Mechanical & Industrial Engineering
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Gesture-based control for automotive applications

A prototype gestural interface is currently under development at Qualcomm, a world leader in 3G, 4G, and next-generation wireless technologies. This interaction modality has not yet been implemented in vehicles but recent research, although limited, suggests potential benefits, in particular a reduction in visual demand and cognitive workload compared to touch-screen interactions (Bach et al., 2008). Previous research has also focused on different design strategies for gesture-based interactions, e.g., participatory design (Reiner, 2012), providing visual feedback (Alpern and Minardo, 2003), and combining voice with gesture (Pfleging et al., 2012). However, little is known on how this new modality compares to voice control. Further, no research has looked at how this new interaction modality affects different aspects of driver distraction. Drivers' attention may be involuntarily captured by an interface; drivers may also voluntarily engage in a secondary task while driving, such as adjusting the radio or answering a cell phone call (Feng et al., 2014). An Australian national crash study identified over 70% of distractions to be voluntary, including the use of mobile phones, adjusting in-vehicle systems, and interacting with passengers (Beanland et al., 2013). As part of this research effort, we will consider both the attentional demands placed on the drivers by different interaction modalities as well as their effects on the drivers' willingness to engage in potentially distracting activities.

A comprehensive literature review will be conducted to identify latest gesture vocabularies and up-to-date design in gesture-based interfaces so as to develop appropriate use cases. Our method will also involve a stage of usability testing to ensure that users understand different gesture interactions that are being implemented by Qualcomm. We will then compare the prototype system with voice and touch controls in a driving simulator study, in terms of reaction times (e.g., time for pressing/releasing the pedal for braking/accelerating) and response errors (e.g., deviation from an assigned driving lane or giving an incorrect gesture input) as well as physiological data for cognitive workload measurements (i.e., eye tracking). We will also include a control condition to assess driving performance of drivers when they are not engaged in in-vehicle information systems.

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