

A Distributed Laboratory: Supporting Practical Experience in Distance Learning

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Abstract - Although the Internet access to multimedia resources is widespread to enable flexible learning, remote access to practical experiences, however, is less common. This paper presents a new paradigm for making laboratory equipment distributed world-wide available to students. The user requirements in terms of quality of service (QoS) and the implementation approaches in terms of efficiency will be presented during the interactive session, in addition to a live demonstration of the on-line facilities.

Introduction

The world-wide spread of the Internet and its general acceptance have brought new opportunities in distance learning as well as in traditional education. A large set of instructional documents and video-taped lectures are nowadays available on-line. Tutors can support remote students using email and video-conference. Classical universities as well as emerging virtual universities cope with this evolution by assessing and proposing synchronous or asynchronous distance curricula. This provides students with more flexibility in both place and time and reduces the campus infrastructure needs [1].

The expositive material typically provided on-line is however not sufficient in many disciplines to support the complete learning experience. Practice is often the key to becoming an effective professional, and this is particularly true in engineering. As a consequence, we have developed a distributed laboratory to support and enhance the delivery of on-line courses on the topic of control engineering [2]. This laboratory enables remote students to perform practical experimentation on real equipment located in various geographical locations. The remote users are provided with real-time video views of the equipment combined with virtual reality representations to reinforce the pedagogical efficiency of the experience and to facilitate the interactivity of the students with the system [3]. Students may carry out a number of pedagogically valuable non-destructive experiments in the distributed laboratory and observe in real-time the results of their actions, individually or collectively.

Every university participating in the distributed laboratory shares with the others one or more state-of-the-art experiments as components of the joint resources available to students. They also share the core implementation tools and the management of the access to the experiences.

Implementation

The implemented client-server architecture upon which the distributed laboratory relies is shown in Figure 1. Multiplatform freeware are provided to the remote users in order to observe and to pilot the laboratory equipment using PCs. The server manages the communication and the I/O peripherals.

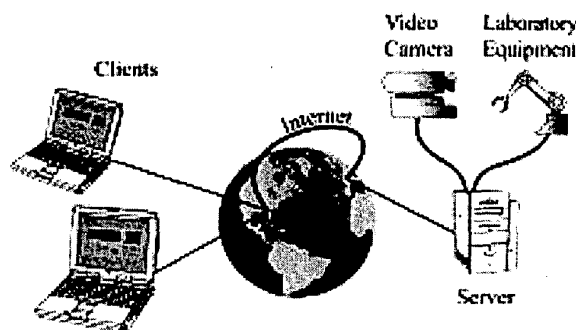


Figure 1: Client-server Architecture.

The distributed laboratory resources are used by students to carry out experimental studies either on campus or remotely, as well as by tutors to present live in-class demonstrations.

The remote access to the on-line resources is available to anyone. Registration and software can be obtained free of charge on a dedicated Web site: <http://iawww2.epfl.ch/>.

References

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