UTC Project Information

Project Title	MPC-592 – Development of an Autonomous Transportation Infrastructure Inspection System Based on Unmanned Aerial Vehicles
University	Colorado State University
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Funding Source(s) and Amounts Provided (by each agency or organization)	USDOT, Research and Innovative Technology Administration $58,000 Colorado State University $58,000
Total Project Cost	$116,000
Agency ID or Contract Number	69A3551747108
Start and End Dates	February 26, 2019 to July 31, 2022
Brief Description of Research Project	With transportation infrastructure in the United States aging and deteriorating, maintenance and inspection of the existing infrastructure become critical. Accurate and efficient inspections inform engineers/managers for better repair decisions/planning, load-rating, and effective management of limited resources. Current human-based infrastructure inspection may be costly, lack quantitative measures of damage, as well as pose a danger to inspectors. Thus, there is a need to develop more cost-effective, quantitative, and safe approaches for infrastructure inspection. In

	response to this need and recognizing the rapid technological improvement of UAV-based remote sensing, this project will explore the potential of UAV-based remote sensing technology in transportation infrastructure inspection with a focus on bridges. The ultimate goal of the study is to develop an autonomous and quantitative infrastructure inspection procedure that requires minimum human intervention. The three project objectives include: (1) Develop an automated process to identify different elements of a structure and establish an as-built element-wise building information model (BIM) , (2) Develop an automated damage evaluation tool that can identify the type, location and amount of structural damage for each element; and (3) Develop a damage documentation tool that maps the identified element-wise damage to the corresponding bridge element in a BIM model.
Describe Implementation of Research Outcomes (or why not implemented) Place Any Photos Here	The proposed UAV-based infrastructure inspection system has been implemented to two bridges in Colorado.
Impacts/Benefits of Implementation (actual, not anticipated)	In current UAS-based inspection, the data analytics techniques of tracking changes of damage growth and locating the damage location in structure were lacking. This research addresses these gaps by advancing the state-ot-the-art technology. The new image computation and machine learning algorithms developed through this project are effective for damage quantification, tracking and localization. These developed data analytics tools allow more quantitative condition assessment (enabling identification of damage location, severity and type), which is superior to the existing practice. The tools are expected to be useful for inspection industry and state DOTs.

Web Links
    • Reports
    • Project Website
	• [MPC Research Report](#)
	
	• [CSU Master's Thesis](#)
	
	• Oct 2021 Journal Article – [Automated Site-Specific Assessment of Steel Structures through Integrating Machine Learning and Fracture Mechanics](#)
	
	• Nov 2020 Journal Article – [Streamlined Bridge Inspection System Utilizing Unmanned Aerial Vehicles (UAVs) And Machine Learning](#)