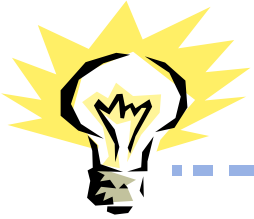


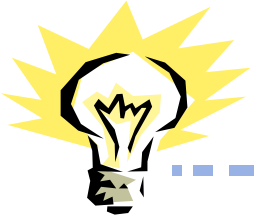
Mobile & Pervasive Computing

Ubiquitous computing resources



Agenda

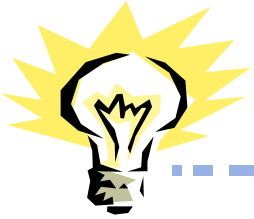
- Area overview
- Four themes
- Challenges/issues



Pervasive/Ubiquitous Computing

- Move beyond desktop machine
- Computing is embedded everywhere in the environment



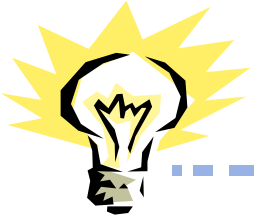


Ubicomp Notions

- Computing capabilities, any time, any place
- “Invisible” resources
- Machines sense users’ presence and act accordingly

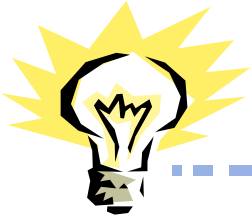


Automatic hand soap dispenser



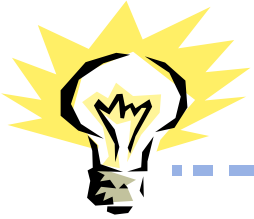
Classic Video Examples

- ▶ Ambient Room - H. Ishii, CHI '98
- ▶ Beyond the Desktop - J. Rekimoto, CHI '00



Four Themes

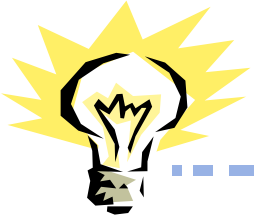
1. Automated capture of experiences with easy access
2. Context-aware/sensitive interactions and applications
3. Ubiquitous services independent of devices/platforms
4. Natural/Implicit interfaces



1. Automated Capture

➤ Motivation

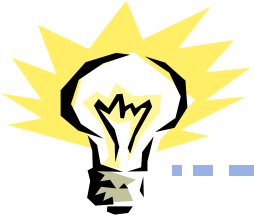
- ❖ Record-taking is hard
- ❖ Multiple streams of information need to be captured
- ❖ Machines are better at some of these things than we are



Examples

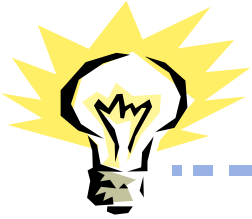
- Meeting capture (scribe at Xerox PARC), Mark Weiser
- Classroom 2000/eClass at GaTech





LiveBoard





Classroom 2000/eClass

The screenshot shows a Netscape browser window titled "cs6751_97_Fall; Interaction: Frameworks and History: Thu Oct 09 15:09:54 EDT 1997 - Netscape". The address bar shows the URL "http://c2000.gatech.edu/zenpad/classes/cs6751_97_Fall/Oct.9.1997.1/html/". The main content area displays "Slide 11" with the following text and annotations:

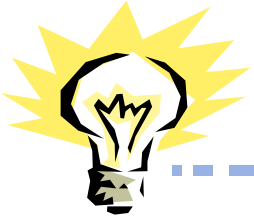
A thematic slicing

See lecture from Fall 96

apologies on ordering and audio name

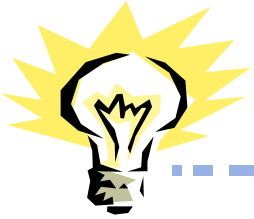
- ✓ Graphics/Visualization
- ✓ Personal Computing
- ✓ Group Computing
- ✓ Programming

The RealPlayer window is titled "RealPlayer: Apr.17.1997.1.ra" and shows a progress bar at 00:11.2 / 54:54.0, with the text "Playing 8.0 Kbps network stream".

