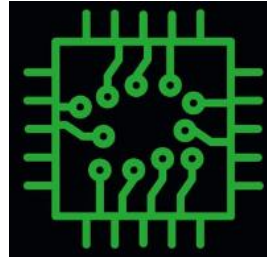# Internet Of Things

First Circuit with RPi board

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Introduction

- **You need the following:**
  - **RPi board**
  - **LED**
  - **Resistor**
  - **Breadboard**
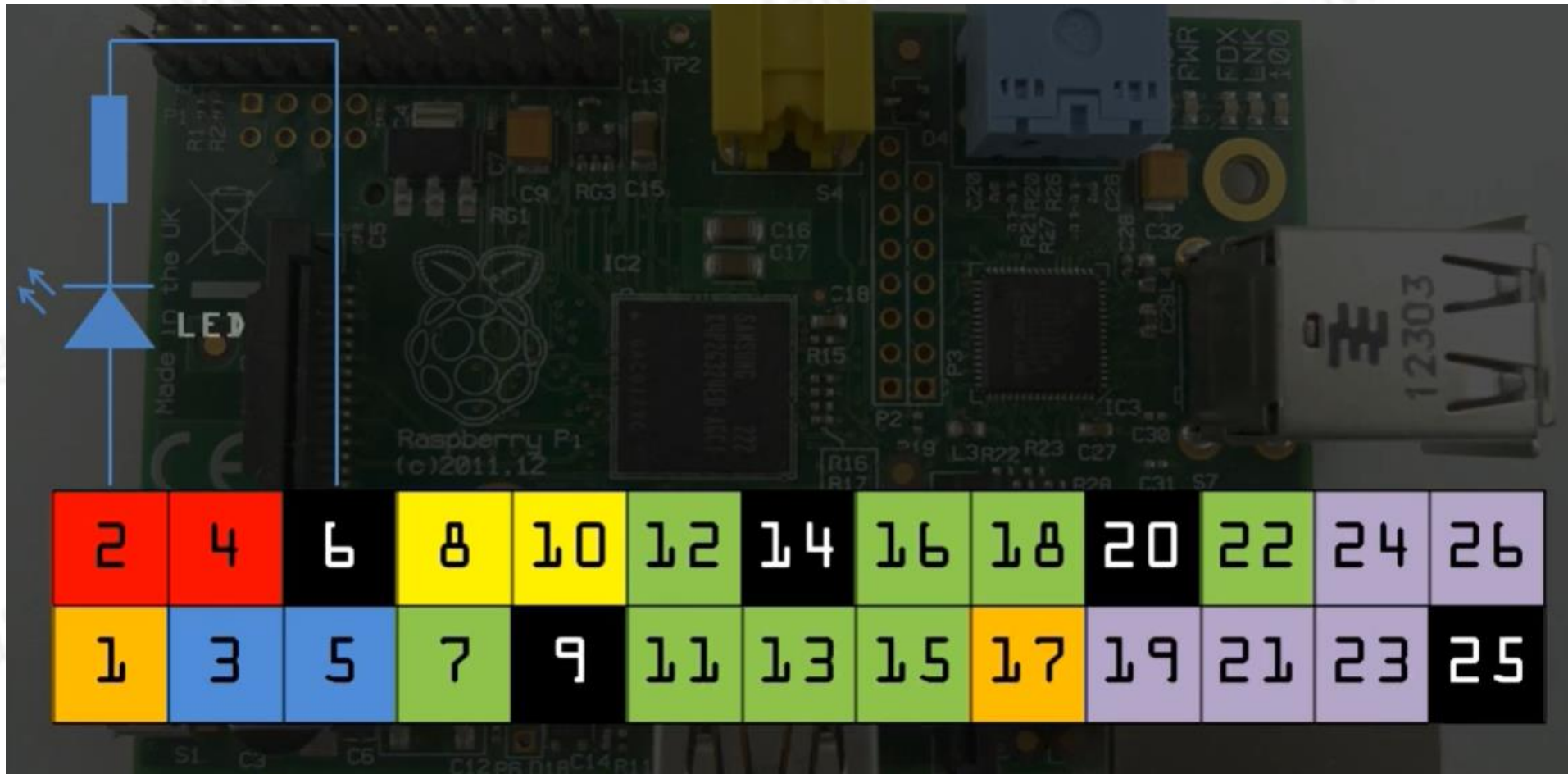 - **Wires**

