

Introduction to Medical ICT Project at NICT

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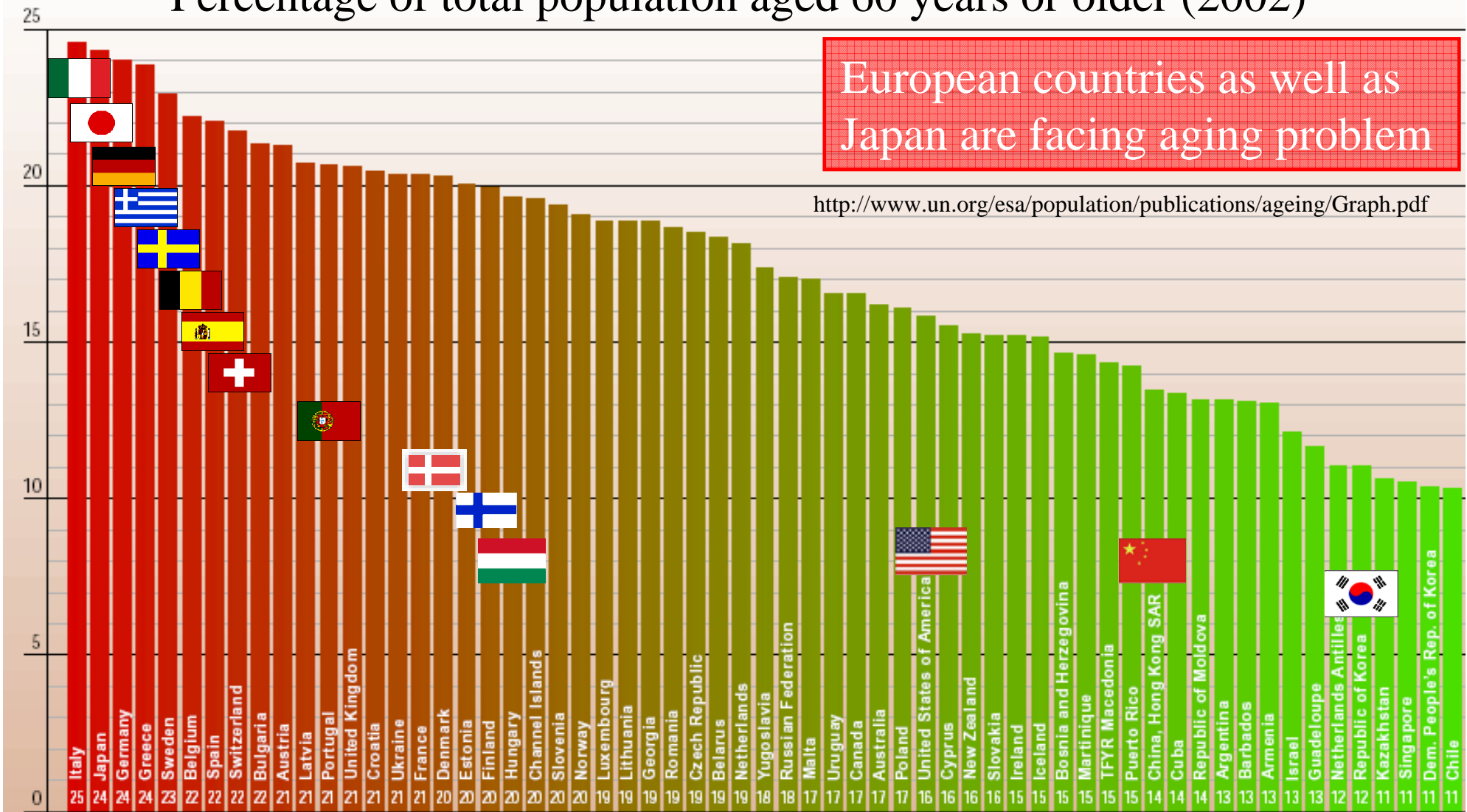
Medical ICT Group
New Generation Wireless Research Center

Topics

- **Background of research**
- **Wireless Body Area Network (BAN)**
- **Activity overview of Medical ICT research**
- **Concluding remarks**

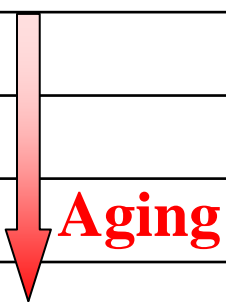
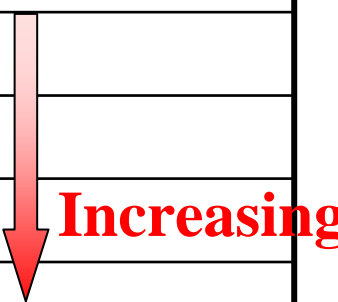
Social Problem: Population Aging

