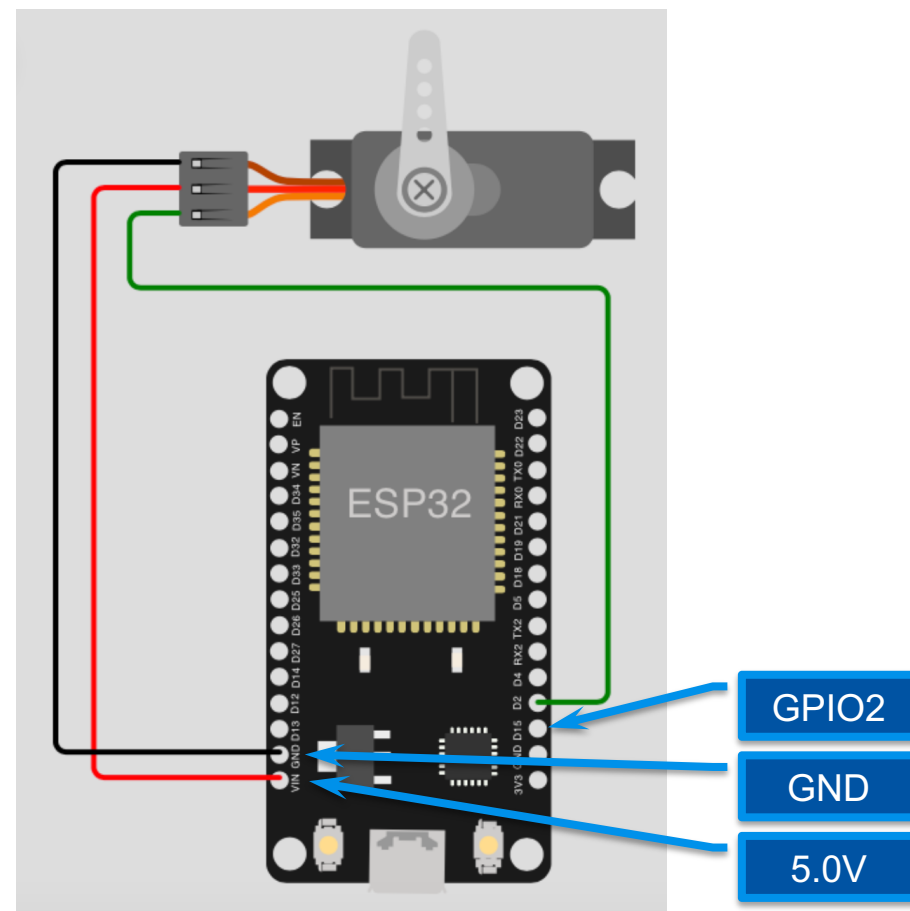
```
r = PWM(Pin(5), freq=20000, duty = MIN)
g = PWM(Pin(4), freq=20000, duty = MIN)
b = PWM(Pin(15), freq=20000, duty = MIN)
```

```
try:
    while True:
        r.duty( getrandbits(10) )
        b.duty( getrandbits(10) )
        g.duty( getrandbits(10) )
        sleep(1.0)
except KeyboardInterrupt:
    r.duty(MIN)
    g.duty(MIN)
    b.duty(MIN)
```

