A Graphical Tool for Design Portable Automation Software

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21-23 June 2006, Madrid
Outline

1. Introduction
2. UniSim
3. Example
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PLCs and industrial automation

- 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:
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Automation projects and IEC 61131-3 standard

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- Many manufacturers - many ways to define automation projects - many different programming languages
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UniSim is an educational tool developed at University of Naples. It 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.
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- 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 gives the possibility to reuse the developed software on a commercial platform → portability.
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Objects hierarchy
Toy example

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
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Control algorithm

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Control algorithm diagram:

- Close0
  - Bc+ [Open2.T>10s]
  - So

- Close1
  - Sc
  - N
  - Mc

- Close2

- Open0
  - Bo
  - Sc

- Open1
  - N
  - Mo

- Open2

- S0
  - S1
  - N
  - La

- S0
  - S1
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Advances in Control Education 2006 - ACE’06
Lab setup

- 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.
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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
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- 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

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