User Interaction: Ubiquitous Computing

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Challenges to HCI Assumptions

- What do we imagine when we think of a computer?
  - "The most profound technologies are those that disappear." Weiser

- 1990's: this was not our imagined computer!
- Single User -> groups -> organizations
- Desktop -> mobile phone -> sensors
- Computing in place -> mobile computing
- Wired -> wireless -> cloud

Synonyms

- Ubiquitous Computing
- Pervasive Computing
- Mobile Computing
- Sensor Networks
- (sort of) Human-Computer Interaction

Variations in Ubicomp

- Embedded Systems
  - Cars
  - Airplanes
  - Smart Control
  - Specialized
  - ASICs
  - Real-time
  - High reliability

Variations in Ubicomp

- New devices
  - Hi-tech
  - Silicone-based
  - gadgets
    - PDAs
    - Cellphones (keitai)
    - mp3 players
    - active displays

Variations in Ubicomp

- New Infrastructure
  - Connecting the existing physical world to a computational scaffold
  - ordinary objects re-envisioned
  - add computation

Ubiquitous Computing

- Any computing technology that permits human interaction away from a single workstation
- Implications for
  - Technology defining the interactive experience
  - Applications or uses
  - Underlying theories of interaction

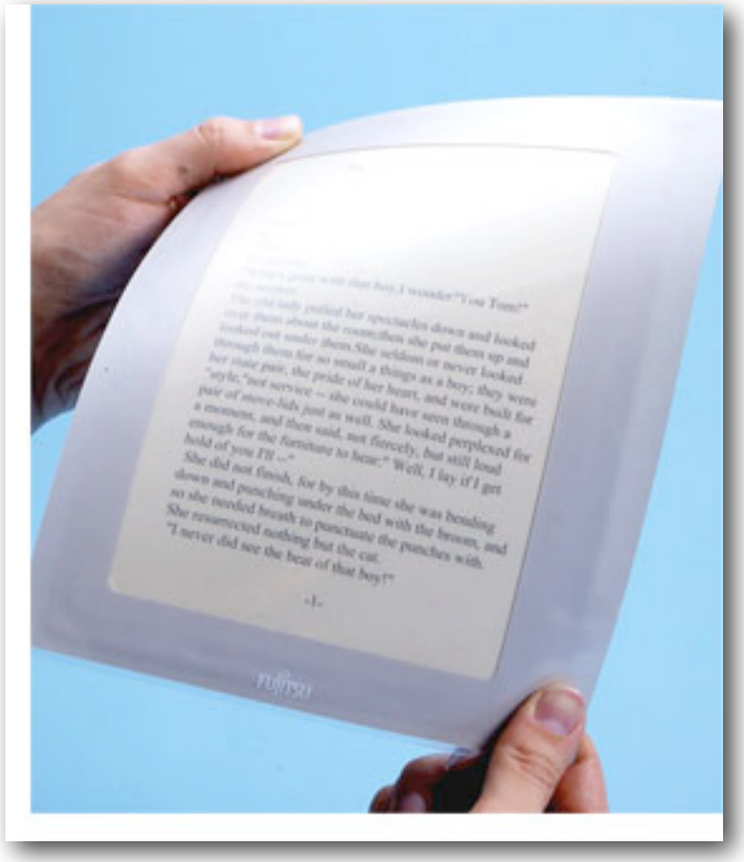
Technology: Scales of devices

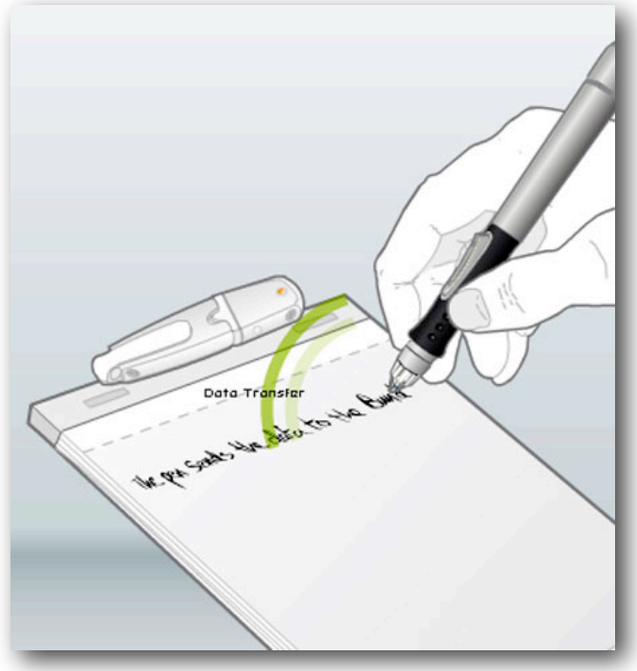
- Weiser proposed
  - Inch
  - Foot
  - Yard
- Implications for device size as well as relationship to people

