UTC Project Information	
Project Title	Technology and Enhancements to Improve Pre-Crash Safety
University	Ohio State University
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Total Project Cost	$848,125.00
Agency ID or Contract Number	DTRT13-G-UTC47
Start and End Dates	O9/30/2013 – 09/30/2017
Brief Description of Research Project	This project focuses on technology improvements that can be implemented in intelligent and autonomous vehicles toward the goal of improving pre-crash safety. First, with autonomous vehicles being on the verge of deployment as part of city infrastructure, the need for autonomous vehicles to be capable of anticipating human driver intent is inescapable. Newer technologies and potentially controversial sensing options, such as gaze direction, driver body language/weight shifting, and even electroencephalogram (EEG) sensors, are available for exploration. Recent research has shown the crucial importance of gaze monitoring. For example, on the approach to curves, driver gaze direction can predict speed at the apex and crashes. Drivers' gaze duration on external signs can predict their ability to keep in their lane. We propose to explore technologies for sensing driver attention and their impact in pre-crash scenarios. In conjunction with Project 1, we will design and test biomonitors and their value in improving crash safety. We will also predict, using behavior models, the extent to which monitoring information can be effective in improving pre-crash safety. Second, we will study the value of V2I and V2V communications for improving pre-crash safety. Using simulator studies—and later, field tests for promising approaches—we will study scenarios in which location and heading information for nearby vehicles is used, and we will test its value in averting crashes or minimizing crash injury. An important element of this understanding is how the (in)accuracy of this information impacts safety performance. V2V hardware testing facilities in OSU's Control and Intelligent Transportations Research (CITR) Laboratory will be used to quantify location accuracy in realistic scenarios. We will also study information accuracy as it impacts information trust in the corresponding behavioral models being

developed in Project 3.

Third, we will study the impact of both intra-vehicle communication cybersecurity on pre-crash scenarios. A number of issues are of concern: external "snooping"; injection of false information externally; and "hacking" the vehicular software. Several countermeasures are being developed, including key generation and filtering. Our focus in the CrIS UTC will be on the implications of cyber-threats on pre-crash safety. For example, cybersecurity countermeasures result in data latency; we will investigate how this latency degrades safety margins. As a second example, inaccurate information, including false warning indicators that may result from either compromised security or communication noise reduce driver trust in the data, and result in a change of driver behavior in response to these indicators. We will study these changes using the behavior models in Projects 2, 3, and 5, and assess the safety impact.

Research Objectives

- Year 1: Assess viable driver attention technologies and V2V/V2I technologies that are likely to improve pre-crash safety.
- Year 2: Experimentally test promising technologies in pre-crash scenarios using the driving simulator facility.

Describe Implementation of Research Outcomes (or why not implemented) Place Any Photos Here	Pending project completion.
Impacts/Benefits of Implementation (actual, not anticipated)	Pending project completion
Web Links • Reports • Project website	http://citr.osu.edu/CrIS/wp-content/uploads/CrIS_UTC_PPPR_Final_Draft_043014.pdf http://citr.osu.edu/CrIS/?page_id=123