Work in Progress - Initiative for the Use of Learning Objects in the Electronics Labs Practice

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Abstract - In this paper we describe how to use a learning object repository in order to store large multimedia files that can been queried by students while they are at home preparing their digital electronic circuits and later at laboratory when they must mount and check them. The system is currently being tested under the pilot project carried out in Electronics Engineering courses. These courses are conducted in the Polytechnic High School at University of Castilla-La Mancha (Spain) with students that attend Digital Electronics subject classes taken during the fourth semester of Bachelor’s degree.

Index Terms - Electronics labs practice, European convergence in higher education, Learning objects.

INTRODUCTION

We have configured a multi-University research group working and developing materials [1]-[2] for helping students in electronics labs practice over several years. Recently, it has been also created a digital repository of learning objects that facilitates reusing other teaching materials, such as exercises or simulations of electric and electronic circuits, but it does not include audio or video documents for guiding in the implementation of laboratory practice due to their large size. Therefore, our objective is to combine both works to store, using current high compression techniques, the laboratory materials and documentation.

Moreover, we intend to integrate the system into the pilot project being carried out in the electronics engineering courses conducted in the Polytechnic High School at University of Castilla-La Mancha (Spain), where new methodologies of teaching-learning are being applied within the framework of European convergence in higher education.

LEARNING OBJECTS

The concept of reusable learning object (LO) is to provide a set of learning knowledge that once developed can be exchanged among institutions or learning management systems in order to build individual lessons and courses [3]. For example, a problem related to the study of a transistor could be used not only in an introductory presentation about the operating bias point, but also on another exercise in which the evolution of the beta forward-characteristic versus base current is desired. This flexibility is performed by its standardized description, (i.e. metadata) [4].

We can find different models according to the quantity of information attached to a file, but the most exhaustive description of education resources can be done with LOM [5]. Metadata adds value to the content, because it makes possible the access to the information without opening or reading the container. Sharing documents is thus easily accomplished identifying their authors or title.

Schematics, manuals, multimedia presentations or data sheets are some resources students shall read fluently to be able to assemble components of a circuit (Figure 1). Unfortunately, organizing them in the laboratory needs a considerable amount of time and space. Our efforts have focused on developing a web interface that allows viewing the descriptions of those sources as well as the tools to manage them. As this place has a known structure, users can search files that match certain criteria such as the lesson or course that they are studying. A server contains all information, making it accessible to instructors and students connected to the network.

FIGURE 1

COMPARISON OF THE LABORATORY LAYOUTS.
A reduced pilot version of the described repository is used by the students coursing Digital Electronic under the pilot project in Polytechnic High School at the University of Castilla-La Mancha (Spain) during 2007/08 academic year. For this subject, students must attend ten sessions to the electronics labs. Each one lasts about three hours, the time necessary for mounting the circuits corresponding to the next themes:

- Logic gates
- Decoders. Applications
- Code converters
- Adder-subtracters
- Arithmetic logic units
- Sequential Systems. Flip-flop
- Sequential Systems. Counters and registers
- Use of memories for the implementation of combinational circuits
- Use of PLD's (PAL) for the implementation of sequential circuits (divided in two sessions)

Table I below summarizes the average time spent by students in order to finish each session properly. The first column shows the required time in the previous course (2006/07) when they did not use these materials.

<table>
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<th>Year 2007/08</th>
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As we can see, in all sessions except 1 and 9, the required time is more than half an hour less for the students that now use the digital object repository. The first session requires more time due to the corresponding explanation about how to use the system. In the same way, the time in ninth session does not change because of the fact that the teacher explains here the use of PALASM software.

**Conclusion**

As we have described before, the use of learning objects repository in Electronics labs practice seems to be a good solution for reducing the time that the students spends while they are mounting their digital electronic circuits at labs. At the moment we are working to shrink the size of multimedia files still further, so they can be used from other sites that have a lower bandwidth than our local area network.

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**References**


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