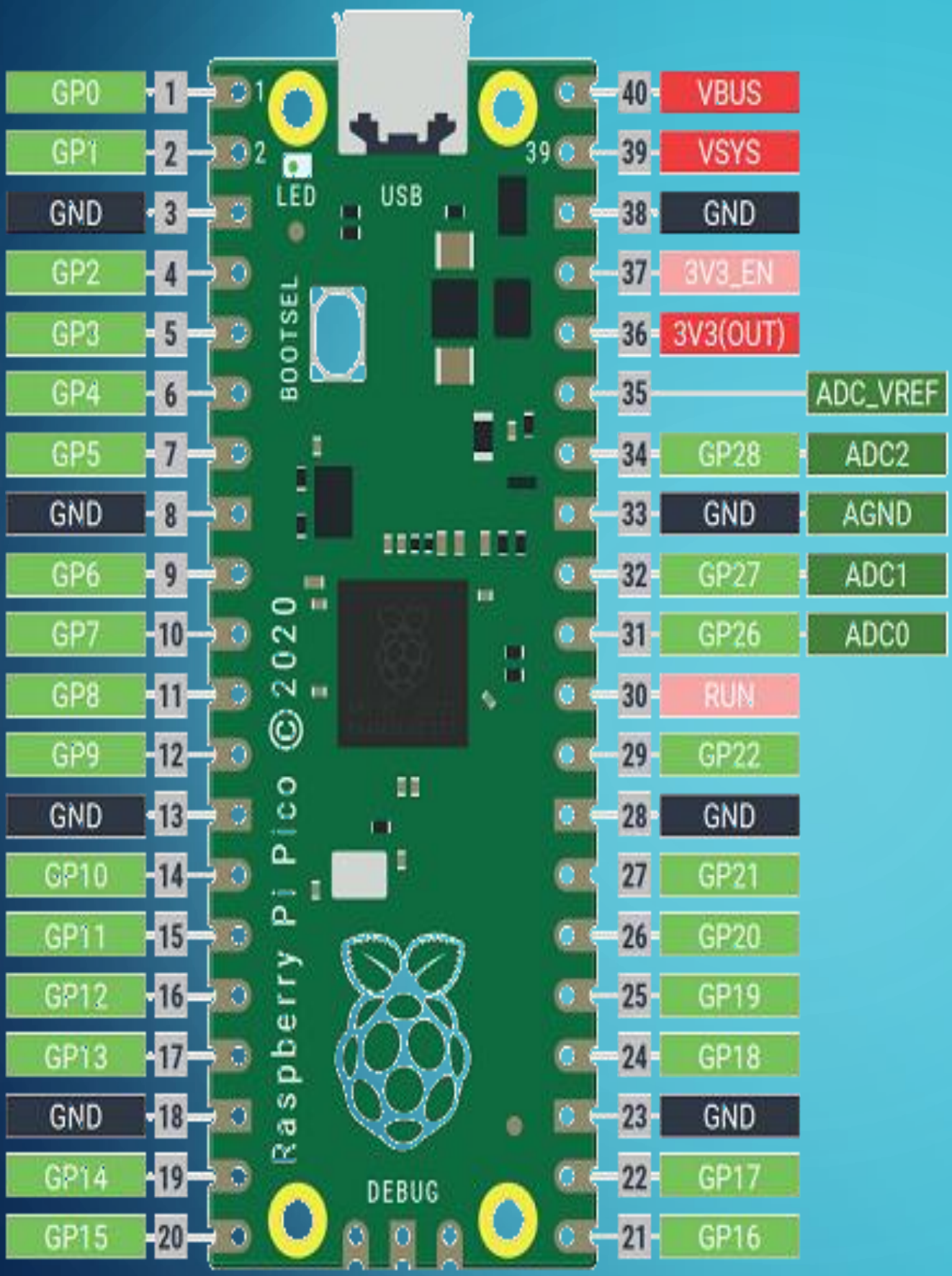
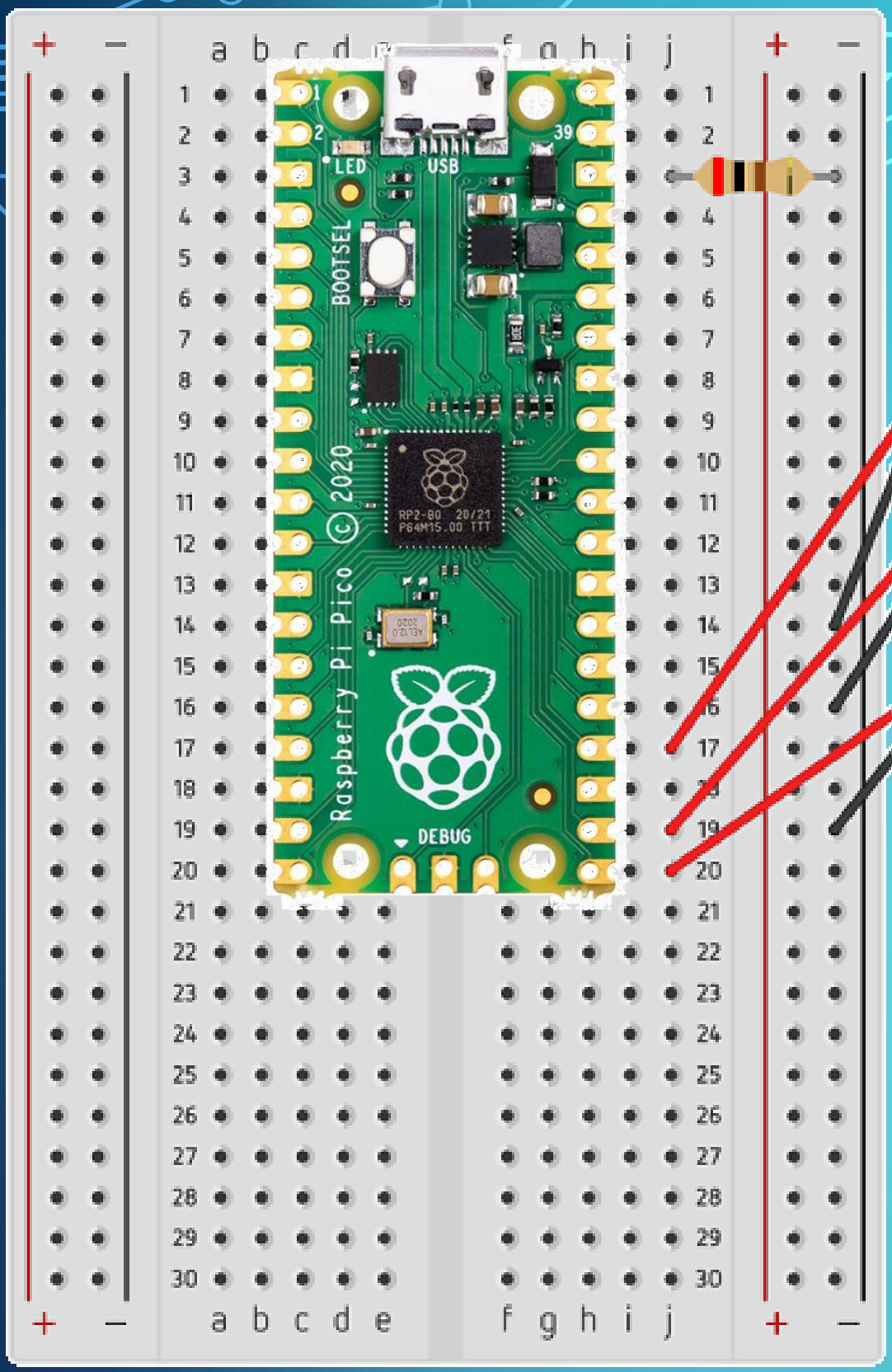

