UTC Project Information	
Project Title	**Cooperative Perception of Connected Vehicles for Safety**
University	Virginia Polytechnic Institute and State University
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Funding Source(s) and Amounts Provided (by each agency or organization)	Safe-D (Federal): $145,358 Matching (Non-Federal): $ 145,537
Total Project Cost	$290,895
Agency ID or Contract Number	Grant No: 69A3551747115 Project: 05-115
Start and End Dates	10/01/2020 and 04/30/2022
Brief Description of Research Project	This project will develop a vision-based cooperative perception and accident (crash) avoidance trajectory plans in dynamic environments for two connected vehicles in which the ego vehicle would face a potentially unseen hazard ahead but could receive safety critical information from a vehicle in front and estimate/predict the trajectory of the potential hazard. There are several challenging technical problems in this V2V and V2X communications environment, aside from the communication itself. Among them are the accurate establishment of the relative position of the involved vehicles and their collective situation relative to the target (which could be a vulnerable road user or another vehicle); the decision of what constitutes a safety critical information/data and when and how to pass (exchange) them with the ego vehicle to be beneficial for safety; passing of only safety critical data and trajectories without having to pass extensive video data between two cooperating partners (vehicles); and how to best determine the final trajectories of the ego vehicle and the corresponding cooperating vehicle in order to avoid a potential/imminent collision with the target. To address these challenges and questions, a combination of algorithms and approaches will be developed based on probabilistic random approaches and other intelligent algorithms to find the optimum ways of cooperating among the two vehicles and defining

	their forthcoming safe trajectories. The results will be tested in a traffic emulation environment with autonomous connected mobile robots. The methods and approaches will be equally applicable to real-life full vehicles upon further development and testing.
Describe Implementation of Research Outcomes (or why not implemented) Place Any Photos Here	1. **Outcomes from DMP** • The initial outcome of this research will be a comprehensive review and survey of all relevant cooperative perception issues and the latest discoveries in the methods. • All programs, and codes developed and results produced under this research will be publicly available according to the DMP of SAFE-D contract. 2. **Outcomes from EWD Plan** • Graduate Student recruited to be onboard full-time on this project. • Creation of a new course module on autonomous & connected vehicles that can be incorporated into educational and workforce development programs. The safety of autonomous vehicles and CAVS will be a priority of the course. • Development of hands-on learning and demonstration module for the summer CEED programs based on project goals/results and outreach activities. 3. **Outcomes from T2 plan** • Publications: Articles with archival values in both peer-reviewed conferences and journals for each one of these areas will be published • Demonstrations: Cooperative perception scenarios will be successfully tested under this project. • Webinars: Beyond the published material, a webinar will be developed, provided there will be sufficient interest from the stakeholders. • Patents: In case there is patentable intellectual property, proper disclosure will be made to VT for further processing and decisions.
Impacts/Benefits of Implementation (actual, not anticipated)	1. Students working in this area will be funded towards the development of new methods to solve the identified problems. 2. Development of academic programs and workforce. 3. New methods will be used both for Autonomous and Connected Vehicles, as a results improvement of vehicle autonomy.

	4. Enhancement of ADAS to improve safety for both vehicles and vulnerable road users, which will ultimately improve the overall road traffic safety.
Web Links • Reports • Project website	https://safed.vtti.vt.edu/projects/cooperative-perception-of-connected-vehicles-for-safety/