Percentage of total population aged 60 years or older (2002)



Increasing Healthcare Cost in Japan

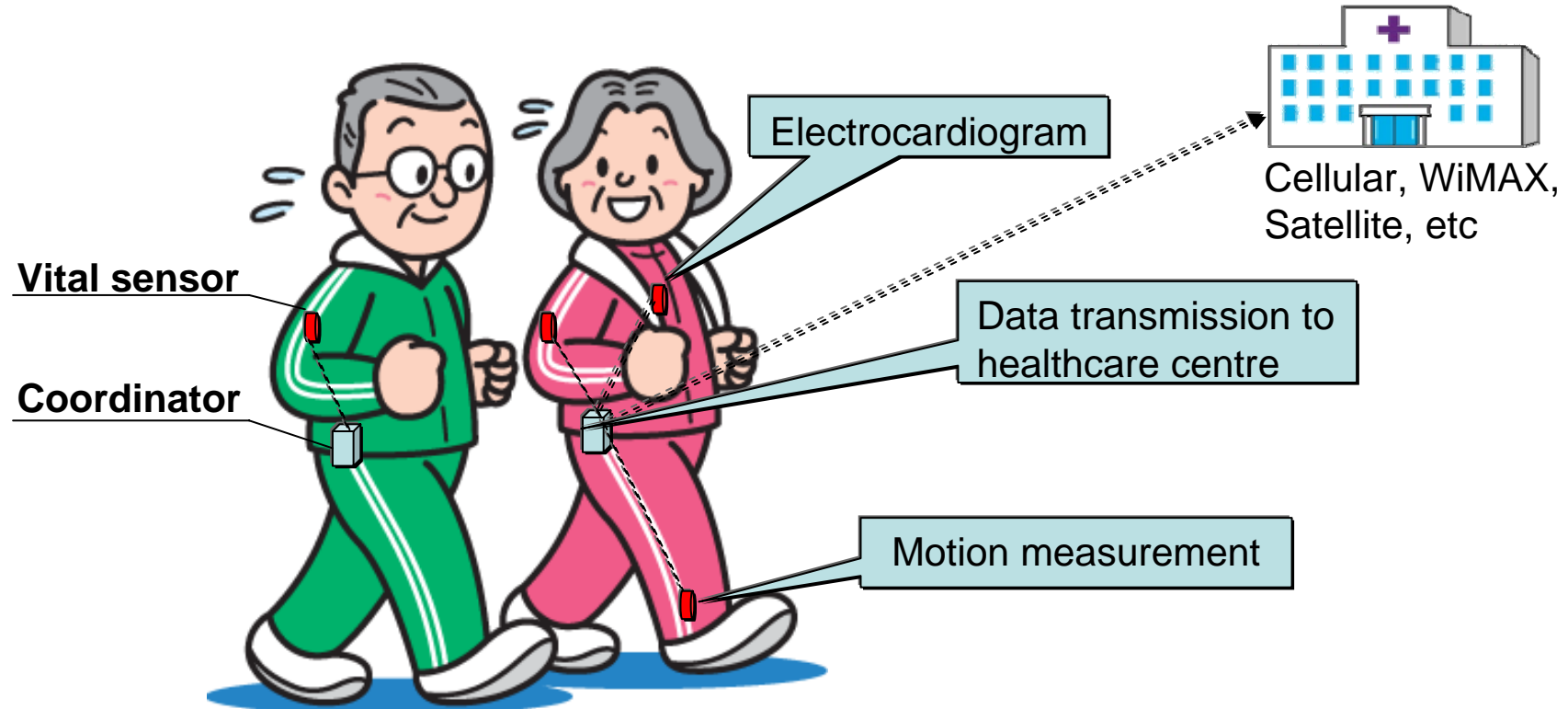
	% of total population aged 60 years or older	% of health care cost to GDP
1996	15.1 %	7.37 %
1998	16.0 %	7.88 %
2000	17.2 %	8.02 %
2002	18.4 %	8.58 %
2010	22.4 % (estimate)	???

