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9. Fire alarm

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Experiment 9: Fire alarm

Short Description

Create a fire alarm with Raspberry Pi Pico and a flame detector sensor from the SCRAPY KIT.

Extended Description

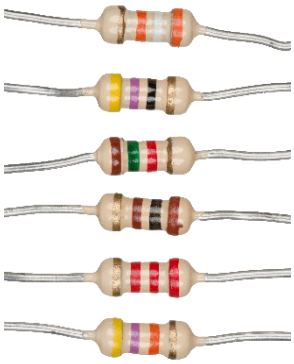
Do you sometimes worry if you turn off the iron after ironing? You may not be sure if you turned off the soldering iron in the workshop. Are you afraid of causing a fire? With the help of Raspberry Pi Pico and flame detector sensor, worries are over.

This experiment is for all ages with no prior knowledge required.

For this experiment, we need a Raspberry Pi Pico, a flame detector sensor, two LEDs (red and green), two 220Ω resistors, a buzzer, connecting wires and a test board to which we will connect it.

By following the steps in this manual, you will learn how to connect a circuit, what resistors are for, and the physics behind it.

The operational principles of the resistor



Resistors are passive electronic components that are commonly used in electrical and electronic circuits. Their primary function is to resist the flow of electric current, hence the name "resistor." They are designed to have a specific resistance value, which is measured in ohms (Ω).

Most resistors use a color-coding system to indicate their resistance value. The color bands are printed on the resistor body and are read from left to right. Each color represents a specific number, and by decoding the color bands, you can determine the resistance value of the resistor.

Resistors can be connected in series or parallel within a circuit. When resistors are connected in series, their resistances add up. In contrast, when resistors are connected in parallel, their equivalent resistance can be calculated using the formula: $1/R\_eq = 1/R_1 + 1/R_2 + 1/R_3 + ...$, where R_eq is the equivalent resistance.

Resistors are essential components in various applications, including voltage division, current limiting, signal conditioning, impedance matching, and many more. They provide control over the flow of current and help ensure the proper functioning of electronic circuits.

In this exercise we used resistors. By placing a resistor in front of or behind the led, we reduced the current everywhere in the circuit, and in this way we protected not only the led, but also the Raspberry Pi Pico. The higher the resistance of the resistor, the lower is the current.

Objectives:

In this exercise, the goal is to create a fire alarm using the Raspberry Pi Pico and a flame detector sensor. Through the exercise, the user will gain knowledge about:

- Working principle of the resistor
- Basic programming in Python
- Connecting circuits

Materials to be used:

- 1 x Raspberry Pi Pico
- 1 x Pico breadboard kit
- 1 x Full-size breadboard
- 1 x Flame detector sensor
- 2 x 220 Ohm resistor
- 1 x Red LED
- 1 x Green LED
- 1 x Buzzer
- Jumper wires

Steps to be followed:

The main steps in the exercise are:

1. Connect the flame sensor to the Raspberry Pi Pico according to the connection diagram.
   Raspberry Pi Pico Board:
   - 3v3: Connect to + pin of the flame sensor
   - GP28: Connect to D0 pin of the flame sensor
   - GND: Connect to GND pin of the flame sensor
   - GP4: Connect to Positive pin of the green LED via a 220 ohm resistor
   - GP5: Connect to Positive pin of the red LED via a 220 ohm resistor
   - GP17: Connect to Positive pin of the buzzer
   - GND: Connect to Ground pin of the board

   Flame detector sensor:
   - D0: Connect to GP28 of Raspberry Pi Pico board
   - +: Connect to 3V3 of Raspberry Pi Pico board
   - GND: Connect to GND of Raspberry Pi Pico board
2. Connect the LED's and buzzer according to the connection diagram;
   Buzzer:
   - Positive leg: Connect to GP17 of Raspberry Pi Pico board
   - Negative leg: Connect to GND of Raspberry Pi Pico board

