

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

Submission Title: [SG15.6a Application Matrix and Use cases for dependable social services based on BAN/5G/AI platform]

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Re: []

Abstract: [This document contains application matrix and focused use case for dependable social services based on BAN-base cloud network and AI data server for SG15,6a]

Purpose: [information]

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IEEE 802.15 SG15.6a

Application Matrix and Use cases for dependable social services based on BAN/5G/AI platform

Virtual Interim Meeting

September 15th, 2021

Ryuji Kohno

Yokohama National University(YNU),
YRP International Alliance Institute(YRP-IAI)

Proposed applications

1. Remote healthcare monitoring
2. Remote sensing and controlling
3. Vehicle internal sensing and controlling
4. Collision avoidance radar
5. Inter-vehicle communications and ranging
6. Wearable and implant wireless medical sensing and controlling
7. Applications for ultra wideband radio
8. Reliable and robust radio control
9. Wearable healthcare sensing
10. Secure remote healthcare and medicine
11. Wireless sensing system for Factory with feedback control
12. Dependable multi-hop inter-vehicle communications
13. Inter-navigation and inter-vehicle information sharing in normal and emergency conditions
14. Single wireless communication network solution that functions both in normal and in disaster environments
15. Disaster prevention, emergency rescue and recovery

Visualizing Portfolio of Focused Applications

Highly Life Critical Uses(High QoS)



Hospital Clinical Service

Remote Diagnosis for Factory Automation

QoS 1; Highest Priority of Dependability

Government Infrastructure

Home Medical Therapy

M2M

Remote Wellness & Well-being

QoS 2; Middle Priority of Dependability

Home & Consumer Uses

Industrial & Governmental Uses

Fitness Massage

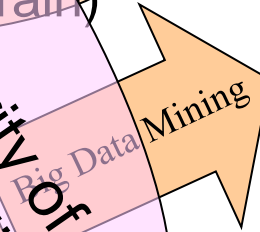
Remote Diagnosis of Infra(bridge/bldg./train)

Sports: Walking, Jogging, Bicycling, Hiking, Skiing etc

Disaster Analysis & Prevention

QoS 3; Relatively Lower Priority of Dependability

Remote Sensing & Controlling Mobile Robots



Less Life Critical Uses(Low QoS)

Three Classes of Focused Potential Applications

We have classified focused potential applications into three classes according to demands of dependability.

QoS 1 Class: Highest Priority Level for Demand of Dependability

1.1 Car Internal M2M

1.3 Remote Diagnosis in Factory

2.3 Professional Medicine

3.2 Public Safety

QoS 2 Class: Middle Priority Level for Demand of Dependability

1,2 Inter-vehicle M2M

2.2 Healthcare

3.1 Life Line (Water/Gas/Electricity Supply)

4.1 Remote Diagnosis of Infra(bridge/bldg./train)

QoS 3 Class: Low Priority Level for Demand of Dependability

2.1 Wellness, Wellbeing

3.3 Government System

4.2 Remote Sensing and Controlling Mobile Robots

4.3 Disaster Analysis and Prevention

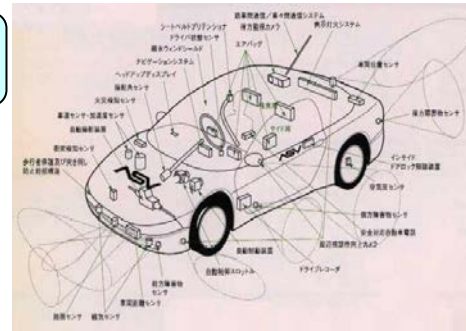
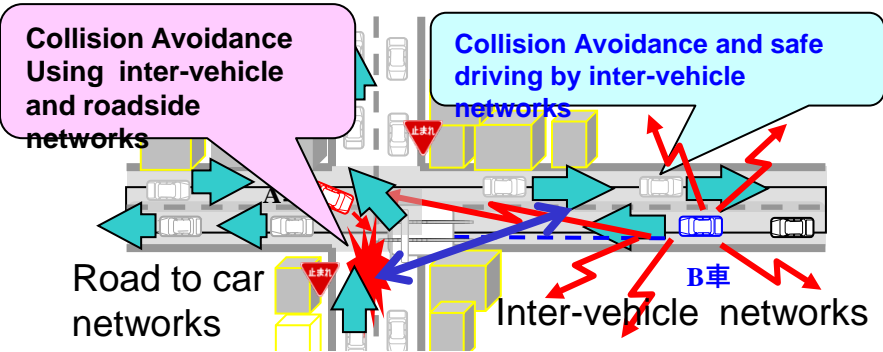
(Case 6) **Would a good wireless solution benefit your application?**

If yes, please describe the benefits you would like to realize

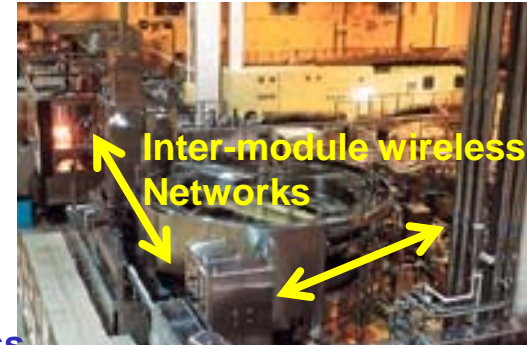
Wireless sensing **and controlling** system for Factory

1. Equipment Diagnosis System in Real-time with real-time feedback
 1. Real-time measuring
 2. Judge immediately with a certain threshold level
 3. **Feedback controlling**
2. Equipment Diagnosis System in Real-time (1)
 1. Real-time measuring and sending data in real-time
 2. Judge based on the comparison with the past data
 3. Analysis of big data
 4. **Feedback controlling machines in remote**
3. Equipment Diagnosis System in Real-time (2)
 1. Real-time measuring and sending data intermittently
 2. Judge based on the comparison with the past data
 3. **Database and data mining with cloud networking**

