

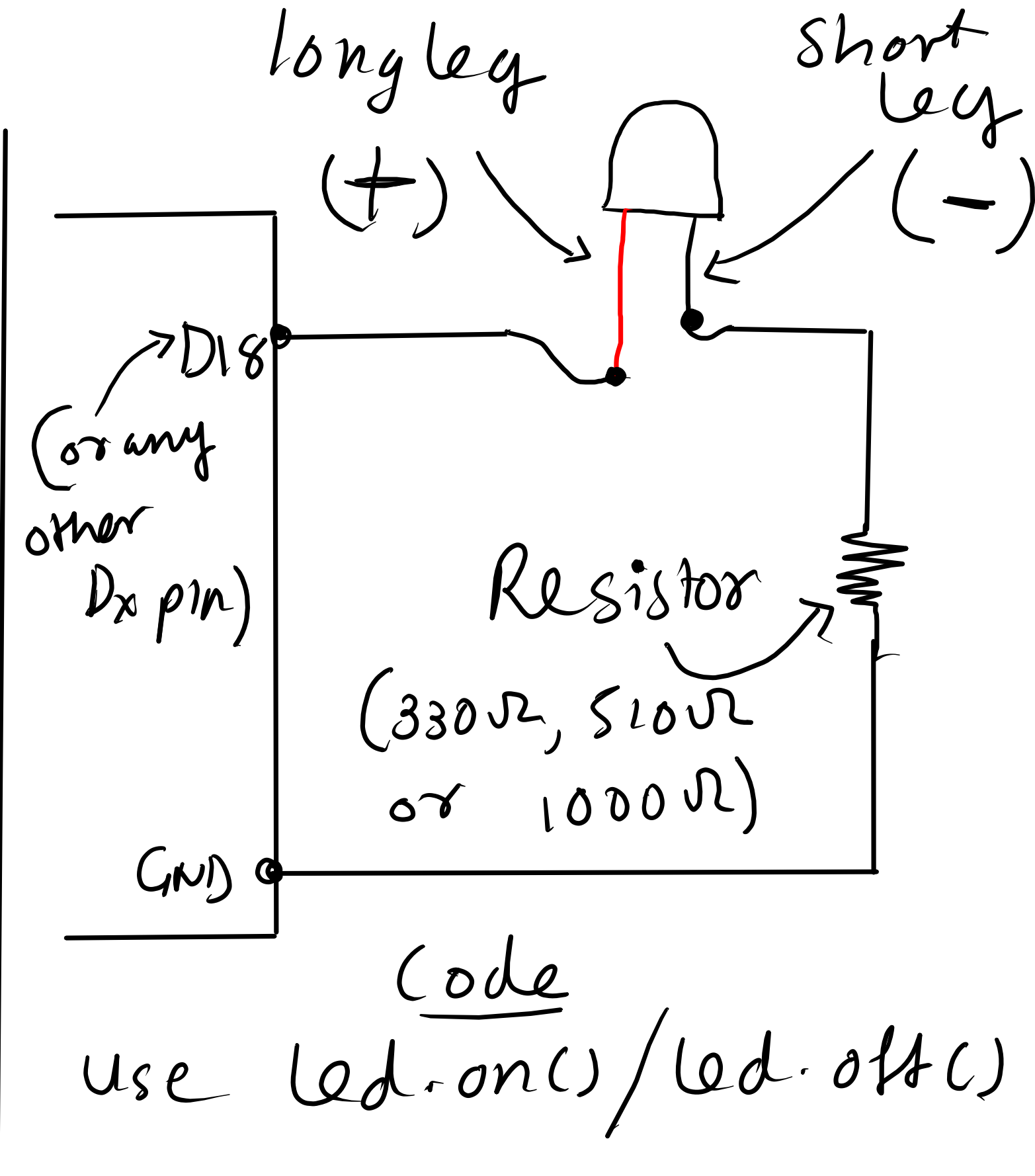
A Primer on Using the ESP32 Correctly

You have been Warned!!!

- 1) Never Use the Vin Pin for anything. This can damage your laptop.
- 2) Always use the power from the breadboard power supply.
- 3) Devices with 2 actively used Pins (LED's Buzzers, Switches) dont need a power supply. (See slides after this)
- 4) Devices with more than 2 pins will mandatorily required the Breadboard Power Supply (See Slides after this)
- 5) If done Correctly, the ESP32 can never get damaged.
- 6) Or it can take less than a second for it to get damaged.
- 7) The most common error that students are making is connecting the power supply's 3.3V to the GND of the ESP32, or connecting the GND of the Power supply to the 3.3v Pin of the ESP32.
- 8) It is easy to make this error, because the GND and the 3.3V Pin are next to each other. Caution is needed.

