

A Virtual Learning Environment for an Engineering Design Course

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Abstract

In the last 10 years, American industries have gone through a large scale restructuring to become much more efficient. During the same period, engineering education has also made changes in improved efficiency, however, more changes are to be expected. We are preparing for training more students with an emphasis on practical applications. This paper presents a virtual learning environment (VLE) project that is currently being developed at the University of Louisville. The VLE project has three major components: 1) multimedia interactive course on the World Wide Web (WWW), 2) "studyware" package, and 3) student database.

Introduction

The evolution of new computer, telecommunication, and multimedia technologies has provided the tools to explore new methods for teaching. However, the development of new technology often out paces our ability to adopt the new technology. We need to access the educational potential of the new technologies and explore new methods to utilize the new technologies for delivering quality higher education.

In the technology-assisted learning environment, the most basic tool is a multimedia personal computer (PC) with networking capability. At the end of 1995, a good quality PC equipped for higher education cost about \$2,000. Just two years ago, a PC with an equivalent performance would cost \$5,000. Now, PCS are widely available on campuses. Now, many students own PCS. Some universities require each student to have a PC. There are also many PCS in work places, offices, and public institutions. Many educational software packages have been developed to make use of these PCS. These software packages may be published on either diskettes or CD-ROM.

Another **significant** new tool that maybe used for educational purposes is the Internet. When the Internet was first established, it was considered by some people to be the information superhighway. [n the early days, people used the **Internet** for e-mail, file transfer, and remote access. More powerful tools like **Archie** and **Gopher** were added later. But in the recent years, the presence of the WWW and web browsers such as **Mosaic** and **Netscape** raised the Internet to its present day status.

The VLE project at the University of Louisville is designed to make use of PCS and the Internet. Our VLE is broader in scope than the traditional PC software or networking applications and we hope the VLE will better integrate the learning environment and new technologies.



The VLE Components

'The apparent difference between the traditional learning environment and VLE is in the role of the classroom. Traditional learning takes place in a classroom at scheduled hours. It is based on the constraint that the teacher and students meet in a preassigned classroom at scheduled hours. In the VLE, the constraint of scheduled classroom meetings is largely removed. Learning may take place in various locations and at convenient hours. It is possible that a student may take one class at his/her home at midnight and the next class in an office, where the student works part time, at lunch time rather than coming to the classroom at scheduled hours. Instead of the classroom lecture, the student connects to a home page on the W W W for a multimedia interactive lecture, through a PC. 'The first VLE component is to develop a multimedia course for WWW distribution, which we call a "web course."

The traditional classroom learning environment has been in practice for several hundred years. Can we replace the classroom learning environment by a web course? The answer is no. We do not think a multimedia interactive course alone can effectively replace the classroom learning environment. Therefore, the web course will be used in conjunction with a studyware package and student database. These are the three components of our VLE.

The Web Course

The VLE course will be placed on the WWW. The WWW is a client/server based approach for accessing and displaying information across the Internet. The students view the WWW by using web browser clients. The more popular browsers are Netscape and Mosaic developed by the National Center for Supercomputing Applications at the University of Illinois. Basically, a browser is a distributed system for information discovery and retrieval over the Internet using a graphical user interface. It can retrieve text, graphics, audio, and video documents from remote locations. However, the student will perceive the complete course to be stored at one location. This feature allows us to implement a course by using the materials developed at other universities in the future. The overall structure of the web course is shown in Figure 1 where audio, video, and text information maybe located at different sites but linked together by using the Hypertext Markup Language (HTML) or an equivalent. Our present web course is composed in the HTML, but we are watching the new Java language closely. At the end of 1995, the HTML was the standard web language. If Java becomes the web standard, we will change our web course from HTML based to Java based.

In a previous research project funded by the NSF [1-4], three engineering core courses were developed with emphasis on engineering design and economics. These courses were developed for a traditional classroom learning environment. We are developing a web course based on the traditional classroom course developed by the Thuesen team. Some of the features of our web course are similar to those found in CD-ROM text books. We also make use of some Internet features that are not offered by CD-ROM, for example, the convenience in updating a web course, student notes facility, and a feedback mechanism..

A web course is really a software package, therefore, it may be updated and/or revised every month. The revision of a web course is similar to software maintenance, which is a standard practice in computer applications. The student notes facility will enable the student to write notes while accessing the web course. The notes are stored in the hard drive in the student's PC. There are two types of notes: 1) bookmark



notes that are attached to a particular location in the web course and 2) general course notes that are not attached to a particular location in the web course. The student feedback software is linked to the web course. At the end of each section, the student feedback link will present a short questionnaire to the

student. Also, on the student's PC monitor display menu bar, there will be one menu item "Feedback." At anytime, the student can click on the Feedback menu item for a pull-down menu that will prompt the student to express his/her feelings about the course and personal progress, and provide suggestions. A portion of the web course is placed in the home page <http://starbase.spd.louisville.edu/~hrleep01/vle/>.

