3D Multimedia Historic Bratislava

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1 ABSTRACT

Urban spaces are now going on-line. In Bratislava, Comenius University team has assembled the contributions from about 100 authors including photographers, writers, graphic designers, programmers, musicians, photogrammetry operators and students of computer graphics into Multimedia Historic Bratislava DVD, the first comprehensive 3D plus multimedia presentation of this kind in the Central Europe. Labeled by the Top Talent Award 2007 Quality Seal, initial batch of 1000 DVD pieces already shipped into the local tourist agency for free-of-charge distribution.
In this paper, we describe the effort and abstract the work-flow for the perspective authors of 3D models, 360 degree panoramas, graphical user interfaces and animated guided tours. We developed our own virtual reality software capable of real-time walkthroughs, which is now also employed in interactive visualizations and tests of planned city structures. Our software encrypts the critical author contributions to prevent copying and using them outside the DVD. Cooperation with Bratislava Old Town Municipality will lead into the internet presentation, making available the valuable content worldwide.

2 VIRTUAL CITIES WORLDWIDE

Fig. 1: The first virtual city ever – Virtual San Francisco (screenshot from www.sedris.org/stc/2001/pp/clover/dc/vrml/startme.wrl)

San Francisco is considered the very first city that was transformed from real to virtual 3D shape. Era of building “real virtual cities” became in 1991 according to Planet 9 Studios [1]. This era was catalyzed by virtual environment standards like VRML (1995), boom of 3D computer graphics and consumer digital photography (mid 90-ties). In 2008, internet presentation of a bigger city is a necessity.
Virtual Old Prague – a typical example of VRML capabilities – was the first 3D city area from the central european region published on the internet [2].

Fig. 2: Virtual Heart of Central Europe snapshot: virtual environment of Chatam Sofer memorial in Bratislava created by Ján Krížik

In 2003, its authors, as well as creatives from other central-european computer graphics labs established a project [3], which lead to awarded presentation of Graz, Maribor, Bratislava & Prague city diamonds. We had chosen the most attractive city spots (by the means of cultural heritage, Fig. 2 is an example of UNESCO world heritage list candidate) and published them in 3D multimedia form on the internet.

Meanwhile, global corporations ([4] is an example) have launched initiatives for capturing major cities worldwide, occupying terrabytes of new virtual geospace. For our region and know-how, this new virtual

geospace lacks of one quantitative and one qualitative feature: most of the central european cities are yet not included in these initiatives, and – publically available city presentations miss the richness of cutting-edge multimedia technology and fine details, that the computer graphics authoring teams offer.

3 PRESENTING A CITY ON (NEW) DIGITAL MEDIA

Virtual presentation of the real city has many applications. The first mentionable were bringing a genius loci to internet users through photographs (Fig. 3) or photopanormas (Fig. 4) with purpose to boost tourism or simply to entertain. Hypertext technology linked the locations from where the photographs were taken into the walk-trough networks. However, they can not be compared to the fully 3D virtual environment, which, if precisely build, offers many extensive applications.

Fig. 3: Standalone (left) and networked (right) digital photographs in Bratislava internet presentations

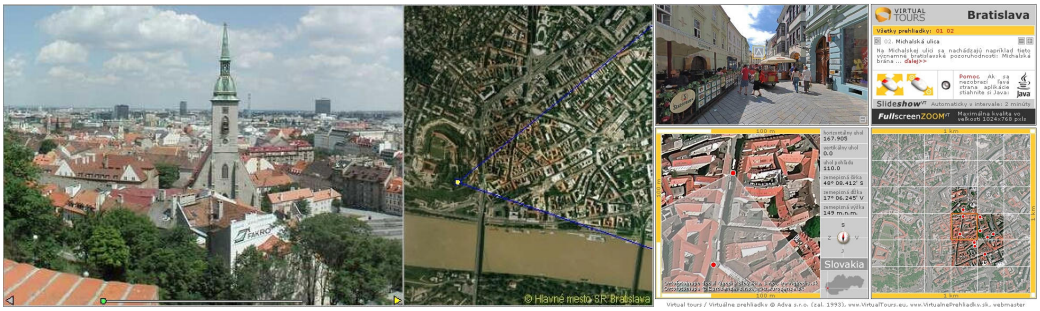

Fig. 4: Standalone (left) and networked (right) panorama presentations of Bratislava