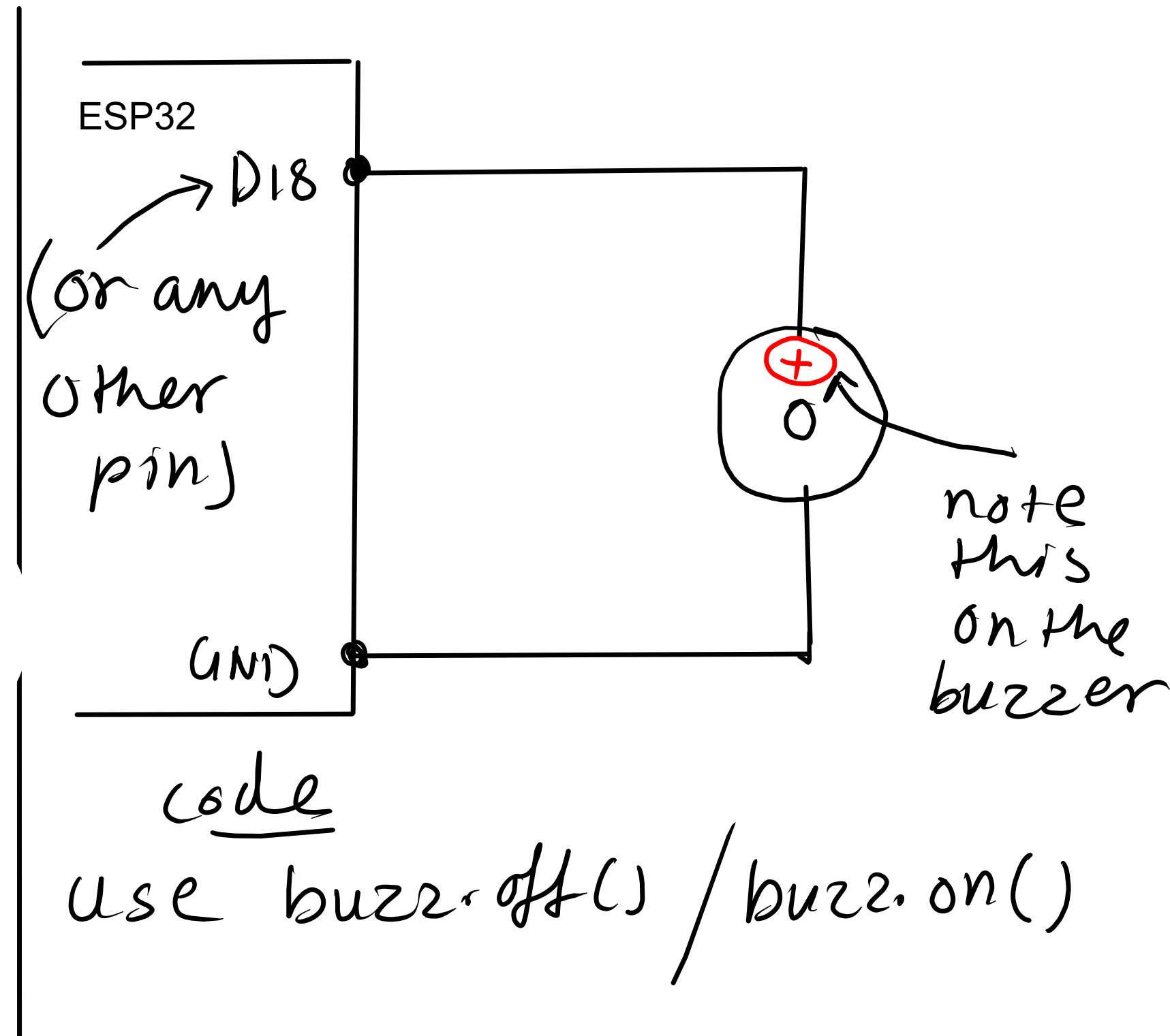
Using an LED

- 1) The LED is a 2 Pin Device.
- 2) It has a short and a Long leg.
- 3) The Long leg is positive, the short leg is negative.
- 4) A resistor is always needed with the LED.
- 5) Any resistor value less than 1000 ohms will work. (330 ohms, 510 ohms, 1000 ohms).
- 6) More the resistance, less the brightness.



