Wearable Computing

Teleseminar Ubiquitous Computing WS 2001

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Overview

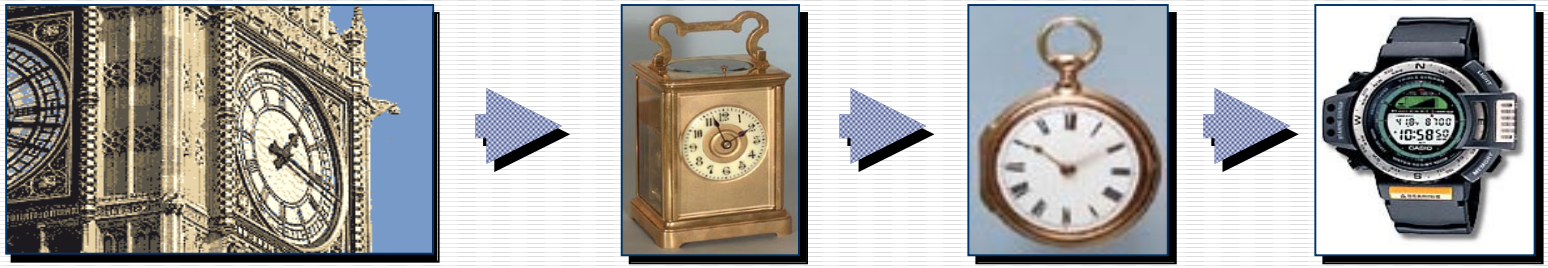
- Short introduction to Ubiquitous Computing
- Wearable computing
  - Vision
  - Technology
  - Applications
- Wearable vs.Ubiquitous Computing
- Testing of Wearable Computing

Ubiquitous Computing

- Visions of Mark Weiser:
  - Computers should become part of the environment
  - No Virtual Reality but Real Virtuality
  - Computers should learn the way of humans
  - „The most profound technologies are those who disappear.“

Evolution

- Of the clock:



- Of the computer:

Wearable Computing

- Vision:
  - „A Wearable computer is a computer that is always with you, comfortable and easy to keep and use, and is as unobtrusive as clothing.“

Defining characteristics

- Portable while operational
- Hands-free use
- Attention getting
- Always on
- Sensors to perceive state of environment
- Takes advantage of the user‘s context

The first wearable computer

- 1955 by Ed Thorp and Claude Shannon, Computer for use in modeling of chaotic phenomena.
- More specifically: for betting odds at roulette.
- Yielded an expected gain of +44% when betting on the most favored „octant“.
- Cigarette pack sized analog device.
- Main input : clicking with toes.

Technology

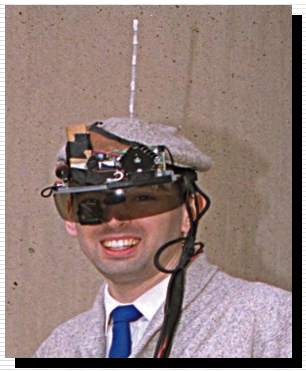
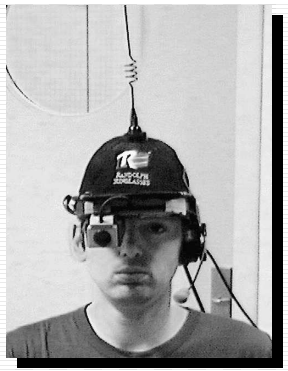
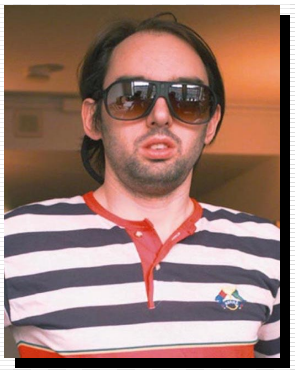
- The vision of wearable computing has many benefits, the question is, how realistic it is ?
- Todays systems are far away from the ideal wearable !

