PROGRAMMING RESOURCES - ACTIVITY SHEET 2

BREADBOARDING

MAKE YOUR FIRST CIRCUIT!

#R1AS02

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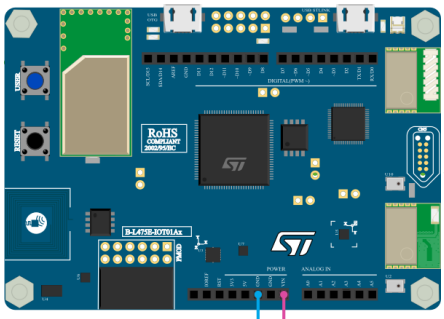

What is it?

A breadboard is basically a rectangular plastic board with a bunch of tiny holes in it to easily insert electronic components to prototype an electronic circuit.

Pre-requisites

- R1AS01 - Blink a LED

Duration

15 minutes

Level of difficulty

Basic

Material

- 1 Programming board "***STM32 IoT Node Board***"
- Micro-B USB Cable
- 1 Breadboard
- 1 set of resistors
- 1 set of LEDs
- Jumper wires

LEARNING OBJECTIVES

- Discover breadboards
- Make a simple circuit on a breadboard
- Make a simple electronic circuit with LEDs and resistors

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BREADBOARDING

When you first lay your hands on a **breadboard**, you will find that there are many **pinholes** and start to wonder how to create a circuit with this small plastic rectangle. Before starting, you need to understand the components of a breadboard. The **pinholes of a breadboard** are made to connect components together. When we want to create an electronic circuit, we need several connections to the same wire.

To do this, the breadboard is organized in **strips**. There are two kinds of strips:

- **Bus strips** are mainly used for power supply connections and are on the two outside columns of a breadboard.
- **Terminal strips** are mainly used for electrical components and are connected line by line. Each strip consists of 5 pinholes, indicating that you can only connect up to 5 components in one particular section.

Resources: https://en.wikipedia.org/wiki/Breadboard#Bus_and_terminal_strips

As long as an electronic component has leads (long metal legs protruding out the component) or pins (shorter metal legs), it can be used with a breadboard. To connect some strips together, we generally use **Jumper Wires**.

Resources: https://en.wikipedia.org/wiki/Jump_wire

STEP 1 - MAKE IT

Wire the power supply

1

Before connecting the components, we generally add some wires to the bus strips to distribute the power supply (**+5V** and pin **GND**). Take two wires and make the following connections.

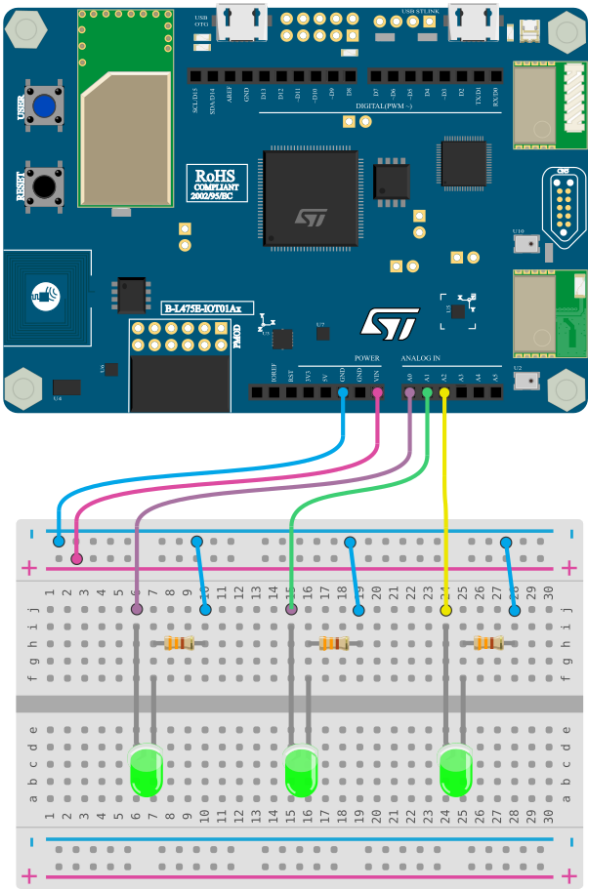
Wire the first LED

2

Our circuit is just a simple LED connected to one pin of the board. Connect the anode of the LED on the pin labelled **A0** (for Analog 0). Then connect the cathode to a resistor (330 ohms) and plug the unconnected resistor's lead into the pin labelled **GND**.

LED has an orientation. To designate the correct orientation, each leg has a name. This is how to find the difference between anode and cathode:

- **Anode: This is the '+' of the LED. The anode leg is longer than the cathode lead.**
- **Cathode: This is the '-' of the LED. The cathode leg is shorter than the anode lead.**



Wiring LEDs

BREADBOARDING

STEP 1 - MAKE IT

Wire other LEDs

3

We will duplicate the previous circuit with two additional LEDs. The anode of these new LEDs will be connected in pin **A1** and pin **A2**.

Connect the board to the computer

4

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.

