Title
Spotlight: focusing on energy consumption of individuals

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**Spotlight: Focusing on Energy Consumption of Individuals**

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**Introduction:** Monitoring electrical energy consumption at the granularity of individuals

**Traditional monitoring systems**

- **Coarse grained at the level of location and time**
  Electrical energy consumption is recorded in terms of location and time. The information provided in terms of amount over a period of days. Essential information such as breakdown in terms of appliances and individuals is missing. This is important in pinpointing energy wastage and improving consumption patterns.

- **Real time**
  The measurement is not provided in real time either. Users are not aware about significant patterns about their usage which could be identified if the information is provided in real time. There are several projects to implement this feature overseas.

**Benefits of finer granularity monitoring**

- **Can monitor individual appliances**
  - Identify usage patterns, efficiency, and service to cost tradeoff at the level of individual appliances.

- **Can monitor individuals**
  - Another dimension in measuring energy consumption. Can pinpoint to areas of energy wastage.
  - Inform users of the cost of their behavior in real time.
  - Help a conscientious user in fine tuning the tradeoffs between their consumption choices and the cost of the choices.

**Approach:** Location-based accounting

**Appliance Classification**

Class I: Serviced inside a physical vicinity. E.g. Television, coffee machine. Focus of our work

Class II: Serviced without physical vicinity. E.g. servers, networked printers

Class III: Always-on appliances. E.g. Refrigerator, alarm clocks

**User desired service range**

**Measured RSSI values**

**Performance of various Token Schemes**

**Useful and wasted consumption for appliances**

**Solution Analysis:** Prototype deployment & Analysis

**System Architecture**

- Users carry a RFID tag
- Appliances instrumented with a power meter and RFID reader
- Backend server to collect data

**System Prototype**

- MICAz motes as RFID tag and reader
- Using RSSI for vicinity information
- COTS Watts up? pro power meter

**Token Issue Algorithms**

- RSSI is unreliable
- Unified Threshold: simple threshold to issue expire tokens
- Calibrated Threshold: Calibrated for individual tags and readers
- Hysteresis Threshold: token expiration is set by hysteresis constant

**Evaluation**

**Ground Truth**

- Instrumented the apartment with cameras
- Images withheld for privacy

**Token Scheme**

- Comparing the three schemes

**Energy Consumption Reports**

- Usage of appliances and comparison with ground truth

**System Prototype**

- MICAz motes as RFID tag and reader
- Using RSSI for vicinity information
- COTS Watts up? pro power meter

**Token System**

- Token Issuing and expiration policy
  - Receive token on entering range
  - Expire token on exit if another user in range
  - Upon entrance of a user, expire outstanding tokens