FORDHAM UNIVERSITY
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Department of Computer and Information Science

Fall 2017 CIS Faculty Research Talk Series

Investigating Connected *k*-Coverage in Two-Dimensional Wireless Sensor Networks: Are We Done Yet?

Speaker: Habib M. Ammari
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Date: September 27, 2017
Time: 12:00 pm – 1:00 pm
Venue: John Mulcahy Hall (JMH) 342

Abstract: Coverage is one of the main essential tasks in the design, analysis, and implementation of wireless sensor networks (WSNs). Various sensing applications may have different coverage requirements. However, regardless of the requested coverage, in order to maximize the network lifetime, it is necessary to minimize the total number of sensors to successfully accomplish the mission for which a sensing application is built. We noticed that the coverage problem in a two-dimensional (2D) space has similarity with the tiling problem in the same space. Indeed, the main question related to tiling in a 2D space can be stated as follows: How can a 2D space be tiled by replicas of a set (or tiles)? This is an instance of the second part of Hilbert's eighteenth problem: Is there a polyhedron that tiles a three-dimensional Euclidean space? In this talk, we focus on the problem of *k*-coverage in 2D WSNs, where each point in a 2D field of interest is covered by at least *k* sensors, with a degree of coverage, $k \geq 1$. In our study, we found that it is helpful to identify a 2D convex tile that best approximates the sensors' sensing range. First, using a hexagonal tiling-based approach, we propose a few sensor placement strategies based on the degree of coverage *k* required by a sensing application. Then, we suggest a more general one using a specific shape of irregular hexagon, which we discover and denote by $IRH(r/n)$, where *r* stands for the radius of the sensors' sensing range, and $n \geq 2$ is a natural number. We prove by mathematical induction that $IRH(r/n)$ is capable of tiling a 2D space. Second, we compute the sensor density corresponding to each of the above sensor placement strategies. Also, we derive the minimum sensor density of the above-mentioned general sensor placement strategy. Third, we compute the relationship between the sensing range *r* and communication range *R* of the sensors for each of those sensor placement strategies.

Speaker's Biography: Habib M. Ammari is an Associate Professor in the Department of Computer and Information Science in the School of Arts and Sciences at Fordham University. He obtained his second Ph.D. in Computer Science and Engineering from the University of Texas at Arlington, in May 2008, and his first Ph.D. in Computer Science from the Faculty of Sciences of Tunis, in December 1996. His main research interests lay in the area of mobile computing and wireless networks, including network connectivity and fault tolerance, connected *k*-coverage, geographic forwarding, mobility, physical security, and information security in wireless sensor networks; applied cryptography; and computational geometry. He has a strong publication record in top-quality journals, such as ACM TAAS, ACM TOSN, IEEE TC, and IEEE TPDS, and prestigious conferences, such as EWSN, IEEE SECON, IEEE ICDCS, and IEEE MASS. He published his first Springer book, "Challenges and opportunities of connected *k*-covered wireless sensor networks: From sensor deployment to data gathering" in August 2009. Also, he published two Springer books, "The art of wireless sensor networks: Fundamentals" and "The art of wireless sensor networks: Advanced topics and applications" in January 2014. He is the recipient of the NSF CAREER Award in January 2011, and a three-year NSF Research Grant Award in June 2009. In March 2014, he was recognized with the Distinguished Research Award at the University of Michigan-Dearborn. Also, he was recognized with the Lawrence A. Stessin Prize for Outstanding Scholarly Publication (*i.e.*, Distinguished Research Award) at Hofstra University in May 2010. He is the recipient of the Nortel Outstanding CSE Doctoral Dissertation Award in February 2009, and the John Steven Schuchman Award for 2006–2007 Outstanding Research by a PhD Student in February 2008, both at the University of Texas at Arlington. He received the Best Paper Award at EWSN 2008, and the Best Paper Award at the IEEE PerCom 2008 Google Ph.D. Forum. Also, he received several service awards, including the Certificate of Appreciation Award at ACM MiSeNet 2013, IEEE DCoSS 2013, and ACM MobiCom 2011, the Outstanding Leadership Award at IEEE ICCCN 2011, and the Best Symposium Award at IEEE IWCMC 2011. He served as Associate Editor of several prestigious journals, such as ACM TOSN and IEEE TC. He is the founder of MiSeNet Workshop. He served as General Chair, Program Chair, Track Chair, Workshop Chair, Session Chair, Publicity Chair, Web Chair, and TPC member of numerous ACM/IEEE conferences, symposia, and workshops. He is an IEEE Senior Member.

Refreshments will be served!

For more information about this Fall 2017 CIS Faculty Research Talk Series, please contact Habib M. Ammari at hammari@fordham.edu