GP0
GP1
GND
GP2
GP3
GP4
GP5
GND
GP6
GP7
GP8
GP9
GND
GP10
GP11
GP12
GP13
GND
GP14
GP15
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
LED
USB
BOOTSEL
DEBUG
Raspberry Pi Pico ©2020
40
39
VBUS
VSYS
GND
3V3_EN
3V3(OUT)
ADC_VREF
GP28
GND
GP27
GP26
RUN
GP22
GND
GP21
GP20
GP19
GP18
GND
GP17
GP16
35
34
33
32
31
30
29
28
27
26
25
24
23
22
21
ADC2
AGND
ADC1
ADC0


a b c d e f g h i j
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
LED
USB
BOOTSEL
© 2020
Raspberry Pi Pico
DEBUG

TrafficLight1

```
from machine import Pin
from utime import sleep
led_red = Pin(18,  Pin.OUT)
led_amber = Pin(17,  Pin.OUT)
led_green = Pin(16,  Pin.OUT)
while True:
    led_red.value(1)
    sleep(2)
    led_red.value(0)
    led_amber.value(1)
    sleep(1)
    led_amber.value(0)
    led_green.value(1)
    sleep(2)
    led_green.value(0)
    led_amber.value(1)
    sleep(1)
    led_amber.value(0)
```

新增第一顆按鈕

```
button_1 = Pin(15,  Pin.IN,  Pin.PULL_UP)
#button_1使用上拉電阻,輸入pin號為15,另一端接GND
```

為何要上拉電阻?

