Project: IEEE P802.15 Working Group for Wireless Personal Area Networks (WPANs)

Submission Title: [Response to IG-BAN's Call For Applications]

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Source: [Huan-Bang Li, Kenichi Takizawa, Bin Zhen, Kamya Yekeh Yazdandoost,, Shinsuke Hara, and Ryuji Kohno]

Company [National Institute of Information and Communications Technology (NICT)]

Contact: Huan-Bang Li.

Voice:[+81 46 847 5104, E-Mail: lee@nict.go.jp]

Abstract: [Discussions on some applications related to body area networks (BAN)]

Purpose: [To provide some application examples for BAN]

Response to IG-BAN's Call For Applications

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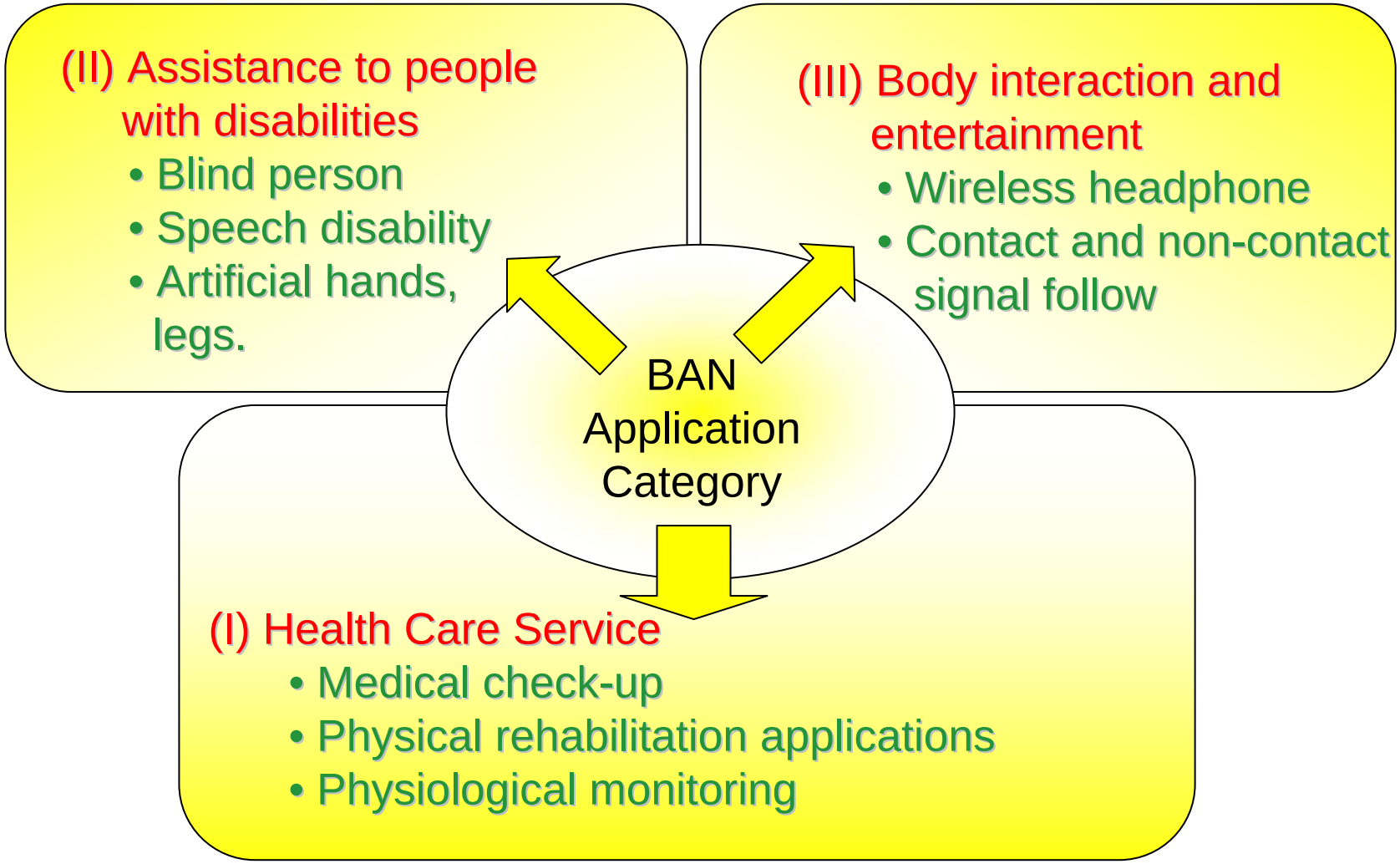
BAN Definition

