Preparation and provision of building information for planning within existing built contexts

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Summary

A prerequisite for planning within existing built contexts is precise information regarding the building substance, its construction and materials, possible damages and any modifications and additions that may have occurred during its lifetime. Using the information collected in a building survey the user should be able to "explore" the building in virtual form, as well as to assess the information contained with regard to a specific planning aspect.

The functionality provided by an information module should cover several levels of information provision ranging from 'simple retrieval' of relevant information to the analysis and assessment of stored information with regard to particular question sets.

Through the provision of basic functionality at an elementary level and the ability to extend this using plug-ins, the system concept of an open extendable system is upheld. Using this modular approach, different levels of information provision can be provided as required during the planning process.

1 Introduction

The current situation in building planning exhibits a significant deficit of IT-tools which are able to support the entire planning process. Currently available tools provide insular solutions to particular aspects within the planning process.

The development of an integrative IT-supported planning environment for planning within existing built contexts is a core aspect of current research activities at the chair for computer science in architecture. (see /Petzold 2004/ and /Thurow 2004/ in this publication). The approach described in this paper is *one* aspect of many within this research project.

This research topic is currently in progress. As a result possible solution approaches will be presented.

2 Information module – Retrieval and presentation of captured data

Planning within existing built contexts is characterised by a close interdependency between existing built substance and resulting planning decisions. A prerequisite for planning within existing built contexts is precise information regarding the building substance, its construction and materials, possible damages and any modifications and additions that may have occurred during its lifetime. As renovation measures progress new problems and questions arise which can have an effect on future decisions.

The geographic separation of building survey (on site), planning (in the office) and building measures (on site) mean that an adequate provision of building related information is indispensable. The planner should be able to "explore" the building in virtual form, as well as to assess the information contained with regard to a specific planning aspect

2.1 Basic requirements of an information module

Due to the unique character of existing buildings and as a result of the process of their planning and building measures, it is not possible to foresee and pre-plan every possible situation in detail. This is a principal aspect of an information provision module attached to an information system. It should provide appropriate functionality or tools which enable information relevant to a particular problem to be filtered out and provided.

A second aspect concerns the dynamic nature of the database data. The extent and granularity (detail) of captured data regarding the building increases successively as the planning process progresses. The form and degree of detail differs and is specific to each project and planning task.

The concept of the information container provides a comprehensive and integrative organisational system which can be extended flexibly so that the information contained can be extended or increasingly enriched /Petzold 2004/. Based upon this concept, the information module should be able to ascertain and present the current status of the ordering structure and its contents.

2.2 Purpose and functionality of the information module – basic principles

Access to the information captured and input during the surveying and planning process can be grouped into three stages:

a) Information retrieval -
   Provision of all information relevant to a particular query,

b) Analysis and assessment -
   The inference of conclusions through the evaluation and interpretation and/or calculation of stored data, resulting in an increased knowledge basis

c) The development of design solutions -
   The creative act of solving a problem based upon results of analyses; the production of new information as a result of planning progress.

The individual stages build upon each other and can occur repeatedly during the planning process.

The task of the information module concentrates on stage a and parts of stage b. The development of intelligent tools for planning plausibility is a separate research area within the research project / Tonn 2004 / / Donath 2004 /

The information module should provide functionality which covers three levels (see Fig. 1):

I. Search and explore –
   Functionality to explore stored data using a navigation method or via database querying,

II. Intelligent search tools –
   The automatic retrieval and provision of information relevant to particular problems or query constellations; the adaptation of the tool to deal with regularly recurring tasks,

III. Analysis, Calculation, Evaluation –
Functionality to support interpretation of database content by the planner, for instance the building element extraction discussed in /Thurow 2004/.

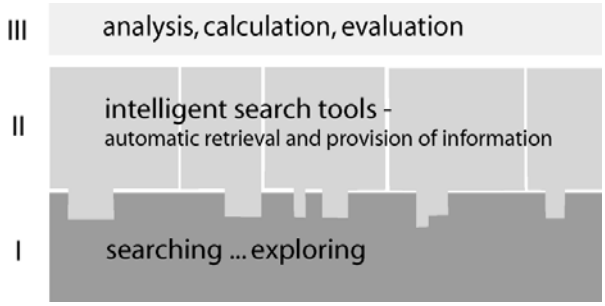

Figure 1: Functionality layers of the information module

The concept of an open extendable system forms the basis for these three levels. The first level provides basic functionality and a platform upon which tools for the second and third levels can be integrated in the form of plug-ins. The design of the basic search and navigation functionality supports an unspecified and broad range of different search queries. Plug-ins build upon this basic functionality by providing tools for specific recurring problem areas within the planning process. As a result new plug-ins can be developed whenever required.

