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Lab No 1

Smart Sensors and Actuators based in Arduino

First Part

Smart Sensors

DCTI-ISCTE-IUL

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Lab No 1

Smart Sensors and Actuators based in Arduino

Objectives:

To obtain Knowledge regarding LabVIEW graphical programming applied for Arduino

- Develop programs for Arduino one using the MarkerHub Linx toolkit for LabVIEW.

- Develop a smart sensor using the Arduino Uno platform and sensors (e.g. temperature (LM35) and light intensity (TSL250 and / or TSL257).

- Use the PWM outputs to implement sensor behavior simulation (eg HIH4000 humidity sensor)

Theoretical Background

LabVIEW (Laboratory Virtual Instrument Engineering Workbench) represents a programming environment with applications being developed called virtual instruments. (Virtual Instruments - VI). The LabVIEW programming language is different from languages like Java, C ++, and MATLAB, where programming is done through text.

LabVIEW can be used in Windows, Mac OS X or Linux, and it can also create applications for real-time platform platforms such as FPGAs, DSPs and microcontrollers.

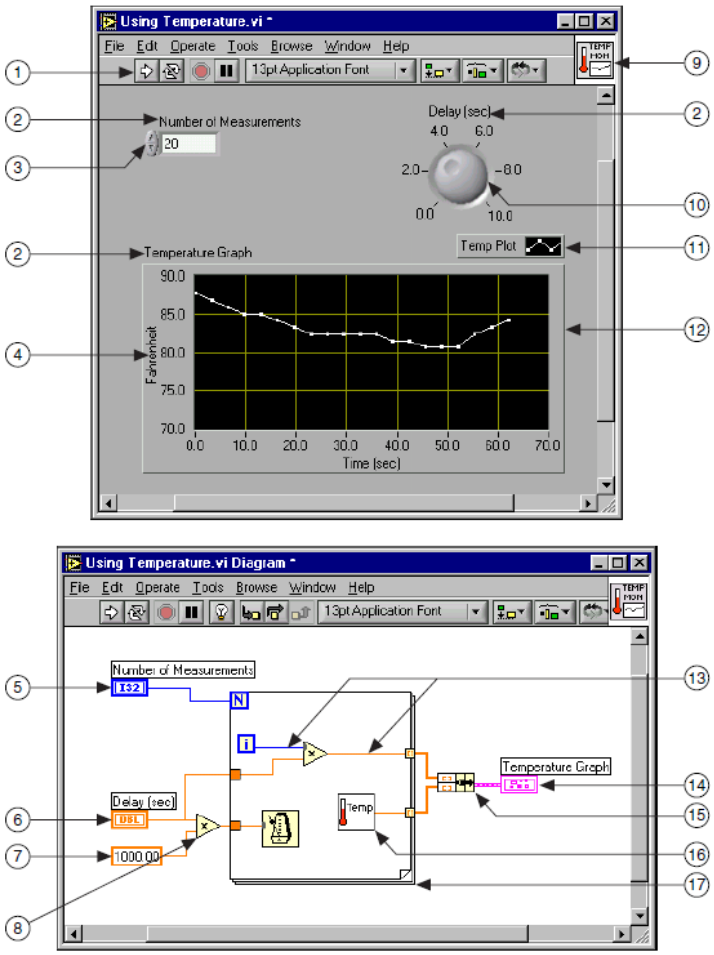
LabVIEW 2015 and LabVIEW Toolkit MarkerHub Linx will be used during lab classes. (Https://www.labviewmakerhub.com/doku.php?id=learn:tutorials:libraries:linx:getting_started)

Each program (VI) has two distinct parts:

• the front panel, which are called controls (inputs) and indicators (results), and in turn is the view window processes or events,

• the block diagram, which represents the environment in which programming is carried out, which means connecting the elements of the front panel with functional elements.

