

**AC 1997-457: Use of Internet in Information Content Creation and Delivery for Promoting Active Cooperating Learning**

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# Use of Internet in Information Content Creation and Delivery for Promoting Active Cooperating Learning

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## ABSTRACT

The teaching process involves dissemination of significant amounts of information. This is accomplished through reading assignments in textbooks and handbooks, and the traditional method of lecturing assisted through the blackboard. The World Wide-Web (WWW) component of the Internet can be used to assist in all these functions. It enhances their quality by giving the faculty more flexibility in using hypermedia technology to develop information rich course content.

The teaching process also includes, ascertaining the proficiency achieved by the students in the subject material through tests, quizzes and assigned projects. It is possible to create mechanisms using the Internet to develop interactive course content to provide immediate feedback to the students. The use of e-mail and special purpose groupware software can assist in promoting active cooperative learning. Some of these technologies are relatively new and this paper will discuss their implementation in two courses taught by the authors in the area of computer applications and structural mechanics. The methodology for developing the course content for WWW using HTML and management of HTTP server will be described. The use of Java to develop interactive content will also be discussed. These examples will be demonstrated live through the use of a local WWW client during the presentation. This paper will give details on how e-mail was used to generate student collaboration in preparing project reports for the course.

Lastly, the issues of the network bandwidth will be discussed. The Internet is getting more and more congested due an increase in data traffic. This provides a damper on using it as a main source of information retrieval for students. New technologies to overcome network bandwidth problems are on the horizon. One such technology, which works on the TV channel concept, will be demonstrated. A new company known by the name of Marimba develops this product. This product allows students to download the course modules during non-peak hours thus avoiding the timings when the WWW acts more like a World-Wide Wait. After that only changes in information on the server side are downloaded for viewing, thus eliminating the downloading of the entire site every time the student accesses the WWW server. In addition to that the local viewing of the course content is significantly faster as compared to accessing a remote site.

## 1. INTRODUCTION

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The growth in the computer local area networking (LAN) and wide area networking (WAN) using a common set of communication protocols such as TCP/IP has lead to a worldwide

computer network, also known as Internet. The merger of computer technology with telecommunication technology is creating new ways of inexpensive communication of the information.

The computers are providing the software tools to create information content in hypermedia format. The introduction of Hypertext Markup Language (HTML) allows one to produce documents that contain pointers to such multimedia elements as sound and video files. It also helps in providing a richer and more engaging experience to the consumer of the information. These documents are served through a World Wide-Web (WWW) server program using Hypertext Protocol (HTTP)<sup>1,2</sup>. The idea is based on client/server computing method. Similar methodologies have been in existence in the past. However, the acceptance of HTML and HTTP protocol as standards by the information technology industry has made the use of Web based technologies for information dispensing a ubiquitous tool.

The WWW based technologies provide a set of tools, which are useful in creating documents, which could be displayed on any computer platform. These documents are hardware and software platform independent, which means that the same document can be displayed on a Windows, Mac or UNIX system with a platform dependent Web browser. The second important feature of these technologies is the global accessibility of the document. Any computer connected to the global network can access these documents. The third important feature of this technology is extensibility. The basic HTML language can be extended with the help of programming languages such as Java<sup>3</sup> from Sun Microsystems. These extensions to HTML produce an active document with interactive capabilities. It is anticipated that these developments will have significant impact on the education process.

## **2. USE OF WEB BASED TECHNOLOGIES IN EDUCATION**

The teaching process involves dissemination of significant amounts of information. This is accomplished through reading assignments in textbooks and handbooks, and the traditional method of lecturing assisted through the blackboard. The WWW component of the Internet can be used to assist in all these functions. It enhances their quality by giving the faculty more flexibility in using hypermedia technology to develop information rich course content.

To assess the usefulness of these ideas two WWW sites were created<sup>4</sup>. These sites were mirror images of each other. One was used to create the course material in the HTML format and the other was to dispense it to students through a HTTP server. Two courses namely the graduate IE930 Microcomputer Decision Support at YSU and undergraduate ME3512 Introduction to Finite Element Method at WPI were taught by using the electronic communication method. A majority of the course content was translated into the HTML format and was accessible to the students through the computer. Homework and the course projects were assigned through these WWW sites. The course topics shown on the course outline were linked to the relevant course content and references through hyperlinks. Figure 1 shows a typical course outline as can be seen through a WWW browser.

