ICT at the Hospital

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ICT at the Hospital

1. ICT in the Hospital
2. What is HBC
   (human body communication) ?
3. The VAD Telemetry System
4. Communication between Person and Robot
   using Human Body Communication

1. ICT in the Hospital

Team Medical Care チーム医療

Patient
患者 ↔

- Medical Doctor 医師
- Nurse 看護師
- Laboratory Technician 研究員
- Therapist 医学療法士
- Clinical Engineer 臨床工学技士
- Skiagrapher 放射線技師
- Pharmacist 薬剤師
- Dietician 栄養士

The cooperation of each person at the Hospital is necessary as medical care team.
近年の病院ではチーム医療体制を組んでいる.

Current Wireless Systems in the Hospital
病院に導入されている無線システムの現状

- PHS (personal handyphone system) : Communication between medical staffs
  病院内の連絡で主に用いられている.
- 13.56MHz RFID : Management of people, medicines and medical instruments.
  職員の立ち入り制限地域への入・退室管理
- Wireless LAN : Connect to the Internet　インターネットへの接続
- PDA (personal digital assistance) : Prevention of discernment mistake of patients, medicines, etc.
  看護師の負担を軽減するために導入 → 投薬ミスや患者の取り違えミスの防止
- Wireless communication devices installed into the portable medical equipment
  可搬型検査機器への無線通信機能の導入 → 検査結果を HIS に無線で伝送
- A small 400MHz wireless data communication module is installed into the vital sensors to send vital data to the nurse station.
  生体情報モニタリング : 400MHz無線通信でで患者の心拍数, 呼吸数, 動脈血中酸素飽和度(SpO2)の情報を, 常時, ナースステーションに伝送し, 集約的に管理する.
- Pager : Call Patients in the hospital　病院内にいる外来患者の呼び出し

Current Wireless Systems Situation in the Hospital
病院に導入されている無線環境の現状

- Everybody can understand to use wireless communication systems, in order to work efficiently with the small number of doctors and nurses of in the Hospital.

  医師と看護師が病院で重労働から開放されるために, 誰もが, 無線通信システムの導入は必要と考えている.
- However, doctors and nurses are negative to install a wireless system in the Hospital, because they are anxious the possibility of interference between medical equipment and wireless equipment.

  しかし, 医師, および看護師は, ワイアレスのシステムを病院に導入することに消極的である. なぜなら, 彼らは医療機器と無線通信機器間の干渉を心配しているからである.
- As doctors and nurses do not have knowledge in wireless, wireless technology education is necessary for them.

  病院において, 医師と看護師は無線通信の知識を持っていないので, 彼らへの教育が必要である.
- Propagation environment in the Hospital is not so good. Each room is isolated by shield wall, and electric wave is barred by many pieces of equipment in the room.

  病院内の個々の部屋は壁の中のシールド板で電磁的に分離されているので, 電波伝播環境は良くない.

Recent Wireless Situation in the Hospital
近年の病院での無線通信事情

- A hospital has come to attain cost effectiveness of management, and does not buy expensive wireless equipment as before, but economical price one.
  病院内で用いる機器も，安価なものが購入されるようになってきた.
- Doctors and nurses are attaching greater importance to safety and certainty rather than to wireless communication regulation.　病院は電波法よりも安全性，確実性を重視している.
- Places in the Hospital are increasing, where we can use the Cellular Telephone and WiFi.
  病院内で携帯電話や無線LANが使える場所も増えてきている.
- WiFi systems receive interference from the microwave medical treatment equipment. (2.45GHz，100W output)
  医療用マイクロ波治療器(2.45GHz，100W出力)からの干渉がある.
- Electromagnetic Shield Board is installed in the wall between Room and Room.
  部屋と部屋の間は電磁的に干渉し内容に，壁はシールド板が入れられている.
- Optical Communication uses between Room and Room.
  部屋と部屋の間の通信には，光通信が用いられている.

