UTC Project Information

Project Title	Development of an Augmented Reality Environment for Connected and Automated Vehicle Testing
University	University of Michigan
Principal Investigator	H. Liu Y. Feng
PI Contact Information	henryliu@umich.edu yhfeng@umich.edu
Funding Source(s) and Amounts Provided (by each agency or organization)	CCAT $150,000
Total Project Cost	$150,000
Agency ID or Contract Number	69A3551747105
Start and End Dates	1/10/2017 - 12/28/2018
Brief Abstract of Research Project	Currently closed CAV testing facilities (such as Mcity) merely provide empty roadways, in which test CAVs can only interact with each other and infrastructure (e.g. traffic signals). However, a complete testing environment should also include background traffic to interact with the test CAVs. Involving real vehicles as background traffic is not only costly, but also difficult to coordinate and control. To address the limitation, in this project we develop an augmented reality testing environment, in which background traffic is generated in microscopic simulation and provided to test CAVs to augment the functionality of the test facility. The augmented reality combines the real-world testing facility and a simulation platform, in which movements of test CAVs and traffic signals in the real-world can be synchronized in simulation, while simulated traffic information can be provided to test CAVs' communication system. Test CAVs "think" they are surrounded by other vehicles and adjust behaviors accordingly. This technology provides a realistic traffic environment to the CAVs, so that test scenarios which require interactions with other vehicles or pedestrians can be performed. Compared to using real vehicles, simulated vehicles can be easily controlled and manipulated in generating different scenarios with much less cost and safety concerns.
Most Relevant CCAT Research Thrusts	Enabling Technologies Modeling and Implementation

Describe Implementation of Research Outcomes (or why not implemented) Place Any Photos Here	The proposed system has been implemented at Mcity test facility at University of Michigan. It has been utilized by research groups at U of M and Mcity affiliated companies for a wide range of projects and demonstrations.
Impacts/Benefits of Implementation (actual, not anticipated)	The impacts from the development of an augmented reality test environment are significant. First, this has the potential to save automobile manufacturers and their suppliers millions of dollars in testing – *per vehicle platform*. This cost savings can be cascaded to consumers, making the cost of a CAV more affordable. In turn, this may increase the penetration of CAVs faster. Second, using an augmented reality test environment will result in a more robust CAV design, a design that is safer for consumers. Third, the augmented reality test environment provides a safe venue to conduct testing. Lastly, the augmented reality test environment for connected and automated vehicles has greatly increased the body of knowledge through the outputs above and the media articles below: Forbes: https://www.forbes.com/sites/samabuelsamid/2017/06/22/university-of-michigan-deploys-augmented-reality-system-to-aid-testing-of-automated-vehicles/#7ec1f4c1e48a Detroit News: https://www.detroitnews.com/story/business/autos/mobility/2017/10/31/mcity-car-test-site-gets-boost-industry/107210346/ Mlive: https://www.mlive.com/news/ann-arbor/index.ssf/2017/06/avoiding_crashes_virtual_reali.html NBC News: https://www.nbcnews.com/mach/science/fake-city-promises-real-change-transportation-ncna809136 Xconomy: https://www.xconomy.com/detroit-ann-arbor/2017/11/03/with-11m-in-new-funding-mcity-looks-ahead-to-2018-and-beyond/ IEEE Spectrum: https://spectrum.ieee.org/cars-that-think/transportation/self-driving/riding-in-a-robocar-that-sees-around-corners
Web Links • Reports • Project website	ccat.umtri.umich.edu