2.3 System architecture concept – the information module as a part of "Freak"

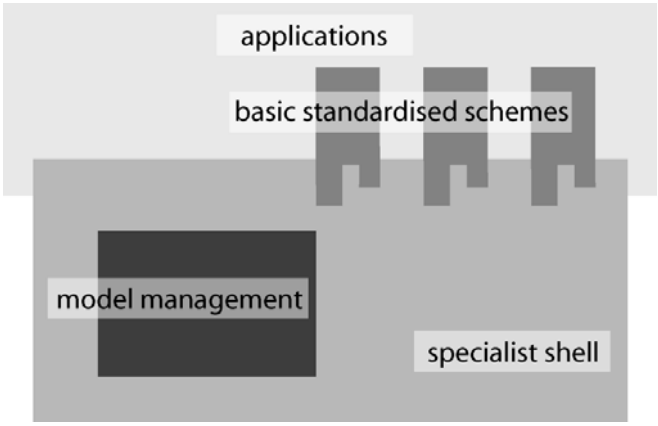

Figure 2: System architecture concept

As shown in Figure 2 the information module consists of several layers. The core is the model administration. This is responsible for providing functions for dynamically modifying and extending the building model. The data administration uses dynamically definable classes with attributes and relational dependencies.

The specialist shell is the second layer and implements the concept of the information container. Different types of information (formal / informal, relational or geometric – see also /Petzold 2004/) can be attributed to each element. Furthermore, the specialist shell also administers the three primary ordering structures used to describe the building in the model:

- Project structure
- Spatial structure
- Building element structure

In addition elementary search functions must be realised within these structures. These can be grouped in three different groups:

Formulation and editing of *search queries*, determination of the current *content / table of contents* and *determination of links* associated with a particular element. Standardised schemes can be included as extensions to the specialist shell and define pattern structures for particular building types (for instance office buildings or industrial buildings). These can take the form of plug-ins which can be defined and attached to the specialist shell.

The specialist shell and the standardised schemes form the basis for applications. These realise the user functionality previously described in section 2.2. The application layer is responsible for coordinating user interaction with the functionality provided by the search functions of the specialist shell and the model administration as well the provision or display of the data in the form of search results, tables of contents etc.

The concept of an open, flexible, integrative and dynamically adaptable system means that the application layer can consist of several search and analysis modules which can be integrated to form a system environment and can be extended with new modules as required.

2.4 Application layer – The functionality of individual modules

In realising the basic functionality of the search / navigation and the display of search results (see section 2.2) three basic structures of the ordering system must be considered. Accordingly a choice of different representation principles is also necessary. The different structures offer the following representation principles:

Project structure:	Hierarchical / tree-structure
Spatial structure:	2D-plan or hierarchical / tree structure
Building element structure:	2D / 3D-graphic (plan or model)

Parallel to these, various different types of information must be represented, including:

- Geometric data
- Formal attributes (e.g. building parameters),
- Informal attributes (Multimedia-data),
- Relational data.

This results in several different kinds of viewers or search modules, which cooperate to differing degrees with one another (Figure 3).

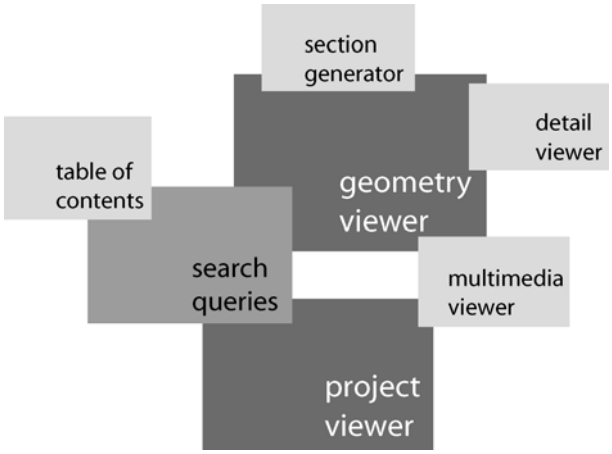

Figure 3: Viewers / search modules and their relationships

The two main viewers include the geometry viewer (2D/3D) and the project-viewer. These allow the user to navigate the database in the form of geometric or hierarchical representations. Closely associated with these two navigation tools are other viewers which provide additional information such as the detail viewer (an overview of a chosen object's attributes) and the multimedia-viewer (display of supplementary multimedia data such as photos, verbal descriptions/text, audio and video sequences). Further tools allow the formulation and edition of search queries or the determination and display of tables of contents. Using a section generator, a geometry-related analysis of the collected building massing data can be undertaken.

