Challenges In Supporting AR/VR HMDs In-Motion

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Reflection statement

We would argue that the scope of the workshop should be broadened to consider displays across the Mixed Reality spectrum, from HUD HMDs (e.g. Glass), to rotationally / positionally tracked AR HMDs (e.g. Hololens) and VR HMDs (e.g. GearVR, Oculus Rift). Whilst the unique capabilities of these displays might be exploited for different use cases (e.g. AR being used to augment the surrounding and external environment, with VR being used for more immersive experiences), they share some overlap in terms of usage, with both having significant merits regarding virtual workspaces and entertainment.

2017 Workshop on Augmented Reality for Intelligent Vehicles
September 24, 2017, Oldenburg, Germany

Both AR and VR HMDs may be problematic in terms of motion sickness, and yet can have notable roles to play in solving or delaying the onset of said motion sickness, for example in rendering content so as not to occlude a view of external motion, or rendering motion alongside content [1]. In addition, both types of displays commonly rely on IMU-based tracking which cannot discriminate between user head movement and vehicle motion, meaning headsets cannot maintain a forward bearing, necessitating a common solution across headsets. This will likely entail some integration of inside-out or outside-in positional tracking and vehicle position/orientation/velocity data, and lead to questions regarding supporting such solutions across a wide variety of transport options and contexts (e.g. public transport as well as autonomous cars).

Fundamentally, AR and VR headsets will allow passengers in autonomous vehicles to augment or entirely escape the surrounds of their vehicle. However, practical problems such as headset tracking, sharing vehicle motion data, and overcoming motion sickness are significant impediments requiring further research.

[1] Mark McGill, Alexander Ng, and Stephen Brewster. 2017. I Am The Passenger: How Visual Motion Cues Can Influence Sickness For In-Car VR. In *Proc. CHI '17*. https://doi.org/10.1145/3025453.3026046