這是因為當 MCU 的 GPIO 某 pin 被設定為 INPUT mode 時,是在輸入高阻抗(input impedance)狀態,
意思是相當於另一端有串接個超級大的電阻擋住,
那意味著 pin 在空接時就等於沒有連接到任何電路,
此時用digitalRead(pin)去讀取它則常常因受到環境雜訊的影響,
有時讀取到 HIGH 有時卻讀取到 LOW, 就是所謂的 floating 狀態!

這樣按鈕沒按下也可能被誤判為有按下
為了確保它在穩定的狀態, 必須接個上拉電阻或下拉電阻!

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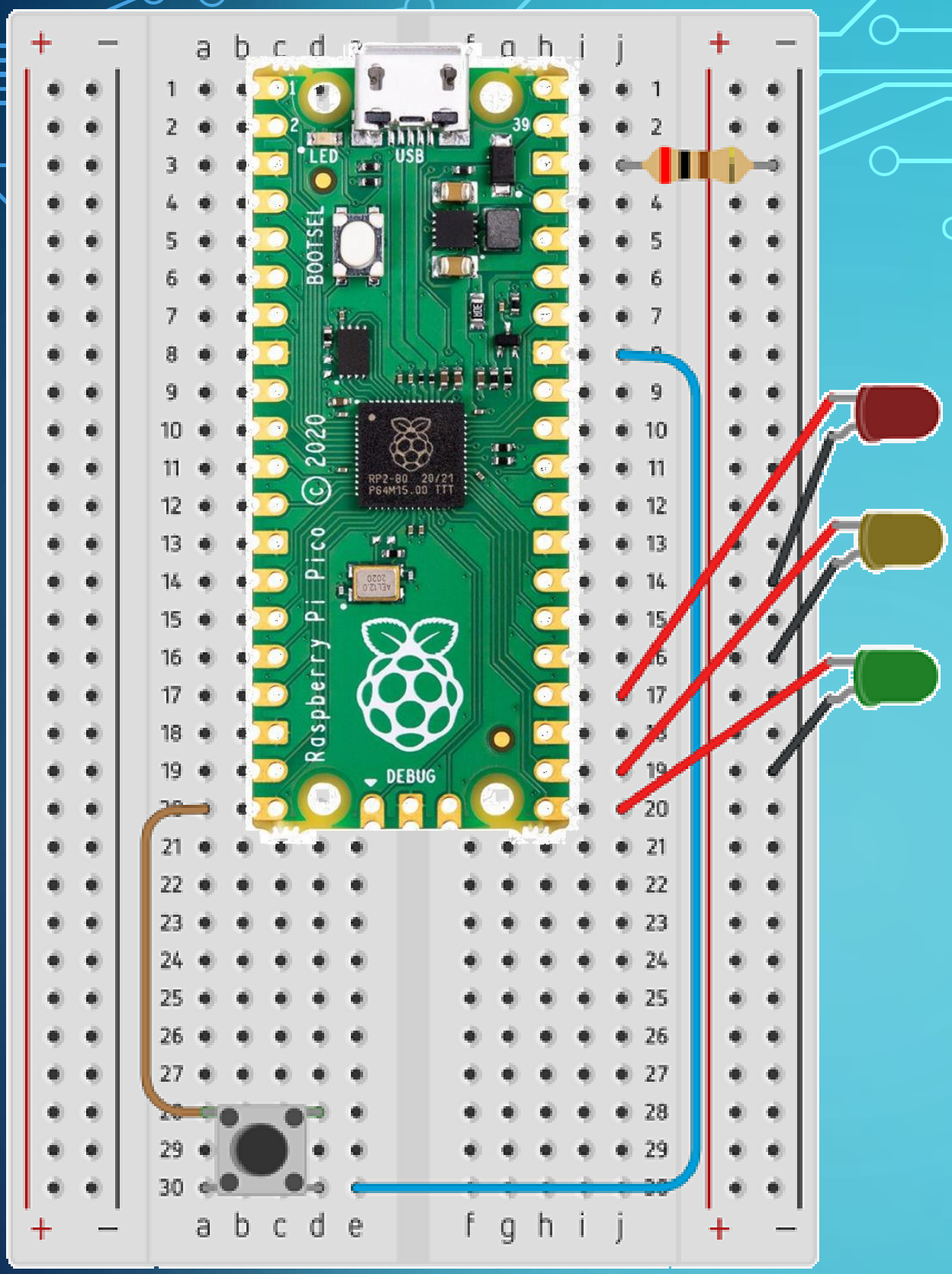
LED
USB
BOOTSEL
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Raspberry Pi Pico
DEBUG