This list of individual tools represents an initial concept and is not intended to be complete. It is possible to integrate further modules into the system concept at any time during the development.

2.5 Prototypical realisation of an user-interface

The screenshots presented here are of a fictional system and represent a first attempt at defining the functionality of an information module and its visual appearance as a graphical user interface. The design concentrates on the provision and combination of search/navigation and analysis functionality where different aspects play a role. On the one hand a flexible search functionality should be provided which can cover any arbitrary search requirement, on the other hand certain recurring searches for particular requirements (e.g. fire safety) should be supported. In addition support should be provided for the formulation of search queries. Further aspects could include structuring the information according to 'thematic' views and the analysis and display of spatial correlations and interconnectivity.

The approach concentrates on the definition of search queries as one of the basic functionalities of the information module. In a geometric representation of the results, this can also be used as filters to display information according to chosen thematic criteria. Through the combination of several filters a specific problem-related context can be defined as required. Traditional architectural representation methods such as exploded drawings or sectional perspectives are examples of the analysis of surveyed building data.

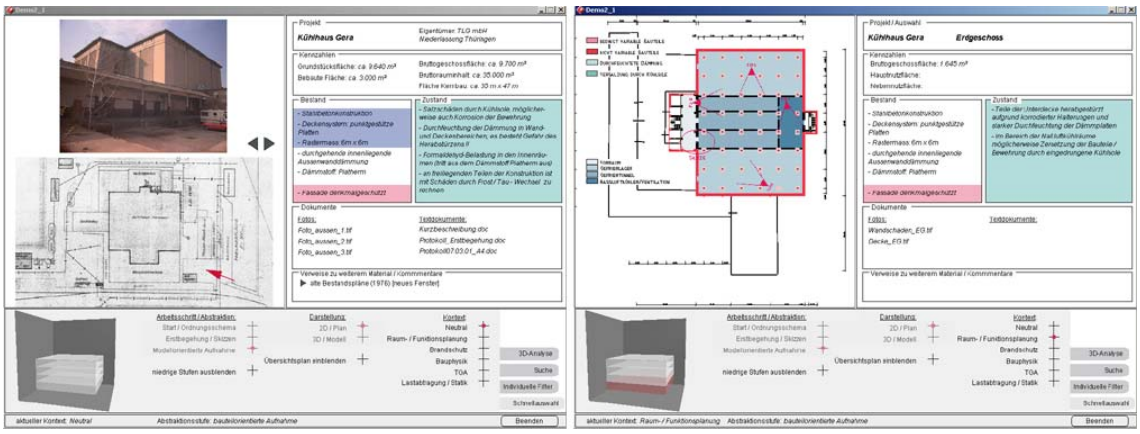

Figure 4:
Two snapshots – project home and a specialist context (problem oriented provision of information)