Source: Ministry of Health, Labor and Welfare in Japan

- If number of hospital visit is reduced to that of 40 %, around 1.6 million US dollars medical expense would be saved in Japan
- How reduce number of visit ?
 - Well-known “**Wireless sensor network**” technology in ICT field
 - One possibility: **Medical/Healthcare system using Wireless Sensor Network**

A Solution: Telemedicine using Wireless Sensor Network on Human Body



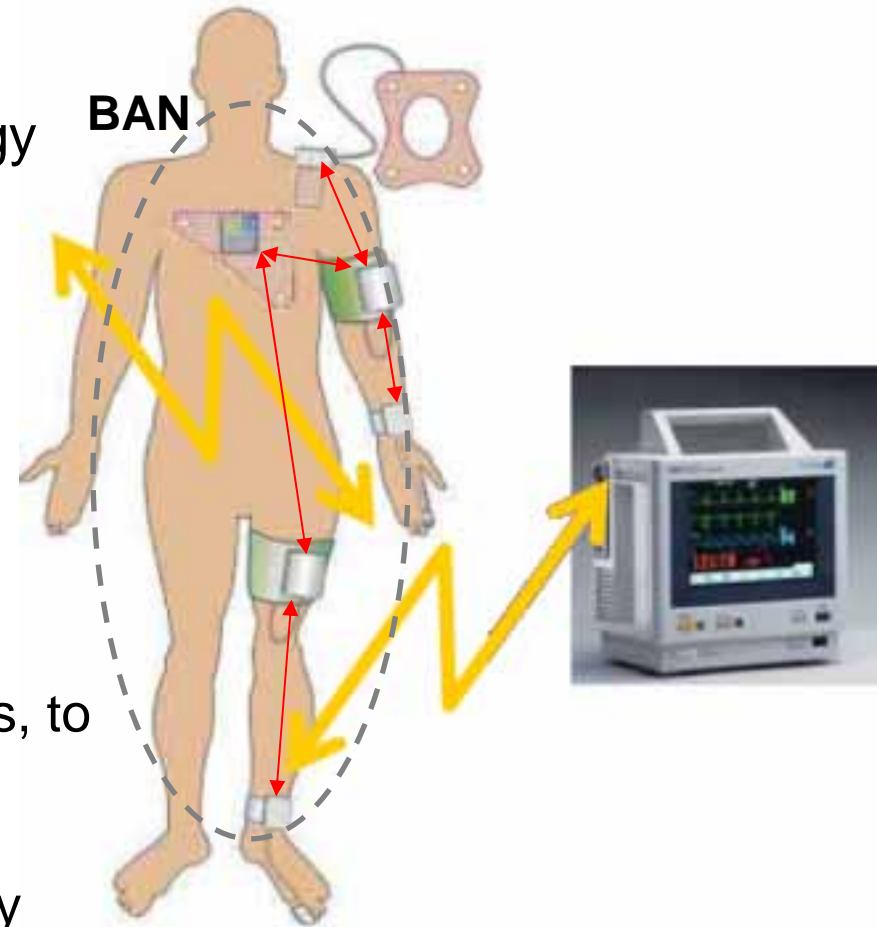
- To collect vital information wirelessly for use of health check and rehabilitation
- Over 24-hours all-day checking is available by wearing sensor NW anytime and anywhere
- When fatal alert is detected during vital monitoring, an ambulance, family and/or policeman could come to the patient automatically

What are features of Wireless Body Area Network ?

➤ A **wireless sensor networking** technology optimized for low power devices and operation **on, in or around human body**

➤ Features:

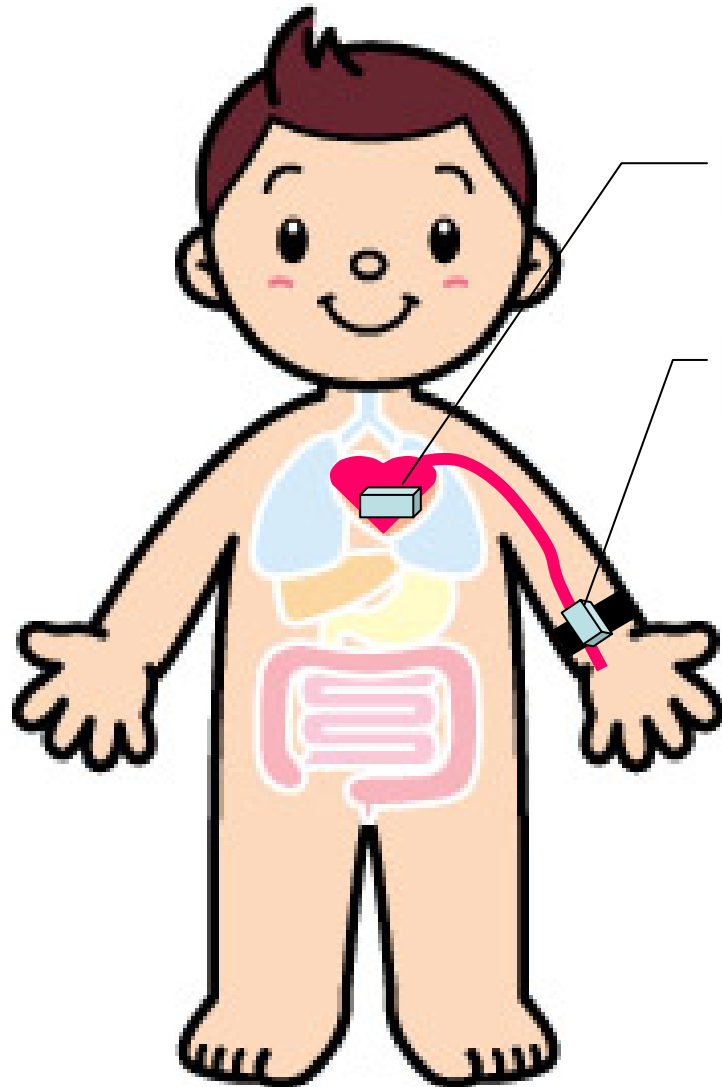
- (a) Wireless coverage: around 2-3 meters, corresponds to body size
- (b) High reliability and secure communications, to protect personal information
- (c) Specific absorption rate (SAR) should be considered to lower thermal influence to body
- (d) Low power consumption, for long battery use



**Wireless, Networking,
Low-power**

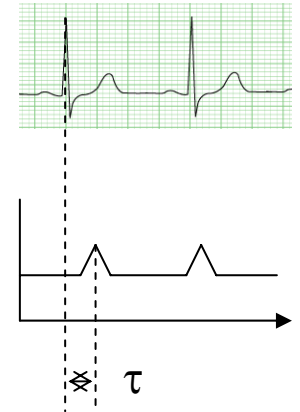
What can multiple sensors do?

A new potential for health measurement



Heart beat using electrocardiograph

Pulsation measurement for blood vessel



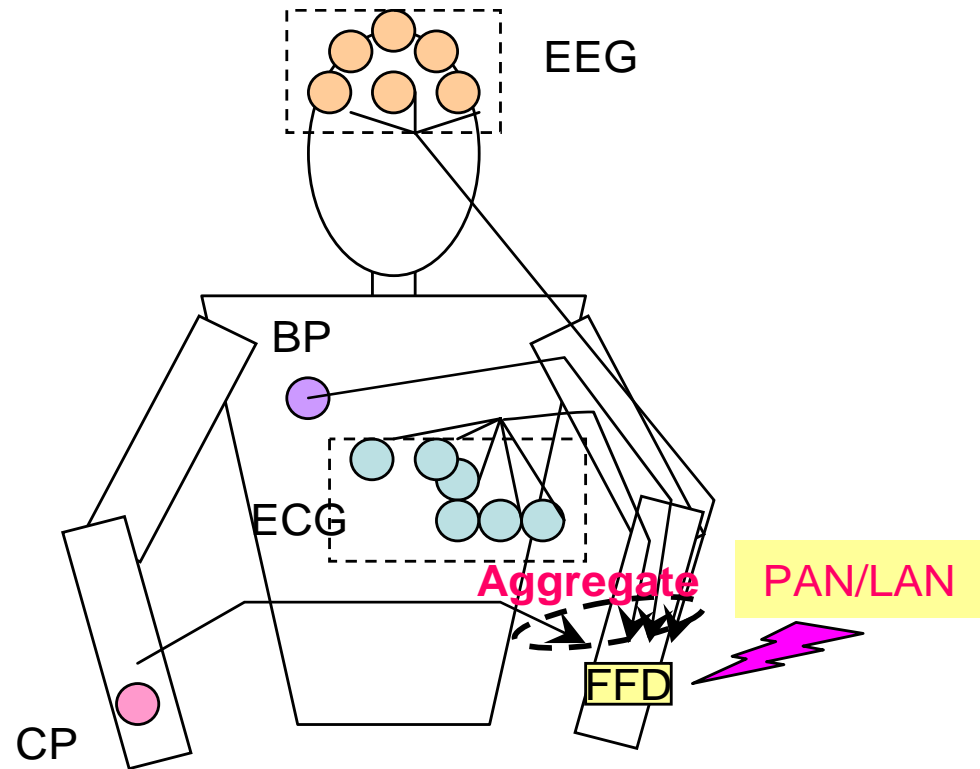
Time difference (τ) between two peaks
concerns **vessel condition** by principle of
hydrodynamics

