Master's Thesis

Models of Cycling Behavior

This thesis is supposed to build upon previous work on the Virtual Cycling Environment (VCE) [1], which integrates a real bicycle into a virtual reality provided by vehicular mobility and network simulation. Our bike on a stationary bicycle trainer (exercise rollers) is equipped with a number of sensors to enable the user to drive within this environment. In a first empirical study, we investigated how the VCE can be used to evaluate modern Advanced Driver Assistance Systems (ADAS) integrated with both cars as well as the bicycle. So far, our cyclist on the VCE can interact only with cars in the simulated environment, but not with other bicyclists. The used road traffic simulator SUMO already supports to integrate bicycles (and bicycle lanes), but the mobility model follows classical car following and lane chance models.

■ The Task

The task is to develop a model of cycling (or cyclist) behavior which can be used within the driving simulator. Starting with psychological studies/accounts of cycling behavior and the existing models of car mobility, a model of bike behavior has to be built and tested for its degree of reality.

This task will be supported by traces we can take for multiple participants cycling between the main campus and the Fürstenallee location. It is part of the task to coordinate the participants and to ensure sufficient quantity and quality of the collected traces.

These traces provide GPS positions, speed and acceleration measures, as well as heading information. Using statistical tools, these traces can be transformed into behavioral rules, which, in turn, can be modeled in the SUMO simulator to represent characteristic cycling behavior.

■ Relevant knowledge/competencies

- programming skills and enthusiasm for complex program environments
- basic empirical skills for setting up experiments and testing the degree of realism
- familiarity with psychological usability approaches can be helpful, but is not necessary

■ In-cooperation

This thesis is being offered (and will be conducted) in cooperation with PsyLab (Prof. Scharlau).

■ Keywords

Cycling simulator, mobility modeling, empirical studies, usability

[1] J. Heinovski, L. Stratmann, D. S. Buse, F. Klingler, M. Franke, M.-C. H. Oczko, C. Sommer, I. Scharlau, and F. Dressler, "Modeling Cycling Behavior to Improve Bicyclists' Safety at Intersections – A Networking Perspective," in *20th IEEE International Symposium on a World of Wireless, Mobile and Multimedia Networks (WoWMoM 2019)*, Washington, DC: IEEE, Jun. 2019.

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