Wireless Sensor Networks and RFIDs

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### Definitions

**Wireless Sensor Network**
Distributed wireless network of sensing and computation nodes.

**Radio Frequency Identification (RFID)**
Generally-passive device from which data may be read via radio frequency communication.

### Sensor network goals and conditions

- Distributed information gathering
- Frequently no infrastructure
- Battery-powered, wireless common
- Battery lifespan of central concern
- Scavenging also possible
- Communication and data aggregation important

### Sensor network hardware power consumption

- **Power consumption**
  - Central concern in design
- **Processor**
  - RISC µ-controllers common
- **Wireless protocol**
  - Low data-rate, simple: Proprietary, Zigbee
- **OS design**
  - Static, eliminate context switches, compile-time analysis
Power consumption central concern in design

Runtime environment?
Avoid unnecessary dynamism

Language?
- Some propose compile-time analysis of everything practical
- Others offer low-overhead run-time solutions

Prototype networks

Detect source of gunshot
- Senses: sound, shock wave, location
- Developer: DARPA, Vanderbilt
- Size: 45 nodes

Structural integrity monitoring
- Senses: vibration, precise displacement
- Developer: Northwestern University
- Size: Deployed in six buildings, constantly growing
  - Approximately 30 nodes

Virtual machines for sensor networks


Wireless demand paging


- Use two wireless interfaces
- One fast but high-power, one slow but low-power
- Awaken node using low-power interface
- Report 20–50% power savings
- Cannot beat 50% because processor consumes half of power
- Are there better alternatives?

Other active areas

- Blind calibration
- Localization
- Operating system design: TinyOS, MANTIS OS, etc.
- Simulation environments
- Efficient implementation of media encoding algorithms
- Security: encryption power implications
- Applications: structure monitoring, security, biology, geology
- Small-scale robotics
- Biomotion capture
Today's goals

- Know how to get access to course resources
  - Website
  - References
- Understand work and grading policies
- Rough understanding of topics we'll cover in course

Homework

- Reading assignments and literature summaries
  - Indicate most important point
  - Don't just copy abstract
  - Keep short – one page
  - You will use this to study from later

- Other exercises
  - Simple design exercises
  - Technical questions
  - Etc.

Report

- Design plan for using wireless sensor network or radio-frequency identification in an application of interest to you

Grading policies

Homework: 20%
Exams: 30%
Report: 50%

Active class participation by students is strongly encouraged

Reading assignment


For each, write a one-page summary.