Introduction

BE CAREFUL

- **Want to make a change on the circuit? Always power off the RPi first**

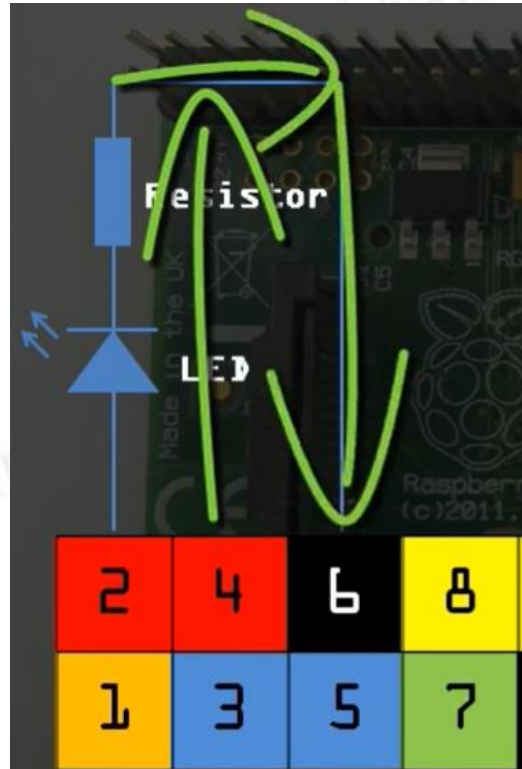- **When powering ON, avoid touching the circuit**

LED Circuit

- **For this circuit, we want to connect the LED to 5 V pin which will supply current as long as the RPi is powered on**

LED Circuit

- **The current will flow from the 5 V pin through the components then returned to ground**
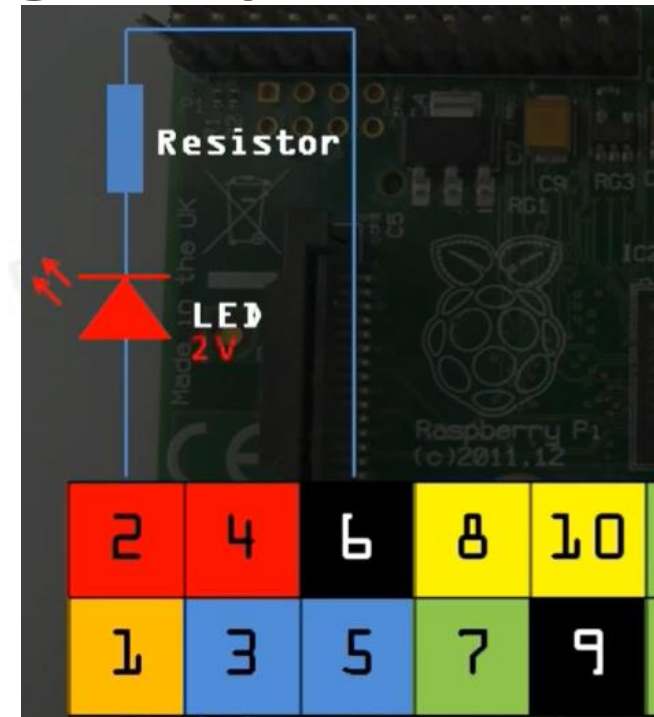
LED Circuit

- **The resistor is placed in the circuit to limit the current**

- **Without the resistor, we would have an excessively high current which would burn our LED**

