Context-awareness and smart spaces
What are Smart Spaces?

- Instrumenting physical spaces with computers to provide useful services
  - Support cooperation & coordination (remote and co-located)
  - Automated capture

- Some issues to consider:
  - Interaction with non-desktop computers (walls, tables)
  - Discovery (how to know what can you do in a smart space?)
  - Interoperability
  - Cost (infrastructure, setup, maintenance, learning)
eClass (formerly Classroom 2000)
eClass

• Captures the lecture experience
  – Audio, Video, Lecture Notes on Smart Board

• Integrates everything for easy replay
Red links display URLs
Blue links display slides
Black links play video

Vannevar Bush (1890-1971)

- 1923 Made Professor of electronic power transmission at MIT.
- 1945 submits "Science, the Endless Frontier" in response to Roosevelt's request. Proposes the Memex in his quintessential article, "As We May Think" on Atlantic Monthly. MEMEX was a conceptual machine that could store vast amounts of

Clicking on teacher's annotation plays video
Aside: Audio Notebook

- Records ink and audio, allows playback
- Simple architecture, not a lot of interpretation
eClass – Student Notes

- StuPad (poorly named 😊)
Guesses on student feedback?
  – Do students prefer using it?
  – Is video useful?
  – Is audio useful?
  – Are slides useful?
  – Does it encourage skipping class?
All things being otherwise equal, I would prefer to take a class that uses Classroom 2000 technology over the same class that does not.
eClass – Student Feedback

• Video not too useful (remember tech constraints)
• Being able to access slides and audio useful
• Divided about if eClass encourages skipping class
  – 40% yes, 34% neutral, 26% no
eClass – Learning

• In 1998, compared two sections of Software Eng
  – one with and one without eClass

• Any guesses?
  – When were things accessed most?
  – Any effect on exam grades?
  – Any effect on note-taking?
  – Any effect on attendance?
eClass – Learning

• Greatest access before exams (of course! 😊)
• No significant effect on exam grades
• Students took far less notes
• No effect on attendance

• Captured notes useful as a “safety blanket”

Capture and Access

Personal Audio Loop

Abaris
Some Discussion Points

• Several installations around Georgia
  – Georgia Tech, Kennesaw State U, Georgia State U

• Privacy issues
  – eClass has cameras only on front area rather than students
  – PAL has short loop (~5 minutes)
  – Generally relies on social constraints rather than technical

• How to know what’s being recorded and when?
• How to convince faculty to use it?
• Cost?
Sony Computer Science Lab
*Pick and Drop*

• A variant of ToolStone
  – Way of easily transferring data
  – Way of using mobile computer like a palette
Sony Computer Science Lab
Augmented Surfaces

• Make it easy to exchange digital info between laptops, table and wall displays, and physical objects
Microsoft Research
Connecting Devices

• Bumping
  – Bump two computers together
  – Have accelerometers in the two devices
  – See co-occurring acceleration data
  – Link

• Stitching
  – See co-occurring pen drag data
Some Discussion Points

• Affordances?
  – How to know what you can do?
  – Walk in a room, what’s going on?

• Feedback?
  – How to know that things are working correctly?

• Cost?

• Why is it faster to connect to a server in Seattle (Amazon.com) than it is to connect two laptops?
  – What are ways of speeding things up?
RoomWare

- Augment furniture to support collaboration
Stanford iRoom
Stanford iRoom

FlowMenu

• Like a pie menu, can specify object, operation, and parameters in a single pen stroke
Stanford iRoom

FlowMenu

- Based on QuikWriting
Stanford iRoom

EventHeap

- Way of gluing software and hardware together
  - Analogous to Event Queue
  - All inputs and outputs connect to Event Heap
  - One Event Heap per room
Event Heap implemented as a Tuple Space
  - Essentially a Blackboard architecture (from multimodal)
  - Why an event heap? Why not an event queue per room?
Smart Homes

• Aware Home  
  – For aging

• “Green” Homes  
  – For energy

• Some Opportunities  
  – Game systems (Sony, Nintendo, Microsoft)  
  – Entertainment (Samsung, Philips, Panasonic, …)  
  – Mobile (Nokia, Motorola)

• Digital Living Network Alliance
Summary

• Systems
  – eClass
  – Pick and Drop
  – Augmented Surfaces
  – Bumping and Stitching
  – Roomware
  – Stanford iRoom

• Issues
  – Basic interaction
  – Capture and Access
  – Discovery
  – Interoperability
  – Cost