PROGRAMMING RESOURCES - ACTIVITY SHEET 12

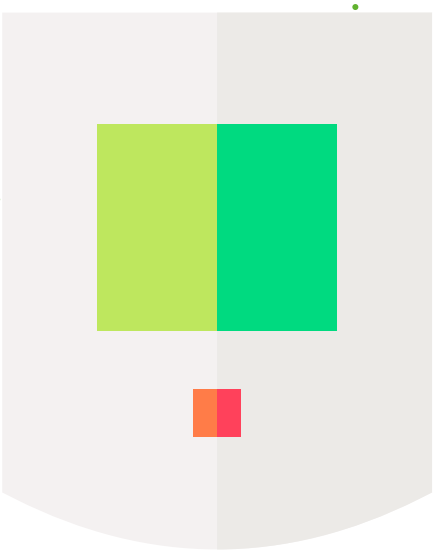
MOTION DETECTION ALARM

#R1AS12

What is it?

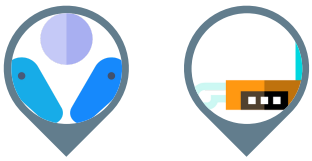
Alarm with 2 kinds of protections: Prevent opening by force and Opening protection.

Available on



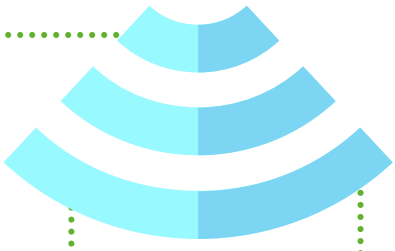
Duration

30 minutes



Pre-requisites

- R1AS09 - Make a tilt sensor with the accelerometer
- R1AS07 - Make a theremin with the distance sensor



Level of difficulty

Advanced

Material

- 1 Programming board "***STM32 IoT Node Board***"
- Micro-B USB Cable
- 1 Breadboard
- 1 piezo buzzer or a speaker
- 1 small DIY cardboard box (around 15x5 cm)

LEARNING OBJECTIVES

- Use distance event block
- Use shake event block

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MOTION DETECTION ALARM

In this activity sheet, we will work on a motion detection alarm, enabling you to keep secure all your precious and important items. For the purpose of the activity sheet, your most valuable object will be contained in a box. We will create an alarm with 2 features:

- Trigger the alarm when the box is shaken,
- Trigger the alarm when someone or something is entering the box.

This will also enable discovering the integrated motion detector and its usages. A motion detector is an electrical device that uses a sensor to detect nearby motion. Such a device is often integrated as a component of a system that automatically performs a task or alerts a user of motion in an area. They form a vital component of security, automated lighting control, home control, energy efficiency, and other useful systems.
Resource: https://en.wikipedia.org/wiki/Motion_detector

STEP 1 - MAKE IT

1 Wire the buzzer/speaker

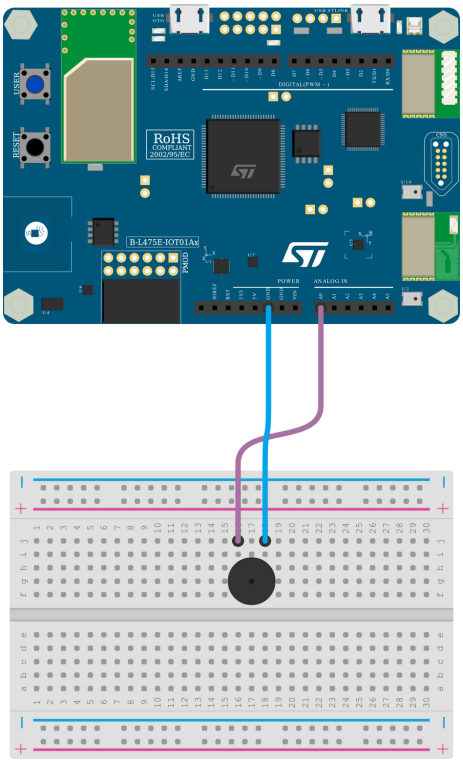
In theory, a buzzer is not polarized (it means that there is no "+" nor "-"), but you often have a pair of wires black/red or signs ("+" and/or "-") on the device. If you are in this configuration, attach the lead on the "+" side of the buzzer to pin **D3** and the other one to pin **GND**. If there is no colour or indication, just plug one wire on pin **D3** and the other one on pin **GND**.