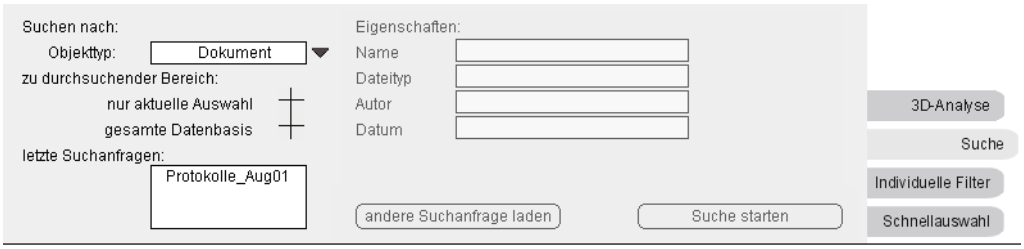

Figure 5: Form with input fields for search queries

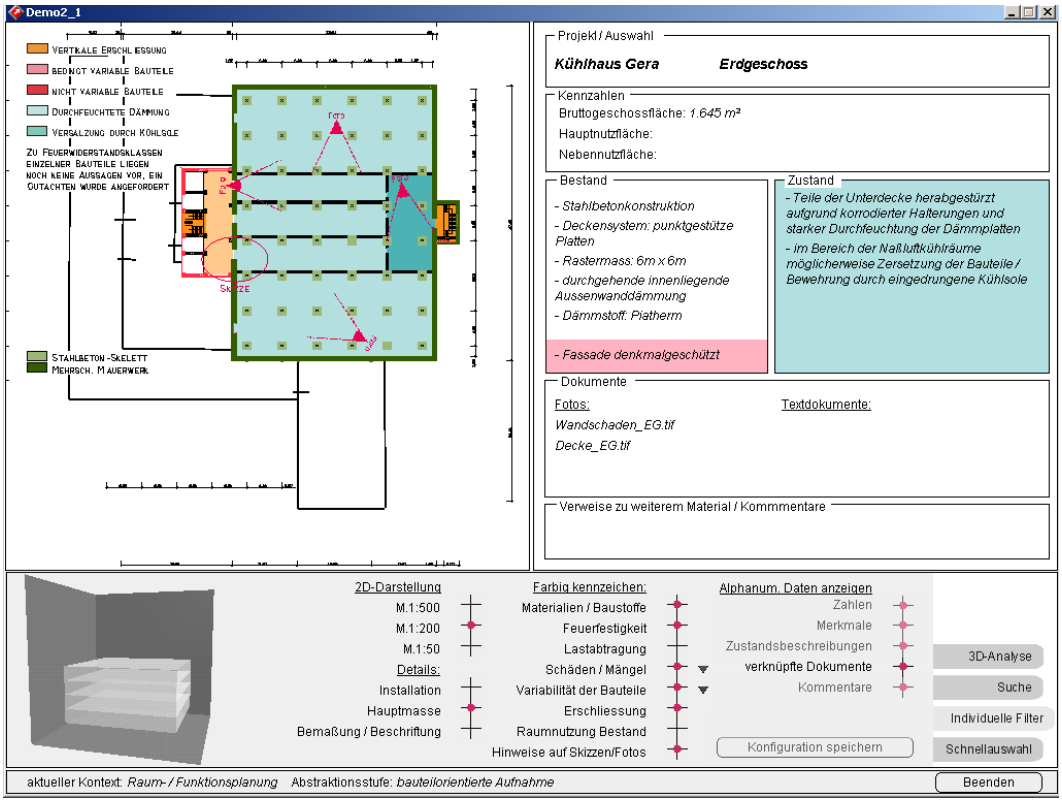

Figure 6: Individual definition of a context using individual filters

3 Conclusions

The content of the information module, the definition of necessary functionality as well as the consideration of a possible system architecture form the central aspects of the approach discussed. A further important aspect, not yet considered in detail, is the question of appropriate forms of information display. This applies both to the representation of search results as well as the presentation of functionality to the user.

The issues and problems discussed here can also be found in other fields e.g. in city information systems, (virtual) library research systems or in archaeological documentation and assessment systems. The approaches used in these fields form a further research topic.

Another research area with direct implications for the approach discussed here is a specific analysis and description of typical (recurring) problems and requirements during the planning process.

4 References

Wangerin, G. (1992). Bauaufnahme – Grundlagen, Methoden, Darstellung. Vieweg, Braunschweig / Wiebaden.

Berger, R. and E (1999) Bauwerke betrachten erfassen beurteilen – Wege zum Verständnis klassischer und moderner Architektur. Augustus Verlag, Augsburg.

Petzold, F.(2001). Computergestützte Bauaufnahme als Grundlage für die Planung im Bestand. Dissertation, Bauhaus-Universität Weimar.

Donath, D., Weferling U. (2003). Digital building surveying and planning – integrative approaches with commercial object-oriented CAAD systems. Digital Design. Proceedings of the 21st Conference on Education in Computer Aided Architectural Design in Europe, Graz 2003, pp 527-531.

Donath, D., Petzold, F., Thurow, T., Weferling, U. (2003). Freak – Consistent surveying and documentation systems as a planning basis for large-scale historic buildings. Accepted paper for CIPA 2003, Antalya.

Petzold, F. (2004). The building as a container of information in the early phases of the building survey. - The starting point for project development and design formulation. In ICCCBE 2004.

Thurow, T.(2004). A vision of an adaptive geometry model for computer-assisted building surveying. In ICCCBE 2004.

Tonn, C., Wolkowicz, C., Thurow, T., Ruth, J., Donath, D.(2004). Plausibility in architectural design –software support for the formal shaping and architect-oriented design of shell structures. In ICCCBE 2004.

Donath, D., Tonn, C.(2004). Plausibility in architectural design – software support for the architect-oriented design of color schemes for interiors and buildings. In ICCCBE 2004.