CISC 836
Design of Usable Computing Systems

T.C. Nicholas Graham
http://www.cs.queensu.ca/~graham/cisc836

Richly Interactive Systems

- Proliferation of new device types permits new styles of applications
  - Smart environments
  - Mobile applications
  - Augmented and virtual reality
  - Distance collaboration

Software Engineering Problems

- Existing methods, tools don't extend to new devices, application styles
- Systems built as "point designs"
- Difficulty in prediction, controlling cost

This Course

- Examines software engineering of interactive systems
- Important quality attributes:
  - Correctness
  - Robustness
  - Maintainability
  - Usability
  - Cost

Course Outline

- Introduction to Human-Computer Interaction as an Engineering Discipline
- Design Methods
- Implementation Methods

Introduction to HCI as an Engineering Discipline

- Tools and Methods to improve Usability Quality Attribute
  - Activity analysis
  - Task modeling
  - Guidelines
  - Iterative refinement process
  - Usability Testing
  - …fit within a design process

Design Methods

- Understanding different properties of novel technologies
- Controlling divergent designs
- Reuse of design, testing across platforms
- Impact analysis of change
- Interaction techniques for novel device types

Implementation Methods

- Software Architecture
  - Architectural styles allow reuse of design knowledge
- Middleware
  - Implementation platforms abstracting low-level implementation details
  - E.g., Jini, Bluetooth

Implementation Methods

- Generation from high-level models
  - Domain, platform, context, task modeling

Course Organization

- Lectures, Discussions, Presentations
- Weekly readings
  - Discussions led by you
- Course project
  - Checkpoints: task model, user interface design, system implementation
- Final report
  - Analysis of project solutions of all three groups

Text book

- Mainly based on papers
  - See course web page for list of other sources

Marking Scheme

Discussion Lead	5%
UI Design Presentation	5%
System Presentation	5%
Task Model	10%
User Interface Design	15%
Final System	40%
Final Report	20%

Course Project

- System to help business travelers find best travel plan from one location to another
- Choose between options combining air, train, bus, automobile
- Allow traveler to trade off travel time, cost, dates
- Versions of system to run on palm pilot, web browser, electronic whiteboard

Task Model

- Tasks users wish to accomplish
- Modeled in terms of subtask relation, task sequencing
- Each group initially develops own task model
  - All groups to use same task model for project

User Interface Design

- Each group chooses a different platform
- Design for specific platform
  - Web-based
  - Electronic whiteboard
  - PDA (e.g., Palm)
  - WAP telephone
- UI Design Presentation

Final System

- Implement prototype
- Class demonstration

Richly Interactive Systems

- Mobility
- Augmented/Virtual Reality
- Collaboration
- Novel I/O techniques
  - Gesture, sound, voice, stylus, …
- Novel devices
  - Mobile phones, PDA's, tablets, cameras, …

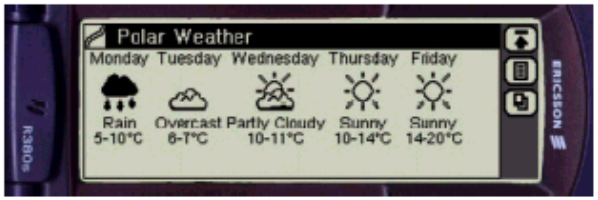
Examples of Novel Devices

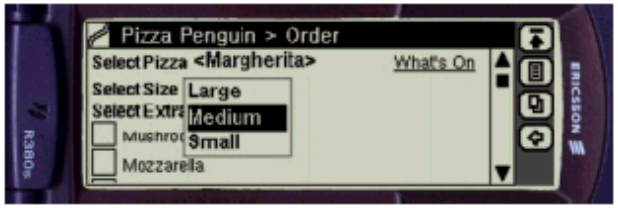
- Ericsson R380 Mobile Phone
- Palm VII Organizer
- Psion Revo plus Organizer
- SmartTechnology Electronic Whiteboard
- Fujitsu Stylistic 3400 Pen Tablet

