Advanced Ubiquitous Media for Interactive Space: A Framework

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Motivation

- Ubiquitous Computing across the Boundaries of Disciplines
- A Framework for Ubiquitous Media Research
- Design Criteria of Interactive Space
Advanced Ubiquitous Media for Interactive Space

Design Space Matrix of Ubiquitous Media

Objects
- ubiquitous media modules

Environments
- real
- augmented reality
- augmented virtuality
- virtual
- mobile
- wearable
- portable
- ambient
- embedded

Humans
- on the move
- in the shops
- at work
- at school
- at home

The Problem
Advanced Ubiquitous Media for Interactive Space

Four Basic Elements:

- Physical-Digital Interaction Interfaces
- Sensing and Perceptual Technologies
- Application and Service Control
- Human and Environmental Adaptation
Advanced Ubiquitous Media for Interactive Space

A Framework

Architecture / Industrial Design / Cognitive Psychology

Physical-Digital Interaction Interfaces

Building Product Design

Human-Environmental Adaptations

Natural Interfaces

reconfigurable spaces

Smart Products

Activity/Location Detection

Sensor Networks

Interactive Media

Sensing and Perceptual Technologies

Embedded Devices

Media Server

Mobile Devices

Application and Service Control

Computer Science / Electrical Engineering / Mechanical Engineering

Psychological Reaction

Social Behavior

Human Multimodal Speech, Gesture, and Motion

Image/Video/Audio Presentation & Automation

Human-Environmental Adaptations

Physical-Digital Interaction Interfaces

Motivation | Design Space | Framework | Interface | Technology | Service | Adaptation | IP++ | Demo
Physical-Digital Interaction Interfaces

From *Explicit* Interaction to *Implicit* Interaction

From *Foreground* Computation to *Background* Computation

From *Single-User* Systems to *Multi-User* Interaction with Mixed Reality
Advanced Ubiquitous Media for Interactive Space

Sensing and Perceptual Technologies

- **Location Sensors**
  Web cam, optical, magnetic, capacitance sensors

- **Mobile Sensors**
  RFID, handheld devices

- **Environmental Sensors**
  Thermostat, humidity, light switches
Application and Service Control

- Transforming *Low-Level* Sensor Data to *High-Level* Application Context
- *Context-Aware* Responsive Actions
- Application Execution and Service Control
Ubiquitous Media Infrastructure

- Sensor networks of walls, furniture, floor
- RF-based information appliance (lights, projectors, and audio/video)
- Web-based coordination manager
- Server
- Database

RF signal to RF receivers

Wireless RF transmitter
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Human and Environmental Adaptation

- Identifying Human Activities and Cognitive Processes
- Visual-Spatial *Attention* with Limited Capacity
- Exploiting *Natural Mapping* between Actions and Perception
- Creating *Spatial Metaphors* to Guide User Behavior
Put It All Together: The *IP*++ Project

*IP*++ is an Extension of Information Portal in the Physical World

*IP*++ Components: *Smart Floor*, *Interactive Walls*, *Smart Cubes*, and *Information Canvas for Ambient Displays*
Advanced Ubiquitous Media for Interactive Space

Interactive Media Exhibition

Theme: TAIWAN NEW LANDSCAPE MOVEMENT.
Anpin Harbor + Intl. Airport

Taipei
October 2004

Kaohsiung
March 2005
Advanced Ubiquitous Media for Interactive Space

The $IP^{++}$ Project

Interactive Media Exhibition

Smart Floor

Motivation  Design Space  Framework  Interface  Technology  Service  Adaptation  $IP^{++}$  Demo
Advanced Ubiquitous Media for Interactive Space

The \textit{IP}^{++} Project

Interactive Media Exhibition

Interactive Wall
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The IP++ Project

Interactive Media Exhibition

Smart Cube
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The IP++ Project

Interactive Media Exhibition

Ambient Display

Motivation | Design Space | Framework | Interface | Technology | Service | Adaptation | IP++ | Demo
Mixed Reality Sustainable Campus

The IP++ Project (II)
Conclusion

The IP++ Project
Beyond Interactive Space

A Framework as a Basis for a Collaborative Research Consortium
http://www.arch.ncku.edu/ialab/

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