Benchmarking the Use of Immersive Virtual Bike Simulators for Understanding Cyclist Behaviors

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ABSTRACT

Recent reports indicate that cyclist fatalities are rising. Unlike automobile driver crash and safety studies, there is very limited information and data on how different environmental or design features impact cyclists' behaviors, attention, and awareness. Real world studies evaluating cyclist behavior are limited due to their inherent safety risk; therefore, there is a need for alternate data to better inform the planning and design of roadways for all users. Immersive virtual environments (IVE) have shown to provide a realistic representation of real-world conditions; however, these tools have not been evaluated and validated for vulnerable road users, such as cyclists. The purpose of this study is to assess the use of an IVE bike simulator to study the impact of design and environmental conditions on cyclists' perceived safety and behavioral changes. By benchmarking cyclists' behaviors and perceived safety in real-life settings compared to its representative IVE bike simulation, we can validate whether these IVE simulators are realistic representations of real-world conditions. Furthermore, by connecting these environments with the latest low-cost human sensing devices, we have built a multimodal human sensing data collection system to track participants' gaze, heart rate, and head movement. The preliminary results from a six-participant pilot study indicate that our simulators are capable of replicating cyclists' speed profile, heart rate changes, and most of the head and gaze behaviors and that these measurements are sensitive to environmental changes.