Work in Progress - Multi-University Development and Dissemination of Online Laboratories in Probability Theory, Signals and Systems, and Multimedia Computing

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Abstract - **This collaborative effort involves five universities, namely, Arizona State University, the University of Washington-Bothell , the University of Texas at Dallas, the University of Rhode Island, and the University of Central Florida. The paper describes educational technology innovations and software extensions that enable the on-line software Java-DSP to be used in three courses at five different universities. The project includes educational innovations, software extensions to support on-line computer laboratories in four courses at five universities, and a dissemination and assessment plan.**
Index Terms – DSP. Java, online labs, signals

INTRODUCTION

Java-DSP (J-DSP) (http://jdsp.asu.edu) is an educational program that enables on-line simulations and web-based computer laboratories. J-DSP is based on an object-oriented programming environment that enables students to establish and run DSP simulations on the internet. The initial version of J-DSP has been developed in the ASU MIDL lab and tested in a senior-level Electrical Engineering Digital Signal Processing (DSP) course (EEE 407). The J-DSP Version 1 (CD-ROM ISBN 0-9724984-0-0) is approximately 42,000 lines of Java code. Papers on J-DSP addressing several DSP related areas have been published previously in archival conference proceedings and journals [1-15].

This work in progress paper presents sponsored work aimed at developing, disseminating, and assessing several new J-DSP capabilities. The project involves five universities and includes significant educational technology innovations that enable Java-DSP (J-DSP) [1] to be used in 4 courses at 5 different universities. The project tasks consist of the following:

a) educational innovation that upgrades the J-DSP GUI,

b) a software development task to extend the mathematical and signal processing functionality of J-DSP,

c) a comprehensive on-line laboratory exercise development task engaging all the Co-PIs at the different universities,

d) a dissemination and assessment plan that involves five universities which committed to testing and providing feedback on the new J-DSP GUI and all exercises and content,

e) a comprehensive pilot test of a new multi-site laboratory concept that allows students in the five universities to run real time distributed on-line simulations,

f) dissemination of all results, practices, and concepts developed

ASU is the lead university, and will execute all the software development tasks. The ASU group will also develop exercises, assessment instruments and dissemination materials. UWB will develop and assess all the computer exercises on the *Multimedia Computing* course; URI, UCF UTD will work on their *Signals and Systems* courses.

EDUCATIONAL INNOVATION

Several educational technology innovations will be made available to the education community including:

o **integrating seamlessly web lectures, simulations, animations** in one unique learning environment, Fig. 2.

o **synchronizing simulations with streaming lectures**; keywords in lectures activate simulations using *J-DSP scripts [3]*

o **capabilities for geographically distributed laboratories;** students from different universities will be able to integrate and run simulations concurrently from different locations;

o **J-DSP scribe tools;** capabilities for the lab instructor to monitor student actions on J-DSP from a remote location in order to provide feedback on-line

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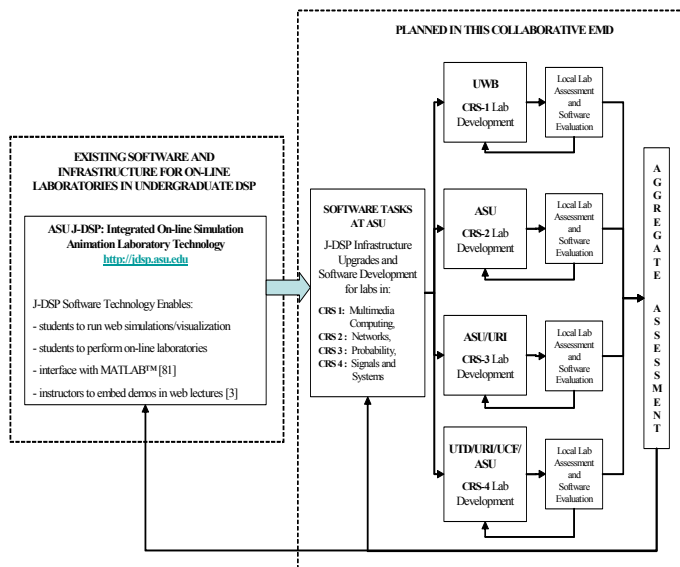
Fig. 1. The Collaborative project involves: a) a software task; b) laboratory development for 4 courses; c) geographically diverse assessment.

A COLLABORATIVE J-DSP LABORATORY

In addition to the online labs developed for the different courses, Fig. 1, we plan to create a laboratory that will enable students at UWB, UTD, UCF, URI and ASU to work concurrently on a distributed real time web lab. The new J-DSP infrastructure will enable collaborative web simulations from different locations,. The J-DSP features that will enable collaborative simulations are called *J-DSP Scripts* [3]. We plan at least one collaborative lab to demonstrate a simple voice-over IP concept (Vo-IP). Vo-IP enables telephony over the internet and involves concepts from DSP and Networks."

REMARKS

A summary of a collaborative NSF EMD project was presented. New J-DSP functions and experiments are being developed and beta sites are being established at five different universities. During the conference presentation the most recent developments in this project will be presented.

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REFERENCES

[1] Clausen A., Spanias A., Xavier A. "A Java Signal Analysis Tool for Signal Processing Experiments, *IEEE International Conference on Acoustics Speech and Signal Processing (ICASSP-98)*, pp. 1849-1852 vol. 3 Seattle, May 1998.

