On-Line Class Presentations to Enhance Distance Engineering Degree Programs

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ABSTRACT

In this time of rapidly changing technology, the delivery mechanisms for educational programs are constantly evolving. Distance education has become more readily available, and the non-traditional student now has enhanced opportunities in many academic fields. In 1989 the school of Engineering and Mines at the University of North Dakota established a distance education program to deliver Bachelor of Science engineering degrees to employees of participating companies. This program was known as the Corporate Engineering Degree Program and has recently expanded into open enrollments and renamed the Distance Engineering Degree Program (DEDP).

The current DEDP delivery format includes videotaped lectures, static Internet Web pages of handouts, e-mail, and on-campus condensed summer laboratories. This delivery format ensures that each distance program has exactly the same content as the on-campus program. Major limitations of the program include the inherent delay in students receiving the videotapes and the asynchronous problems for faculty handling on-campus and distance students in the same class. To shorten the delay in the lecture delivery times, the authors have tested and examined various ways to utilize the power of the Web to synchronize and to better integrate the DEDP student activities with their on-campus counter parts. This paper presents details, procedures, and demonstrations of delivery methods involving text, video and audio capturing software for a Spring 2002 Electrical Engineering course.

Introduction

In 1989 UND's School of Engineering and Mines established a distance education program through Continuing Education to deliver Bachelor of Science engineering degrees to employees of the member companies of the Corporate Engineering Degree

Program (CEDP). In 2001 this program was modified to serve individual students, and it became the Distance Engineering Degree Program (DEDP) delivering chemical, civil, electrical and mechanical engineering courses. To date the program has graduated 8 students, who completed lecture courses through videotape and laboratories through on-campus summer programs. The program enrollment has risen from 8 in fall 1989 to 64 in Fall 2001, and, with the recent change to serve individual students, enrollment is expected to increase. Currently the DEDP is also being considered as a potential supplier of distance engineering courses by overseas educational organizations, such as Academics International in Singapore. In addition to investigating alternative delivery methods for lectures as described in this paper, SEM is also experimenting with online laboratories to further facilitate distance learning. The DEDP offers the only ABET (Accreditation Board for Engineering and Technology) accredited undergraduate engineering programs at a distance.

The current DEDP delivery format includes videotape of lectures given to on-campus students, static Internet Web pages of handouts, e-mail, and on-campus condensed summer laboratories. This delivery format ensures that each distance program has exactly the same content as the on-campus program. One major limitation of the current delivery mode of the DEDP is that it normally takes two (2) to three (3) weeks, sometimes even longer, for the video taped lectures to reach off-campus students. As a result, students enrolled in the DEDP program are at times more than three weeks behind their on-campus peers in submitting the required assignments, projects, and tests. This delay also generates additional load for faculty in terms of grading and advising on-campus and distance students at different points in the course. In general, faculty members consider that under these circumstances a distance student requires 50% more time and attention than an on-campus student. To shorten the delay in lecture delivery times, the authors have tested and examined various ways to utilize the power of the Web to synchronize and to better integrate the DEDP student activities with their on-campus counter parts. However, in considering online course delivery it was important not to overlook student access, and hence methods investigated must be compatible with minimum Internet access configurations.

One of the delivery methods that are currently being tested by the authors uses a combination of the Mimio[TM] text capturing device and Camtasia[TM] on-screen video capturing software to dynamically (in real time) capture the text and other in-class visuals along with the accompanying (instructor's) audio [1,2]. The captured audio and video are then streamed over the Web in a RealPlayer[TM] or Window Media Player[TM] format in either real time or off-line [3,4]. Through this delivery format, the DEDP students have access to exactly the same class presentation material the same day (rather than weeks) that their on-campus peers attended the class. This paper presents some of the details, procedures, and demonstrations of these real-time on-line classes the authors are investigating, along with the advantages that this method offers.

Mimio[TM] Text Capturing

Mimio[TM] is a device that is designed by Virtual link[TM], and it attaches to any whiteboard, or other smooth surface, and electronically captures everything written or

drawn into a laptop or a desktop computer file in real time. The device captures text and hand drawings in the same color as written on the board as shown in Figures 1 and 2.

