Quarterly Progress Report:
Project Number and Title: *4.3. Towards Quantitative Cybersecurity Risk Assessment in Transportation Infrastructure*
Research Area: *Thrust 4 Connectivity for enhanced asset and performance management*
PI: *Dr. Song Han, Associate Professor and Castleman Term Professor in Engineering Innovation, Department of Computer Science and Engineering, University of Connecticut*
Reporting Period: *July 1st, 2020 – September 30th, 2020*
Submission Date: *September 30th, 2020*

Overview:
During this reporting period, the research team makes further advances in the study of the security threats and their countermeasures in low-power real-time industrial wireless networks. The research team extended the centralized Intrusion Detection System (IDS) that we proposed in earlier studies with specification-based intrusion modules added to both the root and the RPL nodes to enhance their ability in detecting a wider range of RPL rules-related attacks. Our extensive simulation results show that the proposed new IDS can achieve high accuracy in detecting the RPL rules-related attacks while incurring a moderate overhead on the devices resources. Based on this work, the research team prepared a manuscript entitled "Detecting Rules-related Attacks in RPL-based Resource-Constrained Wireless Networks" and submitted it to IEEE International Symposium on Signal Processing and Information Technology (ISSPIT), 2020.

During this reporting period, the research team resumes the work on the development of the 6TiSCH real-time wireless network testbed after the lab was re-opened in August. A mobile robotic platform (Turtlebot 2) was purchased and both hardware and software have been installed and tested on it. The Turtlebot will be mainly used as the mobile platform of the physical interferer. Software-defined Radio (SDR)-based wireless device will be programmed to serve as the interferer. The Turtlebot will be programmed to traverse the physical space of the testbed according to either a fixed trajectory or a randomly chosen path to generate interference signals to the devices in the testbed.

In the meantime, the research team continues to work on the literature review on security issues in industrial wireless networks. More details are provided to discuss the security issues in each layer of the industrial wireless networks.

Table 1: Task Progress

Task Number	Start Date	End Date	% Complete
Task 1: Context establishment	Oct. 1st, 2018	Sept. 30th, 2019	100%
Task 2: Threat identification	Oct. 1st, 2019	December. 31st, 2020	80%
Task 3: Consequence identification and impact assessment	Oct. 1st, 2020	Sept. 30th, 2021	40% (some parts of Task 2 are concurrent with Task 3)
Overall Project	Oct. 1st, 2018	Sept. 30th, 2021	Around 70%

Table 2: Budget Progress

Project Budget	Spend – Project to Date	% Project to Date*
* The information will be provided by the Institutional Lead.		

Training/professional development: During the reporting period, two Ph.D. students have participated in this research. One PhD student, Ms. Areej Althubaity, continues to work on the intrusion detection system (IDS) design for 6TiSCH wireless networks to identify Rank-related attacks. She prepared a new manuscript entitled: "Detecting Rules-related Attacks in RPL-based Resource-Constrained Wireless Networks" and submitted it to IEEE International Symposium on Signal Processing and Information Technology (ISSPIT), 2020. The other student, Mr. Peng Wu, focuses on the literature review on the security issues in industrial wireless networks.

Dissemination of research results: During the reporting period, the research team submitted one paper to IEEE International Symposium on Signal Processing and Information Technology (ISSPIT), 2020. The detail of this paper submission can be found in Table 4.

Table 3: Presentations at Conferences, Workshops, Seminars, and Other Events				
Title	**Event**	**Type**	**Location**	**Date(s)**

Table 4: Publications and Submitted Papers and Reports				
Type	**Title**	**Citation**	**Date**	**Status**
Conference Paper	Detecting Rules-related Attacks in RPL-based Resource-Constrained Wireless Networks	Areej Althubaity, Reda Ammar, Song Han, "Detecting Rules-related Attacks in RPL-based Resource-Constrained Wireless Networks", submitted to IEEE International Symposium on Signal Processing and Information Technology (ISSPIT), 2020.	September 26th, 2020	Under submission

Participants and Collaborators:

Table 5: Active Principal Investigators, faculty, administrators, and Management Team Members			
Individual Name	**Email Address**	**Department**	**Role in Research**
Song Han	song.han@uconn.edu	CSE@UConn	Principle Investigator

Table 6: Student Participants during the reporting period				
Student Name	**Email Address**	**Class**	**Major**	**Role in research**
Peng Wu	PhD		Computer Science	Student Researcher
Areej Althubaity	PhD		Computer Science	Student Researcher

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

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**

Table 9: Other Collaborators			
Collaborator Name and Title	**Contact Information**	**Organization and Department**	**Contribution to Research**

Who is the Technical Champion for this project?

Name: Peter J. Calcaterra
Title: Transportation Planner

Organization: Connecticut Department of Transportation
Location (City & State): Connecticut
Email Address: Peter.Calcaterra@ct.gov

Changes: No significant changes on the scope and methodology design in the project.

Planned Activities: Based on the study in this reporting period, we are planning the following activities in the project:

- We will resume our work on the network anomaly detection system based on the channel-level RSSI information, especially after the turtlebot mobile platform and the software-defined radio (SDR)-based physical interferer are implemented.

- We will continue to work on the literature review on security issues in industrial wireless networks.
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- PI Han will recruit undergraduate students at UConn to join the PI's research lab to work with the PhD student researchers on R&D tasks related to this project.