[2] Spanias A. et al, "Development of a Web-based Signal and Speech Processing Laboratory for Distance Learning," *ASEE Computers in Educ. Journal*, pp. 21-26, Vol. X, No.2, April-June 2000.

[3] Spanias A. and Bizuneh F., "Development of new functions and scripting capabilities in java-dsp for easy creation and seamless integration of animated dsp simulations in web courses**,"** *Proc. IEEE International Conference on Acous, Speech and Sign. Proc. (ICASSP-2001),* pp. 2717-20, Salt Lake City, May 2001.

[4] Thrasyvoulou T., Tsakalis K. and A. Spanias, "J-DSP-C, A Control Systems Simulation Environment for Distance Learning: Labs and Assessment," 33rd ASEE/IEEE FIE-03 Conf, pp. T4E_11 - T4E_16, Vol. 2, Boulder, Nov 5-8, 2003.

[5] Spanias A., Ahmed K., Papandreou-Suppappola A., and Zaman M.,"Assessment of the Java-DSPOn-Line Laboratory Software," 33rd ASEE/IEEE FIE-03, Boulder, T2E - 16-21 Vol. 1, Nov 2003.

[6] Spanias A., T. Thrassyvoulou, C. Panayiotou, Y. Song, "Using J-DSP to Introduce Communications and Multimedia Technologies to High Schools," 33rd ASEE/IEEE FIE-03, Page(s):F3A_22 - F3A_27 Boulder, November 2003.

[7] Yasin M., Karam L., and Spanias A., "On-Line Laboratories For Image And Two-Dimensional Signal Processing," 33rd ASEE/IEEE FIE-03, T3E-19 - T3E-22 Vol.1 Boulder, Nov 2003.

[8] Atti V. and Spanias A., "On-line Simulation Modules for Teaching Speech and Audio Compression," 33rd ASEE/IEEE FIE-03, T4E - 17-22 Vol.1 Boulder, Nov 2003.

[9] V. Atti, A. Spanias, C. Panayiotou, Y. Song, Y. Ko, "On the use of J-DSP for on-line laboratories in linear systems courses," Invited Paper, Conference Record of the Thirty-Seventh IEEE Asilomar Conference on Signals, Systems and Computers, Vol 2, pp. 1375-79, Nov. 9-12 2003

[10] Ko, Y. Duman, T., Spanias A., "J-DSP for Communications," 33rd ASEE/IEEE FIE-03, T3E-13 - T3E-18 Vol.1 Boulder, Nov. 2003

[11] A. Spanias, C. Panayiotou, T. Thrasyvoulou, and V. Atti, "Java-DSP Interface with MATLAB and its Use in Engineering Education," in Proc. of ASEE-2004 Conference, June 20-23, 2004, Salt Lake City, Utah.

[12] A. Spanias, et al., "Teaching Genomics and Bioinformatics to Undergraduates using J-DSP" in Proc. of ASEE-2004 Conference, June 20-23, 2004, Salt Lake City, Utah.

[13] V. Atti, A. Spanias, C. Panayiotou, and Y. Song, "Teaching Digital Filter Design Techniques Used in High-Fidelity Audio Applications," in Proc. of ASEE-2004 Conference, June 20-23, 2004 Salt Lake City, Utah.

[14] A. Spanias, C. Panayiotou, and V. Atti, "Graphical Design of Frequency Sampling Filters for use in a Signals and Systems Laboratory," in Proc. of 34th ASEE/IEEE FIE-04, pp. 26-31, Oct. 20-23, 2004, Savannah.

[15] Y. Song, Spanias, A. Atti, V., Berisha, V, "Interactive Java Modules for the MPEG-1 Psychoacoustic Model," IEEE International Conference on Acoustics, Speech, and Signal Processing, 2005. Proceedings. (ICASSP '05).Volume 5, pp.:581 – 584, March 18-23, 2005
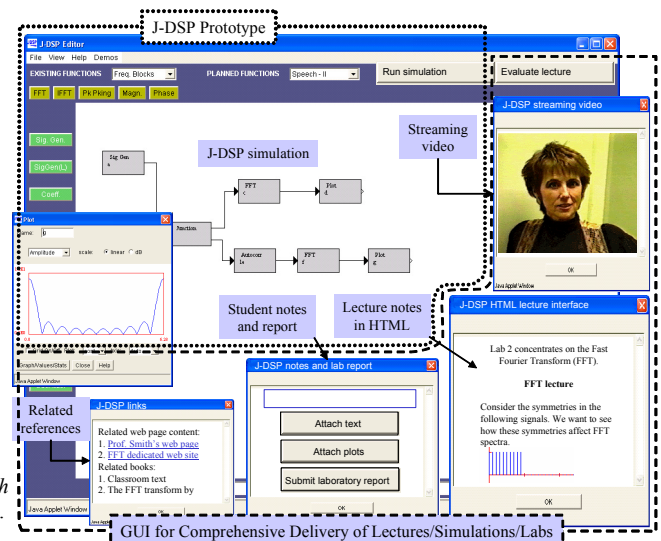
Fig. 2. The freely and universally accessible J-DSP integrates simulations, lectures, HTML content, and animations.