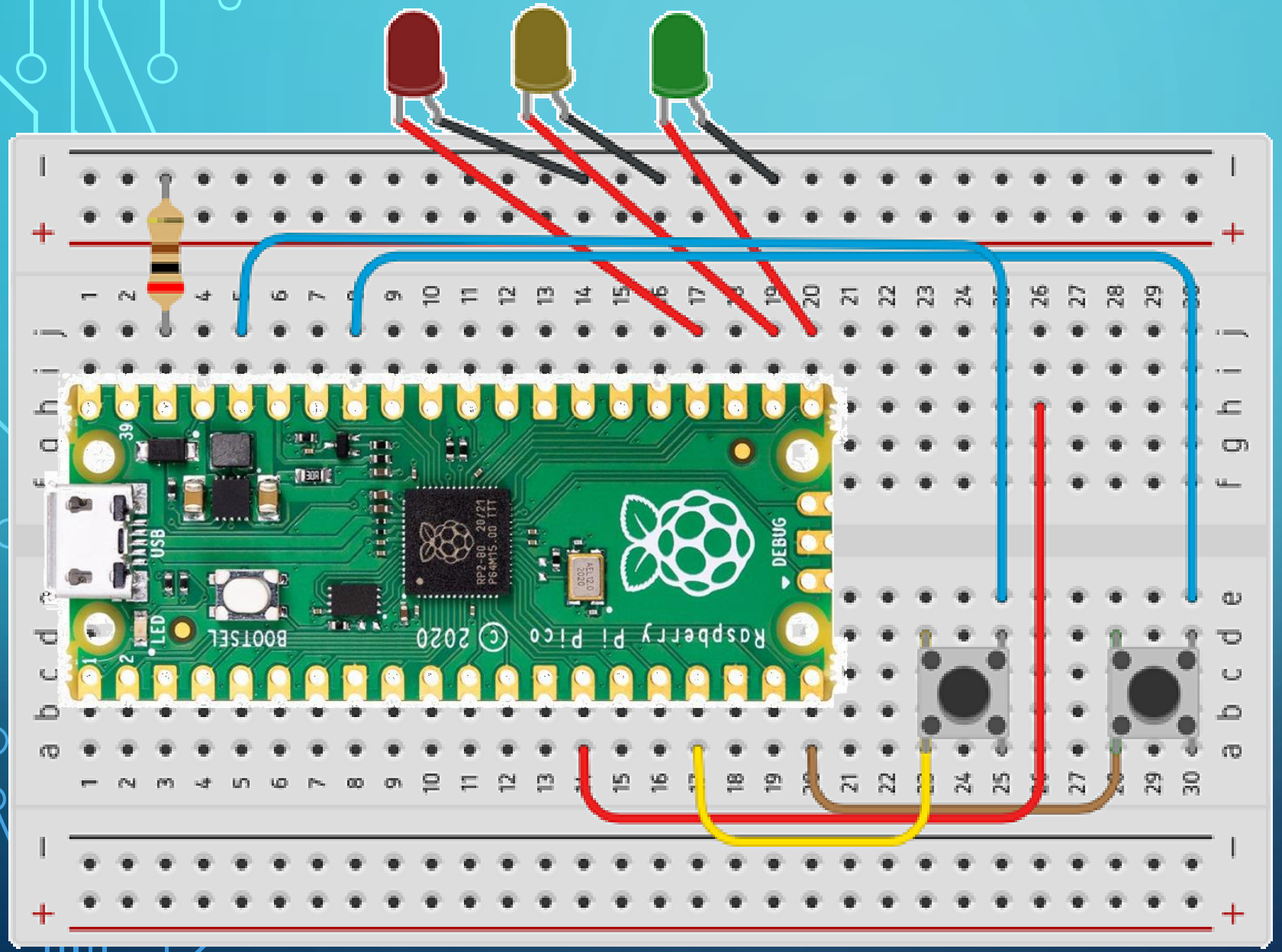
按鈕範例

```
#按鈕使用範例：button_01.py
from machine import Pin
from utime import sleep
led_red = Pin(18,  Pin.OUT)
led_amber = Pin(17,  Pin.OUT)
led_green = Pin(16,  Pin.OUT)
button_1 = Pin(15,  Pin.IN,  Pin.PULL_UP)
#本例使用上拉電阻,輸入pin號為15,另一端接GND
while True:
    if button_1.value() == 0:
        for i in range(3):
            led_amber.value(1)
            sleep(0.5)
            led_amber.value(0)
            sleep(0.5)
```