ICT Security Countermeasures
病院でのセキュリティ対策

- Countermeasure against unjust connection
  不正接続対策
- Countermeasure against an inaccurate user
  不正ユーザ対策
- Countermeasure against hacking (hackers)
  ハッキング対策
- Countermeasure against data destroyer
  データ破壊対策
- Countermeasure against data viewer by eyes
  表示情報を目視で盗まれる場合の対策

The Reason why RFID did not use for Location Detection of Medical Equipment in the Hospital

RFID による医療機器の位置管理が導入されない理由

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- Medical Equipment Administrators want to know not only the position of medical equipment in the Hospital, but also the information of under use of the medical equipment, and whether it is finished using. It is the problem that the medical doctor keeps the medical equipment in his consultation room, which he has not been using for the long time

病院では医療機器の位置の把握も必要であるが，その医療機器が使用中か，使用が終わったものなのかが，本来，知りたい情報．病院内で医療機器が有効に使われていないことが最も大きな問題．（位置情報だけではほとんど情報の価値がない．）

- RFID system cannot be tracked when medical equipment is out of the hospital.
  病院外に出てしまうと位置管理はほぼ不可能．

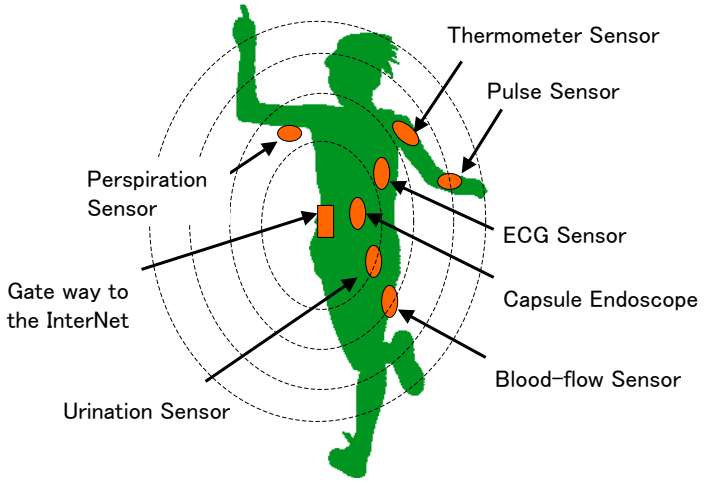
- Transmitting output power of RFID reader is approximately 1 Watt, and is too much power to cause interference with medical equipment.
  RFID リーダ・ライタの送信電力が非常に大きいので，他の医療機器への干渉が心配．

2. HBC (human body communication)

IEEE 802.15.6

Medical and Healthcare

Short Range Wireless Communication (IEEE 802.15.6)



Summary of the WBAN Standard "IEEE 802.15.6"

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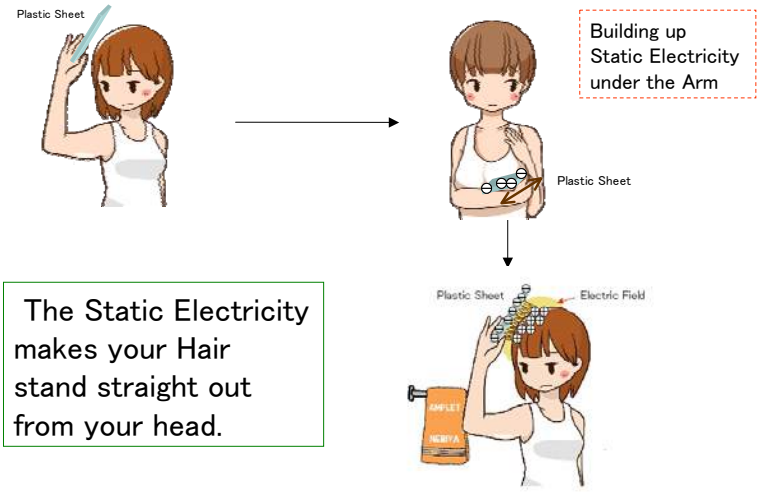
	IEEE 802.15.6			
	UHF Narrow Band Radio		UWB	HBC
PHY	NB-PHY		UWB-PHY	HBC-PHY
Band	402～405MHz	For Implant Equipment (World Wide)	3.1～10.6GHz (UWB)	21MHz Band (5.25MHz Bandwidth)
	420～450MHz	Medical Telemeter (Japan)		
	863～870MHz	ISM Band (Europe)	Depends on the Regulation of Each Country	
	902～928MHz	ISM Band (U.S.A.)		
	950～956MHz	ISM Band (Japan)		
	2.36～2.40GHz	For Medical Equipment (U.S.A.)		
	2.4GHz Band	ISM Band (World Wide)		
MAC	Recommend the same MAC as other similar Wireless Systems			
Range	2m			
Modulation	BPSK, QPSK, GMSK, etc.			
Packet Budget	256 Byte Max			
Data Speed	1～10Mbps			
Power Consumption	Less than 10mA at 3V Operation			
Network	Star Network			

