

CMPE58C

Special Topics in CMPE: Wireless Sensor Networks

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Class Hours: TTT 456
Classroom: ETA A6

Objective:

This course aims introducing concepts and research topics in wireless sensor networks. We will cover topics ranging from MAC, routing, and transport layer protocols to topology, sensor/actuator networks, and new research topics in the field.

Textbook: None

Reference Books:

- *Protocols and Architectures for Wireless Sensor Networks*
Holger Karl and Andreas Willig
Wiley Press
ISBN: 0-470-09510-5
- *Ad Hoc Wireless Networks*
Ozan K. Tonguz and Gianluigi Ferrari
Wiley Press
ISBN: 0-470-09110-X
- *Sensor Network Operations*
Shashi Phoha, Thomas La Porta, and Christopher Griffin (Eds)
IEEE Press
ISBN: 0-471-71976-5
- *Mobile, Wireless, and Sensor Networks: Technology, Applications and Future Directions*
Rajeev Shorey, A. Ananda, Mun Choon Chan, and Wei Tsang Ooi (Eds)
IEEE Press
ISBN: 0-471-71816-5
- *Handbook of Sensor Networks: Algorithms and Architectures*
Ivan Stojmenovic (Ed)
Wiley Press
ISBN: 0-471-68472-4

Expectations

This course requires a certain familiarity with computer networks and wireless systems. The students will merge what they learn with practice by developing a project.

Project

The students will develop a programming project together with the proper evaluation of the proposed method against other method(s) in the literature. The project will be completed with a report and a presentation.

Academic Integrity

Treat the learning as an enriching experience, and follow the honor code.

Grading:

Midterm	30%
Project	30%
Final	40%

Tentative Outline

- **[Feb 20-27 (by TT)]: Introduction**
 - Characteristics
 - Difference from MANETs
 - Sample sensors and features
 - Sample applications
- **[March 6-13 (by TT)]: Application Layer**
 - Factors That Influence Sensor Design
 - Scalability
 - Hardware Constraints
 - Transmission Media
 - Power Consumption
 - Sensor Network Management Protocol (SMP)
 - Task Assignment and Data Advertisement Protocol
 - Sensor Query and Data Dissemination Protocol
- **[March 20 – April 3 (by CE)]: Transport Layer**
 - Why not Classical TCP Solutions? Challenges
 - Algorithms:
 - RMST (Reliable Multisegment Transport)
 - PSFQ (Pump Slowly Fetch Quickly)
 - CODA (Congestion Detection and Avoidance)
 - ESRT (Event-to-Sink-Reliable Transport)
 - **Topology Management**
 - Sensor Deployment
 - Sink Placement
 - Topology Control
 - Clustering
 - Localization (briefly)
 - With or Without GPS
 - ToA, TDoA, AoA, Multilateration, Triangulation, etc.
 - Time Synchronization (briefly)
- **[April 10-17 (by TT)]: Network Layer**
 - Why not Classical Routing Algorithms? Challenges
 - Data Centric Protocols
 - Flooding, Gossiping, SPIN, Directed Diffusion, SAR (Sequential Assignment Routing), Rumor Routing, Constrained Anisotropic Diffused Routing, COUGAR, ACQUIRE
 - Hierarchical Protocols
 - LEACH, PEGASIS, TEEN (Threshold Sensitive Energy Efficient Sensor Network Protocol), APTEEN
 - Location Based (Geographic) Protocols
 - MECN, SMECN (Small Minimum Energy Comm. Net.), GAF (Geographic Adaptive Fidelity), GEAR, Distributed Topology/Geographic Routing Algorithm (PRADA)

[April 24] MIDTERM (followed by a short lecture by TT, probably on WSAN)

[May 1] Spring Break

- **[May 8-15 (by CE)]: MAC Sublayer**
 - Traffic Models
 - Cross-layer Approaches
 - Challenges
 - Basic CSMA/CA (DFWMAC-DCF for IEEE 802.11)
 - Contention (RANDOM)-Based MAC Protocols
 - Sleep-MAC, T-MAC, CCMAC
 - Reservation-Based (TDMA BASED) MAC Protocols
 - TRAMA, FLAMA
- **[May 22 (by CE & TT)]: Project Presentations/Demos**