

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: *October 1st, 2020 – December 31st, 2020*

Submission Date: *December 31st, 2020*

Overview:

During this reporting period, the research team continues to study the security threats and their countermeasures in low-power real-time industrial wireless networks. The paper entitled “Detecting Rules-related Attacks in RPL-based Resource-Constrained Wireless Networks” that was submitted to the IEEE International Symposium on Signal Processing and Information Technology (ISSPIT) during the last reporting period was accepted on Nov. 10th, 2020. Based on the comments received from the reviewers, the research team made further improvement on the manuscript and conducted more comprehensive experiments to evaluate the performance of the proposed intrusion detection systems (IDS). Those new results have been included in the final version of the ISSPIT paper. The Ph.D. student, Areej Althubaity, presented the paper in the virtual conference of ISSPIT 2020 on December 10th, 2020. During this reporting period, Areej also completed her Ph.D. thesis entitled “Towards Detecting Routing-based Internal Attacks in 6TiSCH Architecture” and successfully completed her defense on December 22nd.

During this reporting period, the research team continues to work on the development of the 6TiSCH real-time wireless network testbed. The mobile robotic platform (Turtlebot 2) has been tested and programmed to be able to traverse the physical space in the research lab according to a fixed trajectory. This mobile robotic platform will be integrated with SDR-based wireless devices to form a mobile interferer and test the performance of the proposed IDS in real-life testbed.

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	100%
Task 3: Consequence identification and impact assessment	Oct. 1st, 2020	Sept. 30th, 2021	50% (some parts of Task 2 are concurrent with Task 3)
Overall Project	Oct. 1st, 2018	Sept. 30th, 2021	Around 80%

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, the PhD student, Ms. Areej Althubaity, continues to work on the intrusion detection system (IDS) design for 6TiSCH wireless networks to identify Rank-related attacks. Her paper entitled: “Detecting Rules-related Attacks in RPL-based Resource-Constrained Wireless Networks” is accepted and will appear in the Proceedings of IEEE International Symposium on Signal Processing and Information Technology (ISSPIT), 2020. Areej also completed her Ph.D. thesis entitled: “Towards Detecting Routing-based Internal Attacks in 6TiSCH Architecture”, and successfully completed her defense on December 22, 2020.

Dissemination of research results: During the reporting period, the research team has one paper accepted in IEEE International Symposium on Signal Processing and Information Technology (ISSPIT), 2020. The PhD student, Areej Althubaity, gave the presentation during the virtual conference. The detail of this publication can be found in Table 4.

Table 3: Presentations at Conferences, Workshops, Seminars, and Other Events

Title	Event	Type	Location	Date(s)
Detecting Rules-related Attacks in RPL-based Resource-Constrained Wireless Networks	IEEE International Symposium on Signal Processing and Information Technology (ISSPIT), 2020.	Conference	Virtual Conference	December 10th, 2020

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", in the Proceedings of the IEEE International Symposium on Signal Processing and Information Technology (ISSPIT), 2020.	December 10th, 2020	Published

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
Areej Althubaity	PhD		Computer Science	Student Researcher

Table 7: Student Graduates

Student Name	Role in Research	Degree	Graduation Date
Areej Althubaity	Student Researcher	Ph.D. in Computer Science	12/22/2020

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 continue 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.
- 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.