

## **Turban**

### *Time sensitive modelling of cities and urban fragments in CAD environments*

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**Abstract.** Town planning requires conscious handling of the existing urban structure and knowledge about its history. Only so planned modifications and supplements can be integrated in a sustainable manner into existing urban structures and have lasting effects. Modern CAD environments offer basically the possibility of supporting necessary planning process through additional integrated tools. In the project 'Turban' CAD extensions were developed additionally, providing planners and students with fundamental tools for data-capture and analysis around the temporal process from town developments.

**Keywords.** planning tool; visualization; augmented reality knowledge management

### **The need of town planning tools with time sensitive aspects**

Cities and fragments of cities are constantly growing over the centuries and have in the past accommodated usually slowly to new requirements, besides destruction by force from outside. The present situation of a city can be fully understood only by depicting comprehensibly it's history and development. In modern planning often the sensitive and prospective dealing with the existing city is poorly taken into account, which leads to huge disadvantageous changes of city structures. There is a lack of a tool that continuously supports the past, present and future of buildings and enables planning teams to view the object of the planning in its chronological correlation.

Also annotation, indexing and retrieval of digitized historical material as plans and written documents help to deal with historic sources. The possibility to built up an digital archive of historic material serves as a documentation for future purposes. The visualization of the historic and contemporary dimension of cultural, social and political context aids to make appropriate planning decisions. The growing complexity of questions in urban planning processes leads to interdisciplinary planning teams and therefore more and more defined working structures. In order to create a comfortable working environment and user interface which allows experts and non-experts to have a more professional and more intensive dialogue.

### **Basis of the planning tool**

The basis of the implemented tool is the linkage of geometrical objects with semantic information in a CAD environment. Most important is the indication of the buildings lifespan. Besides the year of construction of a building and its demolition date, information about any conversions can be filed. Along with that any information that can be gathered about the city fragment and its buildings is sorted and linked up with the geometrical object. Theses informations are organized in a data base. The modelled city fragment can be visualized and analyzed along a timeline. The tool was developed in the CAD environment AutoCAD. The linkage with the database (Access) is implemented via extended entity data.

### **Phases of the modelling**

In principle, four subranges can be differentiated:

### Modelling

In the modelling phase urban models are created with usual CAD functions and applications; these models can be created two or three-dimensional. CAD objects, which represent complex structural structures, are combined into geometrical groups.

### Input Phase

In the input phase the geometrical objects are connected with different semantic informations. Including time data about the completion, spatial modifications and the eventual demolition of buildings. Additionally, text specifications concerning the type of structural use, the actual condition of the buildings, Picture, Video and other information can be connected to the geometrical data (fig. 1).