Ericsson R380 Mobile Phone

- 7 lines of text
- 310x100 pixels
- 83x26mm display
- WML (Wireless Markup Language) documents
- GSM Wireless Protocol (9600 bps - 2Mbps)

Ericsson R380 Mobile Phone





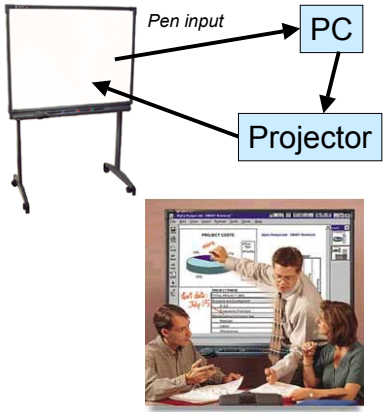
Palm VII Organizer

- 8 MB memory
- Synchronize with PC
- Wireless Internet (via proprietary protocol)
- Stylus input using graffiti gesture recognition
- Application development in C++, Java

Psion Revo plus

- Small keyboard + stylus
- Built-in JVM
- 56 kbps wireless connectivity
- 480x160 display

SmartBoard 540 Electronic Whiteboard



- 37.5" W x 28.2" H
- 2000x2000 touch sensitive panel
- Up to 1600x1280 projector
- Input via plastic pens (stylus)

Fujitsu Stylistic 3400 Pen Tablet

- 400 MHz PIII
- 1028x764, 10.4” Display
- 6 GB HD, Up to 192 MB Memory
- Touch-sensitive panel
- Hand-writing recognition software

Examples of Richly Interactive Systems

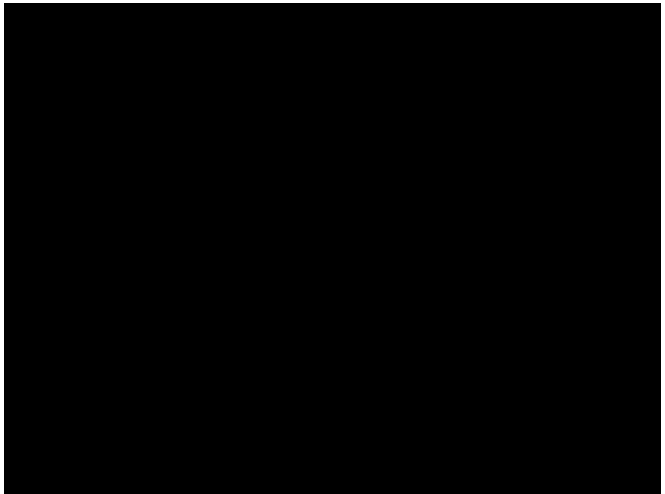
- Tivoli electronic whiteboard for meetings
- Comedi media space
- Electronic tourist guide
- Air traffic control flight strips
- Augmented reality interior design system
- Multiuser computer games

Tivoli Electronic Whiteboard [Moran and van Melle 2000]

Tivoli Electronic Whiteboard

- Meeting support
- Touch-sensitive panel
- Projected display
- Gesture-based interaction techniques for manipulating board contents

Comedi Media Space [Berard et al 2000]



Comedi Media Space [Berard et al 2000]

- Maintain sense of group amongst distributed people
- Cameras in each person's space
- Display shows view of others' spaces

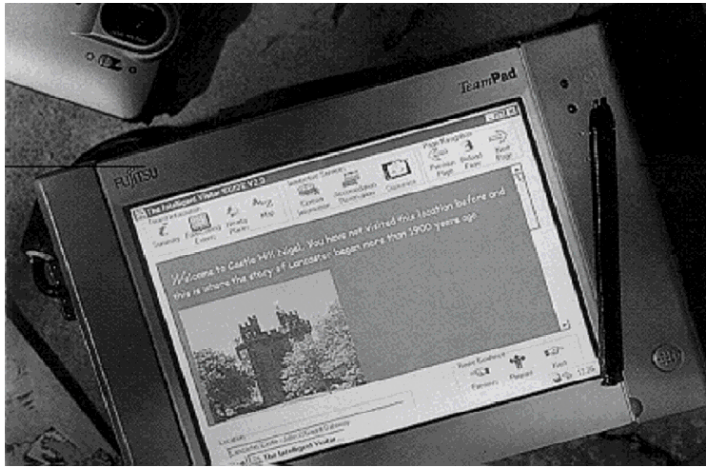
Using media spaces

[Junestrand et al 2000]