The Studyware

The studyware is a collection of software packages that includes software to access the WWW as well as study supporting materials. The WWW software package consists of three diskettes that will enable the multimedia PC used by a student to be connected to the Internet through the point-to-point protocol (PPP) and host computer at a university. This software collection includes a TCP/IP protocol stack, e-mail program, FTP client, Telnet terminal emulator, Archie client, Gopher client, WWW browser, news reader, and client and server of TALK protocol. This three-disk package is known as the ULNET, which also includes an audio file player, viewer for GIF and JPEG files, movie player, and movie viewer. The ULNET collection will be revised periodically to reflect the current status of the Internet connection and usage.

The study supporting materials include a detailed course syllabus and study plan, personal information manager, and package on how to contact the instructor. The personal information manager will include a calendar, address book, and "to do" list. The calendar will be used to remind the student of items such as due dates for assignments and examinations. The contact package will contain information on how to contact the instructor by e-mail, phone, fax, or to meet the instructor in person. The study supporting materials package is currently under development. We are also evaluating low cost video mail technology for student-instructor contact.

The Student Database

A student database will be created for each student to track the progress of that student. This database will include a list that compares the student's progress with the course syllabus and study plan. The database will issue a caution if the student falls behind the schedule of the syllabus and study plan. It will issue a warning if the student is way behind and also send a message to inform the instructor. It will maintain a log file that tracks how much time the student has accessed the web course and will keep a detailed record of the time the student has utilized each part of the web course. If the log file record time happens to be out of a typical range, the database will inform the instructor. The database also will keep a record of the student's performance on exercise problems, projects, quizzes, and examinations. The student database is currently under development.

Evaluation of the VLE

Our present project concentrates on the development work of the VLE, not on the evaluation. However, we have given some thought to the evaluation of the effectiveness of the VLE. The data for teaching the NSF funded courses created by the Thuesen team are already available. This set of data may be used as the data of the traditional classroom learning environment. We will collect the achievements of the students in terms of qualitative measurements and anecdotal evidence in a controlled experiment.

Conclusions

This paper presents a VLE project currently under development at the University of Louisville. The project has three components: web course, studyware, and student database. After the VLE project is completed, we plan to evaluate the effectiveness of the VLE

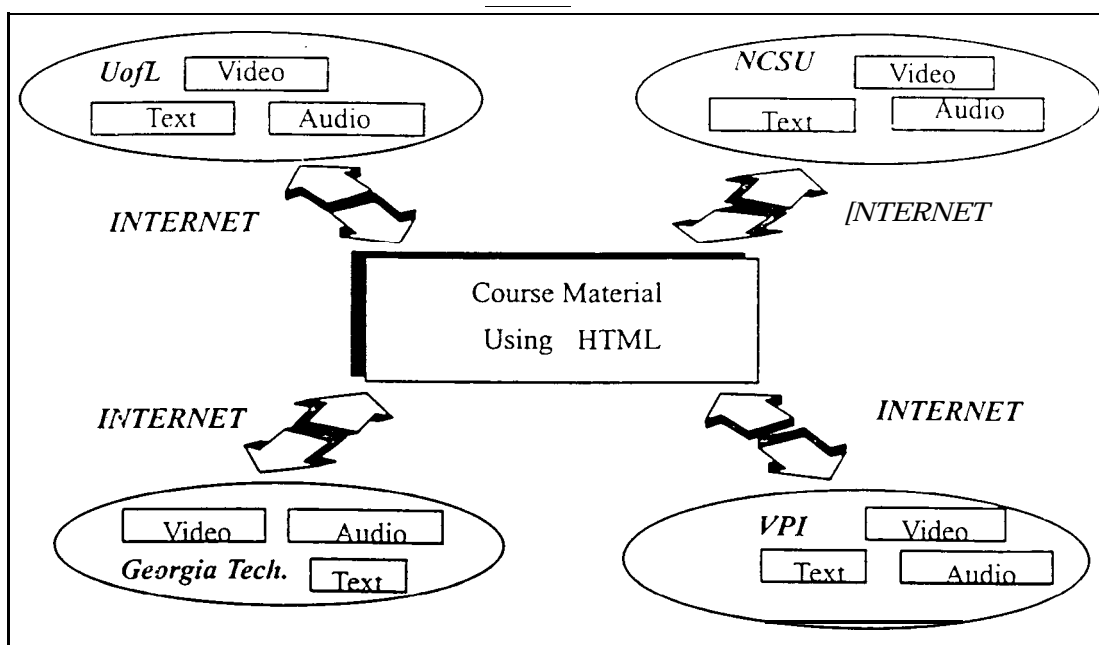


Figure 1. Structure of the Course Material for VLE

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