Mixing Web Technologies and Educational Concepts to Promote Quality of Training in ASIC CAD

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Abstract
Subjects such as ASIC and CAD require a significant amount of training time. The application of Computer Based Learning (CBL) technologies in these cases leads to a reduced workload on teaching staff, allows students to study remotely and in time, convenient for them. Considering all that, a WWW based CBL system for ASIC design training was developed.

The paper presents the content and the layout of the ASIC learning system. The utilisation of WWW facilities and additional technical developments for the mentioned CBL system are explained. Comments on the current experience with the system and the feedback from students are also given.

1. Introduction
The Technical University of Sofia (TUS) uses different forms for the delivery of courses. The main obstacles preventing high-quality education in the traditional “talk and chalk” teaching method were identified as follows:
- ASIC, and generally any CAD technology is nowadays a fast developing area and it is difficult to support students with up-to-date printed textbook;
- There is not enough qualified lecturers in this area;
- Normally lectures and classes are scheduled in fixed hours. In time of economic recession most of the students work part time and can’t attend the scheduled training.

Considering the above mentioned needs and problems, a Web based CBL was developed. The present paper presents the first working version of such a system, developed in the laboratory “Simulation Modelling in Industry” at TUS.

2. Motivation
The development of the WWW, HTML and Graphical User Interface software for accessing the WWW and the Internet has created a new perspective for the delivery of courses on campus and in distant learning for any university course. [1-4]. One of the fundamental objectives of WWW courseware should be the relation and integration of a wide variety of on-line resources and functions into an educationally sound framework. Publishing a material on the WWW has advantages, which include:
- On-line information is cheaper;
- On-line information is recent and actual;
- Changes and updates are made easy;
- It has high quality illustration in colour;
- Animation and video clips can be invoked in the document in order to illustrate complex processes or teaching topics;
- It is cost effective because of the potential number of people who can access the system.

As subjects like ASIC and CAD require a significant amount of training time, the application of CBL technologies in such cases leads to a reduced workload on teaching staff, allows students to study remotely and in time, convenient for them.

3. The hypermedia system
A. Structure
The TUS is currently developing a number of interactive hypermedia webs. The term “web” we further denote a home page and a set of associated pages, images and multimedia files. One of this webs concentrates on teaching ASIC design for undergraduate students.

From the home page (ASIC) several links to subsequent "main" pages are defined. These latter include six pages named PLD, CPLD, FPGA, StdSells, GateArray, ASICCAD, practically one for each major topic of the ASIC course.

Each topic consists of number of pages: lecture notes, examples, case studies, and tutorial problems. The materials in some of the topics of the ASIC web contain links to other educational webs at TUS. For example the ASIC CAD topic relies heavily on the teaching material contained in two other webs - VHDL and ABEL webs which describe in details the corresponding design languages.
Each "main" page is actually a frame set. The frame sets have a uniform layout consisting of three target frames: Contents, Text and Note. The Text frame displays the page containing material that is to be learnt by the students. Some of the hyperlinks in this page point to explanatory notes, which are displayed in the Note frame. For example, when the student clicks on the word Xilinx a list of URL's of additional information for Xilinx FPGAs is loaded. The Contents frame consists of links to headings in Text frame.

B. Techniques

The introducing of Web based teaching material requires an appropriate computer network infrastructure. The TUS campus consists of 10 buildings connected by FDDI backbone. In each building the class rooms and offices are connected with Ethernet networks.

The most common hardware/software Web server configurations in TUS are:
- Sun Sparc with Solaris and Apache server;
- Pentium based PC with Windows NT and MS Internet Server.

The vast majority of Web clients at TUS are PCs with Windows 95 and Microsoft Internet Explorer.

The Web contents development tools used in the present application includes MS Word 97 and Front Page.

4. Practical experience and students feedback

The ASIC learning system contains a number of lessons, which should be completed by the students within a semester of work. Students are allowed to complete them in any order, within certain constrain. If a student does not have the required pre-requisites to complete successfully the particular lesson, the system supplies a number of choices needed to obtain the prior knowledge. These include references to either the appropriate chapter in a book, a specific material on a different web in TUS or to site on the Internet.

The defined hyperlinks between reference and course material allows the student to determine a unique, individual “topic-of-interest path”. This provides a customised alternative to the predetermined course structures, suitable for the particular student.

A student enrolled in a subject will read the lecture notes together with any illustrative material, examples, and case studies. Then he/she will attempt to solve the tutorial problems. If the student has any further questions, then e-mail is used to communicate with the lecturer. In this case the lecturer should reply to the questions within a day. The student should e-mail the solution to the tutorial problems and will be assessed and informed for the results by e-mail.

The described learning system is actually in use at the Department of Electronics since the beginning of the 1996 academic year as part of the fifth year ASIC unit. For the time being the participating students were very active in using all provided facilities of the system. It seems to be well accepted by the students as well as versatile for the education in ASIC design. It was found that student’s progress in knowledge acquisition is quicker in time and better in terms of understudying the material. Discussions with students reveal that they consider this type of teaching to be an enhancement to a lecture-based course rather than a replacement of lectures. They would also like to receive more of this type of material to support the other courses.

Conclusions

The paper presents first attempt of using the World Wide Web as a teaching tool at Electronics Department in Technical University of Sofia. This approach proves to be cost effective and has the following major advantages:
- Lecture material can easily be accessed all over the country and therefore can be used in a distance-based independent teaching strategy implementation;
- Lecture material can easily be kept up-to-date;
- The students are very motivated when using modern computer technologies as part of their learning;
- The WWW allows the play and learn teaching approach, which is more attractive to students. Thus, departments and universities utilising such technologies have the chance to recruit more students;
- Lecturers have more time to spend on enhancing and updating their subject’s material due to the reduction in contact hours.

In fact lecturers will continue their noble role in coordinating subjects and preparing material for the students. The only difference will be the vehicle used for delivering the material.

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References