Wireless Sensor Networks, ENPM677

Course Objectives

The use of distributed wireless sensor networks has surged in popularity in recent years with applications ranging from health monitoring, environmental monitoring, transportation, industrial automation, smart grid applications, structural health monitoring, to people-and object-tracking in both cooperative and hostile environments. This course is targeted at understanding and obtaining experience with the state-of-the-art in such wireless sensor networks which are often composed using relatively inexpensive tiny sensor nodes that have low power consumption, low processing power and bandwidth and equipped with sensing, computation, and wireless communication capabilities. After sensing their local environment, these sensors self-organize to form multi-hop wireless networks capable of relaying their data to a backbone server. Upon completion of this course, you should be able to:

- list various applications of wireless sensor networks
- describe the concepts, protocols, and differences underlying the design, implementation, and use of wireless sensor networks
- propose, implement, and evaluate new ideas for solving wireless sensor network design issues.

References and Textbooks:

- Holger Karl, Andreas Willig, "Protocols and Architectures for Wireless Sensor Networks", Wiley, ISBN: 978-0470095102

- C.S. Raghavendra, Krishna M. Sivalingam, Taieb Znati, "Wireless Sensor Network", Springer, ISBN: 978-0387352695

- Ian F. Akyildiz, Mehmet Can Vuran, "Wireless Sensor Networks (Advanced Texts in Communications and Networking)", Wiley, ISBN: 978-0470036013

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We will heavily use papers related to wireless sensor networks that have appeared in IEEE journal and conference publications.

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Class Meets
Tuesdays
7:00 – 9:40 p.m.

Office Hours
Tuesdays after class or by appointment.

Prerequisites
Digital Communications or permission of instructor

Course Communication
All course communication will be sent through ELMS_CANVAS. Please make sure that you check your e-mails on a regular basis.

Campus Policies

It is our shared responsibility to know and abide by the University of Maryland's policies that relate to all courses, which include topics like:

- Academic integrity
- Student and instructor conduct
- Accessibility and accommodations
- Attendance and excused absences
- Grades and appeals
- Copyright and intellectual property

Topics Covered:

The course will span a variety of topics ranging from radio communications, network stack, systems infrastructure including QoS support and energy management, distributed algorithms and example applications. Examples discussed in the class will include the use of wireless sensor networks in smart grid applications, health monitoring, structural health monitoring and environmental monitoring. The course will cover wireless sensor node and network architectures, and communication protocols in data-link, network, and transport layers. We will address how the unique constraints of sensor networks - wireless, low power, small form factor, limited memory/CPU - affect the design of the system. The tentative list of topics to be covered is as follow: Wireless sensor network architecture, Different platforms and standardization, Distributed infrastructure and design parameters, Physical layer, Modulation, MAC layer and Design Challenges, applications of wireless sensor network in smart grid, structural health monitoring, the role of wireless sensor networks in Internet of Things (IoT), etc.

Assessment and Grading:

This course includes the completion of a project. You can work on a project by yourself, or form a group of at most two students (for this to be approved, the scope of the proposed work should be much broader than that done by an individual student, and must be approved by the instructor). The project work can be theoretical or experimental in nature. For theoretical projects, the students are required to pick a topic related to wireless sensor networks, do a comprehensive literature survey and write an IEEE Conference paper format report. Details of what is expected in the midterm and final project reports will be shared with the students during the semester.

Those students who select to complete an experimental project, will have the opportunity to build a working wireless sensor network and benefit from available matching funds from the OAEE. Specifically:

OAEE will offer 50% matching funds, up to a maximum of $125 from OAEE per group, to student groups for the purposes of purchasing materials for their ENPM677 approved project. It is requested that the following process be followed:

- students submit project proposals and materials/budget requests to Dr. Haghani.
- if approved, students will provide the instructor with a list of parts to be purchased.
- once materials are at OAEE, students come to pick them up and pay their 50% at that time to OAEE directly.
- at the end of the semester, students will be required to submit to the instructor all material used for the WSN project, which will be returned to the OAEE.

It is important to keep in mind that since this course is aimed at wireless sensor networks, any project that you select should be related to this topic. For the project, you will need to write a midterm project report which describes what you intend to do in your project along with a presentation. A Final project report is due at the end of the semester along with a submission of a paper prepared in IEEE style format, either in word or in LaTeX. Students who submit their work in LaTeX format will be considered for a bonus.

Assignments will be given on a regular basis. Assignments will usually come in the form of finding/reading recent papers related to wireless sensor networks, writing a brief summary of the paper and its findings, and preparing a presentation based on the paper in the class.

The following grading policy will be used:

Assignments (including brief summaries and classroom presentations): 35%
Midterm Project Report and Presentation: 20%
Final Project Report and Presentation: 45%

Course-Specific Policies

I expect you to make the responsible and respectful decision to refrain from using your cellphone in class. If you have critical communication to attend to, please excuse yourself and return when you are ready. For more information about the science behind the policy watch: http://youtu.be/WwPaw3Fx5Hk

Students are expected to read recent IEEE papers and make presentations in class. At the end of each presentation, you will be asked to rate the presenter as well as the presentation topic. So it is important to pay attention during these presentations and ask questions.

You are expected to take personal responsibility for you own learning. This includes acknowledging when your performance does not match your goals and doing something about it. Everyone can benefit from some expert guidance on time management, note taking, and exam preparation, so I encourage you to consider visiting http://ter.ps/learn and schedule an appointment with an academic coach. Sharpen your communication skills (and improve your grade) by visiting http://ter.ps/writing and schedule an appointment with the campus Writing Center. Finally, if you just need someone to talk to, visit http://www.counseling.umd.edu.

Everything is free because you have already paid for it, and **everyone needs help**… all you have to do is ask for it.

Names/Pronouns and Self Identifications

The University of Maryland recognizes the importance of a diverse student body, and we are committed to fostering equitable classroom environments. I invite you, if you wish, to tell us how you want to be referred to both in terms of your name and your pronouns (he/him, she/her, they/them, etc.). The pronouns someone indicates are not necessarily indicative of their gender identity. Visit trans.umd.edu to learn more.

Additionally, how you identify in terms of your gender, race, class, sexuality, religion, and dis/ability, among all aspects of your identity, is your choice whether to disclose (e.g., should it come up in classroom conversation about our experiences and perspectives) and should be self-identified, not presumed or imposed. I will do my best to address and refer to all students accordingly, and I ask you to do the same for all of your fellow Terps.