Fig. 5: Avatar introducing Bratislava genius loci (developed by Stanislav Stanek)

Recently, a demand for navigation or exploration assistant in large or complex structured virtual space presentations arised. In small virtual environments like the VHCE spots in Bratislava [3] we are using avatar serving as a tourist guide and a natural source of information (which are easier to absorb using voice, gestures, mimics…). For larger environments we developed authoring tool for producing automated guided tours (Fig. 10). Avatars and multimedia guided tours thus form a new dimension added to static 3D models.

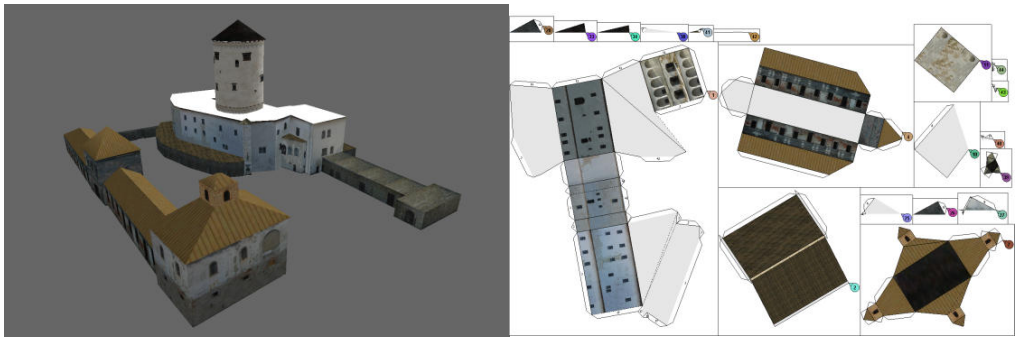

Fig. 6: Papercraft presentation created by Martin Samuelčík: digital 3D model and one its printed paper sheet

Fig. 6 shows one perfect example of mixing traditional and "new" media presentation: if there is a virtual 3D model of the building available, one can transofm it to reality by the means of the old papercraft technology [9]. Such hardcopy 3D result is more convenient for exploration than any modern 2D display visualization.

4 EFFORT IN 3D MULTIMEDIA HISTORIC BRATISLAVA

Composing a website from photographs obviously requires less time than rich multimedia city presentation. Text, picture, video and sound data requires no additional effort to consider in the multimedia presentation design, therefore we briefly discuss only the effort regarding the most recent technologies.

4.1 Panoramas

We use Dersch Tools [10] for creating high-resolutinon 360 degree panoramas. While taking photographs is a matter of minutes, processing them to one detailed panorama requires sometime more than 20 hours.

4.2 3D Model

Construction of the 3D model is the most time-consuming activity in a multimedia city presentation projects. There are different types of the model sources and resulting shapes and today most of them are achievable using low-cost consumer hardware and software [11].

4.2.1 Digital Terrain Models

In our projects we use DTM's easy accessible from the city municipality (usually rough 20 m grids) and for more precise purposes, we buy detailed terrain models from specialized geosurvey companies. Only effort needed is some photorealistic texturing of the terrain data.

4.2.2 Cadastral Data

Fig. 8 shows (publicly available) cadastral data – 2D footprints extruded from the terrain to certain height. Even the model made of such extrusions with one aerophototexture applied on it could be very convincing (see [11], Fig. 10) and its construction in 3D modeling software for 100 buildings takes only couple of hours.

4.2.3 Photogrammetry outputs

Contemporary prices of the photogrammetry-processed precise 3D geometry (Fig. 7 left) are about 100 Euro per hectare in the central Europe. Such geometry is the base for further refining and texturing.

4.2.4 Geometry refining

Photogrammetry process can yield only a rough geometry (unfortunately a lot of projects consist of rough geometry only), unsatisfactory for virtual walkthrough close-ups of complex facades. Refining the geometry in the Fig. 7 took about 20 hours and in general, it is one of the most time-consuming tasks.

