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Experiences from various VRML applications

Abstract

An assamblage of information systems for architecture and urban planning we work on is presented bringing 3d together with multimedia annotations such as pictures, sound, animations or videos to the Web. The information system provides efficient management of the data in databases. Various methods to reduce the data volume as well as the modeling effort and user interfaces for efficient communication and interaction.

Introduction

Information visualization has evolved to a standard technique for the effective communication of information, especially with the success of the World Wide Web. Lately, 3d techniques are more and more applied in this context. VRML97 [CaBM97], plays a major role for making 3d information open to the public over every computer with Internet access world-wide. Using one of the freely available 3d browsers and plug-ins, VRML97 worlds can be integrated in standard web pages and be combined very easily with HTML as well as further multimedia items such as video, sound, and animation.

In addition the constantly growing of computing performance is of particular importance for 3d perspective visualization. In the future an increased demand will exist, on the one hand for administration of 3d-VR data in a structured way within databases, and on the other hand for embedding traditional multimedia data to effectively visualize dynamics in a 3d-environment.

In the field of architecture and urban planning, 3d visualization in the WWW offers a number of opportunities. Using 3d representations in this context is not simply provide a extended view. More important, it opens the possibility to create dynamic worlds and architectural models which can be explored by the user interactively. For instance, developments in planning phases can be made more transparent for planners, citizens, and investors. In the field of facility management tenants, caretakers, investors, etc. can easily receive current information through the Web.

Despite of these opportunities, 3d worlds are still used rarely in the internet for town information and architecture. Our latest projects in the context of 'communication of virtual architecture and spatial information in the WWW' show clearly that the deliberately and object oriented combination of different visualization components is essential for the efficient use of 3d techniques. The following few examples demonstrate several approaches for current developments in this field.

Public display of a zoning plan scheme

State of the Art

The Interactive Graphics Systems Group at the Technische Universität Darmstadt, (TUD GRIS)[1] in cooperation with the Fraunhofer IGD[2] and the CITImage GbR[3] started a pilot

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[1] Technische Universität Darmstadt, FG Graphisch Interaktive Systeme, 3D Graphics Computing, Darmstadt, http://www.gris.informatik.tu-darmstadt.de

[2] Fraunhofer Institut für Graphische Datenverarbeitung, Darmstadt, http://www.igd.fhg.de

project within the area of town planning for the "city of science" Darmstadt. The solution developed in the context of the project O17 - Public display of a zoning plan scheme in the WWW[4] opens a more comfortable way for citizens to acquire information about the development of their , both, in terms of accessibility and visual presentation. Instead of going to public offices to view highly abstract plans and textual descriptions users of the Web-presentation access interactive multimedia presentations and 3d models from everywhere. In the Internet version beyond textual explanations, additional pictures and videos of the places and other secondary information are linked to the plan.

View to athmospheric information

The Internet version is not only more comfortable, it is much more descriptive also for the non-architect: A mouse-click suffices to insert a prototypical development with site topography, which shows, how the new quarter could look like. Another mouse-click switches from the 2D-Plan to the 3D-VRMLmodel of the area without wasting accuracy. One can walk virtually through the area, individually or " with guidance". Despite the complex range of functions the file size could be kept very small, so that also users with slower computers or limited network binding can make use of this innovative pilot project. Another important aspect with such projects is the consistency in approach of the data. The zoning plan scheme of the Internet version is stored in the international standard format VRML97, as a result of converting CAD data, integrating census information and carefully optimizing the content for the Web.

Total use and cost saving will increase, especially if this model is re-used in further phases of the development process, e.g. in the zoning plan scheme design, in phases of mediation and negotiation, and in planning of individual buildings. These performances

produced by different architects can be merged easily and be tested comfortably over one interface. In particular, during each of the construction phases knowledge about the current status of construction is important: adjustments can be implemented optimally with a multimedia model. Marketing and facility management of the created real estates are further phases [BTTD99], [RoMu00].

View to the architectural plan

„ich sehe was, was du nicht siehst" - A unique city information system in the WWW[5], a project of the Interactive Graphics Systems Group (GRIS)[6] and the Fachgruppe Stadt at the Technische Universität Darmstadt[7], is an interactive city guide of Darmstadt. The city is presented as a space, where citizens describe their personal view of the place they live. The goal is an emergence of a powerful, interactive representation of Darmstadt, versatile in the types of the compilation of descriptions. It supports the development of a new picture of the city and it aims at the stimulation of activities and uses of places.

