Quarterly Progress and Performance Indicators Report:

Project Number and Title: Wireless Joint Monitoring System (w-JMS) for Safety of Highway Bridges

Research Area: Thrust 1 Transportation infrastructure monitoring and assessment for enhanced life

PI: *Shinae Jang, Ph.D., P.E, Associate Professor in-Residence, Department of Civil & Environmental Engineering, University of Connecticut, Storrs, CT*
Co-PI(s): *Song Han, Ph.D., Department of Computer Science & Engineering, University of Connecticut; and*
Ramesh B. Malla, Ph.D.,F. ASCE, F. EMI; Professor, Department of Civil & Environmental Engineering University of Connecticut

Reporting Period: ***1/1/2022 – 3/31/2022***

Submission Date: 3/31/2022

Overview:

*Provide **BRIEF** highlights of activities performed during the reporting period.*

- The research team (RT) is working on developing a sensor prototype to monitor the expansion joint
- The RT did National Bridge Inventory (NBI) bridge analysis for bridge selection, and did site visit to candidate bridges for long-term bridge monitoring and identified a candidate bridge
- The RT had a meeting with CTDOT experts to get bridge access on 3/30/2022.

Meeting the Overarching Goals of the Project:

How did the previous items help you achieve the project goals and objects?

- The sensor prototype development helps us achieve long-term bridge monitoring goal.
- The NBI analysis and site visits helped us to identify a reasonable bridge candidate
- Meeting with CTDOT experts to get bridge access is critical to contact the monitoring project

Accomplishments:

List any accomplishments achieved under the project goals in bullet point form…

- Products: a conference paper drafted from the previous QPR (submitted to a conference for final review), sensor board connection (on-going), NBI analysis powerpoint slides
- Meetings: RT attended a seminar lead by the technical champion (Bao Chuong) at UConn, a meeting with CTDOT experts to select a testbed bridge, bi-weekly meeting with RT

Task, Milestone, and Budget Progress:

Complete the following tables to document the work toward each task and budget

Table 1: Task Progress			
Task Number: Title	**Start Date**	**End Date**	**% Complete**
Task 1 Inputs from NE DOTs	10/1/2021	12/31/2021	100%
Task 2 Sensor Development	1/1/2022	4/30/2022	75%
Task 3 Field Data Collection	6/1/2022	5/31/2023	0 %
Task 4 Numerical Modeling	1/1/2023	3/31/2023	0 %
Task 5 Data Analysis and Assessment	4/1/2023	9/30/2023	0 %
Final report preparation and submission	10/1/2023	10/30/2023	0 %
Overall project			30%

Table 2: Milestone Progress			
Milestone #: Description	**Corresponding Deliverable**	**Start Date**	**End Date**
Milestones will closely represent task items listed above in Table 1	Quarterly reports	Will closely follow task dates (See Table 1 above)	Will closely follow task dates (See Table 1 above)

Table 3: Budget Progress		
Project Budget	**Spend – Project to Date**	**% Project to Date (include the date)**
$173,608	$26,643	15.35%

Is your Research Project Applied or Advanced?

☒ **Applied** (*The systematic study to gain knowledge or understanding necessary for determining the means by which a recognized and specific need may be met.)*

☐ **Advanced** *(An intermediate research effort between basic research and applied research. This study bridges basic (study to understand fundamental aspects of phenomena without specific applications in mind) and applied research and includes transformative change rather than incremental advances. The investigation into the use of basic research results to an area of application without a specific problem to resolve.)*

Education and Workforce Development:

Answer the following questions (N/A if there is nothing to report):

1. Did you provide any workforce development or training opportunities to transportation professionals (already in the field)? If so, what was the training? When was it offered? How many people attended?

   N/A

2. Did you hold meetings with any transportation industry organizations or DOTs? If so, what was the meeting's purpose? When was it offered? How many people attended?
   The research team held a meeting with CTDOT to update them on the progress of the research findings on 3/30/2022. The technical champion and another senior bridge design engineer were present at the meeting.

