



2023

3. Spot the intruder

Project number: **2021-1-FR01-KA220-SCH-000031617**



**Co-funded by
the European Union**

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SCRAPY Partnership
31/05/2023



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Experiment 3: Spot the intruder

Short Description

With this experiment students will be able to create a movement alarm to inform them when someone is nearby.

Extended Description

In this activity we will use a sensor called HC-SR501 Motion Detection Sensor. This sensor detects motion by measuring changes in the infrared (heat) levels emitted by surrounding objects. When motion is detected the PIR sensor outputs a high signal on its output pin. HC-SR501 PIR Sensor has an adjustable delay before firing and adjustable sensitivity.

We will use this sensor along with a buzzer, to inform us that someone is close and use the adjustable sensitivity from the sensor to better suit needs in terms of distance.

Objectives:

With this activity, students will experiment with sensors, buzzers and think about way to adjust the sensor to their needs and activity goal.

In terms of knowledge, students will:

1. Understand how a PIR motion sensor detects movement using heat waves.
2. Explain why a motion sensor did or did not “see” a moving object relating with the distance that object is from the sensor.
3. Work and engage with physical computing and a coding language.
4. Find solutions and solve problems during the programming and testing phase.

Materials to be used:

- 1 x Raspberry Pi Pico
- 1 x Pico breadboard kit
- 1 x Full-size breadboard
- 1 x PIR Motion Detector Sensor HC-SR501
- 1 x Red LED
- 1 x Buzzer
- 1 x 220-ohm resistor
- Jumper wires

Steps to be followed:

Let's create a movement alarm that will warn us if someone comes close to where we are!
For this, let's start by

1. Connect the PIR Motion Detector Sensor HC-SR501 to the Raspberry Pi Pico board using connection wires.
2. Connect the buzzer and LEDs to the Raspberry Pi Pico board using connection wires and the 220-ohm resistors to limit the current flow.
3. Write a Python program to control the Raspberry Pi Pico board and use the PIR Motion Detector Sensor HC-SR501 to detect movement.
4. Program the Raspberry Pi Pico board to turn on the red LED and ring the buzzer when an obstacle passes the sensor.
5. Test the alarm system by moving different objects in front of the sensor and ensure that the LEDs and buzzer provide the appropriate feedback.

Raspberry Pi Pico Board:

- GP28: Trigger pin of the PIR Motion Detector Sensor HC-SR501
- GP15: Positive pin of the red LED
- GP14: Positive pin of the buzzer
- GND: Ground pin of the board

PIR Motion Detector Sensor HC-SR501

- VCC: Connect to 5V power source
- GND: Connect to GND of Raspberry Pi Pico board
- Trig: Connect to GP28 of Raspberry Pi Pico board

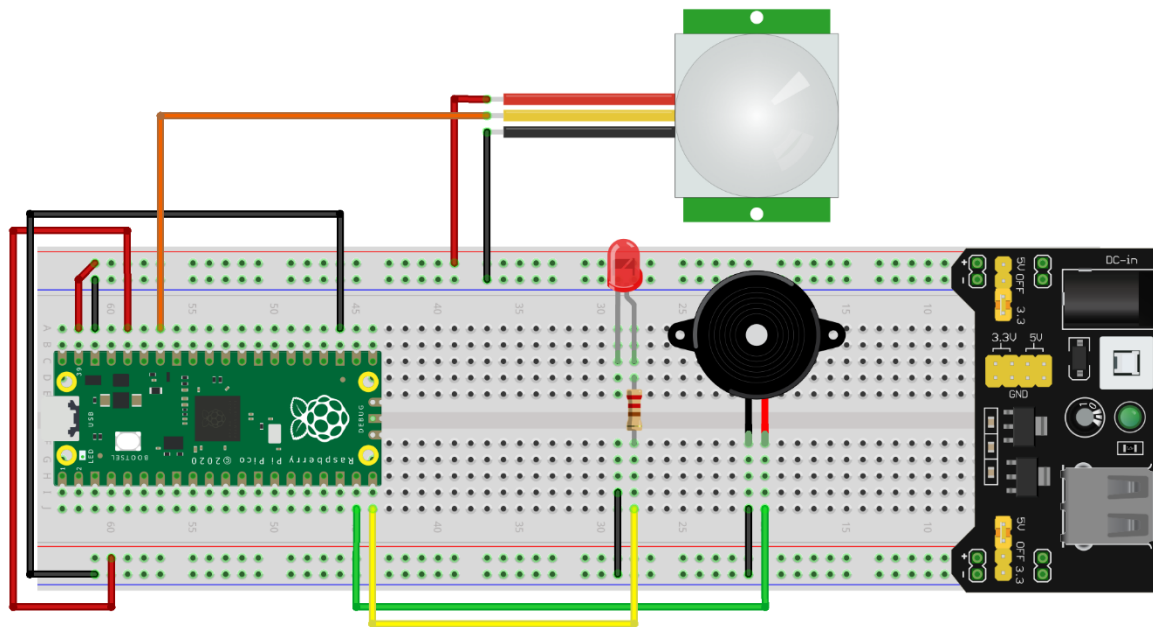
Red LED:

- Positive leg: Connect to GP15 of Raspberry Pi Pico board via a 220-ohm resistor
- Negative leg: Connect to GND of Raspberry Pi Pico board

Buzzer:

- Positive leg: Connect to GP14 of Raspberry Pi Pico board
- Negative leg: Connect to GND of Raspberry Pi Pico board

Wiring diagram



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Code

```
from machine import Pin
from time import sleep

sensor_pir = Pin(28, Pin.IN, Pin.PULL_UP)
led = Pin(15, Pin.OUT)
buzzer = Pin(14, Pin.OUT)

while True:
    if sensor_pir.value() == 1:
        print("ALARM! Motion detected!")
        led.toggle()
        buzzer.toggle()
        sleep(1)
```