Chapter 3
Development of a Web-Based Educational Platform to Interact with Remote Mobile Robots

Luis Payá
Miguel Hernández University, Spain

Oscar Reinoso
Miguel Hernández University, Spain

David Úbeda
Miguel Hernández University, Spain

Luis M. Jiménez
Miguel Hernández University, Spain

José M. Marín
Miguel Hernández University, Spain

ABSTRACT

In this chapter the authors approach the problem that hand-on experiments may present in engineering studies and how Internet has become a powerful tool to improve the students' motivation, interaction and degree of learning. Also, the authors address some challenges that must be taken into account in order to improve the effectiveness of the remote laboratories. They have implemented an interactive tool so that students can monitor and control the evolution of a team of mobile robots through Internet. This platform is designed for a subject whose contents are computer vision and robotics, and it allows students to learn and practice the basic concepts on those fields and their relationship. In this chapter they present the architecture and basic features of the platform and the experiences collected during the use of it.

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INTRODUCTION

The experimental formation of the students plays a very important role in *engineering education*. It is necessary that students learn how to use real industry equipment to solve real problems. This way, the laboratories must provide all the necessary resources to put into practice the knowledge the student acquires in the theoretical study of the subjects. However, the traditional laboratory has a set of lacks that may limit the student's learning, such as the rigid scheduling, the limited number of equipments and the evaluation process. The students cannot experiment freely and sometimes they do not dispose of all the time they require to achieve the objectives of the practical lesson. Besides, the cost of the setting and maintenance of the laboratory is usually high, so the contents of the practical lessons will be strongly conditioned by the number of available equipments. This way, several students will have to share the same equipment and they can not experiment freely to improve their own knowledge. Apart from these facts, the traditional evaluation system is carried out through a report that is checked by the professor to verify if the student has reached the desired level of knowledge. However, the student does not know the result of the evaluation until the professor feedbacks to him the result and, in addition, in that moment the student can not modify the report delivered to improve the evaluation.

During the last years, the development and wide spreading of Internet has allowed the creation of new educational models (Dormido, 2004). A usual application of web-based techniques consists in the development of remote laboratories, which allow the students to train with real systems remotely and with a more flexible timetable. However, there are some challenges that must be addressed in order to improve the effectiveness of the remote laboratories, such as reliability, robustness, transparency and the implementation of a friendly user interface with a high degree of interactivity and feedback to the student.

The remote access to the laboratory through Internet to perform experiments solves the problems previously exposed. The students can access the laboratories in a free timetable, from their own house, and disposing of all the time they require to accomplish the aims of the lessons. Also, the students can access the systems individually, independently of the number of equipments available. At last, through an online evaluation system, the student can know the evaluation results in real time and the professor can take into account not only the final results but also the work the student has actually carried out to evaluate the practices. Even, several educative centres could share their equipments and so, the associated expenses (González-Castaño, Anido-Rifón, Vales-Alonso, Fernández-Iglesias, Llamas-Nistral et al, 2001). It is also interesting to highlight the fact that students are nowadays highly motivated to make use of and benefit from the resources available in remote environments through Internet (Stafford, 2005), and these systems can help us to remove barriers to science for people with disabilities (Colwell, Scanlon and Cooper, 2002).

In this chapter we address some examples of web-based laboratories that have been developed and their main features. The central topic of the chapter is the description of the platform we have developed to remotely access the robots in the laboratory. We present the philosophy we have followed during the design, the applications where it can be used and the experiences the students have felt during the use of the tool. Al last, we outline the future developments to be carried out on the tool to improve its functionality and interactivity.

BACKGROUND

The information and communication technologies have been put into practice in recent years in the field of control systems teaching, with successful results, as (Dormido, 2004) shows. These technologies allow us to implement both virtual