Open MakeCode

5

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

Program your board

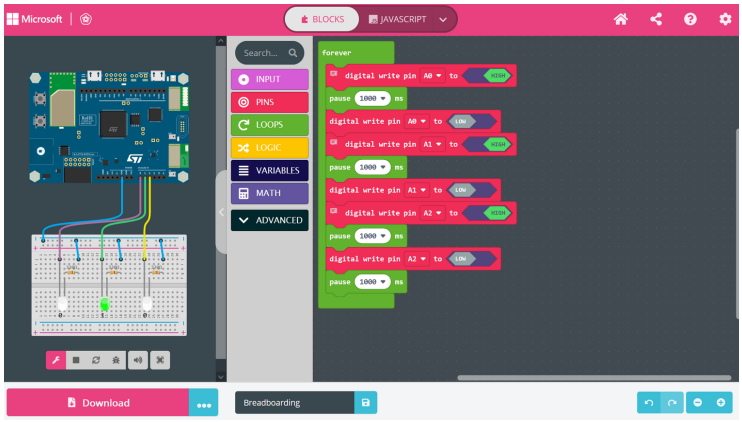
6

Inside the MakeCode Javascript Editor, Copy/Paste the code available in the **Code It Section** below. If not already done, think of giving a name to your project and click on the "**Download**" button. Copy the Binary file on the drive **DIS_L4IOT**, wait until the board finishes blinking and your first program is ready!

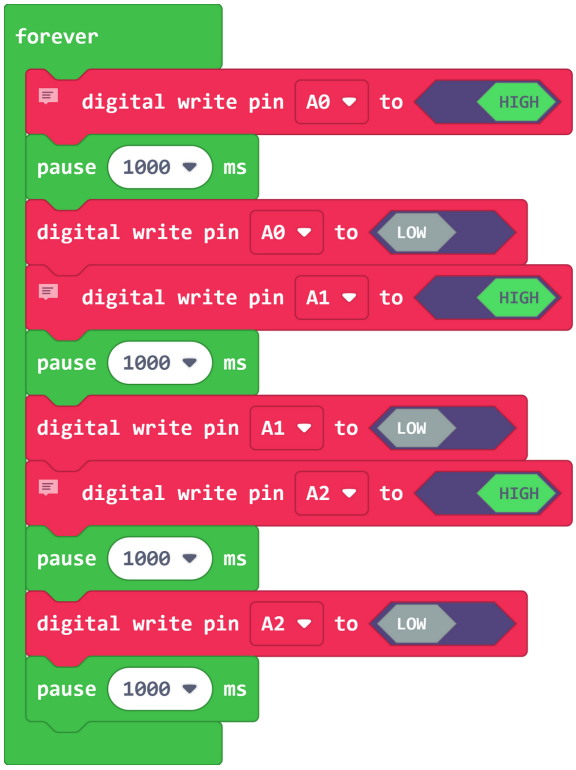
Run, modify, play

7

Your program will automatically run each time you save it or reset your board (push the button labelled RESET). Use the knowledge acquired on this activity sheet to make more or less complex projects and explore the next activity sheets.



MakeCode editor in blocks



Full blocks enabling the program to run

STEP 2 - CODE IT

```
forever(function () {
    // Blink the first LED
    pins.A0.digitalWrite(true)
    pause(1000)
    pins.A0.digitalWrite(false)

    // Blink the second LED
    pins.A1.digitalWrite(true)
    pause(1000)
    pins.A1.digitalWrite(false)

    // Blink the third LED
    pins.A2.digitalWrite(true)
    pause(1000)
    pins.A2.digitalWrite(false)
    pause(1000)
})
```

How does it work?

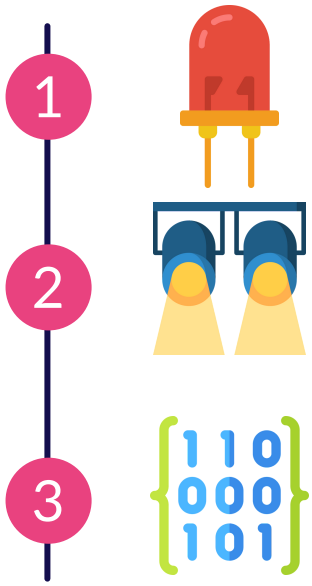
This program is an extended version of the "Blink a led" program adapted with three LEDs. For each LED :

- the digitalWrite block lights off or lights on a specific LED
- the pause block waits a small amount of time.

BREADBOARDING

STEP 3 - IMPROVE IT

By **changing the on/off lighting order**, make a simple animation where the LEDs are turned on and off, one after the other.

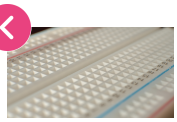


Plug LEDs of different colours - **red, green and yellow** - and try to simulate a stoplight.

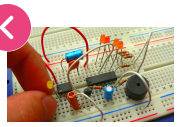
You can use LEDs to approach binary counting! When we count in binary, we represent numbers with arrangments of 1's and 0's. Discover more information on binary counting on the **CS Unplugged resource centre**. Once the basics of binary counting are acquired, **transform this program to show numbers from 0 to 7 in binary with the three LEDs.**
Resource: https://csunplugged.org/en/topics/binary-numbers/unit-plan/

GOING FURTHER

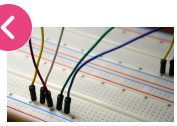
How to Use a Breadboard - Tutorial video giving a basic introduction to breadboards and explaining how to use them in beginner electronics projects. *https://www.sciencebuddies.org/science-fair-projects/references/how-to-use-a-breadboard*



Use a Real Bread-Board for Prototyping Your Circuit - Step by step prototyping with a breadboard. *https://www.instructables.com/Use-a-real-Bread-Board-for-prototyping-your-circui/*



Basic LED Animations for Beginners (Arduino) - Tutorial to revisit some concepts about using LEDs and make some fun effects using the RedBoard Qwiic to control the individual LEDs. *https://learn.sparkfun.com/tutorials/basic-led-animations-for-beginners-arduino/all*



Electronics Basics 10 - An insight into how breadboards work. *https://www.youtube.com/watch?v=fq6U5Y14oM4*

Explore other activity sheets

R1AS03 - Buttons and LED Display