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Improving Human Responses with the use of prototype HUD interface

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Abstract

This paper presents the evolution of our automotive full-windshield HUD interface offering a faster and simplified interface that enhances driver's spatial awareness under low visibility. The system is evaluated in contrast to existing HDD by 45 users in motorway collision scenarios under adverse weather conditions. The derived results demonstrate a clear advantage of the HUD interface in contrast to the HDD.

1. Introduction

Contemporary navigation systems promise to improve driving performance by presenting an optimal route in respect to reducing travel time and/or improving fuel consumption. Hence, they function solely as route calculation machines which affect a singular aspect of the driving experience, namely spatial orientation. Such systems, however, do not support or improve drivers' spatial and situational awareness, that is primarily responsible for the majority of collisions [1,2]. Typically reduced spatial and situational awareness translates to an increased response time and increased probability of collision. The collision occurrences can be increased dramatically under adverse weather conditions that hinder further human vision and spatial awareness. To this end, we have evolved our prototype system through a series of simulations and amendments with view to improve the human responses and evidently reduce the potential collisions [3].

2. Proposed Full-windshield HUD interface

Based on the aforementioned information, our work in the full-windshield Head-Up display (HUD) interfaces focused on the simplification of symbols involved, and cost efficient manufacturing capability (Figure 1). The symbols adhere to our previous design yet achieve reduced cognitive load due to selective tracking of the lead only vehicle, lane departure, neighboring vehicle and blind spot warnings.

Figure 1: Screenshot of the active HUD interface in the 3rd generation VR Driving simulator

3. System Evaluation & Conclusions

The prototype HUD interface has been evaluated in tandem with a typical HDD over 45 user trials using our in-house third generation driving simulator facility. The simulation used 3D stereo visualisation so as simulate depth of field and entailed driving in a motorway environment. The new artificial intelligence of our simulator replicated a rear collision accident scenario sourced from real-life traffic police information and embedded VANET simulation data, thus improving the driving scenario realism [4]. Similarly to our previous simulations, the results presented an average probability of collision avoidance of 25% with HDD in contrast to 95% with the proposed HUD. Notably even the 5% of collisions that occurred with the use of HUD, would not result in fatal accidents due to the reduced speed of the driver's vehicle. The system delivers on its promise of an efficient, non-distracting information display conduit which helps maintain the driver's spatial awareness and reduces significantly the collision occurrences under adverse weather conditions. The driver's anxiety and overall performance is clearly depicted in the example of user 17 below, where the red lines present the collisions during the simulation (Figure 2). On our future work we envisage to improve further the HUD interface and couple it with a novel gesture recognition system aiming also at simplification of interactions and improved response times.

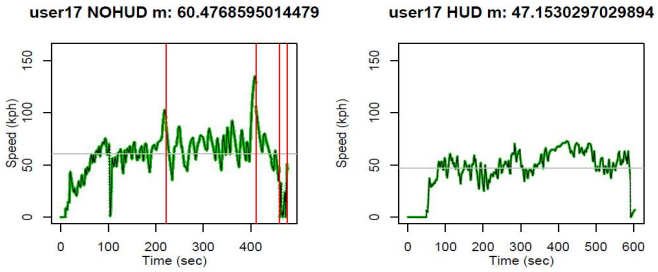

Figure 2: Typical user collisions and responses without and with the HUD

4. References

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