新增第二顆按鈕

```
button_1 = Pin(15,  Pin.IN,  Pin.PULL_UP)
#button_1使用上拉電阻,輸入pin號為GP15,另一端接GND

button_2 = Pin(13,  Pin.IN,  Pin.PULL_DOWN)
#button_2使用下拉電阻,輸入pin號為GP13,另一端接3V3(OUT)
```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USB
DEBUG

按鈕練習：

- 練習題一：新增button_2，使用下拉電阻。並嘗試改寫button_01.py，測試功能。
- 練習題二：button_1亮紅燈、button_2亮綠燈、同時按下黃燈閃爍。
- 練習題三：使用button_1與button_2模擬雙切開關

按鈕練習

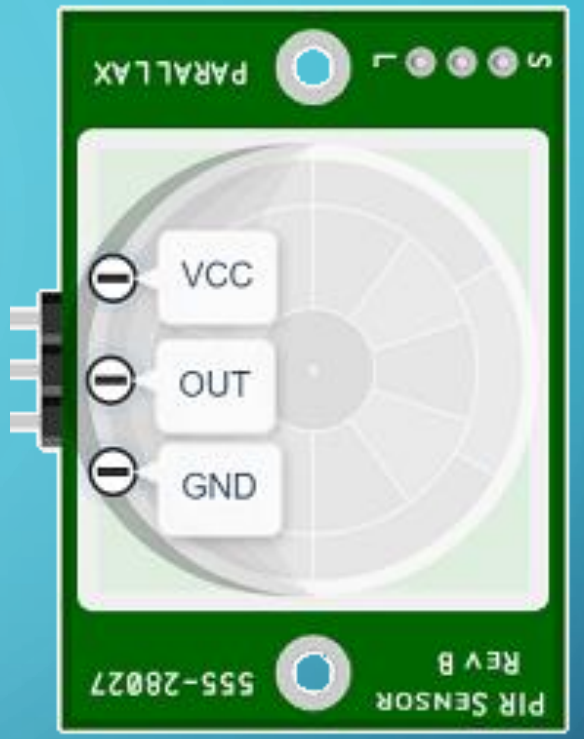
- 練習題四：button-1每按下一次，紅、綠燈狀態互換(紅燈on時，綠燈off)