Figure 1: Mimio™ Capturing Device and Markers [1].

Figure 2: Mimio™ Captured Text on a Laptop [1].

The interactively captured text can be saved on the computer hard drive for instant replay at a later time. At the same time, the captured text can also be saved as a set of graphic snapshots in JPEG, BMP, WMF, EMF, or HTML format. The HTML version of the captured text of lecture presentations can be made available to students over the Internet as a set of static web pages as illustrated in the following figures. Figure 3 shows the html index page of the lecture notes captured by Mimio™. By clicking on the
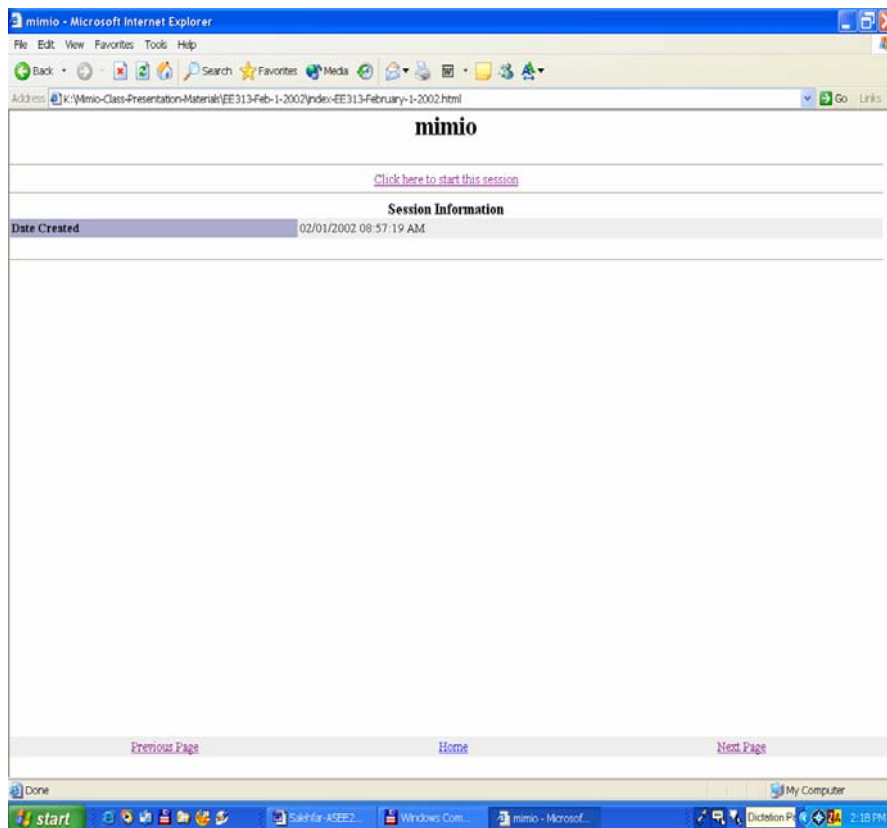

