

A methodology for formulating and exploiting innovative technologies for collaborative robots in a manufacturing setting

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Abstract— This paper presents a methodology that enables the exploitation of innovative technologies for collaborative robots through user involvement from the beginning of product development. The methodology will be applied in the EU-funded project *CoLLaboratE* that focuses on how industrial robots learn to collaborate with human workers in order to perform new manufacturing tasks. The presented methodology is preliminary and will be improved during the project runtime.

I. INTRODUCTION

In recent years, the work performed in the area of human-machine cooperation has focused on facilitating and advancing Human-Robot Collaboration (HRC) solutions, in environments where both humans and robots exist and collaborate [1]. The proposed methodology aims at identifying and describing technologies within the *CoLLaboratE* project, to design, develop and further exploit them. The target users for the system are the manufacturing industries in need of flexible and affordable automation systems. The project provides new and advanced tools for introducing robustness and flexibility to robotic assembly platforms, that will closely interact with end-users. It follows a User-Centered Design (UCD) approach, by involving end-users in developing an efficient solution that is easy and flexible to use and deploy. Four use cases have been identified within *CoLLaboratE*, from different industries and applications.

II. METHODOLOGY

A mixed methodology with a combination of qualitative and quantitative methods [2] is applied, to analyze and exploit innovative technologies for collaborative robots. The exploitation framework for the proposed methodology is based on a theoretical approach, which is a combination of the *Why, What and How* models [3]. This model analysis the *What, How, Why* sequence, and continues in two directions: UCD in product and technology development; and company perspective in business strategy development. The *Why* represents recommendations and user needs. Consequently, it offers the starting point for the design and the purpose of the business. The proposed exploitation framework (Fig. 1) serves as a basis for the *CoLLaboratE* project, and yet, for providing a more generalized method. The proposed framework suggests a 3-step process. This is initiated by identifying technologies that are being developed in the project and includes considering the formulated user

requirements (the *Why*). Technology profiles are formulated by asking technology and use cases representatives, questions on e.g. technology area, functionalities, key components and integration models, applications, implementation process and potential market. The second step (the *What*), focuses on describing and evaluating the identified technologies and building the commercialization strategy. The third step (the *How*) of the framework focuses on reaching out to more potential users of the technology, for further evaluation and market feedback, in order to set up detailed design elements and further technology improvement.

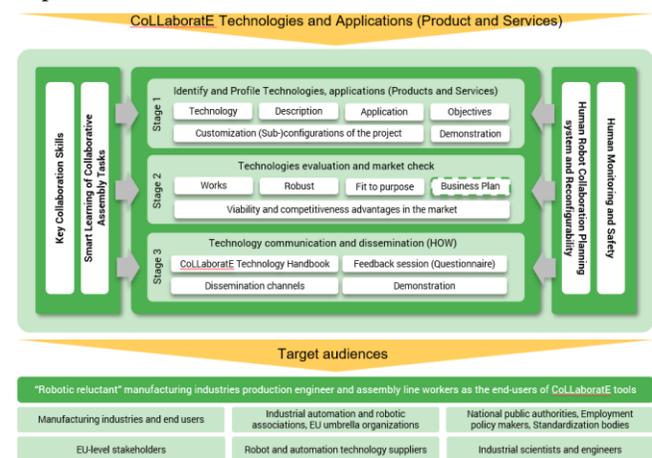


Figure 1. Exploitation framework

III. RESULTS AND CONCLUSION

A first result is the presented novel methodology that, by involving end-users early in the design and development, can support the exploitation of technology. Eventually, the results will consist of a technology index for collaborative robots, to be applied across different industrial settings.

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