Possible Use Cases of Dependable M2M and BAN for Sensing and Controlling



Car LAN & Wireless Harness



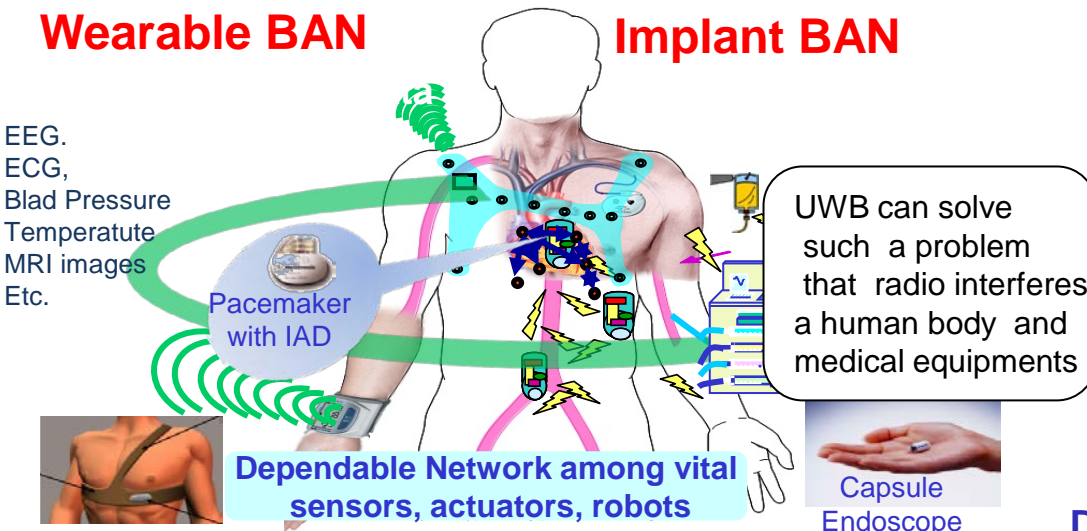
Factory Automation (FA)

Car Navigation & Collision Avoidance Radar
Dependable Wireless Networks for Transportation

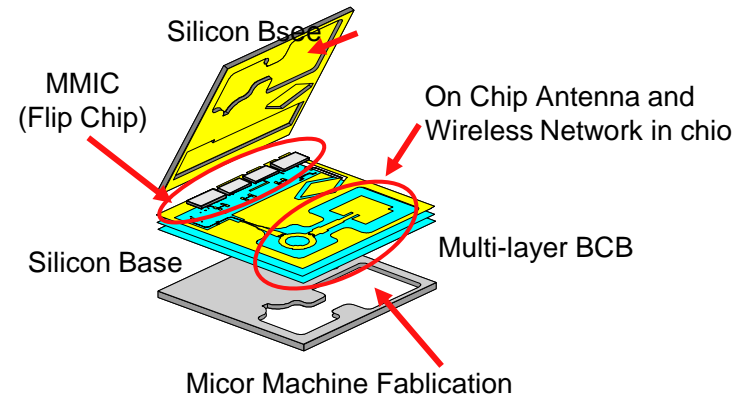
Dependable Wireless Sensing & Controlling for Manufacturing (CIM)

Wearable BAN

Implant BAN



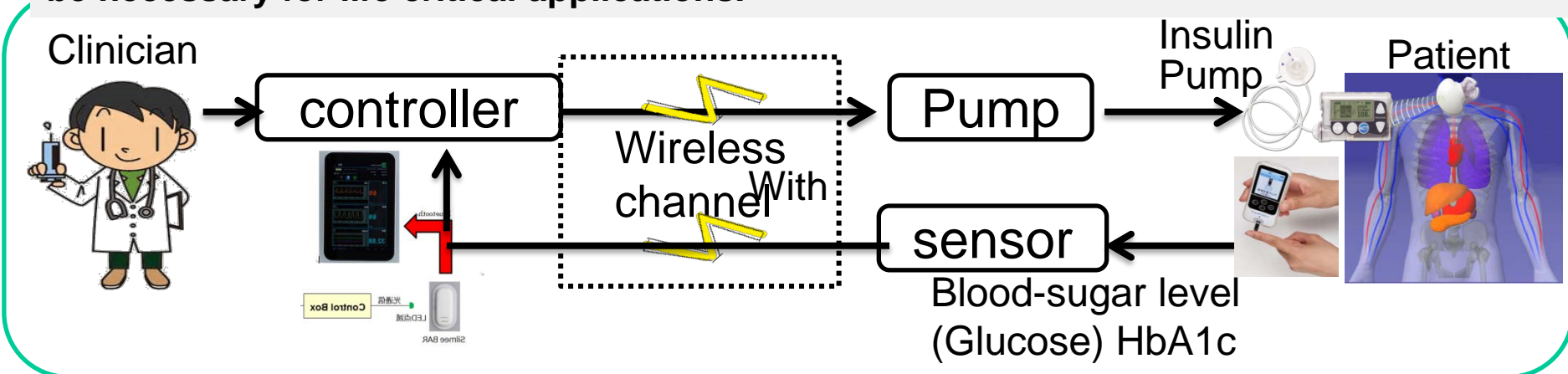
Dependable BAN for Medical Healthcare



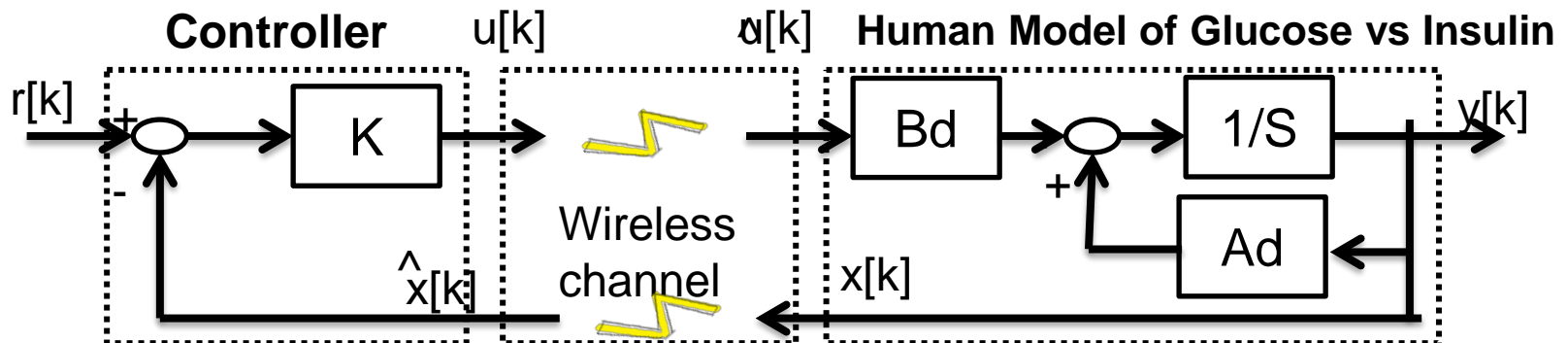
Dependable Wireless System Clock in Micro Circuit & Network in Devices

Automatic Remote Sensing Glucose and Controlling Insulin Pump for Diabetes Patients Using Wireless BAN

Wireless Feedback Controlling based on Cognitive Sensing with Dependable BAN must be necessary for life critical applications.