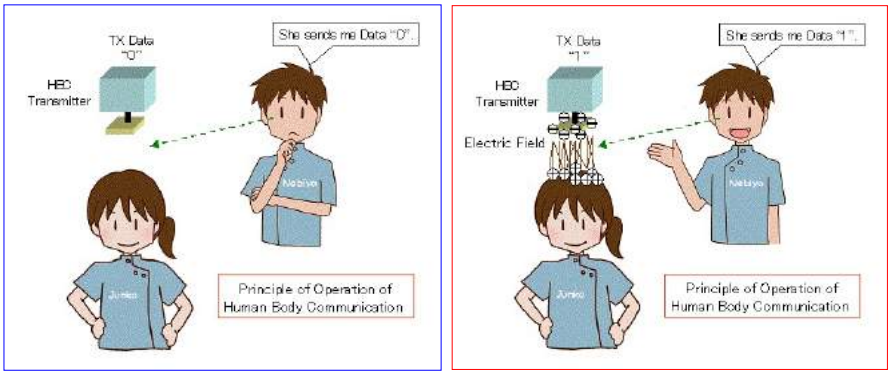
2. HBC Technology

Experiment using Static Electricity



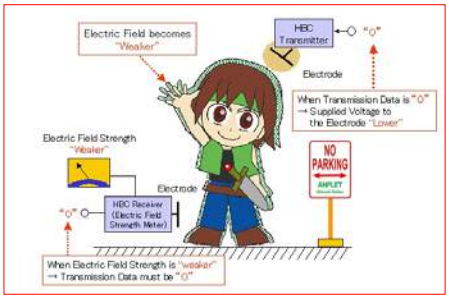
The Static Electricity makes your Hair stand straight out from your head.

Concept of HBC

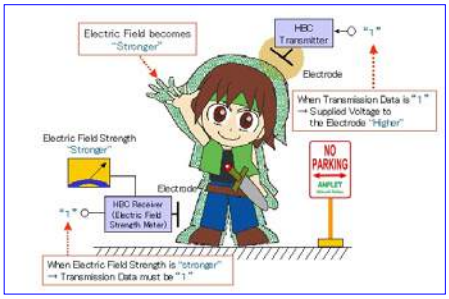


TXD = 0 TXD = 1

Operation Principle of HBC

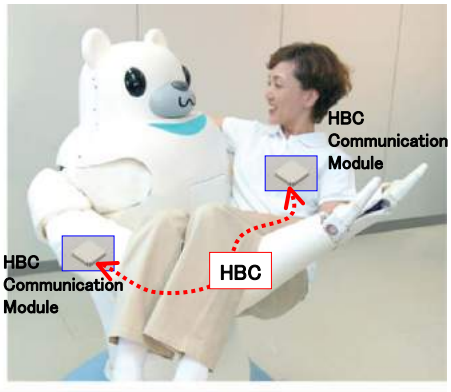


TXD = 0



TXD = 1

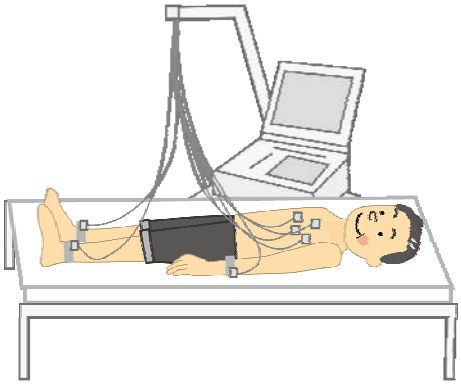
HBC makes Friendship between Person and Robot



