Scilab Arduino Blinking LED Tutorial

Document version 1 – Yann Debray - Scilab Enterprises © - 07/06/2015

This tutorial aims at showcasing the capabilities of Scilab for prototyping electronic embedded systems with Arduino.

- First step (described in this tutorial): Soft real-time Hardware-In-the-Loop
- Second step: Code generation
- Another approach: (Modeling with a) State Machine

Configuration/Arduino Setup

In order to follow this tutorial you need the following configuration:

Software:

- Scilab on Windows 32 or 64 bits (Version >= 5.4)
- Arduino toolbox http://atoms.scilab.org/toolboxes/arduino
  Help on the installation of the module (in French):
  https://www.scilab.org/en/community/education/si/install
- Arduino IDE http://arduino.cc/en/Main/Software

Hardware:

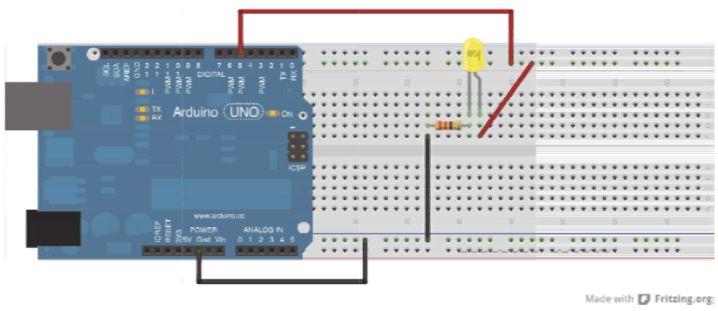
- Arduino Board (driver installation on http://www.arduino.cc/en/Guide/Windows#toc4)
- LED
- Breadboard, Resistance of 10kOhm?, wires (optional)

Installation & Set-up

Go on the following website:
http://www.demosciences.fr/projets/scilab-arduino

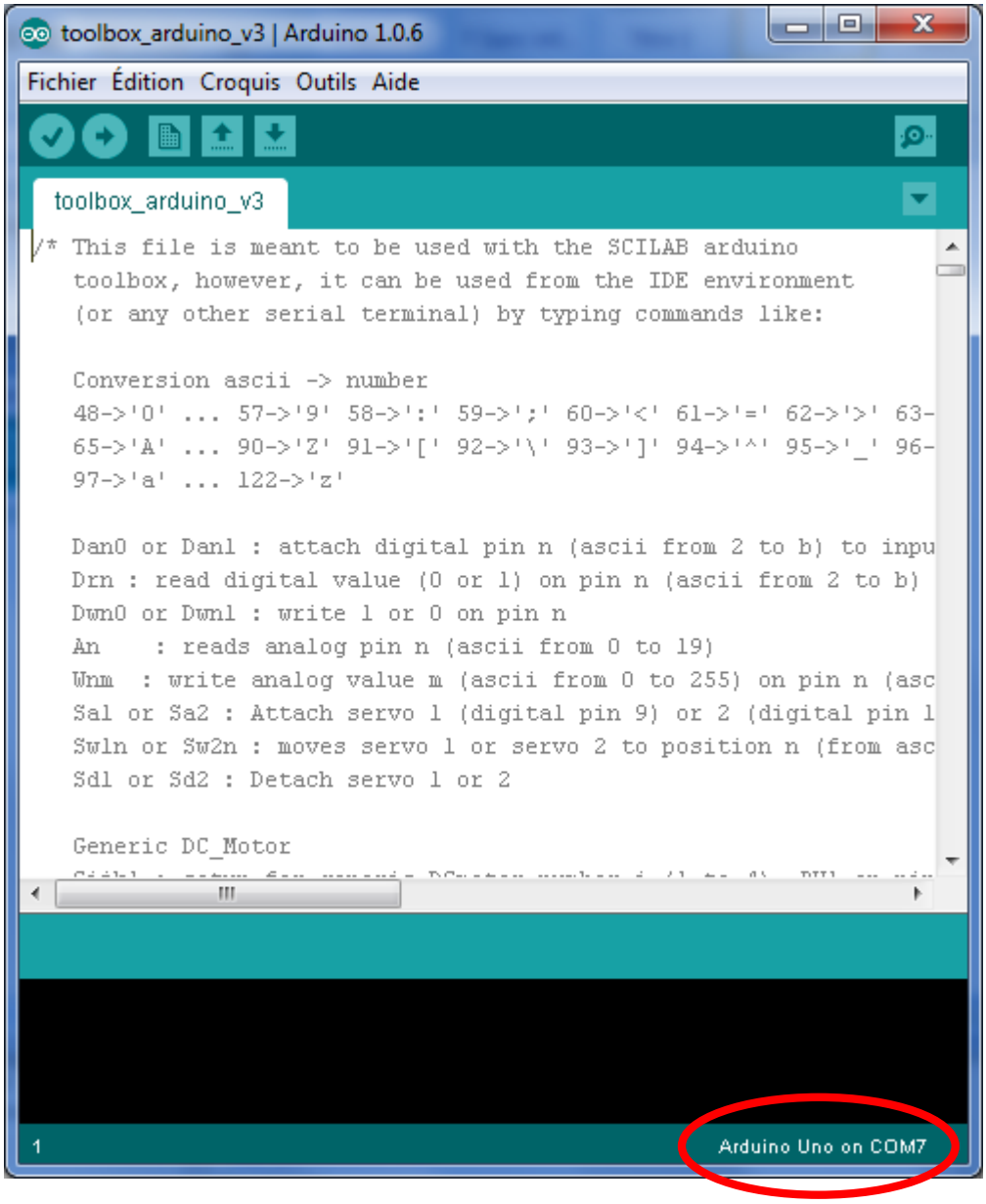
And download the following file:
toolbox_arduino_v3.ino
(you can also download the module from this page)

