Chapter 15
The VISIR Open Lab Platform

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ABSTRACT

The VISIR Open Lab Platform designed at the Department of Electrical Engineering (AET), the Blekinge Institute of Technology (BTH), Sweden, is a platform for opening instructional laboratories for remote access 24/7 with preserved context. VISIR is an acronym for Virtual Instrument Systems in Reality. In VISIR laboratories, students perform physical experiments and laboratory work remotely. A unique interface gives them the feeling of “being there.” The platform software is published under a GPL license, and other universities, schools, et cetera, are invited use it to open their laboratories and to participate in further research and development. Apart from BTH, five universities in Europe have set up VISIR online laboratories for electrical experiments and the Indian Institute of Technology Madras in India will set up one soon. A VISIR community has been established. Common projects are initiated, and the sharing of learning material is being discussed. This chapter is a general introduction to VISIR and its possibilities.

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INTRODUCTION

AET started a remote laboratory project as a feasibility study in 1999 in order to provide more opportunities for students to conduct electrical experiments. The vision was to create an online replica of a hands-on laboratory workbench in order to provide free experimentation 24/7 as a supplement for students enrolled in courses including electrical experiments. The background of the VISIR Open Lab Platform is further told in the next section.

Instructional laboratories for electrical experiments are widely used because both majors and non-majors in electrical engineering perform electrical experiments. Most universities around the world providing engineering education have such laboratories, and they look the same, i.e., they are a kind of de facto standard well-known among teachers and students. Such laboratories contain a number of identical workbenches comprised of at least a DC power supply, a function generator, a multi-meter, an oscilloscope, and a solderless breadboard. The brands and the models of the instruments may vary, but the functions of such instruments are standardized. However, laboratory instruction may differ slightly from country to country. The third section presents traditional hands-on laboratory instruction from a Swedish perspective, i.e., the foundation of the VISIR Open Lab Platform.

Opening a hands-on laboratory for remote access means providing a computer-mediated laboratory. VISIR laboratories are client-server applications, and virtual instrument front panels are displayed on the client computer screen. A major difference for a remote student compared with a collocated one is how to wire circuits and how to connect instruments. A remote student needs a sort of telemanipulator instead of a solderless breadboard to perform these manual actions (Asumadu, 2005). The VISIR Open Lab Platform specifies a relay switching matrix and a virtual breadboard combination. The remote student wires the circuit and connects instruments on the virtual breadboard displayed on her computer screen. The physical circuit and the instrument connections are created in the matrix by connecting appropriate relays. However, students need hands-on activities to become familiar with components and real wiring. Home experimentation is a method for off-campus students without laboratory experience to acquire introductory hands-on experience and to become familiar with electronic components, instruments, and wiring. (Long, 2004; Bhunia, 2004). The fourth section further discusses the possibilities and limitations of VISIR in regard to physical experiments and laboratory work in the electrical domain.

The Platform can be extended into other domains, for example, the mechanical. AET has opened a laboratory for vibration experiments to explore the use of the concept in this area. The electrical circuit is replaced by a mechanical structure. Currently, the structure is fixed, but, later on, it will be possible for the students to modify it. In the vibration area, simulators are still less useful as compared to real experiments and more real experiments are indispensable here. Unfortunately, the equipment is so expensive that the average university can only afford one or two workbenches. The laboratory for vibration experiments is covered in the fifth section. Further extension to other areas, e.g., chemistry, will require more advanced telemanipulators and preferably the transmission of taste and odor.

The elements of the VISIR Open Lab Platform described in the sixth section can be used to implement online workbenches mimicking and supplementing hands-on ones, enabling students to perform physical electrical experiments 24/7 within limits set by a teacher using a web browser only. Here, mimicking means that students on their computer screen are able to recognize the instruments and the breadboard, which most of them have previously experienced in hands-on sessions. Such online workbenches supplement hands-on ones and are the means to offer more
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