How to get rid of knowledge engineers and be happy: a HRC use case

Elisa Foderaro[1], Amedeo Cesta[1], Alessandro Umbrico[1] and Andrea Orlandini[1]

[1] *Institute of Cognitive Science and Technology, National Research Council of Italy. {name.surname}@istc.cnr.it*

The deployment of Collaborative Robots (cobots) in manufacturing scenarios requires to address multiple challenges. It is of paramount importance to endow cobots with the ability of quickly adapting behaviours to actual state of the environment and to keep the user safe and engaged during the interaction. The development of tools that facilitate the integration (and interaction) of AI planning and robotics entails different skills that are all necessary to effectively address the underlying variety of control issues, spanning from low-level control to decisional (and behavioral) autonomy [1]. A crucial knowledge engineering problem is the lack of a generally accepted modeling methodology entailing many potential back-and-forth (re)work over models before defining a proper robot control specification. Some attempts to connect AI and Robotics environments have been made (see, e.g., [2, 3, 4]). These solutions require robotic experts to have some expertise in planning specification. There is still a need for knowledge engineering tools to facilitate communication and interaction between AI and Robotics engineers as well as with domain experts, i.e., production engineers which may be not familiar with planning and robotics technologies and unable to define planning models.

A software tool, called TENANT (Tool fostEriNg Ai plaNning in roboTics) [5], has been proposed to assist production engineers in the definition of goals, tasks, and operational constraints with the aim of providing the automatic generation of planning specification for robot control in collaborative scenarios. The representation framework behind TENANT relies on a state-of-the-art ontology called SOHO (Sharework Ontology for Human-Robot Collaboration) [6]. SOHO provides a "standard" semantics to represent production-related knowledge and, therefore, interpret production engineers input. SOHO supports a contextual and hierarchical structuring of knowledge. This structure is encapsulated by TENANT to collect production-related information, use it to store knowledge and implementing an automatic modeling process. TENANT is now extended proposing a domain-independent and complete knowledge engineering approach for the synthesis of planning models. It aims at constitute a tool to support different human experts in the definition of a complete (and abstract) representation of specific production knowledge of a manufacturing shop-floor. The framework OPIS [7], used in real manufacturing scenarios, is particularly relevant with respect to our objectives. It proposes a well structured formalism describing production resources and operations carried out within manufacturing systems. However, OPIS relies on a specialized description language that can be difficult for domain experts. Therefore, we consider it as a basis to extend the knowledge structure in TENANT extending the concepts considered so far. In the video a new TENANT implementation based on SOHO+OPIS is presented with the aid of realistic collaborative scenarios with a human and an operator cooperating to perform an assembly process.

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