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Wireless Hospital

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"The best way to predict the future is to invent it."
Alan Kay

Problems

- One of the recognized problems at hospitals globally is inefficiency in the management of healthcare processes
- Typical bottlenecks
  - long waiting times: patients
  - long searching times: medical instruments etc. devices
  - double writing: storehouse book-keeping, diagnosis, etc.
  - lost instruments
  - a lack of updated patient's information
  - missing phase information, etc.
- In addition, sometimes the right professional is not available at the critical moment
- All the listed concerns are too common problems which can be solved
- The strong development of wireless technology in recent years has introduced new opportunities for improving hospital processes

Where we can utilize wireless technologies at hospital?

WIRELESS PLAYGROUND AT HOSPITAL

One desk registration

Data transmission from patient to diagnosis devices

Wireless sensors and monitoring systems

Data transmission to doctor when approaching patient

Updated & correct data

Data transmission during the transportation

Wireless location and tracking

Data transmission from medical devices to the system

Automatic guidance through hospital (monitors)
- security
- reliability

Data transmission to the common database (EPR)

Data transmission from the system to doctor

Material tracking
⇒ consumption based invoicing
(especially in private hospitals)
⇒ implants, screws, etc.

Automatic storehouse monitoring

Wireless information collection and delivery

After-care
=> tele-medicine

Rehabilitation
Elderly care, etc.

- By using an *electronic patient record* and *wireless communication*, medical doctors can save around **15%** of their time and nurses over **10%**
  - wireless terminals provide doctors and nursing staff with the ability to access patient data anywhere within the coverage area of the wireless network

- In addition, wireless technology saves time in ordering medicine and other supplies
  - in one ward having 26 beds, 13 hours are spent for ordering and 21.5 hours for handling of deliveries per week
  - in surgical departments, ordering and handling of deliveries may take up to 167 hours and 147 hours per week, respectively

Source: Comparative study of a Finnish and a UK district hospital's doctors' time spending patterns. Unpublished research report, C-Quest Partners Oy, 2006.

- New wireless implementations can
  - improve the efficiency of hospital staff
  - make patients' life easier by removing cables
  - give real time phase information about the hospital processes

- Ubiquitous wireless sensor networks could be the extension of the applications designed for healthcare
  - patient's real-time data available anytime and anywhere to accredited persons
  - systems developed for healthcare sector could be obtained in other areas, such as welfare

- Environmental aware sensors

- **Goals:**
  - Patient being home as long as possible with aid of modern technology
  - Decreasing total healthcare costs

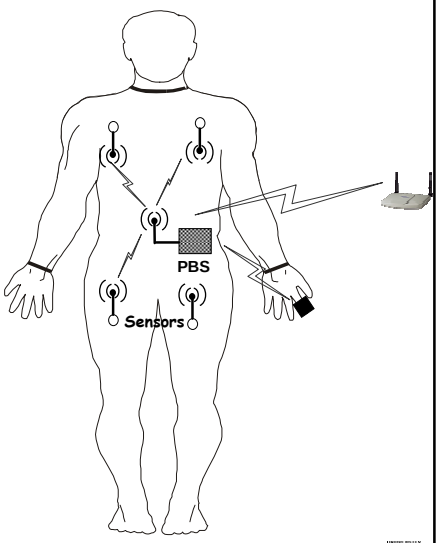
- **System concept for healthcare applications includes:**
  - Non-invasive sensing
    - Easy to wear and install
    - Easy and safe to use
  - Invasive sensing
    - Easy and safe to install and use
    - For example, implanted sensors

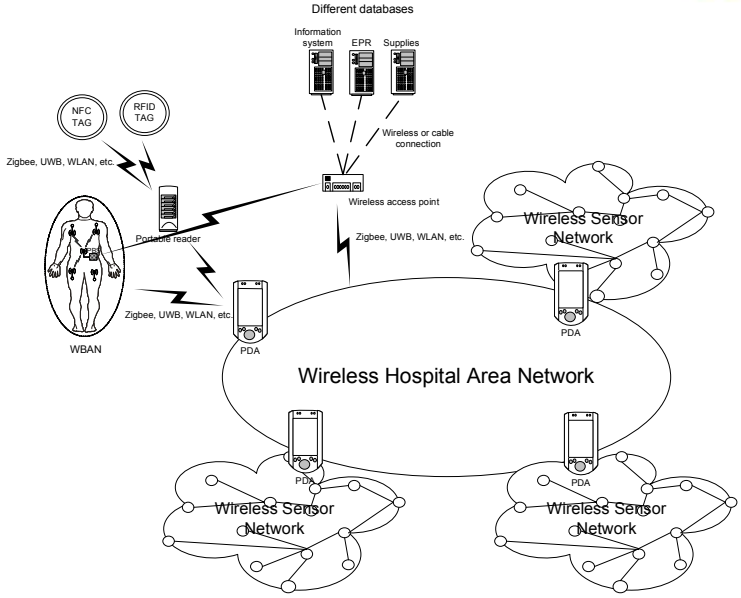
  - Seamless and ubiquitous wireless data communications
    - Security and secrecy
    - Reliability
    - Low energy consumption
    - Easy installation
    - Long lifetime
  - User friendly
    - Easy to use, automatic
  - Scalability and flexibility
  - Utilization of same approaches in homes, elderly care units, children daily care units, hospitals, etc.
  - Dual-use: welfare & sport applications etc.