Communication Image

[Reference] http://rtc.nagoya.riken.jp/RIBA/

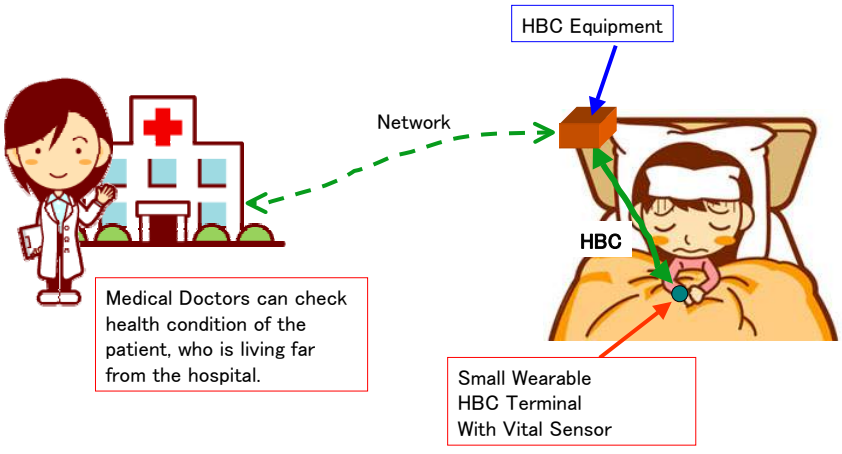
HBC Applications for Medical



If the patient uses wearable vital sensors connected to the data logging equipment, the patient cannot change sides of the bed, and cannot go to the toilet.

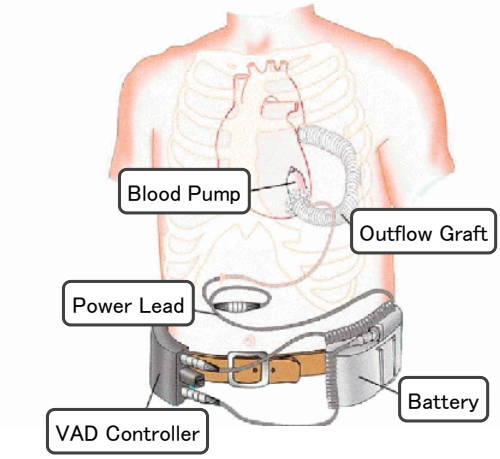
This is the reason why HBC as short range wireless communication to be required in the hospital.

HBC Application for Remote Health Care



3. The VAD Telemetry System

VAD (ventricular assist device) Controller

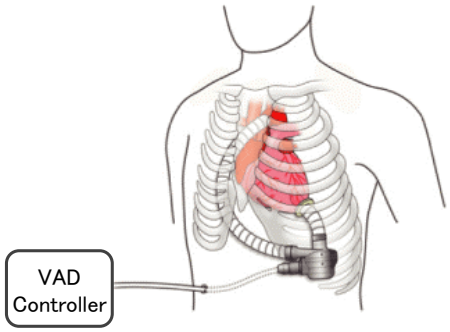


The VAD (ventricular assist device) is the mechanical circulatory device that is used to partially or completely replace the function of the failing heart.

In the last few years, VAD has improved significantly in terms of providing survival and quality of life among recipients.

(Article from "http://en.wikipedia.org/wiki/Ventricular_assist_device")

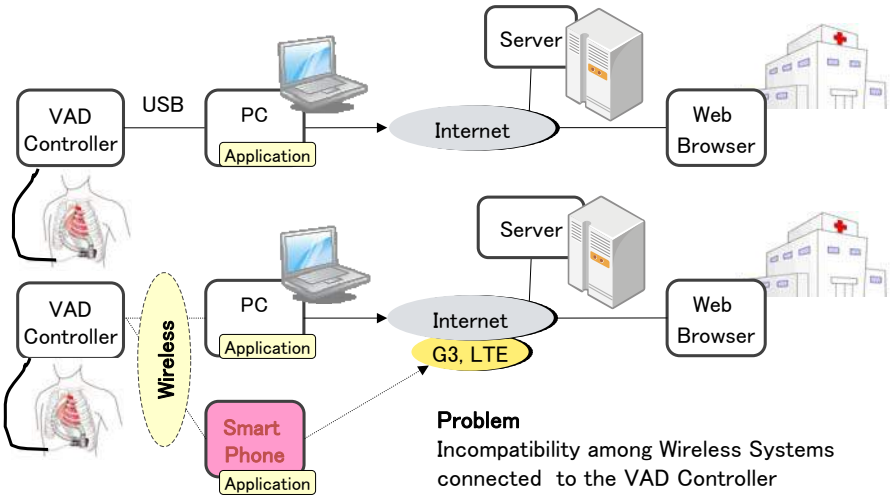
Telemetry System for the Person with VAD



In order to enhance quality of hospital-to-home life for the person with VAD, we start to develop the Telemetry System to transmit cardiac monitoring data and VAD controller data between distant points.

