Virtual City Models - New Approaches in Urban Simulation and City Planning using Virtual Reality Tools

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1. INTRODUCTION

Virtual City Models (VCM) offer city planners, architects and investors a future-oriented digital tool. The visualization of complex urban architecture in virtual reality models is a new method of planning and presentation. A joystick allows the viewer to fly-through the three-dimensional model in real time and have a look from different perspectives at complex topographic structures as well as the smallest architectural details.

Planning and Decision-making Instrument

VCM offers planners, architects and investors an efficient tool for plan controlling and decisions making purposes. Integrating urban development visions and different planning options, simulating various stages of completion and showing projects in infrastructure and traffic engineering are useful tools to evaluate concepts and accelerate decision-making processes. At the press of a button, users may move from one city development option or facade lining element or colouring concept to another. VCM may be used to check infrastructure, traffic engineering and ecological concepts prior to involving implementation costs.

Communication and Marketing Instrument

City administrations may use VCM for location promotion and marketing purposes. VCM allows users to display urban projects and city development concepts in a clear and well-structured manner, to furnish complex information on an understandable basis, and to present intended investments in a credible and convincing way. At the same time, VCM is an attractive tool for informing the media and the public at large: it offers a perfect platform for democratic decisions, transparent planning and community-oriented action. When looking for potential investors at home and abroad, Virtual Reality is an asset showing that those using it are open to innovation and future challenges. In the search for new investors and in presenting the city at national and international trade fairs and printed press events, the virtual model will provide direct access to complex information, visualize infrastructures and projects, and help prospective investors to choose the location according to their needs.

2. TECHNOLOGY

Virtual Reality (VR) is an interactive and immersive real time visualization technology that offers people the opportunity of visualizing, interacting with and manipulating complex data in a real-time 3D environment by means of the most advanced computer technology. VR is a cutting-edge technology and the interdisciplinary communication tool of the future. It allows users to evaluate planning results in real time and to compare alternative concepts. By using this technology decision-making processes are shortened, information and appreciation are improved and the identification with the city increases. VR applications include basically the following components:

- A three-dimensional visual database: the Virtual City Model,
- a real-time software package to interact with, visualize and practically use the database,
- and an appropriate virtual reality hardware system (input devices, computer technology, image representation systems).

Virtual City Models are created by means of state-of-the-art technology. Basic digital geographic data, relevant information obtained from the city's Geographic Information Systems and three-dimensional architecture models are used to establish a geo-referenced three-dimensional municipal database:

- land surveying geographical data (digital cadastral map)
- digital terrain models (DTM), digital surface model (DSM)
- digital aerial imagery, orthophotography
- site plan, floor plan, cross sections, views
- location photographs, model photographs
- material and surface description

The real-time software package allows viewers to interact with the database. The software controls both interaction devices and output systems. Input data is computed in real time to produce at least 20 images per second. As Virtual City Models are of high complexity, they contain extremely large volumes of data and could be presented in the past only on high-performance graphics computers. Now, the software solution HYVE (Hybrid Virtual Environment) allows users to view the models on PCs, too. The resulting cost benefit is considerable: large data volumes are processed in less time, and costly hardware systems are no longer needed.

3. APPLICATIONS

The City of Leipzig aims to give technological, cultural, touristical, urban development, political, representative and visionary themes of the city a new attractive form of presentation. The VCM Leipzig is information-, planning-, marketing- acquisition tool at the same time and can be enhanced optionally.

Urban Development

The VCM Leipzig has been used to check infrastructure, traffic engineering and ecological concepts prior to implementation involving costs. At the press of a button, users can move from one city development option or facade lining element or colouring concept to another.

Themes of urban development can be presented with these instruments much better and can therewith give a suggestion of the future, for instance:

- development of infrastructure, transport planning ("City-Tunnel", bridge "Jahnallee")
- city development (presentation of central projects: "Sportforum", Porsche Leipzig)
- city regeneration (visions and perspectives of the city rebuilding and the city regeneration, for instance Gruenau, the east of Leipzig and the western Leipzig become a new face)

Business Development and Location Marketing

Since the Model can be linked with any kind of actual and planning data the VCM Leipzig is a tool for acquisition and settlement discussions. Marketing relevant data like the economic potential, prognoses and site-related factors resulting from the working process of administration and economy can be made available easily. Main focus is an marketing- and location compatible editing of information with a consistent corporate visual identity.

4. SUMMARY

Virtual City Models are designed for an interactive visualization and presentation by means of virtual reality tools and technologies. VCM may assist in the following fields:

- international, national and regional marketing and location promotion,
- decision making in choosing between various architectural planning options and in competitions for architects,
- preparing occupancy concepts,
- simulating infrastructure, traffic engineering and ecological concepts,
- furnishing information to the media and the public at large.