e.g., harder vessel: smaller time difference

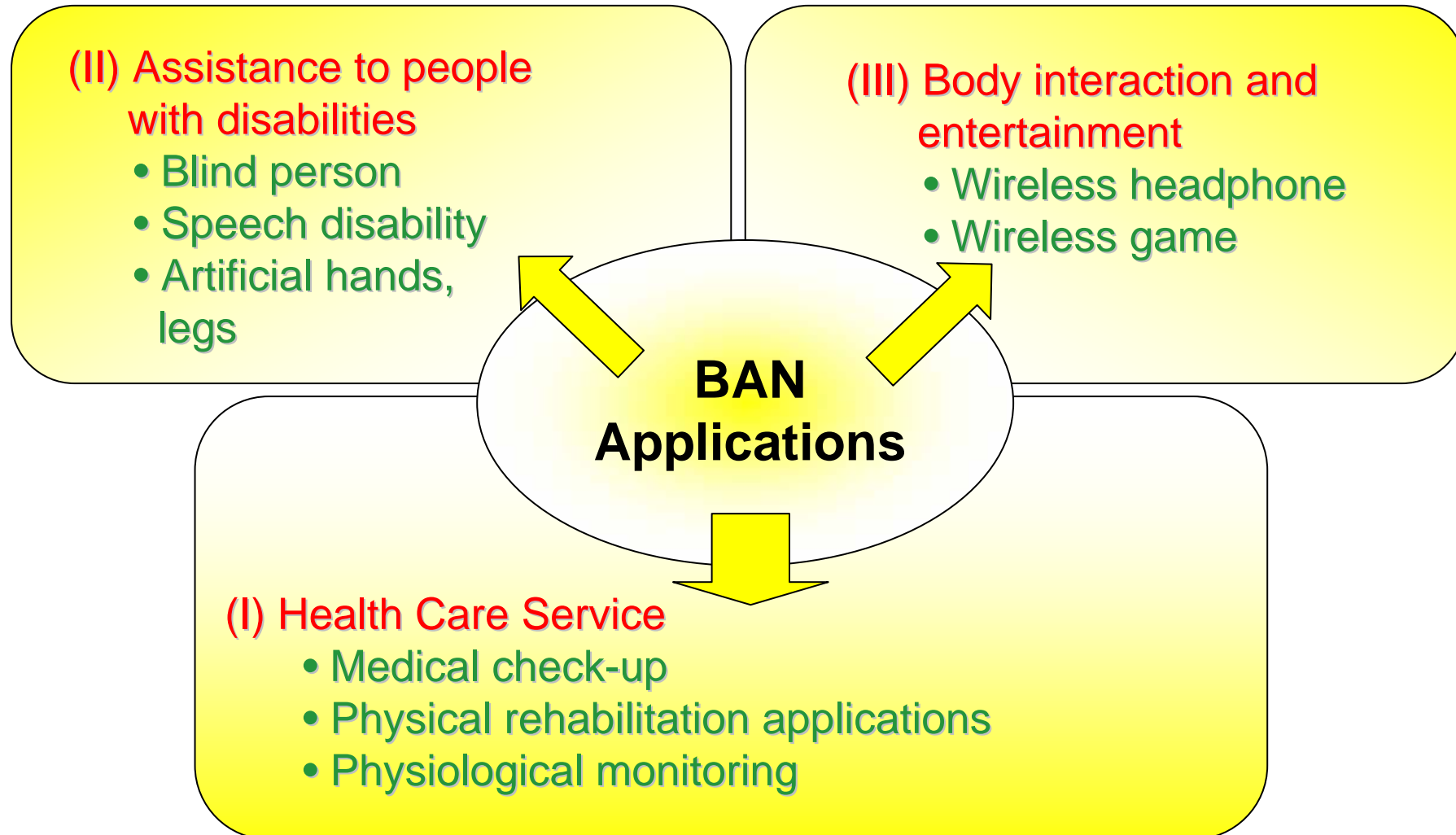
Point: **precise synchronization**
between BAN nodes

