Work In Progress: Collaborative Signals and Systems Laboratories at ASU, UWB, UCF, UTD, and URI

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***Abstract* - This WIP paper reports the status of a collaborative project involving five universities, namely, Arizona State University (ASU), the University of Washington, Bothell (UWB), the University of Texas at Dallas (UTD), the University of Rhode Island (URI), and the University of Central Florida (UCF). The proposed project involves several educational technology innovations that involve software development, design of online signal and systems laboratories, assessment of laboratory practices, and joint dissemination of results. The program also includes a comprehensive pilot test of a new multi-site laboratory concept that allows students in remote sites to form and run concurrently real-time collaborative on-line simulations using the distance learning software and connectivity infrastructure developed as part of this program. The paper will describe the status of these activities and will focus especially on the collaborative laboratory.**

Index Terms – Online labs, web-based education, distance learning, Java software.

INTRODUCTION

The work-in-progress paper reports the status of a collaborative project that involves online laboratories in signals and systems and digital signal processing. The project involves several tasks including software development, laboratory exercise development, assessment, and establishment of new capabilities that enable concurrent collaborative laboratories at different university sites. The project is based on the Java-DSP (J-DSP) (http://jdsp.asu.edu) system which is an internet-based signal processing simulation environment that enables students to establish and run simulations on the internet. J-DSP functionality in signal and systems and other related areas has been described in previously published papers [1-15].

J-DSP is an object-oriented programming environment where signals and systems simulations are established using a graphical user interface based on a block diagram approach. Blocks include signal generators, filters, FFTs, plotters and several other signal analysis functions. Once a block is formed the associated software is activated and when blocks get connected signal flow is established and the program executes. Students are able to design and simulate filters, analyze the signal in the time and frequency domain, etc.

This universally and freely accessible program is based on Java and will run on any PC platform that is connected to the internet. Several laboratory exercises have been developed and assessment results were reported previously [5]. Our efforts now include developing and testing new software infrastructure to support a new simulation environment where students from different sites form and run joint simulations.
We have developed recently, new software and server infrastructure to support this exciting concept. The new J-DSP infrastructure enables collaborative web simulations from at least two different locations. The J-DSP features that enable collaborative simulations are called *J-DSP Scripts* [3]. Students from different universities are now able to integrate and run simulations concurrently. The current version's Editor [2] with the new LoadScript capability enables the multiuser functionality.

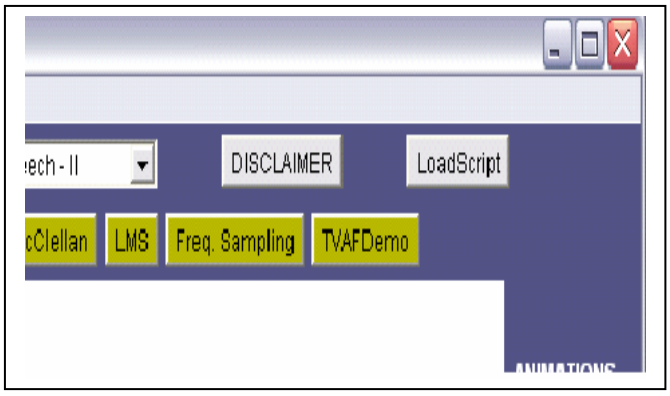

Figure 1. The LoadScript Capability in the Multiuser Version.

Most of the GUI for the J-DSP Editor [2] Frame is identical to the basic J-DSP version except for the 'LoadScript' button on the top right hand side as shown in Figure 1. Students from two different sites see the same environment and can communicate through a custom chat window. Every action taken in terms of establishing and connecting blocks is seen by all participating parties. In this manner the students can form together a joint simulation, exchange ideas and results, design and test a system jointly etc. This concept enables distance learners to be lab partners with on-campus students and therefore have laboratory experiences similar to those of on-campus students. The facility also provides an environment for collaboration between students at different universities. The initial login screen is replaced by a list of current users logged

in as shown in Figure 2. Once users are available on the list, they can be selected. Clicking the button 'Start Collaborative Simulation' begins the session. A channel is created between the two users via a server that continuously runs from a UNIX machine that uses sockets. Also the list of users is replaced with a screen containing the user's login name and the J-DSP multi-user version logo.

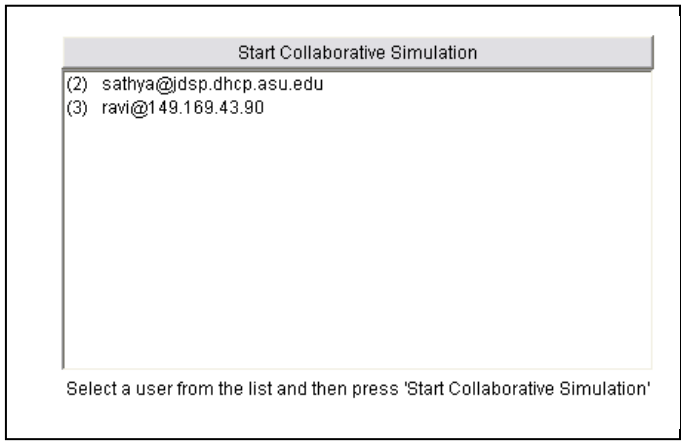

Figure 2. The list of users in a Multiuser session.

The Export Script mechanism available in J-DSP is used to transform the graphical simulation into a series of J-DSP Scripts which are sent as a java String. As soon as a user participating in a collaborative simulation exits, the other user in the collaboration is notified. A list of the login names, their host addresses, login times etc are displayed continuously on the UNIX terminal and hence the administrator can keep track of the different users. A figure with the UNIX terminal displaying a list of user login times, user numbers, host addresses and user ids is shown in Figure 3.

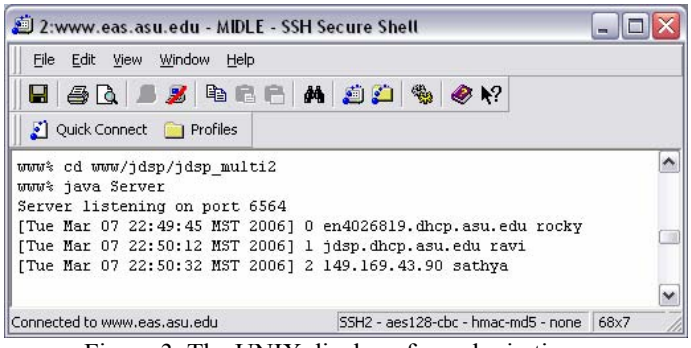

Figure 3. The UNIX display of user login times.

Tests have been carried from several remote locations. We have run real time collaborative simulations between ASU and UWB and assessed the experiment. In addition, we have tested the software and run collaborative simulations from international locations including Toulouse-France (at the site of ICASSP-06), London-U.K., and India. We have collected data associated with the performance of this educational tool for different network traffic conditions and bandwidth.

REMARKS

We presented initial results from a project task involving the development of software infrastructure that enables students to collaborate from different remote sites. We also present initial assessment results from several tests including assessments from local and international collaborative experiments.

ACKOWLEDGMENT

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