The body area network (BAN) is a technology, that to provide interconnection of wearable lightweight sensors and/or actuators and/or devices attached to or in the vicinity of the body (< 2 – 5mters), depending on a person's need. The BAN can take a continuous measure and transmit a vital sign or body physiological data to facilitate the remote monitoring for the purpose of Health care service, Assistance to people with disabilities and, Body interaction and entertainment.

BAN Application Category



(I) Wearable Health Monitoring System

(1) Medical Check-up

- EEG sensors for monitoring brain electrical activity.
- ECG sensors for monitoring heart activity.
- A Breathing sensor for monitoring respiration.
- A blood pressure sensor.
- A carotid pulse sensor.
- Heart rate.
- SpO2.
- Body temperature.
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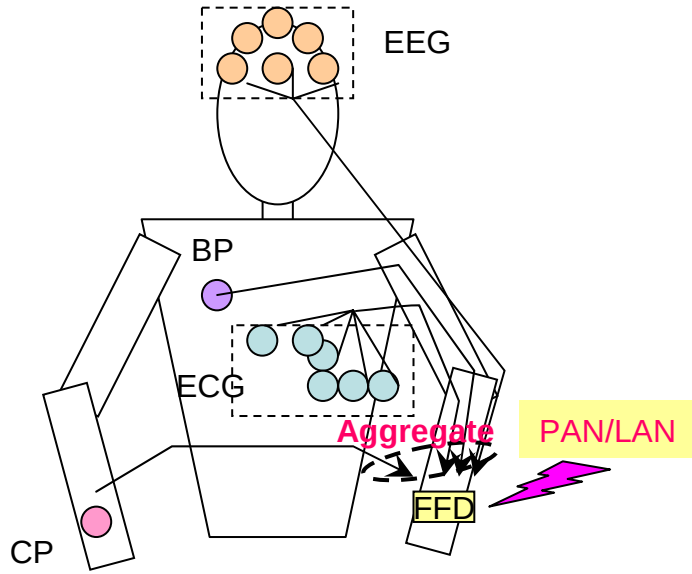

(I) Wearable Health Monitoring System
(2) Elder People Assistance

- **Tilt sensors for monitoring accident fall-down.**
- **'Foot' sensors for monitoring steps.**
- **A Breathing sensor for monitoring respiration.**
- **A blood pressure sensor.**
- **Movement sensors for monitoring activities.**
- **Heart rate.**
- **Body temperature.**
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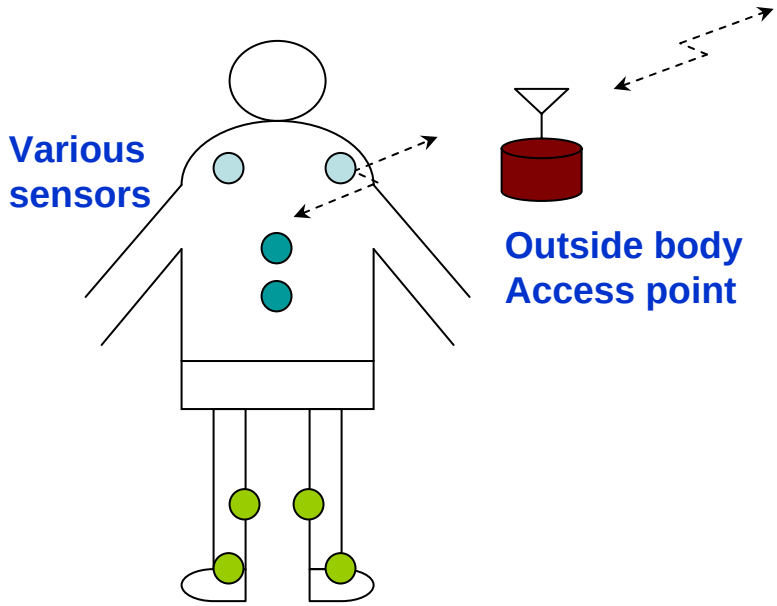
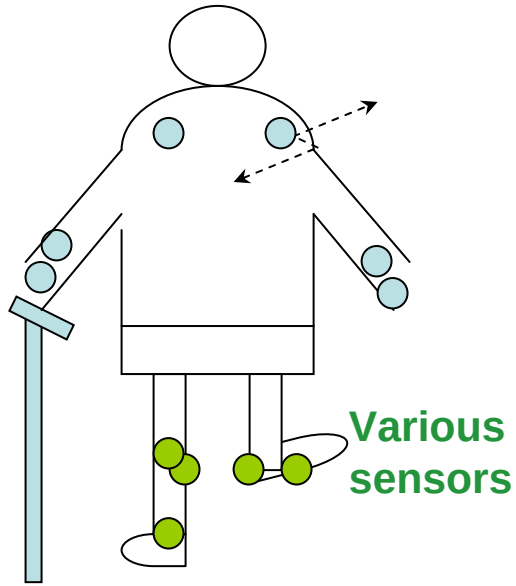


