5 – Context-Aware Computing

Viktoria Pammer-Schindler
May 11, 2015
Days and Topics

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<td>Intro</td>
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<td>March 16</td>
<td>Designing Interactive Systems – Assignment 1 Published in Detail</td>
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<td>March 23</td>
<td>Prototyping + Evaluating Interactive Systems</td>
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<td>- Paper Presentation and Discussion (Assignment 1)</td>
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<td>- Android Sensing Tutorial Day will be Announced!</td>
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Recap

Designing Interactive Systems
Technology focus: Context-aware smartphone applications as approximation of ubicomp visions

Methodology:
- UCD Iterative Process (Analyse – Design/Implement – Evaluate)
- Stakeholder Analysis, Context Diagrams, Work Modelling, Storyboards, Mock-Ups, Cognitive Walkthrough

Technology
- User Interfaces for Ubiquitous Computing
- Context-Aware Computing
Today

Why Context-Aware Computing
What is Context and Context-Aware Computing
Design Steps
Architectures
Discussion - Challenges
Why Context?

... to improve human-computer communication
Context-aware Computing – General Idea

1. Systems constantly collect contextual information (whatever this is)
2. Application developers make use of it where reasonable, so that systems are easier to interact with
3. Users need not make explicit what contextual information is relevant
… in Ubiquitous Computing: Relevance

Assumption: situations impact how users would like an application to behave

-> In ubiquitous computing, the situations of use are much more varied than in traditional computing

-> high need for context-aware systems in ubicomp settings
… in Ubiquitous Computing: Feasibility

Sensing technologies have become widely available (smartphones, FitBit, wireless blood pressure monitors or scales....)

Sensing infrastructure / devices are increasingly networked
What context-aware systems/services/apps do you know?
What is Context?

- Spatial information: Location
- Temporal information: Time of day, season
- Environmental information: Temperature, light
- Identities of nearby people and objects
- Changes to people and objects
- Computing infrastructure: CPU, OS, memory, interfaces, available networks incl. reliability, executed software
- User’s current status (e.g., emotion, focus of attention, location, orientation)
What is Context?

Current characteristics

Of a person/place/object

Of relevance to the human-computer interaction

– Who/what
– Where
– When
– What is happening
So what: System Adaptation

System determines context
  – implicitly
Derives user intent from context
  … with respect to itself (the system)
  … and adapts its appearance and/or behaviour
Typical Functionalities of Context-Aware Systems

Provide information
- Emphasize most relevant information in UI
- Automatic preselection (filtering) of information

Execute commands
- Emphasize available commands that are estimated to be more relevant
- Automatically execute commands

Tagging information entities with contextual information for later retrieval

Adapt User Interaction
Typical Context-Aware Systems

Tour Guides (general: location-based information presentation)
Reminders (time, location, sleep cycle, …)
Environmental controls (e.g., window control, heating, …)
## Design Steps

<table>
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<tr>
<th>Reminder: System Adaptation</th>
<th>Implications for Design</th>
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<tr>
<td>System determines context</td>
<td>What sensors are necessary?</td>
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<tr>
<td>Derives user intent with respect to itself</td>
<td>How to process sensing data in order to derive “intent”?</td>
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<tr>
<td>Adapts appearance and/or behaviour</td>
<td>Adaptation rules</td>
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1. Adapts appearance and/or behaviour
2. Derives user intent with respect to itself
3. System determines context
System Architectures - Elements

Data Producers

Data Consumers

Storage
Widget-based architecture
Blackboard-based architecture
Challenges

Sensors - reliability
Power management
Interoperability (sensors, devices)
Privacy and Postprocessing impact system architecture

Data postprocessing: Rules, statistical analysis, machine learning

Conclusions are often not 100% accurate
- Modeling ambiguity
- Sensor fusion

Understanding human intent is non-trivial
CONCLUSION
Recap

Context-Aware Computing is supposed to improve HCI
Context means relevant (to HCI) characteristics of persons/objects/places in the environment
Context-Aware Computing means adapting systems to context
Design Steps – adaptation rules, relevant context, postprocessing and sensors
Architectures – Widget-based vs. blackboard-based
Challenges
Readings

Key readings:

– Krumm, Ubiquitous Computing Fundamentals, Chapter 8 “Context-Aware Computing”