A Graphical Tool for Design Portable Automation Software

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Outline

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Control of industrial processes is today dominated by computerized systems.

Programmable Logic Controller (PLC) are widely used for industrial automation.

PLCs have been developed in the late 60’s, and since then have evolved into powerful devices.

Teaching PLCs programming in industrial automation classes.

Students should learn how to:
- design automation systems (methodology)
- develop automation software (practice)
Automation projects and IEC 61131-3 standard

An automation project includes all the information about the control system configuration, the data and the code.

- Many manufacturers - many ways to define automation projects - many different programming languages
- The *IEC 61131* standard has been introduced by the *International Electrotechnical Commission*
- IEC 66131 - Part 3 specifies:
  - how an automation project should bestructured
  - the programming languages that can be used by the developers
Although IEC 61131-3 has been introduced in 1993, only few manufacturer produce devices which fully complies with the standard.

Students who have learned IEC 61131-3, should be introduced to the platform available in the laboratory.
UniSim is an educational tool developed at University of Naples

- UniSim can be used to design automation software which complies with IEC 61131-3
- UniSim allows to avoid the choice of a specific commercial platform when teaching PLCs programming.
- Thanks to its simulation engine, UniSim allows to validate off-line the developed software
- UniSim can be used to fast prototype the automation systems using a desktop equipped with low-cost I/O boards
UniSim can be used
- by the teacher - in the classroom to work out examples
- by students - when solving their homework

UniSim interfaces with off-the-shelf I/O boards, thus it can be used during lab activities

Labs do not need to be equipped with a large number of expensive commercial PLC platforms

UniSim makes use of the *XML Formats for IEC 61131-3* to import/export the projects. This feature give the possibility to reuse the developed software on a commercial platform
→ portability
UniSim - Software architecture

UniSim

- It has been designed by using an object-oriented approach
- It has been developed on the .Net platform
Objects hierarchy
Requirements

- The door must be opened when the button $Bo$ is pushed.
- The door must be closed when the button $Bc$ is pushed, or if it stays open for more than 10s.
- If an object is detected by $Sp$ while the door is moving, lamp $La$ must be turned on.
Control algorithm

- Close0
  - Bc+[Open2.T>10s]
  - So
- Close1
  - N
  - Mc
  - Sc
- Close2
- Open0
  - Bo
  - Sc
- Open1
  - N
  - Mo
  - So
- Open2
- S0
  - tSp
- ([Close1.X]+[Open1.X])*Sp
- S1
  - N
  - La
The **Host** runs the control algorithm with UniSim and a graphical user interface for the process.

The **Target** runs the xPC Target real-time OS, which executes the process simulator.
UniSim

- It allows to teach IEC 61131-3 standard without tying to any commercial platform
- It can be used to easily set up a lab for an industrial automation class using only off-the-shelf devices
- It uses XML Formats for IEC 61131-3 guaranteeing software portability
But

- It is a *work in progress* release
- Not all the features provided by the standard have been implemented
  - Only one *resource* can be specified in each *project*
  - Only the *sequential functional chart* and the *ladder diagram* languages have been implemented yet
  - ...
- The development of UniSim it is itself a way to teach IEC 61131-3 standard

By the way

UniSim is distributed with a *GPL* license

http://wpage.unina.it/detommas/unisim