Modeling User Behavior in Home Automation Systems

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Presentation Outline

- Motivation and Goals
- Learning User Habits
- Learning User Actions
- Use of Learning in the OpUS System
- Conclusion
Motivation

- Home automation systems offer basic functionalities
- Schedules are defined as scenes and are fixed (sleeping, away, present)
- Each scene contains rules that control heating, lights, boilers, etc.
- Automation systems lack intelligence and ability to adapt

Goal

- Improve the current home automation systems
- Create a learning agent for user modeling
- Introduce a dynamic system for schedule adaptations
- Decrease costs and consumption using behaviour modeling
Based on results obtained by observing each user, the system can create models for user behaviour:

- probability that the user sleeps
- probability that the user is present and awake
- probability that the user is away
- etc.
Learning User Actions

Actions the user performs are a result of discomfort:

- adjust temperature
- hot water usage
- open window
- adjust illumination
- adjust shading
Learning User Actions

Based on the **context** the probability of an action changes:

- **current value**
  - 18°C
  - 19.5°C
  - 22°C

- **current scene**

- **current activity**

- **current time**
  - 5:00
  - 16:00
  - 22:00
Use of Learning in the OpUS System

- The model of the user enables optimization of:
  - scenes (parameter values),
  - schedule (scene duration).

- Which results in:
  - decreased consumption, costs and environmental impact,
  - Increased comfort (e.g. higher probability of an appropriate temperature, when the user needs it).
Conclusion

- Learning consists of:
  - inducing a model of user behavior,
  - predicting the user actions.

- Learning enables more accurate and personalized schedules for home automation that:
  - decrease costs,
  - increase comfort.

- Learning is an essential part of smart homes (e.g. the OpUS system).