4.2.5 Texturing

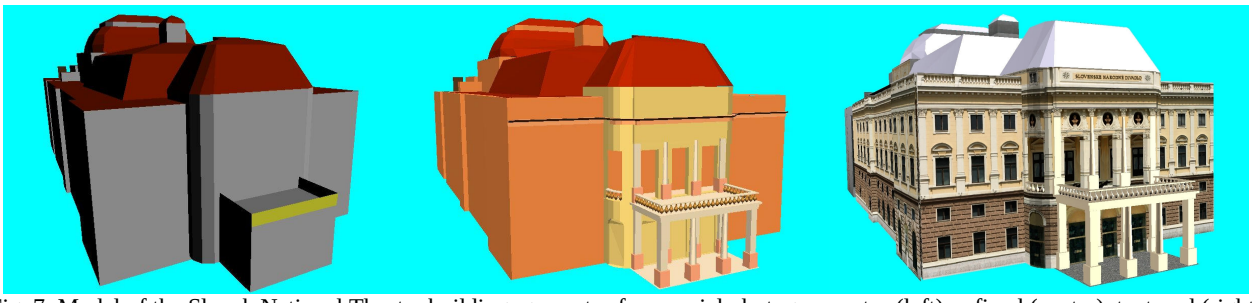

Fig. 7: Model of the Slovak National Theatre building: geometry from aerial photogrammetry (left), refined (centre), textured (right)

The most effortful task in the process of constructing a photorealistic 3D model is texturing. Capturing the photographs from the ground, processing them (the retouch process takes approx. 70% of the texturing time) and mapping onto object in Fig. 7 took about 30 hours. Estimated number can increase up to about one hour per one facade meter in case of narrow streets, complex facades and obstacles in front of them.

4.2.6 Modeling Standalone Structures

Church Klarisky shown in the Fig. 8 is an example of standalone object that deserves to be modeled in fine details from scratch. Taking photographs of the church took one hour, building its geometry was estimated to

about 30 hours, subsequent texturing took approx. 20 hours [12]. Multimedia Historic Bratislava DVD includes 5 other fine detailed buildings, construction of each one required more than 100 man-hours.
For very rare cases of special building shapes the construction time can be shortened ([11] shows our method for symmetrical building models created in couple of seconds).

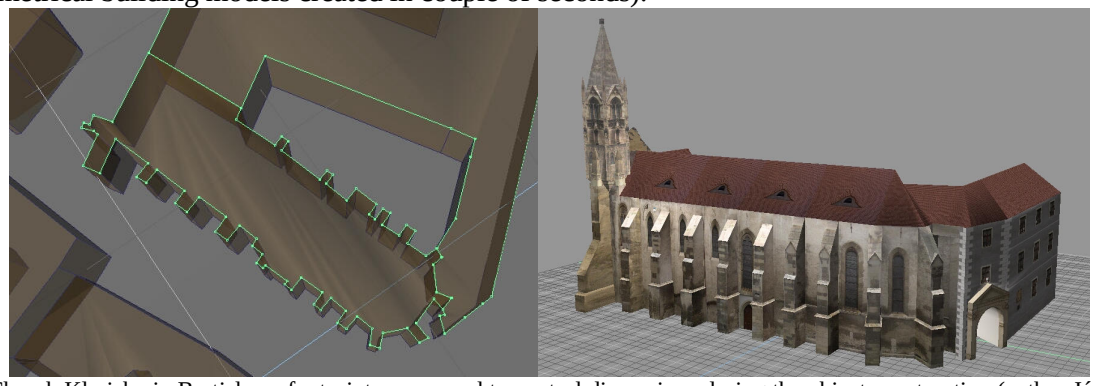

Fig. 8: Church Klarisky in Bratislava: footprints were used to control dimensions during the object construction (author Ján Šutara)

4.2.7 Small Objects

Trees, traffic signs, and similar objects enrich virtual urban environments. Custom approach is to build a set of prototyped objects that are placed into the space with different attributes like height, orientation or scale (poplar trees in the Fig. 9 are instances of two objects instantiated with different heights)

4.3 Software for Content Visualization

Virtual San Francisco and other similar internet virtual environments used common free VRML clients (like [13]). However, they were not optimized for the large amount of data. On the other hand, proprietary renderers capable of fast interaction are mostly packed into undue huge and expensive software systems. As a compromise – fast and lightweight renderer – we developed our own visualization and interaction software.