  觀察練習題四功能是否如預期，如何修正。

- 練習題五：修正練習題三-使用旗標。

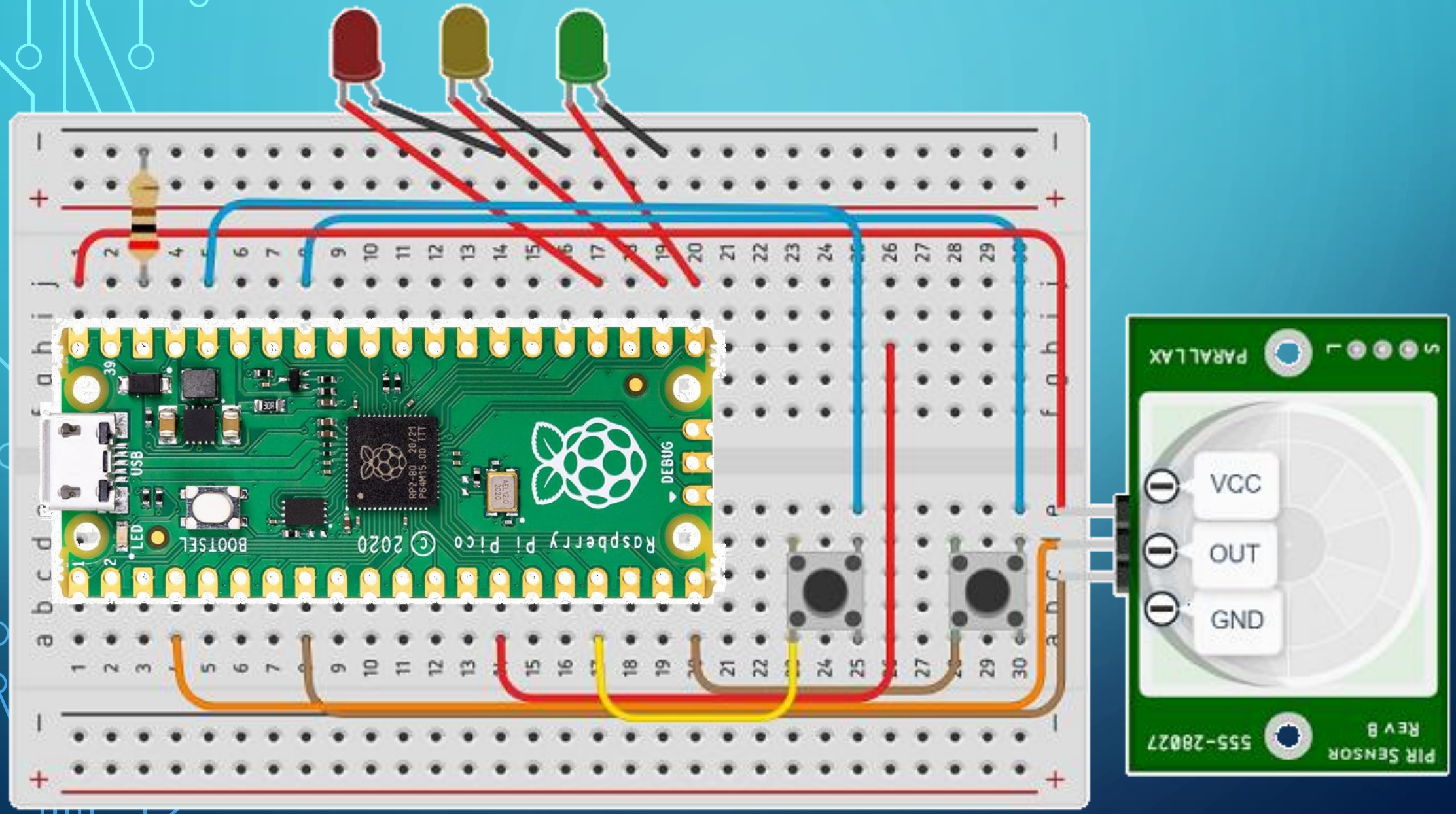
新增人體紅外線偵測器 (PIR HC-SR501)

```
PIR = Pin(1, Pin.IN, Pin.PULL_DOWN)
#VCC→5V輸出(VBUS)
#OUT→GP1
#GND
```



Finally, you need to connect the power wire. Don't connect this to your Pico's 3V3 pin, though: the HC-SR501 is a 5 V device, meaning that it needs five volts of electricity in order to work. If you wire the sensor to your Pico's 3V3 pin, it won't work – the pin simply doesn't provide enough power.

To give your sensor the 5 V power it needs, wire it to the very top-right pin of your Pico – VBUS. This pin is connected to the micro USB port on your Pico, and taps into the USB 5 V power line before it's converted to 3.3 V to run your Pico's microprocessor. All three HC-SR501 pins should now be wired to your Pico: ground, signal, and power.

