MAKE A VERY READABLE THERMOMETER

#R1AS11

Available on

Pre-requisites
- R1AS04 - Basic Light Sensor

Material
- 1 Programming board "*STM32 IoT Node Board*"
- Micro-B USB Cable
- 1 Grove LCD I2C Text Display
- 1 Grove jumper cable

What is it?

In this activity, we will learn how easy it is to read the temperature sensor of the board and display its value.

Duration
20 minutes

Level of difficulty
Intermediate

LEARNING OBJECTIVES

- Read the temperature sensor
- Use an LCD text display

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Temperature is a physical quantity that expresses hot and cold. It is the manifestation of thermal energy, present in all matter, which is the source of the occurrence of heat, a flow of energy when a body is in contact with another that is colder or hotter. In this activity, you will be able to discover the usage of the temperature sensor, integrated into the board. A temperature sensor is an electronic device that measures the temperature of its environment and converts the input data into electronic data to record, monitor, or signal temperature changes.

STEP 1 - MAKE IT

Connect the display to the board

To connect the Grove LCD screen, we will use the **I2C** Bus. For our screen, we use the **I2C** connection through the Grove cable with the following convention :
- Red for **V+** (**3V3**)
- Purple for **SDA** (**D14**)
- Green for **SCL** (**D15**)

Connect the board to the computer

With your USB Cable, connect the board to your computer by using the **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

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

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 finish blinking and your datalogger is ready!

Run, modify, play

Your program will automatically run each time you save it or reset your board (push the button labelled RESET). If everything is working well, your board will update the LEDs' status to show that the data collection is running. Try to understand the example and start modifying it by changing the period between two measurements, adding other data from other sensors of the board. Try to display as much data as you want in many locations to understand how the temperature and evolve.

Connect the display to the board

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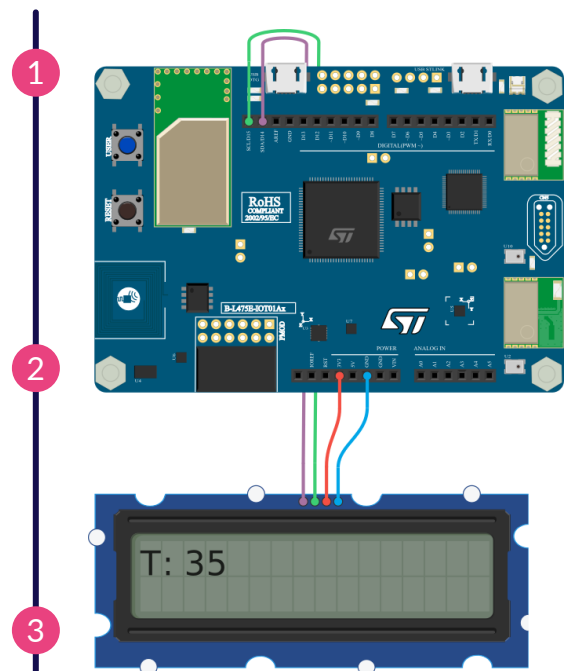
STEP 2 - CODE IT

```
lcd.clear()
forever(function () {
    lcd.setCursor(0, 0)
    lcd.ShowValue("T", input.temperature(TemperatureUnit.Celsius))
    pause(500)
})
```

How does it work?

The code consists of:

- a clear screen block
- a forever block
- a set cursor position block
- a show value block

The LCD Screen keeps a cursor to the next insert location. When we want to write somewhere on the screen, we always need to set the position of the cursor first.

Before writing on the display, we erase the screen by calling the function LCD.clear().

On each iteration of the loop, before writing something, we set the cursor to the origin of the screen (at the first character of the first line).

input.temperature(TemperatureUnit.Celsius) returns the integer value of the temperature in degrees Celsius. The value is shown on the screen with the function LCD.ShowValue(). The first parameter of this function gives the label of the value and the second, the value to be shown.

Simulation of the temperature sensor

You can play with the simulated sensor by touching the little thermometer icon shown on the board simulator. You can change the sensed value (e.g. just like touching the actual sensor on board with our finger) which accordingly changes the one on the LCD display.

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STEP 3 - IMPROVE IT

Try to modify the program of this activity to **read each sensor one by one and display its value on the LCD screen**. Get familiarized with the various available sensors. Try also to **utilize additional blocks from LOGIC or LCD to display text or values.**

1

Add a condition that changes the backlight according to the temperature value. For example, you can set the backlight in blue when the temperature is below 10° and red when the temperature is above 20°.

2

Put your board at different places in your classroom to **create a comparable set of data**. If you wish, you can also get in contact with other schools in your country or abroad to enlarge your dataset and work on meteorological topics.

3
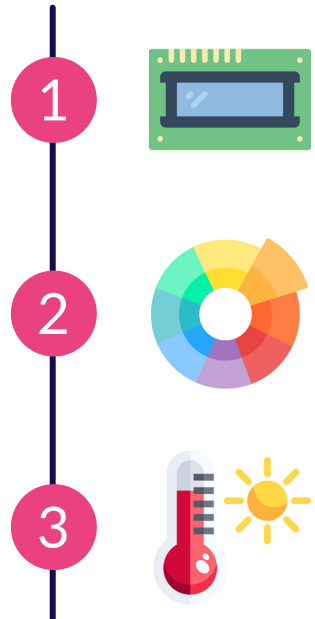
GOING FURTHER

Liquid-crystal display - Learn more about the history and characteristics of LCF. *https://en.wikipedia.org/wiki/Liquid-crystal_display*

LCD Alarm Clock with many faces - including many of the other LCD1602 clocks found on maker sites. *https://www.hackster.io/john-bradnam/lcd-alarm-clock-with-many-faces-new-version-9352a2*

The Chrome Dino Game on an LCD Shield. *https://create.arduino.cc/projecthub/Unsigned_Ar duino/the-chrome-dino-game-on-an-lcd-shield-883afb*

Light Meter - Measure and display light levels. *https://learn.adafruit.com/light-meter*

Explore other activity sheets

R1AS10 - Text Display

R1AS15 - Collecting data