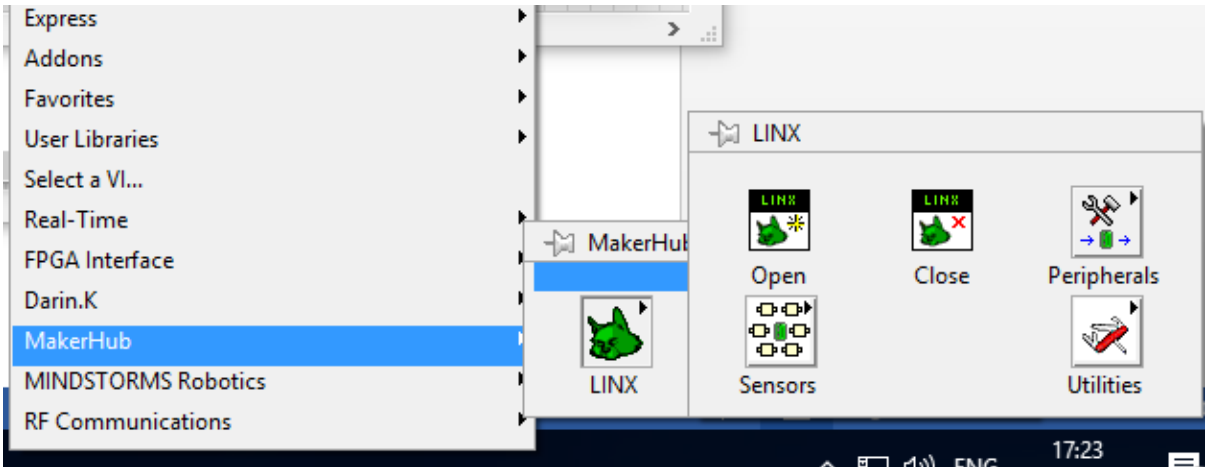
Figures 1 and 2 show the appearance of the front panel and a block diagram:



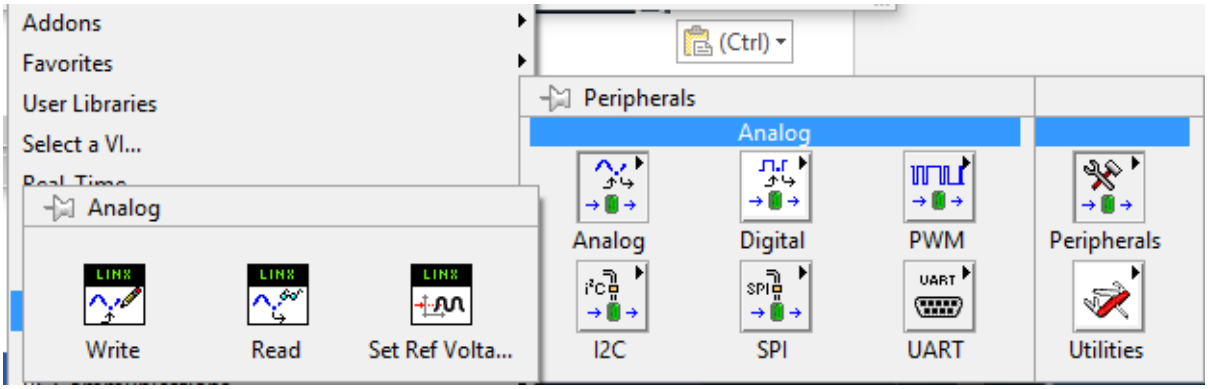
1	Barra de ferramentas	6	Terminal de controle numérico	12	Gráfico XY
2	Título do objeto	7	Constante numérica	13	Via de ligação de dados
3	Controle numérico digital	8	Função de multiplicação	14	Terminal do gráfico XY
4	Legenda livre	9	Ícone	15	Função de agrupamento
5	Terminal de controle numérico digital	10	Controle numérico deslizante	16	SubVI
		11	Legenda de plotagem	17	Estrutura de For Loop

The Marker Hub Linx Toolkit includes functions associated with the control of the Arduino platform.

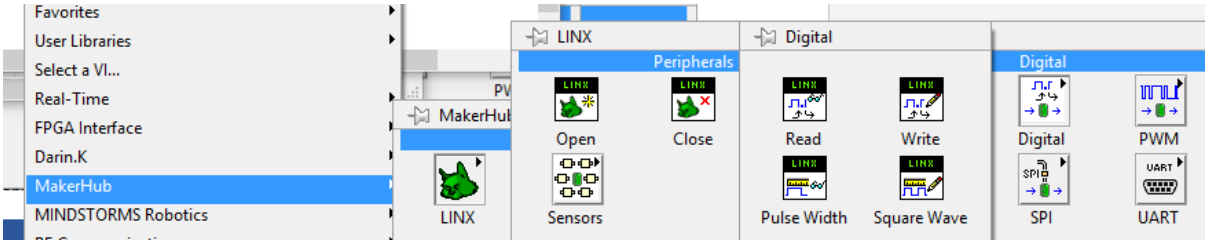
Thus the linx platform functions can be considered



