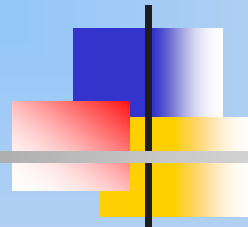


# CSE498: Wireless Sensor Network Design



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Lehigh University

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# Outline

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- Course introduction
- Introduction to wireless sensor networks
- Summary and homework



# Course Objectives

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- Be able to
  - list various applications of wireless sensor networks
  - describe the concepts, protocols, and differences underlying the design, implementation, and use of wireless sensor networks
  - propose, implement, and evaluate new ideas for solving wireless sensor network design issues
- Ph.D. research oriented training
  - Present and discuss ideas and results
    - Teamwork
  - Broaden technical background



# Textbook

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- No textbook
  - Papers and materials will be handed out or available at the Blackboard System.
- Prerequisites
  - CSE404 (Computer Networks) or Instructor's permission.



# Tentative Course Schedule

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- [www.cse.lehigh.edu/~cheng/Teaching/CSE498-06/schedule.html](http://www.cse.lehigh.edu/~cheng/Teaching/CSE498-06/schedule.html)



# Grading

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- Homework: 10%
  - Due Monday 11:55 PM. No late hand-in homework will be accepted.
  - Submit your work through the Blackboard course website to "Digital Drop Box".
- Individual project (30%)
  - Presentation: 10%
  - A survey paper: 20%
- Take-home exam (20%)
- Group Project (30%)
  - Presentation: 10%
  - Demo: 10%
  - Report: 20%
- Academic integrity
  - All graded work, except the group project, should be your own!



# Basic Course Information

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- Course website
  - <http://www.cse.lehigh.edu/~cheng>
- Office hours
  - Tuesdays from 4 PM to 6 PM and Thursdays from 5 PM to 6 PM, and by appointment
  - Packard Lab 326
  - Email: [cheng@cse.lehigh.edu](mailto:cheng@cse.lehigh.edu)



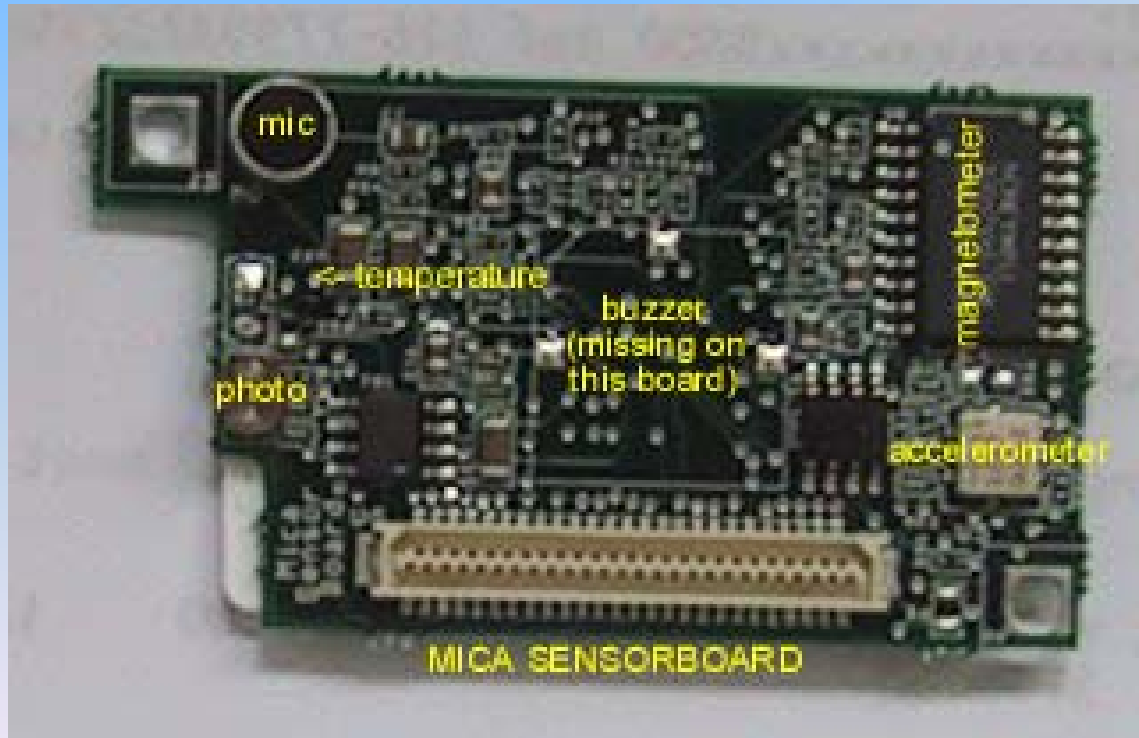
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# Wireless Sensors

- Sensing, computing, communication



# Wireless Sensor Networks (WSN)

## ■ Improvement over traditional sensors

### ■ Traditional

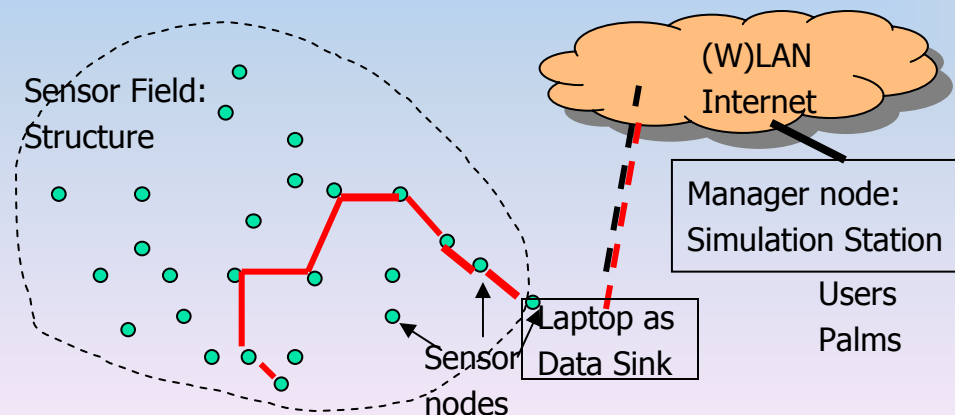
Far from phenomena  
or several sensor positioned