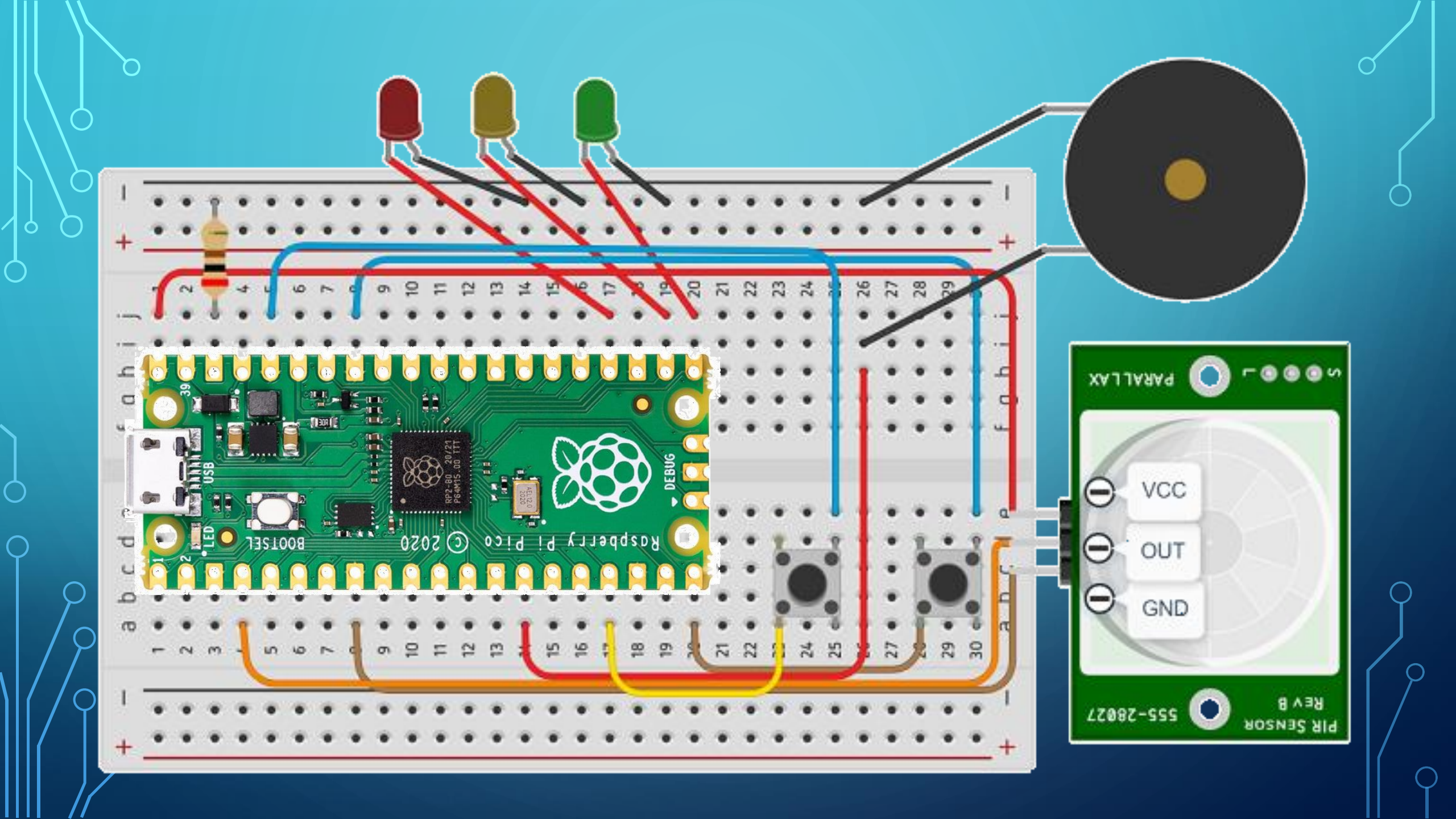

VCC
OUT
GND
PARALLAX
PIR SENSOR
REV B
555-28027
Raspberry Pi Pico © 2020
DEBUG
BOOTSEL
LED
USB

人體紅外線範例

```
#PIR使用範例： PIR_01.py
from machine import Pin
from utime import sleep

PIR = Pin(2,  Pin.IN,  Pin.PULL_DOWN)

i=0
while True:
    print(i,PIR.value())
    sleep(1)
    i+=1
```


VCC
OUT
GND
PARALLAX
PIR SENSOR
REV B
555-28027
Raspberry Pi Pico © 2020
DEBUG
BOOTSEL
LED
USB

新增蜂鳴器

```
#蜂鳴器使用範例：buzzer_01.py
from machine import Pin
from utime import sleep

buzzer = Pin(10,  Pin.OUT)

For i in range (3):
    buzzer.value(1)
    sleep(0.5)
    buzzer.value(0)
    sleep(0.5)
```

行人優先權的紅外線感測

行人優先權的紅外線感測-1

```
#pedestrianfirst_IF.py
#使用IF判斷式
def trafficLight():
    ...
def pedestrian_first():
    ...
while True:
    trafficLight()
    if PIR.value() == 1:
        pedestrianfirst()
```

行人優先權的紅外線感測-2：IRQ_01.PY

```
#pedestrianfirst_IRQ.py
#使用中斷 IRQ
#設定當PIR偵測到人體時(電壓 RISING),啟動中斷 IRQ
def trafficLight():
    ...
def IRQ():
    ...
while True:
    PIR.irq(trigger=Pin.IRQ_RISING,handler=IRQ)
    trafficLight()
```

行人優先權的紅外線感測-3：THREAD_01.PY

```
#pedestrianfirst_thread.py
#在另一個Thread執行偵測PIR狀態的程式
Import _thread
def trafficLight():
def pedestrian_first():
def PIR_sensor_thread():
_thread.start_new_thread(PIR_sensor_thread, ())
while True:
    trafficLight()
    if PIR_sensor == True:
        pedestrian_first()
        PIR_sensor = False
```

