

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 (SHH), the velocity control of a DC motor (VCDCM) 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, SHH

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

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Perspectives In Control Engineering:

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monitoring networked control systems and etc 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

Perspectives in Dynamical Systems II – Numerical and Analytical Approaches Jan Awrejcewicz,2024-06-18 This proceedings volume gathers selected peer reviewed papers presented at the Dynamical Systems Theory and Applications International Conference DSTA 2021 held virtually on December 6 9 2021 organized by the Department of Automation Biomechanics and Mechatronics at Lodz University of Technology Poland This volume focuses on numerical and analytical approaches while Volume I concentrates on studies on applications Being a truly international conference this 16th iteration of DSTA received submissions from authors representing 52 countries The program covered both theoretical and experimental approaches to widely understood dynamical systems including topics devoted to bifurcations and chaos control in dynamical systems asymptotic methods in nonlinear dynamics stability of dynamical systems lumped mass and continuous systems vibrations original numerical methods of vibration analysis non smooth systems dynamics in life sciences and bioengineering as well as engineering systems and differential equations DSTA conferences aim to provide a common platform for exchanging new ideas and results of recent research in scientific and technological advances in modern dynamical systems Works contained in this volume can appeal to researchers in the field whether in mathematics or applied sciences and practitioners in myriad industries *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 *erspectives 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 **Control Theory** Francisco Miranda,2015 Control Theory is a field of applied mathematics and engineering that deals with the basic principles underlying the analysis and design of control systems Controlling a system

means to influence the behavior of the system in order to achieve a desired goal Control theory deals with the use of a controller to achieve this purpose Control theory has been recognized as a mathematical subject since the 1960 s it has contributed to scientific and technological progress in many areas over the last few decades Control theory has been extensively used in modern society from simple applications such as temperature devices to sophisticated systems in space flight The aim of this book is to solve different problems concerning control systems This book joins a number of recent works in control theory and is useful as a source for researchers in this field concerning control systems

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Dynamical Systems in Theoretical Perspective Jan

Awrejcewicz,2018-09-01 This book focuses on theoretical aspects of dynamical systems in the broadest sense It highlights novel and relevant results on mathematical and numerical problems that can be found in the fields of applied mathematics physics mechanics engineering and the life sciences The book consists of contributed research chapters addressing a diverse range of problems The issues discussed include among others numerical analytical algorithms for nonlinear optimal control problems on a large time interval gravity waves in a reservoir with an uneven bottom value distribution and growth of solutions for certain Painlevé equations optimal control of hybrid systems with sliding modes a mathematical model of the two types of atrioventricular nodal reentrant tachycardia non conservative instability of cantilevered nanotubes using the Cell Discretization Method dynamic analysis of a compliant tensegrity structure for use in a gripper application and Jeffcott rotor bifurcation behavior using various models of hydrodynamic bearings Essays on Control H. L. Trentelman,Jan C Willems,1993-07-01 **Essays on Control** H. L. Trentelman,Jan C. Willems,1993 The acquisition of knowledge about systems and the processing of information about them are key features of modern control engineering technology This is the theme for a volume of articles setting out the scope and content to be covered at the European Control Conference ECC 93 in Groningen the Netherlands The book provides a broad overview of the field of control and a discussion of its development both from a theoretical and an engineering perspective It contains the fully developed articles on which the plenary addresses and mini courses of the Conference are based *Fundamentals of Control Engineering* Aniruddh Mohan,2025-02-20 *Fundamentals of Control Engineering* explores the evolving landscape of control engineering covering classical principles and advanced methodologies Authored by experts this book provides a comprehensive understanding of control systems principles applications and challenges It adopts a multifaceted approach covering classical control theory modern strategies and specialized topics like quantum control intelligent systems and biomedical control Each chapter balances theoretical principles with practical applications making it suitable for students researchers and engineers The inclusion of advanced topics such as quantum control and intelligent systems reflects emerging technologies reshaping the field Practical examples and case studies showcase control engineering's relevance in various industries while interdisciplinary perspectives emphasize integrating control principles with fields like AI quantum mechanics and healthcare The book also addresses ethical considerations reliability issues and quantum coherence providing a holistic view of the field's opportunities and hurdles *Fundamentals of Control Engineering* is a valuable resource for understanding the multidisciplinary facets of control systems ideal for students researchers and professionals **The Engineering of Large Systems**,1998-09-25 Since its first volume in 1960 *Advances in Computers* has presented detailed coverage of innovations in hardware and software and in computer theory design and applications It has also provided contributors with a medium in which they can examine their subjects in greater depth and breadth than that allowed by standard journal articles As a result many articles have become standard references that continue to be of significant lasting value despite the rapid growth

taking place in the field This volume is organized around engineering large scale software systems It discusses which technologies are useful for building these systems which are useful to incorporate in these systems and which are useful to evaluate these systems **The Tool Engineer** ,1941 *Fuzzy Logic in Artificial Intelligence* Anca L. Ralescu,James G. Shanahan,1999-07-28 This volume constitutes the thoroughly refereed post workshop proceedings of an international workshop on fuzzy logic in Artificial Intelligence held in Negoya Japan during IJCAI 97 The 17 revised full papers presented have gone through two rounds of reviewing and revision Three papers by leading authorities in the area are devoted to the general relevance of fuzzy logic and fuzzy sets to AI The remaining papers address various relevant issues ranging from theory to application in areas like knowledge representation induction logic programming robotics pattern recognition etc

The Building News and Engineering Journal ,1904 *Dynamics of Disasters* Ilias S. Kotsireas,Anna Nagurney,Panos M. Pardalos,Arsenios Tsokas,2021-03-09 Based on the Fourth International Conference on Dynamics of Disasters Kalamata Greece July 2019 this volume includes contributions from experts who share their latest discoveries on natural and unnatural disasters Authors provide overviews of the tactical points involved in disaster relief outlines of hurdles from mitigation and preparedness to response and recovery and uses for mathematical models to describe natural and man made disasters Topics covered include economics optimization machine learning government management business humanities engineering medicine mathematics computer science behavioral studies emergency services and environmental studies will engage readers from a wide variety of fields and backgrounds

Combined Embodiment Design and Control Optimization Julie A. Reyer,2000 **Computational Intelligence and Optimization Methods for Control Engineering** Maude Josée Blondin,Panos M. Pardalos,Javier Sanchis Sáez,2019-09-20 This volume presents some recent and principal developments related to computational intelligence and optimization methods in control Theoretical aspects and practical applications of control engineering are covered by 14 self contained contributions Additional gems include the discussion of future directions and research perspectives designed to add to the reader s understanding of both the challenges faced in control engineering and the insights into the developing of new techniques With the knowledge obtained readers are encouraged to determine the appropriate control method for specific applications Viewpoints ,1928

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