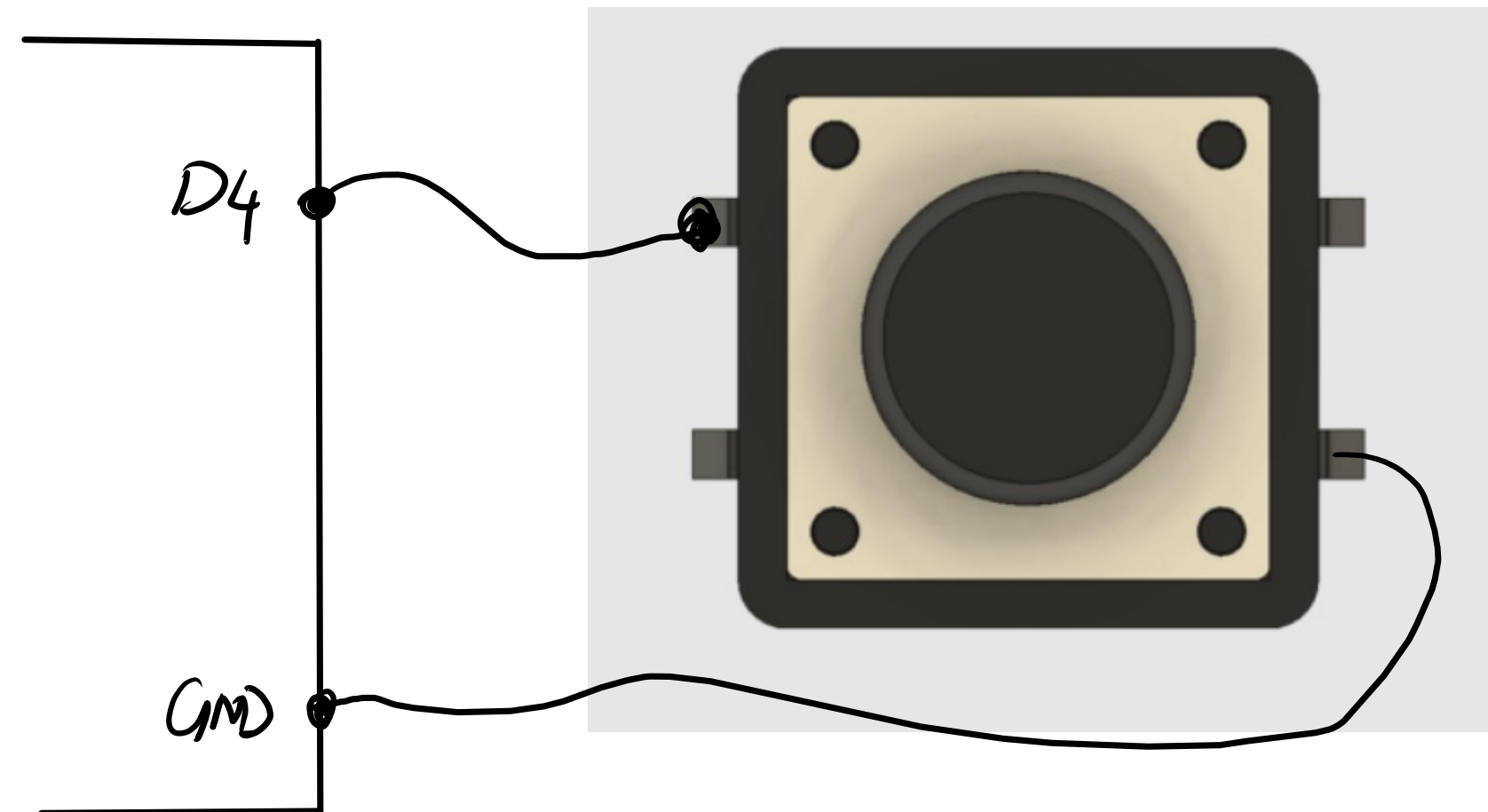
How to Connect a Buzzer

- 1) This is a 2 Pin Device.
- 2) It does not require a resistor.
- 3) Because of how it is constructed, when you put this on the breadboard, you will not be able to see its pins. It is very easy to miss the row/column in which its pins are. Double check!!
- 4) It can generate sound, but some success has been achieved in generating tones.



