MarTREC UTC Project Information Form
USDOT Tier 1 University Transportation Center
Agency ID or Contract Number DTRT13-G-UTC50

Project Title: In-Situ Monitoring and Assessment of Post Barge-Bridge Collision Damage for Minimizing Traffic Delay and Detour
Project Abstract (Brief Description): Bridges over major navigation waterways often suffer from barge collisions. After collisions, both bridges and navigation waterways are usually closed to traffic for assessing the collision damage of bridge structures, leading to substantial traffic delay or detour. The ultimate goal of this project is to improve the mobility and emergency preparedness for the transportation systems of both highways and navigation waterways through implementing Intelligent Transportation Systems. This project aims to develop an efficient in-situ monitoring and data processing scheme for assisting bridge professionals to reliably assess the barge-bridge collision damage and make prompt and informative decision on the operation the bridge and navigation waterways. The project will explore the efficient sensor deployment that can unitize low-cost acceleration sensors to effectively capture the useful information on collision damages, and effective data processing scheme that integrates Bayesian probabilistic inference and in-situ sensor data to assess collision damages and their uncertainties, and validate their effectiveness through extensive simulated tests.
Describe Implementation of Research Outcomes (or why not implemented) -The results from the numerical evaluation show that the framework can rapidly determine the probability of structural damage of a measured collision accident in less than one second. Even through levels of measurement errors or noises have significant impacts on the performances of models, the rate of correct prediction for all events in testing data is larger than 97.5% with measurement errors up to 5% and 72.50% with measurement errors up to 10%. Based on this research, we have completed a manuscript titled "Probabilistic machine learning approach to promptly assessing probability of barge-bridge collision damage of piers" and submitted to the Transportation Research Board for presentation and at the 2016 TRB Annual Meeting. Now, we are concentrating upon the optimization study of sensor deployment that can efficiently capture effective information on collision damages with minimum sensors. This study could significantly reduce the number of acceleration sensors as well as cost of their installment and maintenance.
Impacts/Benefits of Implementation (actual, not anticipated) Once a barge-bridge collision event happens, field dynamic measurements can be collected from the collided bridge structure with the sensor network. The best feature vectors are then extracted and input into the best classification models of each of the trained classifiers. With the identified threshold of each classifier, the prediction probability of the damage locating in each of the sub-regions can be determined.
Web Links: http://www.jsums.edu/imtrans/
Budget (Funding) Amounts & Source(s) (US DOT +Match(s) =Total Costs): $50,000 MarTREC + $25,000 JSU matching = total cost of $75,000
Project Start and End Dates: 07/01/14 – 06/30/15. A no cost extension has been granted through 06/30/16. Project Complete
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Principal Investigator Institution (University): Jackson State University