Adding Collaboration to the MIT Microelectronics WebLab

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Recognizing the dearth of laboratories and the importance of hands-on experiences in engineering education, the I-Lab project was launched by I-Campus in 2000. I-Campus is an MIT-Microsoft initiative which goal is to enhance learning through the use of new Internet technology. I-Lab's mission is to explore the technology and pedagogy of online laboratories, real laboratory experiments that can be accessed through the web. I-Lab is deploying several remote, web enabled laboratories where students can carry out experiments from anywhere at any time. Our motto is, "If you can't come to the lab… the lab will come to you!"

The MIT Microelectronics WebLab (or WebLab for short) is an online laboratory for microelectronics device characterization and is the most advanced project in I-Lab. WebLab enables students to conduct real-time measurements on microelectronic devices through a Java applet. Any Java-enabled web browser can access WebLab and connect to the hardware devices behind the server. This provides an efficient, cost effective way for students to perform microelectronics laboratory experiments. The students do not need to worry about a lack of devices, facilities, strict laboratory hours, or transportation. In addition, the university can provide hundreds of students with the laboratory experience using just one set of devices. WebLab has been very successful. Over 200 MIT students used it to perform experiments in the fall semester of 2001 alone. In addition and at the same time, 30 students from Singapore also connected to the remote laboratory in their classes in the Singapore-MIT Alliance.

There is one major drawback to WebLab when compared to a real laboratory. WebLab is a single user application and students working on WebLab experience no interaction with other students. In a real laboratory there are always other students around working on the same assignment or on other assignments and there are also instructors helping the students. This interactive environment is more pleasant and effective from an educational point of view.

To make up for the lack of interaction, we are developing a collaboration system for WebLab. The collaboration includes functionality for users to form ad-hoc teams, chat among team members, and share experimental setups and results. Our new collaboration features make WebLab more lively. The interactions that it enables constitute a significant step towards bringing a rich laboratory experience online.

The Weblab Collaboration System is centered around a Java Servlet running on the WebLab server. Each client running the WebLab Applet opens a persistent socket connection with the Servlet. Then, the Java Servlet communicates to the WebLab Applets through messages to provide all the collaboration functionality. The advantage in using this system is that it provides synchronous communication, and it is available for any internet connection that is not behind a firewall. Unfortunately the only form of communication through a firewall is HTML, which does not provide real-time communication.

When users first sign on to the system, they are placed in the generic Lobby team. Here, they can see the other users in the Lobby and chat with them. The users can also leave the Lobby to join other existing teams or create new teams. Each team has a token holder that controls the changes in the team test bench. Only the token holder can make modifications so the users pass the token back and forth to take turns making changes. Apart from the team test bench, each user has his own individual test bench where he can carry out his own experiments.

Figure 2 shows the client's interface to the new WebLab Collaboration System. There are two test bench frames on the left. The top frame is the individual domain that provides individual access to WebLab to each user. The bottom frame is the team domain shared by a group of users. The inputs and measurements in the team domain are synchronized between all users in the same

team. Beneath the two test bench frames is a chat frame where users of the same team can communicate with one another. The two frames on the right show the existing teams and the members of the user's current team. In our current prototype, users can create news teams and jump back and forth between existing ones. All of the communication in the WebLab Collaboration System is done in real time.

Weblab Collaboration System is tentatively targeted for deployment in June of 2002.
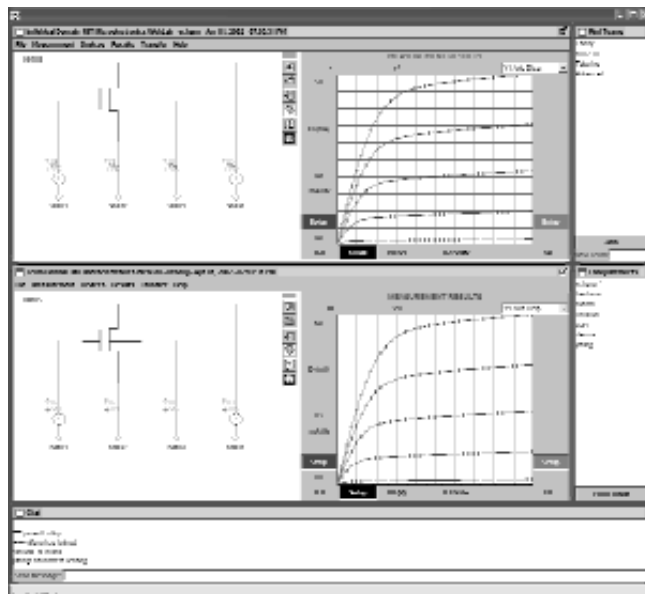

Fig. 2: Client's view of the Microelectronicncis WebLab Collaboration System.