Tapiola 3D Model Reconstruction from FGI Roamer System

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In the past few years, it has been seen remarkable development in mobile laser scanning (MLS) to accommodate the need for large area and high-resolution 3D geographic data acquisition. MLS serves one of the probably fastest growing market segments, which is 3D city modeling (Toth, 2009). Advanced real-time visualization for location-based systems such as vehicle navigation (Cornelis, et al, 2008) and mobile phone navigation (Chen et al., 2010) require large scale 3D reconstructions of street scenes. Google, Microsoft, Tele Atlas and NAVTEQ are currently expanding their products from 2D to 3D, even though currently most of their 3D models are only available for fly-through views. This has created a demand for ground-based models as the next logical step to offer 3D visualizations of cities (Pollefeys, 2008).

This paper presents methods for generating photorealistic 3D city models from MLS data, which were collected by FGI Roamer system, to enable the use of photorealistic models in a mobile phone for personal navigation. The test site is located in the Tapiola area, Espoo, Finland. It is an area of commercial buildings, with the tallest building being 45 m in height. The reconstruction of 3D model included two steps: geometry reconstruction and texture mapping. During the procedure of geometry reconstruction, the main focus is on the automated processing algorithms for noise point filtering, ground and building point classification, detection of planar surfaces, and on the derivation of the key points (e.g., corners) of building. Buildings were extracted by transforming 3D point cloud to binary images and employing image processing technology for non-building data removal, and then transforming the cleaned binary image back to 3D point cloud. This method utilized powerful image processing technology for point cloud classification. During the procedure of texture mapping, we use the existing software for texture preparation and mapping, e.g. 3ds Max.

Figure 1. 3D models of Tapiola area

The resulting 3D models of Tapiola area is shown in Fig. 1. The model accuracy was evaluated by the field testing ---using the resulting 3D models on a smart phone for real time positioning and navigating in the Tapiola. The model accuracy meets the outdoor navigation requirement (less than 1m). As a result, 3D photorealistic Tapiola models from high resolution MLS data were successfully reconstructed according to the requirement of a smart phone based navigation: small model size, good visual appearance, and desired model accuracy.

References

[1] Zhu, L., Hyyppä, J., Kukko, A., and H. Kaartinen, 2011. *Photorealistic Building Reconstruction from Mobile Laser Scanning Data*. Remote Sensing, Vol. 3(7), pp.1406-1426. doi:10.3390/rs3071406.