

From Real to Virtual Environment – Integration of Publicly Available Geodata into a Simulation Environment

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Abstract

Inland shipping is an important mode of transportation in Germany and especially in North Rhine-Westphalia [1]. Even though the air pollution from inland waterway vessels must be drastically reduced in the future, they offer a promising alternative to the road transportation on the way to transporting loads in the most environmentally friendly way possible. Unlike trucks, inland waterway vessels consume only one third of energy. Thus, inland shipping can be much more climate friendly [2].

For the further development of this transportation domain, many research projects are currently carried out. One of them is the project “AutoBin” funded by the European Regional Development Fund (short: ERDF). Goal of this project is the fully automatization of a test vessel. Numerous sensors, including multiple high-definition (mono)-cameras, two LiDAR systems and positional sensory equipment are mounted on board of the test vessel. Before test runs are performed with the vessel, training and validation of the control algorithms will be carried out using simulations. Therefore, a virtual environment based on the test area is built as a work package in the project. A part of the Dortmund-Ems-Canal, starting from the harbour in Dortmund and ending at the Waltrop lock, is selected as test area. Low traffic density and, above all, no dangerous goods transport are the main reasons for choosing this area. [3]

The fact that the test vessel is equipped with such a large number of sensors and especially high-definition cameras, results in a (photo)-realistic virtual environment necessary in order to generate qualitatively equivalent data in the simulation. Modelling such an environment by hand is very time consuming and requires a high level of knowledge in 3D-modelling. Therefore, already available data is taken as a base for the simulation environment.

There are many open-source data sources regarding the geoinformation of various locations. This contribution describes the fusion of these sources to generate a simulation environment based on the real world. Figure 1 shows the general flowchart of the integration of different data sources into the simulation environment.

Official nautical chart material is used to generate the waterway whereas, for the surroundings of this waterway, the Geobasis NRW is used to get the elevation profile next to it [4]. Buildings and Landmarks (trees, powerlines, etc.) are also important for the realistic impression of the simulation environment. Therefore, the positions of such objects are extracted from open-source data, such as OpenStreetMap (OSM). A realistic texture is then generated from orthophotos and images taken by an unmanned aerial vehicle (UAV).

To view the resulting simulation, an appropriate visualization is necessary. This contribution further shows the possibility to integrate the simulation environment in the test and control centre VeLABi. This centre is the base infrastructure funded by the Ministry of Transport of the State of North Rhine-Westphalia for the development of autonomous inland ships. In addition to workplaces for the controlling and monitoring of (semi-)autonomous vessels, it contains a stereoscopic 3D simulator for the visualization of the view out of the wheelhouse. The simulation environment is integrated in this simulator which thus can visualize a drive on the virtual Dortmund-Ems-Canal. [5]

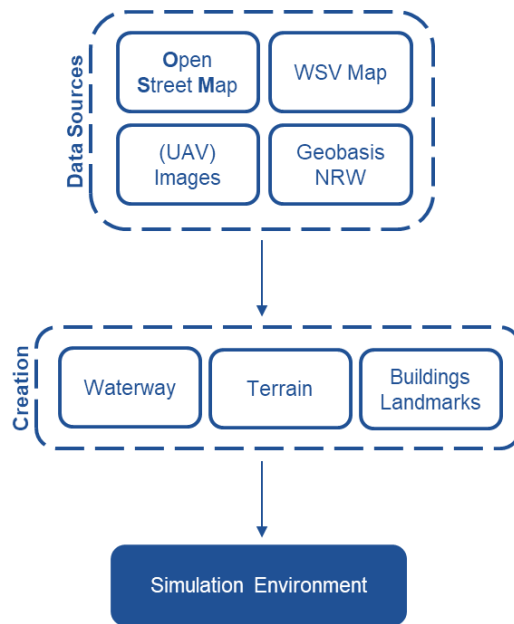


Figure 1: Flowchart of the different data sources and their integration in the simulation

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