Hardware Requirements

- Cabling: Must be few, unobtrusive, flexible, save
- Displays:Must be small, unobtusive, have several configurations, high image quality
- I/Os: Must be easily switchable, accessible, easy to learn and use, alternative interfaces
- Power: Must drive multiple peripherals simultaneously, alternative sources
- Standard: Must conform to a standard desktop environment, incorporate industrie standard component

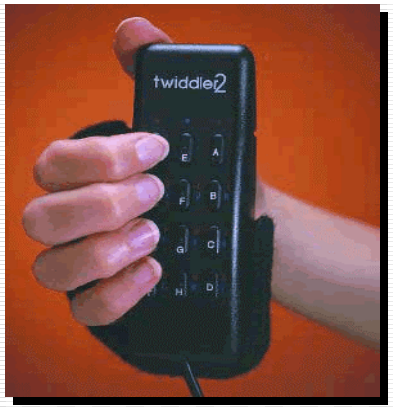
Displays

- Very important for the performance of a wearabel
- Two main kinds:
  - Common portable LCD's
  - Head mounted displays:

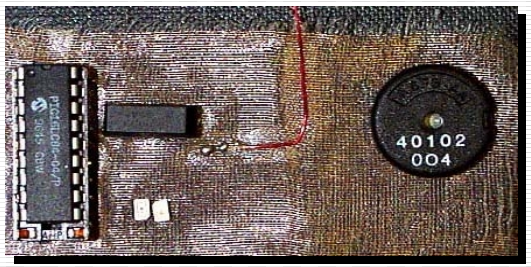
Input devices

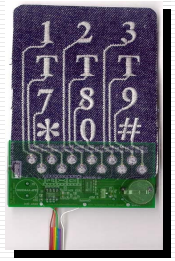
- Ever tried to type on a normal keyboard while walking down the steet ... ?
- Ability to access and control a wide range of different applications and products.
- Today, there exist mainly:
  - Language processing
  - Mobile variants of keyboard



Packaging Technology

- Modules should be integrated inside clothes
  - No impact on appearance
  - No impact on comfort





Complete systems

- Examples of published systems:
  - Xybernaut
  - IBM Wearable Thinkpad

- **Charmed product**

- **Navigator 2**

- **Xybernaut**

Is there a need for WC ?

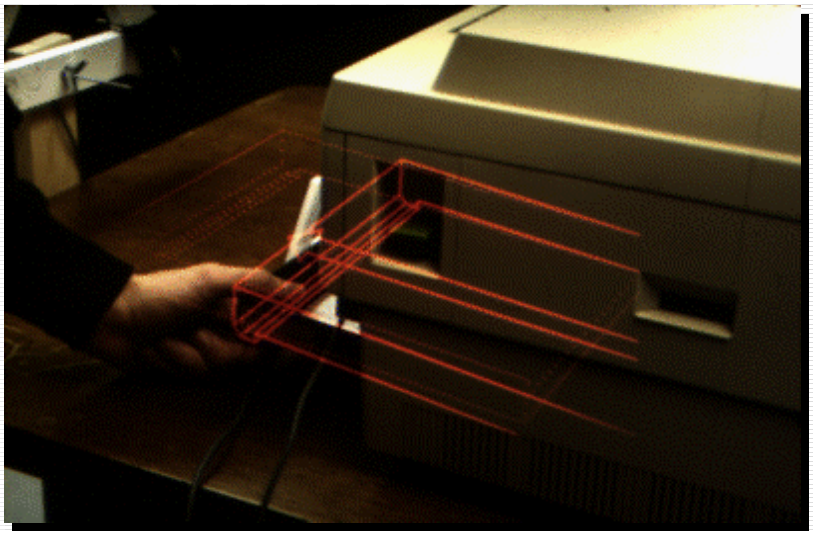
- Wearble Computing could highly improve performance and communication, together with a reduction of stress and information overflow.
- Obvious need in the following domains:
  - Maintenance, repair
  - Construction, manufacturing
  - Fire fighters, police ,resque teams
  - Teaching, education
  - Disabled people, health sector

Applications

- Mediated and augmented reality
- Infomation access (context sensitive)
  - In museums, internet connection, ways plans, ...
- Managing personal data
  - Images, phone numbers, termins, ...
- Exploring and documentation
  - Room measurement, stocktracking, ...
- Military
  - Live satelite view, aiming ,flight, ...

