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HABILITATION THESIS

– ABSTRACT –

Engineering and Managerial Aspects of User Interaction Design in Industrial Applications

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This habilitation thesis was developed by assoc.prof. Mircea Fulea, Design Engineering and Robotics Department, Technical University of Cluj-Napoca, to obtain this qualification according to the Romanian legislation. The thesis comprises two main sections, which summarize the scientific, professional and academic results, and the career development plans.

The first thesis section, covering the time interval from obtaining the PhD qualification until now, presents – under the form of case studies – the scientific, professional and academic results which the author has obtained, following two core research directions: (1) user interaction design in industrial applications, and (2) operations management and technical project management.

The second thesis section highlights the career development plans, discussing the development of three components: educational and professional, scientific and research, and institutional management, and also discussing how the author envisages to correlate these three core components.

The introductory chapter presents the author's perception on the role of PhD student coordinator, and discusses the grounds and reasons for choosing the two directions in which the author researched during the reporting period.

The first chapter highlights the scientific, professional and academic results obtained by the author since he obtained the PhD degree (2011).

The second chapter presents the first core research direction, *User Interaction Design in Industrial Applications*. The first subchapter grounds the *usability* and *user experience* keywords in the context of designing the interaction with industrial applications, and continues with a case study on designing the user interaction within a robotized application for cardiac rehabilitation, and with a case study on improving the quality of a process by using interaction design principles. The second subchapter discusses the industrial (software) application flexibility and reconfigurability as a need of customizing the results / outputs these applications provide to their users. It includes a case study on control architectures for reconfigurable robotized cells and one on managing the palletizing patterns in a flexible robotized application. The third subchapter approaches the product-service system paradigm as an innovative business model for which the user interaction (in industrial applications) has to be thoroughly planned. The two case studies included in this subchapter present a reconfigurable robotized palletizer implemented as a product-service system, and the emotional aspects related to the functionalities of a product-service system in the railway modelling domain.

The third chapter presents the *Operations Management and Technical Project Management* research direction. The first subchapter focuses on innovation management and contains a case study centred on a research project (coordinated by the author), entitled *innDrive – Integrated Innovation Management System*, carried out in the time interval 2014-2017. The project aim was to develop a novel information system, based on a multi-layer innovation model (including innovation systems covering all key business processes), addressed to SMEs, for supporting them in implementing comprehensive, multi-dimensional innovation management systems. The second subchapter presents a case study on the *Market-IT* FP7 research project in which the team the author was part of developed a software application to support SMEs from the electromechanical domain in structuring and

systematizing their product, service or process innovation. The third subchapter presents approaches on process improvement and discusses a case study related to prioritizing internal development projects within SMEs, a case study related to a framework for assessing business line correlations, a case study related to improving the design process of a software application, and one related to a framework for defining the vision of a service. The fourth subchapter presents the development of the Technical Project Management master program, run in a strategic partnership with Emerson, which the author of this thesis coordinates, in a team with two colleagues from the Design Engineering and Robotics department.

The fourth chapter presents the academic career development directions that the author of this thesis plans to undertake: research, educational and professional, and institutional development, and also discusses how the author envisages to correlate these directions.

The final chapter presents the conclusions, and the thesis ends with the publication list which contains all the scientific papers and results obtained by the author after finishing his PhD thesis.