Palete de controlo – open-close linx device



Control palette functions of "analog input"



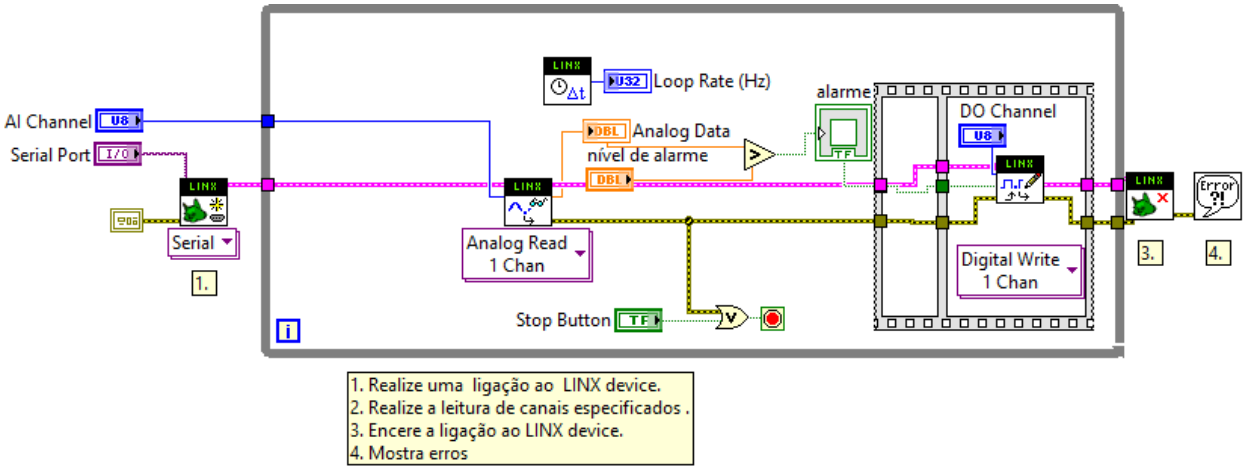
Control palette functions of "digital input / output"

Before using the functions have to carry out programming of the Arduino Uno platform using the LINX firmware.

Select in LabVIEWTools>>LINX>>LabVIEW Marker HUB>>LINX FIRMWARE WIZARD>>[RUN]

Exercise I: Develop LabVIEW software for generating alarms using a virtual LED and then a real LED (the LED that corresponds to digital output 13 of the Arduino). The LED will switch on when the acquired voltage value is over and imposed value by the user. The voltage will be applied on the analog A0 channel through a potentiometer.

Help I



Exercises II:

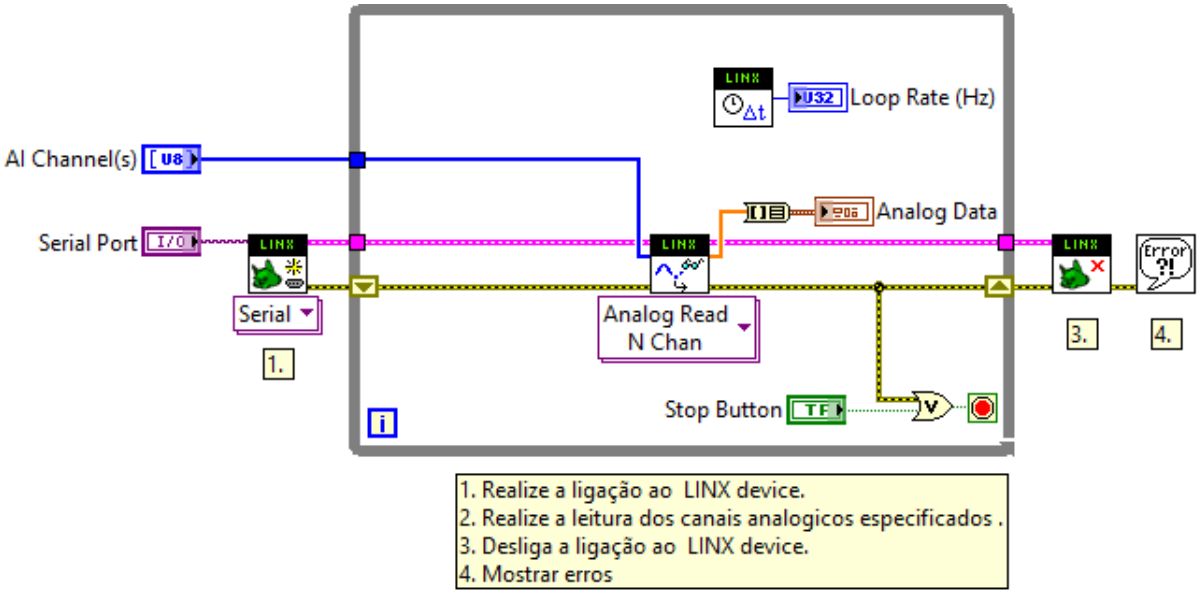
Implement an Arduino-based smart sensor and LabVIEW software that characterizes the quality of the indoor environment. Temperature values from two sensors will be acquired. Ambient temperature levels will be included for each of the acquired quantities and alarms will be generated in case the values are outside the comfort range defined for each of the users.