Vital Sensing Application

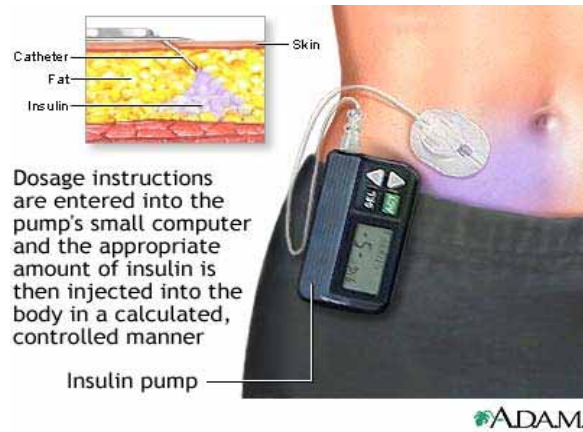
- Body temperature sensor
- Electroencephalogram (EEG) – Brain waves
- Electrocardiogram (ECG) – electrical activity of heart
- Motion sensor – motion of breath and body
- Blood pressure sensor (BP)
- Artery pulse sensor (CP) etc...



BAN Applications



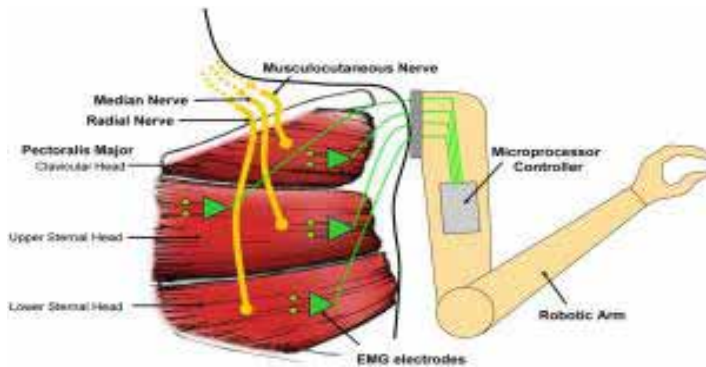
Other Application Examples



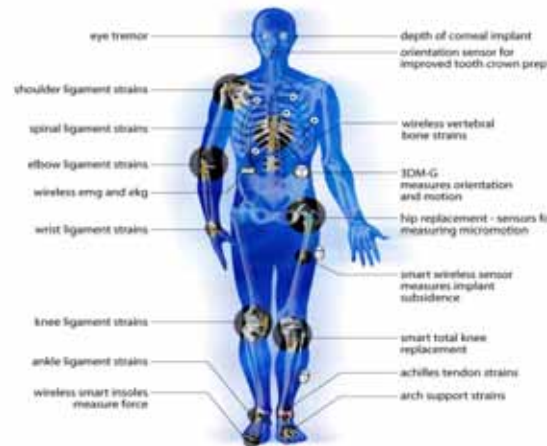
Remote control of medical devices
Insulin pump

Fitness monitoring
Pacing information etc.

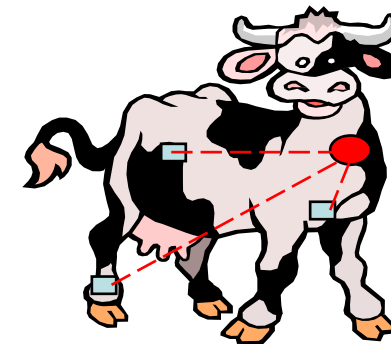
Wearable audio and video
Collaborative function



