

Automation and Control Engineering Laboratory: Students Perspectives

Celina P. Leão, Filomena O. Soares, Vitor Carvalho, and Rosa M. Vasconcelos

Abstract— This paper presents a study carried out in order to evaluate the students' perception in the development and use of remote Control and Automation educational kits. The study is performed under a statistical analysis of a questionnaire. The questionnaire aims to identify and evaluate the students' opinions regarding the use of didactic kits through the Remote Laboratory in the teaching and learning in Automation and Control subjects. The students' reaction to this test was quite positive. The analysis pointed out that successful results were achieved not only in the learning progress on the Automation and Control fields (hard skills) but also on the development of the students soft skills, leading to encouraging and rewarding goals, motivating their future decisions and promoting synergies in team work.

Index Terms— Automation, Control, Engineering Education, Questionnaires, Statistical Analysis.

I. INTRODUCTION

In this paper, regarding Automation and Control education [1], different technologies and learning environments are described, in order to develop illustrative and interactive situations, as for example, virtual processes, local and remote laboratories and interactive animations. Students can develop web-animation for an Automation and Control topic; students can design a particular experimental rig for local and remote control; students can practice topics related to an Automation and Control subject using web-based learning environments, previously constructed by other students; students can solve exercises with real equipment that others have designed and implemented. In all, this is a dynamic learning task: some students actively participate in the development of the learning content and other students simply use and test them. It is regarded as a team work function.

This study explored educational experiences in Automation and Control subjects where students acted as designers and as final users. The basis of this project is the

development of three remote control laboratory kits implemented by the designers' students. These kits were used in Automation and Control lessons as real world examples developed by students for students' knowledge development.

In order to understand the students' response to the learning through Remote Laboratories, in particular in Automation and Control Engineering, a questionnaire was filled by the end-users students and further analyzed under a statistical test.

It is the researchers believe that the end users students' expectation on this new teaching-learning approach is relevant in the continuity and improvement of this methodology.

The paper is divided in four sections. Section 1 gives an overview of the developed study; section 2 details the three kits implemented and tested in the Remote Laboratory; the students' attitude evaluation is presented in section three as well the corresponding statistical analysis to the questionnaire. Finally, section four shows the final comments and conclusion of this study.

II. CASE-STUDY DESCRIPTION

Three case-study kits were designed and implemented in the remote laboratory: the "small intelligent" house (SIH), the velocity control of a DC motor (VCDOM) and the temperature control of a classroom (TCC). A brief description of the different kits is performed in the following.

A. The "small intelligent" house, SIH

The first kit is a frame toy house equipped with several sensors and actuators for controlling daily house functionalities, namely: authorized from door opening, inside stair lights, alarm intrusion system and attic temperature control (Figure 1a) [2]. The control was implemented by a PLC (CQM1H-CPU61) from Omron [3]. The staircase illumination is performed by three push buttons placed at different places through the stairs. For the internal illumination, a motion detector was used and whenever it detects movement, a signal is sent to the PLC, activating the light. Regarding the alarm system, whenever it detects an intrusion, there is a light and sound signal. The control function activates and deactivates the alarm. The sound is performed by an independent circuit, a LM555 based timer circuit [4]. The door has a DC motor and a light bulb that is switched on when the door is opened. The attic temperature control is performed by an Omron temperature controller (ESCK) [3].

To control the door, the alarm, the internal illumination and the staircase illumination it was necessary to develop

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C. P. Leão, is with Production and Systems Department, University of Minho, Campus de Guadalupe, 4710-057 Braga, Portugal. (e-mail: cp@deps.uniminho.pt).

F. O. Soares is with Industrial Electronics Department, University of Minho, Campus de Azurém, 4800-058 Guimarães, Portugal. (e-mail: fsoares@dei.uniminho.pt).

V. Carvalho, is with Polytechnic Institute of Castelo e Ave, Barcelos, Portugal (e-mail: vcarvalho@ipcastelo.pt).

R. M. Vasconcelos is with Textile Engineering Department, University of Minho, Campus de Azurém, 4800-058 Guimarães, Portugal. (e-mail: rvasconcelos@dei.uniminho.pt).

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