Work In Progress - Remote Experimentation Lab For Students With Learning Disabilities

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Abstract - Recent advances in developing remote experimentation labs allow meeting the challenges of making them usable for learning disabled student, who experience difficulties in following the instructions to perform remote experiments. Many times, a confusion caused by the delays between initiating an action in the laboratory and the execution of that action and, as a result, the student does not know if he/she has done the experiment in the correct way. In this paper we address the problems faced by learning disabled individuals by adding new features in Automated Internet Measurement Lab (AIM-lab) at RPI including audio-visual instructions and feeds, voice/video conferencing, and text chat with fellow students. With the added new features in AIM-Lab, learning disabled students will benefit from performing the real-time experiments in a remote setting and therefore their learning process will be more effective than in traditional limited time lab sessions.

Index Terms - Remote measurements, learning disability, semiconductor device characterization, disabled students.

INTRODUCTION

The learning disability disorder manifest itself as an imperfect ability to listen, think, speak, read, write, spell, or do mathematical calculations. Conditions such as perceptual disabilities, brain injury, minimal brain dysfunction, dyslexia, and developmental aphasia might lead to learning disabilities [1]. The students with learning disabilities often require special attention (and may also need access to assistive technologies) in order to keep up with their classmates.

Our work on remote lab systems for semiconductor device characterization resulted in development of Automated Internet Measurement Laboratory (AIM-Lab) [2], the novel learning tool designed to improve student’s educational experience. The laboratory has been used in senior/graduate courses on device modeling and circuit simulation. It includes experiments involving characterization of diodes, bipolar junction transistors, Light Emitting Diodes (LEDS) and Complementary Metal Oxide Semiconductor (CMOS) test circuits. In this paper we discuss new features which should make the AIM-Lab more suitable for the needs of the students with learning disabilities. Other systems for running experiments of the Internet (see, for example, [2]) can also incorporate such features.

SYSTEM ARCHITECTURE

Figure 1 shows the AIM-Lab system architecture. The student (client) opens the AIM-Lab website using his or her web browser and runs a Java applet, which opens a new pop-up graphic user interface (GUI) window requesting to enter the parameters of the measurement to be performed. When the client submits the request, the commands are generated by the applet according to the parameter set specified by the user and sent via TCP/IP client socket to the server over internet. The TCP/IP server socket activates the driver interface layer (DIL) [2]. The DIL then sends the commands to instrument driver using GPIB (general purpose interface bus). The experimental instrumentation in AIM-Lab consists on Hewlett-Packard (HP 4142B) direct-current source/monitor with one source monitor unit (SMU) for each separate voltage source or measurement node. These SMUs directly connect to the device test chip, which is designed and fabricated especially for the AIM-lab and/or to other integrated circuits or discrete devices under test. The output current voltage characteristics of the devices are acquired by DIL via GPIB and the data returns to the client through internet for further processing. The above architecture works well when designed for an independent study. Optional audio/video chats, message boards, and online conferences will provide an array of channels for collaboration, which depend on learner concurrency and learning goal [3]. Learning disabled students would greatly benefit from such collaborative approach for remote experiments. The proposed new system would provide audio/video interactive instructions and chat and video collaboration with the peers, which would help learning disabled students to keep up with their classmates.

1 http://nina.ecse.rpi.edu/shur/remote

October 22 – 25, 2008, Saratoga Springs, NY
38th ASEE/IEEE Frontiers in Education Conference
T4E.9
STRATEGIES FOR IMPLEMENTATION

Fig. 2 shows a schematic AIM-Lab system architecture supporting various web-based communication technologies such as text messaging, video, and voice conferencing. The student interaction with the remote laboratory software/hardware complex will be organized using an integrated multimedia learning environment for distance education [4].

Video and Voice Conferencing
Java Media Framework (JMF) or Video Conferencing Tool (VIC) make it possible to embed real-time applications into a client browser window (as shown in Fig. 2). JMF is a versatile Application Programming Interface (API) for incorporating time-based content into the JAVA applet. It is portable and independent of the underlying hardware.

VIC is a real-time video conferencing application. VIC is designed with a flexible and extensible architecture to support heterogeneous environments and configurations. By building a system with supporting IP multicast along with the JMF or VIC tools it is possible incorporate video conferencing capabilities into a current remote experimentation setup [6].

User Interface

In addition, JMF can play various media files such as AVI, MDI, MPEG, QuickTime, and WAV in the Java applet, change the content type format, and capture audio and video from user’s microphone and camera and transmit them in real-time over the internet [5].

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Figure 1 AIM-Lab system architecture [2].

Figure 2 Modified AIM-Lab system architecture

DISCUSSION

Adding new features such as online live video feeds, voice and video conferencing, and text messaging to current system will increase online collaboration among peers. Learning disabled will be able to chat and discuss technical problems with fellow students and instructor while performing experiments in a remote setting. This approach will also help instructors by providing easier ways to deliver the guidance and to monitor the progress of the student more carefully. An instructor’s designing activities for learning disabled students should discuss strategies to balance cognitive load as these students become familiar with the new remote experimentation system having many features [7]. Finally, efforts will be made to make the whole system low-cost and user-friendly.

CONCLUSION

We have described the current AIM-Lab system architecture and presented strategies for improving the current remote experiment architecture to address learning disabled students needs. The new approach will help these students in their effort to achieve excellence in learning.

REFERENCES


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