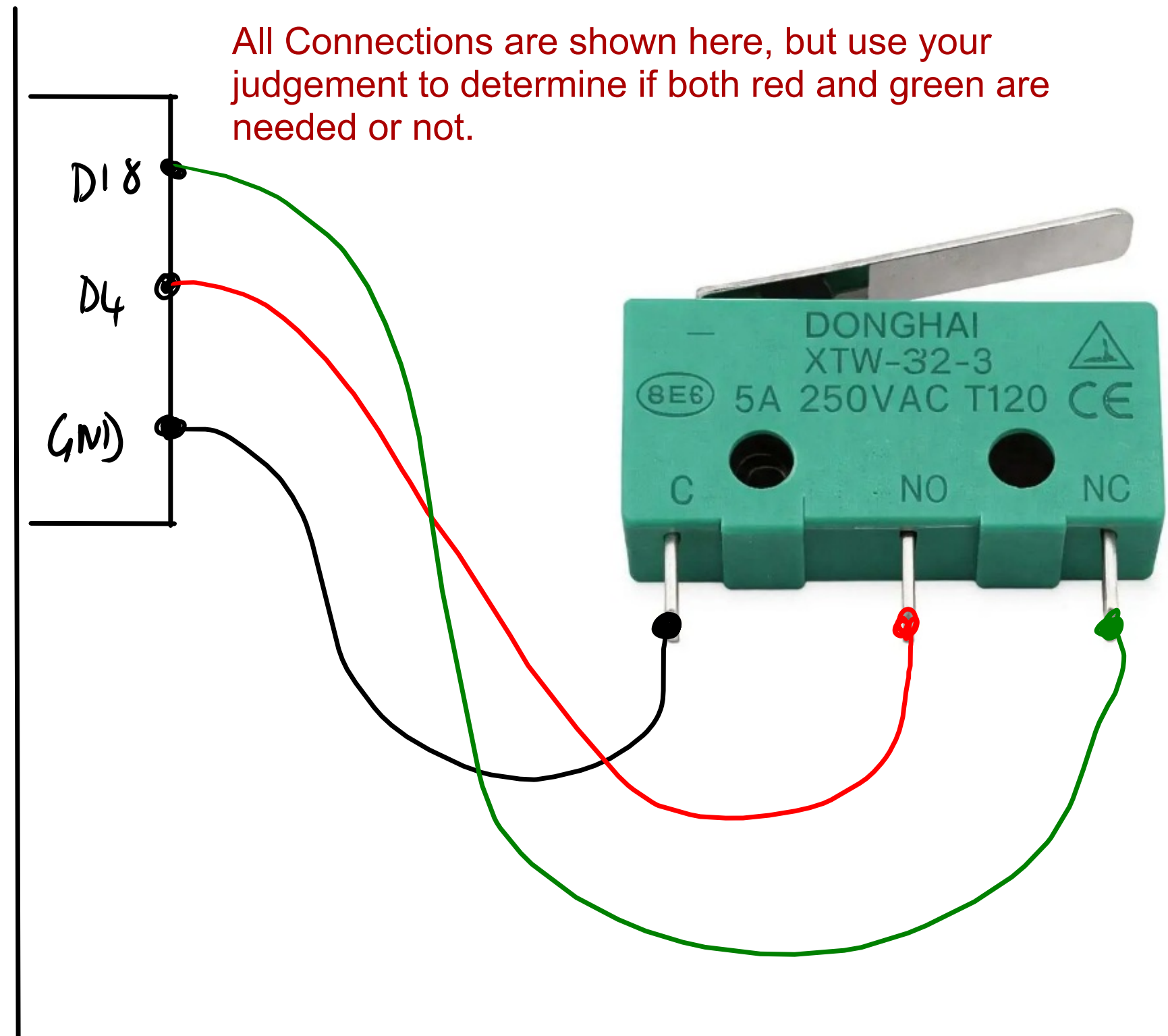
Tactile Switches (Square in Shape)

- 1) It has 4 terminals.
- 2) Use any one pair of diagonal connections.
- 3) It may look like it has 4 terminals, but one pair of diagonal connections is redundant.
- 4) Set the Pin as an input in code.
- 4) Enable the Pull Up Resistor in Code.



Roller Lever Switch

- 1) This Switch has three terminals.
- 2) Read the names of the terminals on the switch.
- 3) C or COM is a common connection.
- 4) NO stands for Normally Open.
- 5) NC Stands for Normally Closed.
- 6) Without Pushing the switch, internally, COM is connected to NC.
- 7) When you press the switch, COM- NC connection breaks, and COM-NO connection is established.
- 8) When you release the switch, COM- NO connection breaks, and COM-NC connection is established.



Devices with connections of more than 2 Pins.

Includes the following

- 1) Neopixel Strip or Ring.
- 2) Servo Motor.
- 3) Stepper Motor.
- 4) DC motor driver
- 5) All Sensor Modules (Light, Sound, Ultrasonic)

A) Always Use the Breadboard Power supply with these devices.