- **If we choose that has too high value, our LED will not light**

- **If we choose a resistance that is too low, we risk creating a high current**

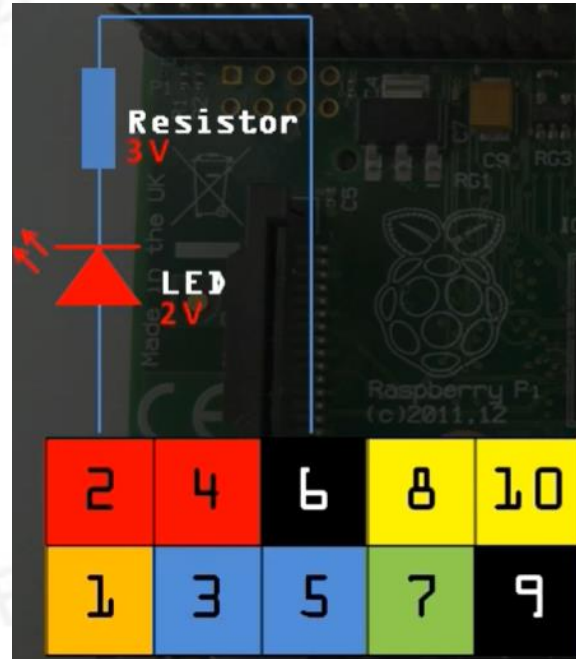- **How do we choose the desired resistor value?**

LED Circuit

- **What the voltage drop across the resistor should be? That means how much the 5 V that we are supplying should be used by the resistor**

- **If we are using Red LED, it has a voltage drop of 2 V**

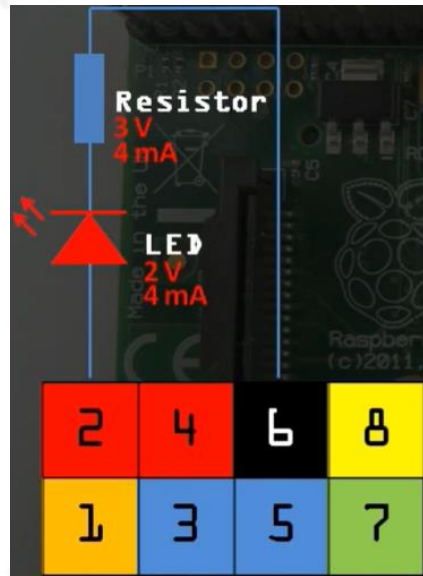- **That means there 3 V left over**

LED Circuit

- **These 3 Volts must be used by the resistor**

- **Next, we must consider the current passing through the circuit**
- **Small LEDs usually will light with a current around 4 mA**

LED Circuit

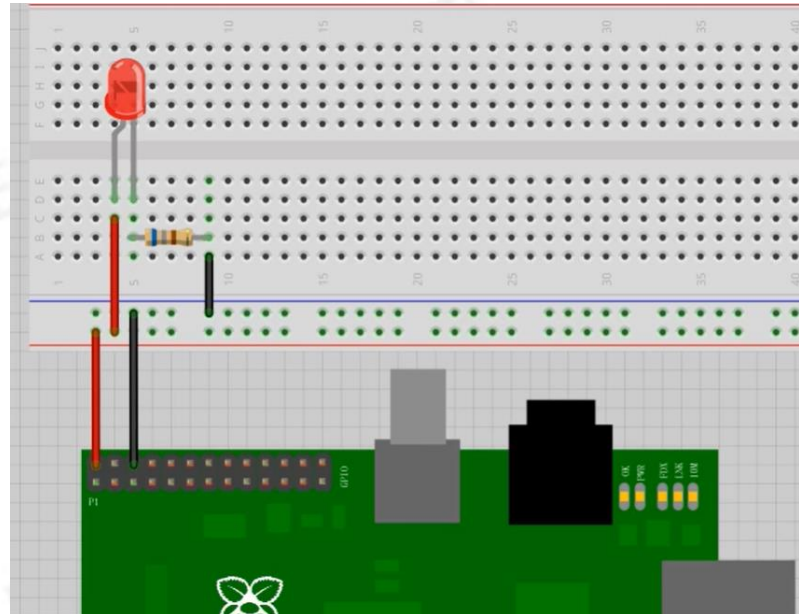- **This means 4 mA will also passing through the resistor**