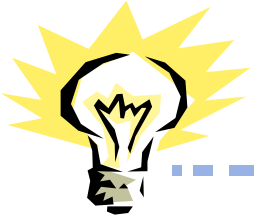


Live Monitoring



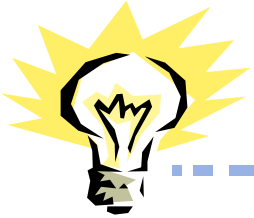


- Stream integration -- At what level?
 - ❖ Very finest level of actions or more coarse?
- Modifying a record after the fact
 - ❖ Can student notes be added later?
 - ❖ Change a heart rate?
- Networked interaction
 - ❖ Why can't your notes be put up on the Liveboard?
 - ❖ Are doctors (or family or police) notified?



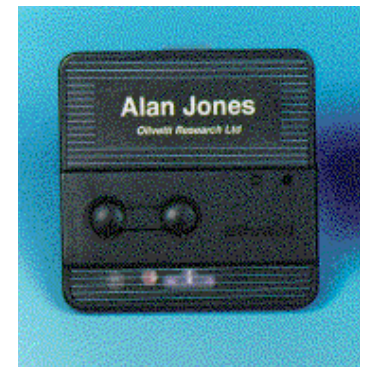
2. Context-Aware Computing

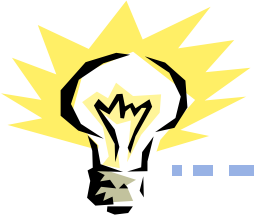
- Computing services sense aspects of environment (location, user emotion,...) and tailor provided services
- Walk into conference room, my email is projected on a big screen there



