

An eLab platform for electrical engineers' education

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Extended abstract — New Information and Communication Technology for Education has opened up a wide range of possibilities to enhance and expand educational activities. Educational material is now accessible in a variety of formats including audio, video, simulations and animations. Most of them can be used through the Internet. A particular subclass of learning matter consists in lab exercises, which are vital part of engineering and science education. This paper proposes an eLab platform for electrical engineer education. Within this platform, real electronics experiments are run via the Internet. The different experiments cover a wide range of electronics for undergraduate students like passive circuits (RC, CR, LCR filters) active circuits (operational amplifier: functions and limits, differential pair amplifiers, voltage amplifier for feedback investigation, ...). All these circuits can be measured in the frequency domain, using a gain-phase analyser and in the time domain, using a function generator and an oscilloscope.

The eLab platform can be briefly explained as follows: In eLab the student work is guided by a textbook (HTML pages with course material, and questions to answer). The textbook contains links to measurement forms to be filled in by the user. The results of the measurements are stored in the student's notebook. Moreover students can comment the results of their measurements in their notebook which can be read and evaluated later by the teacher.

For convenience, eLab functions are distributed over 2 computers (inexpensive PCs). The front-end is the Web server [1] which also manages the database (for user accounts, textbooks, notebooks, results, etc) and processes the results (mainly plotting curves from results). The Instrument Server drives the measurements. Both servers use the popular LAMP open-source set-up (Debian distribution of Linux, Apache, Mysql, PHP), and communicate using the NuSOAP package [2] for SOAP WebServices in PHP. The instruments are connected to a National-Instruments IEEE-488 (GPIB) board. An extension for GPIB function calls has been added to PHP, making it possible to use only one programming language for all tasks in eLab (except for a small Java interactive plotting applet). Note: the PHP extension for GPIB has been made open-source as part of the « linux-gpib » project. [3]

WebServices are also used to add « Single Sign-on » (SSO) facilities to the core of eLab: besides « local users » (mainly from the electrical engineer department), registered users that have already been authenticated (by login + password) on some « partner » web sites can move seemingly (that is without having to enter their login and password again) to the eLab environment. Currently we support SSO connections from the Emerge European project portal [4], and from the Ulysses' e-learning platform [5] for undergraduate students from Bordeaux 1 university.

The platform is in use for one year, about one thousand “clients” (teachers, students) have used this tool from all over Europe and have performed more than ten thousand measurements. The platform is quite robust and flexible: new experiments will be added in the near future as well as a distributed administrative tool for user account and textbook management.

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REFERENCES

[1] The eLab portal <http://centrevirtuel.creea.u-bordeaux.fr/>

[2] The NuSOAP project <http://dietrich.ganx4.com/nusoap/>

[3] The Linux-GPIB project <http://linux-gpib.sourceforge.net>

[4] The Emerge Project Portal: <http://150.244.56.80/emerge/>

[5] Ulysse e-learning platform: <http://www.ulysses.u-bordeaux.fr/>