3D Terrain data pipeline to create content for virtual reality environments (VREs), and some sample applications

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The 3D Terrain ("3DMaasto") project was a group project of VTT, Helsinki University of Technology (presently Aalto University), University of Helsinki, and Finnish private companies, and it was supported by Tekes (Finnish Funding Agency for Technology and Innovation).

The project purpose was to automatically generate visualization models of built and unbuilt environment from aerial and satellite images. These models are then presented using computer graphics technology. Other types of data, e.g. architectural and CAD models, can also be imported to the visualization system.

The resulting Virtual Reality Environments are easily scalable: from laptop PC to stereo wall projector to VTT Cave with 3 wall displays.

The 3D Terrain data pipeline consists of 3 main components: The first one generates a digital terrain surface model from aerial images containing the ground colors and a digital elevation model. The second one generates virtual buildings from building corners coordinate data in text format. The third one generates virtual trees from satellite images (visible and near infrared channels) with statistically representative forest parameters.

All 3 generate 3D model files in the binary format used by the visualization system, and the separate 3D model files (the terrain surface model, the virtual buildings, the generated trees, and the optional architectural models) are combined into one VRE during presentation.

One demonstration visualizes the Otaniemi area, including the Digitalo building CAD model. However, often simple VRE visualization is not enough, one might want to present the results of various simulations and measurements in the VRE, too. For these purposes various applications have been developed.

For EU Talos project it was necessary to simulate the motion of an Unmanned Ground Vehicle (UGV) in terrain. Therefore the visualization code has been enhanced with physics code and other features. UGV simulations have been done in multiple test areas.

Various experiments and demonstrations on how to move (navigate) in the VRE have been done. The user can move in the VRE consisting of Digitalo architect model and Otaniemi area by using the VTT-built multitouch table, which is placed in the VTT Cave (with 3 wall displays to visualize the VRE).

Another application demonstrates the effect of the possible sea level rise caused by the global warming in the Otaniemi area. Yet another application visualizes the measured building information parameters in VTT buildings in Otaniemi area: electricity MW, electricity MVar, heat consumption, or water consumption.

References

[1] Tekes MASI - Mallinnus ja simulointi 2005-2009, MASIT09:

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