- **Now we can use Ohm's law to calculate the resistance**

$$R = \frac{V}{I} = \frac{3}{0.004} = 750\ \Omega$$

LED Circuit

- **So, we need a resistor close to 750 ohm**

- **LEDs typically functions well up to 20 mA**

- **A resistor with slightly lower value still works just fine**

- **Now we can setup the circuit on the breadboard**

LED Circuit

- **One common error is to place the LED backwards**
- **The LED has long flat section that looks like a negative symbol called (Cathode), this side needs to lead towards ground**
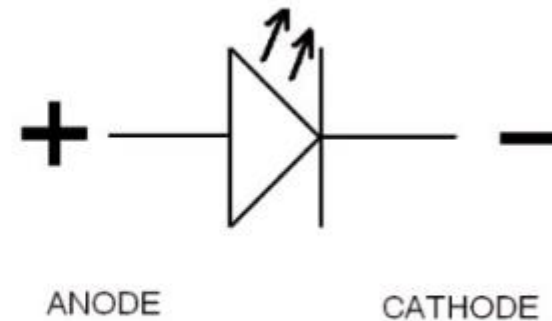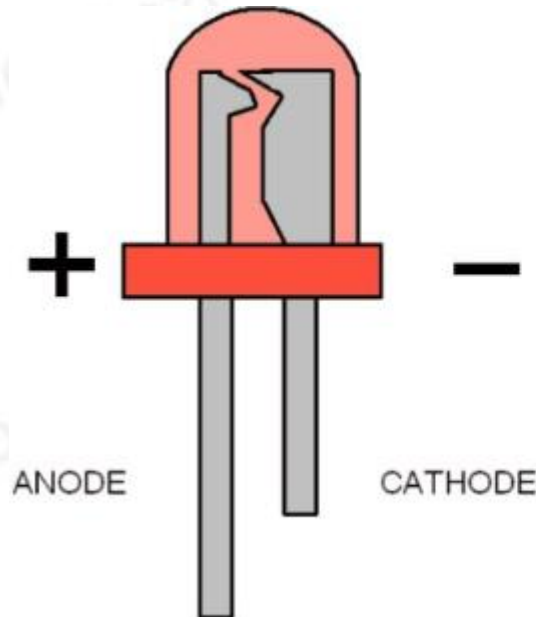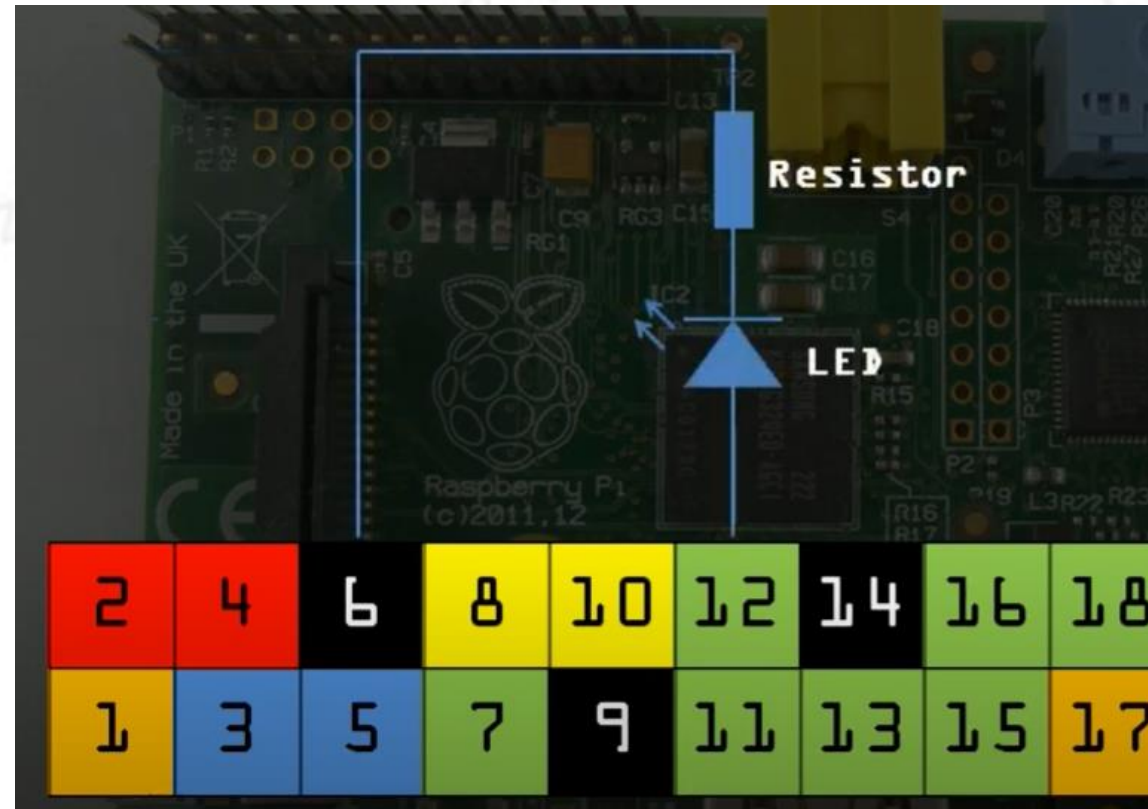
Blinking LED Circuit

