A QoE Evaluation of an Immersive Autonomous Virtual Reality Driving Experience

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INTRODUCTION

At the early stages of adoption, Autonomous Vehicles (AVs) with high automation (SAE level 4 and 5) will share the streets with other road users (i.e. pedestrians, human-driven vehicles, cyclists, etc.) and depend on current infrastructure with its irregularities (i.e. unmarked roads) [1]. These challenges demand testing AVs in computational simulated environments and investigating how users interact with these systems.

The immersion delivered by simulations may influence the user's perceived QoE [2]. In this context, this work promotes a VR autonomous driving experience in a street in Athlone, Ireland, using two different formats: firstly, photogrammetry to provide realistic 3D content and secondly a non-photorealistic environment. This system was built to investigate the impact of graphics quality on immersion levels and perceived QoE.

AIMS AND OBJECTIVES

- Understand the relationship between graphics quality and immersion levels in AV-based simulators from a QoE perspective.
- Compare the user's perceived QoE of AV technologies under different levels of immersion.
- Test AV User Interfaces (UI) and feedback modalities to determine the scenario that delivers the highest QoE.

METHODOLOGY

Photogrammetry is a method that uses photos taken from different angles to computationally define the sense of depth of the captured scene. In the first method, videos from the real environment were collected to create the photorealistic environment using Autodesk Recap Photo [3]. For comparison, the environment was also built using traditional meshes modelled in Blender [4] which can be defined as a low-polygon-based method. This quality produced by the low-polygon-based approach can be observed in other studies [5, 6] in which textures were applied over flat surfaces, such as planes or boxes, with no depth level on building structures and low texture quality. The final product is an environment that looks more like a game.

The simulation for both methods runs on the HTC Vive Pro Eye [7] with eye tracking capabilities used to study a user's attention and focus during the simulation.

Fig. 1 - Preview of the photorealistic environment that will be used to compare user's QoE with the low-polygon type.

CONCLUSION

This demonstration endeavours to create a basis that fulfills the needs for assessing AV technology in VR. Objective and implicit metrics are addressed to understand what promotes the highest level of immersion when using a HMD. The possibility of rendering an application's graphics in different levels allows a study of the impact of these features on a user's perceived QoE. In addition, the findings from this study will facilitate an understanding of the relationship between technology adoption, trust in AV, cybersickness and optimal feedback mechanisms for each rendered graphics modality.

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