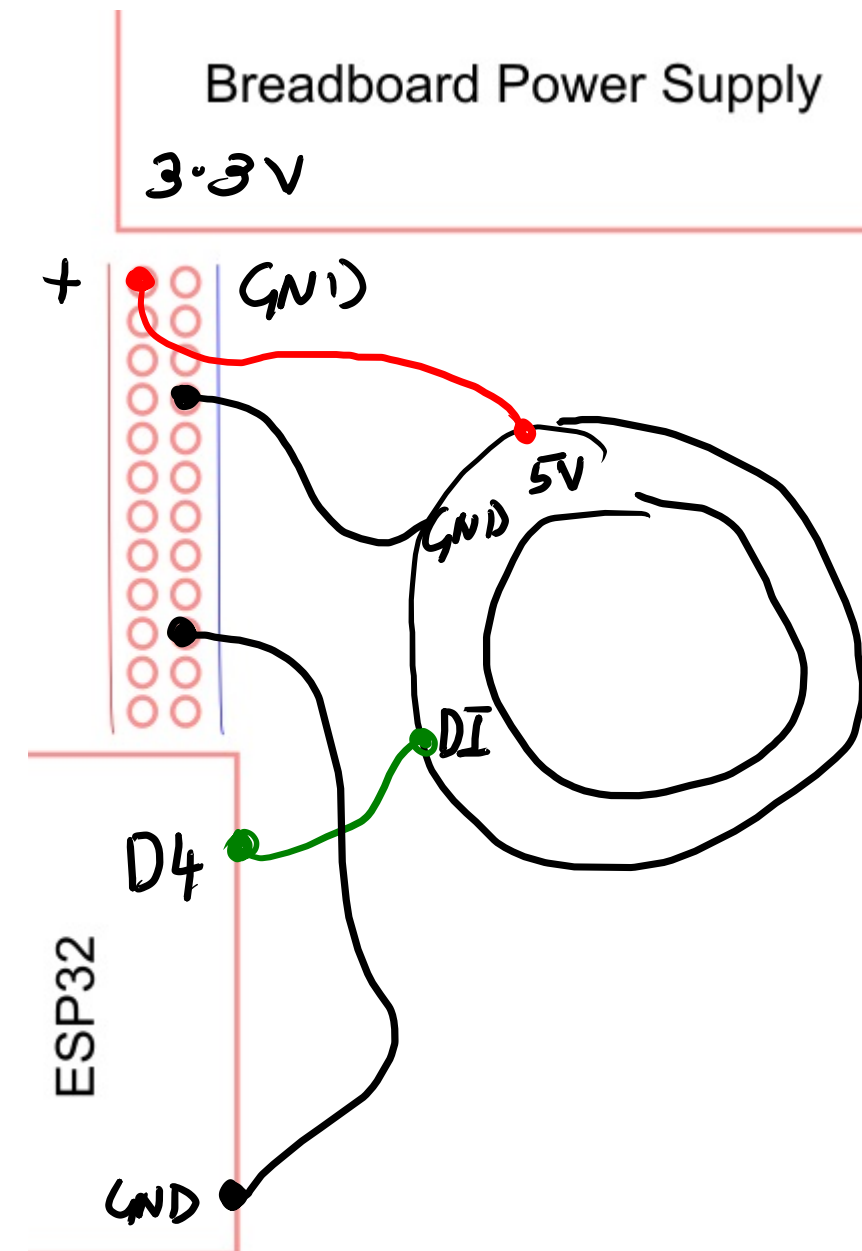
B) Imagine the 3.3v Pin **does not exist** on the ESP32.

C) Make sure the GND of the breadboard power supply is connected to the GND of the ESP32.

D) **ONLY SIGNALS ARE RECEIVED BY THE ESP (IN CASE OF SENSORS) OR GENERATED BY THE ESP32 (IN CASE OF OUTPUT DEVICES LIKE SERVO'S OR NEOPIXEL RING)**

Neopixel Strip or Ring

- 1) The device is very sensitive. If you connect its power terminals in reverse, it will instantly get damaged.
- 2) 5V pin connects to Breadboard Power supply's 3.3v line.
- 3) GND connects to GND of the Breadboard Power supply.
- 4) DI pin connects to a spare Dx pin on the ESP32.
- 5) Connect the GND line of the breadboard power supply the GND pin of the ESP32 together.



What will you Check before turning on power...

Breadboard Power supply Row set to 3.3v?

(+) Sign on breadboard power supply aligns with red row?

(-) Sign on breadboard Power supply aligns with blue row?

5V of Neopixel device connected to 3.3v line?

