



Sketch Manager

Software Lab Project 2012: Development of a plugin program for sketch management in two different CAD-Tools

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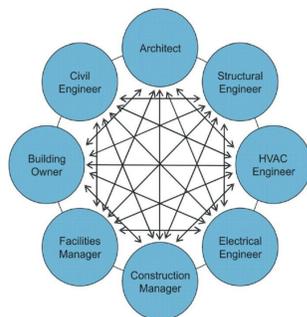
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Abstract

The new developed software tool "Sketch Manager" enables the exchange of geometrical and logical sketch data between different CAD tools of the construction industry by using XML as a transfer and storage format. The user friendly GUI for managing sketch files is integrated as a plugin in the CAD software and as a standalone version for administrative purposes. This allows reusing sketch data software comprehensive.

Motivation

Especially in the construction industry many different participants take part in the realization of a project. For the implementation of the projects various CAD tools are used to develop plans and models. In the CAD tools for example profiles of tunnels or bridges are built. These sketches can't be transferred without a loss of information between the common CAD tools. To overcome this discrepancy the exchange of the sketch data from the different CAD tool is to be carried out via a neutral XML-format.

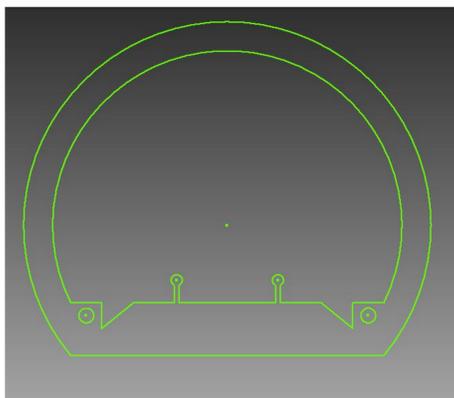


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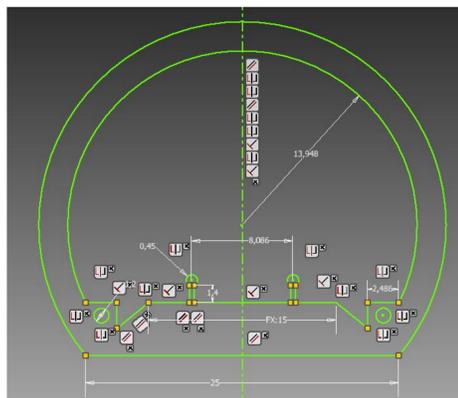
Another problem is that created sketches within a complex model cannot be used again for successive, comparable problems. By storing sketch data in an external structured database it is possible to build a reusable catalog of sketches that originally had been developed in different CAD tools. For a user-friendly management of these sketches an application tool with filter functionality is required.

Initial Situation

Existing exchange formats as for example DXF, IGES or DWG, lead to loss of essential information in the sketches. Based on the cross-sections in sketches, in most cases only the geometrical raw data can be transferred. The most relevant logical data, which are dimensions and dependencies of the elements to each other will be lost. Especially in the construction industry with many different people and companies working on one project over its lifetime the loss of these dependencies can have serious consequences.



geometrical raw data



geometrical raw data + logical data

Another problem, which has to be solved, is the incapability to reuse once generated cross sections. Even within one CAD tool it is often not possible to save a sketch separately and thus to use it again in other projects. When working with multiple CAD tools, reusability of sketches nowadays is very complicated.

To minimize the resulting high financial and staff resources in their use of Autodesk Inventor and Siemens NX, the industrial company Obermeyer requested from the TUM a solution for this problem. The final software-application should set the focus on their two relevant CAD products but have the possibility to be expanded by other tools.

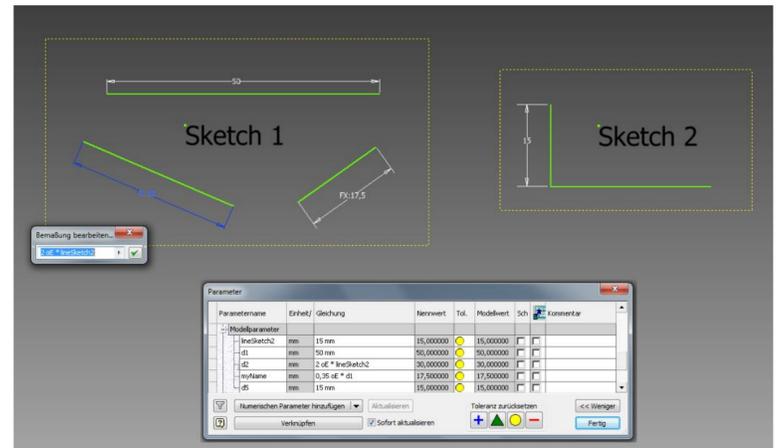


How it was achieved

The first step was to make oneself familiar with the two CAD tools Autodesk Inventor and Siemens NX. Especially the different formats of the sketch information and the completely different APIs had to be studied thoroughly. Additional things to study where the programming language C#, SQL-databases, the XML-format and many other topics.

