

InterchangeSE - A Real-Time Multiplayer Network 3D Visualization Framework to Simulate Driving Behavior and Interactions

Anuj Sharma

Pitt-Des Moines, Inc. Professor in Civil Engineering, Iowa State University, anuj@iastate.edu

Vijay Kalivarapu

Assistant Scientist, Iowa State University, vkk2@iastate.edu

This abstract presents the developmental progress of a collaborative research project between the Iowa State University and the Turner-Fairbank Highway Research Center, a division of the Federal Highway Administration. The overarching goal of the project is to design, develop, and demonstrate a simulation environment to study the interactions among several stakeholders representing different decision perspectives in a partially connected-automated multimodal transportation system.

Using a client-server network architecture, a multiplayer interactive 3D visualization framework called InterchangeSE was developed connecting three physical driving agents (a bicycle, and two cars) to a traffic simulator application (i.e., VISSIM). In this framework, each driving agent is presented with a 3D model of a traffic scenario on a computer screen and a human is allowed to ride or drive within the scenario using rigs such as a physical bicycle or a racing car steering wheel gear. Their positions and directions are network synchronized among each other and then inserted, via a custom built server, into the VISSIM traffic simulator using its COM interface. VISSIM then computes traffic for the vehicles it generates while also responding to the physical agents' positions as additional vehicle entities within its traffic network. The computed VISSIM traffic is relayed back to the network server, which is then broadcasted to the physical agents. Each physical agent (i.e., the bike, car) is then presented with a copy of the moving traffic that was computed to respond to his/her driving behavior, all in real-time.

The 3D visualization framework and the client-server network architecture was built using the Unity3D game engine. A simplistic COM interface example provided by VISSIM was modified to enable network communication between physical agents and VISSIM. Planned next steps for this project include implementation of Connected Autonomous Vehicle simulator CARLA within the framework, support for authoring traffic scenarios for use by the Turner-Fairbank Highway Research Center, and also hooks to post-process driving behaviors using bio-sensors.

Keywords: roads;