Carleton University

Department of Systems and Computer Engineering

SYSC 5306 ***Mobile Computing Systems*** ***Winter 2012***

Course Outline

Instructor*: Thomas Kunz, CB 5202, 520-3573, tkunz@sce.carleton.ca*

Office Hours: Tuesdays 2-3 pm

Wireless Communication and Mobile Applications are recent paradigms in communications and computer science. This course will provide an introduction and overview of communication alternatives for mobile data applications, focusing on mobility-related aspects of higher-level protocols, and examines in depth the infrastructure, available services, and application paradigms for mobile applications.

Resources: There is no single textbook that adequately covers the diverse range of topics (and buying multiple textbooks is clearly not very appealing financially). Here are two reasonably complete books, though:

- *Mobile Communications*, 2nd edition, by Jochen Schiller, Pearson Education Limited 2003, ISBN 0-321-12381-6.
- *Ad Hoc Wireless Networks: Architectures and Protocols*, by C. Siva Ram Murthy and B.S. Manoj, Prentice Hall 2004, ISBN 0-13-147023-X (despite the title, it also covers many cellular/WLAN topics briefly).

Also, in particular as a starting point for the course project, you may want to look at the following books (in addition to the references provided in the Appendix section on the website). I put these and a few other references also on reserve in the university library.

- *Handbook of Sensor Networks: Algorithms and Architectures*, edited by Ivan Stoymenovic, John Wiley & Sons 2005, ISBN 0-471-68472-4.
- *TinyOS Programming*, by Philip Levis and David Gay, Cambridge University Press 2009, ISBN 978-0-521-89606-1.
- *Wireless Sensor Networks*, by Ian F. Akyildiz and Mehmet Can Vuran, John Wiley & Sons 2010, ISBN 978-0-470-03601-3.

I will post my slides, plus other reference material, on the course webpage, http://kunz-pc.sce.carleton.ca/sysc5306/. I will also post marks, etc. on this webpage.

Prerequisites: EACJ 5607 (ELG 5374) or SYSC 5201 (ELG 6121) or permission of the Department.

Marking Scheme: There will be a final exam worth 20%, two assignments during the term worth 15% each, and a course project, which is worth 50%. The final exam is for evaluation purposes only and will **not** be returned to students. All documents have to be submitted as a hardcopy and softcopy, and follow certain formatting guidelines (in particular length and font size limitations). See below for a discussion of these requirements.

Plagiarism and Cheating: Plagiarism and cheating at the graduate level are viewed as being particularly serious and the sanctions imposed are accordingly severe. Students are expected to familiarize themselves with and follow the Carleton University Student Academic Integrity Policy. The Policy is strictly enforced and is binding on all students. Plagiarism and cheating – presenting another's ideas, arguments, words or images as your own, using unauthorized material, misrepresentation, fabricating or misrepresenting research data, unauthorized co-operation or collaboration or completing work for another student – weaken the quality of the graduate degree. Academic dishonesty in any form will not be tolerated. Students who infringe the Policy may be subject to one of several penalties including: expulsion; suspension from all studies at Carleton; suspension from full-time studies; and/or a reprimand; a refusal of permission to continue or to register in a specific degree program; academic probation; or a grade of Failure in the course.

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Due Dates: The final exam will be in class on Wednesday, April 4. A project proposal is due in class on Monday, February 27 (i.e., right after the winter break). The first assignment will be handed out in class on Wednesday, January 25, due Wednesday, February 15 (submit via e-mail BEFORE class). The second assignment will be handed out Wednesday, February 15 and is due Wednesday, March 7 (again, submitted via e-mail BEFORE class).

	Due Date	Weight
Assignment 1	February 15	15 %
Project Proposal	February 27	0 %
Assignment 2	March 7	15 %
Final Project Presentation	Late March	10 %
Final Exam	April 4	20 %
Final Project Report	April 16	40 %

You will be asked to give an in-class presentation about your project in March, schedule to be determined after the Winter break. The hardcopy of the final project report is due Monday, April 16, in my office, by noon, the softcopy (submitted via e-mail to tkunz@sce.carleton.ca) is due the same time.

