Know4Car

An Internet-based collaboration Platform for Managing Manufacturing Knowledge

Newsletter

Issue 4 | May 2014

Assembly Line Balancing

One of the most important outcomes of the Know4Car project is the development of an agent for the assembly line balancing. The balancing of the assembly line is one of the core phases of the design process that deals with the efficient assignment of processes among the workstations, considering a series of criteria, such as cycle time and production cost. The ALB agent that was developed to support the collaborative design of a line considers information stored in the data repository of the Know4Car platform. In detail, the ALB agent takes as input all processes for the assembly of the product including precedence and compatibility relations, as also all different process configurations. The user only needs to select the products or variants to be assembled for the line. All other relevant information are automatically retrieved from the PPR Library, including cost and time information for all above mentioned process configurations. Then, a series of alternative process sequences are generated by the ALB agent based on the different process configurations. Finally, the ALB agent evaluates the valid process sequences against some user-defined conflicting criteria such as the desired cycle time, the number of stations and budgetary restrictions that are defined through weight factors. Based on the evaluation criteria, the best line balancing option, as also a number of alternative results are stored in the PPR library.

The assembly line balancing task is implemented through a software agent as a part of a cloud-based system, contributing in the reduction of time and effort required for sharing results between agents that perform certain tasks in different process planning phases.

Assembly Sequence Generation

The development of an assembly sequence generation algorithm capable of supporting engineers in assembly operations, is one of the most important outcomes of the Know4Car project so far. The assembly sequence generation algorithm is based on a six step methodology that has as input an assembly CAD and as output an XML file containing the assembly sequence. The basic part of the algorithm is the execution of intersection tests that are used for the calculation of the disassembly sequence of parts as well as their subtraction paths. After the disassembly sequence and subtraction paths are generated, they are reversed resulting in the assembly sequence and insertion paths of the parts. Through the six step methodology depicted in Figure 2, the final assembly sequence information are collected in a standard XML structure that can be further communicated to an AR component in order to assist human operators in real-time for the assembly of a product through virtual instructions.

News

Know4Car General Assembly
When: 21-22 May, 2014
Where: AB Volvo, Göteborg, Sweden-
Contact Name: Dr. Thomas Lezama

World Manufacturing Forum 2014
When: 1-2 July, 2014
Where: Milano, Italy

Recent Publications

Multi-Criteria Assembly Line Design under Demand Uncertainty, Nikolaos Papakostas, George Pintzos, Christos Giannoulis, Nikolaos Nikolakis, George Chryssolouris. Proceedings of the 8th International Conference on Digital Enterprise Technology - DET 2014

Managing mechatronic proucts variability with a domain specific approach. Amir Hossein Ebrahimi, Pierre E.C. Johansson, Kristofer Bengtsson, Knut Åkesson. Mechatronics 2014.

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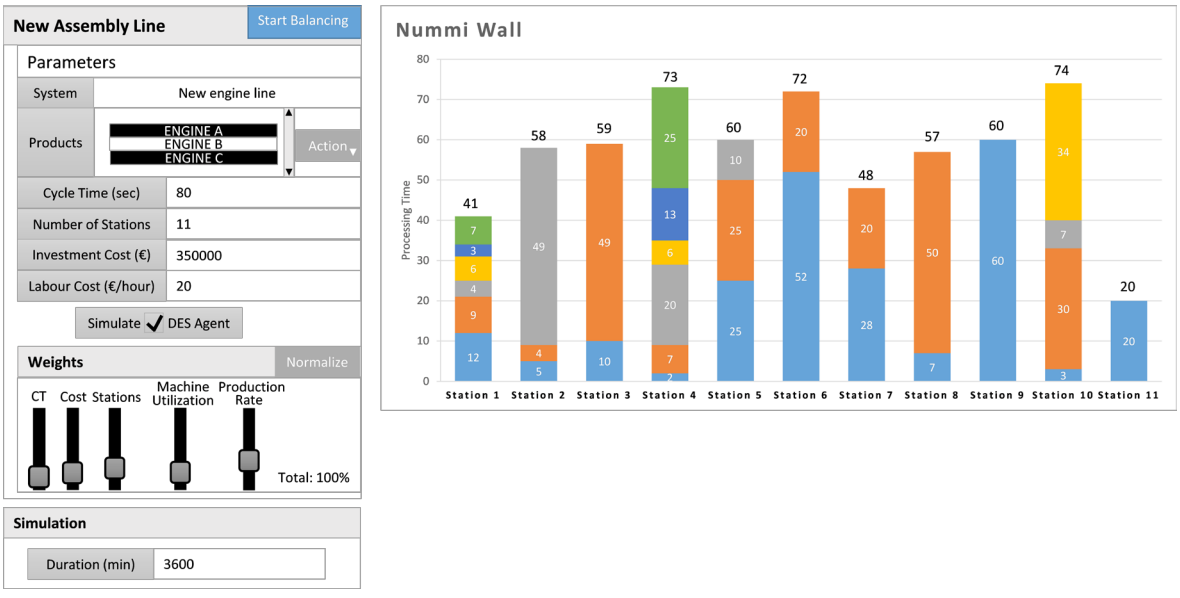

Figure 1. Screen caption of the Web user interface for the assembly line balancing.