Plug your Arduino Board to your PC, open the Arduino IDE and flash the file toolbox_arduino_v3.ino on the Arduino Board.
Set up the following hardware configuration:



Configuration blocks

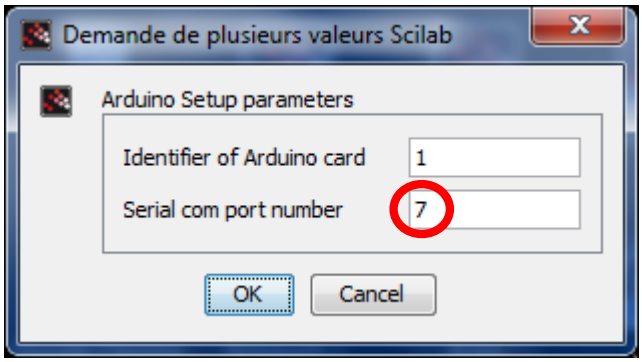
In order to acquire the Port number linked with the Arduino board, look in the bottom right corner of your Arduino IDE:



Start to build the Xcos schema, with the configuration blocks:

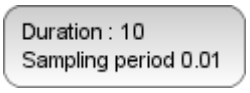
This allows a serial communication between Arduino and Scilab.

Double click on the block to let the following dialog box appear:

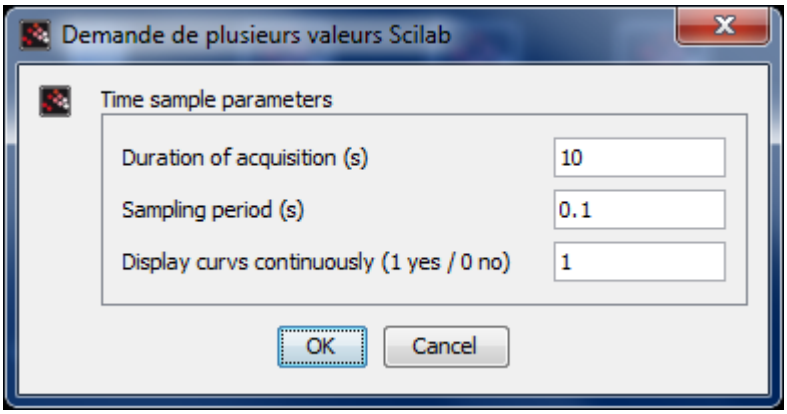


Set the Serial com port number with the information acquired in the previous step.

The sampling of the signal for the blocks of the model and the time of acquisition are configured by this block:



The sampling period can be specified and has to be at least twice smaller than the period of evolution of the model (Nyquist-Shannon sampling theorem)



Xcos model

Simulating an input signal for the LED can be done with the Pulse Generator block **PULSE_SC**:

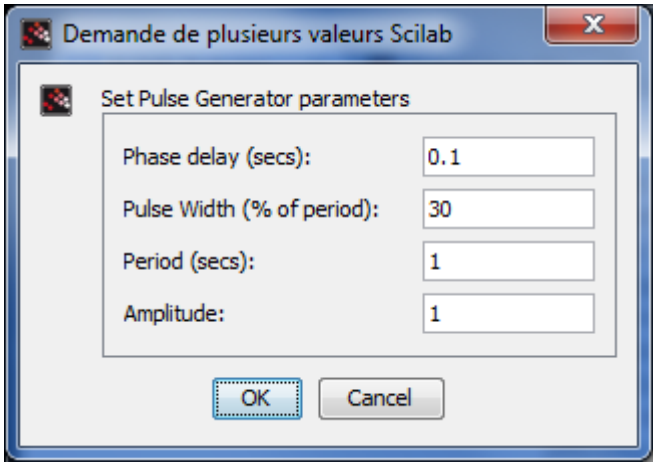
http://help.scilab.org/docs/5.5.2/en_US/PULSE_SC.html

By double clicking, you can adapt the following parameters:

- **Phase delay (secs)**
  The offset of the block. It must be less than Frequency*(1-(Pulse_width/100)).
  Type 'pol' of size -1.
- **Pulse Width (% of period)**
  The pulse width. It can take values from 1 to 100.
  Type 'pol' of size -1.