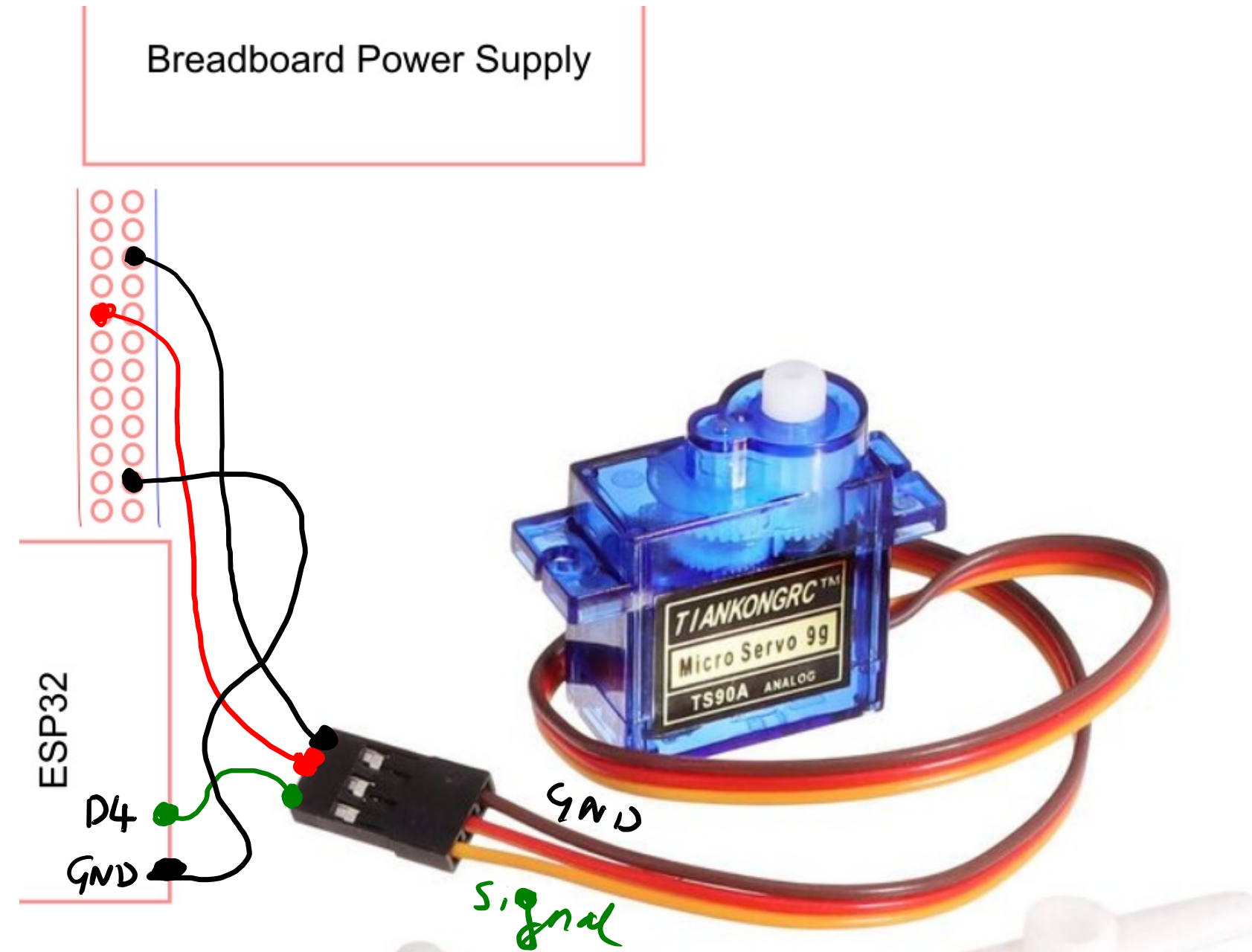
GND of Neopixel device connected to GND?

GND of ESP32 to GND of Power supply?

Is your code using the pin that the Neopixel is connected to?