- **Now, power ON your RPi and the LED will light**

- **Next, we want to turn ON and OFF the LED using GPIO pin**

- **To do that, we need to write a simple Python program**

- **But before that we need to make small updates on the circuit**
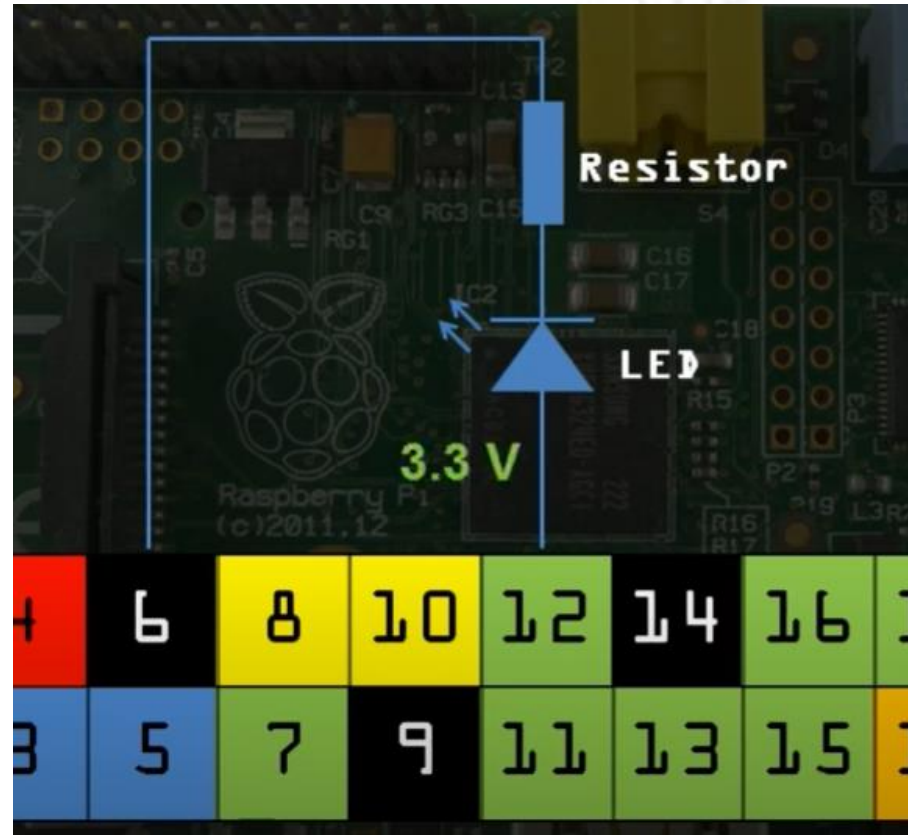
- **Can you expect these updates?**

