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The Development and Simulation of an Urban Traffic System for the Usage in Immersive Virtual Environments

Marco Weißmann [a,*], Dennis Edler [a], Julian Keil [a], Frank Dickmann [a]

[a] *Ruhr University Bochum, Geography Department, Bochum, Germany, marco.weissmann@rub.de, dennis.edler@rub.de, julian.keil@rub.de, frank.dickmann@rub.de*

* Corresponding author

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Abstract:

The global debates on the consequences of climate change have contributed to a re-thinking of traffic systems, especially in urban areas. A reduction of pollution emissions by motorized vehicles is considered as an important contribution to reduce urban heat and to increase health conditions in cities. To simulate potential planning scenarios in a realistic way, possibilities of 3D visualization have been explored. Modern potentials of virtual reality, however, still require exploration in these approaches. This also refers to the simulation of urban traffic systems which are based on multisensory animations and interaction. The interaction includes 1) the animated objects with each other and a traffic light system, and 2) the avatar (the user's virtual ego) with these interacting objects.

A current VR-based research project is dedicated to urban developments in the context of smart(er) cities. The developed immersive virtual environments are designed for geography school lessons to transfer knowledge and simulate how future cities could be improved by means of smart city solutions in order to tackle societal, economical and environmental issues. Within the project, the geography lessons are designed by experts of didactics in geography (Ministry of Education North Rhine-Westphalia and Geography Department, University of Cologne). One urban key topic is smart mobility.

Using the game engine Unity, an immersive virtual environment was designed to visualize the present and future traffic conditions of a highly dense urban area (Figure 1). The case study is based on a model (not a real city) which brings together specific considerations of urban traffic, such as mirroring the complex interplay of individual and public transport and different (smart) transport technologies in future (lower-emission) scenarios. Moreover, dense rush hour conditions based on car traffic are replaced by other forms of interacting mobility. Additionally, changes in the type of usage of traffic areas are implemented.

Figure 1. Complex interactions of animation paths used to simulate an urban traffic system in an immersive virtual environment

This contribution has a methodological focus and considers possibilities but also difficulties in the design of a reliably running (open-end) traffic system. This system is able to react to individual behaviour of the user (including individualized motion of the avatar), without leading to accidents situations and uncorrectable traffic jams. The application has been evaluated using input from pupils and teachers in geography classes (Figure 2). Results of this evaluation are presented and discussed.

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Figure 2. Pupils evaluate the Smart Mobility VR application using a WebGL browser application

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