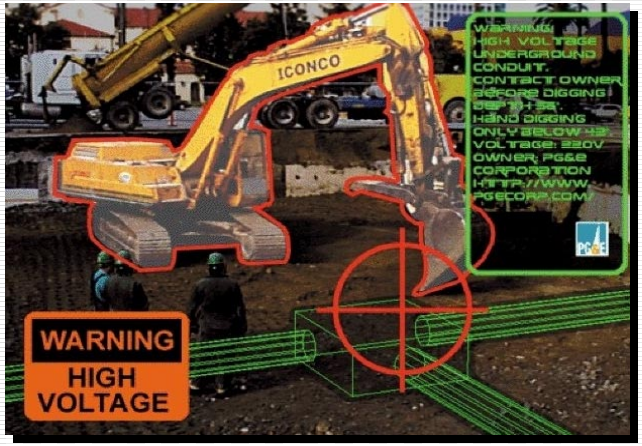
Application Examples

- **KARMA** (Knowledge-based Augmented Reality for Maintenance Assistance)



- Maintenance
- Construction
- Repair

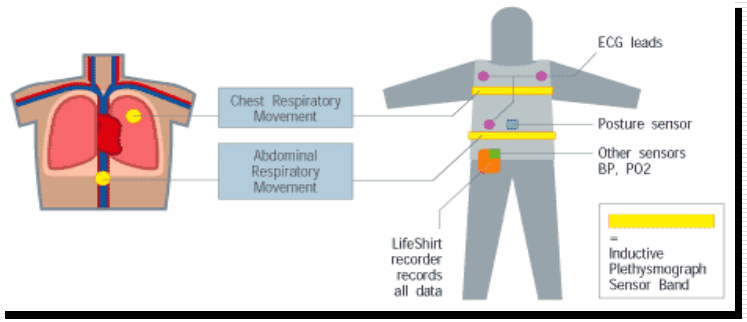
- Mobile personal



Application Examples

- **MARS** (Mobile Augemented Reality System)

- **LiveShirt** (VivoMetrics)



Wearbale vs. Ubiquitous Computing

- Been posed as polar opposites even though they are often applied in very similar applications
- Problems with ubiquitous computing:
  - Privacy issues
  - Difficulty with personalized information
- Problems with wearble computing:
  - Localized information
  - Localized control (interfaces)
  - Resource management

Possible Solutions

- A combination of ubiquitous and wearable computing ?
- HIVE – distributed agents platform
  - Links programs running on wearble computers and „desktop computers“
  - Main abstactions are agents, that are:
    - Autonomous
    - Proactive
    - Self-describing
    - Able to interact
    - Mobile

Example Applications with Hive

- Theme music
  - Agent for playing cd:
  1. Resource finding agent searches CD agent
  2. Sending music url to CD agent. (*privacy, personalization)*
  3. CD agent plays it or not (*localized resources*)

- „Where‘s brad?“ agent
  - Agent for finding an person. (*localized information*):
  1. Same resource finding agent. But now searching for agents associated with a person.
  2. Found person can decide which information to reveal (*privacy, personalization)*

Testing of wearables

- To understand the user interaction it is necessary to examine:
  - User‘s direct interaction
  - External context the user perceveives during interaction
- Evaluation sytems must:
  - collect both kind of data
  - have littel influence on user and wearable

Conclusions

- Many potentional applications for wearables
- Not a completely new technology but:
  - Computers (Wearbles) as real helpers, not as burdens
  - Symbiosis of humans and computers
  - Still some new challenges

Wearable Computing Challenges

- Interface desing, packaging, communication architecture
- Aim of research: close the gap between the vision and reality