Center for Embedded Networked Sensing

A New Light Sensing Module for Mica Motes

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http://nesl.ee.ucla.edu/research/illumimote

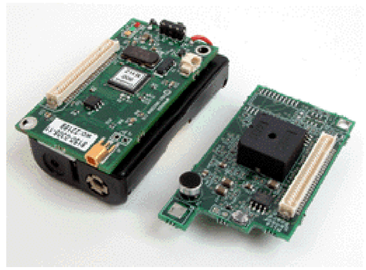
Introduction: Sensor network applications require high-fidelity light sensors

Sensor Network Applications

- **Light is an important information**
  - Media Production
    Sensors are deployed on film set to collect data (light information)
  - Light Control
    Home and office automation
  - Environmental monitoring
  - Safety and security
- **Requirement**
  - ***High-fidelity Light Sensors for Wireless Sensor Nodes***

Mica Motes and Mica Sensor Boards

- **Mica motes are the de facto standard for sensor nodes**
  - Low power, light weight and foam factor package
  - Well-supported software infrastructure
- **Available mica sensors are inadequate for high-fidelity applications**
  - Photo sensors on MTS310 and MTS400
  - Narrow dynamic range and slow response time



Problem Description: A New Light Sensing Package for Mica Platforms

Sensing Capabilities

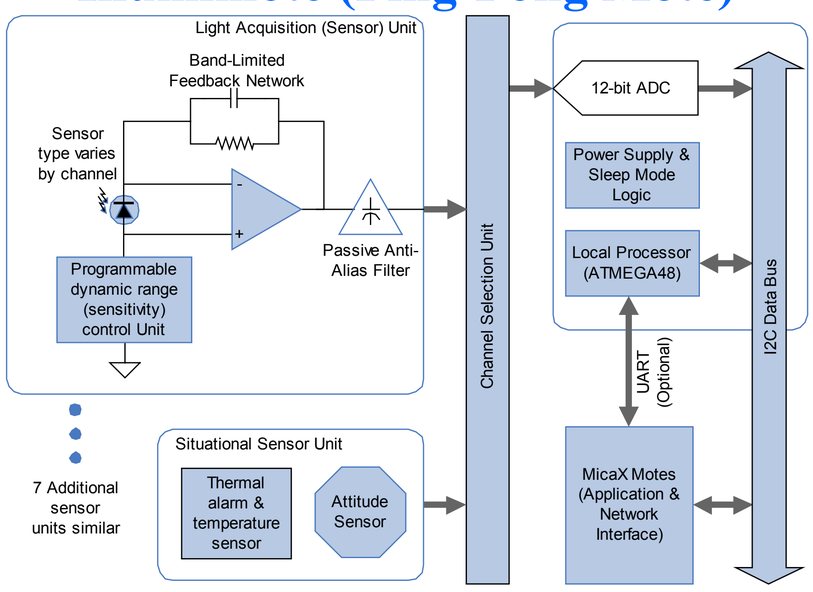
- **Incident Light Intensity Sensor**
  - Aiming for the precision of a commercial light meter
- **Color Intensity Sensors**
  - Color temperature calculation (future work)
  - Color intensity sensors for red, green and blue
- **Incident Light Angle Sensors**
  - Determination of the angle to the strongest incident light source
- **Situational Sensors**
  - Temperature and board attitude (its own orientation)

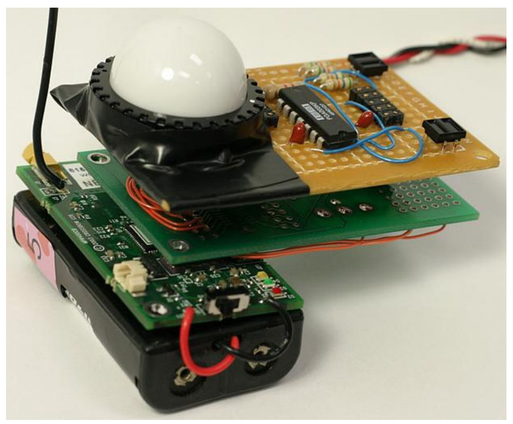
Application Requirements

- **A foam factor package compatible with Mica platforms**
  - Small size and battery powered from Mica
  - Connector to Mica platforms
  - Data communication with Mica
  - Local on-board microprocessor for in-sensor computation
- **Fast response time and wide dynamic range**
  - Capture lighting changes in one film or video frame (e.g. 33ms)
  - Light intensity measurement capability from 0 to greater than 20,000 lux
- **High sensitivity and power management**

Proposed Solution: High-Performance Light Sensing Module for the Mica Mote

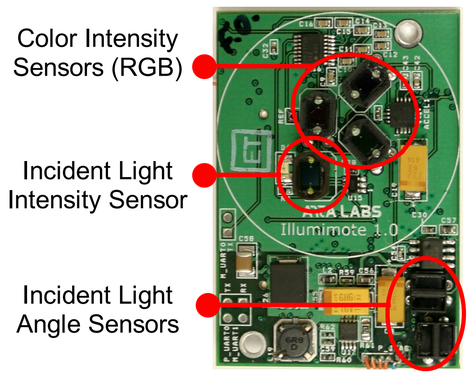
Illumimote (Ping-Pong Mote)



