TUTORIALS

Wednesday, January 30, 2008
(From 9.00 to 12.30)

TUTORIAL 1 (From 9.00 to 12.30)

Title

"Localization Techniques in Wireless Sensor Networks: Fundamentals and Advanced Research Results"

Tutorial Speaker and Affiliation

Prof. Davide Dardari, University of Bologna (Italy)

Abstract

Localization represents a fundamental issue in most wireless sensor network (WSN) applications. Sensed data without position information is often meaningless. Positioning is also essential for basic mechanisms composing the WSN to work efficiently. Unfortunately, propagation (e.g., indoor), battery drain, cost and size constraints preclude the utilization of GPS in most of the nodes in many WSN applications.
Positioning occurs in two steps. First nodes measurements of certain physical quantities (e.g., signal time-of-arrival, angle, received power, connectivity) are obtained, then the measurements are combined using positioning techniques to deduce the location on the nodes.
In this tutorial, the theoretical fundamental limits in positioning as well as practical schemes will be explained. The main positioning error sources will be illustrated. Particular emphasis will be given to distance estimation (ranging) and positioning techniques based on ultra wide bandwidth (UWB) signals due to their potential achievable accuracy and their recent adoption in the IEEE 802.15.4a standard. Some results derived from measured data in real environments will be shown to investigate the effect of system parameters on ranging and positioning accuracy.

Short biography

Davide Dardari received the Laurea degree in electronic engineering (summa cum laude) and the PhD degree in electronic engineering and computer science from the University of Bologna, Italy, in 1993 and 1998, respectively. In 1998, he joined the Dipartimento di Elettronica, Informatica e Sistemistica to develop his research activities in the area of digital communications.
He has been involved in educational activities at the Engineering Faculty, University of Bologna, Italy, since 2000 dealing with *Digital Communications and Electrical Communications*. He has also played several important roles in various National and European Projects. Since 2005, he has been a Research Affiliate at Massachusetts Institute of Technology (MIT), Cambridge, USA. Now, he is an Associate Professor at the University of Bologna at Cesena, Italy, where he participates with WiLAB (Wireless Communications Laboratory).
Recently, he has focused his activity on ultra-wide bandwidth (UWB) systems, ranging and localization techniques, as well as wireless sensor networks. He is an active member of the IEEE where he is the current secretary for the *Radio Communications Committee* of the IEEE Communication Society. He was co-chair of the Wireless Communications Symposium of the 2007 IEEE International Conference on Communications, and co-chair of the 2006 IEEE International Conference on Ultra-Wideband. He currently serves as an Editor for IEEE Transactions on Wireless Communications, Lead Editor for the EURASIP Journal on Advances in Signal Processing (Special Issue on Cooperative Localization in Wireless Ad Hoc and Sensor Networks) and Guest Editor for Proceedings of IEEE (Special Issue on UWB Technology & Emerging Applications).
He also serves as a reviewer for Transactions/Journals and Conferences, and as a TPC member for numerous international conferences.

TUTORIAL 2 (From 9.00 to 12.30)

PART 1 (1 hour and 30 minutes)

Title

"6lowpan networking in practice and theory"

Tutorial Speaker and Affiliation

Zach Shelby, Sensinode Ltd. (Finland)

Abstract

In this tutorial students are exposed to the leading edge features of IPv6 over IEEE 802.15.4 standardization (6lowpan). The material covers not only protocol aspects, but also practical implementation aspects of 6lowpan with a short live demonstration. Issues regarding basic IPv6 and UDP compression with 6lowpan, mesh-under features, new routing activities, neighbor discovery, and backbone routing are covered.

Short biography

Zach has an M.Sc. (Eng.) from the University of Oulu and a B.Sc. (Eng.) from Michigan Technological University, and is finishing a PhD with RWTH Aachen. Zach worked for 10 years as a research scientist and research manager first for VTT and later for the Centre for Wireless Communications (CWC) and has been responsible for developing innovative
research in the area of wireless embedded networking. His results include a large portfolio of publications, public talks, broad research cooperation and a key patent. Zach is one of the founders of Sensinode Ltd. currently in the position of CTO. During his career, the mission has been clear, making the Internet of Things a reality.

PART 2 (1 hour and 30 minutes)

Title

"Computing in the Real World with Java"

Tutorial Speaker and Affiliation

Joe Polastre, Sentilla ltd. (USA)

Abstract

Pervasive Computing is about making the real world -- and everything in it -- smarter, through the use of small, wireless, battery-powered computers (often called "motes") that can be put anywhere or attached to anything. By moving beyond wireless sensing to a full computing environment, pervasive applications can revolutionize the way we live, work, and play. Pervasive applications range from automatically watering your plants when they need water to tracking millions of containers as they move goods throughout the world.

Conventional wisdom asserts that low-power resource-constrained systems are incapable of running fully featured computing environments, such as Java. This talk shows the basic architecture of a pervasive computer, the unique resource constraints in pervasive computing, a Java Micro Edition (JavaME) platform extended to pervasive computing by Sentilla, and techniques for developing and debugging applications distributed across large numbers of pervasive computers. Java-powered systems require efficient kernel design and cross-layer communciation between Java applications and low-level kernel operations. Applications must be written with resource and power constraints in mind, and services must transcend traditional layered boundaries to efficiently execute applications. To achieve these goals, Sentilla introduces a new approach to using Java on embedded systems enabling protection, isolation, and security in low-power systems that do not natively support these features. Java provides huge improvements over conventional embedded C approaches thereby enabling developers to build new protocols, new sensor drivers, and new data models quickly and easily.

Short biography

Joe Polastre is Co-founder and Chief Technology Officer of Sentilla Corporation.
Dr. Polastre is responsible for defining and implementing the global technology strategy and overseeing Sentilla's product roadmap. Dr. Polastre's experience with pervasive computing stems from his deep background with wireless sensor networks, having deployed the first-ever autonomous network on Great Duck Island, Maine, in 2002.
In addition to his practical experience, Dr. Polastre sits on numerous technical boards and commissions and is a tireless evangelist for pervasive computing. His ability to explain the technology in a straightforward and engaging manner puts him in constant demand for
speaking engagements worldwide. Dr. Polastre holds Ph.D. and M.S. degrees in Computer Science from the University of California, Berkeley, and a B.S in Computer Science from Cornell University.