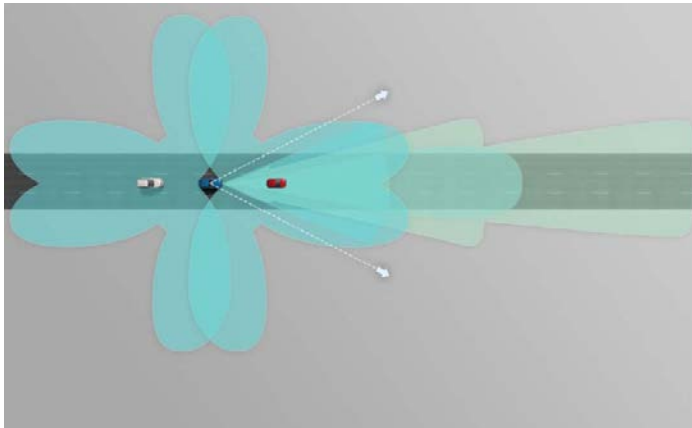
Wireless Feedback Sensing and Controlling Loop for Diabetes Patients



Feedback Delay Loop Model with Motion Equation

Dependable IoT/M2M for Advanced Driver Assistance Systems(1/2)

- 4-6 Mono Cameras
- 1-2 Stereo Cameras
- 2-4 Mid-Range Radar
- 2 Long Range Radar
- 8-16 Ultrasonic Sensors, 4 Wheel Speed Sensors
- Redundant Data Center
 - Number Crunchers for Data Fusion
 - ABS, ESP, ...
 - Some ECUs we can't tell you details today ☺
- Interaction with Powertrain, Body Domain, Navigation, Airbag, CAR2CAR, CAR2Infrastructure



Surround vision with redundant sensors



Automated Driving is leaving the Research Labs.
Soon it will be in mass production.



Does this look familiar to data centers?

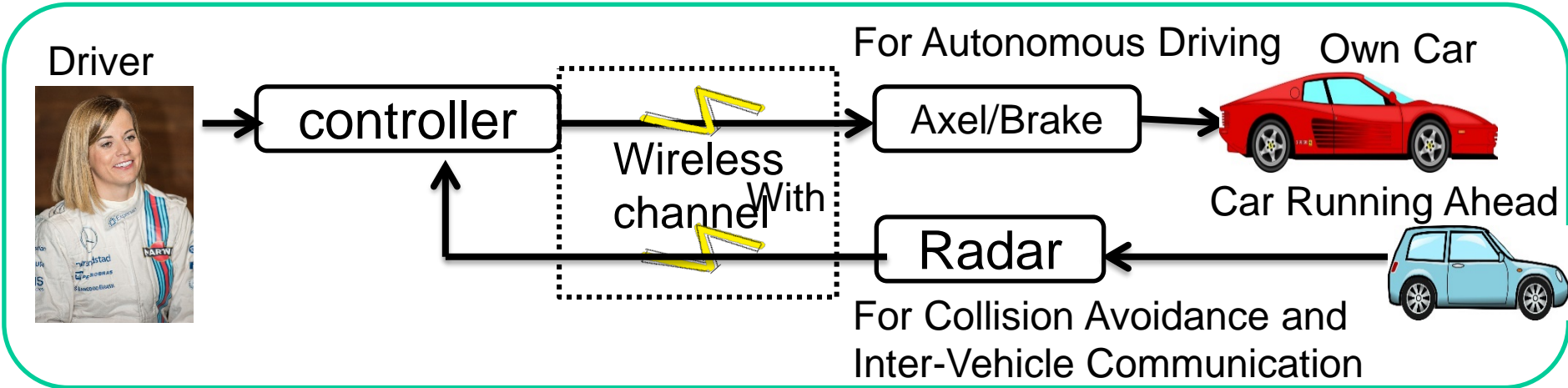
For automotive, Inter-vehicle communications(IVC) and Machine-to-Machine(M2M) inside a car like auto braking and autonomous driving must be core applications of Dependable M2M and IoT.

Dependable IoT/M2M for Advanced Driver Assistance Systems(2/2)

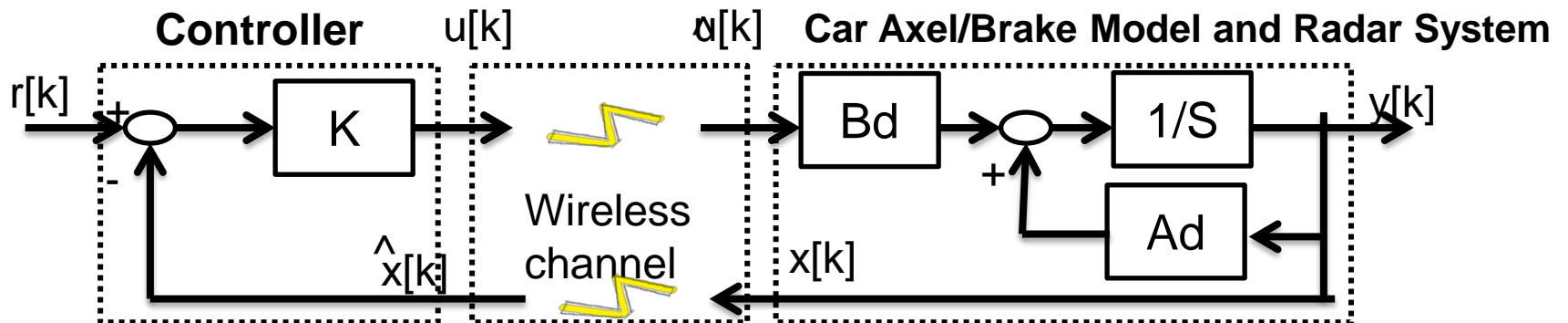


Demands for Internet of Things increase but Machine-to-Machine (M2M) should be reliable and secure, so Dependable BAN for Medicine must be good matched with Dependable M2M and IoT.

