ENG ME 544/EC 544   Networking the Physical World

2008-2009 Catalog Data:

ENG ME 544/EC 544   Networking the Physical World   Prereq: ENG EC 312 and ENG EC 450; ENG EC 441 is desirable; C programming experience. Considers the evolution of embedded network sensing systems with the introduction of wireless network connectivity. Key themes are computing optimized for resource constrained (cost, energy, memory, and storage space) applications and sensing interfaces to connect to the physical world. Studies current technology for networked embedded network sensors including evolving protocol standards. A laboratory component of the course introduces students to the unique characteristics of distributed sensor motes including programming, reliable communication, sensing modalities, calibration, and application development. Experience with the C language is required. Meets with ENG EC 544; students may not take both for credit. 4 cr.

Class/Lab Schedule: 4 lecture hours per week; 2 hour lab per week

Status in the Curriculum: Elective

Textbook(s) and/or Other Required Material: Networking Wireless Sensors, Bhaskar Krishnamachari, (ISBN-13: 9780521838474 | ISBN-10: 0521838479), January 2006, Cambridge University Press.
Wireless Sensor Networks Seminar, Crossbow Technology, Inc. 2005
References: Wireless Sensor Networks, C.S. Raghavendra, K.M. Sicalingam, and T. Znati, Eds., Springer, New York, NY, 2004.
A. Hac, "Wireless Sensor Network Designs", John Wiley & Sons, 2003
C. Siva Ram Murthy and B.S. Manoj, "Ad Hoc Wireless Networks : Architectures and Protocols", Prentice Hall PTR, 2004.
Edgar H. Callaway, Jr, Wireless Sensor Networks - Architectures and Protocols, by ., Auerbach Publications, 2003
 J.A. Gutierrez, E.H. Callaway, Jr., and R.L. Barrett, Jr., Enabling Wireless Sensors with IEEE 802.15.4, Low-Rate Wireless Personal Area Networks, IEEE Press, 2003
C. Perkins, Ad Hoc Networking, Addison Wesley, 2001
C.-K. toh, Ad Hoc Mobile Wireless Networks: Protocols and Systems, Prentice Hall, 2002.
TinyOS reference materials: http://www.tinyos.net/ and http://sourceforge.net/projects/tinyos/
nesC: a Programming Language for Deeply Networked Systems: http://nescc.sourceforge.net/
Mote and Sensor Users Guides http://www.xbow.com/Support/manuals.htm

Coordinator: Thomas Little, Professor, Electrical and Computer Engineering

Prerequisites by topic:
    1. Computer Organization
    2. Microprocessors

3. Introduction to Computer Networking

Goals:
1. Teach design principles and tradeoffs in low-power embedded network sensor systems
2. Teach principles of operating system design in constrained microcontroller-sensor systems
3. Teach programming techniques for resource-constrained microcontroller-sensor systems
4. Teach computer networking principles applied in mesh sensor networks
5. Gain experience with state-of-the-art sensor network components

Course Learning Outcomes:

As an outcome of completing this course, students will:
  i. Understand design principles and tradeoffs in low-power embedded network sensor systems
 ii. Understand principles of operating system design in constrained microcontroller-sensor systems
iii. Understand programming techniques for resource-constrained microcontroller-sensor systems
 iv. Understand computer networking principles applied in mesh sensor networks
  v. Be able to use and program state-of-the-art sensor network components

Course Learning Outcomes mapped to Program Outcomes:

Program:	A	B	C	D	E	F	G	H	I	J	K
Course:	i-v	i, iv, v	i, ii, iv	i, v	i, iii, v	i	i, v	i, v	i-v	v	i, v
Emphasis:	3	4	3	5	5	4	4	3	1	1	1

Topics:
Students will choose projects that synthesize their experience and learnings in the earlier part of the course. Projects will involve reprorgramming of sensor network motes and will focus on either (a) refinement of concepts for individual system components (e.g., implementing a new routing protocol) or (b) end-to-end application development (e.g,, designing and implementing a reliable peer-to-peer delivery service).

Contribution of Course to Meeting the Professional Component:
Engineering topics: 100%

Status of Continuous Improvement Review of this Course:
Date Last Reviewed: Spring 2009   **Reviewed by**: ECE Undergraduate Comm.
Prepared by: Thomas Little