Disability assistance
Muscle tension sensing and stimulation



Implantable sensor
www.microstrain.com



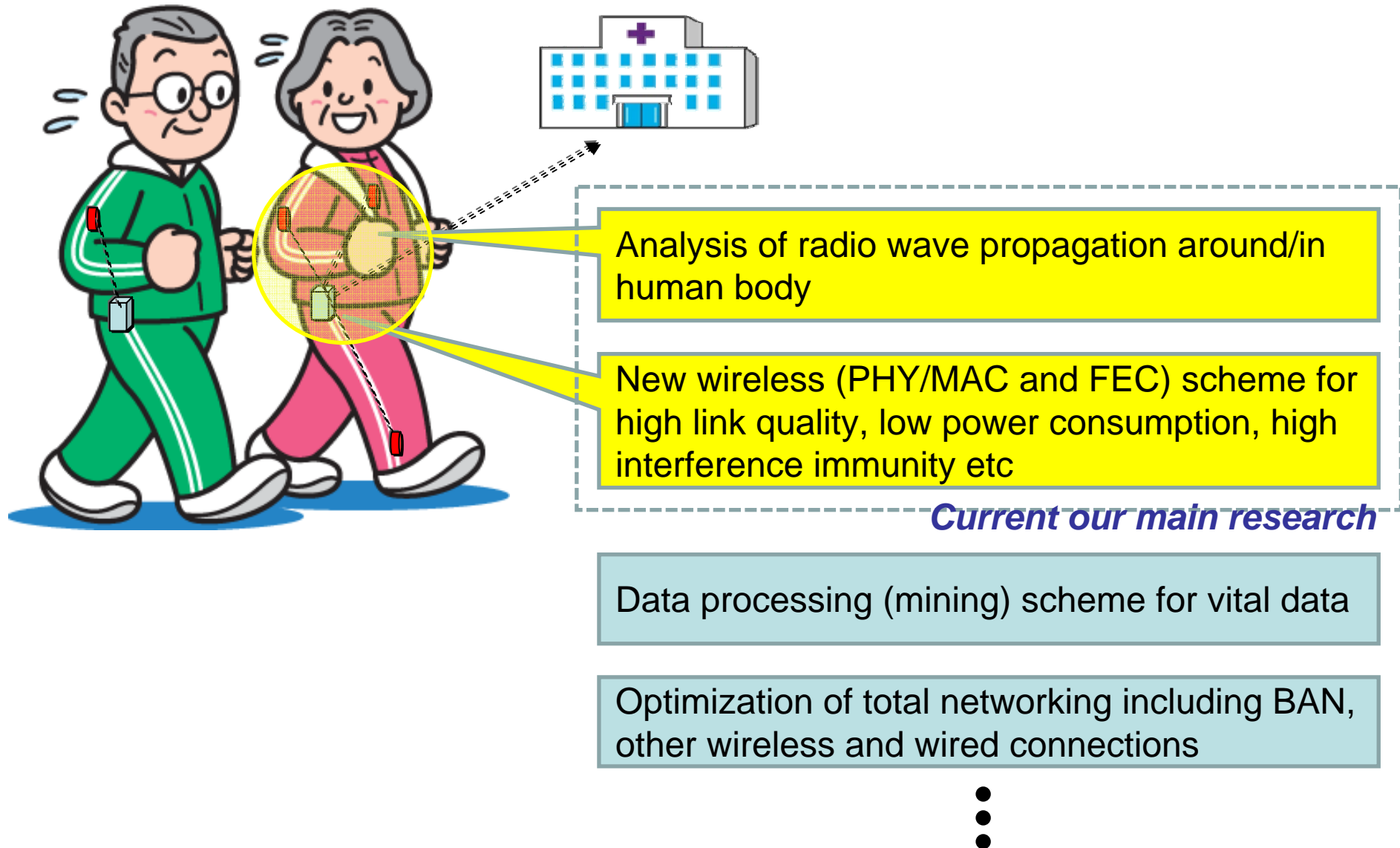
Animal applications
Health monitor and infectious disease control in early phase, e.g. bird flu

Medical ICT Project in NICT

- NICT established **Medical ICT Project** in 2006FY to promote R&D and standardization for Medical ICT
- Currently NICT is coordinating **Medical ICT Consortium** (15 Companies, 3 Universities and NICT) to make successful business models and to promote R&D by collaborating with industrial and academic partners



Research Subject



Experimental Study

- Development for wireless BAN to examine core technologies such as propagation modeling, small antenna, new PHY/MAC and FEC etc.

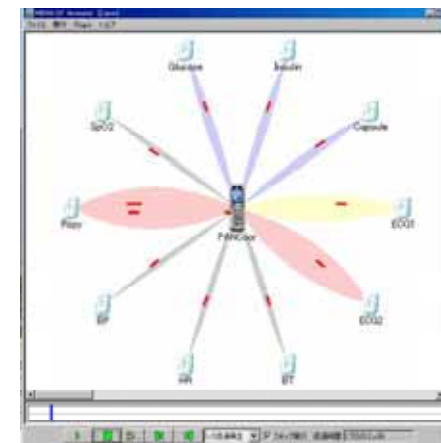
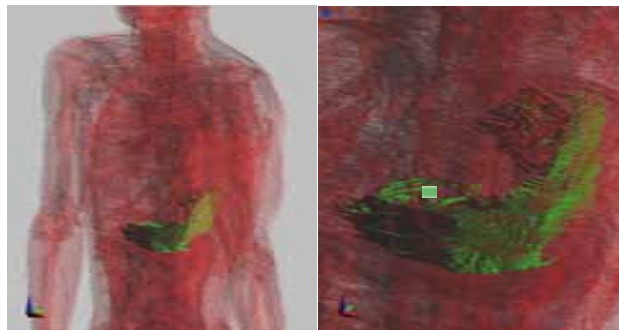


