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Knowledge management for space activities in the digital era (2)

Author: Ms. Audrey Berquand
University of Strathclyde, United Kingdom

Mr. Francesco Murdaca
University of Strathclyde, United Kingdom

Dr. Annalisa Riccardi
University of Strathclyde, United Kingdom

Mr. Tiago Soares
European Space Agency (ESA), The Netherlands

Mr. Sam Gerené
Rhea Group, Belgium

Mr. Norbert Brauer
Airbus Defence and Space SA, Germany

ONTOLOGY BASED COGNITIVE ASSISTANT FOR EARLY DESIGN OF SPACE MISSIONS

Abstract

Cognitive Assistants (CAs), decision support tools based on computational intelligence methods, have the potential to enhance the productivity of human experts by providing new insights on large amount of data accumulated in their field. CAs are already successfully being used in the aeronautical, automobile, agricultural, legal and medical fields. However in the space field few expert systems or only incomplete ontologies have been developed so far. At the times of Big Data analytics space mission design can also benefit from computational intelligent methods, capitalizing on previous, present and future studies and lessons learned to support experts in the design process. This paper describes the early stages of the development of an ontology based expert system, also called Design Engineering Assistant (DEA), for the preliminary design of space missions in the frame of concurrent engineering sessions. An expert system is an artificial intelligence program built for a specific domain that is able to use its knowledge to respond properly to users' queries. The architecture of an expert system usually consists of three main components: a knowledge base, an inference engine and a user interface. In the frame of this study automatic or semi-automatic ontology learning techniques are applied to build a complete space mission ontology taking advantage of accumulated unstructured and structured data from the space domain. The primary targeted users are space systems and subsystems experts taking part into concurrent engineering studies. Concurrent engineering is a centralized way of engineering which significantly accelerates and improves the quality of design outputs at the early stages of mission design. The experts iterate on the design during common study sessions thus greatly enhancing the communication between the different subsystems. This paper presents how a cognitive assistant could support space systems experts, whether by relieving their workload, by allowing them to capitalize on pasts designs and lessons learned or by providing hints of alternative design solutions during the design iteration.