Augmented Reality Vehicle system: Left-turn maneuver study

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Abstract:

Augmented Reality (AR) is a promising paradigm that can offer users with real-time, high-quality visualization of a wide variety of information. In AR, virtual objects are added to the real-world view in real time. The AR technology can offer a very realistic environment for enhancing drivers' performance on the road and testing drivers' ability to react to different road design and traffic operations scenarios. This can be achieved by adding virtual objects (people, vehicles, hazards, and other objects) to the normal view while driving an actual vehicle in a real environment. This paper explores a new Augmented Reality Vehicle (ARV) system and attempts to apply this new concept to a selected traffic engineering application namely the left-turn maneuver at two-way stop-controlled (TWSC) intersection. This TWSC intersection experiment, in addition to testing the feasibility of the application, tries to quantify the size of gaps accepted by different driver's characteristics (age and gender). The ARV system can be installed in any vehicle where the driver can see the surrounding environment through a Head Mounted Display (HMD) and virtual objects are generated through a computer and added to the scene. These different environments are generated using a well-defined set of scenarios. The results from this study supported the feasibility and validity of the proposed ARV system and they showed promise for this system to be used in the field-testing for the safety and operation aspects of transportation research. Results of the left-turn maneuver study revealed that participants accepted gaps in the range of 4.0–9.0 s. This finding implies that all gaps below 4 s are rejected and all gaps above 9 s are likely to be accepted. The mean value of the left-turn time was 4.67 s which is a little bit higher than reported values in the literature (4.0–4.3 s). Older drivers were found to select larger gaps to make left turns than younger drivers. The conservative driving attitude of older drivers indicates the potential presence of reduced driving ability of elderly. Drivers' characteristics (age and gender) did not significantly affect the left-turn time. Based on the survey questions that were handed to participants, most participants indicated good level of comfort with none or small level of risk while driving the vehicle with the ARV system. None of the participants felt any kind of motion sickness and the participants' answers indicated a good visibility and realism of the scene with overall good system fidelity.

Keywords:

Augmented reality, Intelligent transportation system, Left turn maneuver, Gap acceptance

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