3d area

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[3] CITImage GbR, Darmstadt,
http://www.citimage.de
[4] O17 - Public display of a zoning plan scheme in the WWW,
http://www.citimage.de/O17/high/d/parent.htm

[5] „ich sehe was, was du nicht siehst", Darmstadt,
http://www.ich-sehe-was.de/was-du-nicht-siehst
[6] Technische Universität Darmstadt, FG Graphisch Interaktive Systeme, 3D Graphics Computing, Darmstadt,
http://www.gris.informatik.tu-darmstadt.de
[7] Technische Universität Darmstadt, Fachgruppe Stadt, Darmstadt,
http://www.tu-darmstadt.de/fb/arch/
version2000/fb15_framesets/fachgebiete_fach.htm

Places described by individuals are being taken from their geographical context, thus enabling new interrelation and connections. Besides texts and pictures, by means of 360° views, video and audio clips, and VRML supported 3d visualizations are used. The visitors have the possibility to select their personal scout and to take individual advise assisted by a variety of 3d worlds.

A great number of divert participants is essential to the success of the steadily growing project. An important topic in this project is, to offer a simple way of building 3d-worlds for users who are not trained in building 3d worlds [RoMu00].

Baumhaus goes 3D-Internet[8] - a project realised by a team of architects and web designers of c-cop – was started to examine the qualities of different types of 3d-interactive media in the field of real estate marketing and facility management.

baumhaus darmstadt – different types of 3d data

The experiences leaded to a grammar for the communication of spatial information, we would like to show in Paderborn.

Further projects which explore architectural models are described by [Hage00] and [Wieg00].

Requirements for future Web3d applications

These projects show, that many components of 3d worlds could be reused and optimized by storing them in databases. Another motivation is to implement an information system and the WWW together to a component of e.g. a facility management system.

The idea is to show, how components of a house or public and office building can be exchanged, to fade out or in different elements such as walls, the roof, or other parts. All elements from the buildings as well as animation elements are stored in the database. Selecting one of these elements generates a specific view to the building or parts of it by means of database queries. Another possibility is to generate guided tours through the building (especially for users, who are not used to 3d navigation).

An interesting approach is to combine freely available tools which stood the test in the use of web applications to a 3d architectural or town information system. No need to search for a long time: „LAMP: Linux, Apache, MySQL, PHP" [Reic00], in combination with various kinds of multimedia formats seems to be convenient to converge to a satisfying solution. The application system is easy to configure and to apply to other areas of applications. All of these tools are offered for download from the Web.

- Apache Webserver[9] + MySQL[10] + PHP4[11]
- VRML as a standard 3d exchange format for the Web + further multimedia data (TXT, IMG, JPG)
- In the future: X3D [E3TG00] Inside of the new version of VRML (VRML200x) is a specification for encoding the VRML scene graph using XML. Also inside of VRML200x is the UTF-8 encoding of the scene graph. This is the exact same encoding as exists in VRML97, what means that the old VRML syntax does not go away. [Abou00]

Using this tools the following requirements appear:
- 3d elements based on VRML97/X3D as fundamental building blocks
- authoring of these components using standard VRML modeling tools
- management of VRML-based components in databases
- on the fly generation of 3d scenes based on VRML-components
- standard interactions between components automatically integrated

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[8] baumhaus darmstadt,
www.c-cop.de/baumhaus/start.htm

[9] The Apache Software Foundation,
http://apache.org/
[10] MySQL, http://www.mysql.com/
[11] PHP, http://www.php.net/

The requirement to allow for a combination and interaction of generic 3D objects calls for a component-based approach. While component-based approaches have been used successfully in the 2d domain with "standards" for specific application areas (e.g. JavaBeans), such approaches were not as successful in 3d. animation elements integrating both 3d geometry and behaviour have also been proposed quite a while ago by [DöLS97]. Closer to the JavaBeans idea is the work from [DoGr].

A very basic component structure is also available in VRML97, namely the PROTO concept. But it is missing all the aspects of object-oriented systems such as inheritance and reflection.

However components can only be defined for specific application domains. In the full paper we will discuss the specific requirements in the field of facility management and town planning.

Conclusion

The presented projects prove that 3d visualization represent outstanding and suitable means of information brokering in the WWW when the respective application as well as the medium restrictions and target groups are considered carefully. In particular, in the context of town information and architecture data interactive VRML97-based visualization offer a great number of opportunities.

Dynamic VRML nodes allow the integration of further multimedia data such as text, picture, sound or videos dynamically from a data base into a VRML scene. If the data is changed, the visualization will be affected directly. During the representation of such special VRML components in a VRML-browser directly executable SQL query will be set to the data base, and the received multimedia data will be embedded into the 3d-scene. Areas of application would be for example Facility management or the urban planning.

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