TIDC Transportation Infrastructure Durability Center AT THE UNIVERSITY OF MAINE

Quarterly Progress Report:

Project Number and Title: Thrust #1 Distributed Fiber Optic Sensing System for Bridge Monitoring
Research Area: Thrust #1
PI: Xingwei Wang, Electrical and Computer Engineering Department, University of Massachusetts Lowell
Co-PI(s): TzuYang Yu, Civil Engineering Department, University of Massachusetts Lowell.
Reporting Period: *07/01/2021-09/30/2021*
Submission Date: **9***/20/2021*

Overview: (Please answer each question individually)

During this quarter, we actively sought support and built collaboration with MA DoT. We have obtained permission to install new sensing systems in bridges located at Lowell, Chelmsford and Methuen.

Additionally, we continue to monitor the sensors installed in New Hampshire. This effort continues to increase our data base and it is used to evaluate the performance of the sensors during different time of the year. Also, we started the interface system development.

Table 1: Task Progress

Task Number	Start Date	End Date	% Complete
Task 1: Sensor development	1/1/2019	6/30/2019	100%
Task 2: Signal processing and sensor characterization	1/1/2019	06/30/2022	70%
Task 3: Preliminary field tests on bridge	6/1/2020	9/30/2021	90%
Task 4: Explore OFDR interrogation system.	07/01/2021	12/31/2022	20%
Task 5: Long term monitoring	01/01/2021	06/30/2023	30%
Task 6: Hardware and software improvement	07/01/2022	12/31/2023	0%

Table 2: Budget Progress (cost share not included)

Project Budget	Spend – Project to Date	% Project to Date*
$ 309,838.00	$ 119,242.08	53.57%

Include the date the budget is current to.

Describe any opportunities for training/professional development that have been provided…

Describe any activities involving the dissemination of research results (be sure to include outputs, outcomes, and the ways in which the outcomes/outputs have had an impact during the reporting period. Please use the tables below for any Publications and Presentations in addition to the description of any other technology transfer efforts that took place during the reporting period.)… Use the tables below to complete information about conferences, workshops, publications, etc. ***List all other outputs, outcomes, and impacts after the tables*** *(i.e. patent applications, technologies, techniques, licenses issued, and/or website addresses used to disseminate research findings).*

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Table 3: Presentations at Conferences, Workshops, Seminars, and Other Events				
Title	**Event**	**Type**	**Location**	**Date(s)**
Distributed Sensing Textile for Bridge Monitoring	TIDC Showcase Presentation	Showcase	Online	06/23/2021
Optical Fiber Sensing textile for Temperature and	Smart structure + Nondestructive evaluation.	(SPIE)Conference	Online	03/22/21-03/26/21
Development of a System level distributed Sensing technique for long-term monitoring of concrete and composite bridges	TIDC Showcase Presentation	Showcase	Online	04/21/2019

Table 4: Publications and Submitted Papers and Reports				
Type	**Title**	**Citation**	**Date**	**Status**
Conference	Optical Fiber Sensing textile for Temperature and Distributed Measurment			Accepted by the conference
Journal	Pipeline monitoring using fiber optic textile for Structural Health Monitoring			Updating draft with comments provided by the coauthors
Journal	Structural Health Monitoring of a bridge using optic sensing textile			In review from other coauthors

Encouraged to add figures that may be useful (especially for the website)…

Figure 1 M-17-017I-93 Bridge that we will install sensing textile soon.

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Participants and Collaborators:

Table 5: Active Principal Investigators, faculty, administrators, and Management Team Members			
Individual Name	**Email Address**	**Department**	**Role in Research**
Xingwei Wang	Xingwei_wang@uml.edu	Electrical and Computer Engineering	PI
TzuYang Yu	Tzuyang_yu@uml.edu	Civil Engineering	Co-PI

Use the table below to list all students who have participated in the project during the reporting. (This includes all paid, unpaid, intern, independent study, or any other student that participated in this project.)

Table 6: Student Participants during the reporting period				
Student Name	**Email Address**	**Class**	**Major**	**Role in research**
Andres Biondi		Ph.D.	ECE	Conduct field tests and analyze signals
Rui Wu		Ph.D.	ECE	Conduct field tests and analyze signals
Lidan Cao		Ph.D.	ECE	Conduct field tests and analyze signals
Gandhi, HarshNareshkumar"		Ph.D.	CE	Remote structural sensing

Table 7: Student Graduates			
Student Name	**Role in Research**	**Degree**	**Graduation Date**

Use the table below to list organizations have been involved as partners on this project and their contribution to the project.

Table 8: Research Project Collaborators during the reporting period						
Organization	**Location**	**Contribution to the Project**				
		Financial Support	**In-Kind Support**	**Facilities**	**Collaborative Research**	**Personnel Exchanges**
Luna Innovation	Virginia. USA					
Omnisens	Switzerland					

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Note: Technical discussion through Zoom meeting.

List all other outputs, outcomes, and impacts here (i.e. patent applications, technologies, techniques, licenses issued, and/or website addresses used to disseminate research findings). Please be sure to provide detailed information about each item as with the tables above.

Have other collaborators or contacts been involved? If so, who and how? (This would include collaborations with others within the lead or partner universities, especially interdepartmental or interdisciplinary collaborations.)

Table 9: Other Collaborators

Collaborator Name and Title	Contact Information	Organization and Department	Contribution to Research
			(i.e. Technical Champion)

Number of active industrial partners involved in this research project

- 1 Saint Gobain

Number of technologies deployed in transportation applications through pilot or demonstration studies because of this research project. We conduct weekly meetings to discuss the project progress. UML Ph.D. student, Andres Biondi, went to Saint Gobain from time to time to work with their engineers on the sensing textile testing.

- LUNA

LUNA Innovation has provided an extension module to be used with the OFDR controller.
LUNA software updated.

Number of active State DOT partners involved in the research project.

- MA DOT, we have met MA DOT, presented our work, and discuss more field test plans.

Number of technical Champions actively involved in this project:

Craig Stratton.
Director of Sensing Sales- Northeast USA and Canada.
Email: strattonC@lunainc.com.
Phone: 864-509-7635

Changes:

No change.

Planned Activities:

We will continue to collect data every few months as weather permits and study the response of the sensor to different weather conditions.