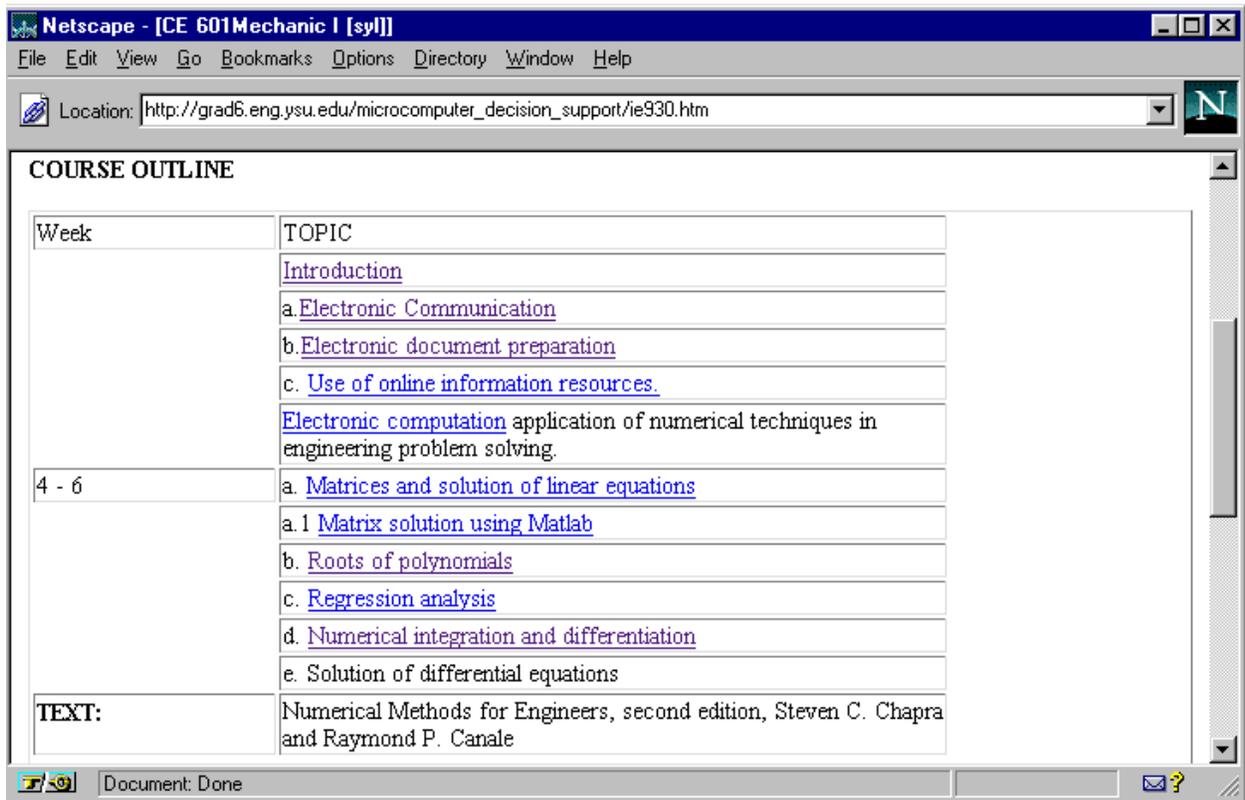


Figure 1: Course outline for IE930 Microcomputer Decision Support at YSU.

This was a significant undertaking, however, it was found to be very helpful in dispensing lecture-related information. A WWW site by the name of the Finite Element Method universal resource (*FEMur*) has been established to provide information regarding finite element method<sup>5</sup>. It also contains resources for teaching the finite element method.

The teaching process also includes, ascertaining the proficiency achieved by the students in the subject material through tests, quizzes, homework and projects. It is possible to create mechanisms using the Internet to develop interactive course content that provides immediate feedback to the students. A Java applet at URL <http://femur.wpi.edu/Interactive-Learning-Tools/index.html> that demonstrates and assists students in assembling the FEM stiffness matrix was developed. The student is provided with two element stiffness matrices and a drag and drop method is instituted to assist students in placing the stiffness elements from individual stiffness matrices into the global stiffness matrix as shown in Figure 2. The applet also provides students with immediate feedback by displaying “correct” or “incorrect” as shown in the Figure 2. It can also provide a complete solution if requested by using the Auto-Solve option on the screen. These options make it an extremely versatile tool in demonstrating the global stiffness assembly process of the finite element method to the students.

