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REMOTE AND VIRTUAL LABORATORIES FOR ENGINEERING EDUCATION

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SYNOPSIS

A multidisciplinary team in the Engineering School of the University of Porto has been working on the implementation of a remote and virtual laboratory that is being used for teaching. That collaboration has already resulted in the development of a realistic simulation of a Michelson interferometer, and the implementation of a remote control system for a real interferometer is underway.

INTRODUCTION

The term Virtual Laboratory is used in the literature to refer to various different things: it could mean a large-scale facility with remote access, a network of tools or of laboratories, or a geographically-distributed community of scientists working together in a common project. The virtual laboratory that we discuss here is a network of software tools for simulating laboratory experiments. The remote laboratory is a network of tools that can be used to control remotely a real experiment in a real laboratory.

Two important ingredients in remote and virtual laboratories are tools for person-to-person (P2P) communications and for person-to-equipment (P2E) communications (Vary, 2000).

The interplay of virtual and remote laboratories has many advantages in engineering teaching. Students can understand better the physical principles involved in an experiment, through a simulation with just enough features, avoiding unnecessary complications. The remote laboratory allows them to get familiar with a real system, avoiding the risks of breaking some expensive equipment, or accidentally changing some settings that might be hard to reset correctly.

RESULTS

We have created two simulations of a Michelson interferometer for our virtual laboratory. One of those simulations is a very realistic recreation of a real interferometer that is currently in operation in our Physics Laboratory. Those tools are being used to support a course for engineering students. We are currently working on the system that will allow that interferometer to be controlled remotely. For P2P communications we use the Learning Management System Moodle, which includes all the tools we need to put our content on-line and to allow interaction among students and teachers.

The P2E tools that we are using are web services and PHP scripts. Those scripts should be easy to incorporate into the Moodle system. All the software we are developing is distributed with Free Software licenses, to allow other Institutions to adapt it to their needs.

The software for one of the simulations was developed by students within the framework of a course on computing and graphics. Thus, while the students work on their course assignments they contribute to this project creating tools that will be used by students in other courses.

CONCLUSIONS

Remote and virtual laboratories have many advantages for teaching. They provide a better learning experience for students and a powerful testbed for teachers. We have set-up a basic infrastructure that can be extended to other learning objects in Engineering and Science. There are many experiments that can be implemented for further work on this project (Kartweit, 200). The development of virtual and remote laboratories for teaching are also a good way to focus students synergies into a product that will be actually used by the school with many benefits.

REFERENCES

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