2 Connect the board to the computer

With your USB Cable, connect the board to your computer by using the **micro-USB ST-LINK connector** (on the right corner of the board). If everything is going well you should see a new drive on your computer called **DIS_L4IOT**. This drive is used to program the board just by copying a binary file.

3 Open MakeCode

Go to the **Let's STEAM MakeCode editor**. On the home page, create a new project by clicking on the "New Project" button. Give a name to your project more expressive than "Untitled" and launch your editor.
Resource: makecode.lets-steam.eu



Wiring the buzzer/speaker

4 Program your board

Inside the MakeCode Javascript Editor, Copy/Paste the code available in the **Code It Section** below. Give a name to your project (more expressive than "Untitled") and click on the "**Download**" button. Copy the Binary file on the drive **DIS_L4IOT**, wait until your alarm is ready.

5 Run, modify, play

Your program will automatically run each time you save it or reset your board (push the button labelled RESET). Put your programmed board in your box or in a closet and see the reaction when shaking or opening it. Try to understand the example and start modifying it by changing the distance for the opening detection.

MOTION DETECTION ALARM

STEP 2 - CODE IT

```
let isAlarmEnable = false

// Turn on/off the alarm when "User" built-in button is pressed
input.buttonUser.onEvent(ButtonEvent.Click, function () {
    isAlarmEnable = !(isAlarmEnable)
    pins.LED.digitalWrite(isAlarmEnable)
})

// When the board is shaking
input.onGesture(Gesture.Shake, function () {
    if (isAlarmEnable) {
        music.playTone(880, 3000)
    }
})

// When the distance is over 1,000 millimeters (1 meter)
input.onDistanceConditionChanged(DistanceCondition.Far, 1000, DistanceUnit.Millimeter,
    function () {
       if (isAlarmEnable) {
            music.playTone(880, 3000)
    }
})
```

How does it work?

This program is a simple aggregation of what has already been learned in the previous activity sheets. As you can see, there are 3 parts in addition to a variable enabling to know the alarm state. Let's detail them hereunder:

Turn on/off the alarm

The first block aims to detect when the built-in button is pressed. When this event occurred, we invert the alarm state: isAlarmEnable = !(isAlarmEnable).

Shake detection

When the board is shaken, then if the alarm is turned on (if (isAlarmEnable) {...}), it means that someone tries to force our box, so we have to ring the alarm (startAlarm)!

Opening detection

Consider your box is closed. The distance between the object inside the box and the cover is nearly 0. When someone is opening your box, then your object is not anymore in direct contact with your cover. In this case, the distance between your precious treasure and the closer item will be higher than previously. You can then detect the opening of your box by approaching the variable of distance change (onDistanceConditionChanged). This will enable when we detect a distance greater than 1,000 millimetres (this distance can be adapted) with your alarm turned on, to identify that someone has opened the container and the alarm should ring (startAlarm)!

MOTION DETECTION ALARM

STEP 3 - IMPROVE IT

By **adding a second variable**, you can make the alarm tone repeating forever until the alarm is turned off.

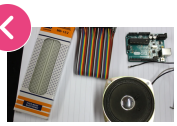
By **adding a two-tone alarm noise**, you can change the melody of your alarm.

You can give the user a **little delay to desactivate the alarm** before ringing.

GOING FURTHER

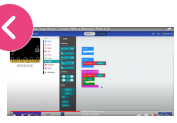
Arduino IR Alarm - Tutorial for building your own infrared alarm using an Infrared Proximity Sensor. *https://www.instructables.com/Arduino-IR-Alarm/*

Arduino Door Alarm - Apply what you have learned to build a DIY door alarm. *https://www.instructables.com/Arduino-Door-Alarm-1/*



Radio door alarm - Tutorial to create a wireless alarm to warn you when someone opens a door. *https://microbit.org/projects/make-it-code-it/door-alarm/*

Make an Alarm for Your Room - Program an alarm for your room with a Micro:bit. *https://www.youtube.com/watch?v=aqRh9Phjcwc*



Explore other activity sheets

R1AS14 - Create an egg timer

R1AS15 - Collecting data