TrafficLight()修改

規則1：

逐行點燈、熄燈

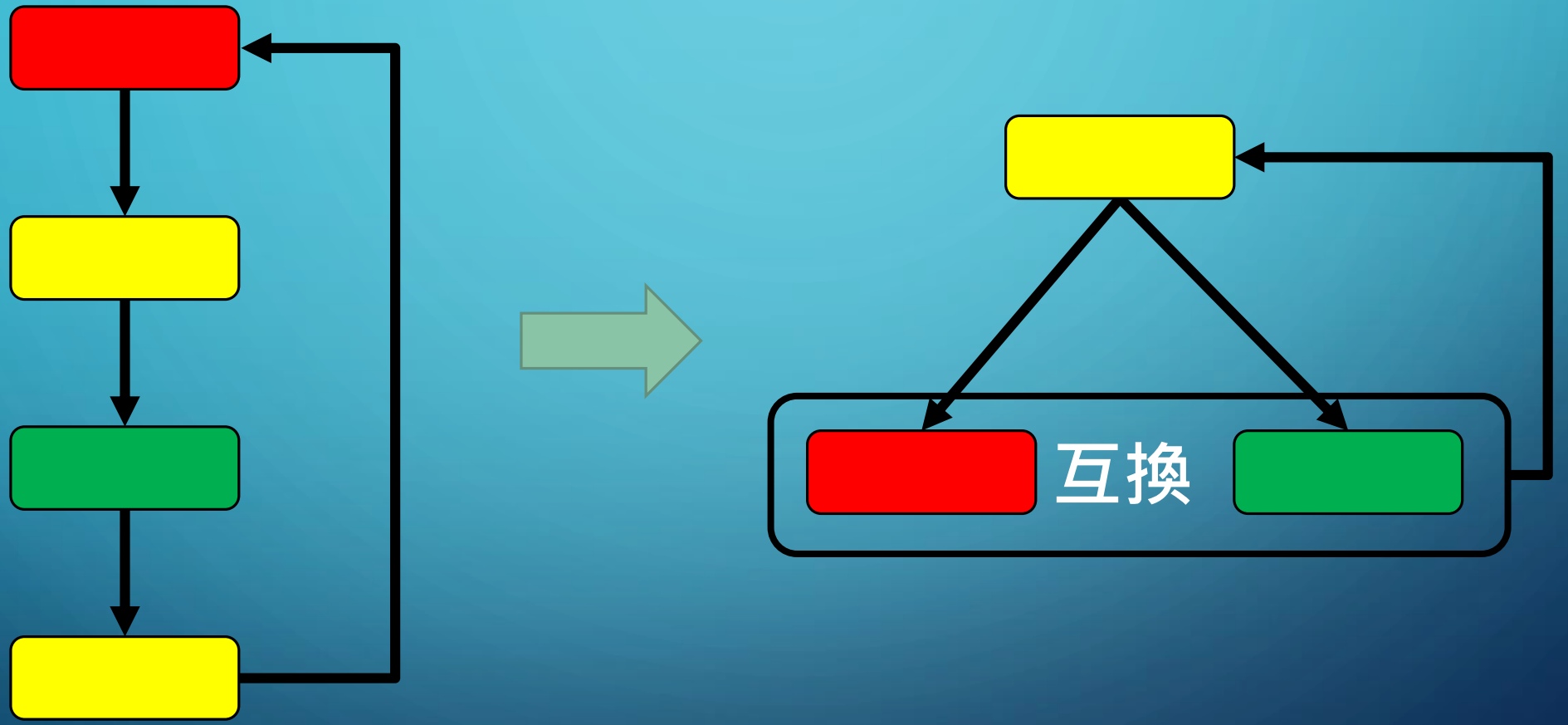
規則2：

先亮黃燈,再亮紅(綠)燈

規則3：

同一時間只亮一燈，使用變數控制

TrafficLight()修改： TRAFFICLIGHT2.PY



TrafficLight()修改： TRAFFICLIGHT3.PY

led_red.value(1 == True == 有值)

	i=0	i=1	i=2
i %3	0	1	2
(i+1)%3	1	2	0
(i+2)%3	2	0	1

	i=0	i=1	i=2
i %3	false	true	true
(i+1)%3	true	true	false
(i+2)%3	true	false	true

	i=0	i=1	i=2
~i %3	true	false	false
~(i+1)%3	false	false	True
~(i+2)%3	false	true	false