(I) Wearable Health Monitoring System

(3) Physical Rehabilitation

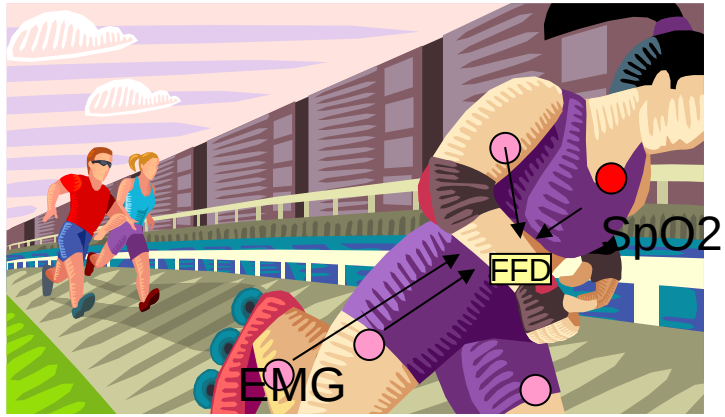
- **Tilt sensors for monitoring accident fall-down.**
- **'Foot' sensors for monitoring steps.**
- **Wrist and ankle sensors for monitoring safety.**
- **Movement sensors for monitoring activities.**

Starting protection mechanism or powering mechanic support system



(I) Wearable Health Monitoring System
(4) Physiological Monitoring

- A accelerate sensor for monitoring instant .
- A ‘foot’ sensor for monitoring steps.
- A Breathing sensor for monitoring respiration.
- A blood pressure sensor.
- A movement sensor for monitoring activities.
- Heart rate.
- Body temperature.
-



Electromyogram	
Dynamic range	50dB
Sampling rate	10kHz
Data rate	100kbps
# of sensors	10~

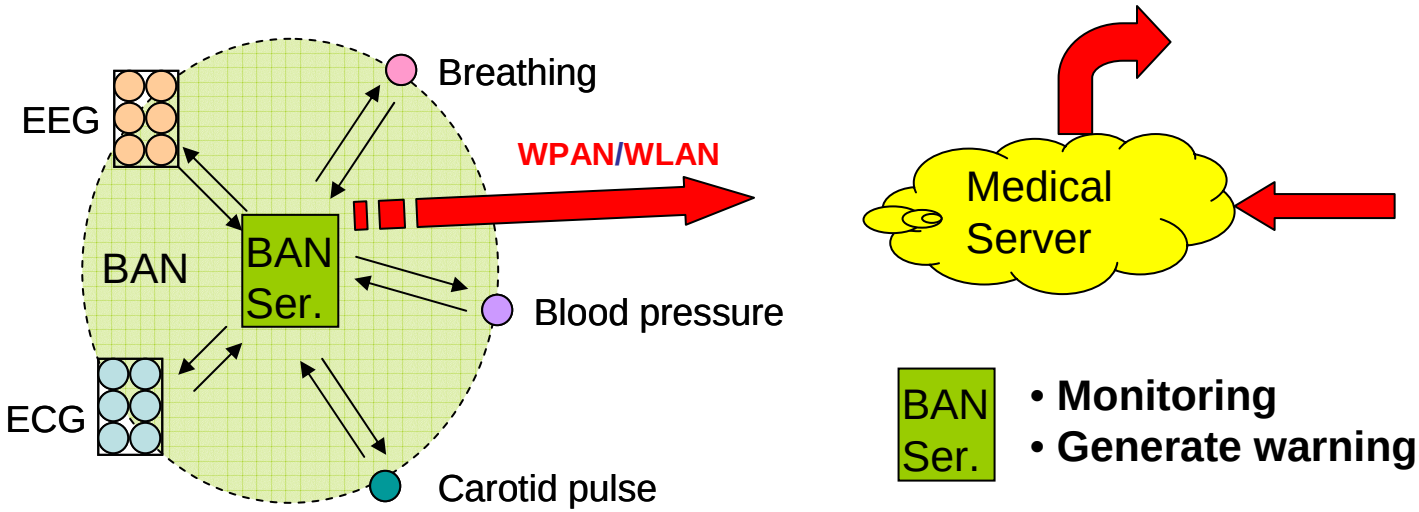
Acceleration, SpO_2	
Dynamic range	20dB
Sampling rate	1Hz
Data rate	~1kbps
# of sensors	single or array