Collision Avoidance Radar and Automatic Braking Using Wireless Dependable M2M/BAN



Wireless Feedback Sensing and Controlling Loop for Autonomous Driving



Feedback Delay Loop Model with Motion Equation

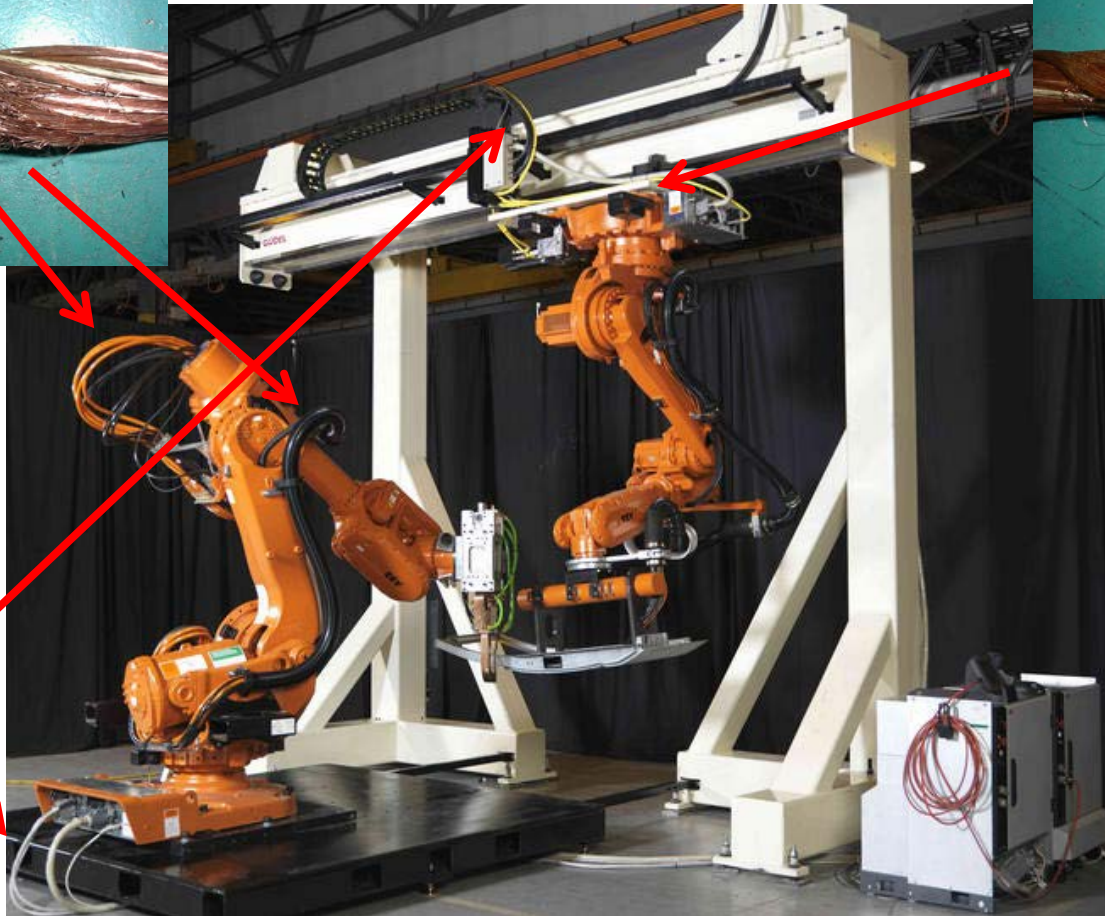
Response to CFI: Case 6

Hiroshi Kobayashi, Nissan Automotive Co. Ltd.

Update in Development of Wireless Sensing System for Factory

Doc.:IEEE802-15-15-0221-01-0dep
IEEE802-15-15-0711-00-0dep
IEEE802-15-15-0711-01-0dep
IEEE802-15-16-0077-00-0dep

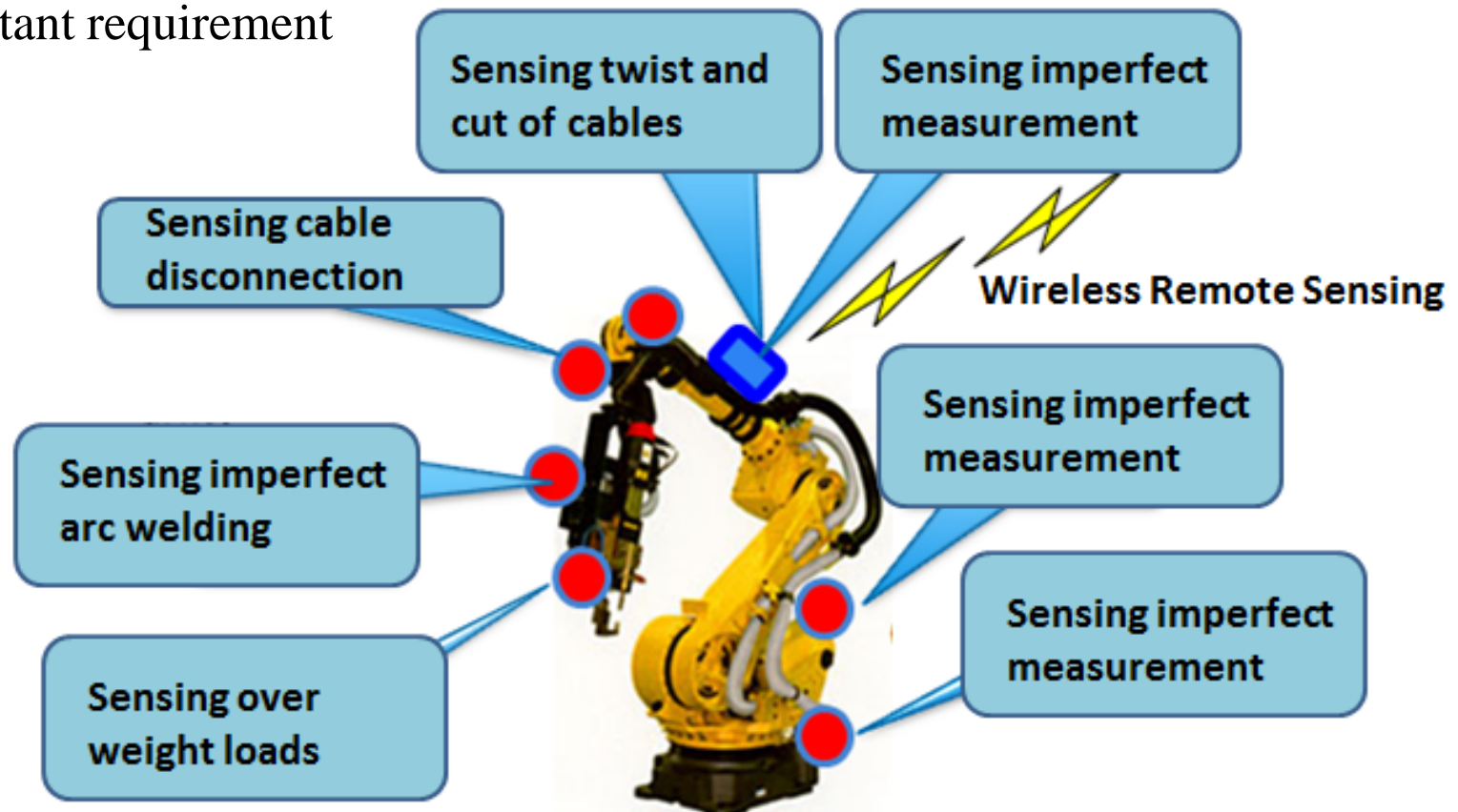
Use case 2; Detection of Twist and Cut of Cables



