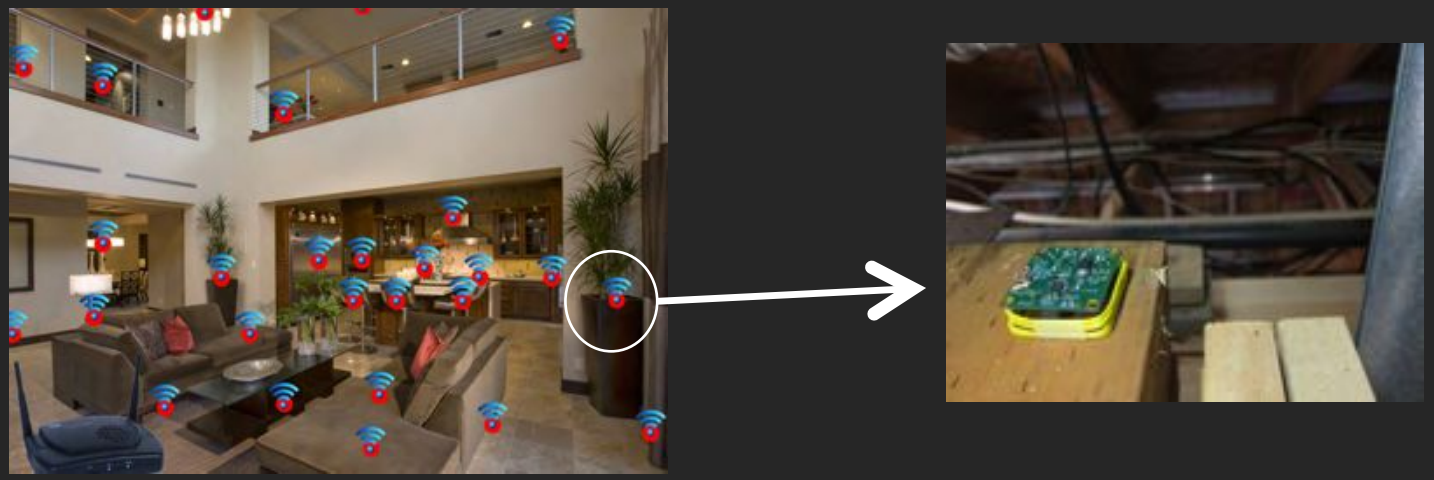
The Role of Sensors in Our Daily Lives

Shwetak N. Patel
University of Washington

Sensors and Embedded Systems

- Sensors: collect data from the physical world
- Embedded systems: process and transmit that sensed data



Sensor Systems Are Already Around Us

- The modern automobile is an example
  - Provide critical safety features
    - Anti-lock braking, collision avoidance, traction control, etc
  - Once luxury features are now mandated

The Vision of Computing with Sensors

- Implicit interaction
- Invisible
- Provide appropriate feedback to user

Extending the Vision to Other Applications

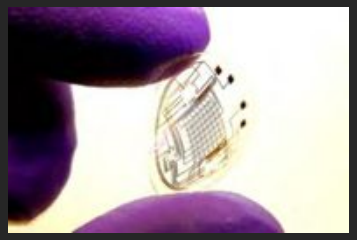
- Health
  - Home health, remote care, on body sensors
- Safety
  - Roads, bridges, homes
- Sustainability
  - Energy and water use monitoring, demand response