Assignments: CMC Microsystems supports the course by providing a set of wireless sensor nodes for classroom use. We will use either Moteworks or TinyOS to program these nodes. Moteworks is based on an earlier version of TinyOS, but is a richer development environment, providing additional support for routing, interfacing the nodes with PCs, etc. It will be a simpler environment to work in, but will not support the latest features of TinyOS. Either platform will be fine for the course, but if you plan to pursue the coursework further for research/publication purposes, you may want to consider running TinyOS 2.1. You can download Moteworks from the course webpage. You can also download and install TinyOS on most computer platforms. You should use January to get familiar with at least one of these programming platforms.

Project: 50% of your mark will be determined by a course project. The goal of the project is to take the work done for the assignments one step further: explore a technical concept related to the course, present the results in a cohesive format, and suggest in-depth a research project that would extend the reviewed state-of-the-art. Then, using the motes, actually do (parts of) the suggested research. The work should aim to explore previously unknown facts/insights. To ensure that students are on the right track, I require a 2-page proposal (submitted by e-mail) by February 27 the latest. This proposal should outline the suggested topic and why it is relevant to the course, provide the suggested structure of the final report, and list references to be used in the research. Also, all students will give brief presentations on their projects towards the end of the course, these presentations will be scheduled after the Winter study break. The purpose of the presentations is to outline the research problem, the proposed solution, and to solicit feedback from the class on the work done to-date.
The final report is limited to at most 15 pages (counting everything). The following points should be kept in mind when researching project topics:

- Use publicly available references, academic journals, conference proceedings (I expect each final report to be based on at least 8 articles that appeared in traditional academic venues, plus references derived from the WWW and other sources), the majority of which were published within the last two years.
- Projects should not "rehash" course content: assume that everything discussed in the course, as demonstrated by the course notes, is known to a reader of the report.
- Reports and suggested research should focus on **technical** issues, not marketing hype/business case.

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The submissions have to use 11pt fonts or larger, printed single-sided with 1in margins all around. The text may be typeset single-spaced. Some other formatting requirements are:

- Cover page, table of content, abstract, and reference list are mandatory for the final report.
- The review of the related work should not exceed 7 pages, with the rest reserved for the introduction and motivation, the research proposal, suggested solutions, how to test/validate your idea, expected outcomes, etc. This includes a discussion of the experiments, results, and their analysis (including a comparison to related work).
- In addition to the report, your e-mail submission should include all scripts, scenarios files, etc. that you used to derive your results. Add a README file that explains what you did/how to regenerate your data.

Failure to adhere to these requirements will result in a loss of up to 30% of the project mark.

Some projects may well be of interest to CMC, who shares the classroom toolkit with other faculty members over the year. CMC provides an incentive for students to write Application Notes, which are shared with the CMC community. Authors of successful application notes will be paid a small stipend by CMC as well. If this is of interest to you, we can discuss this opportunity once you have settled on a topic.

Students with Disabilities:
Students with disabilities requiring academic accommodations in this course are encouraged to contact a coordinator at the Paul Menton Centre for Students with Disabilities to complete the necessary letters of accommodation. After registering with the PMC, make an appointment to meet and discuss your needs with me at least two weeks prior to the final exam. This is necessary in order to ensure sufficient time to make the necessary arrangements. Please note the following deadlines for submitting completed forms to the Paul Menton Centre: ***March 7, 2012*** for the Winter Term.

Course Outline:

- Introduction and History
  - Overview of technologies for wireless communication
  - Marketplace (growth, dominant technologies)
- Data in Wireless Cellular Systems
- Introduction to NS2/Motes
- Data in Wireless Local Area Networks
  - Wireless LANs: IEEE 802.11
  - Personal Area Networks: Bluetooth
  - High-Speed Wireless Networks: HiperLan
- Internet Protocols, Mobile IP
- TCP over Wireless Links
- Ad-Hoc Networks, Sensor Networks
- Services and Service Discovery
- System Support for Mobile Applications (subject to the availability of time)