In both programs, bridge and tunnel constructions are based on a 2D sketch. That consist of geometries, whose degrees of freedom are reduced by a variety of dimensional and geometrical constraints. This results in forced dependencies, which determine certain properties of the sketch geometry.

The description of the geometry in Autodesk Inventor is based on points. In contrast, Siemens NX is using angles. These different formats partially have to be translated for conversion into a neutral format. Within the constraints, the use of parameters represents a particular complexity. The dimensional Constrains can either include a constant value or a mathematical expressions with a reference to other parameters. The designation and the allocation of these parameters can be specified by the user individually. Moreover, there is the problem that the parameters which are referred to, can also be outside the exporting sketch.



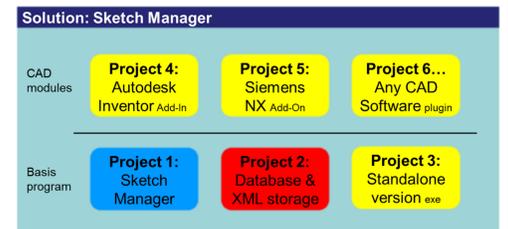
Dependency of parameters

The transfer format of the sketch data between the CAD tools has been designed as a neutral XML format, which can be parsed into or out of the specific formats. A structured storage of the XML files is realized via a database that can be accessed through a user-friendly GUI.

What was achieved:

The implemented application "Sketch manager" consists of several modules. Via the graphical user interface (Project 1), that is integrated into the various CAD tools, the export and import process of a sketch can be triggered.

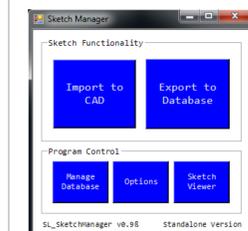
In the software tool Autodesk Inventor (Project 4) the newly created functionality is implemented as add-in and allows for example converting the specific format to XML via data export.



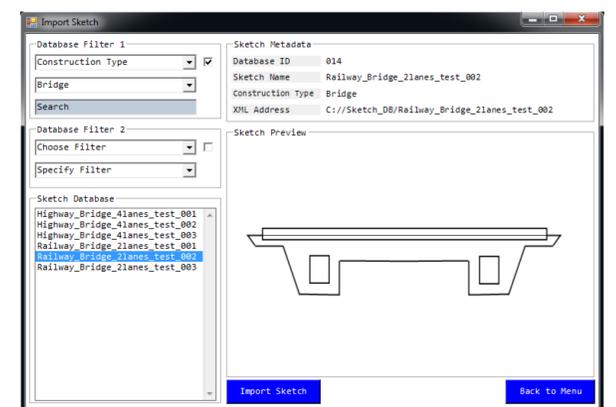
In the XML format, both the geometric raw data and the geometric and dimensional constraints are deposited. The structured storage of XML files is accomplished via a database (Project 2), allowing selective access to the sketches.

In Siemens NX (Project 5) the sketch manager is included as an add-on and allows the user to import the sketch data from the neutral format. This parsing is required to meet the specific NX format requirements.

The import and export was realized for both Autodesk Inventor and Siemens NX and allows an exchange of sketch data in both directions. Additionally, the software has been structured in this manner, that other CAD tools (Project 6) can integrate the functionalities of the Sketch Manager and can be easily (only parsing) included in the workflow.



For administrative purposes, also a standalone version (Project 3) is available, which allows the management of the database, independent of an installed CAD application. The access to the Sketch Manager takes place via a main menu, where the functionality of the import and export are available for the standard user. The other options are only enabled for the administrator and are used to manage the database. In the Export dialog for example, the user is able to select one of the existing sketches of the drawing, give it a name and additional metadata such as the Construction Type.



By pressing the Export button, the sketch information is stored in the neutral XML database.

The stored metadata are used during the import process for the selective display of the available sketches.

As another feature, a preview of the sketch is presented in the import screen. During import, the sketch data are automatically converted into the format of the active CAD tool and available for further processing.

Conclusions / Outlook

For the industrial partner Obermeyer a software product is provided, that allows the exchange of the essential elements of sketches between the CAD tools Autodesk Inventor and Siemens NX via an externally stored neutral format. Above the benefits of loss-free exchange of sketch data between different CAD tools, the implemented software solution gives the opportunity to reuse once created cross-sections.

Via the graphical user interface functionalities are provided to the user, which allow managing a large number of stored sketches.

The software is designed to connect additional CAD tools and could become a practical application with some further development.

References

- [1] Prof. A. Borrmann : Bilaterale Schnittstellen und Interoperabilität
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