

**Project Title:** Digital Twin for Driving

**Recipient/Grant (Contract) Number:** Carnegie Mellon University, Grant #: 69A3552344811

**Center Name:** Safety21 National University Transportation Center for Promoting Safety

**Research Priority:** Promoting Safety

**Principal Investigator(s):** Erick Guerra University of Pennsylvania

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**Project Partners:**

- JITSIK LLC
- Delaware Valley Regional Planning Commission
- PA Safe Roads PAC

**Research Project Funding:** \$159,178.63

**Project Start and End Date:** 07-01-2023 to 06-30-2024

**Project Description:**

Digital tools for mapping are now an integral tool for navigation. Waze, Google maps have leveraged Satellite and Google Street imagery which allow us to have an accurate representation of any set of GPS coordinates. This technology evolved just a couple of months ago with the release in May 2023 of dynamic models of the Earth. Companies like Cesium, a Google backed up startup based in Philadelphia is offering Unity and Unreal models of the Earth, with an Application Programming Interface (API) that can be leveraged for any dynamic Geospatial application. While a number of drone applications have been developed, no solid test has been developed for a driving application. We propose with this project to test the Unity and Unreal API of the Earth to assess the drivability of these Virtual Reality models. We will partner with Jitsik LLC, a small startup in Mixed Reality who has been paving the way in this direction. Jitsik recently established a proof of concept for driving, by integrating two scenarios taken from Google Earth. The first scenario is a mountainous road just outside Denver, Colorado. The second scenario is a downtown neighborhood of Denver, Colorado. These proofs of concept were quite successful in the sense that they were easy to deploy, with very little coding. On the downside, the simulated Denver downtown neighborhood offered a rough terrain. It is indeed the result of imperfections from satellite imagery. We propose with this project to explore the drivability of this Unity/Unreal Earth API. We propose to target Roosevelt Blvd in Philadelphia, which has already been the subject of academic research (Erick Guerra). The Roosevelt Blvd lies in an urban area, but often feels like a highway. We propose to leverage the Digital Twin of the Roosevelt Blvd and develop filtering techniques to remove existing traffic, smooth the road. Once the environment has been cleaned up, we will add Virtual Traffic lights and stops to make the scenario ready for a Human Subject Research Project. We anticipate some techniques developed through this research project will become part of a toolkit that can be applied to any neighborhood in the world to create a Digital Twin of that neighborhood. This project is a collaboration between the University of Pennsylvania Engineering Department and Jitsik LLC, a startup in Mixed Reality, led by Dr. Helen Loeb. Helen has been working in driving simulation for over a decade.

**Outputs:**

**Anticipated Outputs** We anticipate the development of a toolkit that can be reused for any neighborhood in the US, so that drivers can have a simulated experience in the environment they live in. The project will improve safety by paving the ground to Human Subject Research so that dangerous roadways can get better designed.

**Outcomes/Impacts: Anticipated Outcomes/Impacts** This project is very ambitious as it aims to make satellite imagery of the earth drivable for urban planners, for driving safety and for education. Drivers may want to experiment driving on the left in the UK before renting a vehicle. Drivers may want to visualize a merger of highways before actually being there. Google released 3D visual directions for driving through its API. This project goes one step further by making these models drivable.