Health

- Microsoft Kinect

- Mobile Phones

- On body

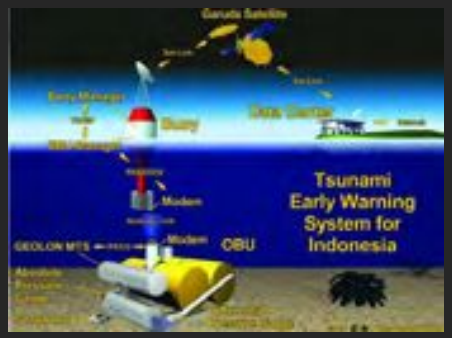


- Smart Homes

Safety

- Bridges

- Tsunami alerts



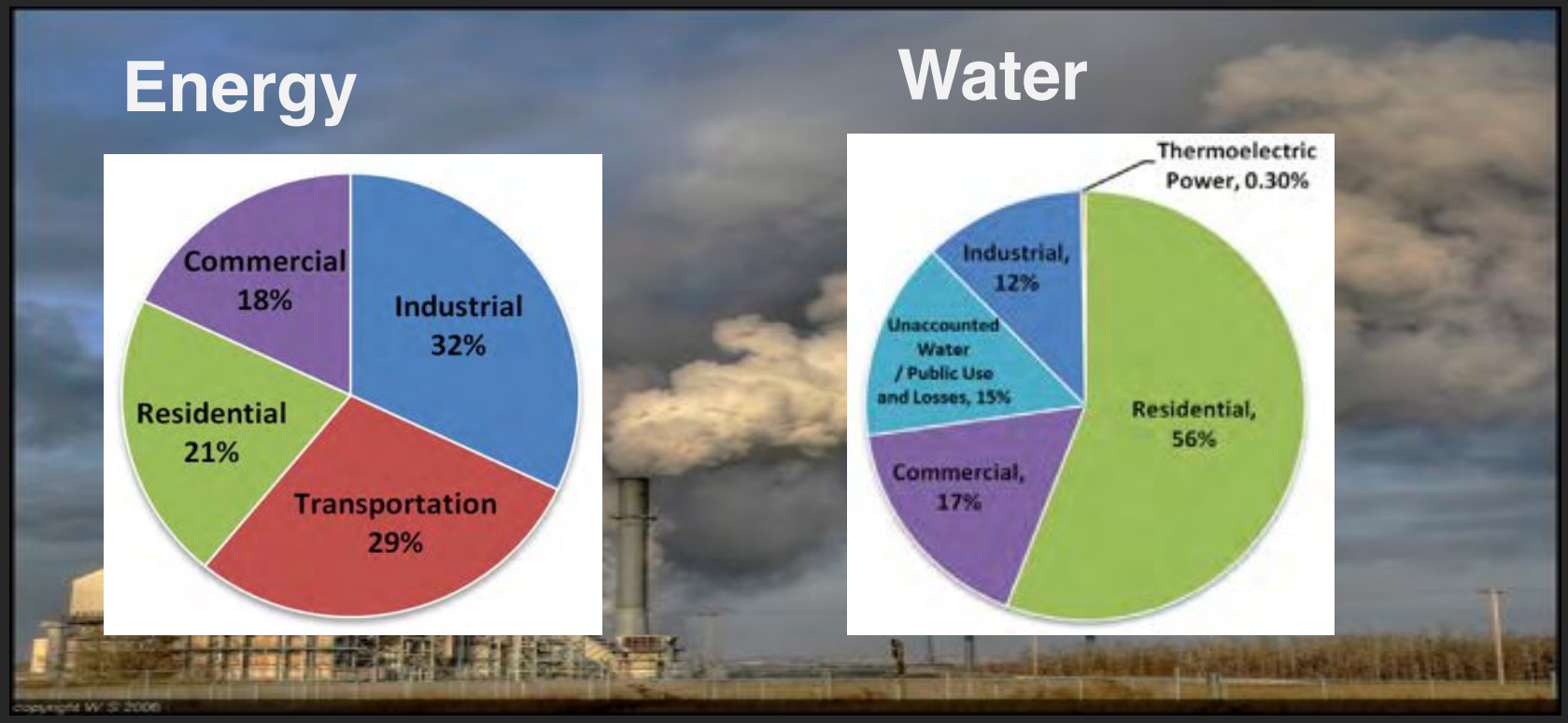
- Home safety and loss prevention

Sustainability

- Energy and water monitoring

- Automated appliance and lighting control
- Smart grid energy load balancing

Residential Resource Monitoring Example




Municipal
Services Statement
City of Tempe
P.O. Box 29617
Phoenix, AZ 85038-961
480-350-8361
480-350-8400 (TDD)
LINDER HOLLINQUEST
7450 S KENWOOD DR
TEMPE AZ 85283-4921
Account Number: 100687-00154711
Utility Amount Due: 127.52
Voluntary Donation: 1.00
Total + Voluntary Donation: 128.52
Date Due: 1/8/2007
PLEASE FOLD BEFORE TEARING
Account Activity
Date Description Amount
12/12 Payments Received Thank You 100.00
12/12 Water Quality Fee 0.13
12/12 Tempe City Tax 0.61
12/12 State Tax 2.15
12/12 Sewer Service Charge 7.28
Service Address: 7450 S KENWOOD LN
Meter read date: 11/20/2006
Gallons delivered: 20,200
Days of service: 27