Função que retorna um número aleatório de 10 bits

# Sistemas Embarcados

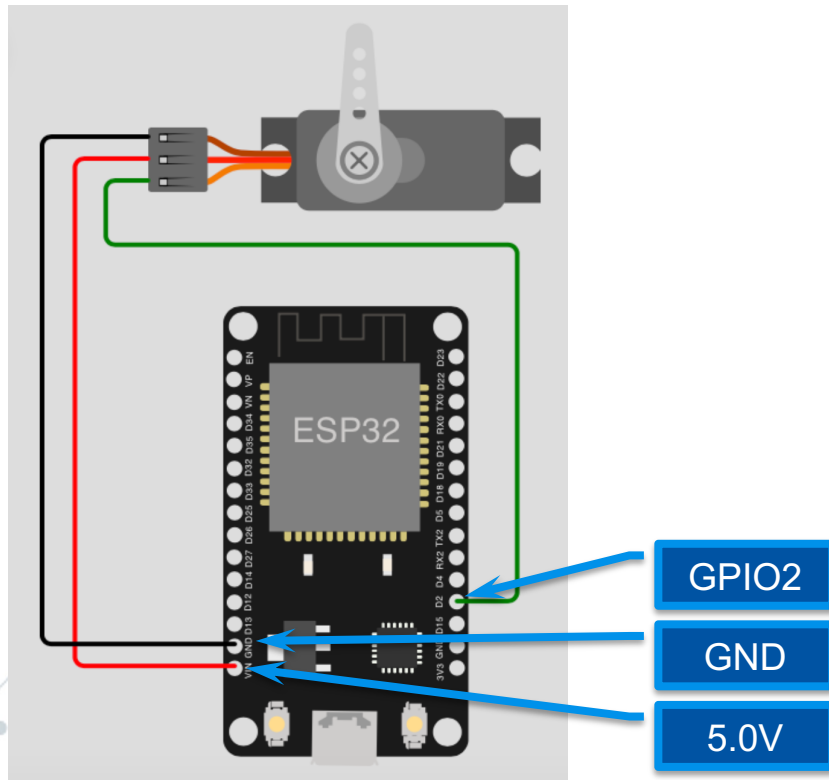
- Node MCU
  - Servo motor
    - Materiais
      - Node MCU
      - 1 Servomotor 9g
      - 1 Protoboard
      - Fios e jumpers





# Sistemas Embarcados

- Node MCU
- Servo motor



```
from time import sleep
from machine import Pin, PWM

servo = PWM(Pin(2), freq=400, duty = 0)

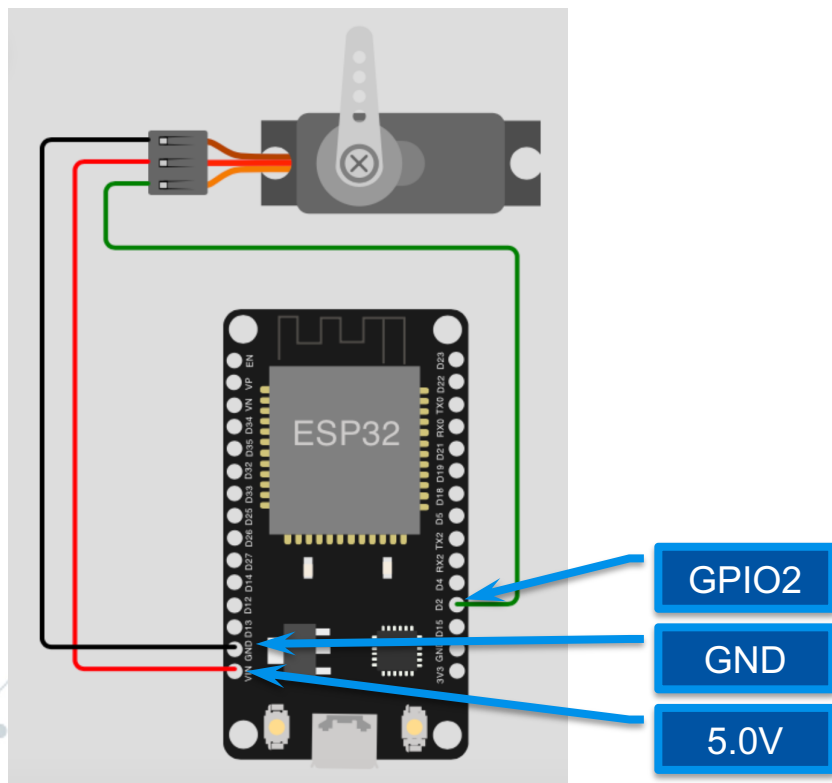
servo.duty(0)

while True:
    for valor in range(0, 1024):
        servo.duty(valor)
        sleep(0.001)

    for valor in range(0, 1024):
        servo.duty(1023-valor)
        sleep(0.001)
```

# Sistemas Embarcados

- Node MCU
- Servo motor



```
from time import sleep
from machine import Pin, PWM

servo = PWM(Pin(2), freq=400, duty = 0)
servo.duty(0)
velocidade = "rapido"
while True:
    if velocidade == "rapido":
        for valor in range(0, 1024):
            servo.duty(valor)
            sleep(0.001)
        for valor in range(0, 1024):
            servo.duty(1023-valor)
            sleep(0.001)
        velocidade = "lento"
    elif velocidade == "lento":
        for valor in range(0, 1024):
            servo.duty(valor)
            sleep(0.01)
        for valor in range(0, 1024):
            servo.duty(1023-valor)
            sleep(0.01)
        velocidade = "rapido"
```