EEL 6788 - Advanced topics in wireless networks

Focus on urban sensing

Lotzi Bölöni

School of Electric Engineering and Computer Science
University of Central Florida- Orlando, FL

January 9, 2010

Welcome to EEL 6788 - Advanced topics in wireless networks

- This class is a vehicle for students to immerse themselves into current research topics in wireless networks.
- To clarify a misunderstanding caused by the EEL prefix: this is not an electrical engineering class. Our perspective is computer science computer engineering: software, networking protocols, some hardware. We are not interested in antennas, signal processing etc.
  - EE majors are, of course welcome to the class.
- Every year, we choose a different topic. Previously we had:
  - Ad hoc networks
  - Sensor networks
  - Sensor networks from an agent perspective

This year's topic: urban sensing

- How to use the ubiquitous personal devices
  - best example being smartphones
  - ... but also cameras, watches, personal health monitors etc.
- to **sense** our environment
- **collect**, **validate**, **integrate** and **secure**

the data

- and **deliver** it to interested customers, either centralized

or distributed.

- Also known as **participatory sensing**, **urban computing**

etc.

Example 1: real time distributed environment monitoring

- monitor the level of allergens in areas around the city
- use the cell phone's sensor to sense the data
- distribute the information
  - to centralized locations where a map is created
  - peer to peer to people who are interested

Challenges

- How do we know that people are interested?
- What is the motivation in sending?
  - Free-rider problem

Example 2: citizen science

- setting up a study which monitors some environmental value important to the community
  - e.g. noise, pollution, vibration caused by trucks, water quality
- real world studies are very expensive
- use cellphones to record data, send it to a central location

Challenges

- Do we trust the data?
  - Can we prevent malicious users to distort the values?
  - What about recording errors?
  - The issue of motivation

Example 3: price arbitrage

- prices of products show a variation across stores
- stores rely on the fact that comparison shopping is expensive
    - time
    - fuel cost
    - attention span
- use peer-to-peer networks to record / take a picture of prices
- distribute it to interested parties.

Challenges

- Motivation, free-riders, trust
- Conflict of interest: do I want to share the deal I found?
    - **Idea**: prospect of mutual benefit

Who is interested in urban sensing?

- Industry
  - Microsoft
  - Nokia
- Academia
  - UCLA
  - Dartmouth
  - MIT
- Startup companies

About the instructor

- Lotzi Bölöni
- http://www.eecs.ucf.edu/~lboloni
- HEC-319, lboloni@eecs.ucf.edu (preferred), phone: (407) 243-8256 (google voice)
- Background: BSc in Romania (Tech. Univ of Cluj), PhD Purdue 2000, Sillicon Valley startup gig (CPlane, network mgmt), joined UCF in 2002.
- Research interests:
    - autonomous agents, especially coordination, teamwork, cultural models, etc.
    - mobile computing, sensor networks etc.
    - distributed systems, scheduling etc.

Class organization

- It is a **research class**. Goal is to collectively explore an interesting new domain.
- Strong emphasis on student participation.
- The culminating experience (and determining factor of the grade) is the **project**
  - ▶ real world smart-phone application (Android, iPhone, WebOS etc)
  - ▶ real world PC-simulated smart-phone application (eg. Android emulator)
  - ▶ netbook apps
  - ▶ simulation of urban sensing scenarios (YAES etc.)
  - ▶ surveys
- Projects with programming components can be 1-2 persons, survey projects are 1 person only.
- Objective: projects as scientific papers.

Class deliverables and grading

- Presentation (20%)
- Project (60%)
- Homeworks (20%)

Presentation

- Research a topic in urban sensing and present it in class in a 20 min presentation.
  - ▶ The goal is to be able to cover more material than if I would have to lecture.
  - ▶ The goal of the presentation is to teach us.

- It is usually centered around a single application. I would expect it to be a bit more than summarizing a paper: you need to read the background of the persons, the circumstances etc.

- Example: CenceMe from Darthmouth. Yes there is a paper which describes the Nokia N900 version. But there is also a later iPod application, it might be that there is a small company as well etc.

- I will put up a series of suggested topics, you can come with your own.

- Send me the presentation in Powerpoint, OpenOffice or PDF ahead of time such that I can put it on the webpage.

Project

- Real world application using a smartphone platform (Android, iPhone etc.)
- –//– with smartphone emulated on a PC (eg. Android emulator)
- –//– simulated on a PC (eg. YAES ...)
- Netbook apps (preferable using peer-to-peer wireless)
- Surveys

- Programming projects 1-2 person, surveys 1 person only.
- You can get away without programming, but you then you need to read a lot.

Project as paper

- Check the website for the exact deliverables of a project.
- They are structured such that you can send the project to a conference / journal.
- ... and I think you should
- ... consider it as an exercise in a research project

Homeworks: reading assignment

- Two or three reading assignments on papers relevant to the topic.
- Deliverable: 500 word summaries on the papers.

Timeline (approximative)

- January 25: Send your choices of presentation
- Feb 8: Decide on the project, assemble the teams.
  - ▶ Make sure you have a half page description about the specification of the project: what tools are you going to use, what functionality do you expect to work at the end of the project.
- March 8: Half time report of the project
  - ▶ Some code should be working... Ideal report: we have done most of the functionality, but we need some debugging.
  - ▶ The final report is already started, with the already accomplished
  - ▶ Find a way to show me where are you staying: come to the office hours and demo it, show it over skype, send me a video, send me working code, ... something.
- about April 7-26: in-class presentations of the projects
  - ▶ Focus on demo
- April 26: final reports due

FEEDS issues

- The first preference would be to actually come to the class for your presentation and present your project.
- But you can record your presentation and we will play them in class:
  - ▶ Using the Powerpoint record presentation model.
  - ▶ Video tape it.
  - ▶ Use the Tegrity recording feature.
  - ▶ ... I am open to other technological approaches, e.g. video conferencing.
    - ★ A challenge is that it needs to retain an accessible Tegrity record.