  - Wireless Hospital Area
    - Connected to data systems and various applications of the hospital processes
    - Standardized transmission protocols and radio interfaces
    - E.g., WLAN/Wi-Fi, ZigBee, UWB, Bluetooth and RFID
    - In Finland, WLAN is generally used at the hospitals
    - Patients are allowed to use cell phones inside wards
  - Integration
    - Wireless support for hospital top level management
    - Wireless support for hospital information systems
    - Wireless integration of medical, clinical and diagnostic data
  - Wireless Applications
    - Wireless tracking of patients, staff, equipment and materials
    - Continuous wireless monitoring of the vital parameters of patients
    - Continuous wireless connection to optimal specialists
    - Wireless access (automatically) to all medical and clinical data needed

Wireless BAN

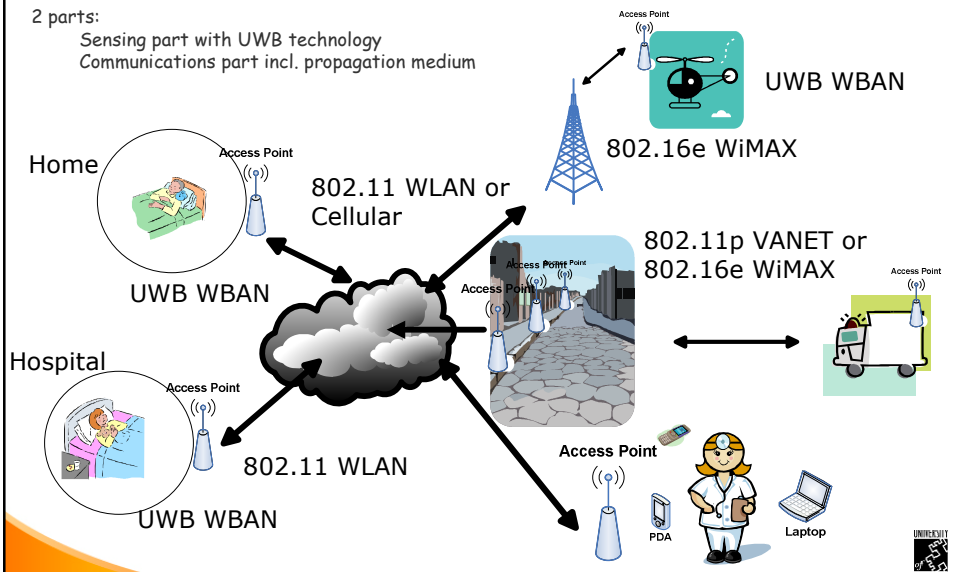
- Portable base station (PBS) is a key element in WBAN solution
  - All traffic from body sensor nodes goes through PBS
  - Point-to-point links between sensors and PBS
  - PBS as a gateway to backbone network
- Different sensors are used to monitor and transfer biomedical data
- Real time monitoring
- Variable data rates between sensors and PBS
  - support to several radio interfaces





CWC's future directions in wireless medical ICT

2 parts:
Sensing part with UWB technology
Communications part incl. propagation medium



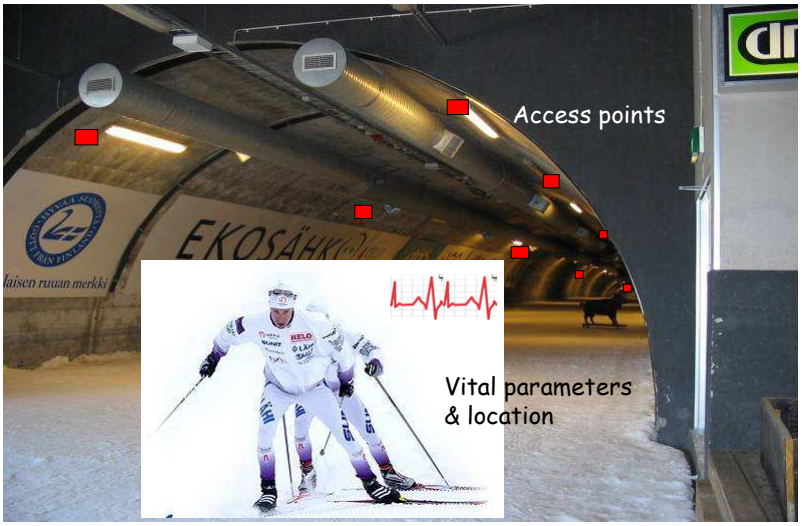
Integration to Living Lab

- Implementing operational system requires
  - User tests before wide scale adaptation
    - Test users are needed
    - Locations for test implementation

    => Good test practices

- Living Lab environment can offer facilities for experimental studies

Wireless Ski Tunnel: as an example



Summary

- Improve the healthcare and welfare processes using wireless technologies
- The ideas can be utilized in the children, disabled and aged people care
- Similar procedures and technologies than used in healthcare can be used in environmental monitoring and ubiquitous wireless sensor networking

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