Grant agreement no: FP7-610603

European Robotic Pedestrian Assistant 2.0 (EUROPA2)

Start of the project: 01.10.2013
Duration: 3 years

DELIVERABLE 1.4

Maps of the Partners Sites Available

Due date: month 10 (4 August 2014)
Lead contractor organization: GeoAutomation
Dissemination Level: PUBLIC

Figure 1: An overlay of the available mapped streets of Zurich over a satellite image of the city. Cyan lines represent the driven streets with available map information.

1 Introduction

Deliverable 1.4 consists of publicly available map data recorded at the project partners' sites using GeoAutomation technology. For this intermediate deliverable, we provide the maps of Zurich (CH) and Leuven (BE). The remaining maps, namely of Freiburg (DE) and Oxford (UK), will be provided at M16. Indoor maps for selected places will be provided later during the project to the beneficiaries.

2 Available Maps

The available maps consist of tracks (features detected in 2D in the image sequences and reconstructed in the 3D world) and poses (position and orientation of the van, also used as the origin of the coordinate system of the cameras). Finally there is the original imagery, which is aligned with the tracks and poses to perform 3D measurements. Due to size (ca. 400 GB), the original imagery is not directly available on the server but can be provided on request.

The data is organized in zones, which denotes areas that are driven/recorded in a continuous fashion. Whenever the car stops, or needs repositioning to another area, a new zone starts. The data for Zurich consists of zones 104-118, and a separate set of logfiles is available for each zone. For each zone, two files are available, one for the poses of the vehicle and one for the features tracked. Similarly, the data for Leuven has subdivided in zones 126, 201, 202, 203, 204. Figure 1 and Figure 2

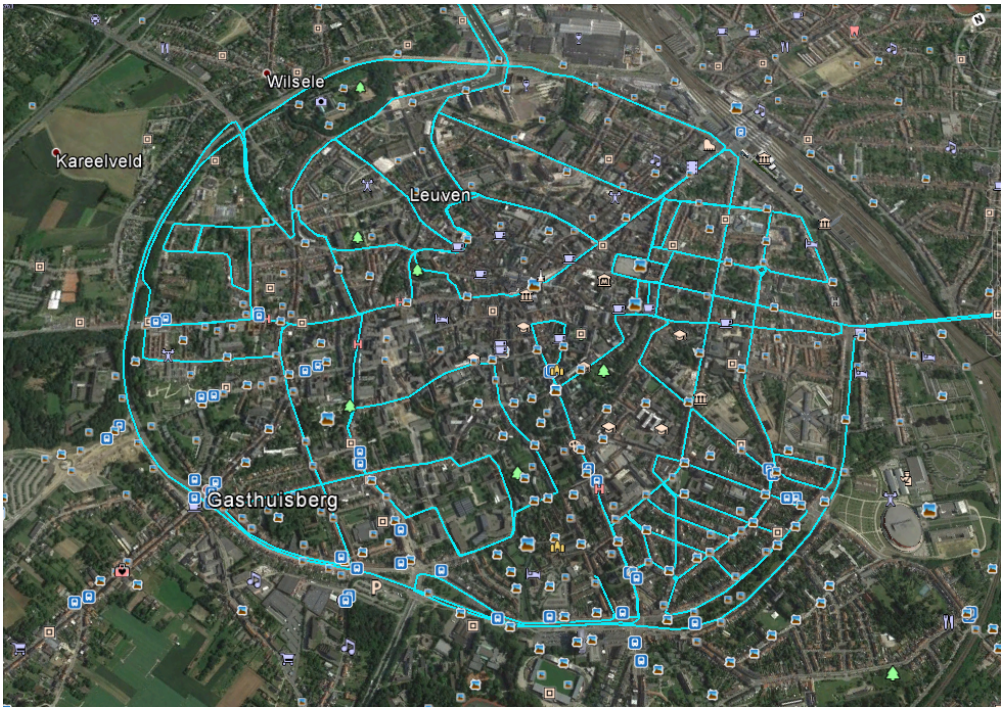

Figure 2: An overlay of the available mapped streets of Leuven over a satellite image of the city. Cyan lines represent the driven streets with available map information.

show an aerial view of Zurich and Leuven, respectively, with the available mapped streets overlaid on top of it.

The poses, stored in the pose file, are relative to the initial pose of the van in the world and consists of the 3D position and orientation of the vehicle. The tracks file contains the 3D information of the reconstructed track and the original 2D features that were used to compute these 3D coordinates. Figure 3 gives an example of how the available data looks like. The van poses are depicted as a continuous white line, while the tracks are depicted with colored points in 3D, where each color correspond to one of the zones. When zooming in as in Figure 4, the white lines indicate the path followed by the car, positioned in the midst of the pointcloud reconstructed from the 2D features detected in the imagery (colored points). The relationship between the 2D features and the 3D world/pointcloud is determined by the relative transformation between each camera position and the van's position, which is calibrated in advance.