(I) Wearable Health Monitoring System

(5) Supposed Technical Parameters

- **EEG ~ 10 kbps**
- **ECG ~ 10 kbps**
- **A Breathing sensor ~ 10 kbps**
- **A blood pressure sensor ~ 10 kbps**
- **A carotid pulse sensor ~ 10 kbps**
-

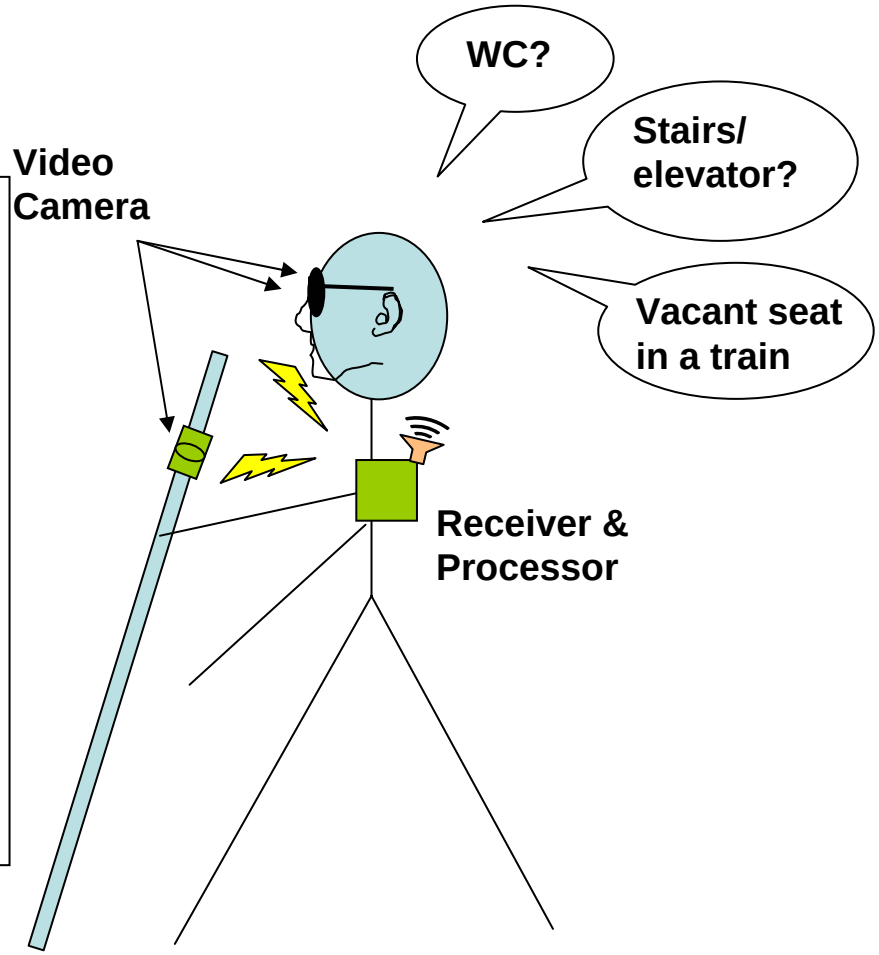
• Communication range ~ 2m
• Aggregate data rate ~ 1Mbps