Development of a small antenna for BAN and propagation measurement using body-fantom



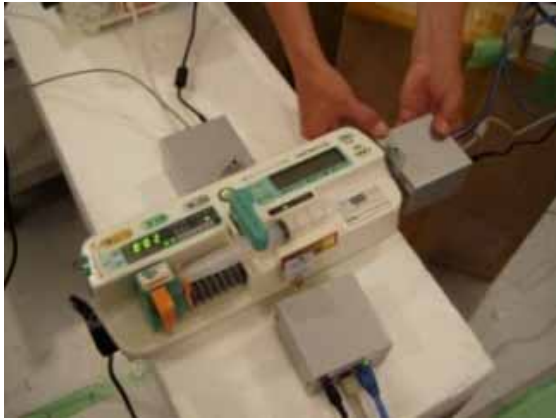
Experimental developments of BAN regarding several PHYs

- Surface-absorption-ratio (SAR) evaluation for human hazard using FDTD method



IEEE802.15.4 MAC evaluation on a software tool "MIRAI-SF"

Experimental Study



- Coexistence test between medical equipment and developed wireless system



- Electro-magnetic environmental measurement at operating room



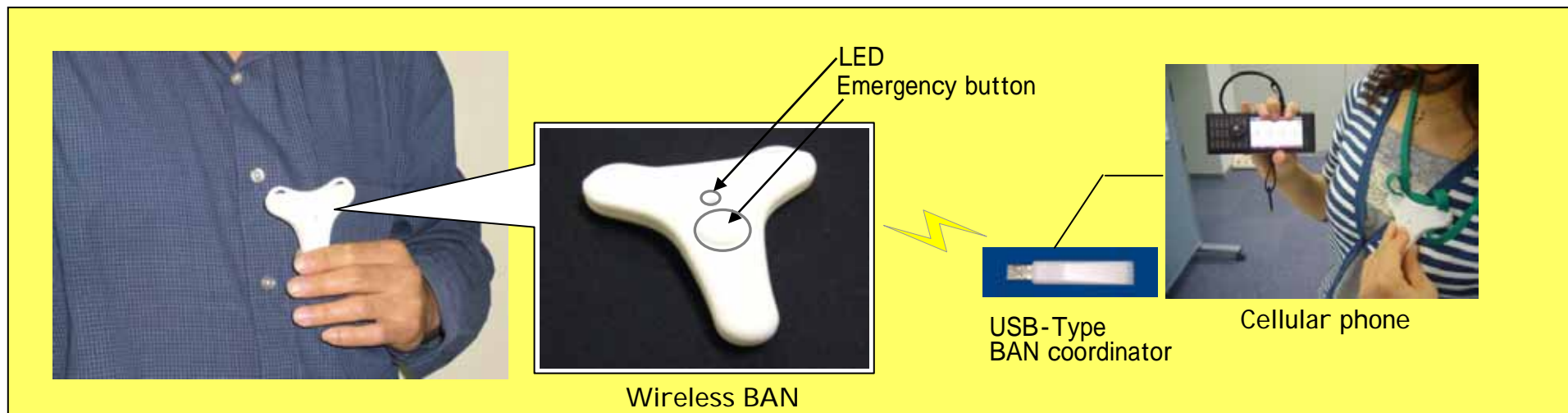
- Experiment using internet-satellite (WINDS) connecting to BAN for evaluation of future possible ubiquitous medical network

Pendant-Type Wireless BAN

(Developed by NICT)

4 Functions: electrocardiogram, motion (body pose) sensor, body temperature and emergency button

- ✓ Electrocardiogram and body temperature to check heart condition
- ✓ Motion sensor; detection of stumbling for elderly people
- ✓ Emergency button to call family, doctor and/or ambulance
- ✓ Incorporated NICT's low-computational complexity data-processing technology



Concluding Remarks

- According to population aging, *Medical ICT* will play important role, also can create a major market for industry and new R&D paradigm for academia
- *Medical ICT* is an innovative application for wireless technologies, because almost all advanced technologies, e.g. UWB, SDR ..., could be applicable to create more ideal wireless medical systems
- At *IEEE802.15.6*, PHY and MAC standardization of BAN is currently being discussed for realizing various applications; NICT is one of main contributors - refer to *IEEE802.15* web-site