

Internet-based Teleoperation Laboratory

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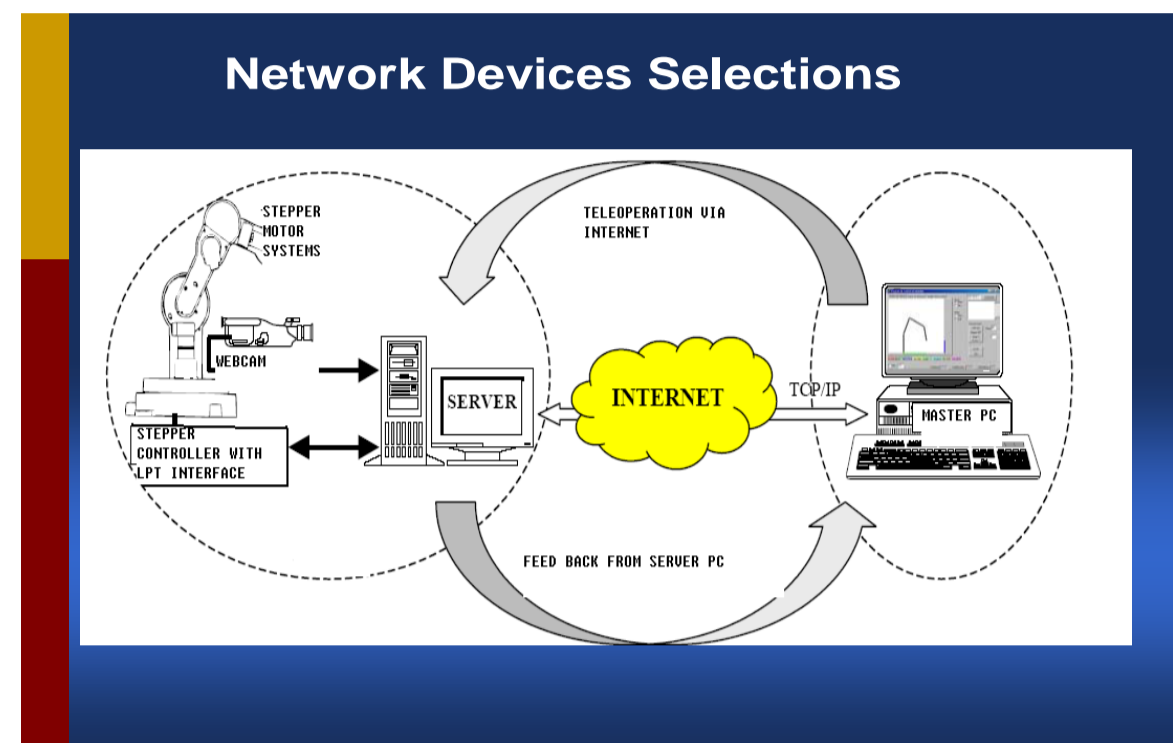
Enhancing Learning and Teaching Environment

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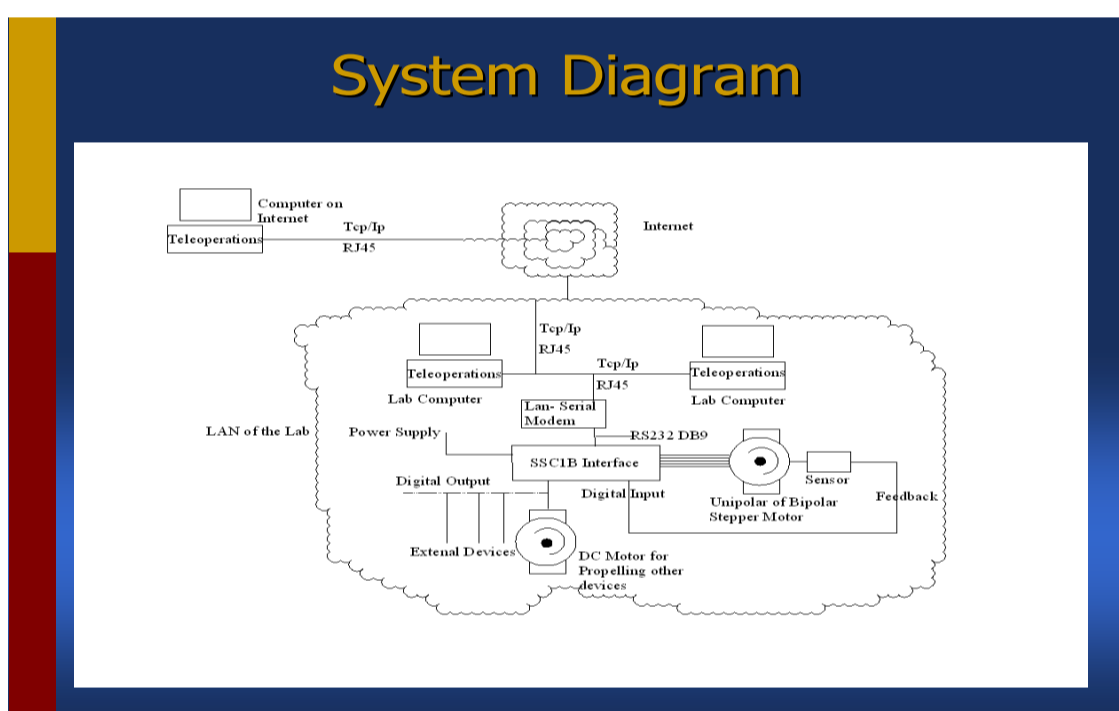
Internet-based Teleoperation Laboratory for Distance Teaching and Learning

