ELECTRICAL & COMPUTER ENGINEERING SEMINAR

"Communication and Coordination in Wireless Sensor and Actor Networks"

by
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B103 Engineering Bldg.

Abstract & Biography

Wireless Sensor and Actor Networks (WSANs) are distributed systems of heterogeneous devices, referred to as *sensors* and *actors*, that sense, control, and interact with the physical environment. Sensors are low-cost, low-power, multi-functional devices that communicate untethered in short distances. Actors are resource-rich devices that collect and process sensor data and consequently perform actions on the environment.

This talk is concerned with coordination and communication problems in WSANs. First, communication and coordination problems are jointly addressed in a unifying framework for the case of static actors. A sensor-actor coordination model is proposed, based on an *event-driven partitioning* paradigm. Sensors are partitioned into different sets and each set is associated with a different actor. Data delivery trees are created to optimally react to the event and timely deliver event data with minimum energy expenditure. The optimal partitioning strategy is determined by mathematical programming, and a distributed solution is also proposed. Furthermore, the actor-actor coordination problem is formulated as an optimal task assignment problem, and a distributed solution of the problem based on an analogy with a one-shot auction is presented.

Application scenarios for WSANs with mobile actors are then studied. The mobility of actors is coordinated to optimally accomplish application-specific tasks, based on a nonlinear optimization model that accounts for location and capabilities of heterogeneous actors. A location management scheme is introduced to handle the mobility of actors with minimal energy consumption. A location management scheme is introduced to handle the mobility of actors with minimal energy consumption for resource-constrained sensors. The proposed scheme, which is the first localization scheme specifically designed for WSANs, is shown to consistently reduce the energy consumption with respect to existing localization services for sensor networks.

Tommaso Melodia received his "Laurea" in Telecommunications Engineering and Doctorate in Information and Communication Engineering from the University of Rome "La Sapienza", Rome, Italy, in 2001 and 2005, respectively. He is currently pursuing his Ph.D. in Electrical and Computer Engineering while working as a research assistant at the Broadband and Wireless Networking Laboratory (BWN-Lab), Georgia Institute of Technology, Atlanta, under the guidance of Dr. Ian F. Akyildiz. He is expected to graduate in July 2007. His main research interests are in wireless sensor and actor networks, wireless multimedia sensor networks, underwater acoustic sensor networks, and in wireless networking in general. He is the recipient of the BWN-Lab Researcher of the Year 2004 award.

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