Labwork 3 – ADC

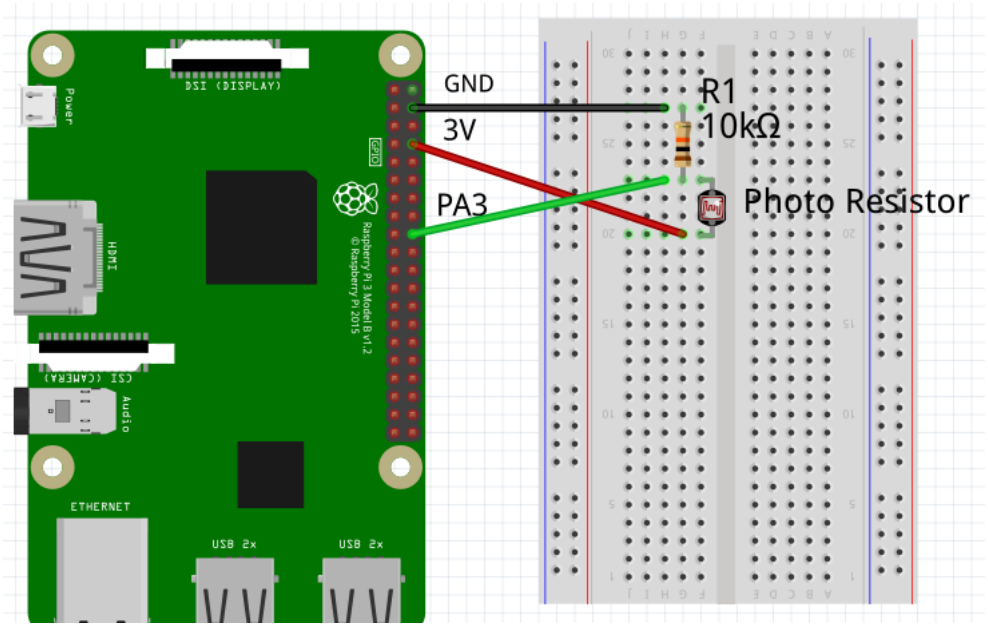
H. Cassé <hugues.casse@irit.fr>

In this labwork, we will use ADC to get the values provided by a photoresistor and potentionmeter.

1 Reading values from a photoresistor

This exercise aims to set up a photoresistor and to use it to switch on lights according the current light (as for automatic light).

Build the electrical assembly below:



Briefly, the 3.3V power pin of the STM32F4 is connected to a photoresistor (red wire). It is then connected to a $10k\Omega$ resistor that end up onto the ground pin of the STM32F4 (black wire). The green wire is connected to the STM32F4's PA3 pin that is used to read the voltage. The pin PA3 is connected to ADC1 port 3.

The photoresistor has a resistance that decreases with the quantity of light around. When it is put into dark, the resistance is minimal and the voltage is maximal.

Beware: the power must 3.3 V and not 5 V as the ADC maximal input is 3.3 V. In the same way, a resistor of 10 $k\Omega$ must be used to prevent shortcut. In doubt, ask to the teacher or the available multimeter.

Then, we can start to implement several applications:

1. Implement an infinite loop that reads the photoresistor voltage (converted to 12-bit by the ADC and that display it). Hide or provide light to the photoresistor to observe the changes.

2. Add a LED to the assembly that is initially switced off. When the light goes below some threshold (you have to determine), the LED is switched on. When the measured light goes above another threshold (you have also to determine), the LED must be switched on.

Source: 🗀`src/ex12.c`

Beware: do not forget the resistor with the LED!

2 Programming ADC with interrupts

As for timer and GPIO, the ADC can rises interrupt in order to signal that the applications that a conversion is achieved.

The following features has to be taken into account to program these interrupts:

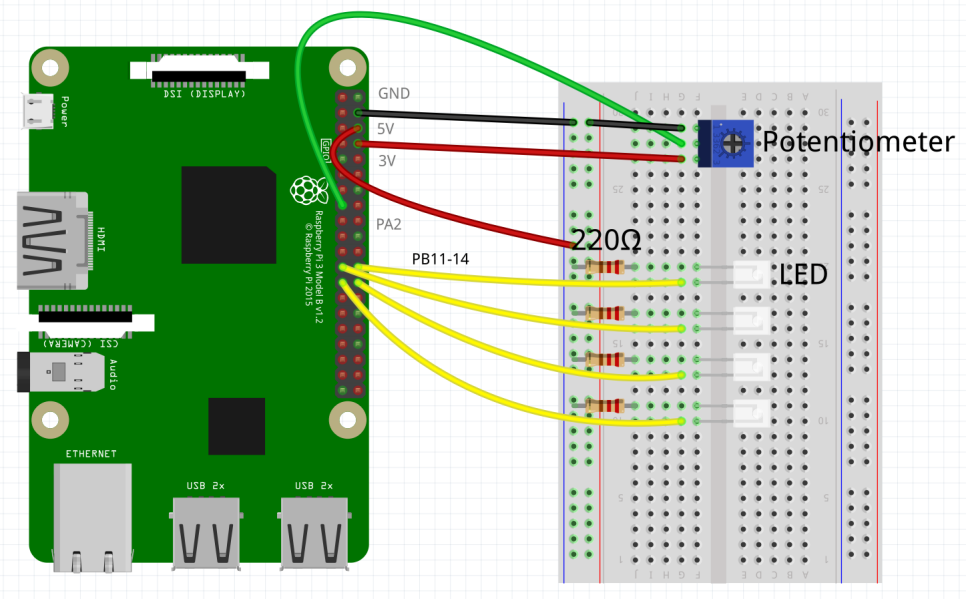
- The ADC1 is has for interrupt number `ID_ADC1`.
- To enable interrupt in ADC1, the bit in mask `ID_EOCIE` (End Of Conversion Interrupt Enable) must be set in `ADC1_CR1`.

1. Implements the application of the previous section to use end-of-conversion interrupts.

2. Use the timer, with interrupts, to trigger the photoresistor conversion for a period of 100 ms (10 Hz frequency).

Source: 🗀`src/ex13.c`

3 Vue-meter with a potentiometer



The circuit above implements a potentiometer that which value will be made visible on the four LEDs mounted as a vue-meter. A vue-meter represents a value by lighting on zero or several LEDs in order. With 4 LEDS, we can represents 5 values: all LEDs switched off, 1 LED lighted on, 2 LEDs, 3 LEDs and 4 LEDs.

The potentiometer is a button that can be turned to fix a value. Depending on its position, its resistance is more or less high and the delivered voltage is inversely proportional to its position.

To Do: implements the application that, depending on the value of the potentiometer, swicthes on or off the LEDs to implement the vue-meter.

Source: `src/ex14.c`