Electric Power Sensing for Demand Response

Low-power AC current and voltage sensors for DR Homes

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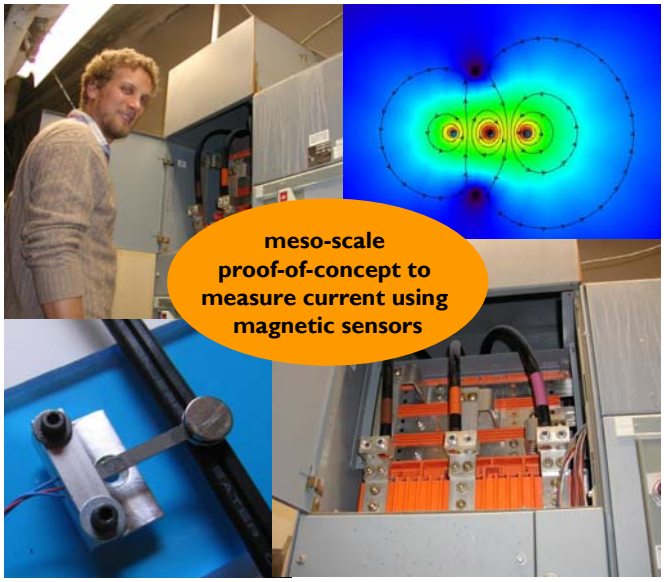
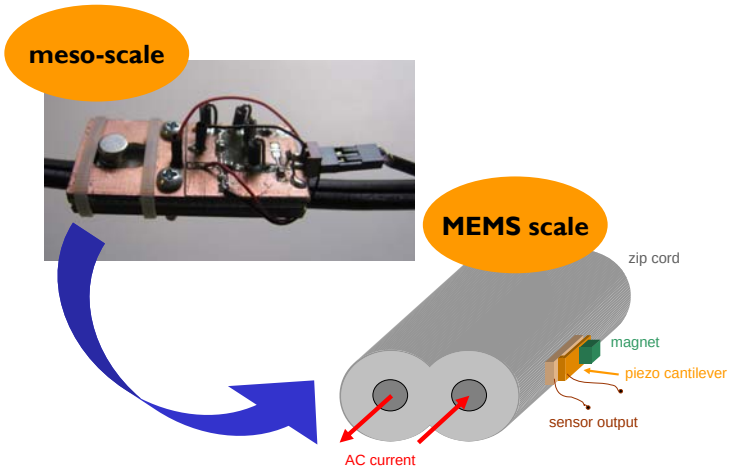
Vision

- Develop low-cost, low-power MEMS electric power sensors to ubiquitously monitor electricity end-use in California homes for Demand Response
- Sensors should be fully passive, proximity-based, and self-powered thus requiring no electrical contact, complex installation, or batteries

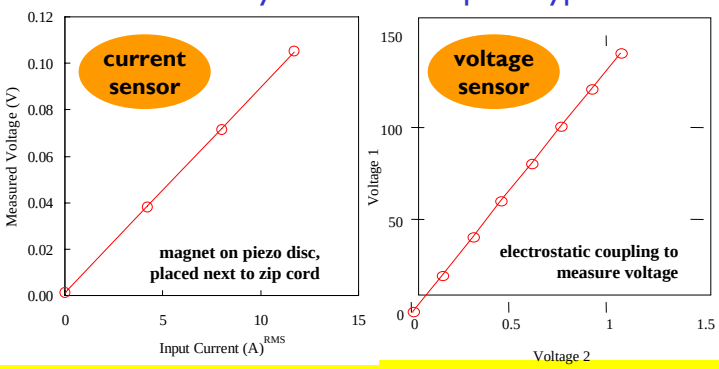




Methods

- A proof-of-concept project will measure current in a 3-phase, 480 VAC, 400 A (max) breaker panel on the UC Berkeley campus (pictured upper right)
- Piezoelectric cantilever/permanent magnet current sensor prototypes will monitor and transmit current data to a remote location using wirless sensor nodes from Dust, Inc.
- Traditional current transformers will be used for calibration and data validation

Preliminary results: initial prototypes



Research Questions

- Can current be accurately monitored by measuring the magnetic field near a power cord?
- Can voltage be accurately monitored without a reference to ground potential?
- Can an intelligent sensing scheme involving MEMS magnetic field sensors accurately monitor current without requiring precise alignment?
- What is an appropriate design for a MEMS magnetometer in this application?

Findings

- A piezoelectric current sensor prototype mounted near a wire carrying a 13 A, 120 VAC current produced sufficient power to operate a wireless radio on a 1% duty cycle
- Voltage sensing experiments using capacitative coupling have exhibited highly linear response

Demand Response Enabling Technology Development
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