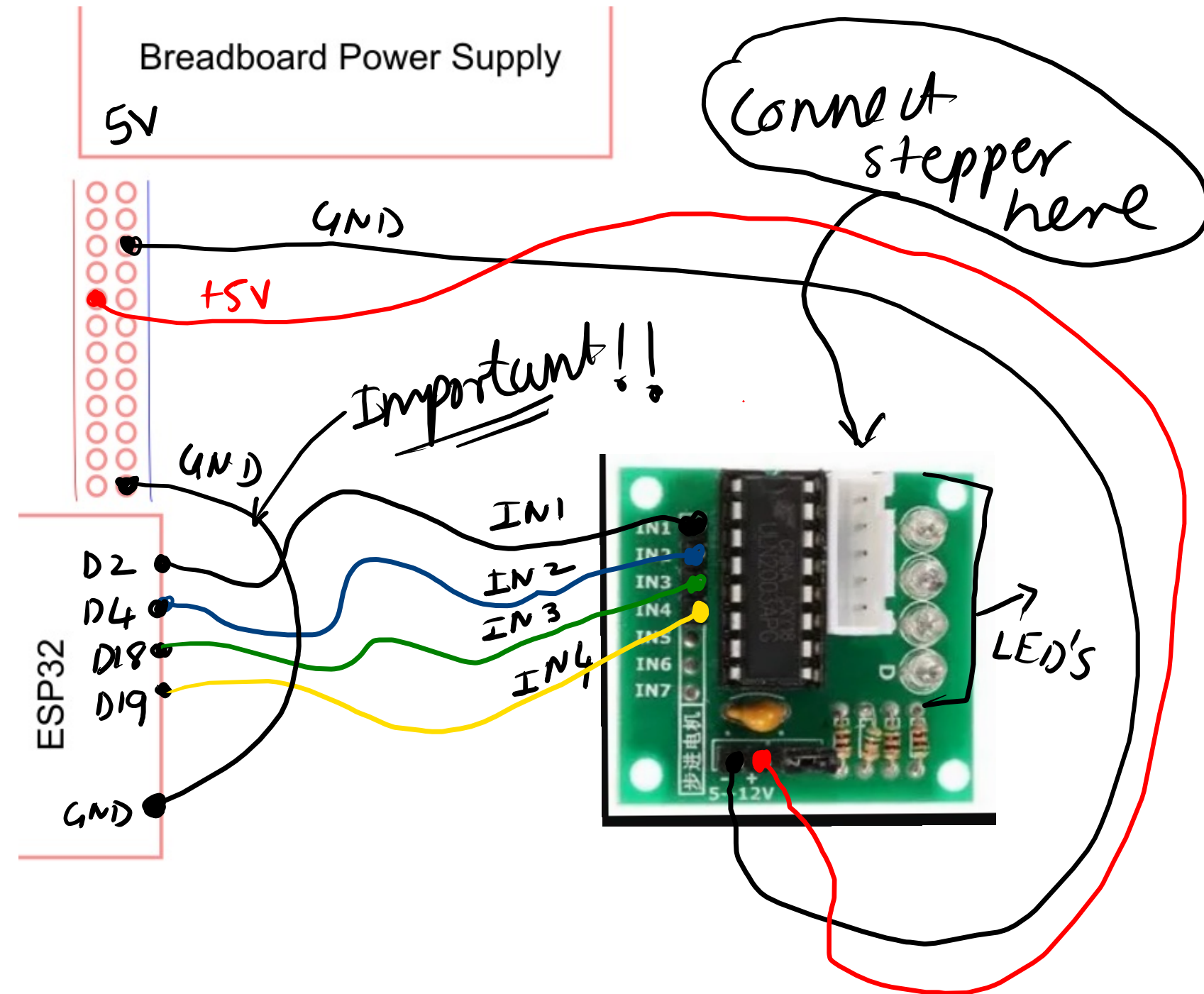
Servo Motor

- 1) The Motor Provides partial angle rotation. 0 degrees to 180 degrees.
- 2) This is a high current device, so it requires the breadboard power supply mandatorily.
- 3) Do not connect it to the 3.3v of the ESP32.
- 4) Ground of the Breadboard Power supply and the ESP32 need to be connected together.
- 5) Do Not Connect it to Vin.
- 6) Use the Servo Library.



Stepper Motor


- 1) Runs from 5V. Switch your Breadboard Power supply selection jumper to 5V side.
- 2) Connect Power pins and check correctly.
- 3) You can mess up the sequence of excitation of the coils inside the motor. **Increase the delay** between the steps to see if IN1, IN2, IN3 and IN4 LED's are lighting up in the correct sequence.
- 4) 2048 steps for one full revolution.
- 5) Use 3ms sleep time for fastest speed.
- 6) use `time.sleep_ms(3)` for a 3ms sleep.