Date Description Amount
12/12 Water Consumption 20.11
12/12 Water Service Charge 13.99
12/12 1% Delinquent Fee 0.40
12/12 Sewer Charge 11.48
12/12 Residential Refuse 17.41

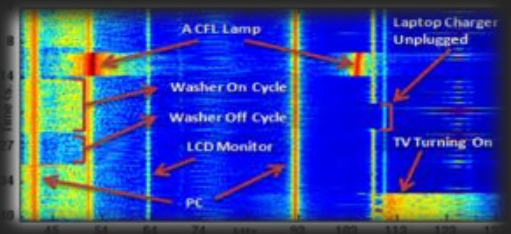
Residential Resource Monitoring

- 15-20% reduction in energy use with appliance-level feedback
  - Studies date back to the 70s
    - Sensor deployments were challenging
    - Had to install sensors at every appliance location

New Approaches

Sensing and Hardware — *Signal Processing & Machine Learning* — *Feedback Interfaces*

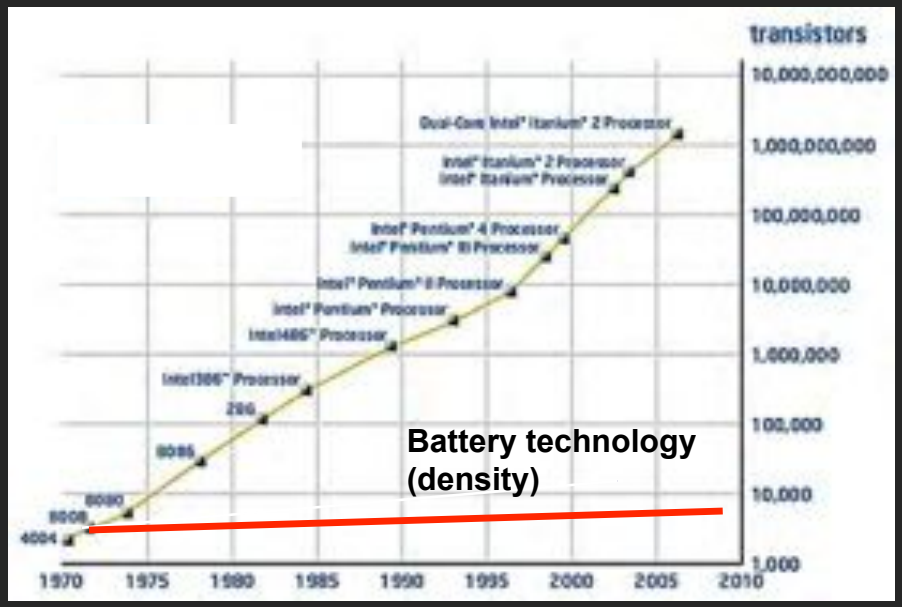
Electricity *Water*



- Single-point sensing for whole home energy itemization
- Infer device usage from noise
- Provide actionable feedback

New Challenges

- Battery life of sensor systems
- Power harvesting techniques



Summary

- Have made a lot of progress in sensors and systems to support them
- Huge amount of potential in applying them to important applications
- Emerging need for low-power solutions and ways to provision sensors

Questions?