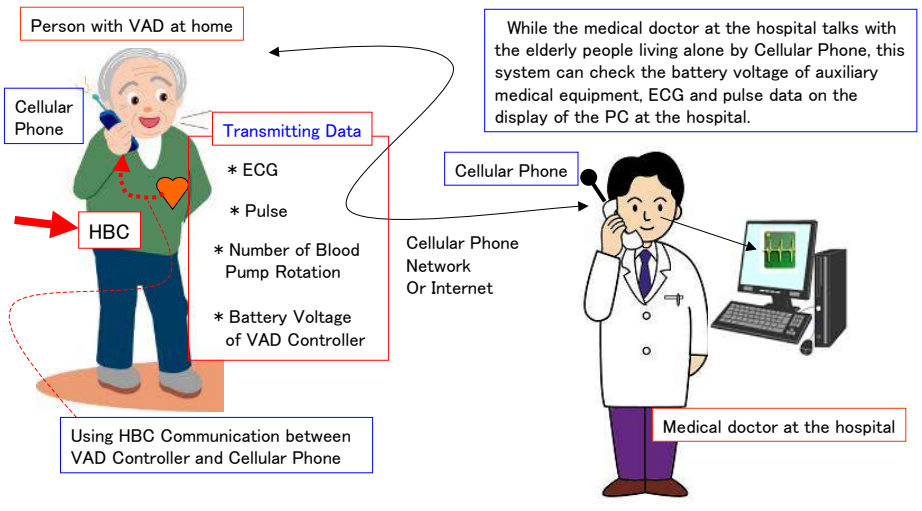
(Figure from "http://www.evaheart.co.jp/wp/medical/")