Technology: Scales of devices

- Inch
  - smart phones
  - PARCTAB
  - Voice Recorders
- Individuals own many of them and they can all communicate with each other and environment.

Technology: Scales of devices





- Foot
  - notebooks
  - tablets
  - digital paper
- Individual owns several but not assumed to be always with them.

Scales of devices

- Yard
  - electronic whiteboards
  - plasma displays
  - smart bulletin boards
- Buildings or institutions own them and lots of people share them.

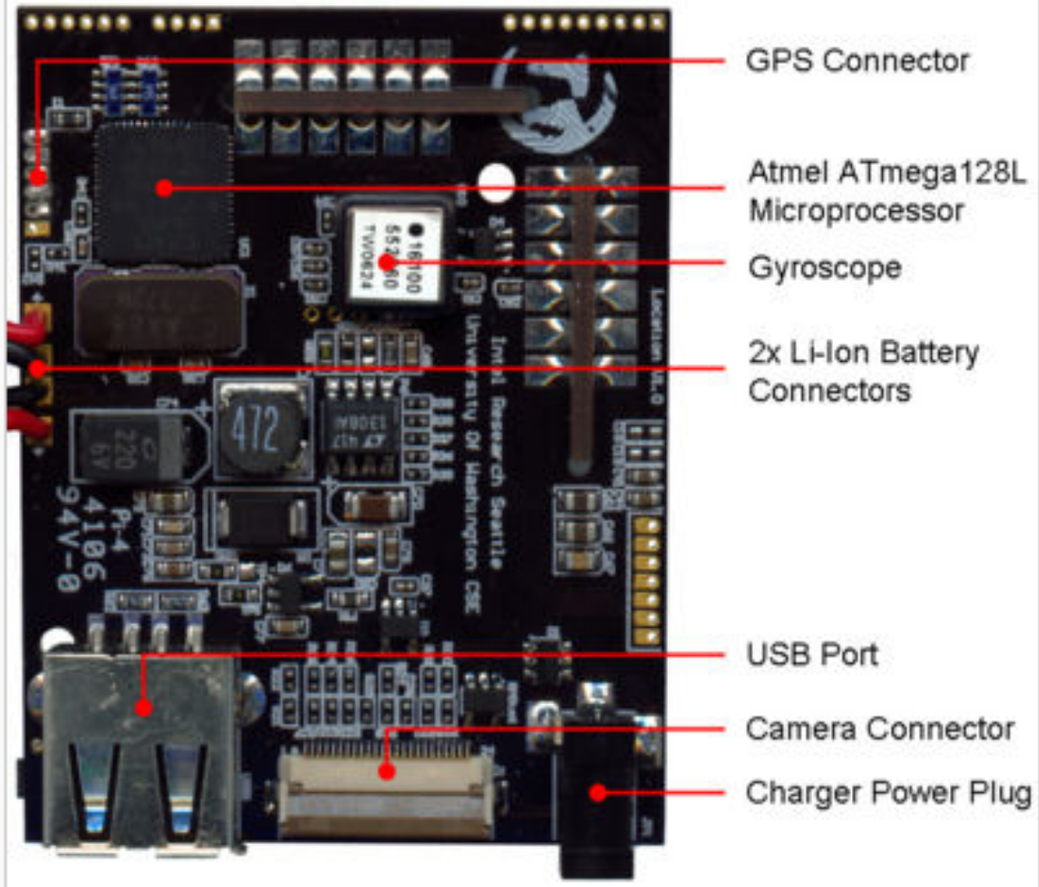
Technology: Redefining the Interaction Experience

