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EPES: Engineering System for Optimization of Product life-cycle through adapted eco-services

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Abstract

EPES system will consist of a set of interoperable ICT tools, which will enable the manufacturing and engineering companies enter into a continuous process of upgrading their products along their life cycle within the frame of the Virtual Factory and Product Service System concept, through a configurable and adaptable set of software services. The services will focus on improving the performance of products in operation taking into account different knowledge based aspects as reliability, availability, maintainability, costs, productivity, quality, energy efficiency, environmental impact, working environment, etc. In this regard, and having as a reference an industry driven Business Case focused on the windmill sector, the approach followed by EPES to generate and develop high added value services to support the windmill farms maintenance will be discussed. The capabilities resulting from the research will enable the capitalization on trustable global and local Sustainability Intelligence. Product engineering teams will be able to exploit this intelligence to adapt design, operation and disposal strategies through managed “eco-constraints” relevant to their market contexts.

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1. Introduction

Optimization of the life-cycle of existing industrial products is very much dependable on the possibilities of continuously updating them by incorporating edge technologies, replacing worn out pieces by new improved ones, even conceptually changing components of the product itself.

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New industrial products will surely benefit from the possibilities of incorporating incoming and more sustainable best available technologies. However, the highest impact will result in extending the operating life of existing products towards the “Long Life Eco-products” concept as described in Sorli et al. (2012) and Heilala et al. (2012). For instance, traditional maintenance systems just cared on replacing worn out parts without a knowledgeable analysis of the upgrading possibilities that may rise from the concepts of sustainable development. Hence, EPES eco engineering system (EPES Project 2011) goes, in fact, far beyond these traditional maintenance systems, incorporating knowledge (eco-constraints and objectives) coming from the environmental and social bottom lines, aimed at achieving a continuous improvement of product operation and end-of-life use so as to cover upcoming requirements related to several sustainability aspects, such as:

- Improvement of energy efficiency, environmental impact, waste management, etc. during the operating life of the product
- Enhancement of the useful life span of the product
- Improvement of environmental impact by disposal at the end of life; increasing re-use (re-manufacturing, overhauling, components transferring, etc.) and reducing waste
- Optimization of productivity (availability), reliability, maintainability
- Reduction of overall costs in operation
- Improvement of working environment: more friendly products, easier to use and maintain, and improved workers’ health and safety conditions
- Collaborative Knowledge Management on the products by means of the Virtual Factory (Camarinha-Matos et al. 2008) by integration of actors: producer, customer and user, maintenance service, technology providers, experts and researchers, aiming at product design improvement by knowledge reuse

EPES will focus on the research and development of novel methods and tools for the conceptualization of an eco-process engineering system, which will constitute a comprehensive platform that will enable a dynamic composition of “eco-advice” services adaptable to the different products and operating conditions. This framework will leverage a sustainable life-cycle management of existing products in operation.

2. EPES European Project: Eco-Process Engineering System for composition of services to optimize product life cycle

Upon the above mentioned needs, EPES project (September 2011 – September 2014) was submitted and, following a successful evaluation, got funded by the European Commission under contract FP7-FoF-ICT-2011.7.3-285093. The project approach is to develop a set of software components, as shown in Fig. 1, which will constitute an Eco Process Engineering System enabling the industrial companies, including SMEs, to generate innovative dynamic life-cycle services oriented to follow-up a continuous improvement of product operation and end-of-life use.

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