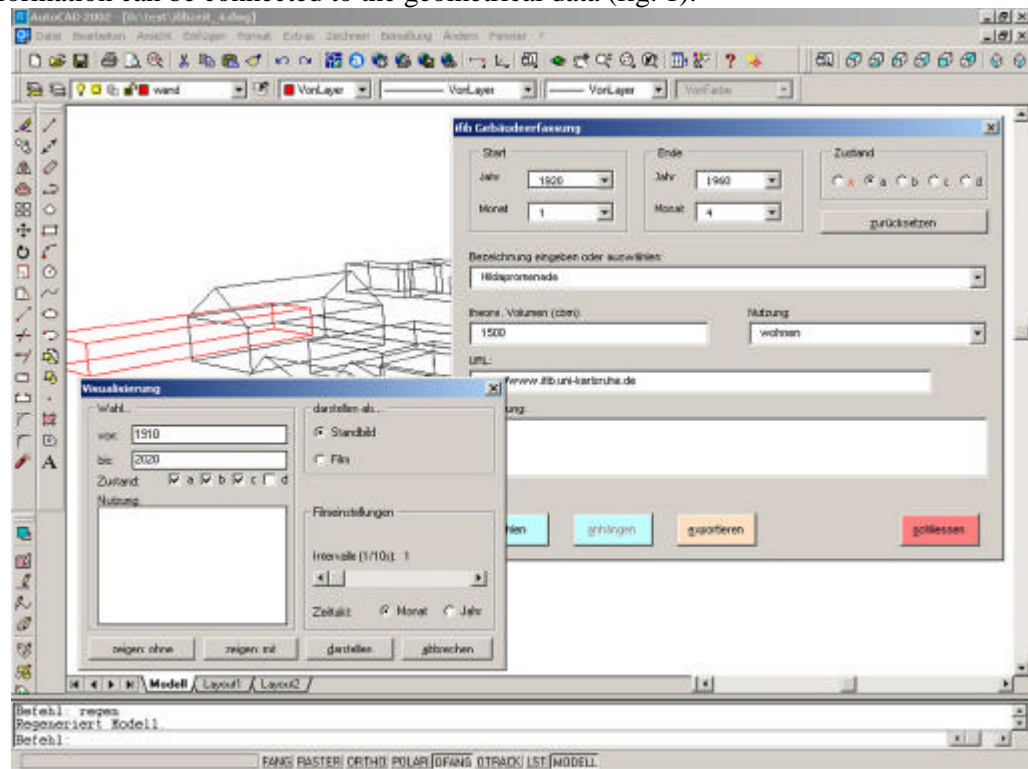


Figure 1. Connecting geometrical objects with semantic information

### Visualization Phase

The visualization phase enables the time-related representation of the urban accommodation in form of a snapshot, a film representation or different kinds of data base queries. For this, static snapshots at the beginning and final date of the desired view period are selected. For film representations additionally temporal intervals are defined, which influence the rate of the representation. In both cases the visualization of the urban status can be modified within a selected time window by further parameters (e.g. condition of the buildings). The representation is effected in both cases within the CAD environment and can be combined at will.

### Analyze Phase

The different types of visualization of the geometrical and semantic information allow the planning team a specific view over former, existing or planned buildings and enable them to analyze different kinds of aspects of buildings in a fixed time range. Possible aspects are the change and development of the use, inhabitants, surfaces, volumes and materials. The visual representation of a city fragment within a time range supported by an extensively data base forms an extensive support tool for planners and students.

### Next Steps: mobile access to the city

At present the education and research project is further extended. A transfer of the presented methods is desired to portable, mobile devices. In connection with a possible positioning of the user in the urban context methods of 'augmented reality' are discussed, enabling planners to visualize not only passed but also future planned conditions of the city and city fragments on a mobile device.

Target of the project is the conception, development and implementation of a mobile interactive system for navigation through urban 'information spaces' of the past, present and future (fig. 2).

