Research Topics in Wireless Sensor Networks

Po-Yu Chen

Multimedia Network Laboratory
Department of Computer Science
National Tsing Hua University

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