- **Period (secs)**
  The Period of the signal.
  Properties : Type 'pol' of size -1.

- **Amplitude**
  The amplitude of the pulse. It can support all scicos types.
  Properties : Type 'mat' of size [-1,-1].



As specified in the configuration blocks, the period of the signal (1s) is more than twice the period of sampling (0.1s).

Digital input of the Arduino board

In our example, we plugged the LED in the digital I/O 13 of the Arduino board, so we will have to set the pin 13 successively to 1 and 0 (electrically speaking to 5V or 0V), to turn respectively the LED on and off.

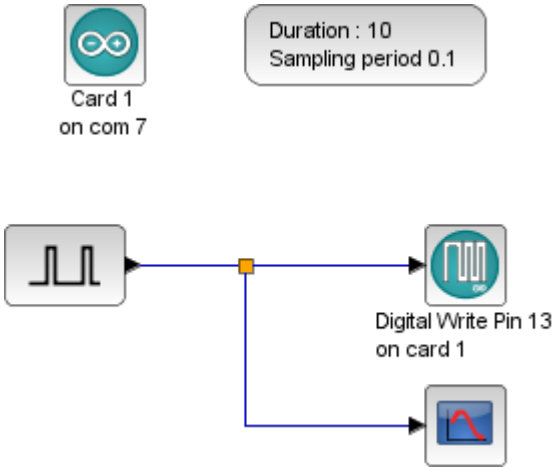
Behavior visualization

In order to display the signal turning on and off the LED while the command of the circuit, we will add a scope to the model:

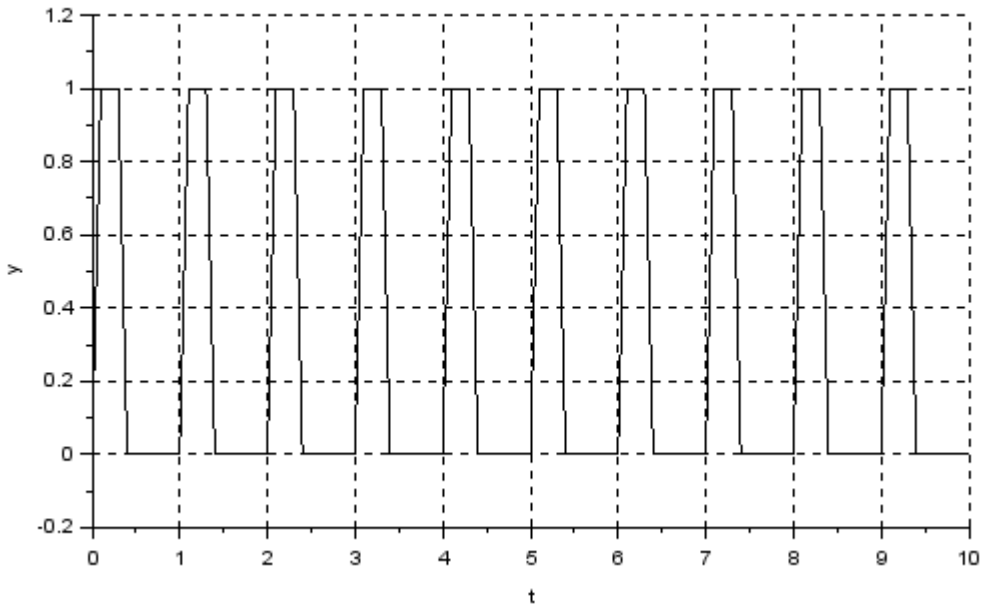
We need to use here a scope provided by the Arduino module's blockset, which doesn't require a clock parameter input, as it is directly synchronized with the sampling period of the configuration block.

Simulation/Acquisition of the signal

After linking all of the previously described blocks, the Xcos schema should look like this:



After hitting on the play button, the LED blinks at the same time as the following curve is plotting:



Sources

- TP3 : Acquérir et piloter des systèmes à l'aide de cartes Arduino et d'une Toolbox Xcos dédiée - TP3 Démosciences 2012.pdf http://www.demosciences.fr/projets/scilab-arduino
- Scilab / Xcos pour l'enseignement des sciences de l'ingénieur – © 2013 Scilab Enterprises chapitre « 4- acquisition et pilotage de moteur (module arduino) » - livret_Xcos.pdf www.scilab.org/fr/content/download/1017/9485/file/livret_Xcos.pdf
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