- Family dinner with distributed people
- Image filtering for privacy

Electronic Tourist Guide

[Cheverst et al 2000]

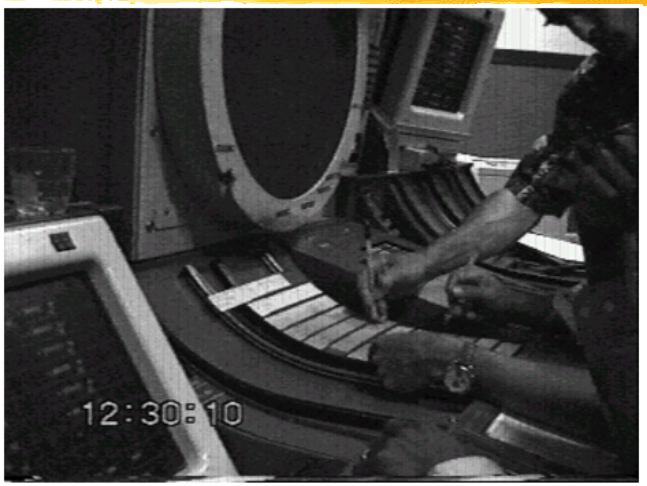


Electronic Tourist Guide

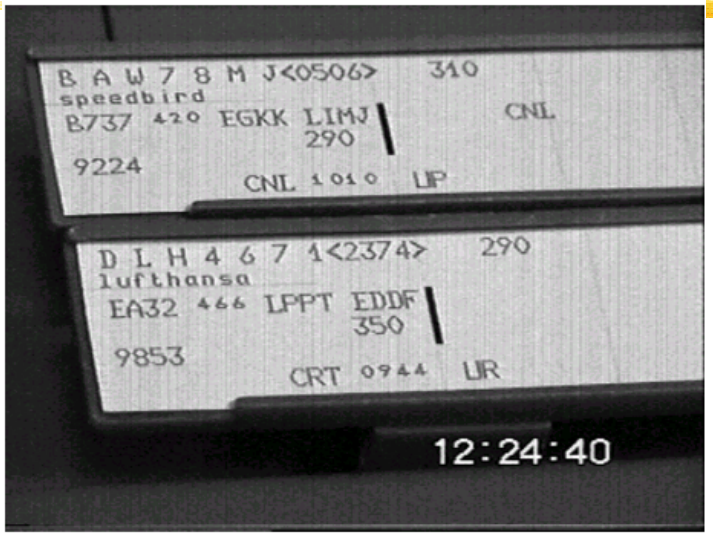
[Cheverst et al 2000]

- Portable device allows people to see tourist information in context
- Partially-connected operation

Augmented Reality Flight Control [MacKay et al 1998]



Augmented Reality Flight Control [MacKay et al 1998]



Augmented Reality Flight Control [Chatty et al 2000]

Augmented Reality Interior Design [Anabuki et al 2000]

Augmented Reality Interior Design [Anabuki et al 2000]

- See-through virtual reality glasses
- Gestures to manipulate virtual objects (furniture)
- Virtual furniture superimposed over real room

Dark Age of Camelot Video Game

Dark Age of Camelot

Dark Age of Camelot

- Computer game allowing thousands of people to interact in real time
  - > 100,000 subscribers
- Each player controls a game "avatar"
- Can walk through, interact with virtual world
  - "Fight" other players, monsters