Stony Brook University
The Graduate School

Doctoral Defense Announcement

Abstract

Self-Adaptive, Scalable and Energy-Efficient Algorithms for

Unattended Sensor Networks

By

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Wireless sensor networks are playing an increasingly important role in a wide-range of applications, such as medical treatment, outer-space exploration, battlefield surveillance, emergency response, etc. A wireless sensor network is generally composed of a large number of distributed sensor nodes, with each node having limited communication, computing and sensing capability. For such large scale and resource-limited networks, energy-efficiency and scalability become two critical issues. Unlike traditional networks, sensor networks usually work in an unknown or hazardous environment, such as outer-space, seabed and battlefield. Little information about the environment can be obtained before the sensor nodes are deployed. Therefore, each sensor node must be able to ``learn and think" itself, and also cooperate with each other to make decisions more efficiently and reliably. Thus energy-efficiency, scalability and self-adaptability are very important capabilities for unattended mobile sensor networks. Due to the special characteristics of sensor nodes and their working environments, classical algorithms and protocols designed for traditional networks may not be suitable for sensor networks. The goal of my research is to provide an integrated suite of self-adaptive, scalable and energy-efficient algorithms and protocols for large, unattended sensor networks. To achieve this goal, I have been working three closely related topics in mobile sensor networks: First, develop efficient self-deployment algorithms for sensor nodes in unknown working environments where there is no information about the environment available, and no remote control from human-being; Second, develop new adaptive collision avoidance mechanisms at the medium access (MAC) layer that can decrease collisions and provide higher throughput than traditional approaches with only minimum overhead for exchanging control messages; Third develop efficient self-adaptive data gathering algorithms at the network layer. This research will focus on energy-efficiency, scalability and self-adaptivity of the sensor-actuator networks to provide a comprehensive cross-layer solution to the above issues.

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