Our Proposed VAD Telemetry System

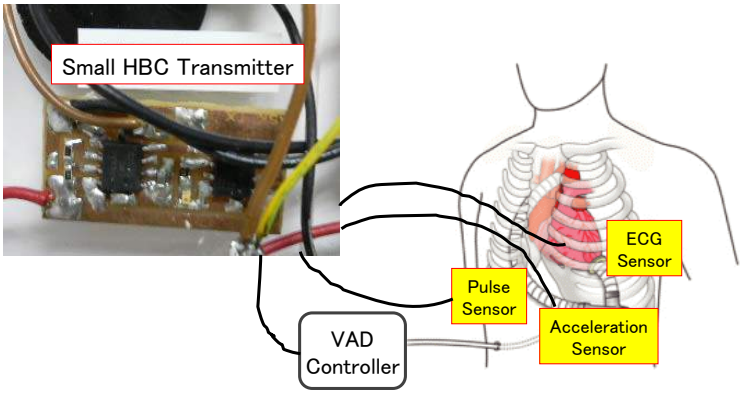


Problem
Incompatibility among Wireless Systems connected to the VAD Controller

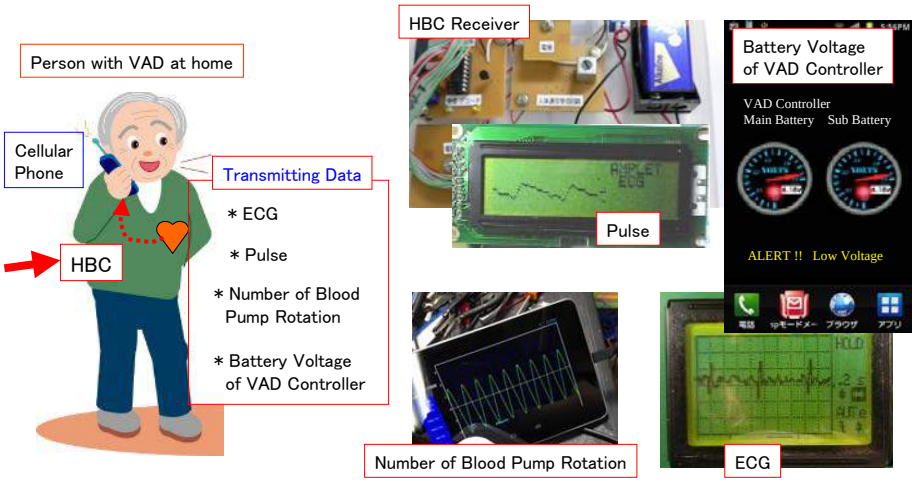
Our Proposed VAD Telemetry System



Prototype of Small HBC Transmitter



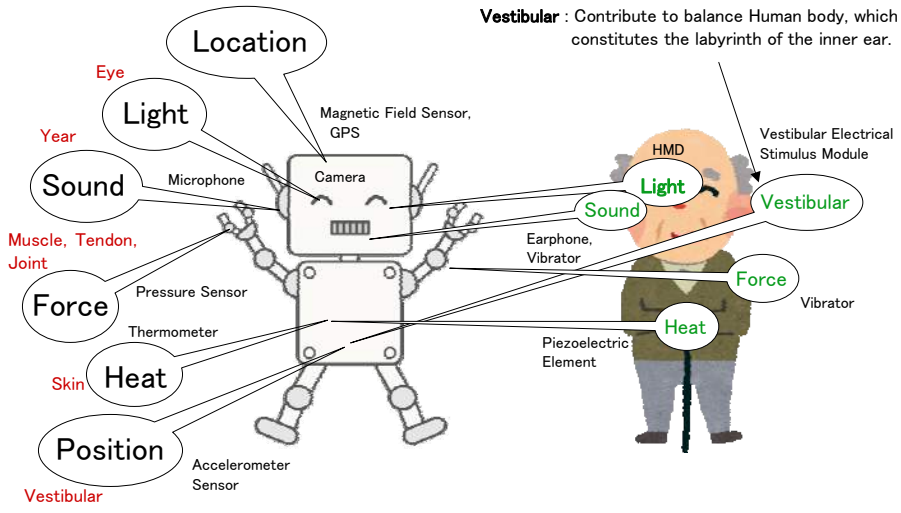
Prototype of Small HBC Receiver



Measurement of Electric Field Intensity over VAD

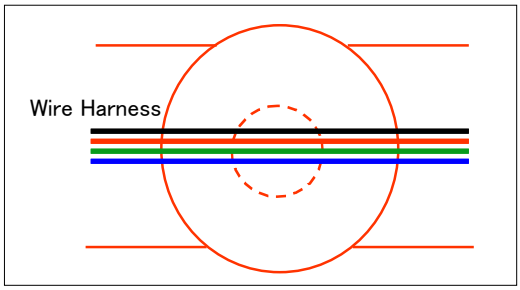
4. Communication between Person and Robot using Human Body Communication

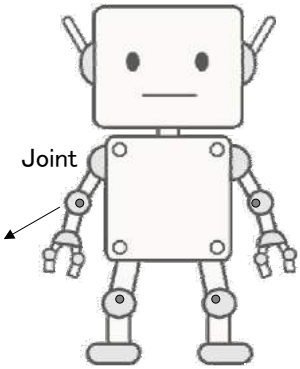
The Personal Care Robot for aged Person



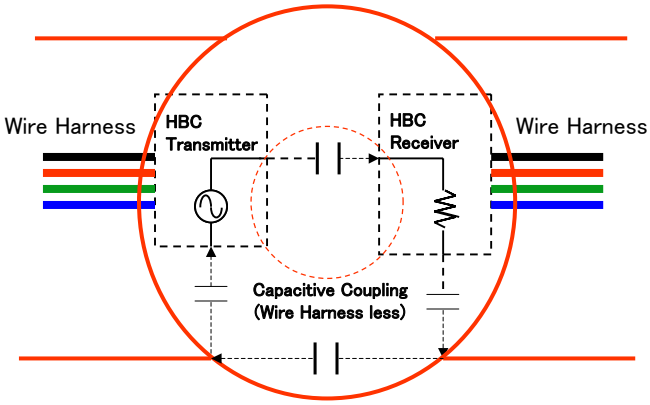
The Issue of Wire Harness Breakage at Joints of a Robot

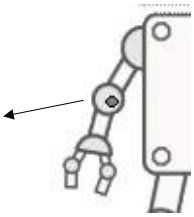
After many times bending Arms of the Robot ・・・
Wire Harness Breakage at the Joint should happen to occur. It is a Problem !!





The Solution of Wire Harness Breakage using Human Body Communication Technology





The Latest Trends and Applications of Human Body Communication

The First Technical Handbook of "Human Body Communication" in Japan
The editor-in-chief : Dr. Hideyuki Nebiya
Publisher : CMC
Price : JPYEN 64,000 (Not Including TAX)

Recent Engineering Technology of Health Care and Medical Care

Dr. Hideyuki Nebiya has written the Section 2-3 "Wireless Body Area Network"
Publisher : Publisher : Johokikou
ISBN Code : 978-4-86502-061-8
Price : JPYEN 55,000 (Not Including TAX)

Technology for Service Robot

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Dr. Hideyuki Nebiya has written the Section 4-10 "Human Body Communication"
Publisher : Publisher : Johokikou
ISBN Code : 978-4-86502-096-0
Price : JPYEN 64,000 (Not Including TAX)

Thank you for your attention.

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