Distributed Sensing for Energy Usage Monitoring

Self-powered energy efficiency nodes

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Why do we need distributed sensing?

What would distributed sensing look like in a smart office building?

Structural health monitoring

Environmental monitoring

Smart office buildings

Images from M. Tilghman, needofficespace.com, cowcoop.org
Central Nervous System for the Earth (CeNSE)
Multi CeNSE Chip Goals

Design the Swiss Army Knife of sensors
- Lots of sensing functions
- Low cost
- Useful in many situations

Easily integrated into wireless infrastructure
- Small size
- Low power
- Leverages existing technology
Multi CeNSE Chip Design

Design Specifications:
- Micro electro mechanical systems (MEMS) based sensor
- 11 sensing functions
- 1 cm x 1 cm sensor die

Guiding design principle: Don’t worry, be crappy
Multi CeNSE Chip Overview

- Y-axis anemometer
- Photodiode
- Band gap temperature sensor
- Z-axis accelerometer
- X-axis anemometer
- Light detector
- Humidity sensor
- CO sensor
- Z-axis accelerometer
- Hall effect sensor
- Metal temperature sensors
- Doped temperature sensors
- Y-axis accelerometer
- X-axis accelerometer
- Pressure sensor
Results and Immediate Future

Validating and testing sensors

 Biggest challenge: isolating and compensating for changes in multiple conditions

Applications of sensor data
  • Behavior change
  • Feedback control
Future of the Project

Self powered energy efficiency nodes (SPEENs)
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