Virtual Cities 2.0: Generating web-based 3D city models and landscapes based on free and user generated data (OpenStreetMap)

N. Neubauer, M. Over, A. Schilling, A. Zipf

http://www.geographie.uni-bonn.de/karto/

1 Virtual Geographic Information

NeoGeography or geoWe2.0 are recent buzzwords for a paradigm shift on how geographic information is managed, processed and visualized on the Web through non-specialist user communities. Goodchild (2007) coined the term *Virtual Geographic Information* "VGI" for projects that collect geographic information through volunteers. The collection of information by masses of volunteering individuals enabled by Web technology resulted in particular in the OpenStreetMap (OSM) project, which is strongly influenced by the Wikipedia concept. OSM aims at creating free vector geodata covering the whole planet. In large areas in Europe – in particular the densly populated ones - this data set is already richer than commercial street data sets and can be used by mass market applications like the OpenLS services offered in OpenRouteService.org for large parts of Europe.

2 OpenStreetMap 3D (OSM3D)

This paper describes an approach to visualize OSM data (landuse, streets, POIs etc.) in 3D. This can be done either by simply draping raster images generated from OSM data as texture on a Digital Elevation Model (DEM). But for achieving a high degree of quality this is very resource intensive. An alternative approach that is used in GDI-3D is to integrate the OSM vector data and the Shuttle Radar Topography Mission (SRTM) data, which is also public domain, in order to construct a digital elevation model as integrated TIN including all vector information. The principle has been described in (Schilling et al. (2007, 2008) with data from official administrative sources. The result is better suited for 3D visualizations through Web Services such as the OGC Web 3D Service (W3DS) draft specification. This approach requires intensive preprocessing, since the integration of the vector data with the DEM demands high computing resources. But as this can be precalculated and optimized the resulting visualization offers higher performance and offers vector-quality in contrast to raster pixel maps. Currently such a 3D OSM covering whole Germany is being processed and will be presented online in short time. The data preparation involves a high performance computing cluster (GRID-computing) to perform the task in a reasonable time span. The service will be available online at www.gdi-3d.de. Figure 1 gives a first impression on what can be achieved with such an approach with SRTM data. Of course also higher resolution DEMs can be used if available.

Figure 1: examples of OSM road and land use data that has been combined with a SRTM 3 arc-seconds (ca. 90m) terrain model. Primary and secondary roads have been flattened more than cycle ways and little forest tracks. Thus a more natural appearance is achieved.

3 OSM based 3D City Models

The OSM community not only captured roads and paths but also more and more POIs, objects, landuse areas, and even buildings. The latter can be extracted and extruded into 3D and placed on the OSM-DEM as described above. Usually the building data does not (yet) come with height information. Therefore default values have to be used. But first results show, that adding additional OSM features, although in a very basic form, leads to a more realistic impression and better 3D visualizations. In most cases only important buildings are mapped by the OSM community currently, but of course also selections based on semantic attributes (simple tags in the case of OSM) are possible.

Figure 2: Web based 3D service based on combining OSM and SRTM: buildings extruded into 3D and POIs displayed as 3D symbols delivered from OpenLS Directory Service. Presented is the city of Karlsruhe based on OpenStreetMap data combined with SRTM data.

Figure 3: Freiburg im Breisgau with POIs, landuse and buildings from OpenStreetMap

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