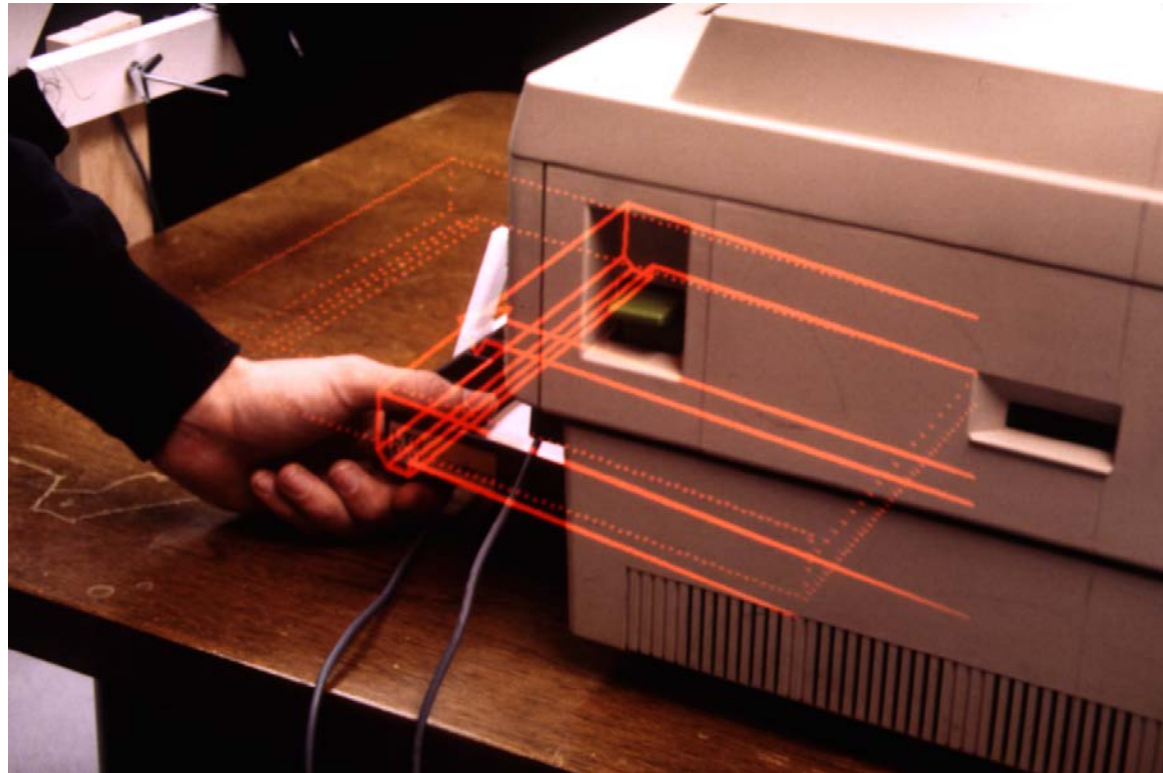
Examples

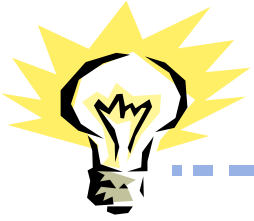
- Apple reminders with location tags
- Active Badge & PARCTab
- Shopping assistant
- Cyberguide
- Perception system for recognizing user moods from their facial expressions
- House where position is sensed and temperature adjusted automatically



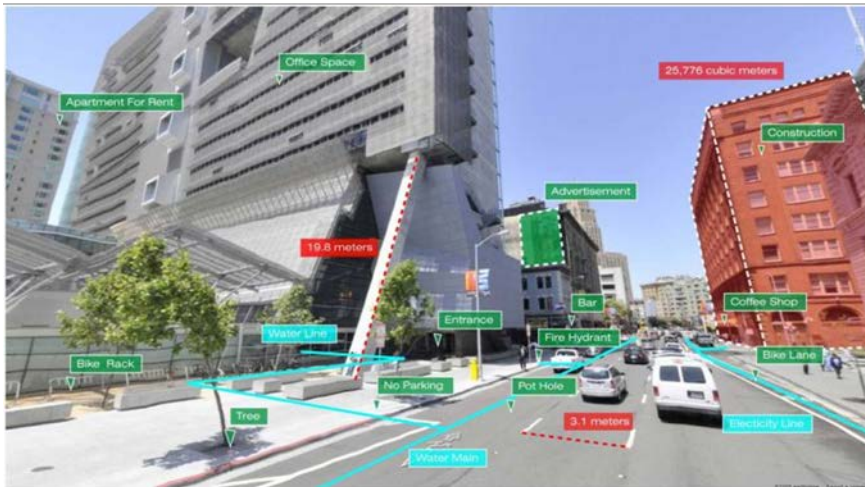


Augmented Reality

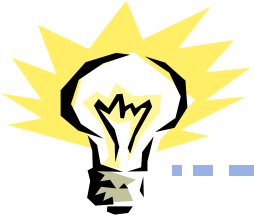




Ambience



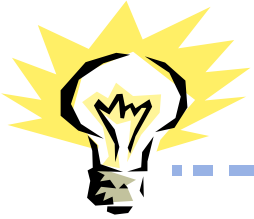
Fall 2019



Dynamic Driving Difficulty

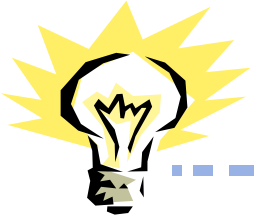
- Assess current driving difficulty
- “Intervention”??





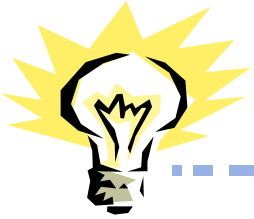
Issues

- Registration, registration, registration
- How to integrate all the different aspects of context?
- What about the loss of privacy?
- Clutter, relevance?