(II) Assistance to People With Disability

(1) Blind Person Assistance --- Find Objectives

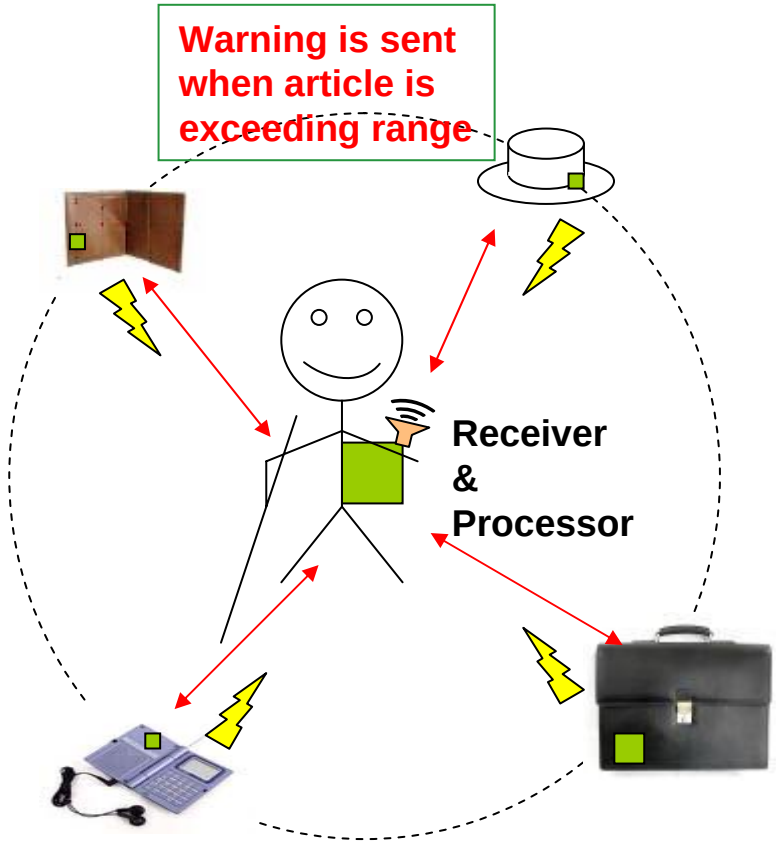
- ✓ Image transmission between camera and receiver (Several Mbps within 1.5 meters?)
- ✓ Image – Voice processing (High speed)
- ✓ Location



(II) Assistance to People With Disability

(2) Blind Person Assistance --- Check Belongings

- ✓ Warning message is sent when belongings reach a defined range
- ~100kbps within 1 - 2 meters.
- Positioning
- ✓ Network forming (to overcome blocking)?



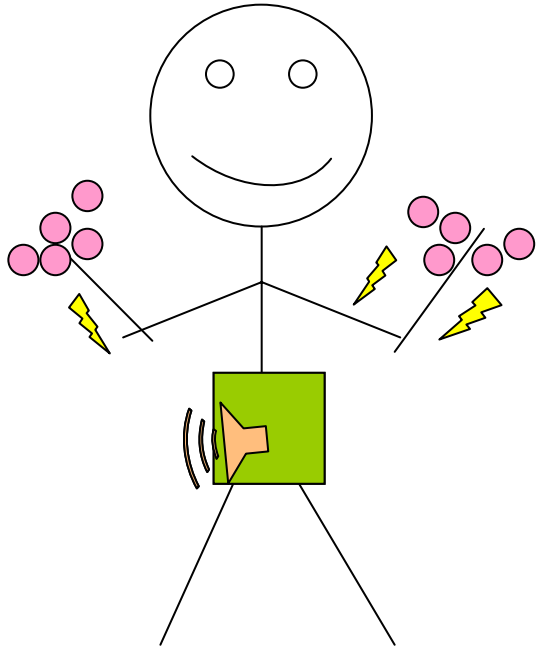
(II) Assistance to People With Disability

(3) Automatic sign language interpreter for speech-impaired person

✓ A system which interprets sign language into speech, by measuring the distances between sensors on body and fingers.

✓Movement sensors?

(~10Mbps within 1 - 2 meters?)