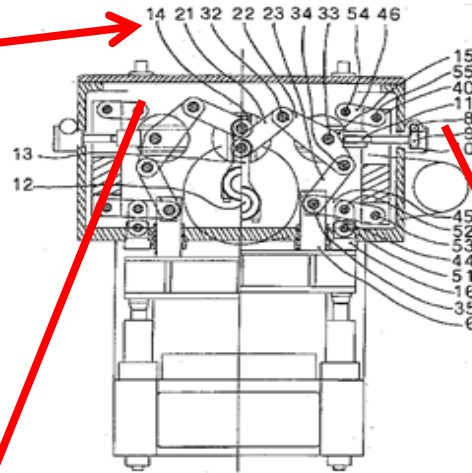
Prediction and Real-time Detection of twist and cut in signal and power cables

Use case 3; Real-time Monitoring or/and Controlling Robots

In order to improve QoS of controlling robots in factory lines, real-time sensing and controlling with permissible feedback control loop must be important requirement



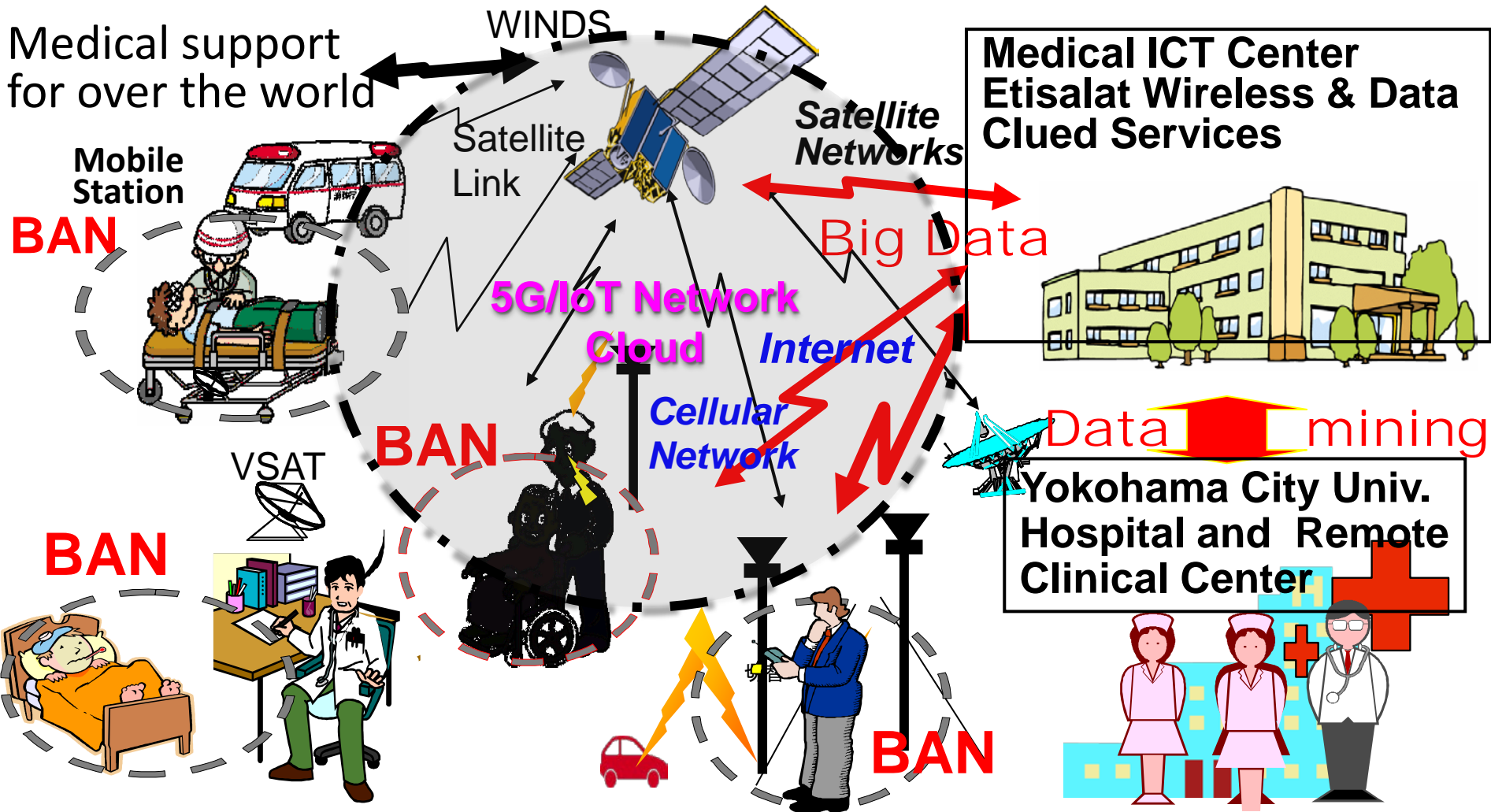
Use case 1; Detection of Cracks in Press Machine