- Implicit input
  - Sensor-based input
  - Extends traditional explicit input (e.g., keyboard and mouse)
  - Towards “awareness”
  - Use of recognition technologies
  - Introduces ambiguity because recognizers are not perfect
    - Probabilistic interaction is a new paradigm

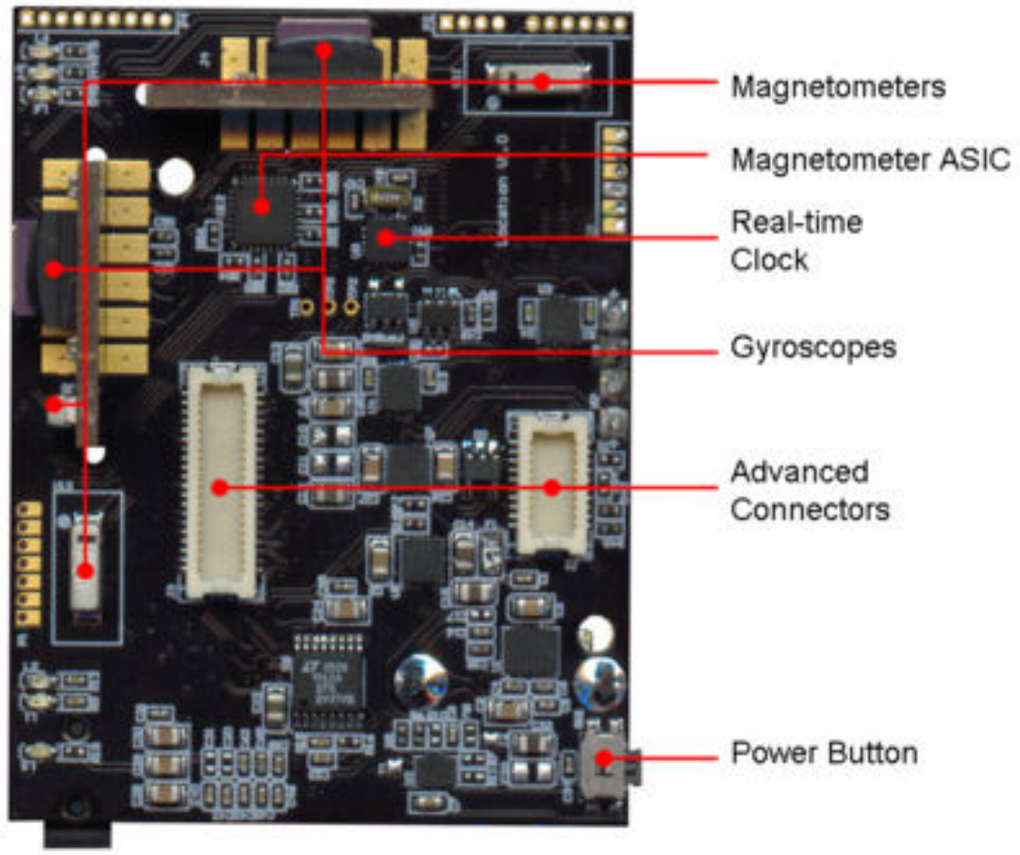
Technology: Different inputs

- Large-Screen Touch
  - MS Surface
    - http://www.metacafe.com/watch/618189/microsoft_surface_computing_the_power/
    - http://www.youtube.com/watch?v=CZrr7AZ9nCY

Overview Images



Top of the LSB



Bottom of the LSB

Proximity range sensor:

