

UTC Project Information	
Project Title	A Sensor Fusion and Localization System for improving Vehicle Safety in Challenging Weather Conditions
University	Texas A & M University
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Funding Source(s) and Amounts Provided (by each agency or organization)	TTI: \$139,910 Matching: \$50,499
Total Project Cost	\$190,409
Agency ID or Contract Number	Grant No: 69A3551747115 Project: 04-117
Start and End Dates	05/01/2019-08/31/2021
Brief Description of Research Project	The safety of autonomous\connected vehicles primarily relies on their ability to accurately sense the environment. The sensing problem is significantly challenging in weather conditions which include sudden change in lighting, smoke, fog, snow, and rain. Therefore, accurate sensing in adverse weather conditions is a critical and important safety problem that needs to be solved for any successful deployment of autonomous vehicles. There is currently no single sensor currently available in the market that can handle all the possible performance aspects and adverse weather conditions. The objective of this project is to use a combination of Radars and FIR cameras in addition to a LIDAR based system to map the environment and localize the vehicle with respect to the lanes on the road. This project will develop a prototype of an all weather sensing and localization system which will be useful for any autonomous or connected vehicle. The performance of the developed system will be corroborated with several data sets collected at Rellis. Demonstrations of the developed technology will also be done at the yearly Automated Vehicle Symposium, and SAE conferences.
Describe Implementation of Research Outcomes (or why not implemented) Place Any Photos Here	<p><i>Deliverable 1:</i> Sensor fusion algorithms that merge information from Radars, FIR Cameras with LIDARs to create a map of the environment in real-time during challenging weather conditions.</p> <ul style="list-style-type: none"> • Plan to collaborate with Ford on formulating the sensor fusion problem. • Perform literature review of the existing algorithms. • Develop and implement sensor fusion algorithms.

	<p><i>Deliverable 2:</i> Localization algorithms that identify the position of the vehicle with respect to the lanes during challenging weather conditions.</p> <ul style="list-style-type: none"> • Plan to collaborate with Ford on formulating the localization problem. • Perform literature review of the existing localization algorithms. • Develop and implement the localization algorithms. <p><i>Deliverable 3:</i> Datasets with information from all the sensors collected during different weather conditions (sun glare, rain, fog, snow).</p> <ul style="list-style-type: none"> • Install any new sensors in the autonomous car. • Collect data sets in challenging weather conditions. <p><i>Deliverable 4:</i> Integrated Sensor Fusion and Localization Software.</p> <ul style="list-style-type: none"> • Formulate the integrated sensor fusion and localization problem. • Implement the algorithms for the integrated problem. <p><i>Deliverable 5:</i> Report documenting all the algorithms with the results obtained for different datasets.</p> <ul style="list-style-type: none"> • Prepare quarterly and yearly reports of the project. <p><i>Deliverable 6:</i> Materials (presentations, posters, data) generated during the implementation of the Education and Workforce Development Plan.</p> <ul style="list-style-type: none"> • Document the datasets collected in the experiments. • Prepare homework modules for the relevant courses. • Document all the papers, presentations, reports generated in the project.
<p>Impacts/Benefits of Implementation (actual, not anticipated)</p>	<p>New sensor fusion software will be available for both human-driven and autonomous vehicles that combines information from multiple onboard sensors for understanding some critical off-nominal, challenging weather scenarios. This has the potential to significantly help in vehicle safety.</p>
<p>Web Links</p> <ul style="list-style-type: none"> • Reports • Project website 	<p>https://www.vtti.vt.edu/utc/safe-d/index.php/projects/a-sensor-fusion-and-localization-system-for-improving-vehicle-safety-in-challenging-weather-conditions/</p>