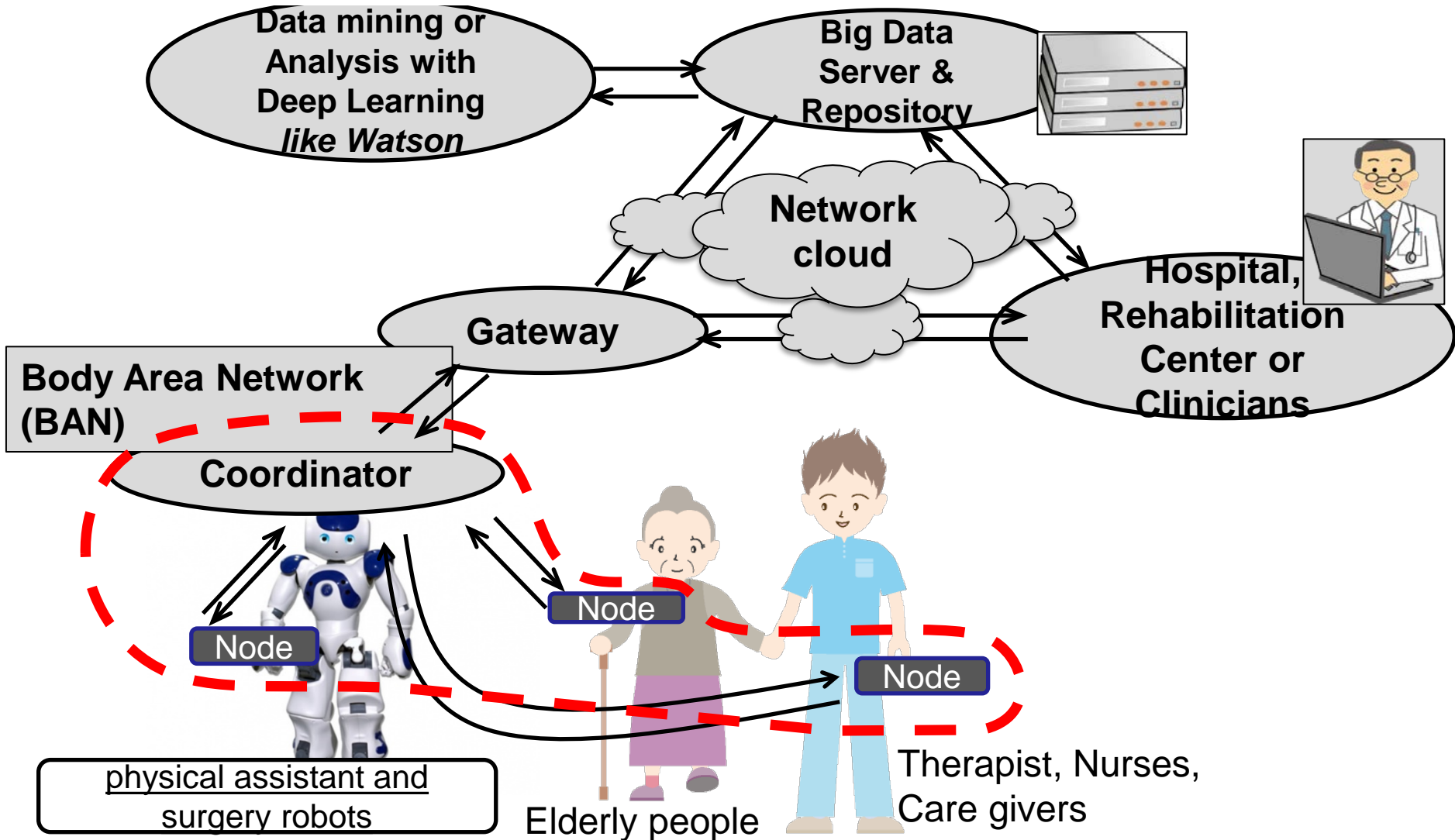
Prediction of cracks and any damages in press machines is keen to keep stable operation of lines in factory automation.



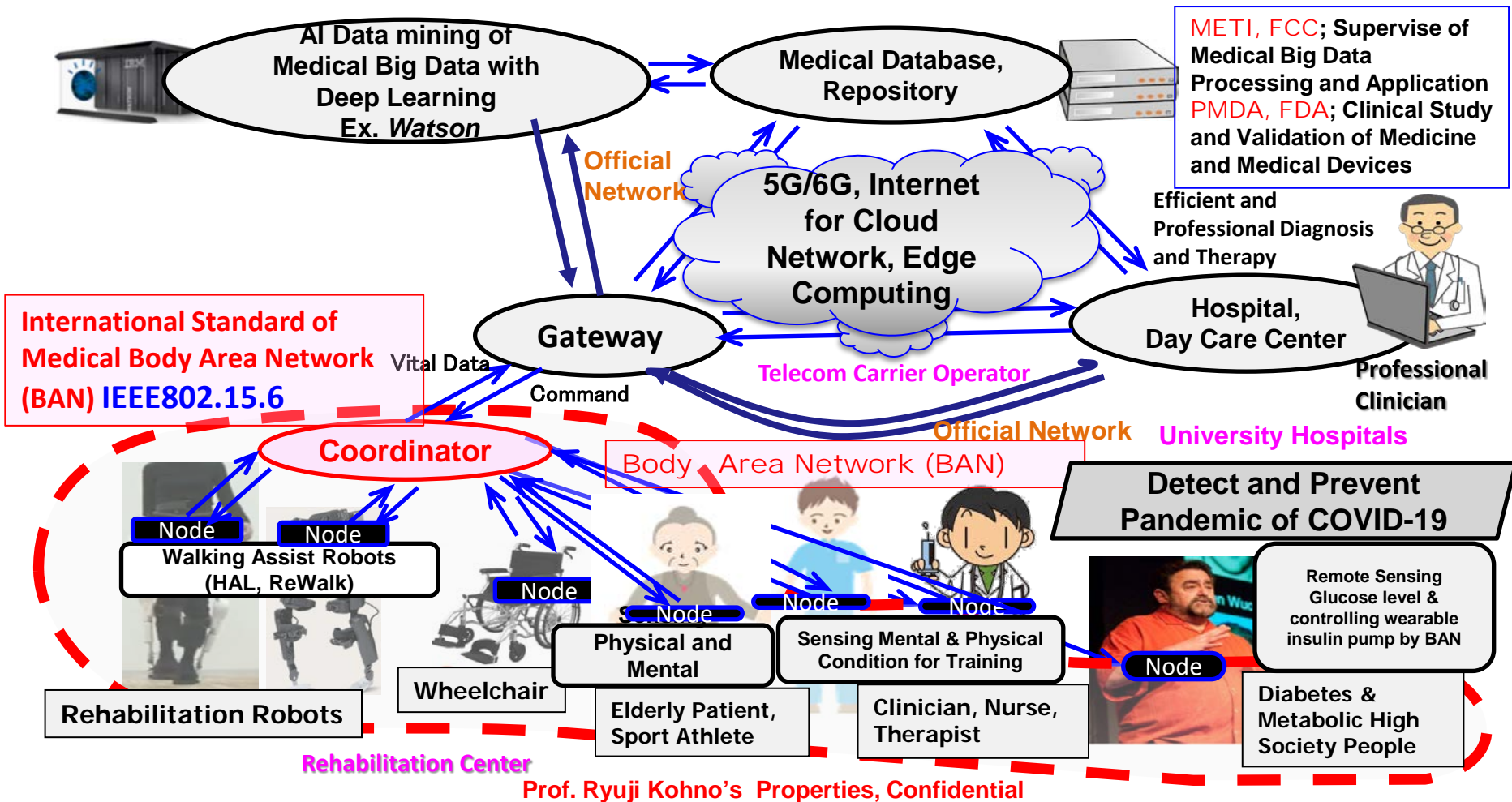
Remote Medicine; Medical ICT & AI with BAN