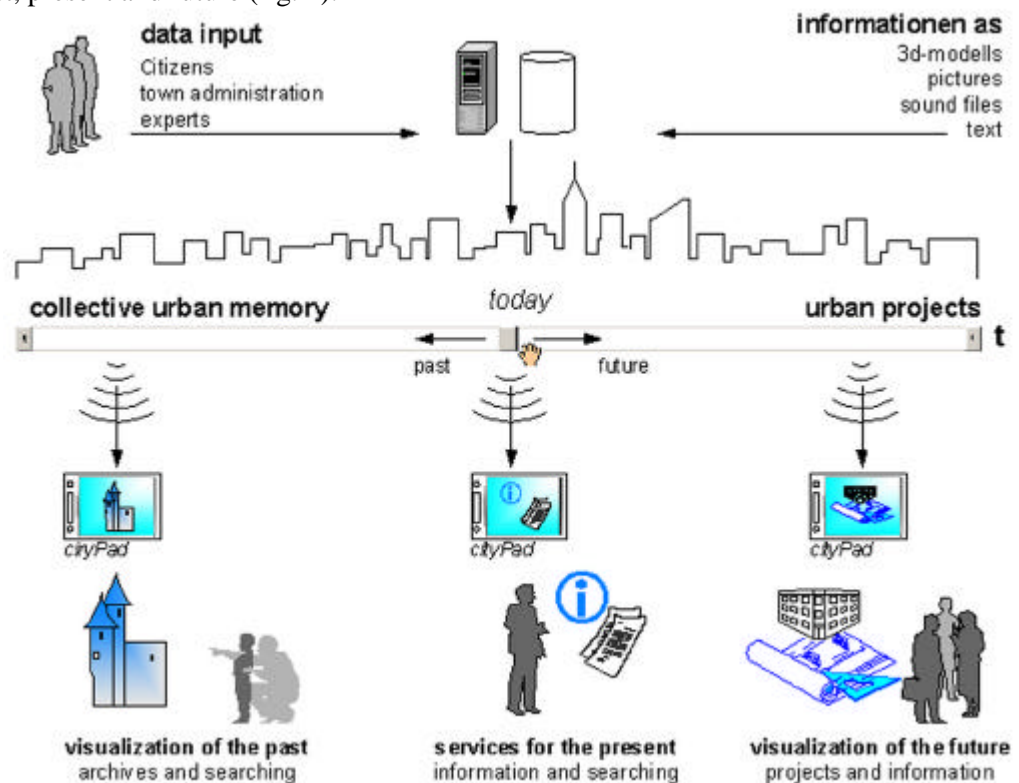


Figure 2. Concept of the Access to the City Project

By the term of the 'information space' the linkage and visualization of usually not visible, city-referred information and services with real objects and urban spaces are understood (augmented reality). A substantial feature of the project is thereby the inclusion of passed historical and future planned city statuses with constant integration of present services already established - as a virtual mirror of an urban environment in constant change and a data space for the passing on of generation-

spreading knowledge. The access to urban information spaces takes place via modified and extended Handheld PCs (cityPADs), which open positional and adjustment-dependent sources of information by four subsequent steps.

- detection of the cityPADs

- geographical direction regulation of the cityPADs

- determination of the temporal and content-wise focusing by the user

- copying and representing the selected information spaces

Place-, time- and direction controlled transmission of context based information in the real environment procure a direct and immediate impression; and furthermore builds a basis for different use possibilities for citizens, councils and planners.

The cityPad should offer the basis of different use possibilities by making available:

- three-dimensional models of historical, present and future buildings

- linked picture, sound and text material

- subjective reports of time witnesses

- Expert knowledge of planning and responsible persons

- Location Based Services (Catering trade, urban service achievements, etc.)

Place, time and direction controlled transmission of context referred information in the real environment obtain a direct impression and form the basis of different use possibilities for citizens, city administration and planning concerning the three view levels past, present and future:

#### *The past aspect*

- Set-up of a collective city memory and its use in the real urban context

- The representation of the structural and cultural urban history shapes an authentic identity of the users beyond of city marketing

- The knowledge about the historical development creates a point of view for the evaluation of future planning decisions

- Overlay of existing buildings with three-dimensional illustrations of former buildings at the same place

#### *The present aspect*

- Integration of existing mobile services (mail, telephone, sms)

- Mobile access to city information and service facilities (Authorities, events, gastronomy, leisure time)

- Localization of other users of the cityPad in a three-dimensional visualization of the city

#### *The future aspect*

- Supply of a decision supporting tool during phases of urban project development by including a historical and cultural data base



Figure 3. cityPad

## References

- Amor, R.: 1998, *A Survey and Analysis of Integrated Project Databases*, CIB-W78
- Azuma, R., Baillet, Y., Behringer, R., Feiner, S., Julier, S., MacIntyre, B.: 2001, *Recent Advances in Augmented Reality*, IEEE Computer Graphics and Applications 21(6), pp. 34-47
- Björk, B.C.: 1992, *A unified approach for modelling construction information*, Building and Environments, 27, pp. 173-194
- Eastman C.M., and Siabiris, A.: 1995, *A Generic Building Product Model incorporating Building Type Information*, Automation in Construction, 3(4), pp. 283-304
- Galle P.: 1995, *Towards Integrated, 'Intelligent', and Compliant Computer Modeling of Buildings*, Automation in Construction 4(3), 189-211
- Schmalsteig, D., Fuhrmann, A., Hesina, G.: 2000, *Bridging multiple user interface dimension with augmented reality*, Proceedings of the IEEE and ACM International Symposium on Augmented Reality, pp 20-29