The information of the tracks and poses is used by GeoAutomation to measure and delineate all necessary features to create detailed GIS related topographic maps. In EUROPA2 this will be used to indicate areas in the map where the robot is allowed to navigate. Moreover, this will be integrated with the perception and mapping modules of EUROPA2 to include and geo-reference interesting features for navigation.

All the data will be made available on the EUROPA2 websites together with the final version of this deliverable.

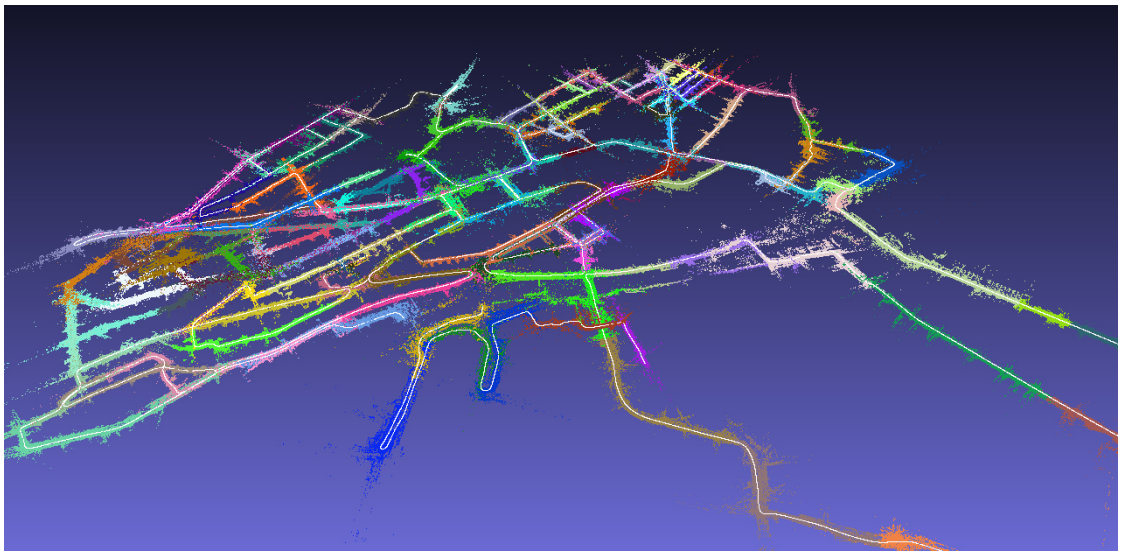

Figure 3: An example of the tracked points and the vehicle poses available for the map of Zurich. The white line represents the path taken by the vehicle, while different colored points depict the visual features tracked over time. Points with the same color have been aligned jointly and belongs to the same zone.

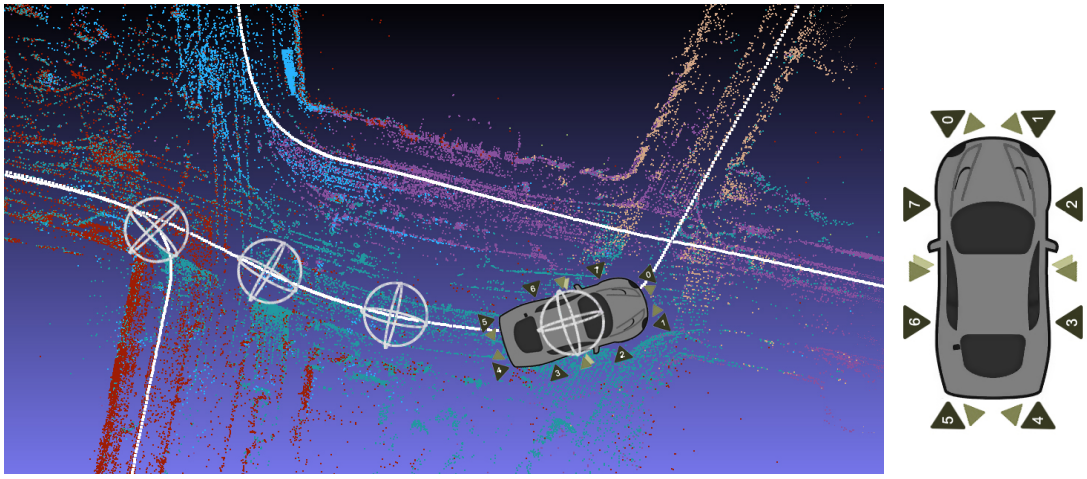

Figure 4: A portion of the above map showing the path followed by the car (white) in between the local features points (colored) that have been reconstructed in 3D.

3 Compatibility of Maps with External Tools

The data can be exported in other open formats. Keyhole Markup Language (KML) files can be generated and then imported in three-dimensional Earth browsers, such as google earth[1]. The **.kmz** files, that are part of the delivery, are also linked to "Google Earth" when it is installed. Using this data, it is possible to show the routes that have been followed together with the track/frame numbers that correspond to the output data (see Figure 1 and 2 for examples of use). A compact representation of the total 3D pointcloud, covering the most important features, together with the poses or van's positions is available by exporting the data to a Polygon file format (PLY). The file can be then easily imported in e.g. meshlab for visualization.

[1] `http://earth.google.com`