

German-Spanish Collaboration on Virtual Reality Design Review of Large CAD Models

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Introduction

The increasing mobility of researchers all over the world allows not only for better personal and professional education but also for expansion of know-how. Strengthening relationships between research centres of different countries is crucial for improving the general situation of the scientific community. One of the aims of the INI-Graphics Net, an international network of institutions for education and training, is the transmission of information between centres from different countries.

Integrated Actions Program

The open borders policy among the countries belonging to the EC facilitates making connections between research centres from different European countries. The Integrated Actions Program, created and financed by the ministries of Foreign Affairs and Science and Technology aims for the exchange of knowledge in scientific environments in the EC. The governments subsidize short stays of researchers in foreign centers. The

program also tries to establish a basis for long-term collaborations.

In this context, several research visits of one month or less will take place between Fraunhofer IGD (Department of Industrial Applications) and VICOMTech to work on a project about VR visualization for large CAD models. The German-Spanish Integrated Actions Program will finance the exchange, with the participation of the German Agency DAAD and the Spanish Ministry of Science and Technology. This cooperation will last 2 years.

Virtual Reality Viewers and traditional CAD systems

Why is the Virtual Reality (VR) viewer for Design Review for a large CAD models interesting? Although the whole model can supposedly be shown with the usual visualization tools of medium-level CAD systems, when the amount of information to be shown is increased above certain limits, these tools are just not powerful enough. Also, the functionality required is sometimes not available, since it goes

German Abstract

Im Rahmen der Kooperation mit dem Fraunhofer IGD im Bereich VR-Umgebungen für CAD-Design wird es mehrere Austauschbesuche von bis zu einem Monat zwischen dem Fraunhofer IGD (Abteilung Industrielle Anwendungen) und VICOMTech geben. Ziel ist es, gemeinsam an einem Projekt zur VR-Visualisierung für großformatige CAD-Modelle zu arbeiten. Dieser Austausch wird vom deutsch-spanischen Integrated Actions Program, sowie dem DAAD und dem spanischen Ministerium für Wissenschaft und Technologie finanziert. Die Kooperation ist für einen Zeitraum von 2 Jahren geplant.

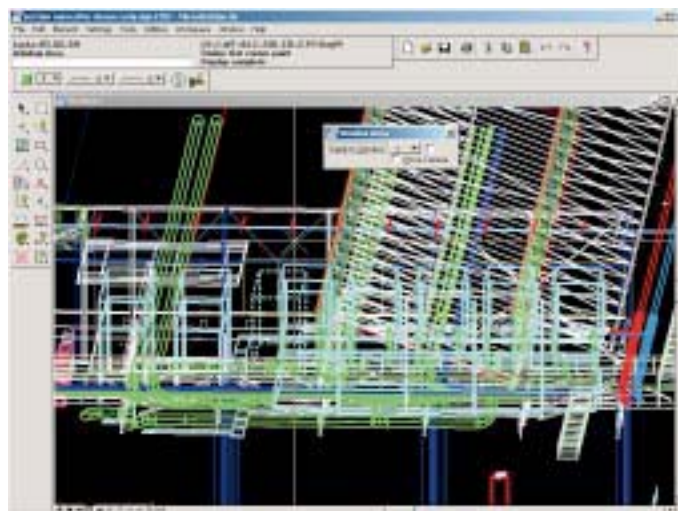


Figure1: CAD System with a large CADmodel of a Plant Design

beyond the mere display of geometric information (for example: PDM connections, cooperative work, etc.). On the other hand, the VR viewers allow immersed 3-D visualization, which is clearer, friendlier, more intuitive than many of the visualization tools offered by CAD systems, and can be customized to satisfy specific needs. Therefore, it is sometimes a good solution to »translate« large CAD models into VR systems that allow better understanding, inspection, and manipulation of the model. In this translation process it is important to maintain the information stored in the original model, this is, not only the visual appearance but construction, design and user-oriented information. A key factor here that is especially underestimated is the semantics involved in the process.

Large Model Problem

Most CAD systems have some VR tools but usually they are quite simple and not very powerful:

- They can deal only with large and medium models
- They do not maintain the additional information associated with the CAD model.

To improve the translation and 3-D visualization capabilities implies working with the system resources as a limit. In this project, the user knowledge is considered a key factor for improving the performance with the same model and resources. The point is to try to use the semantics associated with the user knowledge and needs, as well as the model characteristics, with the goal of han-

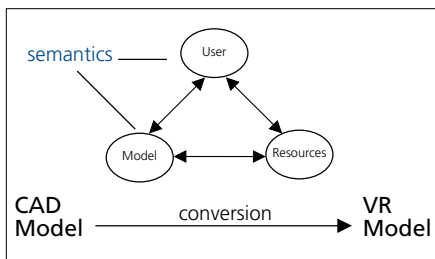
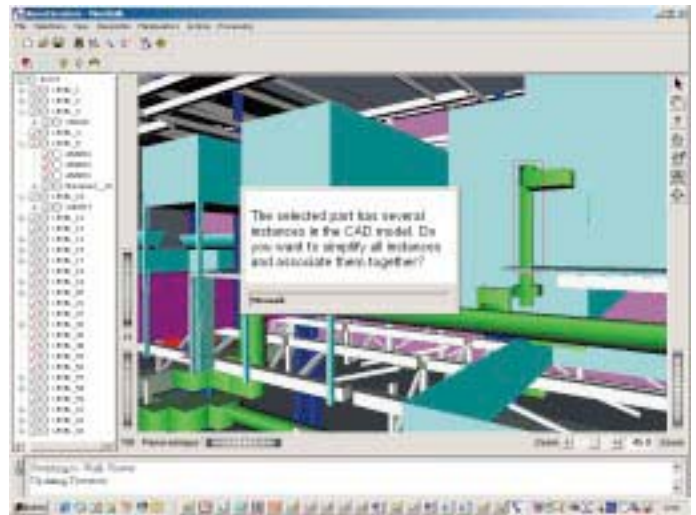


Figure 3: Semantics as a decisive factor in the conversion process CAD->VR

Figure 2: Semantic based VR System for Design Review of the Large CAD model



dling the model intelligently so that the VR model does not overload the computer resources. Thus, it is necessary to analyse the semantics of the information stored in the CAD model as well as require input from the final user regarding the semantics of the model.

Figure 3: Factors applied to large CAD models conversion - introduction of user and model semantics as a key factor in the conversion process

Semantics

Semantics is associated with user knowledge, not only in the design stage but in the conversion and visualization stages too. We call it »explicit semantics« when the knowledge can be extracted from related information placed by users -in a structured way- in the CAD system during the modelling stage (layer schema, names, version, well-structured groups...). On the other hand, we call it »implicit semantics« when a user is necessary to identify and fully reconstruct the knowledge stored in the model (catalog reconstruction, removal of aids for model construction, importance of a specific part...). An important fact related to implicit semantics is that the converted model is user customized.

With the intelligent use of the user and model semantics in the conversion process, we expect to

improve considerably the performance of VR systems for inspection of large CAD models in a normal computer used in a designed workplace.

Application Areas

This approach can be applied to any scientific or technical area that uses large CAD models, such as:

- Industrial Plan Design
- Mechanical Parts
- Architecture

During the period of this collaboration, we will try to determine the importance of different factors for different large models and different user profiles and use those key factors to automate the conversion process for different user-resource profiles.

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