Embedded pool

Rush 01: Final boss

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Summary: Making a big project

Version: 1

Chapter I

Introduction

The Saint-Michel station, located in the 5th arrondissement of Paris, is one of the oldest and most iconic stations of the Paris metro. The construction of this station was a colossal undertaking, which required the use of innovative construction techniques to adapt to the geological and architectural constraints of the city.

The Saint-Michel station was built in 1910, as part of the extension of the Paris metro's line 4. The main difficulty encountered during its construction was related to the depth of the ground, which made it impossible to build a station on the surface. The engineers therefore decided to dig a tunnel at a depth of more than 20 meters under the Seine, in order to be able to build the station below the level of the river.

The construction of the Saint-Michel station was also marked by architectural considerations. The station was designed by the architect Hector Guimard, who created a unique design inspired by Art Nouveau. The station is characterized by cast iron pillars adorned with floral motifs and metal entrances that resemble caves. Today, the Saint-Michel station is one of the most famous in Paris, and is often considered a remarkable example of Art Nouveau architecture.

Chapter II

General instructions

Unless explicitly stated otherwise, the following instructions will be valid for all assignments.

- The language used for this project is C.

- It is not necessary to code according to the 42 norm.

- The exercises are ordered very precisely from the simplest to the most complex. Under no circumstances will we consider or evaluate a complex exercise if a simpler one is not perfectly successful.

- You <u>must not</u> leave <u>any</u> files other than those explicitly specified by the exercise instructions in your directory during peer evaluation.

- All technical answers to your questions can be found in the `datasheets` or on the Internet. It is up to you to use and abuse these resources to understand how to complete your exercise.

- You <u>must</u> use the datasheet of the microcontroller provided to you and comment on the important parts of your program by indicating where you found the clues in the document, and if necessary, explaining your approach. Don't write long blocks of text, keep it clear.

- Do you have a question? Ask your neighbor to the right or left. You can ask in the dedicated channel on the Piscine's Discord, or as a last resort, ask a staff member.

	Exercise 00

Final boss
Turn-in directory : *ex00/*
Files to turn in : `Makefile, *.c, *.h`
Allowed functions : `avr/io.h, util/delay.h, avr/interrupt.h`

For this final rush, you will need to develop a firmware for the devboard to test that everything is working correctly.
To do this, you will need to use everything you have learned so far.

At startup of the firmware, all segments of the 7-segment as well as **D1**, **D2**, **D3**, and **D4** must light up for 3 seconds, then turn off for 1 second.
At any time, it must be possible to test **SW1**, **SW2**, **SW3**.

When the button **SW1** is pressed, the LED **D9** lights up.
When the button **SW2** is pressed, the LED **D10** lights up.
When the button **SW3** is pressed, the LED **D11** lights up.

The program has several modes to display different things on the 7-segment.
When you press **SW1**, you go to the next mode.
When you press **SW2**, you go to the previous mode.
After the last mode, we return to the first one.

The LEDs **D1-D4** display in binary the mode we are currently in.

Here is what each mode does:

- 0: Displays the value of ADC RV1 in decimal (0 to 1023).
- 1: Displays the value of ADC connected to LDR **R14** in decimal (0 to 1023).
- 2: Displays the value of ADC connected to NTC **R20** in decimal (0 to 1023).
- 3: Displays the internal temperature of the MCU in decimal (0 to 1023).
- 4: Displays "-42-" and flashes LEDs **D5**, **D6**, **D7**, **D8** in red, then green, then blue (1 second between each color).
- 6: Displays the ambient temperature in Celsius.
- 7: Displays the ambient temperature in Fahrenheit.
- 8: Displays the humidity in percentage.
- 9: Displays the time in 24-hour format (23:23).
- 10: Displays the day and month.
- 11: Displays the year.

It should be possible to set the date and time using the serial port.
By sending for example: "28/02/2023 18:03:17"

> ⚠ Attention, the time must be maintained even if the board is unplugged and re-plugged.
> Use the RTC of your board.