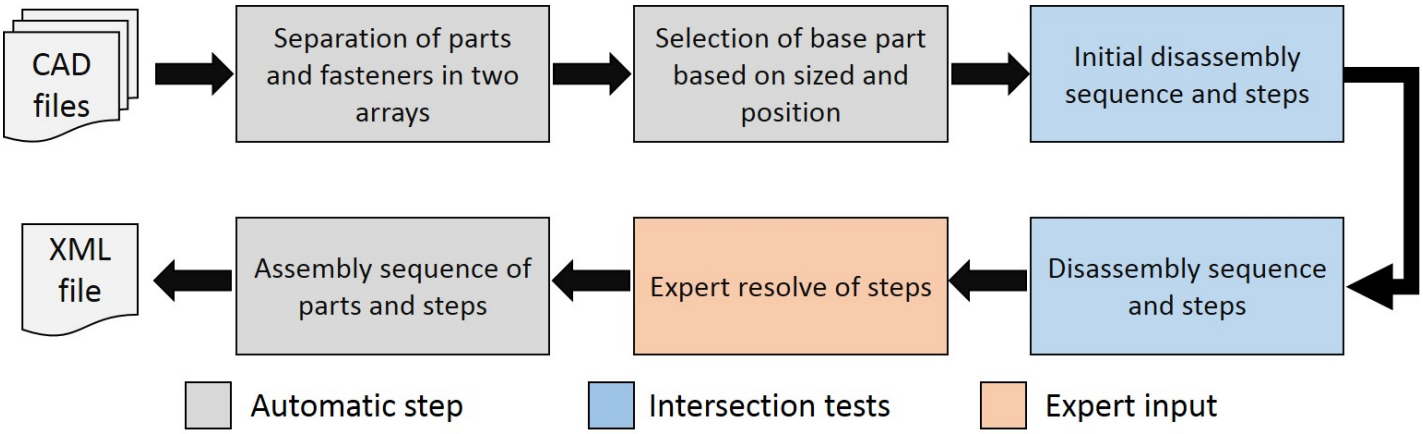

Figure 2. Six step methodology for assembly sequence generation.

Information Extraction

The information extraction mechanism is a key outcome of the K4C project that was developed as an effort to support organizations participating in extended engineering environments to easily share information residing in their engineering files with partners that own different commercial platforms. The extraction mechanism has been developed in order to transform data from several types of engineering files into common readable information for all involved partners in a collaborative project. The main focus of the mechanism is given to the standardization of process related engineering information. Therefore, much effort was dedicated to the extraction of production information from process, engineering and other product manufacturing files, in order for a common representation of data to be shared within all participants of a collaborative engineering project in a semi-automated way.

The extraction of information is implemented during the upload of a file to the system. For instance, an engineer uploads a product assembly file to the system and the service extracts all useful parameters (components, processes, resources, etc.) for the product. Then, the user may store the parameters in the PPR Library for future use, as also create a new product/line or update the data in existing ones (Figure 4). The integration of the extraction service in the platform is considered significantly important towards the elimination of non-adding value tasks for engineers in modern extended engineering environments.

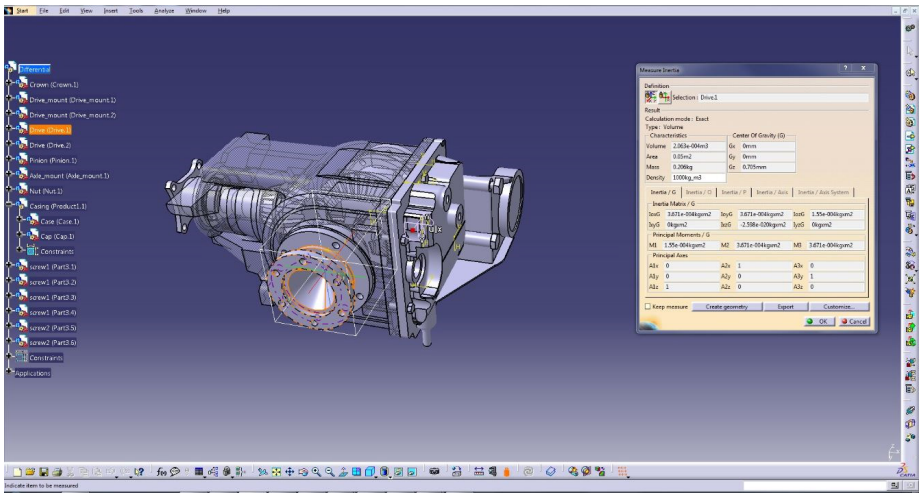

Figure 3. Screen caption of the assembly sequence generation process.

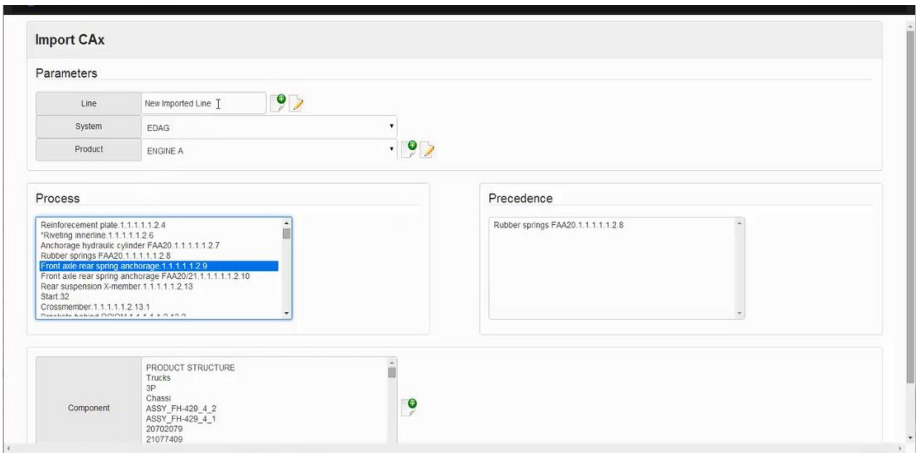

Figure 4. Screen caption of the Information extraction web-application