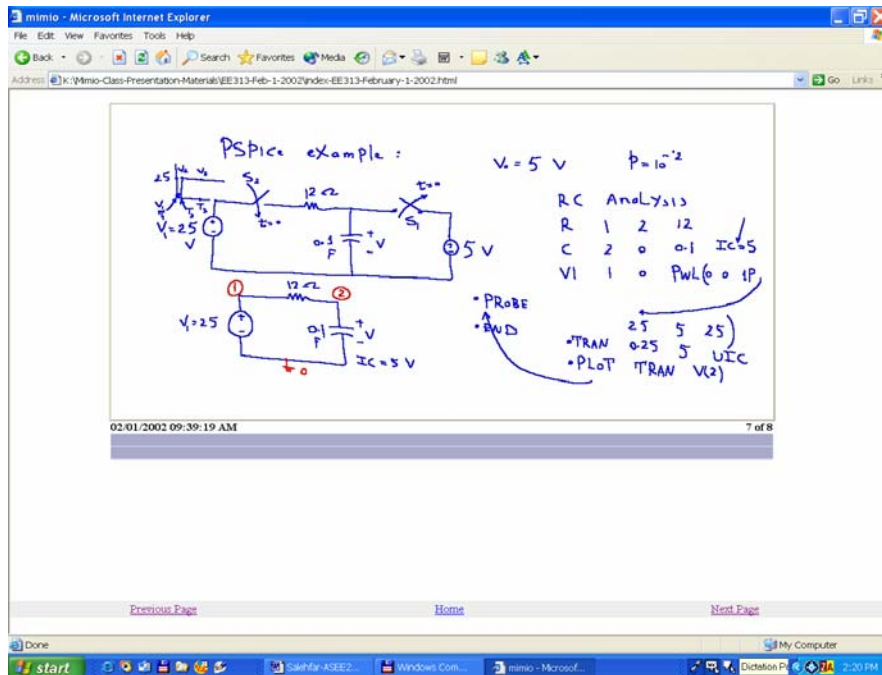Figure 3: HTML Index Page created by Mimeo

Figure 4: Static HTML Lecture Notes

"Next Page", "Home", or "Previous Page" links, the user is able to move back and forward through the lecture notes. A sample of a static html page for handwritten material is shown in Figure 4.

Combined with the Mimio's core software, Virtual Link's BoardCast software can also be used to capture and automatically synchronize the voice of the presenter with the captured handwritten text in real time. The combination of handwritten text and voice can be archived on hard drive or streamed live over the Internet through the freely available RealPlayer^{TM} or RealOne^{TM} software as shown in Figure 5. The course material files are
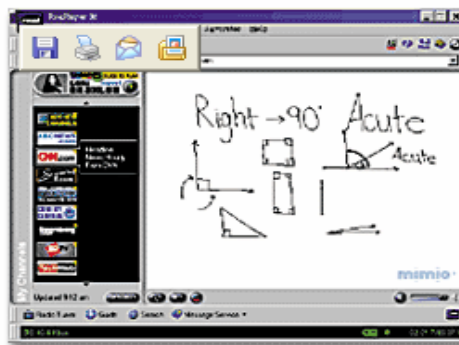

Figure 5: Mimio BoardCast Through RealPlayer [1].

easily handled through a 56 K modem with a 200 MHz computer using Windows 95, and a web browser.

A weakness of the Mimio^{TM} system is that it cannot capture computer-generated visuals such as power point presentations or videos. The problem is more severe if and when computer based animations or software simulation demonstrations are used in the classroom during lectures. This means that off-campus students will not have equal access to exactly the same classroom materials as their on-campus peers.

To mitigate or eliminate the problem, the authors have successfully combined the Mimio^{TM} system with a screen video and graphics capturing software to interactively grab voice, handwritten text and drawings as well as computer generated text, audio, and video. The Camtasia^{TM} audio and video capturing software by TechSmith^{TM} works extremely well with the Mimio^{TM} capturing device. The presentation materials captured by the integrated system of Mimio/Camtasia^{TM} can be archived or streamed live over the Internet in several different high-resolution formats including RealOne^{TM} and or Windows Media Player^{TM}.   The figures in the next section of the paper show Internet based snapshots of the materials presented in one of the classes offered and taught to on-campus and off-campus electrical engineering students in the spring of 2002.