Blinking LED Circuit

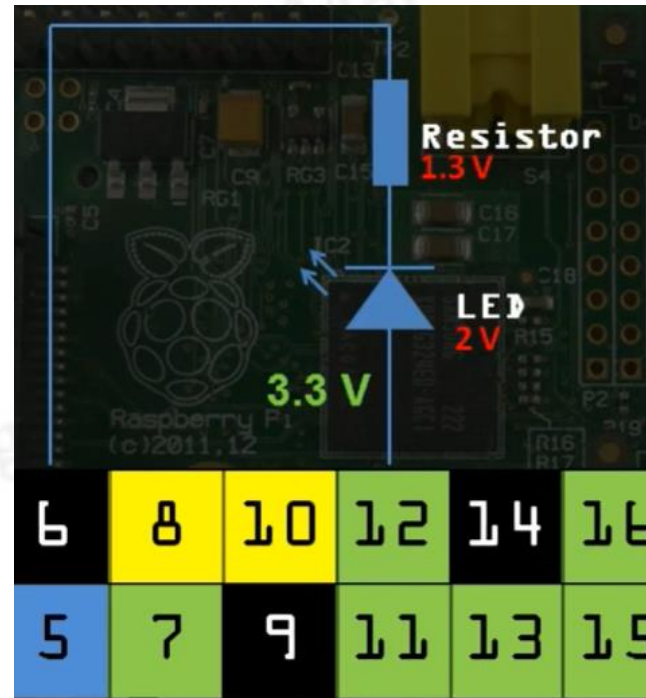- **We will use GPIO pin at pin 12, but any of the GPIO pins would work fine**
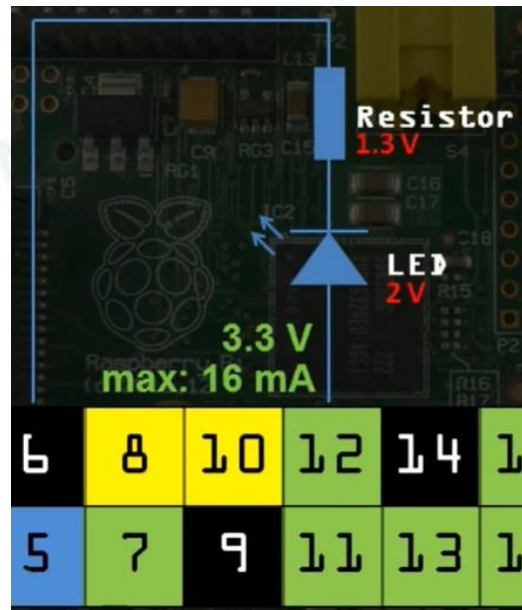
Blinking LED Circuit

- **Remember that GPIO pins use 3.3 V**

Blinking LED Circuit

- **If we are using Red LED, it has a voltage drop of 2 V**
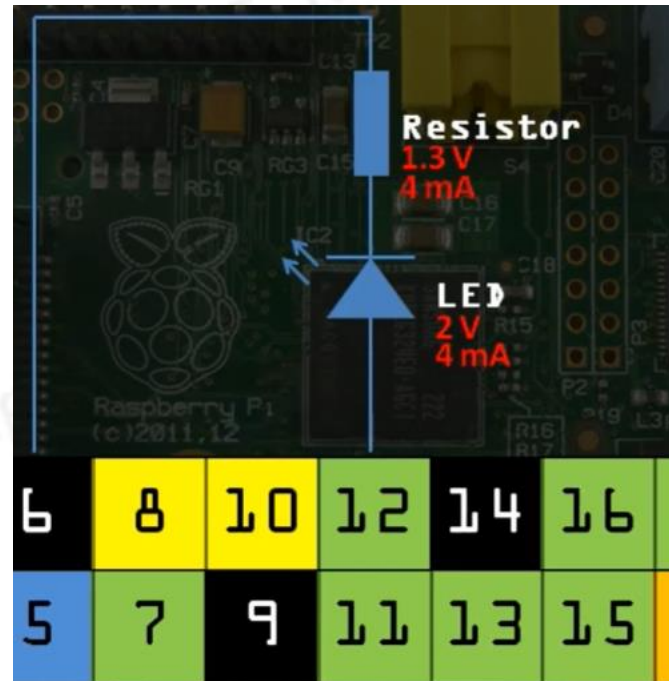- **So, there will be 1.3 V left across the resistor**

Blinking LED Circuit

- **Recall that we are using the resistor to limit the current passing through the circuit**

- **This is important when dealing with GPIO pins as only 16 mA of current can safely pass through a GPIO pin**

