Designing Pervasive Systems for Society

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Overview

- What are pervasive systems? How do we envision them?
- How can we design such pervasive systems?
- Building on our ideas
  - Pervasive systems as public services?
  - A “metaphor” for combining architecture and pervasive systems.
  - Design ideas for pervasive systems in public spaces.
Today’s pervasive systems

- Mostly “smart” rooms or “smart houses.”
- They’re like islands of computing support.
What is the vision?

- Computing to be part of everyday life, and everyday tasks.

- Current systems fall short – they are physically and conceptually limited.
  - Designed for specific physical locations and specific social situations.
  - The proposed solutions include speech, gesture, tactile & kinaesthetic I/O, environment sensing, person and object tracking, and data mining.
Most pervasive systems utilize location as a prime characteristic. Many other dimensions could be explored

- Context awareness.
- Replace physical sensing and simplistic assumptions with theoretically-informed and empirically derived models.
- Modeling of goals and intentions of the users and the system (status, actions, goals).
- Social issues that the design, deployment and use of pervasive systems raise.
Towards “truly pervasive” systems

- Systems that pervade the Physical, Social and Cognitive environments.

What about today’s systems?
- Domestic vs. Public pervasive systems.
- Public pervasive systems:
  - Cover towns, cities, countries.
  - To be used regardless of location or identity.

How to design such public systems?
Building on existing knowledge

- Use the established approach of User – Task – Domain.
- Designing pervasive systems is similar to designing traditional systems.
- Extend the User – Task – Domain approach to address social issues.
- The approach now becomes Citizens – Spheres – Spaces respectively.
The intended users of a public pervasive system may usefully be viewed as “the public.”

Designing without knowing your users?

- Many systems do it: Trains, buses, electricity, telephone, television.

Citizenship

- Civil rights
- Political rights
- Social rights
What tasks might users carry out using a public pervasive system?

Group them in categories, based on the nature of information.

- *Public, social, private spheres.*

Information spheres to capture the cognitive environment – a way to think about the system.
Currently usurped by the simpler concept of location.

Physical locations have embedded social dimensions (understandings, protocols, presence of others).

Group them in categories
- Public, social, private spaces.
- Spaces & Interaction spaces.

Architecture and civil engineering
- PPS guidelines.
- Pervasive systems should exist in harmony with these.
Building on our ideas
Pervasive systems as Public Services?

- Access to information is a public good.
- A truly pervasive system is a nationwide carrier of information.
- A nationwide carrier of a public good is a public service.
- Therefore, is a pervasive system a public service?
What are public services?

- At least three definitions
  - Services considered as public or for the common good.
  - A service provided to the general public.
  - A service provided by a public entity.
- Public services are universal (people equally entitled to benefit from them).
- Obligation to supply.
Beyond economic & political characteristics of PS’s

- Public services have some common functional characteristics.

- Products & services persist over long periods
  - Become embedded in everyday life.

- Infrequent changes
  - Must undergo public scrutiny.

- Centralized production
  - Assure uniformity & stability.
Combining Architecture and Pervasive Systems

Why?

The built physical environment is a pervasive system.

Well understood, studied for long time.

A number of useful ideas can be drawn.

Guidelines provided by the Project for Public Spaces.

• Accessible, activities, comfortable, sociable.
What did we gain?

- A metaphor for combining architecture and pervasive systems.

- **Traditional approach:**
  - Computers: store, retrieve, monitor, calculate.
  - Humans: patterns, extrapolate, creative.

- **A new metaphor:**
  - Architecture: manipulate physical spaces to provide greater functionality.
  - Pervasive systems: provide functionality to overcome physical limitations.
  - Essentially, architecture manipulates *physical spaces*, while pervasive systems manipulate *interaction spaces*.
Design Implications

- A pervasive system is...
  - a set of digital artefacts.
  - a part or extension of the physical environment.

- Duality of views applies to design ideas (e.g. security).

- Accessible (are people aware of the system’s existence?) – WiFi.

- Minimum requirements – walk up to it and use it. (Water fountains).

- Comfort – mechanical equipment hidden or not? (User interface hiding backend – CYSMN).

- Orientation, surprise, activities.
In summary

- Description of what truly pervasive systems could be like.
- How can such systems be designed (Citizen - Sphere - Space).
- Where does this approach take us?
  - Public services.
  - The role of Architecture, spaces and interaction spaces.
  - General design implications/ideas.
The end
Thank you

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