Fig. 9: Example of the new structures embedding: interactive visualization of the Winter Hockey Hall proposal in Bratislava

Our visualisation software is able to present vast urban spaces fluently in both large and small scales. Fig. 9 shows its application in urban planning – winter hockey hall has been built in the “real” virtual environment.

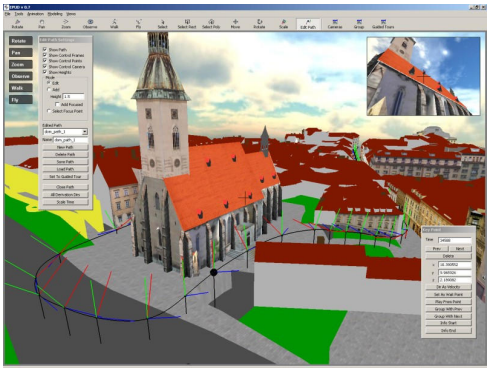

Fig. 10: Guided Tour authoring tool

We also developed a tool for creating guided tours, consistsing basically of camera paths along which the guided tour author can place text, pictures, sound, etc. and thus prepare impressive movie-like presentations.

5 MULTIMEDIA HISTORIC BRATISLAVA PRESENTATION

Due to the amount of collected data (2.5 GB), we decided to coose DVD as a carrier for our city presentation. Presentation layer of the Multimedia Historic Bratislava DVD (sophisticated user interface and the overall layout, wich took about 650 hours to develop) was made in HTML and Adobe Flash internet standards, therefore its future transition to the internet will be quite straightforward.

Fig. 11: Multimedia Historic Bratislava DVD screenshot

Fig. 11 shows basic user interface layout with horizontally arranged icons representing the media (text, photography, video, panorama, 3D model) and vertical icons representing objects or areas in the city.

Special photo bonus (including the most famous Bratislava photograph from the 1968 soviet occupation) and audio bonus (audio gallery compiled from Slovak Radio broadcasting archive) are packed into DVD. All sensitive data are enrypted and therefore not visible to the DVD user, which avoids their separate copying, distribution or further individual use.

Multimedia History Bratislava presentation was implemented for our original multimedia kiosk hardware [9] with touch-screen interface, as well. Fig. 12 shows this adapted human-machine interface.

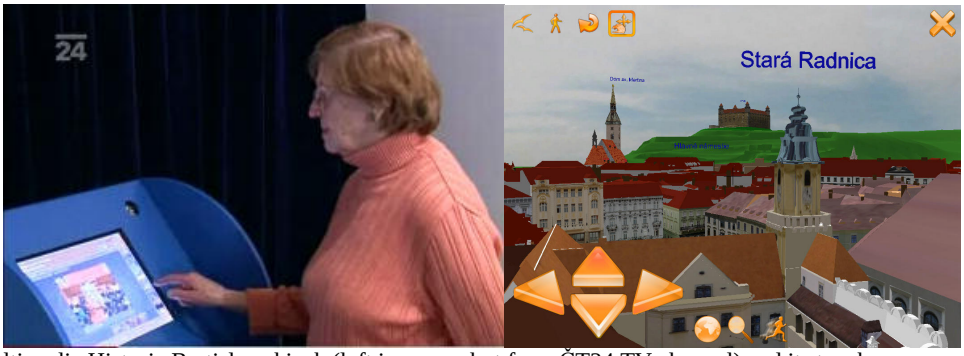

Fig. 12: Multimedia Historic Bratislava kiosk (left is a snapshot from ČT24 TV channel) and its touch-screen user interface

6 CONCLUSION

It have not been a long time since the first real place occurred in the virtual space. New technologies are emerging rapidly. We tried to employ them to form a product, that now serves as an electronic guide in the city museum, introduces the city to newcomers as well as to people desiring to explore it by the new means.

7 ACKNOWLEDGEMENTS

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