SEVENPRO – Semantic Virtual Engineering Environment for Product Design

PROJECT PRESENTATION

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Presentation overview

- Challenges of information management in industrial context
- Semantic representation of knowledge
- SEVENPRO overview
- SEVENPRO modules and functionalities
- Key ideas
Industrial context

- Ever more complex and customised products
- Shorter product development cycles
- Strong competition in a global market

⇒ Need for:
  - More efficient product engineering in time and cost
  - More added value and personalisation in products
  - Integration among engineering tools.
  - Integration of knowledge not only inside engineering teams but within the whole organisations
  - Better management of knowledge -> reuse
Challenges

Huge amount of information
Distributed among different human groups and ...
... different computing infrastructures and supports
Sometimes, knowledge has no “computer form”
From information to knowledge

Getting from information to knowledge is complicated

Knowledge is hardly re-used because access is difficult (many times based on personal relationships)

Work and efforts often repeated in different islands

Partial and not up-to-date solutions
Traditional solutions

Each puzzle part is in a different COMPUTING language involving database tables, arrays, XML ...

Gap between field knowledge and the programmers
Programmer ends up being a field expert or vice-versa
Additional problem: knowledge and needs do evolve
Applications have a hard time keeping the pace
The objective of SEVENPRO is to develop technologies and tools supporting deep mining of product engineering knowledge from multimedia repositories and semantically enhanced 3D interaction with that knowledge in integrated engineering environments. CAD designs, documental repositories and ERP/corporate Databases will be the main data&knowledge sources supported.

The project aims to develop technology and software components to be integrated in product engineering environments.
Approach

- Product, projects, documents, etc, are defined by user-written ontologies
- Engineering data repositories are annotated: knowledge is extracted from inside data repositories (CAD, ERP, docs)
- This structured information can be accessed by users
- This semantically represented knowledge data can be data-mined to discover non explicit knowledge.
SEVENPRO modules
Semantic server agent

Gateway to the Corporate Knowledge Repository that holds the semantically represented knowledge

Dispatches query results to the client modules

Performs changes requested by the client modules

ACID compliant (Atomicity, Consistency, Isolation, Durability)
Semi-automatic extraction of relevant knowledge from corporate repositories

Document annotator: extracts statements from textual documents, guided by the ontology

CAD annotator: extracts design sequence and assembly information from CAD files

ERP annotator: accesses legacy tabular data
Semantic engineering tool

Main entry point for end-users, allows to navigate through product knowledge, with an ontology-driven user interface

Navigation by product structure, projects, documents, etc

Maintenance of all product-related information and documents, with version management for items and documents

Access to the annotations

Creation of concepts and links between concepts
Semantically enhanced VR

Another way to intuitively search and retrieve all item-related information present in the knowledge base

VR is a privileged medium to access the knowledge base

Information displayed immersed in the 3D scene

Navigation through product structure, associated documents, item versions and revision
Semantically enhanced VR

Extension: ease authoring tasks by using information available in the knowledge base

Automatically access item related information and documents

Infer and propose animation based on part type, relations between parts, assembly information (position, orientation, degrees of freedom)

Embedded inference engine (CORESE)
Relational data mining

The knowledge base describes large amount of items, along with their associated information: documents, design sequences, etc. Structured engineering data about the company products.

RDM algorithms are aimed to find non-trivial relations between these data, making implicit knowledge explicit.

For now, focused on design data: sequences of operations in part design.

Discovery of:
• frequent design patterns
• classification and/or association rules
• design clusters.
Key ideas

- Knowledge based management
- Knowledge evolved by users, no programmers needed and the applications are automatically configured
- Relevant knowledge and information is accessible for all
- Automatic extraction of info and knowledge
- Integration of islands of info - systems
- Reuse of knowledge -> Productivity