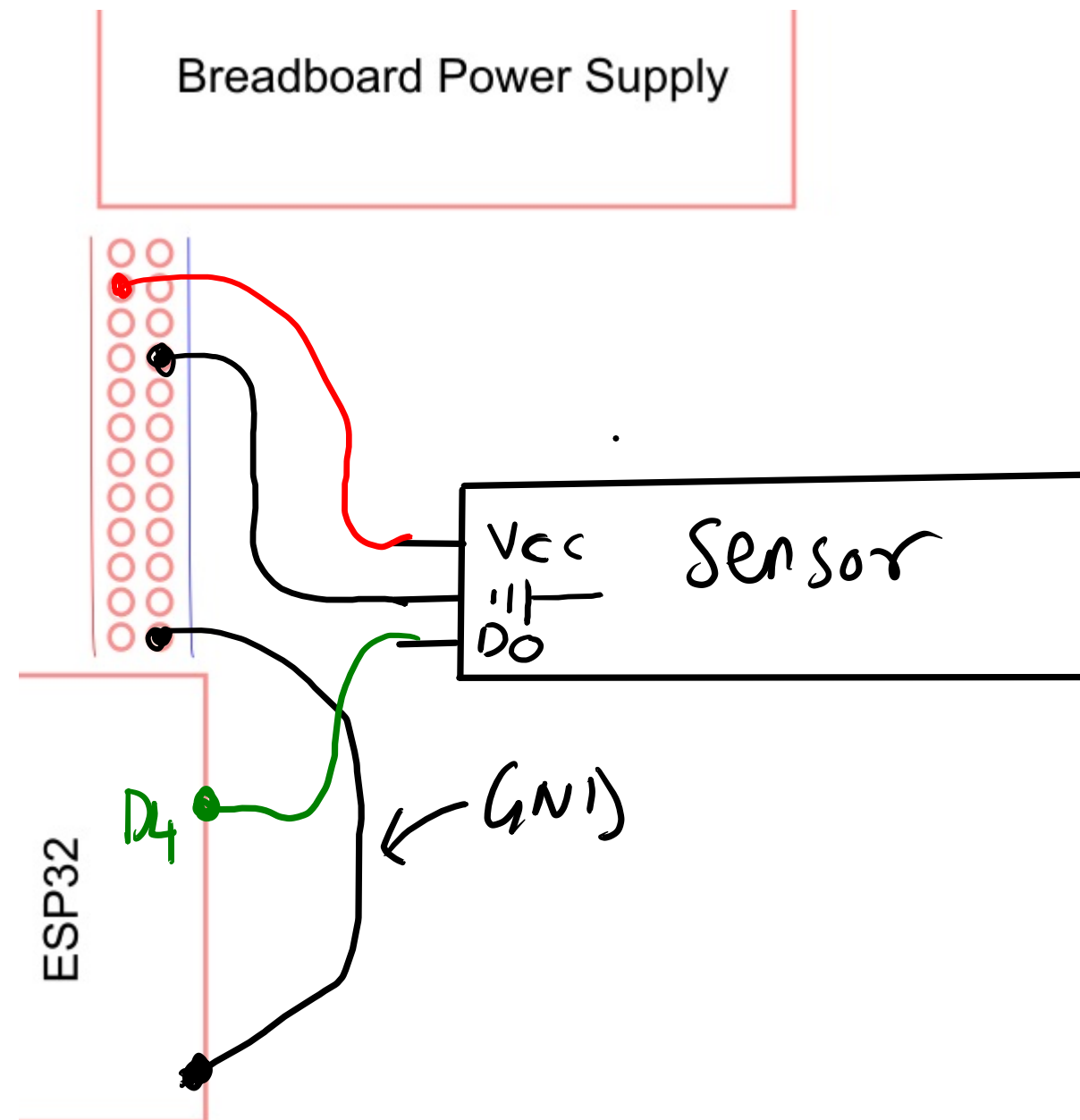
Sensor Modules

- 1) Working with Sensor Modules is tricky, but there are some fundamental concepts. The trickiness lies in naming of pins.
- 2) On different sensors, the Power connections can be named as follows

Vcc, 5V, + -> All these connect to 3.3v
Gnd, G, - -> All these connect to GND
- 3) DO, Out -> These connect to ESP32 Pins to sense the output of the sensor.
- 4) Sensors with 3 pins will provide a 1 or 0 status which can be read by any input pin.
- 5) Some sensors require a library (ultrasonic sensor), which can be a tad bit tricky.
- 6) Most sensors will have a sensing LED, which glows when the sensor get triggered.
- 7) Keep space to reach and adjust the sensor using a screwdriver.
- 8) **No sensor will ever be connected to 5V. This can be harmful for the ESP32.**

 Symbol for GND

Typical Sensor Connection



Ultrasonic Sensor

The Ultrasonic Sensor measures distance using echolocation.

There are 4 pins on this sensor,

- a. Vcc, which connects to 3.3v of Breadboard Power supply.
- b. GND which connects to GND of Breadboard Power supply
- c. Trig Connects to a spare Dx pin on the ESP32 e.g. D4
- d. Echo Connects to a spare Dx pin on the ESP32, e.g. D18.

Use the hcsr04 library with the sensor for easy measurement of distance.