3. Did you host/participant in any K-12 education outreach activities? If so, what was the activity? What was the target age/grade level of the participants? How many students/teachers attended? When was the activity held?

   N/A

Technology Transfer:

Use the table below to complete information about conference sessions, workshops, webinars, seminars, or other events you led/attended where you shared findings as a result of the work you conducted on this project:

Table 4: Presentations at Conferences, Workshops, Seminars, and Other Events					
Type	**Title**	**Citation**	**Event & Intended Audience**	**Location**	**Date(s)**
N/A	N/A	N/A	N/A	N/A	N/A

Use the table below to report any publications, technical reports, peer-reviewed articles, newspaper articles referencing your work, graduate papers, dissertations, etc. written as a result of the work you conducted on this project. Please list only completed items and exclude work in progress.

Table 5: Submitted/Accepted Publications, Technical Reports, Theses, Dissertations, Papers, and Reports				
Type	**Title**	**Citation**	**Date**	**Status**
Conference paper	Technical survey and literature review on bridge joint monitoring practices	Ren, D., Fils, P. Jang, S., Malla, R. M. (2022). "Technical survey and literature review on bridge joint monitoring practices." *American Society of Engineering Education Northeast Conference 2022*	3/18/2022	Draft manuscript was submitted on 3/18/2022, and accepted for presentation.

Answer the following questions (N/A if there is nothing to report):

1. Did you deploy any technology during the reporting period through pilot or demonstration studies as a result of this work? If so, what was the technology? When was it deployed?

   N/A

2. Was any technology adopted by industry or transportation agencies as a result of this work? If so, what was the technology? When was is adopted? Who adopted the technology?

   N/A

3. Did findings from this research project result in changing industry or transportation agency practices, decision making, or policies? If so, what was the change? When was the change implemented? Who adopted the change?

   N/A

4. Were any licenses granted to industry as a result of findings from this work? If so, when? To whom was the license granted?

   N/A

5. Were any patent applications submitted as a result of findings from this research? If so, please provide a copy of the patent application with your report.

   N/A

6. Did industry organizations or DOTs provide cost-share (cash or in-kind) to your research during the reporting period? Who was the organization? Please provide an in-kind support invoice from the organization with your report (this is kept confidential and used for record keeping purposes only).

N/A

Describe any additional activities involving the dissemination of research results not listed above under the following headings:

Outputs:
Definition: Any new or improved process, practice, technology, software, training aid, or other tangible product resulting from research and development activities. They are used to improve the efficiency, effectiveness, and safety of transportation systems. List any outputs accomplished during this reporting period:

N/A

Outcomes:
Definition: The application of outputs; any changes made to the transportation system, or its regulatory, legislative, or policy framework resulting from research and development activities. List any outcomes accomplished during this reporting period:

N/A

Impacts:
Definition: The effects of the outcomes on the transportation system such as reduced fatalities, decreased capital or operating costs, community impacts, or environmental benefits. The reported impacts from UTCs are used for the assessment of each UTC and to make a case for Federal funding of research and education by demonstrating the impacts that UTC funding has had on technology and education.. List any outcomes accomplished during this reporting period:

N/A

Participants and Collaborators:

Use the table below to list individuals (compensated or not) who have worked on the project other than students.

Table 6: Active Principal Investigators, faculty, administrators, and Management Team Members				
Individual Name & Title	**Dates involved**	**Email Address**	**Department**	**Role in Research**
Shinae Jang, Ph.D., P.E.; Associate professor in residence; Department of Civil & Environmental	1/1/2022 – 3/31/2022	Shinae.jang@conn.edu	Civil & Environmental Engineering	PI

Engineering, University of Connecticut				
Song Han, Ph.D.; Associate Professor; Department of Computer Science & Engineering, University of Connecticut	1/1/2022 – 3/31/2022	Song.han@uconn.edu	Computer Science and Engineering	Co-PI
Ramesh Malla, Ph.D., F. ASCE; F. EMI; Professor; Department of Civil & Environmental Engineering, University of Connecticut	1/1/2022 – 3/31/2022	Ramesh.malla@uconn.edu	Civil & Environmental Engineering	Co-PI

