UTC Project Information – Project #3.19	
Project Title	Detection and Monitoring of Material Aging and Structural Deterioration using Electromagnetic and Mechanical Sensors with Virtual Reality and Machine Learning Modeling
University	University of Massachusetts Lowell (UML)
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Funding Source(s) and Amounts Provided (by each agency or organization)	Federal: $199,256 University of Connecticut: $224,378
Total Project Cost	$ 423,634.00
Agency ID or Contract Number	69A3551847101
Start and End Dates	06.01.2022 – 07.31.2024
Brief Description of Research Project	The problem we are trying to solve is the detection and monitoring of aging civil infrastructure components and systems in New England by using visual information and subsurface images in a virtual reality (VR) environment for data visualization and machine learning (ML) for data interpretation. Material aging and structural deterioration of selected candidate structures (e.g., highway bridges) will be frequently (from twice a day to once a week) inspected to develop large amount of sensor data for condition assessment using machine learning. The problem is important because, with frequent inspection of civil infrastructure systems, processing and visualization of large amount of multiple-format sensor data have become a challenging task at the system's level for bridge engineers. Registration of 2D photographs and sensor images in a 3D environment aided with VR equipment (e.g., headsets, handles, controllers) can help bridge engineers to better register inspection and monitoring data in multiple formats (e.g., photographs, images, texts, sketches) to actual structures. Frequent inspection of structures can produce large amount of data required by machine learning, as well as capturing the weekly, monthly, and seasonal changes of background/baseline information. In this base funded project, we propose to 1) collect electromagnetic (EM) (e.g., optical, radar, and laser sensors) and mechanical (e.g., impact-echo, ultrasonic testing, pulse tomography sensors) sensor data on a frequent basis (from twice a day to once a week) to develop large amount of data for machine learning interpretation, 2) study the effect of material aging on structural deterioration of highway bridges, and 3) develop a VR platform for rendering sensor data (including bridge rating and inspection reports) of inspected bridges in a 3D environment for the convenient interpretation of sensor data.

Describe Implementation of Research Outcomes (or why not implemented) Place Any Photos Here	This project is in its initial research phase. Implementation of research outcomes will be reported upon completion of the research outputs.
Impacts/Benefits of Implementation (actual, not anticipated)	This project is in its research phase. Impacts and benefits of the research will be reported after the implementation phase.
Web Links • Reports • Project website	