

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: April 1st, 2020 – June 30th, 2020

Submission Date: June 30th, 2020

Overview:

During the reporting period, the research team at UConn has continued to study security threats and their countermeasures in low-power real-time wireless networks. The research team prepared the camera ready for the paper entitled: “Specification-based Distributed Detection of Rank-related Attacks in RPL-based Resource-Constrained Real-Time Wireless Networks”, which was accepted in the 3rd IEEE International Conference on Industrial Cyber-Physical Systems (ICPS 2020). The research team also presented this work on June 10th in the online format of the conference.

The research team also keeps working on the development of the 6TiSCH real-time wireless network testbed. Several more network management functions are added to ensure real-time and reliable data services. In particular, we added the function to include simulated concurrent interferers in the network to emulate how that will affect the network performance and how the proposed dynamic network management techniques can adapt to those interference and ensure the QoS of the network. Due to COVID-19, the UConn research labs have all been closed and we are not able to implement physical interferers in our testbed. The experiments will be planned and conducted once the lab is re-opened.

In the meantime, we continue working on a comprehensive literature review on security issues in industrial wireless networks. In that article, we summarized the design goals and challenges in industrial wireless networks, the existing standardization efforts, and the security issues in each layer of the industrial wireless networks, including the physical layer, the data link layer, and the network and transport layers. We also summarized the existing solutions to resolve those security issues and their drawbacks.

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	Sept. 30th, 2020	50%
Task 3: Consequence identification and impact assessment	Oct. 1st, 2020	Sept. 30th, 2021	30% (some parts of Task 2 are concurrent with Task 3)
Overall Project	Oct. 1st, 2018	Sept. 30th, 2021	Around 65%

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 the camera ready and present the paper entitled: “Specification-based Distributed Detection of Rank-related Attacks in RPL-based Resource-Constrained Real-Time Wireless Networks” in IEEE ICPS 2020 on June 10th. Areej is planning to defend her Ph.D. dissertation by the end of 2020. The other student, Mr. Jiachen Wang, focuses on the development of the 6TiSCH wireless network testbed and the RSSI-based network anomaly detection systems.

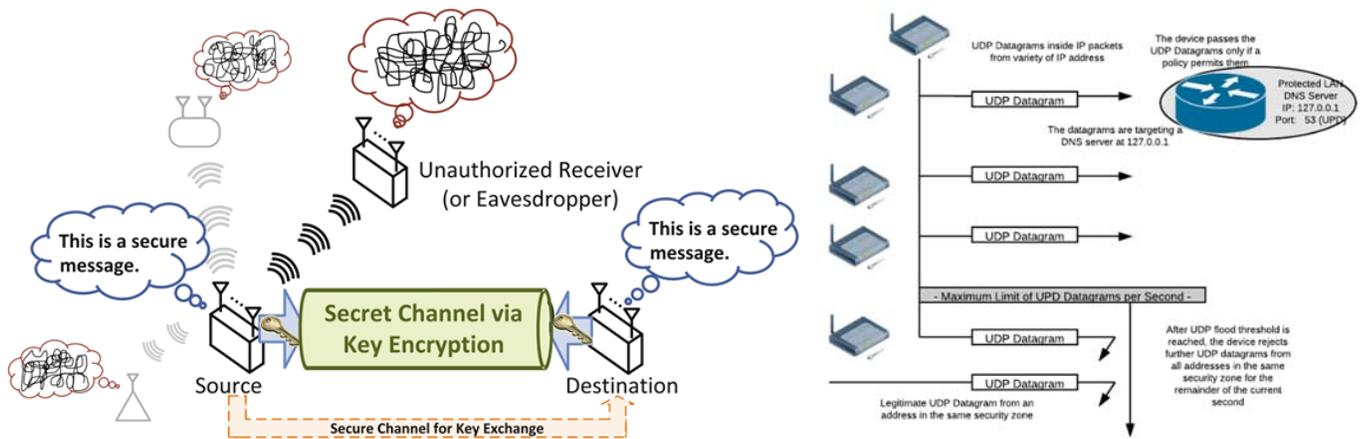
Dissemination of research results: During the reporting period, the research team presented one paper in major international conference. The details of this presentation can be found in Table 3.

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

Title	Event	Type	Location	Date(s)
Specification-based Detection of Rank-related Attacks in RPL-based Resource-Constrained Real-Time Wireless Networks	IEEE International Conference on Industrial Cyber-Physical Systems (ICPS 2020)	Conference	Tampere, Finland (Online)	June 10 th , 2020

Table 4: Publications and Submitted Papers and Reports

Type	Title	Citation	Date	Status



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
Jiachen Wang		PhD	Computer Science	Student Researcher
Areej Althubaity			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 plan to continue to work on the network anomaly detection system based on the channel-level RSSI information. The proposed method will be implemented on the 6TiSCH network testbed once the research lab at UConn is re-opened.
- 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.