Will be performed the conversions **VT->T.**

A system with 2 LEDs (virtual and real) will be implemented to inform the user about the higher and lower values than an imposed limits Tmin and Tmax.

Help II

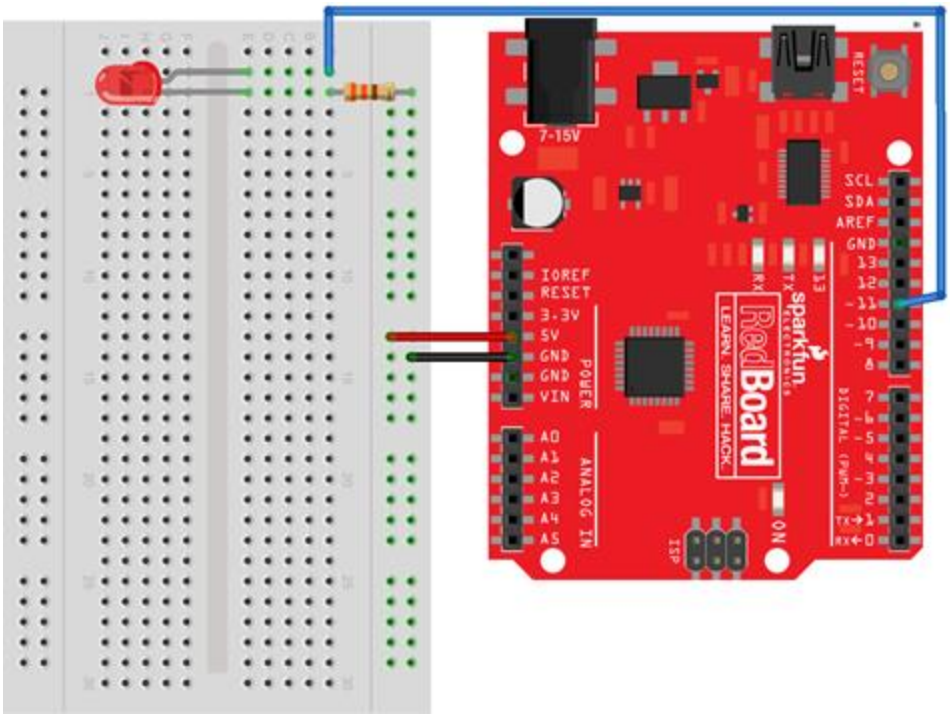
Multichannel acquisition with Arduino



Exercises III:

Implement an Arduino-based smart sensor / actuator type sensor with two LEDs on the output whose illumination intensity is proportional to the force applied on the level of a force sensor (piezo resistive). Consider two levels of force that originate the “Led ON” action.

Help III. Two outputs of the Arduino 1 (pin 10 and 11 example) will be used.



Exercise IV (Independent Work):

Implement a relative humidity simulator based on the characteristics of HIH4000 series relative humidity sensor which output is expressed by an Arduino Uno PWM output. An additional LED will be used as the user interface whose intensity will change according to the simulated relative humidity value in the range 20% -80%.

Note: documentation:

LM35 ou equivalente - http://www.ti.com/lit/ds/symlink/lm35.pdf

Documentação LabVIEW basic encontra-se disponibilizada no E-learning

Linx tutorial https://www.labviewmakerhub.com/doku.php?id=learn:tutorials:libraries:linx:start

Arduino PWM

https://www.arduino.cc/en/Tutorial/PW