On-Line Class Material

When students connect to an online course's web page, they will see the screen shown in Figure 6. On this page the students are instructed to install the RealOne^{TM} and/or Windows Media Player^{TM} programs for free by clicking on their corresponding URL links. The students will need to install these programs on their machines only once
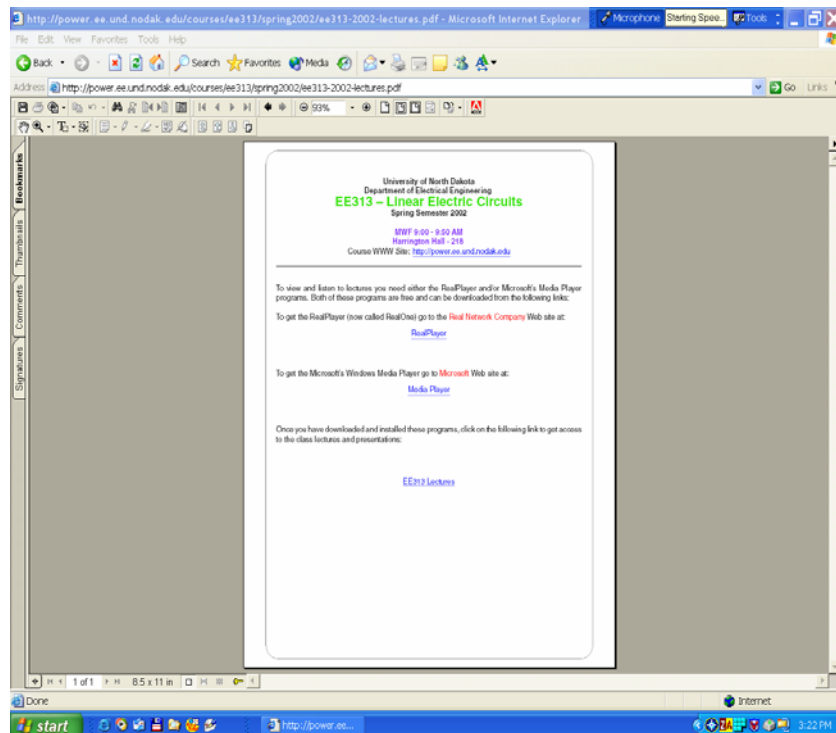

Figure 6: The First Page Linked to the RealOne and Media Player Sites
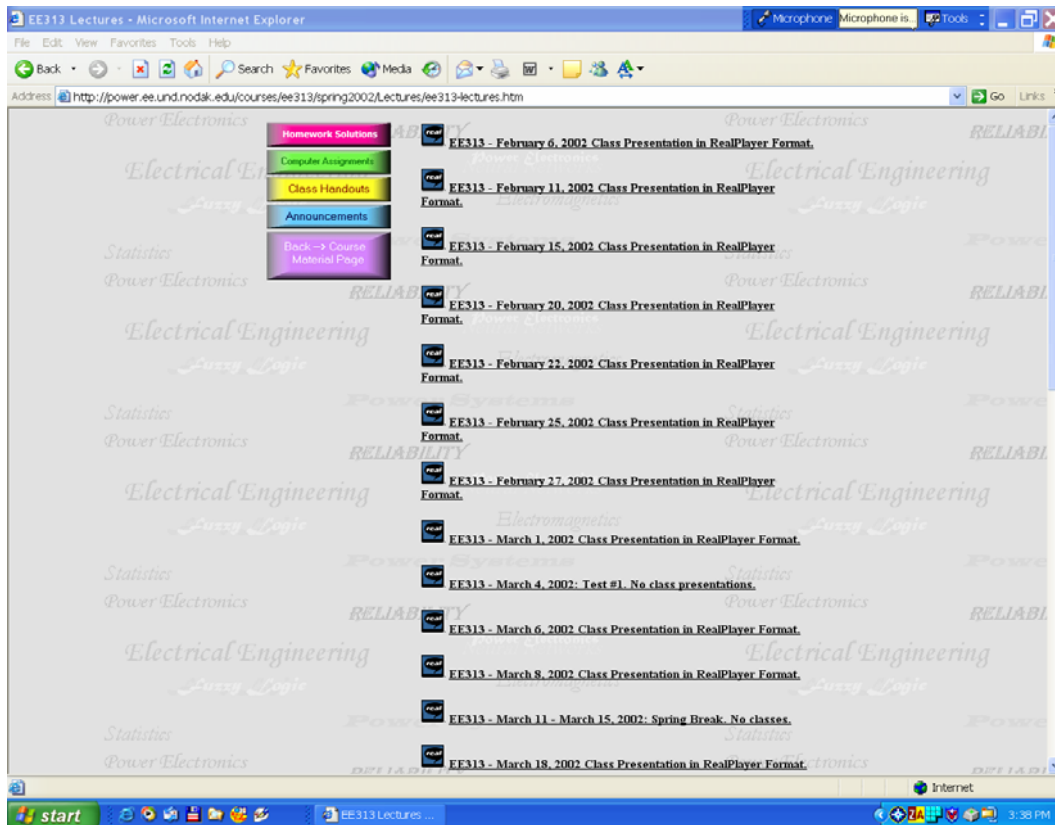
Figure 7: Links to the RealOne^{TM} and Media Player^{TM} Lecture Materials