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

Table 7: Student Participants during the reporting period

Student Name	Start Date	End Date	Advisor	Email Address	Level	Major	Funding Source	Role in research
				Email is not included in the external report and is only used for internal purposes.	*(i.e. UG, MS, PhD)*		*(i.e. TIDC, Other university funds, , unpaid intern, etc.*	*What work are they conducting?*
Pierredens Fils	1/1/2022	3/31/2022	Shinae Jang		Ph.D.	Civil & Environmental Engineering	GAANN	Edited survey questionnaire, created Google form, drafting a survey report, finding the links for sensor parts

Daisy Ren	1/1/2022	3/31/2022	Shinae Jang		B.S.	Civil & Environmental Engineering	TIDC	Conducting literature review, drafting a conference paper, searching existing sensing systems
Jiachen Wang	1/1/2022	3/31/2022	Song Han		Ph.D.	Computer Science & Engineering	Unpaid student participant	Lab sensor systems and data communication demos and support

Use the table below to list any students who worked on this project and graduated or received a certificate during this reporting period. Include information about the student's accepted employment during the reporting period or if they are continuing their students through an advanced degree

Table 8: Students who Graduated During the Reporting Period

Student Name	Degree/Certificate Earned	Graduation/Certification Date	Did the student enter the transportation field or continue another degree at your university?
N/A	N/A	N/A	N/A

Use the table below to list any students that participated in Industrial Internships during the reporting period:

Table 9: Industrial Internships

Student Name	Degree/Certificate Earned	Graduation/Certification Date	Did the student enter the transportation field or continue another degree at your university?
N/A	N/A	N/A	N/A

*Use the table below to list **organizations** that have been involved as partners on this project and their contribution to the project during the reporting period.*

Table 10: Research Project Collaborators during the reporting period						
Organization	**Location**	**Contribution to the Project**				
		Financial Support	**In-Kind Support**	**Facilities**	**Collaborative Research**	**Personnel Exchanges**
		List the amount	*List the amount*	*Mark with an "x" where appropriate*		
Connecticut Department of Transportation	Newington, CT		X (comments/advice; monetary value not known		X	

*Use the table below to list **individuals** that have been involved as partners on this project and their contribution to the project during the reporting period.*

Table 11: Other Collaborators				
Collaborator Name and Title	**Contact Information**	**Organization and Department**	**Date(s) Involved**	**Contribution to Research**
	For internal use only			*(i.e. technical champion, technical advisory board, test samples, on-site equipment, data, etc.)*
Bao Chuong, P.E.; Transportation Supervising Engineer; Connecticut DOT – Bridge Design		Connecticut Department of Transportation, Newington, CT	1/1/2022 - 3/31/2022	Technical champion
Andrew Cardinali, P.E.; Transportation Principal Engineer; Connecticut DOT – Bridge Design		Connecticut Department of Transportation, Newington, CT	1/1/2022 - 3/31/2022	Bridge load rating document

Use the following table to list any transportation related course that were taught or led by researchers associated with this research project during the reporting period:

Table 12: Course List						
Course Code	**Course Title**	**Level**	**University**	**Professor**	**Semester**	**# of Students**
i.e. CE 123		Grad or undergrad?	Where was the course taught?	Who taught the course?	Enter Spring, Fall, Summer, Winter and the year	How many students were enrolled in the class?
CE 2110-001	Applied Mechanics I	undergraduate	University of Connecticut, Storrs, CT	Shinae Jang (PI)	Spring 2022	102

Changes:

List any actual or anticipated problems or delays and actions or plans to resolve them (list no-cost extension requests here)…

- No specific problems or delays are identified.

List any changes in approach and the reasons for the change…

- The project is on track and no change has been requested.

Planned Activities:

List the activities planned during the next quarter.

- Preliminary installation of the sensing system on a field bridge
- Finalizing the sensing system for field implementation and data collection
- QPR3 submission