TOWARDS CL2M: ENABLING FEED-FORWARD MECHANISMS IN PRODUCT DESIGN

Motivation & Objectives
With the advent of emerging technologies such as Web 2.0, customers are increasingly exchanging information concerning their experience with the use of the product. By actively collecting information from the product use phase with the aim of using it for product development and improvement, companies enable the process of closing the information loop. This project provides a technical solution to integrate the customer feedback into CAD systems. This solution is made to help the designer make a decision about future improvements of the product. It provides an easy way to visualize customer feedback directly in the CAD model.

Knowledge-based engineering
Knowledge Advisor, the KBE tool of CATIA V5 is used to create parameters corresponding to the different types of customer feedback. Those parameters are driven by a KBE tool called Design Table which can have an xls format. Rules and checks are also used to add more knowledge into the CAD model (see use case). A check is a set of statements intended to let the user know whether certain conditions are fulfilled or not. It usually appears in the relations node in the specification tree with a traffic light icon, switching to red or green according to the check’s status. A rule is a set of instructions, generally based on conditional statements, whereby the relationship between the parameters is controlled.

Information and knowledge structuring
There is a real need to capture and structure information and knowledge coming from the product usage phase to create a computer interpretable model of knowledge about this domain of study. Ontology, which is an approach to provide a shared understanding of a given domain, will be used. The use of ontology combined with an inference engine can help discovering new knowledge. Protégé is a free open-source platform will be used for building and reasoning about ontologies.

Use-case: Electronic cigarette
The first step is to parameterize the model. This step is necessary in order to being able to drive the model through parameters. Two types of parameters will be used. The first type include parameters specific to the design. It includes geometric parameters (length, width, diameter etc.) or others (Material, color etc.). The second type of parameters is specific to the customer feedback application. It includes four parameters for each part, corresponding to the four types of feedback. The part 3 for example will contain under the node parameters: Physical 3, Functional 3, Behavioral 3 and Ergonomic 3. These parameters are declared as strings that can have only three possible values: “Positive”, “Negative” or “Neutral”. These values can only be changed via design table.

General framework
The first step is to extract the product structure from the specifications tree of the assembly design workbench. An xls format of this structure is then transferred to Protégé in order to add more knowledge in it. A first table structure is then created thanks to the ontology and the reasoning engine. This table contains the structure of the “General impression” table. The feedback processing layer will then populate this table with corresponding appreciations (Positive, Negative or Neutral). The finalized table will be used in the Knowledge advisor workbench as design table where it will interact with parameters, rules and checks. A second output from the reasoning engine, corresponding also to the product structure input, is a second table structure of the feedback extracts dedicated to the “Detailed feedback” part. The feedback processing layer will populate it with customer feedback extracts coming from different feedback channels. The populated table will serve as database for the VBA application.

Results
In the “general impression” part, a color map appears directly on the 3D CAD model. Red, yellow and green correspond respectively to a negative, neutral and positive feedback about each specific part of the product.

The “detailed feedback” part of the application is a UserForm with two combo-boxes. The first one is used to select a specific part. The second one is used to select a type of customer feedback. Unlike the “general impression”, the “Detailed feedback” takes each part separately. It also contains a button to come back to the start menu and a button to visualize the result via the 3DXML plugin of Dassault Systèmes.

The customer feedback is visualized via a flag attached to the part. Another technique is to display the feedback in a second independent window.