if they have not done so already. On this same page, a link is provided to the next page where all the lecture materials in RealOne^{TM} and/or Media Player^{TM} format are provided as shown in Figure 7.

The next four figures show snapshots of some of the RealOne^{TM} and Media Player^{TM} based lecture materials. The file is operated very much like a videotape player, and the time into the lecture is displayed together with the total time. An image of the instructor may also be included, and this image can be changed periodically. Figure 8 presents typical handwritten equation development and Figure 9 shows output from PSpice Probe. Circuit drawings and equations are illustrated in Figure 10, and the final figure details quarter wave symmetry.

A survey of students who accessed the spring online course generated positive comments, and this delivery method clearly has potential to replace the expensive and cumbersome videotape delivery.
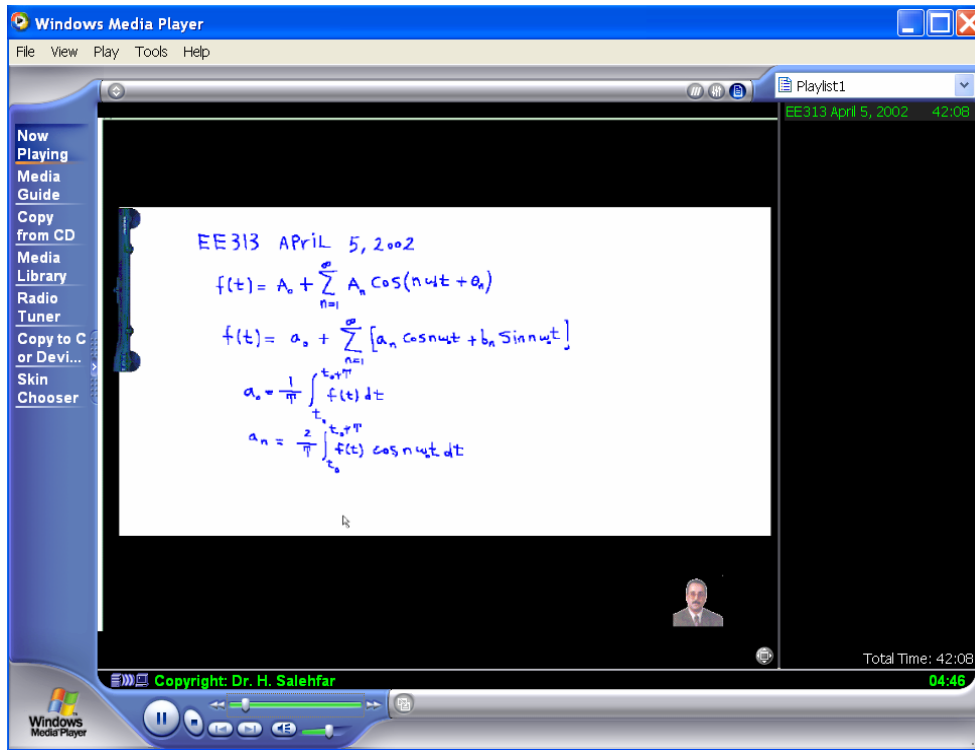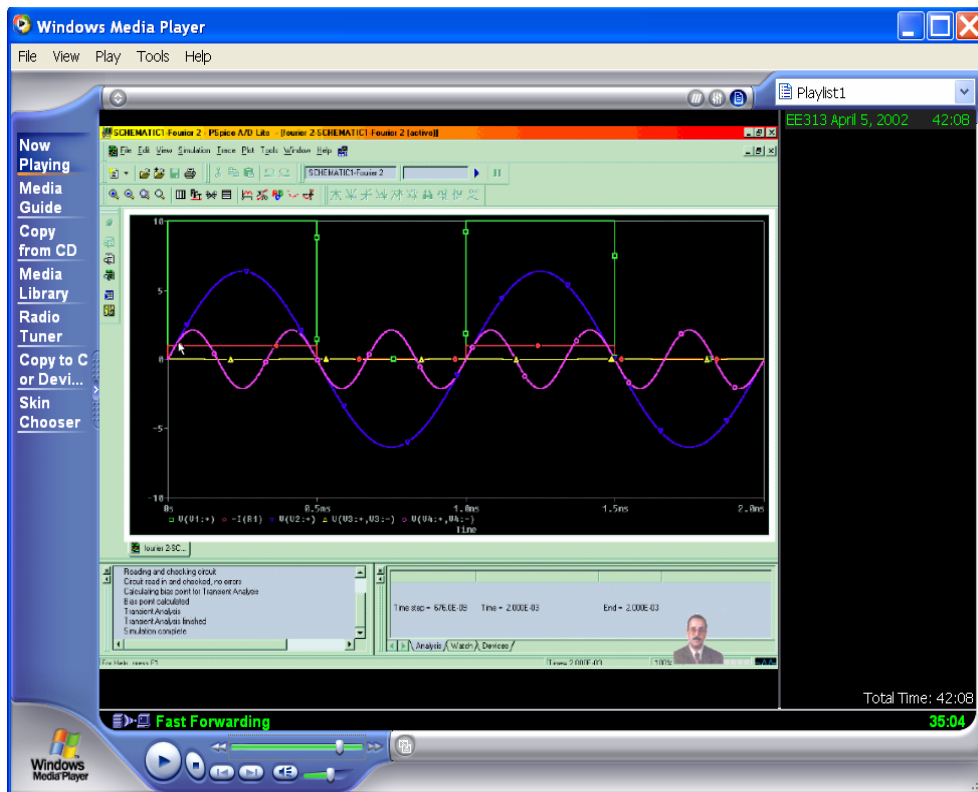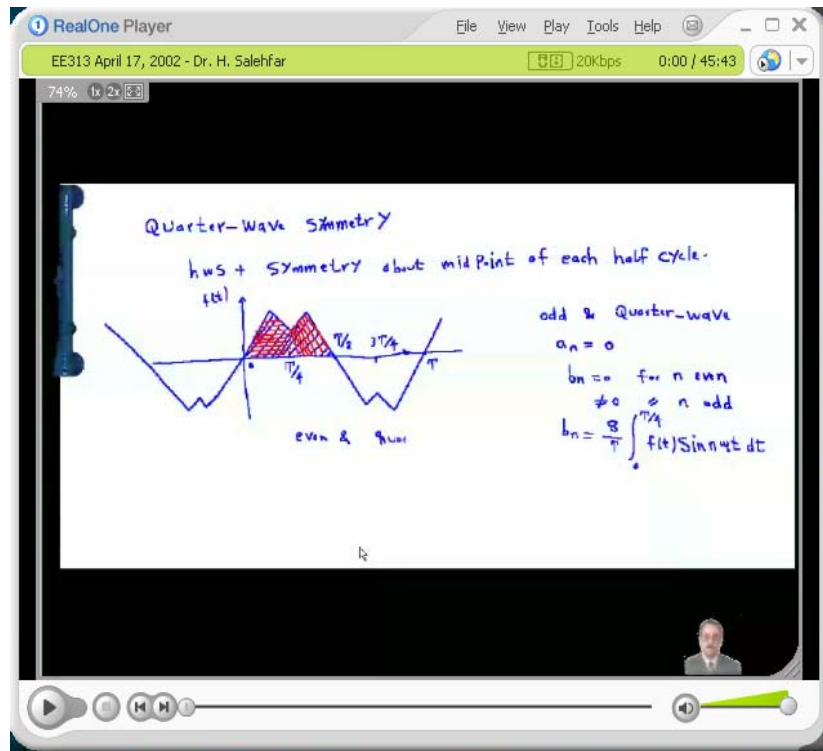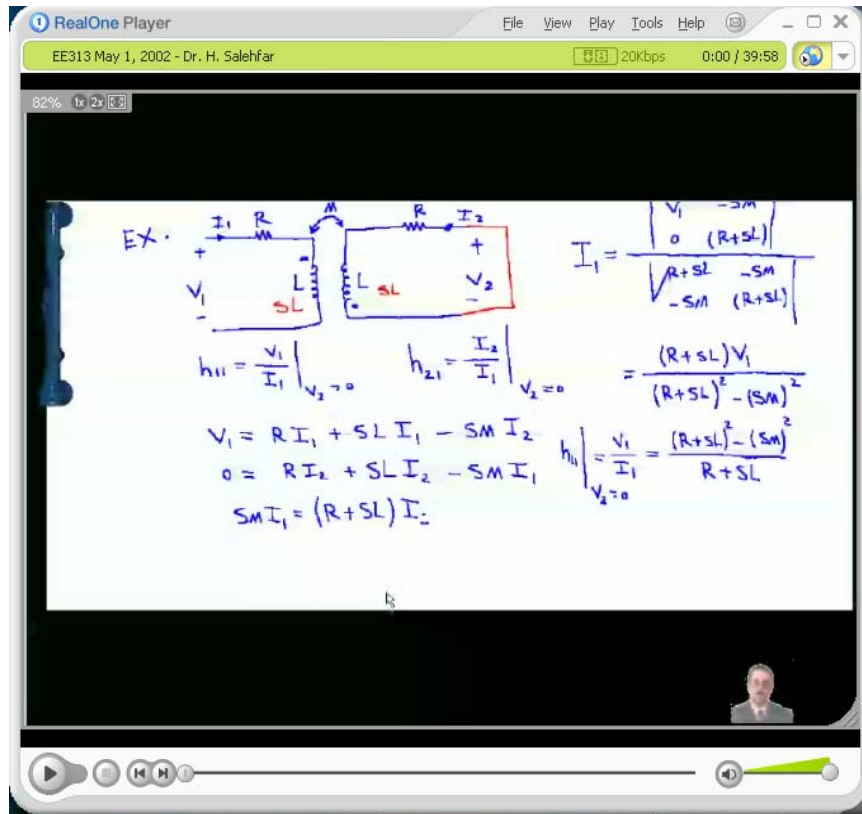
Figure 8: Presentation Snapshot-a

Figure 9: Presentation Snapshot-b

Figure 10: Presentation Snapshot-c

Figure 11: Presentation Snapshot-d

Conclusions

The authors are using a combination of the Mimio^{TM} text-capturing device and Camtasia^{TM} on-screen video capturing software to dynamically (in real-time) capture the text and other in-class visuals along with the accompanying (instructor's) audio. The captured audio and video are then streamed over the Web in a RealPlayer^{TM} or Window Media Player^{TM} format in either real time or off-line. Through this delivery mode, the Distance Engineering Degree Program (DEDP) students of the University of North Dakota have equal access to exactly the same class presentation material the same day (rather than several weeks later) that their on-campus peers attended the class. Students' reaction to the new delivery mode has been very positive.

The School of Engineering and Mines and the Department of Continuing Education are surveying all DEDP students to determine the level of access that students have with regard to online material. Further trials are being planned and it is considered that this method of delivering distance courses has great potential.

For an actual demonstration of the method discussed in this paper, the readers are invited to visit the following Web site:
http://power.ee.und.nodak.edu/courses/ee313/spring2002/Lectures/demo/ee313-lectures-demo.htm

References

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