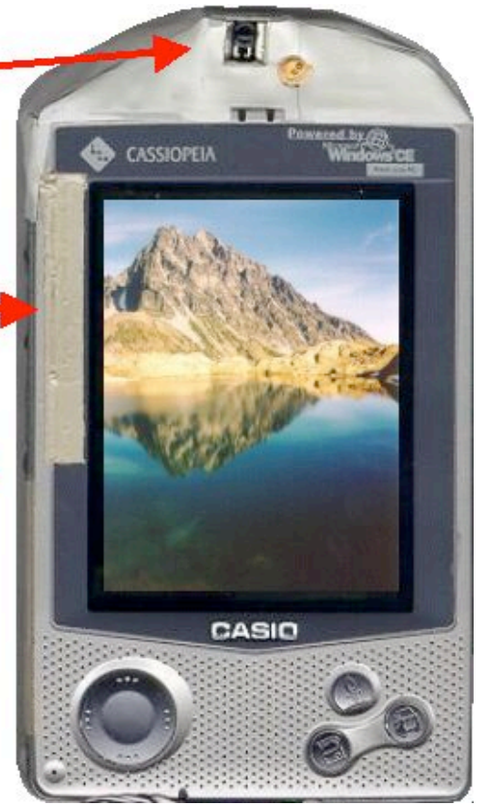
- Infrared (IR) receiver
- IR emitter (below receiver to right)

Touch sensitivity:

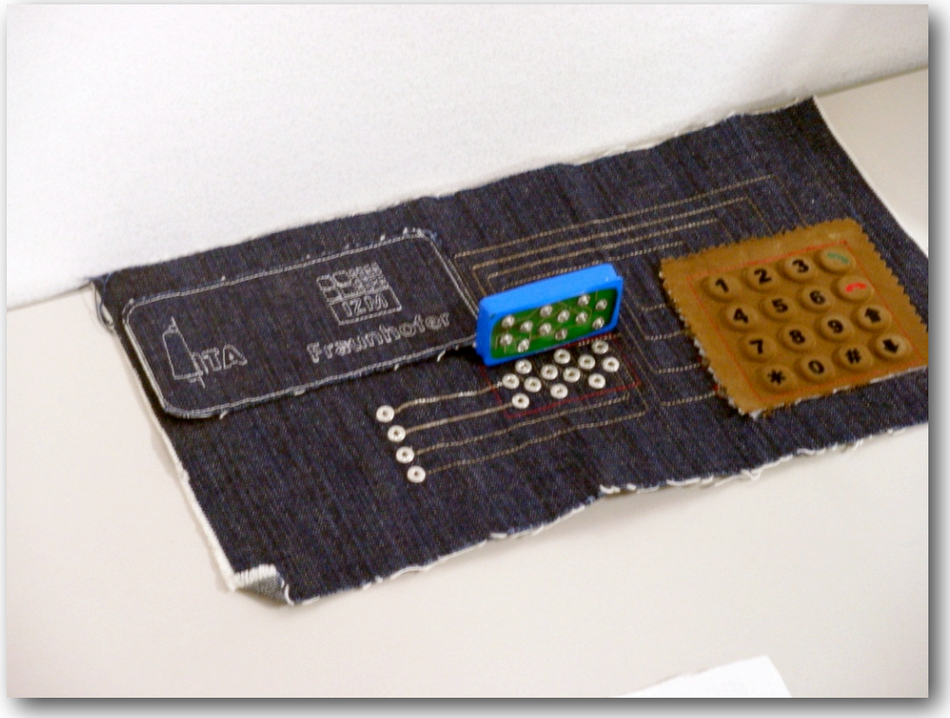
- Screen bezel
- On sides & back of device

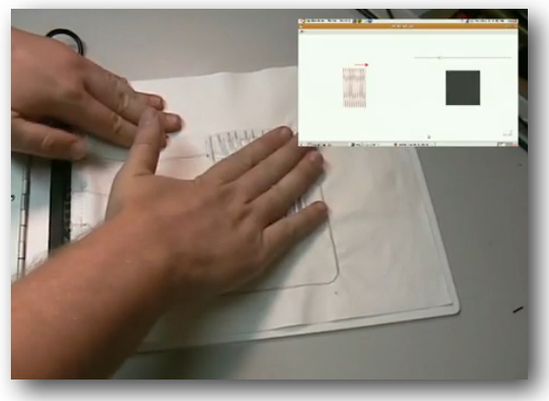
Tilt sensor:

- Inside device, in plane of the display
- 2-axis linear accelerometer



Technology: Different inputs





- Textile Interface Swatchbook
  - http://www.youtube.com/watch?v=NKWWa6BvUts
  - http://www.youtube.com/watch?v=Valtk6pXiHY