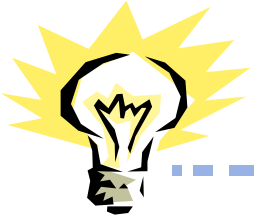
3. Ubiquitous Services

- Care about service, not application
- Want to receive a message using whatever device is handy nearby
- Message is tailored to work according to device



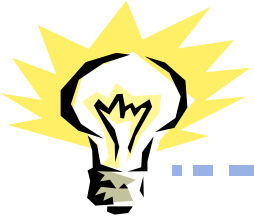
Mobile Messages

- ▶ Text, SMS, email, voicemail are all interchangeable
 - ❖ Phone call leads to voicemail which leads to speech to text, which can be accessed via text or email...
 - ❖ Email address sends SMS, vice versa



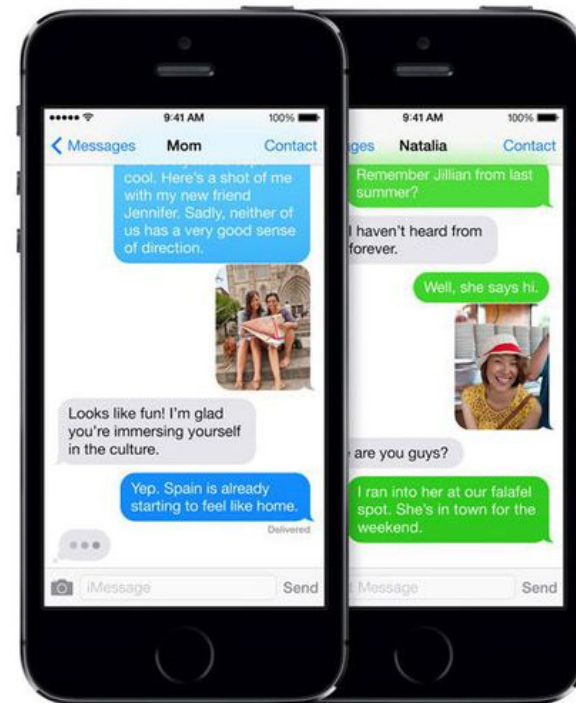
PARC Active Badge

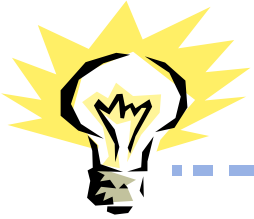
- Phone call “chased” the user’s badge
 - ❖ Even down a hall
 - ❖ Can do this with VOIP like Vonage (sort of)



iMessage

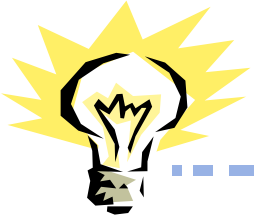
- Cross-platform messages: iOS, OS X, Android, SMS, Windows, etc.
- Mobile, desktop, etc.





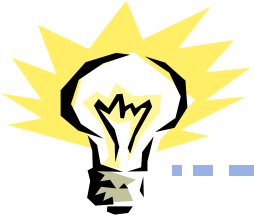
Issues

- What is software infrastructure for integration?
- Do we get it by just adopting some standard?
- Reciprocity (what if you text someone whose phone does not accept messages?)
 - ❖ Technological and sociological
 - ❖ Someone (grandma) might have an email address, but not check it while on the road!



