
CHALLENGES FOR SOFTWARE ENGINEERING IN AUTOMATION

A PREPRINT

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ABSTRACT

This paper gives an introduction to the essential challenges of software engineering and requirements that software has to fulfill in the domain of automation. Besides, the functional characteristics, specific constraints and circumstances are considered for deriving requirements concerning usability, the technical process, the automation functions, used platform and the well-established models, which are described in detail. On the other hand, challenges result from the circumstances at different points in the single phases of the life cycle of the automated system. The requirements for life-cycle-management, tools and the changeability during runtime are described in detail.

Keywords Automation,Software Engineering, Models,Tools

1 Introduction

Automation deals with the automation and control of systems, consisting of hardware and a growing software part. An automated system is composed of a technical process, which runs in a technical system that contains all necessary technical components required for automating the technical process, the automation system and the process and operating personnel,see The technical system can be either a technical product, e.g.a sensor itself or a washing machine,or a technical plant.Technical products are mass products with a limited number of sensors and actuators and a high degree of automation, for example, home appliances. Due to the special structure of the systems and the boundary conditions concerning process, hardware and interaction with the technical process and operating personnel, specific requirements arise.

2 Automation & Daily life

Automation systems are nowadays an inseparable part of everyday life,in various application domains.The pervasive nature of such systems, their impact on humans 'physical and social environment and the corresponding safety/security issues necessitates them, more specifically, their software and hence the software engineering to fulfill strict quality standards. However, the combination of software and hardware and the distribution of the systems in a wide range of different application domains increase the systems' complexity and lead to complex correlations in software engineering, which become more and more difficult to handle. Adding to this complexity is the increased demand for high flexibility

in today's software solutions, which is needed to enable the adaption to ever changing market requests. Furthermore, the development of these systems requires the collaboration of diverse disciplines, whose target oriented coordination is a crucial criterion for success. Therefore, it is essential to gain a common understanding of the necessary requirements that have to be satisfied during the engineering of the system. In software engineering of automation systems, crucial requirements arise from the entire life cycle of the automated systems—from the beginning of the engineering, over the run-time, to the end of its operation. Based on the described characteristics, existing requirements for software engineering in automation from today's perspective will be identified. These requirements shall lead to a better understanding and, thus, to a more successful and constructive collaboration of automation and software engineering.

3 Challenges to software engineering automation

software engineering of automation systems, crucial requirements arise from the entire life cycle of the automated systems—from the beginning of the engineering, over the run time, to the end of its operation. Based on the described characteristics, existing requirements for software engineering in automation from today's perspective will be identified. These requirements shall lead to a better understanding and, thus, to a more successful and constructive collaboration of automation and software engineering. The state of the art in Software Engineering in automation is summarized in Vyatkin[1]. A view group work on different sub-challenges, i.e. Estevez, Marcos et al.[2], Biffi and Zoitl [3], and Thramboulidis [4] and on software engineering for plant and manufacturing systems[5]. But a more general and joined approach including colleagues from computer science seems to be helpful; this is one of the reasons why the authors summarize the domain specific challenges as a basis for further joined research. The following section highlights the basic relations and refines the requirement categories. In the third chapter, the specific challenges in automation software engineering are explained in detail. Finally, a summary of existing and further challenges will be discussed.

3.1 Problems

- Usability Challenges
- Changeability during Run time
- Specific Platforms and Their Constraints
- Closed Loop Control and Real Time Behavior for a Safe and Secure Operation
- Life-Cycle-Management

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