Internet in service of science and hands-on experience

Recently, many e-learning systems have been launched that enable their participants to gain knowledge and obtain their degrees by attending virtual lectures and undertaking virtual tests and courseworks. But, even though knowledge matters, it is very weak and hard to apply if it is not based upon an experience. In some fields this experience could be gained in virtual reality (such, for example, as economical systems). In the field of engineering, however, there are two options. One is similar to the one above (simulation using such packages as MATLAB, Circuit Maker, ANSYS and ADAMS). The other option is to build systems using mechanical and electrical components and testing their performance in real conditions in a laboratory.



System Diagram

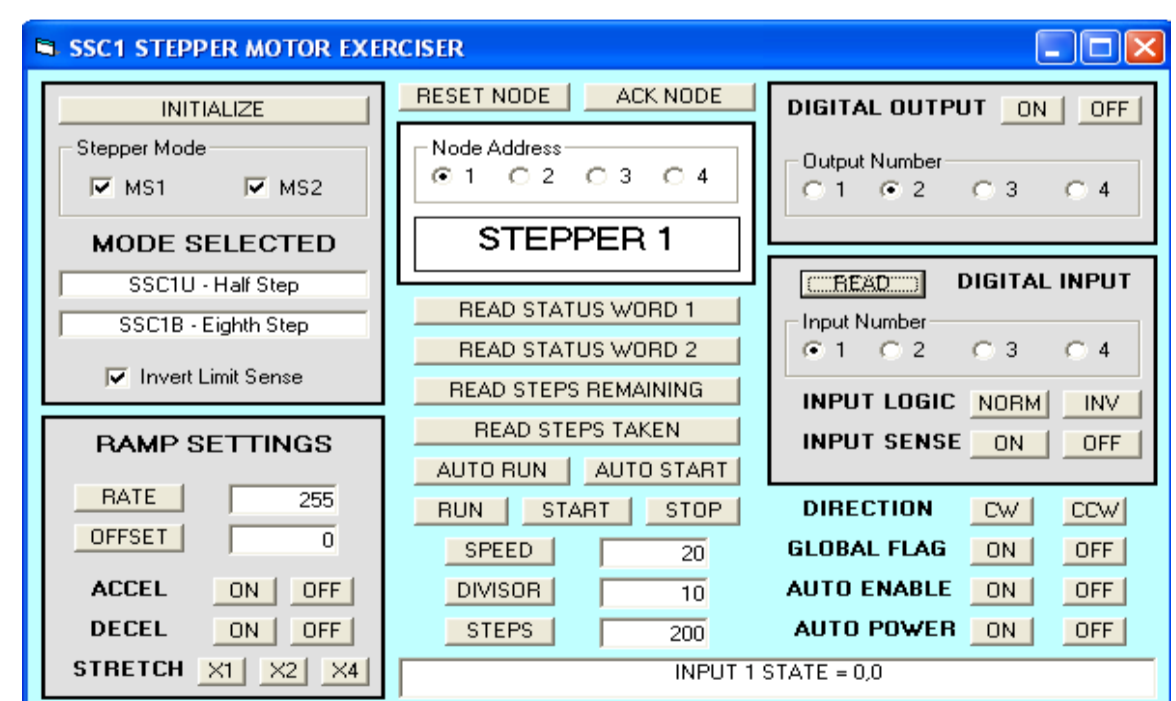


The two merged: Internet operated Laboratories

At the present time students perform all experimental courseworks and laboratory exercises when university workshops and laboratories are open. However, there are many situations when students cannot obtain the access to laboratory equipment due to different reasons, such for example, as disability, illness, restrictions on flexibility of working hours of part-time students or remote location of a place of residence. In order to help students with such problems to participate in real-time laboratory experiments, an Internet-based Teleoperation Laboratory (ITL) is developed at Coventry University.

How the ITL works

The ITL system allows students to perform practical exercises on real laboratory equipment remotely from home. A control algorithm developed by a student is located on his home computer (a client computer), whereas the real equipment is connected to a mini-server in the university laboratory. The communication between the client computer and the mini-server is organised via the Internet. The system allows students to control such equipment as a stepper motor, DC motor, relays, LED's, a lamp and microprocessor. The conversion of the TCP/IP protocol (used in the Internet connection) into the RS232 protocol (used by a driver board) is performed by a modem installed in the university laboratory. The advantage of this system is that no additional hardware is required to be installed on a client's (student's) site. Thus, no any financial cost is imposed on students in order to operate the university equipment from a home computer. In order to monitor the performance of the experiment, the visual feedback (based on a video camera attached to the equipment) is provided. In effect, a student can change parameters of a control algorithm on-line in order to obtain the required behaviour of the system in the real time.



The interface of the control system on a student's computer

The ITL system can also be used as a practical tool for distance learning, remote control of industrial equipment in areas where access is difficult or dangerous for a human. The Internet-based Teleoperation control could also reduce the cost of running a laboratory for the University due to the reduction of the required support of technical personnel. This will especially be appreciated when numbers of students in a class increase.