Engineered positions

### WSN

densely deployed inside or  
close to phenomena

Randomly deployed





# Wireless Sensor Networks

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- Applications

- Geophysical/structural/habitat monitoring
- Security surveillance, disaster area or battlefield information collection
- Health, home and other commercial areas



# Uniqueness of WSN

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- Different from wireless ad hoc networking

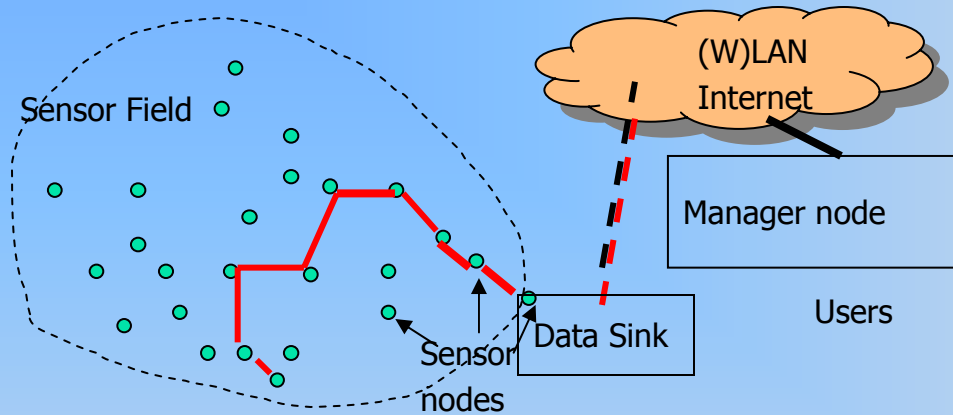


# An Important Design Constraint/Goal

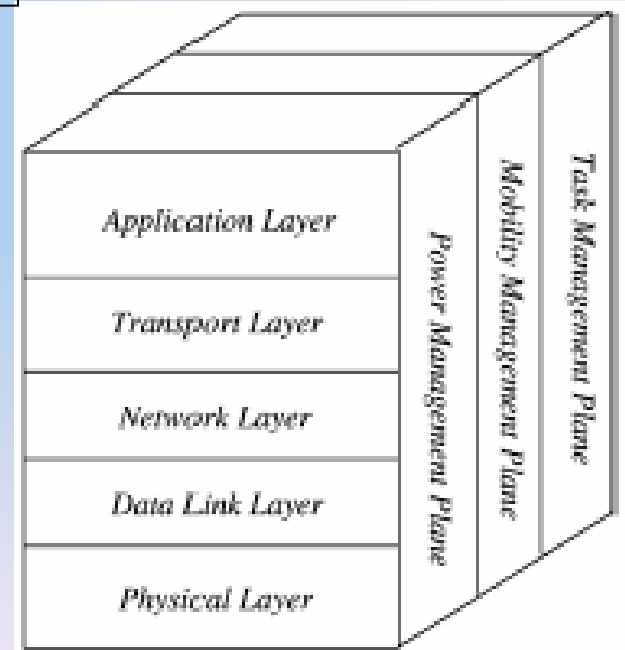
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- Energy constraint vs. long network lifetime
  - Prolonging network lifetime at the cost of lower throughput or higher transmission delay

# WSN Communication Architecture



- Not all of the layers are available in a WSN





# Application Layer

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- Sensor management protocol
  - Software to perform administrative tasks
    - Rules related to data aggregation and clustering
    - Time synchronization
    - Topology management
      - Moving sensor nodes, turning off sensor nodes
    - Key distribution
    - Sensor network reprogramming



# Transport Layer

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- Challenges
  - TCP in wireless environment => TCP splitting
  - Attribute-based naming



# Network Layer Schemes

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- SMECN
  - Creates a subgraph of the sensor network that contains the ME path
- Flooding
  - Broadcasts data to all neighbor nodes regardless if they receive it or not
- Gossiping
  - Sends data to one randomly selected neighbor
- SPIN
  - Sends data to sensor nodes only if they are interested (ADV, REQ, DATA)
- SAR
  - Creates multiple trees where the root of each tree is one hop neighbor from the sink; select a tree for data to be routed back to the sink
- LEACH
  - Forms clusters to minimize energy dissipation
- Directed diffusion
  - Sets up gradients for data to flow from source to sink during interest dissemination
- ...



# Data Link Layer

| Category                                 | Resource sharing mode                                      | Application domain  | Disadvantages  |
|--|--|---|--|
| Dedicated assignment or fixed allocation | Pre-determined fixed allocation                            | Appropriate for continuous traffic and provides bounded delay | Inefficient for bursty traffic                           |
| Demand based                             | According to demand or user request                        | Useful for variable rate and multimedia traffic               | Additional overhead and delay due to reservation process |
| Random access or contention based        | Channel contention when transmission packets are available | Suitable for bursty traffic                                   | Inefficient for delay-sensitive traffic                  |

- Examples in each category



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  - **Refer to Blackboard**