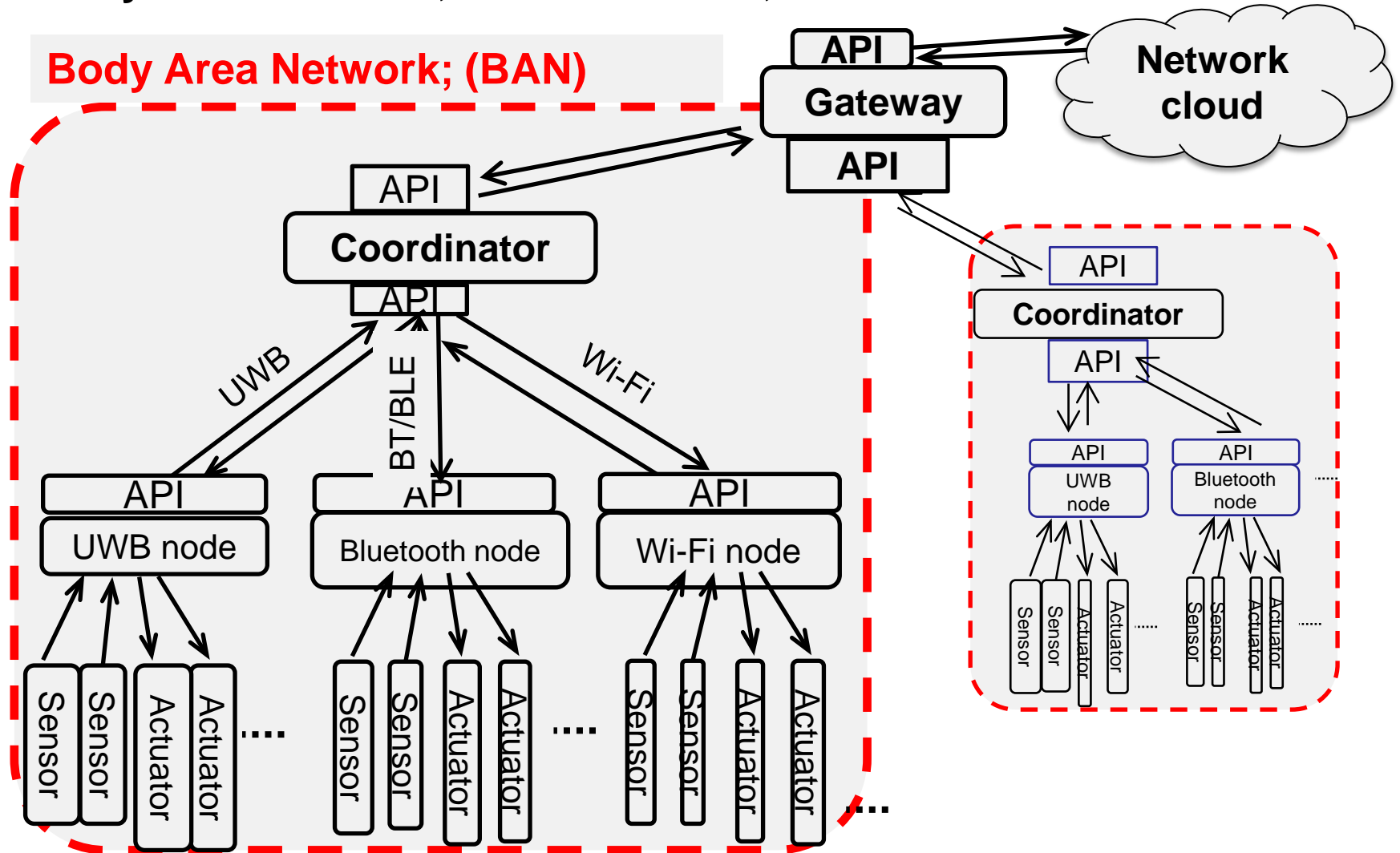
Platform by Wireless BAN, Network Cloud, Big Data Server with Data Mining for Elderly People Care



Universal Platform with Integrated ICT, Robotics and AI by Remote Sensing and Mining of Vital Data for High Quality of Life with Medicine, Wellness, and Sport



Medical Healthcare Data Mining and Networking Based on Universal Platform by Wireless BAN, Network Cloud, Data Server with AI Data Mining

