COE 545 – Wireless Sensor Networks

Course Information – T192

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COE Dept.

KFUPM

Administrative Information

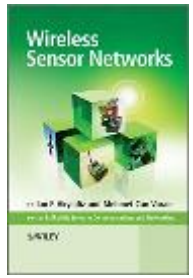
- Class Schedule
  - Time: M. W. 8:10-9:25PM (tentative)
  - Location: 24-165
- Office Hours
  - Mon. 3:00-4:00 PM , Wed. 9:00-10:00AM (tentative)
  - or By appointment
- Office
  - Location: 59-1040
  - Tel: 1038
- Course pages
  - My Webpage: http://faculty.kfupm.edu.sa/COE/barnawi/coe545-T182.html
  - Blackboard 9.1 course page

Course Goals

- Introducing some existing applications of wireless sensor networks
- Learn the various hardware, software platforms that exist for sensor networks
- Presenting elements of network protocol design and how to apply these principles in the context of wireless sensor networks
- Providing an overview of the various network level protocols for MAC, routing, time synchronization, aggregation, etc.
- Strengthen research skills in the area of wireless sensor networks through paper presentations on various issues in sensor networks as well as a through a research project

Course Material

- No specific textbook but, there is a couple of books that are recommended for reading:
  1. **Protocols and Architectures for Wireless Sensor Networks** by Holger Karl and Andreas Willig, *Wiley, ISBN:* 0-470-09510-5, June 2005 avalable in KFUPM Main Library TK7872.D48 K37 2006
  2. ***Wireless Sensor Networks***, by Ian F. Akyildiz and Mehmet Can Vuran, John Wiley & Sons 2010, ISBN 978-0-470-03601-3 electronic version is available https://onlinelibrary.wiley.com/doi/pdf/10.1002/9780470515181
  3. ***Fundamentals of Wireless Sensor Networks: Theory and Practice*** by Dargie, Waltenegus and Poellabauer, Christian, John Wiley & Sons 2010, ISBN: 9780470997659 - available in KFUPM Main Library TK7872.D48 D37 2010



Course Material

- These are three additional open access books on wireless networks and wireless sensor networks that may be of interest to you:
  1. ***Mobile Ad Hoc Networks: Applications***
  2. ***Mobile Ad Hoc Networks: Protocol Design***
  3. ***Wireless Sensor Networks***

- Reading list:
  - Journal and conference articles mainly from IEEE, ACM, Elisver and Springer
  - References of this list will be posted in the course webpage

- Lecture slides
  - Check course webpage and Blackboard

Course Lecture Dynamics

- By instructor
  - This will include theory, fundamental information
- By the students
  - This will include focused surveys and presentations on selected research papers or technologies, typically open for debate and discussion
- By invited speakers
  - We will have a couple of lectures by invited speakers based on availability

Reading-list Presentation Details

- Each student will assigned and present a number of papers (2 to 3)
- Student reading list will be posted about 1-2 weeks in advance
- A short critical review (2-3 pages max) must be submitted with the presentation one day in advance. A sample will be posted the on Blackboard
- Each presentation is 30-35 min at the most

Reading-list Presentation Details

- Each student presentation should have and will be evaluated based on:
  - Identifying the problem statement
  - Discussing related background
  - Discussing the main proposed solution in the paper
  - Discussion of the major results and findings
  - Evaluating the merits of the proposed solution by identifying discrepancies and research holes
  - Suggest potential improvements and possible future research directions

Course Research Project

- Goals
  - To experience the process of identifying and solving a research problem in the area of wireless sensor networks
  - Learn and improve technical writing skills
  - Learn and improve presentation skills
- Simulation
  - Use any simulation tool that you are familiar with (e.g. ns-2, Cooja, MATLAB, etc.)
  - Or write your own code (C++, Java, Python, etc)
- Mathematically-oriented
  - This may include the application of a theory towards modeling, design, optimization, etc.

Course Research Project Details

- Individual work is preferred
- Teams can be considered based on the problem and approval of instructor
- Submitting a proposal is required:
  - A set of few recommended projects will be provided
  - A pre-proposal discussion with the instructor including topic selection
  - A formal proposal write-up (2 to 4 pages max)
    - Should include rough schedule of project milestones
    - Should address comments and improvements suggested by instructor and peers
  - Final draft of project proposals must be submitted on the due date
  - Proposal presentation and discussion is required

Course Research Project Details

- A final project presentation and peer grading (towards end of semester)
- Submission of final report in a technical paper form (and, if applicable, a demo)
  - IEEE or ACM conference-style research paper (6-12 pages max) detailing your project
  - Refer to the course page for tips and guidelines for preparing the paper

Course Grading Policy

- Assignments and selected paper presentations : 15%
- Guidelines and grading criteria for paper presentations:
  - Problem statement (0-10)
  - Related background (0-10): Compare and relate the work to other works
  - Presentation skills (0-15): Illustrate key ideas of the work with examples and figures; clarity in delivery and finishing within time
  - Knowledge (0-30): The depth and breadth of knowledge of the presented material. Ability to identify unsolved problems.
  - Critical thinking (0-20): identify discrepancies, research holes, and potential improvements of the work
  - Summary report (0-15)

Course Grading Policy

- Project: 35%
  - (see previous slides for project details)
  - Spend some time as soon as possible to explore various topics in the area and choose the one that you could contribute in, proposal discussions will also help
  - The project will be evaluated in stages:
    - Proposal (0-15)
    - Progress report (0-5)
    - Final presentation (0-30)
    - Demo (0-10)
    - Final Report (0-40)

Course Grading Policy

- Short Mid-term Exam: 20%
  - Will be discussed in class
- Final: 30%
  - The final exam will utilize
    - All class presentations
    - Handouts
    - One or two selected papers by instructor

Important Dates

Project Proposal	**February 26, 2020**
Mid-Term Exam	**March 09, 2020**
Project Proposal Presentations	**March 16, 2020**
Project Presentations	**April 22, 2020**
Project Final Report	**May 03, 2020**
Final Exam	**May 07, 2020**

Topics to Cover

- Introduction
- Sensor node architecture
- Power and Energy Management
- Wireless Communication
- MAC Protocols for Sensor Networks
- Network Bootstrapping and Clustering
- Routing and Data Aggregation

Topics to Cover

- Synchronization
- Localization, Cross-layer Design
- Miscellaneous topics
  - Security
  - AI and Machine learning
  - Underwater Sensor networks