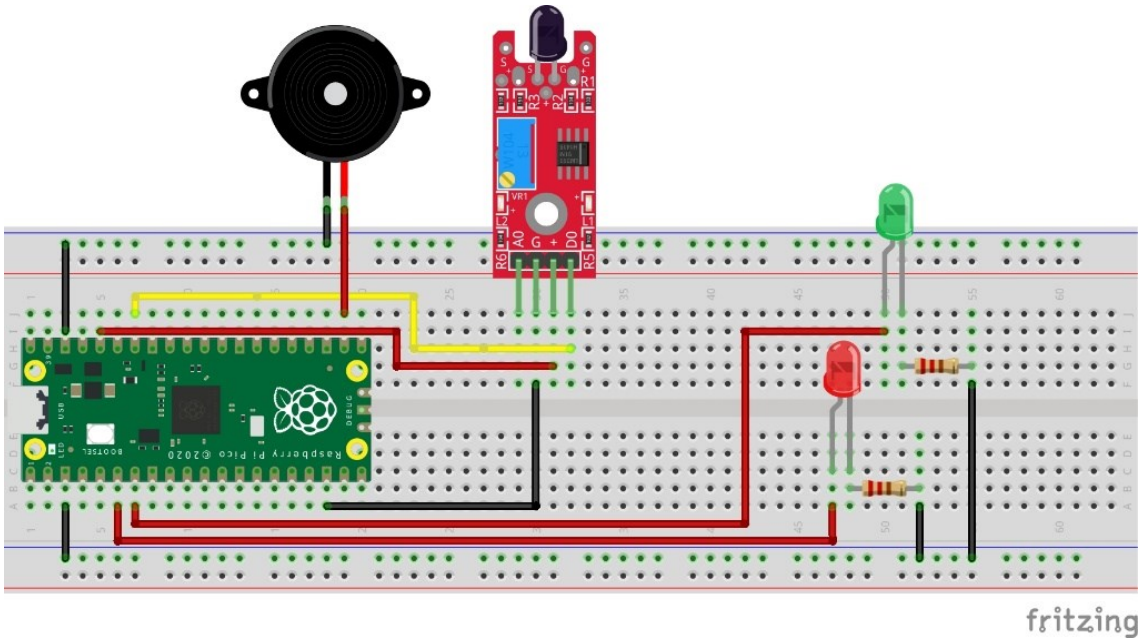
Red LED:
- Positive leg: Connect to GP4 of Raspberry Pi Pico board via a 220 ohm resistor
- Negative leg: Connect to GND of Raspberry Pi Pico board

Green LED:
- Positive leg: Connect to GP5 of Raspberry Pi Pico board via a 220 ohm resistor
- Negative leg: Connect to GND of Raspberry Pi Pico board

3. Write a program that will turn on the green LED if the sensor is not activated;
4. Write a program that will turn on the red LED and turn off the green led when the sensor is activated;
5. Write a program that will turn on the buzzer when the sensor is activated;
6. Test the program on the flame at different distances.

From step 3 to step 5 it is necessary to test the sensor to make sure that the program works.

Wiring diagram



Code

```
from machine import Pin
from time import sleep

#define pins
green_led = Pin(5, Pin.OUT)
red_led = Pin(4, Pin.OUT)
buzzer = Pin(17, Pin.OUT)
flame_sensor = Pin(28, Pin.IN)

while True:
    if flame_sensor.value() == 1:
        red_led.high()
        green_led.low()
        buzzer.high()
        sleep(1)
    if flame_sensor.value() == 1:
        red_led.low()
        green_led.high()
        buzzer.low()
        sleep(1)
```

Conclusion

In this interesting project, we used a Raspberry Pi Pico to create a fire alarm. As an additional element, we used a flame detector that works by registering the light of the flame and sending a signal to pin D0. The Raspberry Pi Pico reads the signal and, depending on it, turns on the red or green LED. In this exercise, we also learned how to use resistors to reduce the current in the circuit and thus protect the elements in the circuit.

To learn more: by adding more LEDs or a display it can provide more detailed feedback. Creating a wireless interface, it will allow the system to communicate with a mobile device or other external device.