Course Number: EE 662

Course Title: Wireless Sensor Networks

Catalog Description: Sensor platforms, wireless channel characteristics, time synchronization, medium access control, topology control, routing protocols, localization, coverage and placement, detection and tracking, query processing.

Credits: 3

Coordinator: Yusuf Ozturk, Professor of Electrical and Computer Engineering

Instructor: Yusuf Ozturk, Office: E411 Engineering Building, Tel. 619-594-4550, Email: yozturk@mail.sdsu.edu, Office Hours: 02:00 PM - 4:00 PM Tuesday and Thursdays, All other times by appointment

Class/Laboratory Schedule (Sessions per week and hours per session): The class meets for two lectures a week. Each lecture is 75 minutes.

Class covers systems issues in wireless sensor networks and will involve programming Telos sensor nodes, Motes, Zigbee nodes and other building blocks of sensor networks. Class involves building distributed hierarchical sensor systems.

Prerequisites by Topic:

- C++, Software design and engineering basics, Introductory level computer networks.

Prerequisites by Course:

- Consent of the instructor.

Course Objectives:

- Introduce wireless sensor network architectures and communications protocols
- Provide an understanding of mutual relationships and dependencies between different protocols and architectural decisions by offering an in-depth investigation of relevant protocol mechanisms.
- Introduce sensor network platforms, operating systems and programming tools for sensor networks.
- Introduce design spaces for sensor networks
- Study wireless sensor network solutions with practical implementation examples and case studies.
References:

- Protocols and Architectures for Wireless Sensor Networks, Holger Karl, Andreas Willig
- Papers Distributed by Instructor

Topics Covered:

- **Introduction to wireless sensor networks**: Challenges for WSNs, enabling technologies.
- **Single node architecture**: Hardware components, energy consumption of sensor nodes, operating systems and execution environments.
- **Network architecture**: Sensor network scenarios, optimization goals & figures of merit, design principles for WSNs, service interfaces of WSNs, gateway concepts.
- **Physical Layer**: Wireless channel and communication fundamentals, physical layer & transceiver design considerations in WSNs.
- **MAC Protocols**: Fundamentals of (wireless) MAC protocols, low duty cycle protocols and wakeup concepts, contention-based protocols, schedule-based protocols, the IEEE 802.15.4 MAC protocol.
- **Link Layer Protocols**: Error control, framing, link management.
- **Naming and Addressing**: Address and name management in wireless sensor networks, assignment of MAC addresses, distributed assignment of locally unique addresses, Content-based and geographic addressing.
- **Time Synchronization**: Introduction to the time synchronization problem, protocols based on sender/receiver synchronization, protocols based on receiver/receiver synchronization.
- **Localization and Positioning**: Mathematical basics for the lateration problem, single-hop localization, positioning in multi-hop environments, impact of anchor placement.
- **Topology control**: Flat network topologies, hierarchical networks by dominating sets, hierarchical networks by clustering, combining hierarchical topologies and power control, Adaptive node activity.
- **Routing protocols**: Gossiping and agent-based unicast forwarding, energy-efficient unicast, broadcast and multicast, geographic routing, mobile nodes.
- **Data-centric and content-based networking**: Data-centric routing, data aggregation, data-centric storage.
- **Transport Layer and Quality of Service**: Reliable data transport, congestion control and rate control.
- **Security in WSN**.

Grading:

There will be a number of small group projects that will account for 40% of the course grade. The projects will be parts of a large project. Each group will submit separate conference-style reports at the end of each report and at the end of the course.
Besides the course projects, there will be a mid-term for 20%, and regular paper reviews for 10% and a final exam for 30%.

Projects/Presentations 40%
Midterm 30%
Final 30%

Website: We will use the blackboard system for this course
http://blackboard.sdsu.edu
Instructors website: http://ozturk.sdsu.edu

Laboratory Resources:

Laboratory resources composed of Motes sensor network platform, Telos nodes and cricket nodes are available in E202F.

Assignments and Reading List

- Each student is expected to read papers and submit a short summary of each paper.
- The term project will be implemented by groups of 2-3 students and will run as a software engineering project.

Missed Quizzes and Exams

Missed exams can be made up only under extenuating circumstances such as medical or family emergencies. Please see the instructor as soon as possible if you know you will be unable to attend an exam. Make-up exams will be given by prior arrangement only. (This means you have to inform me before the exam that you will be gone. Just not showing up for the exam will result in a grade of zero)

Academic Integrity

Academic integrity is one of the fundamental principles of a university community. San Diego State University expects the highest standards of academic honesty from all students. Violations of academic integrity include the following: (1) unauthorized assistance on an examination, (2) falsification or invention of data, (3) unauthorized collaboration on an academic exercise, (4) plagiarism, (5) misappropriation of research materials, (6) unauthorized access of an instructor’s files or computer account, and (7) any other serious violation of academic integrity as established by the instructor.
If your academic integrity is not maintained on a test or assignment, you will automatically receive a grade of zero for that test or assignment and you will be reported to the Dean’s Office, in accordance with SDSU academic integrity policy. Penalties can be severe. More specific information is available in the SDSU Bulletin, both in print and on-line.

**Students with Disabilities**

Students who need accommodation of their disabilities should contact me privately to discuss specific accommodations for which they have received authorization. If you have a disability, but have not contacted Student Disability Services at 619-594-6473 (Calpulli Center, Suite 3101), please do so before making an appointment to see me. The web site for Student Disability Services is: [http://www.sa.sdsu.edu/sds/index.html](http://www.sa.sdsu.edu/sds/index.html)

If you are a student with a disability and believe you will need accommodations for this class, it is your responsibility to contact Student Disability Services at (619) 594-6473. To avoid any delay in the receipt of your accommodations, you should contact Student Disability Services as soon as possible. Please note that accommodations are not retroactive, and that I cannot provide accommodations based upon disability until I have received an accommodation letter from Student Disability Services. Your cooperation is appreciated.