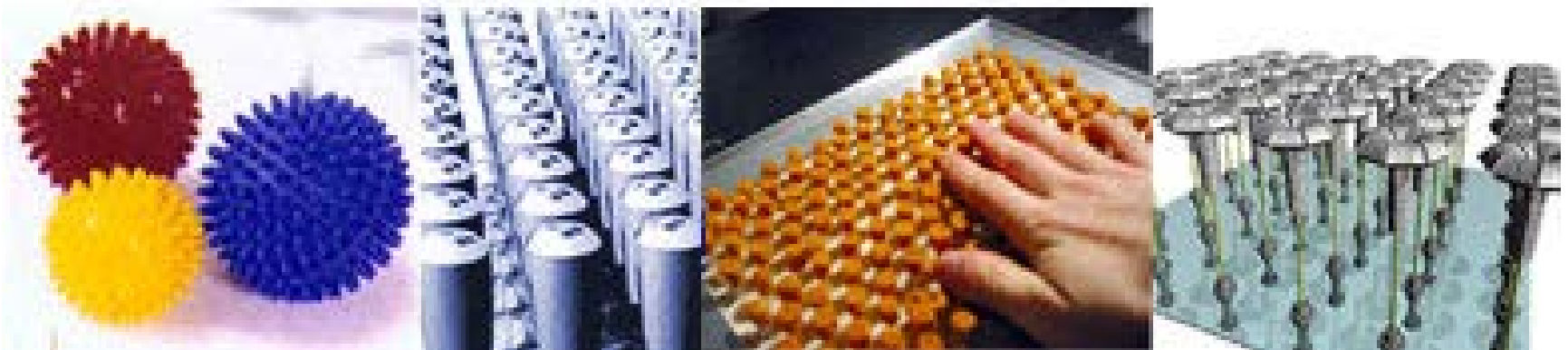
4. Natural/Implicit Interfaces

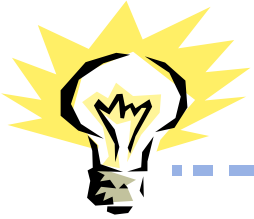
- Computer interfaces and devices are more natural interaction tools
 - ❖ Pen input
 - ❖ Speech
 - ❖ Gesture
 - ❖ Tangible interfaces



Examples

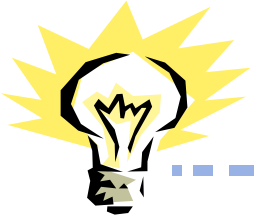
- Pen applications
- Speech applications
- Gesture pendant
- H. Ishii's tangible UI work at MIT
 - ❖ Note: videos





Gesture Pendant, Glass Input

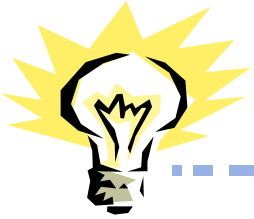




Personal Ambient Displays

Personal Ambient Displays are small, physical devices worn to display information to a person in a subtle, persistent, and private manner. They can be small enough to be carried in a pocket, worn as a watch, or even adorned like jewelry. In our implementations, information is displayed solely through tactile modalities such as heating and cooling, movement and vibration, and change of shape.

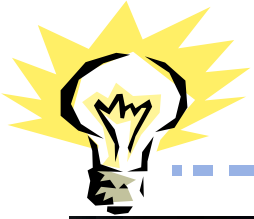




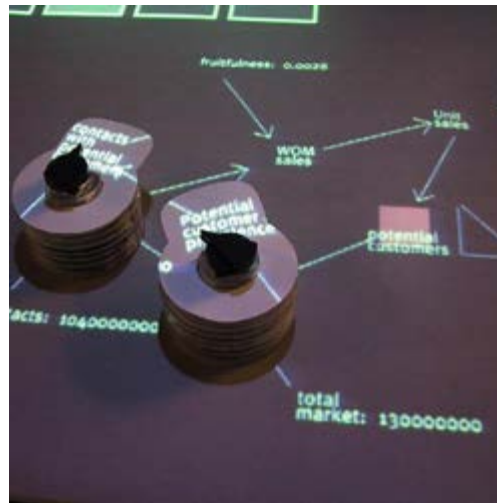
Pins and Super Cilia Skin

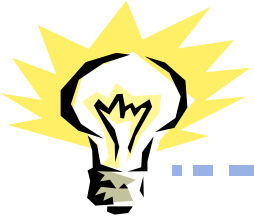


Super Cilia Skin is a multi-modal interactive interface, conceived as a computationally enhanced membrane coupling tactile-kinesthetic input with tactile and visual output. An array of individual actuators (cilia) use changes in orientation to display images or physical gestures as physical or tactile information.



