Research Topics in Wireless Sensor Networks

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Outline

- Introduction
- Research Topics
- Summary and Discussion
Introduction

• The characteristics of sensor nodes
  – Small and cheap
  – Limited in communication and computing
  – Limited in power
Research Topics

- Hardware Design
- Network Architecture
- MAC Protocol
- Routing Protocol
- Time Synchronization
Hardware Design

• Signaling processing
  – Noise
  – Multi-path Fading

• Antenna
  – The antenna direction

• Power-aware modulation
  – Binary modulation
Network Architecture

- Number of sensor nodes in a sensor network is much higher than ad hoc network.
- Sensor nodes experience failures much more frequently than nodes in ad hoc network.
- Sensor nodes are simpler than nodes in the Internet and ad hoc networks.
- Sensor nodes are very limited in power.
- The header of a Internet packet is too long for sensor networks
  - each node must have a permanent address.
- The use of acknowledgment packet should be used sparingly.
Network Architecture

• A new architecture will
  – Combine power and routing awareness
  – Integrate data with networking protocols
  – Communicate power efficiently through the wireless medium
  – Share tasks among neighbors
  – [1] [2]
MAC Protocol

• Sensor networks need a simple MAC protocol [3] [4] [5] [8]
• Power saving issue
• Cross-layer design
Time Synchronization [7] [9]

• Sensor network applications require collaborative execution of a distributed task among a large set of sensor nodes.
• Time synchronization is critical in sensor networks for diverse purposes including
Time Synchronization

- The clocks in a sensor network can be inconsistent due to several reasons.
- Design issues of synchronization algorithm
Time Synchronization

- Network Time Protocol (NTP)
  - It is used in wired networks
- Traditional synchronization method
  - A server periodically sends a message containing its current clock value to a client.
  - Extension method
    - Request (client) and Response (server)
Summary and Discussion

- Power saving issue
- Routing protocol
- Efficient data aggregation