Engineering Education Challenges and VISIR

Virtual Instrument Systems In Reality

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Outline

- Engineering educations challenges
- BTH actions
- Conclusions and a future scenario
Why More Experiments in Engineering Education?

• A sustainable society needs engineers who are able to design high quality goods and services complying with the principles of nature.

• Universities should deliver engineers with a documented solid laboratory experience.

• More experiments may encourage young people to opt for engineering.
Experimenting is a sort of conversation with nature

- You perform a physical experiment and nature answers
- The delicate activity is formulating a good question and is interpreting the answer
- Students need to practise a lot to be fluent in this language i.e. to train laboratory work
Three Challenges

• Implement learning objectives of instructional laboratories
• Evaluate laboratory work individually
• Provide free access to laboratory resources without rising the cost
Examples of learning objectives

• Devise an experimental approach, specify appropriate equipment and procedures
• Apply appropriate sensors, instrumentation to measure physical quantities etc.
• Demonstrate the ability to collect, analyze, and interpret data, and to perform and support conclusions
• Identify the strengths and limitations of theoretical models as predictors of real-world behaviors
Three Ideas

• Translate the objectives into a large collection of experiments
• Include practical exams in the courses
• Offer a possibility for students to perform experiments at any time
University activities

• Create an infrastructure of collaborative laboratories and of other learning material
• Define practical exams
• Involve industrial partners
Workbench for electrical experiments

- There are many such workbenches worldwide
- Teachers and students are familiar with them
- They are a de facto standard
- They are used by majors in electrical engineering as well as non majors
History

- In 1999 a remote laboratory project was started
- Today laboratories in electronics, security, radio and signal processing are online
- At the end of 2006 a disseminating project, VISIR, was started
- IAOE started VISIR SIG spring 2009
Open Laboratory Organization and Demo

[Diagram showing a web server, client PCs, and devices connected through the internet.]
Characteristics of the workbench for electrical experiments

- available for experimenting 24/7
- supports laboratory work training
- supports low-cost practical exams
VISIR laboratory administration

• The VISIR web interface is used to introduce courses, lab sessions, personal accounts etc.

• Different roles such as administrator, teacher and student are defined and they have different access rights

• Time reservation for laboratory classes as well as for students are provided
Integrating with Other Systems

- LMS (HTML embedding)
- iLabs
Moodle Interface
Online Workbench for electrical experiments
Distributed Resources

Client computer side

Virtual front panel

Virtual breadboard

Equipment Server side

XML, TCP/IP

Source/instrument board

Switching matrix

XML, TCP/IP
Virtual Instrument Shelf

- Other universities use other models in their local laboratories
- It should be possible for students to select the instrument models they are used to
Example of Virtual Instrument shelf
VISIR Standards

Agilent panels

Tektronix panels

NI Soft panels

XML based protocols

IVI compliant functions

Student selector

University selector

GPIB

PXI

LXI

http://www.ivifoundation.org/
Instrument Drivers

- VISIR recommends IVI drivers
- The VISA Standard is accepted too but the instrument functions should be those defined by the IVI Standard
Signal processing laboratory

• Setup for vibration experiments
The Aim of the VISIR Project

- Is establishing a large VISIR Community of collaborating universities/organizations
- Is distributed standardized laboratories
Existing VISIR Laboratories

- University of Deusto, Spain
- FH Campus Wien University of Applied Sciences, Austria
- Blekinge Institute of Technology, Sweden
- Carinthia University of Applied Sciences (CUAS), Austria
New VISIR Laboratories

• Instituto Superior de Engenharia do Porto, Portugal
• National University for Distance Education, Spain
• Indian Institute of Technology Madras, India
The VISIR Open Laboratory Platform Software Distribution

- A public subversion repository with all software modules are available (http://svn.openlabs.bth.se/trac/)
- Members of the VISIR Community will be granted write access to branches in the repository
- Write to the trunk is limited and will require code review
How to Join the VISIR Community

• Join The International Association of Online Engineering (IAOE)
  http://www.online-engineering.org/

• Sign up for SIG VISIR (a Special Interest Group within IAOE) and its Mailing List
How to Set up An Online VISIR Workbench for Electrical experiments

• Download the software and instructions published at http://svn.openlabs.bth.se/trac

• Buy a standard PC and LabVIEW and the PXI hardware from National Instruments

• The switching matrix is commercially available
Competences Required to Implement a VISIR Online Workbench

• Experience of analog electronics, PXI, and LabVIEW
• IT experience (Web, PHP, MySQL, XML, C++, FLASH etc.)
Conclusions

• Start from traditional laboratory education and continue using new means
• Adapt to the Bologna Process
• Collaboration
A Future Scenario

- Collaborative remote laboratories organized in an infrastructure similar to university libraries
- Ubiquitous resources for physical experiments existing in the real world as well as in the virtual one
THANK YOU FOR YOUR ATTENTION