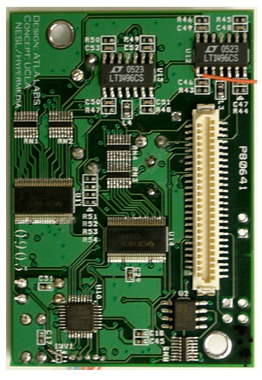


(a) Prototype of Ping-pong board

(b) Fabricated Ping-pong board with attachment of lumisphere

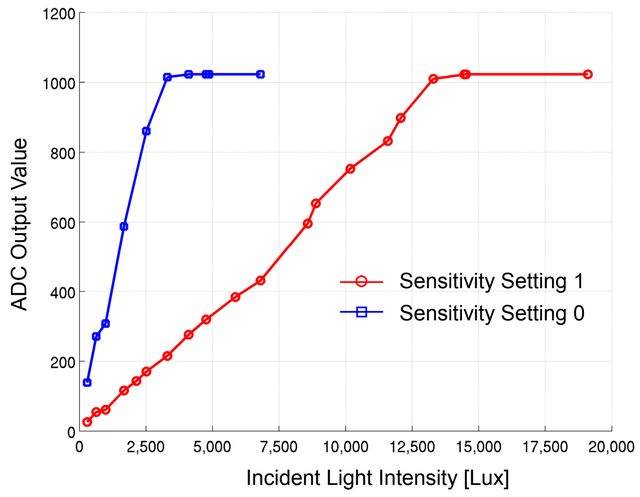


(c) Front side of Ping-pong board

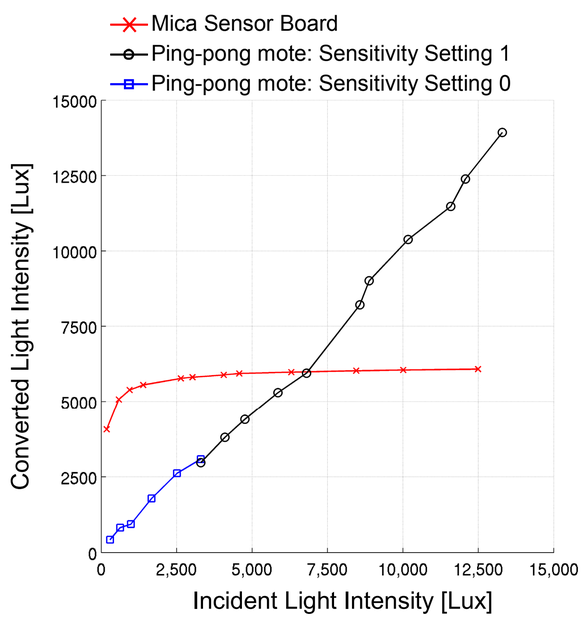


(d) Back side of Ping-pong board

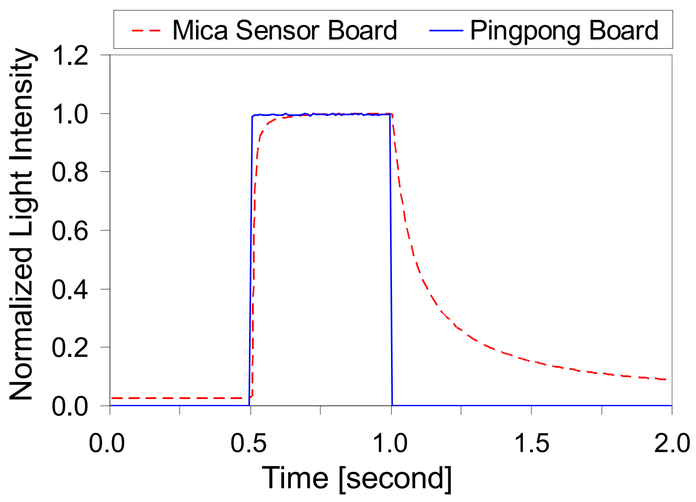
Performance Results



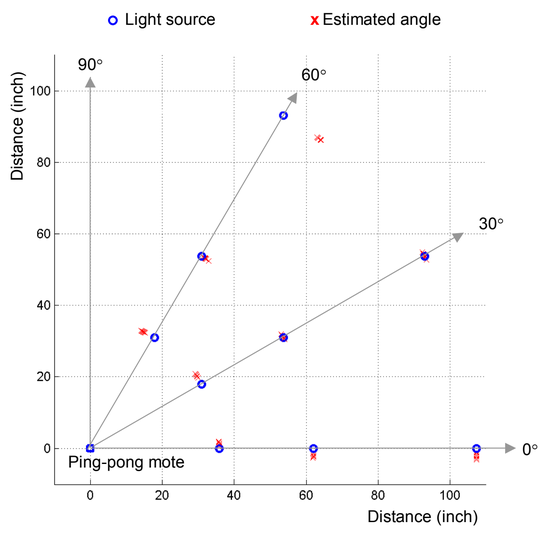
Two Sensing Sensitivity Settings



Dynamic Range Comparison with Mica Sensor Board



Response Time Comparison to a Light Pulse



Incident Light Angle Estimation (Average error: 2.63°)

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