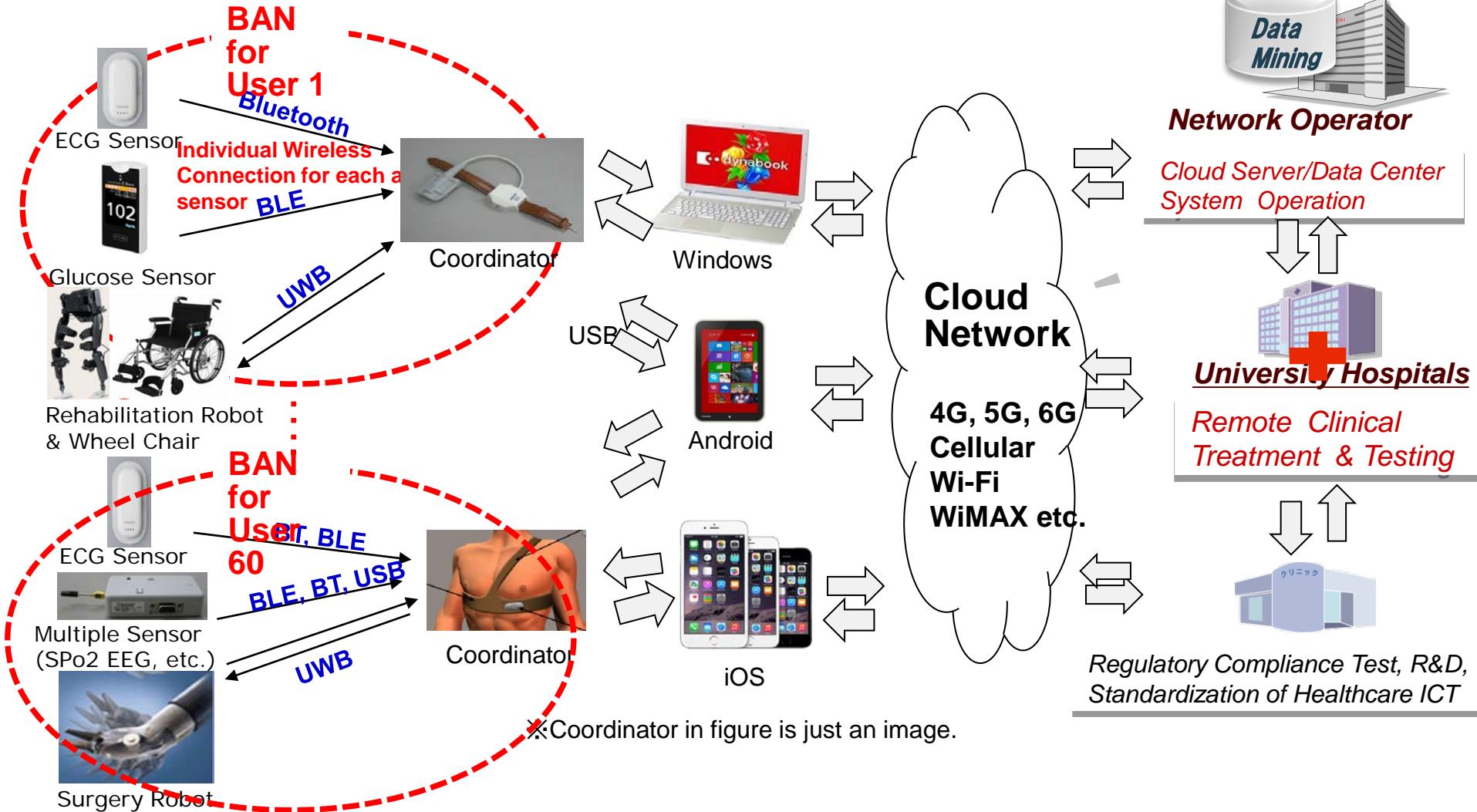


High Quality of Life by Parasports Supported by Wireless BAN, Network Cloud, Assisting Robots, AI Data Science

1. Guarantee Safe and Enjoyable Training and Games for Parasports ex. Chair Basketball & Ski
2. Fair Judgement of Sport Games with Wireless Sensing



Integrated Platform among Wireless BAN, 5G/6G Cloud Network and AI Data Servers





ISMICT 2020 - 14th IEEE International Symposium on Medical Information Communication Technology **Nara, Japan, 20-22 May, 2020**

Call for Papers

The 14th International Symposium on Medical Information Communication Technology, ISMICT 2020, aims to establish a forum to present new research and development results, exchange ideas, discuss practices, and share experiences among Technology and Medicine sides, including healthcare, wellness, clinical therapy, and surgery, as well as ICT, mechanical, and biomedical engineering. Moreover, activities of standard, regulation and business for medical ICT devices, systems and services will be promoted by national and international government and industry.

More information at: www.ismict2020.org

Important Dates

Paper submission deadline: 15th December 2019
Acceptance notification: 17th February 2020
Camera-ready paper due: 31st March 2020

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15th International Symposium on Medical Information and Communication Technology

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14-16 April 2021

Xiamen, China



Papers are invited on topics including, but not limited to, the following:

- Communications systems for medical applications
- Body area network (BAN) technologies
- Privacy and security issues
- Wearable and implantable devices
- Wellness and sports training
- Medical device regulatory science
- Pervasive health care and patient monitoring
- Cybersecurity in healthcare
- Internet of Medical Things
- AI/data analytics for medicine, healthcare and welfare

Authors are invited to submit full papers of 4-6 pages. The review process is according to the IEEE regulations and accepted papers will be included in the IEEE Xplore.

More information at: www.ismict2021.org

Important Dates

Paper submission deadline: 31, Dec, 2020
Acceptance notification: 15, Feb, 2021
Camera-ready paper due: 1, Mar, 2021
Conference Date: 14-16, April, 2021



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**SCOPE**

Internet of Medical Things (IoMT), healthcare cybersecurity, biomedical informatics, and molecular communication and computing for medicine are the focus of the 16th International Symposium on Medical Information and Communication Technology (ISMICT) to be held in Lincoln, Nebraska, USA, May 2-4, 2022. The theme is New Dimensions into Healthcare and Medicine. Papers are invited on topics including, but not limited to, the following:

- AI/Data Biomedical Analytics
- Bioinformatics and Systems Biology for Medicine, Healthcare and Welfare
- Bio/Molecular Communication and Computing for Medicine
- Body Area Network (BAN) Technologies
- Communications Systems for Medical Applications
- Cybersecurity in Healthcare
- Information Theory and Processing for Biomedicine
- Internet of Medical Things and Bio-Nano Things
- Medical Device Regulatory Science
- Nanocommunications and Nanonetworking for

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PAPER SUBMISSION

Authors are invited to submit full papers at ismict2022.unl.edu (will be active soon...) in accordance with the following schedule:

September 15, 2021	Paper submission deadline
Feb. 25, 2022	Paper acceptance notice
March 31, 2022	Final paper due