This thesis is supposed to build upon previous work on integrating simulation tools covering road traffic and wireless communications with different types of real-time driving simulators [1]. We already have a stationary bicycle trainer (exercise rollers, steering angle sensor) integrated with this tool chain. In essence, a candidate can now already ride the bike in an artificial environment displayed via Unity 3D and can interact with the system in various ways.

The engineering part

Haptic feedback has been very successfully been used for human machine interaction in the bicycle domain already [2]. The engineering part of the thesis is to integrate different options for providing haptic feedback to the cycler. Options include simple vibrations or even directed haptics using small wheels integrated into the handlebar to guide the driver. Validation is planned based on a small empirical study.

The psychological part

The task is to design and conduct an experiment in which cyclists circumvent obstacles on the street with the help of haptic feedback. The experiment with different conditions (e.g., initial cycling speed, visibility of obstacle) and dependent variables (e.g., duration of obstacle circumvention, precision of driving) has to be designed and transferred into a virtual setting. Furthermore, distance and location of the obstacle have to be transformed online into haptic feedback via the handlebars. The central psychological task is to design haptic feedback so that cyclists can accommodate their speed and direction without much cognitive effort.

In-cooperation

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

Keywords

Cycling simulator, haptic sensors, sensor engineering