Workbenches

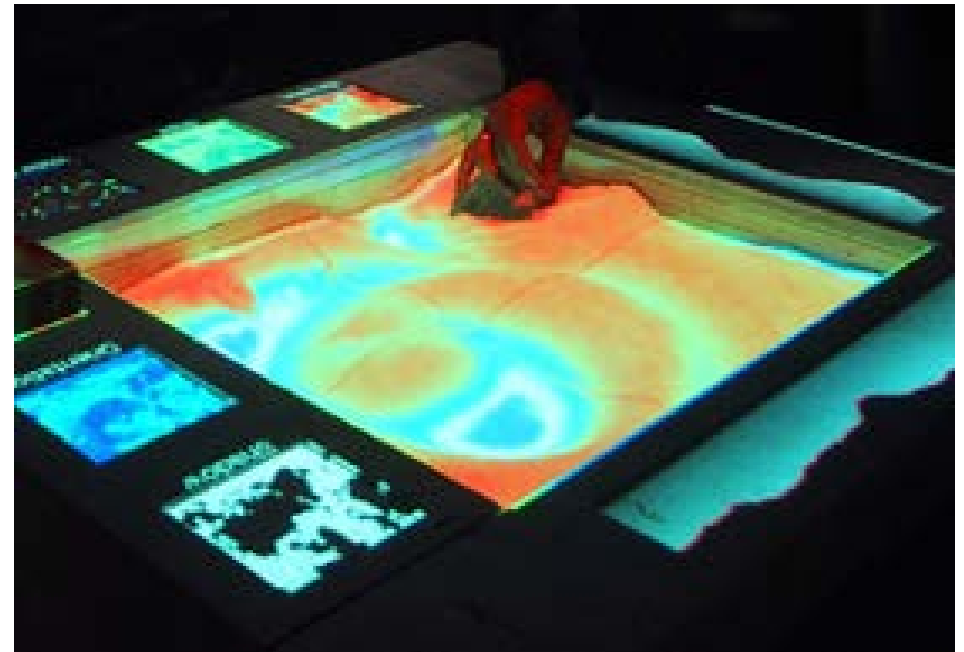




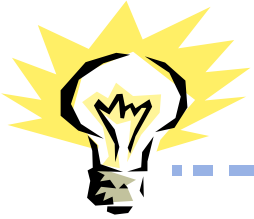
SandScape

SandScape is a tangible interface for designing and understanding landscapes through a variety of computational simulations using sand. Users view these simulations as they are projected on the surface of a sand model that represents the terrain. The users can choose from a variety of different simulations that highlight either the height, slope, contours, shadows, drainage or aspect of the landscape model. The users can alter the form of the landscape model by manipulating sand while seeing the resultant effects of computational analysis generated and projected on the surface of sand in real-

time

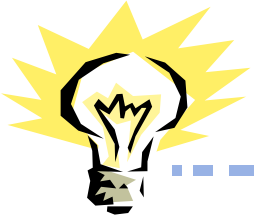


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Issues

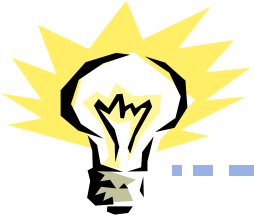
- Errors are more likely (handwriting recognition, speech, ...) How to discover and correct them?
- Is there truly value added?



Wearable Computing

- ▶ Computation devices (many forms) accompany you, rather than you seeking them out

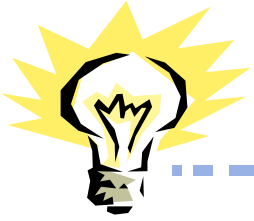




Google Glass

- Privacy?
- Social acceptance?
- Use case(s)?
- Business model?

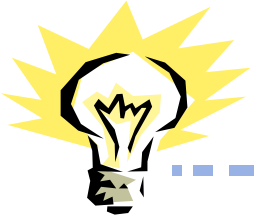




Wearable Computing

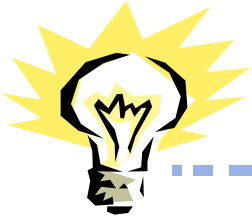
➤ Wrist-worn devices





Evaluation

- How do we evaluate these technologies?
- Challenge in Classroom 2000
- Glass?
- Disengagement and distancing from the world? Or more integration?



Interested in More...

- Mobile/Ubiquitous Computing
(Prof. Abowd, Prof. Starner)
- Readings, discussion, research-oriented
- Also, many HCI faculty at GT do mobile, wearable, and ubiquitous computing