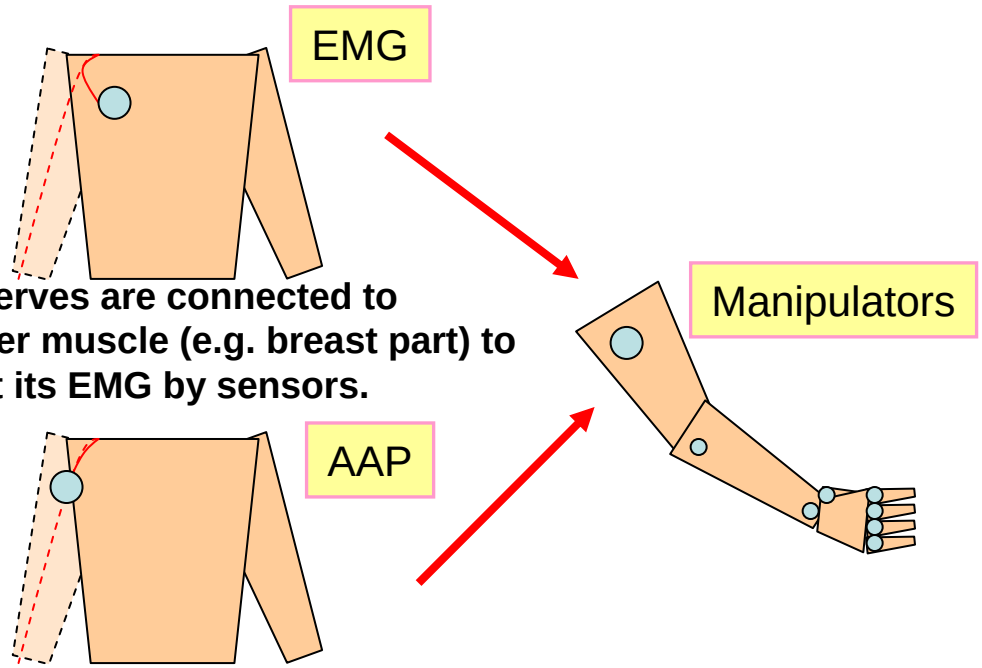


(II) Assistance to People With Disability

(4) Artificial hands

Electromyogram (EMG)	
Dynamic range	50dB
Sampling rate	10kHz
Data rate	100kbps
# of sensors	array

Axon action potential (AAP)	
Dynamic range	50dB
Sampling rate	20kHz
Data rate	200kbps
# of sensors	array



The nerves are connected to another muscle (e.g. breast part) to detect its EMG by sensors.

In this case, AAP (nerve signal) are directly measured by sensors.

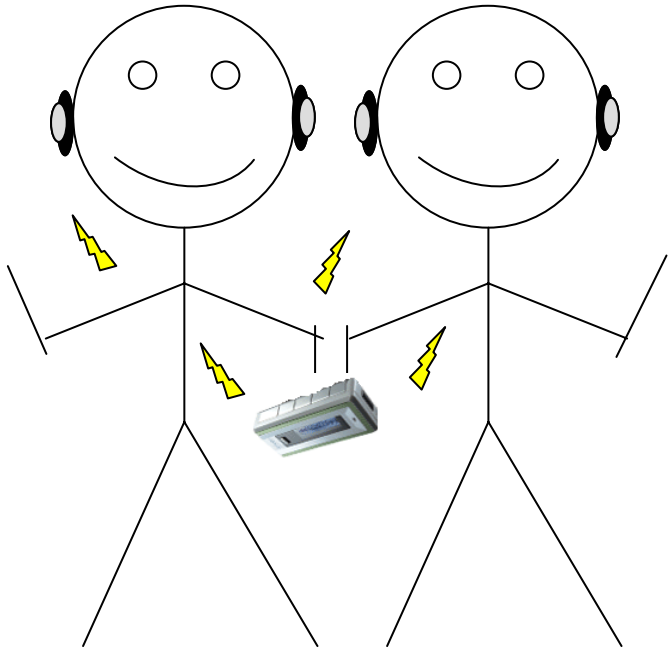
Aggregate data rate: ~10Mbps

Range: <2 meters

(III) Body Interaction and Entertainment

- ✓ Wireless headphone.
- ✓ Audio, video source sharing.

(~10Mbps within 1 - 2 meters?)



Conclusion

- Scope: attached to body and/or in the vicinity of body (2 – 5 meters).
- Data rata: up to several tens of Mbps.
- Different QoS requirements depending on applications.
- Plentiful application areas.