Participatory Design Of Sensor Networks: Strengths and Challenges


October, 2008
2008 Participatory Design Conference
Phones as Research Instruments
Defining Participatory Sensing

*Individuals and communities make decisions about when and how to participate in:*
Capture → Storage → Access → Analysis → Sharing

*Inspired by:*
- PGIS
- Participatory urban planning
- Photovoice
- CBPR in public health research
- CBPR in info tech design
Example: CycleSense
PD = Necessary for Participatory Research

Research decisions about research goals and methods affect the design of collection instruments.

<table>
<thead>
<tr>
<th>Data Goals</th>
<th>Tools</th>
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<tbody>
<tr>
<td>Location</td>
<td>GPS</td>
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<td>Images</td>
<td>Camera</td>
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<td>Sound</td>
<td>Microphone</td>
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<td>Activities</td>
<td>Accelerometer</td>
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<table>
<thead>
<tr>
<th>Sharing Goals</th>
<th>Tools</th>
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<tbody>
<tr>
<td>No one</td>
<td>Protected database</td>
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<tr>
<td>Friends &amp; Family</td>
<td>Social network sites</td>
</tr>
<tr>
<td>Research Group</td>
<td>Limited access database, visualizations</td>
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<tr>
<td>General Public</td>
<td>Visualizations, web publishing</td>
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It won’t be (fully) participatory sensing without PD
Benefits: Gathering Local Knowledge

Understanding gained within a setting and social group

Target phenomena known to participants
  • E.g. biker’s knowledge of poor path surfaces

Identify local problems & research questions
  • Investigate a community issues
  • Document neighborhood assets
  • Make a case
Benefits: Understanding & Improving Systems

Lots of data: hours of latitude and longitude readings • real-time traffic • humidity & temperature readings • air quality

Participants must understand:

• What is collected
• How it is processed
• How it is aggregated & interpreted
• How it is visualized
Benefits: Addressing Privacy Concerns

*Recording routines, frequent locations, real-time activities*

- Willingness to share personal data variable, contextual
- PD processes can encourage discussion of privacy issues and planning for privacy features

*Issues to discuss:*

- Granularity (necessary to know specific locations?)
- Sharing (who—and how many—will see data?)
- Retention (temporary repository vs. archive?)
- Reuse (future researchers? governments? companies?)
Challenges: Diverse User Populations

Sensing participants can be anyone:

• Different levels of technology experience
• Multiple languages
• Diverse comfort with design and research roles
• Varying time & energy for design process

Approaches:

• Move from data (“what do you want to know?”) to systems (“what could help you find that out?”)
• Scenario construction
• Design games
Challenges: Institutional Impediments

**Distributed design process:**
- Undergrads + grad students + programming staff + faculty
- More than a dozen associated designers per project
- Need to designate “mediators” or go-betweens

**Slower pace of participatory design**
- Can we sell students & faculty on a stickier design process?
Initial Work: Linking PD and Participatory Sensing

Taking Notes via Phone

Erich gets on his bike, stashes his backpack, and fasts his bike to work, he speaks to anyone hazards he sees and notes about things he likes at work, he logs in to CycleSe each location where he records.

Picture Perfect Sensing

Dorothy is frustrated by the potholes that litter her route. She complains about the potholes, uses her mobile phone to document the potholes, and commutes to her workplace with particular attention to her phone. These photos of potholes are automatically shared online, where they attract attention.

Automated Data Collection

I [NAME] take my heavy-instrument to my garage. Attached to the frame of my bike is a GPS device that collects data on potholes. I upload data such as the bike's position and the central server through my mobile phone. The data is analyzed automatically to create a map of potholes. The map is sent to the city council for reporting. At work, I use my personal mobile device with CycleSe to see all the data the devices collected during the day.
Thanks!

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Urban Sensing @ CENS

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