Fall 2015 Colloquium
Computer and Information Sciences

Energy Harvesting Active Networked Tags (EnHANTs) — Measurements, Algorithms, and Prototyping
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Abstract: We discuss a new type of wireless devices in the domain between RFIDs and sensor networks – Energy Harvesting Active Networked Tags (EnHANTs - http://enhants.ee.columbia.edu). Future EnHANTs will be small, flexible, and self-powered devices that can be attached to objects that are traditionally not networked (e.g., books, toys, clothing), thereby providing the infrastructure for various Internet-of-Things tracking applications. We describe the paradigm shifts associated with the underlying enabling technologies. Then, we present the results of an indoor light energy measurement campaign and of a kinetic energy study that have been conducted in order to characterize the energy availability for EnHANTs. We discuss low complexity energy-harvesting-adaptive algorithms which aim to allocate resources uniformly in respect to time. Finally, we present the design considerations for the EnHANT prototypes which harvest indoor light energy using custom organic solar cells, communicate and form multihop networks using ultralow-power Ultra-Wideband Impulse Radio (UWB-IR) transceivers, and adapt their communications and networking patterns to the energy harvesting and battery states. We also describe a small scale EnHANTs testbed that uniquely allows evaluating different algorithms with trace-based light energy inputs and discuss experimental results.


Bio: Dr. Gil Zussman received the Ph.D. degree in Electrical Engineering from the Technion in 2004 and was a Postdoctoral Associate at MIT between 2004 and 2007. In 2008 he joined the faculty of the Department of Electrical Engineering at Columbia University where he is currently an Associate Professor. His research interests are in the areas of wireless, mobile, and resilient networks. He is a co-recipient of 5 paper awards, including the ACM SIGMETRICS’06 Best Paper Award and the 2011 IEEE Communications Society Award for Outstanding Paper on New Communication Topics. He received the Fulbright Fellowship, two Marie Curie Fellowships, the DTRA Young Investigator Award, and the NSF CAREER Award. He was also the PI of a team that won first place in the 2009 Vodafone Americas Foundation Wireless Innovation Project competition.