**Instructions:**

Drag and drop the local element stiffness cells into their proper location within the global stiffness matrix (in accordance with the direct assembly method).

$$\underline{K}_1 = \begin{bmatrix} 5.96917e+006 & 5.96917e+006 \\ -5.96917e+006 & 5.96917e+006 \end{bmatrix} \begin{matrix} 2 \\ 1 \end{matrix} \quad \underline{K}_2 = \begin{bmatrix} 4.97431e+006 & -4.97431e+006 \\ -4.97431e+006 & 4.97431e+006 \end{bmatrix} \begin{matrix} 1 \\ 3 \end{matrix}$$

$$\underline{K} = \begin{bmatrix} & & \\ & & \\ & & \end{bmatrix} \begin{matrix} 1 \\ 2 \\ 3 \end{matrix}$$

Restart      Zero Fill      Auto-Solve

Hint!      Help?      Feedback

Figure 2: Java applet for FEM matrix assembly.

The information dispensed through the WWW server is always available. Students can access this information anytime from the convenience of their dormitories or homes if they have an on-line connection. This convenience allows them to concentrate on the information content of the class lecture without worrying about taking notes. Any missed lecture could still be accessed through the WWW site. This information can be read at their own pace in a self-directed fashion.

The Internet is primarily about communication where the computers assist information creation and it is transmitted through the network from one computer to another. This allows for both synchronous and asynchronous communication modes. However, due to bandwidth limitations asynchronous communication is much more efficient on the Internet. Both of these courses used e-mail as one main communication method. The IE930 course at YSU used it extensively to communicate between students and between student and teacher. There were group collaborative projects via e-mail communication and the finished project in the HTML format was used for coordination within the group. Novel techniques in which every student was involved in grading the projects of every other student in the class were used to foster the collaborative learning experience. This became possible only because of the availability of such Internet technologies as e-mail and WWW.

### **3. TECHNICAL ISSUES IN THE USE OF WEB BASED TECHNOLOGIES**

As shown earlier the WWW is an enabling technology. It allows implementing creative teaching methods that lead to an improved learning experience. However, it also involves a thorough familiarity of Web based technologies on the part of the instructor. He/she needs to know about the use of HTML in document creation, HTTP server management and familiarity with the efficient use of e-mail program clients. This is a formidable undertaking. However, the future looks bright due to the release of easy to use software products to assist instructors in performing all these tasks.

Another concern is that the Internet is getting more and more congested due to the increase in data traffic. This provides a damper on using it as a main source of providing information to students. New technologies to overcome network bandwidth problems are on the horizon. A new company known by the name of Marimba<sup>6</sup> is developing one such technology, which works on the TV channel concept. It allows the students to download the course modules during non-peak hours, thus avoiding the time periods when the WWW acts more like a World-Wide Wait. After the course modules are initially downloaded, only changes in the information on the server side are downloaded for viewing. In addition to that the local viewing of the course content is significantly faster as compared to accessing a remote site. This technology is based on the Java programming language which allows one to produce interactive, computer platform independent course material. This is also in some respect similar to the technology of Connected PC<sup>7</sup> promoted by Intel Corporation. The Internet is in a constant state of growth and intelligent use of some these technologies will lead to a better teaching process.

### **4. CONCLUSIONS AND RECOMMENDATION FOR FUTURE WORK**

It is possible to employ Web based technology in the teaching process successfully. However, the technology itself is in the state of evolution and it is anticipated that in the near future it will become much more robust and easier to use. Once educators become familiar with it, its use will increase considerably. The teaching and learning process is information centric and if employed judiciously the WWW based technologies greatly facilitate this process. They make it possible to implement creative teaching methods that enhance the learning process of students through collaborative learning. This process supports the active learning mode where student assume greater role in enhancing their learning as compared to the existing passive learning mode. It is recommended to continue the use of WWW in the teaching and learning processes.

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