Blinking LED Circuit

- **For our LED, we will need 4 mA of current**
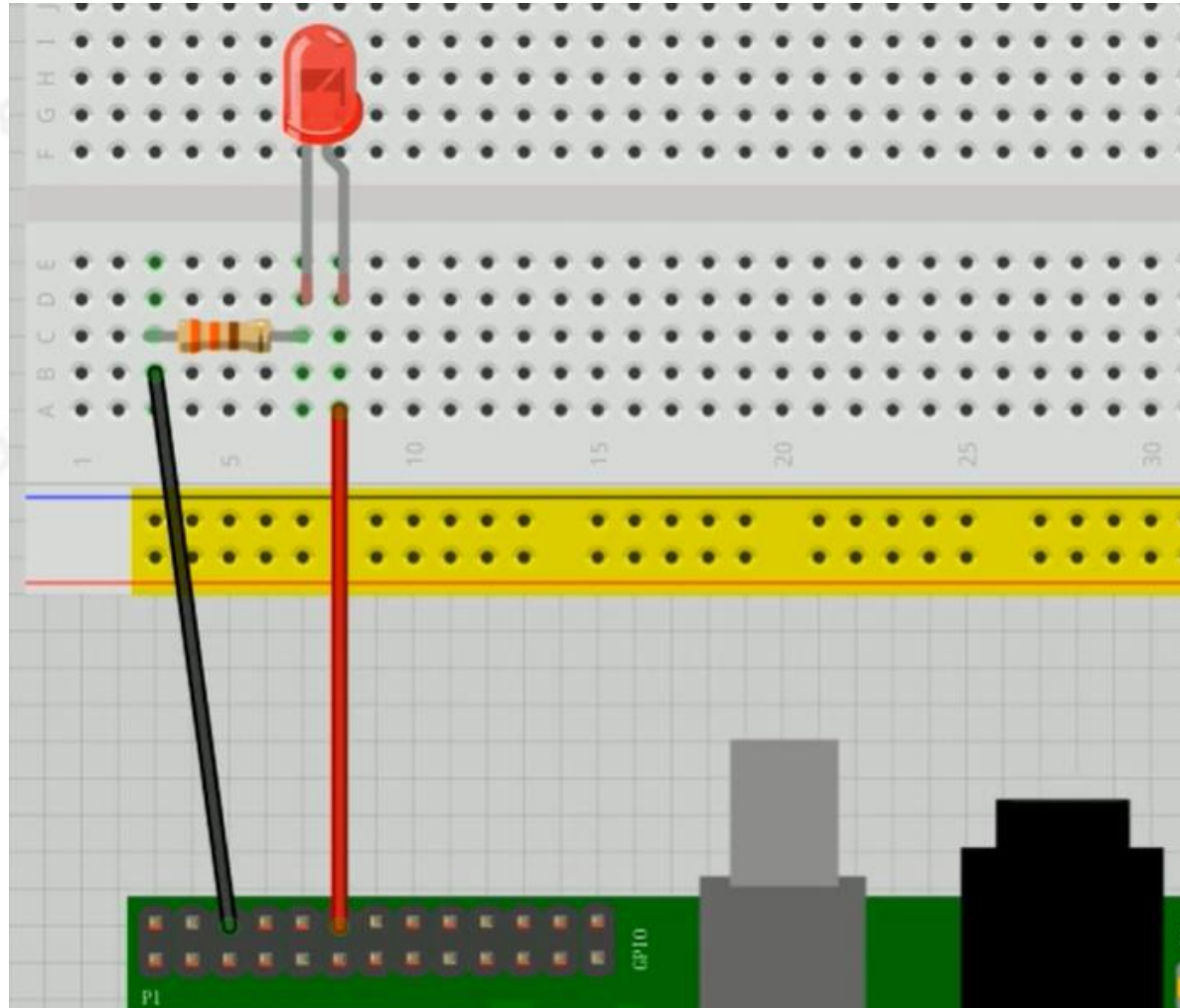- **So, we will be fine with the safe current limit**

Blinking LED Circuit

- **To calculate the value of the resistor we use Ohm's law**

$$R = \frac{V}{I} = \frac{1.3}{0.004} = 325$$

- **So, 330 Ohm resistor should work just fine**

Blinking LED Circuit

Blinking LED Circuit

- **Now it's time to write the code**

Any Questions???