CoCo Seminar Series Spring 2018

Resilient Wireless Sensor Networking in Challenging Environments

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Engineering Building H-9 (Knoll-MacDonald Commons / Watson Commons)

Recent years have witnessed growing interest in deploying wireless sensing applications in real-world environments. For example, home automation systems provide fine-grained metering and control of home appliances in residential settings. Similarly, assisted living applications employ wireless sensors to provide continuous health and wellness monitoring in homes. However, real deployments of wireless sensor networks (WSNs) pose significant challenges due to their low-power radios and uncontrolled ambient environments. Our empirical study in over 15 real-world apartments showed that low-power WSNs based on the IEEE 802.15.4 standard are highly susceptible to external interference beyond user control, such as Wi-Fi access points, Bluetooth peripherals, cordless phones, and numerous other devices prevalent in residential environments that share the unlicensed 2.4 GHz ISM band with IEEE 802.15.4 radios. To address these real-world challenges, we developed three practical wireless network protocols including the Adaptive and Robust Channel Hopping (ARCH) protocol, the Practical Transmission Power Control (P-TPC) protocol, and the Adaptive Energy Detection Protocol (AEDP). ARCH enhances network reliability through opportunistically changing radio's frequency to avoid interference and environmental noise; P-TPC reduces the energy consumption of sensors by dynamically adjusting transmission power based on link quality; AEDP reduces false wakeups in noisy wireless environments by dynamically adjusting the wakeup threshold of low-power radios. Another major trend in WSNs is the convergence with smart phones. To deal with the dynamic wireless conditions and varying application requirements of mobile users, we developed the Self-Adapting MAC Layer (SAML) to support adaptive communication between smart phones and wireless sensors. SAML dynamically selects and switches Medium Access Control protocols to accommodate changes in ambient conditions and application requirements.The first part of the talk will discuss the empirical study revealing the key challenges. The second part of the talk will introduce AEDP and SAML.

Dr. Mo Sha is an Assistant Professor of Computer Science at Binghamton University. His research interests include Wireless Networks, Internet of Things, Embedded and Real-Time Systems, and Cyber-Physical Systems. For more information, contact Hiroki Sayama (sayama@binghamton.edu). http://coco.binghamton.edu/