

# 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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# Perspectives In Control Engineering

**Sabine Zange**



## **Perspectives In Control Engineering:**

**Control Systems: A Historical and Philosophical Perspective** Ali Khaki-Sedigh, 2025-07-02 This book offers an exploration of the historical and philosophical aspects of the field of control systems engineering By examining the historical and philosophical underpinnings of control systems this book provides a holistic understanding of the challenges faced by control engineers and the need for a multidisciplinary approach Written for engineers scientists and students this book delves into the evolution of control systems theories from ancient times to the present day highlighting the key contributions of influential thinkers and innovators The book also explores how philosophical concepts such as induction falsification and process philosophy have shaped our understanding of control systems The book s unique approach combines historical narratives with philosophical perspectives to provide a deeper understanding of the field By examining the historical development of control systems you will gain insight into the motivations and technological constraints that have influenced the evolution of control systems analysis and design methodologies From the early applications of automation to modern and postmodern control systems which rely on sophisticated algorithms and artificial intelligence this book provides a comprehensive understanding of the field s progress The book concludes by examining the future of control systems through the perspectives of leading control scientists and engineers This comprehensive approach will equip the reader with a deeper understanding of the field to tackle complex problems in control systems analysis and design     Perspectives in Control Engineering Technologies, Applications, and New Directions Tariq Samad, 2001 What important research developments are under way in control science and engineering What are key challenges in control technology applications to different domains What new directions are being charted for control systems Now practicing control engineers and students can find accessible answers to these multifaceted control issues without the intensive mathematical analysis usually found in control systems books This all in one resource brings you state of the art research results by contributors who are leading experts in control You will find insightful introductions and discussions of future trends for a range of control technologies and applications including Computer aided control system design Discrete event systems Intelligent control Industrial process control Intelligent transportation systems **PERSPECTIVES IN CONTROL ENGINEERING** is the one stop volume you need to gain an overview of the latest advances in control systems Sponsored by IEEE Control Systems Society     **From Chaos To Order: Methodologies, Perspectives And Applications** Guanrong Chen, Xiaoning Dong, 1998-06-06 Chaos control has become a fast developing interdisciplinary research field in recent years This book is for engineers and applied scientists who want to have a broad understanding of the emerging field of chaos control It describes fundamental concepts outlines representative techniques provides case studies and highlights recent developments putting the reader at the forefront of current research Important topics presented in the book include     **EBOOK: Management Control Systems: European Edition** Robert Anthony, Vijay Govindarajan, Frank Hartmann, Kalle Kraus, Göran Nilsson, 2013-04-16 Management Control

Systems helps students to develop the insight and analytical skills required of today's managers. Students uncover how real world managers design, implement and use planning and control systems to implement business strategies. The first European edition is specifically aimed at an international audience and it has been thoroughly updated to include the latest developments in the field.

**Mechatronics '98** J. Adolfsson, J. Karlssén, De Montfort University, 1998-08-28 Mechatronics a synergistic combination of mechanical, electronic and computing engineering technologies is a truly multidisciplinary approach to engineering. New products based on mechatronic principles are demonstrating reduced mechanical complexity, increased performance and often previously impossible capabilities. This book contains the papers presented at the UK Mechatronics Forum's 6th International Conference held in Skövde, Sweden in September 1998. Many of these high quality papers illustrate the tremendous influence of mechatronics on such areas as manufacturing machinery, automotive engineering, textiles, manufacture, robotics and real time control and vision systems. There are also papers describing developments in sensors, actuators, control and data processing techniques such as fuzzy logic and neural networks, all of which have practical application to mechatronic systems.

**Control Engineering**, 1994 Instrumentation and automatic control systems. *Perspectives in Control* Dorothee Normand-Cyrot, 2011-11-09 Perspectives in Control comprises twenty one essays by leading experts in the field of control. Most of these were presented as plenary lectures at the colloquium Perspectives in Control held at Paris, June 1998 and organised by the GdR Automatique to mark the occasion of the sixtieth birthday of its founder, Ioan Doré Landau. The book provides a unique opportunity to report the views of the world renowned authorities on some of the directions in which control disciplines might evolve in various areas at the threshold of the twenty first century. The variety of essays, which includes advanced methodological contributions and overview tutorials as well as more philosophical reflections, contributes to the richness of the book. Many aspects of the field are discussed, including adaptive control, passivity concepts, nonlinear control, system identification, supervisory control, diagnosis, emerging applied fields such as mechatronics, air traffic control, power plants and educational devices. Many of the pioneering aspects of Professor Landau's work are covered. The book will be of interest to scientists as a guide to challenging research subjects and of value to applied researchers as a survey of the current state of the art and potential of the field.

**Organisational Behaviour and Analysis** Derek Rollinson, 2008

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concepts and various aspects of action to describe the relations between the structure dispositions functions and goals of technical systems and with human action The author developed this approach as part of his research on Multilevel Flow Modelling MFM He based the framework on concepts of action and means end analysis drawing on existing theories from several areas of study including philosophical logic semiotics and phenomenological approaches to social science Here he applies it to three modeling situations related to the interaction of technical artefacts and humans One involves the relation between designer and artefact another the relation between technical artefact and its user and the third the relation between a natural object and its user All three are relevant for modelling complex automated processes interacting with human operators The book also discusses challenges when applying the foundations for modelling of technical artefacts Overall it provides a cross disciplinary integration of several fields of knowledge These disciplines include intelligent process control human machine interaction and process and automation design As a result researchers and graduate students in computer science engineering and philosophy of technology will find it a valuable resource

**Hydraulic Engineering and Sustainable City Development III** Xun Wu, Wei Zhen Chen, Wei Jun Yang, Jian Guo Liang, 2014-09-19 Selected peer reviewed papers from the 2014 3rd International Conference on Civil Architectural and Hydraulic Engineering ICCAHE 2014 July 30 31 2014 Hangzhou China Ludendorff's Own Story Erich Ludendorff, 1919 **Engineering**, 1920 *The Tool Engineer*, 1941 Proceedings American Society for Engineering Education. Conference, 1994 Proceedings of the IEEE Workshop on Real-Time Applications, Washington, DC, July 21-22, 1994 IEEE Computer Society. Technical Committee on Real-Time Systems, 1994 *Combined Embodiment Design and Control Optimization* Julie A. Reyer, 2000 *Proceedings*, 1995 **Railway Electrical Engineer**, 1927

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