Syllabus

EE 579: Wireless and Mobile Networks Design and Laboratory

Spring 2014

Innovative Network Protocols and Applications with Mobile Wireless Devices

Instructor:
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Motivation:

In today's network-centric world, most objects are becoming embedded with sensors and gaining the ability to communicate with each other. In what's called the "Internet of Things," sensors and actuators embedded in physical objects, from roadways and cars to pacemakers and RFID tags, are linked through wired and wireless networks, often using the same Internet Protocol (IP) that connects the Internet. These information networks churn out huge volumes of data that can be analyzed to create improved living environments, new business models, and novel applications that were unthinkable before. For instance, consider the smartphone you are carrying. It has at least a dozen sensors built into it, including a GPS, an accelerometer, a proximity sensor, an ambient light sensor, a compass, and so many more. For many consumers, these smartphones and tablets have started replacing personal computers as the default computing device. Motivated by this trend, an increasing number of vendors and cellular operators have also started deploying high-speed access networks, such as LTE, LTE Advanced, WiMAX, etc., leading to an increasing shift of data traffic from fixed to wireless networks.

Course Description:

The goal of this course is to learn how to design and develop network protocols and applications using wireless and mobile devices. This is primarily a laboratory course, so the learning will be primarily hands-on. We will introduce and give you access to at a wide range of hardware platforms, such as Tmote Sky wireless sensor motes, Sun SPOTs, Androids, iPhone, Nokia N95 mobile devices, and MikroTik Routers. These platforms operate on a range of wireless technologies, including IEEE 802.15.4 (ZigBee), Bluetooth, IEEE 802.11, 3G/4G Cellular, etc. There are correspondingly a wide range of languages and software environments for programming these devices and logging their information: Java, C/C++, NesC/TinyOS/Contiki, XML/web services, J2ME, RouterOS, etc.

We will begin this course with brief introductory tutorials on programming and working with all these platforms: Android (iOS), MikroTik, Sun SPOT, and Tmote. There will be a small number of assignments within the first half of the course, which will get you familiar with at least a significant subset of these platforms. After this initial phase of familiarization, you will work in a group of 3 students to define and propose a substantial project that you will work on for the rest of the semester. We have some concrete ideas for cutting-edge, potentially high-impact protocol implementations for wireless networks that you could choose to work on, or you have the freedom to pick your own. For this project, you may choose any available hardware/software combination, and work at any layer: Link Layer, Network Layer, Transport Layer, and Application Layer, so long as it is not a stand-alone single device application that does not involve any network communication.

The main expectation is that your project will be something substantial, novel, and cool, and reflect the capability of second-year graduate students at a top-ten engineering school! The best projects from the class will be showcased to a select audience at the end of the semester.

As this is a lab course, you should expect to spend a significant amount of time outside of class hours. During the class times, besides introducing you to the various platforms, we will also seek to understand various key design themes in wireless and mobile networks: sensing, localization, mobility, robustness, energy-efficiency, privacy, etc., through in-class lectures, discussions of research papers, and talks by invited speakers. As a key element of collaborative, participative learning, you will be asked to regularly contribute written material in the form of pointers, summaries, and critiques of research papers.

Note that this is a very programming-intensive course. It is expected that the students taking this course already have a strong background and considerable experience with object-oriented and network programming (through courses such as CS 402, CS 551 OR other prior experience). This laboratory course will **not** teach you how to program. Beyond a very brief introductory tutorial in class, and pointers to a wide range of online resources and some books, you are going to be left **on your own** to master the software development environments, libraries and interfaces that are unique to each platform. If you do not feel comfortable about your ability to master a new and unfamiliar programming environment largely on your own, and spend countless (possibly frustrating) hours coding, debugging, testing software, this is **not** the right class for you.

On the positive side, the unique learning process in this class, which emphasizes self-motivated knowledge acquisition, independent problem-solving, hands-on experience, open-ended design, aiming for innovation, communicating your ideas orally and in writing, is sure to prepare you well for a real-world engineering environment beyond USC.

Course Materials and Info:
URL (Blackboard): http://blackboard.usc.edu
Textbook ("Required"): There is NO required text for this course.
Textbook (Recommended):
Pointers to many useful online references and forums will be posted on blackboard.

Grading Policy:

Diagnostic Exam	5%
Lab Assignment	30%
Written Contributions (paper critiques, summary)	10%
Mid Term Progress Report	10%
Final Project and Report	45%

The final letter grade will reflect your score in the course relative to others to some extent, but more so your absolute performance. As a general rule, I give students with a total score of 90 and above an 'A', 80 and above a 'B', and 70 and above a 'C'.

Attendance: You are expected to attend ALL lectures and discussion sections. More than two unexplained absences will result in grade reduction.

Academic Conduct: You are expected to maintain the highest standards of academic conduct. Any form of plagiarism or other violation of academic integrity will be referred to Student Judicial Affairs and will result in a stiff penalty (ranging from a letter grade reduction to an "F" in the course).

Academic Accommodations: Students requiring academic accommodations based on a disability are required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to me as early in the semester as possible. DSP is located in STU 301 and is open 8:30 a.m. - 5:00 p.m., Monday through Friday. The phone number for DSP is (213) 740-0776**.**