Development of Mouthpiece Type Remote Controller for Disability Persons -- 3rd --

Shojiro George TERASHIMA:
Niigata Institute of Technology
Takuya KITAZAWA:
Sabun Industry Co. Ltd.
Eiichi SATOH:
Niigata Institute of Technology

Back Grounds

- Disability people use powered wheelchair
- The person who can move upper limb
  → They control wheelchair by joystick

- The person who can't move even upper limb
  → They need to use
  another control system

Back Grounds

Niigata Institute of Technology, JAPAN

A variety of operation systems

have been developed

Controller	Problems
Chin Controller	Higher level injured person Can't be applied
Head Motion	↑ ↑ ↑
Voice Control	Herd to distinguish "voice command" & "conversation noise"

We focused on the tongue motion

Back Grounds

"Tongue Motion" has lots of merits

- can move fast
- move accurately
- connected to brain through cranial nerve
- avoid serious damage even in the case of cervical cord injury

→ Mouth piece type remote controller would be available!!

Concepts & Specification

Niigata Institute of Technology, JAPAN

Before development of

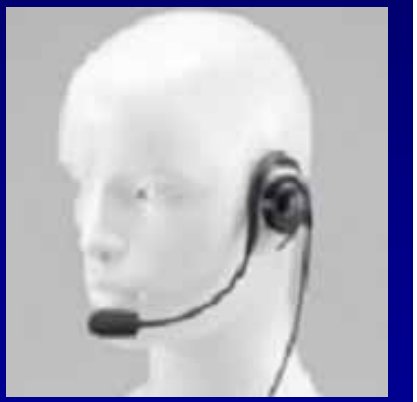
Mouthpiece type remote controller

1) Controller with cable : insanitary (saliva)

→ Need to be wireless

2-a) Wireless controller needs a battery!!

2-b) Battery has strong toxicity



Solution

→Passive RFID can work without battery!!

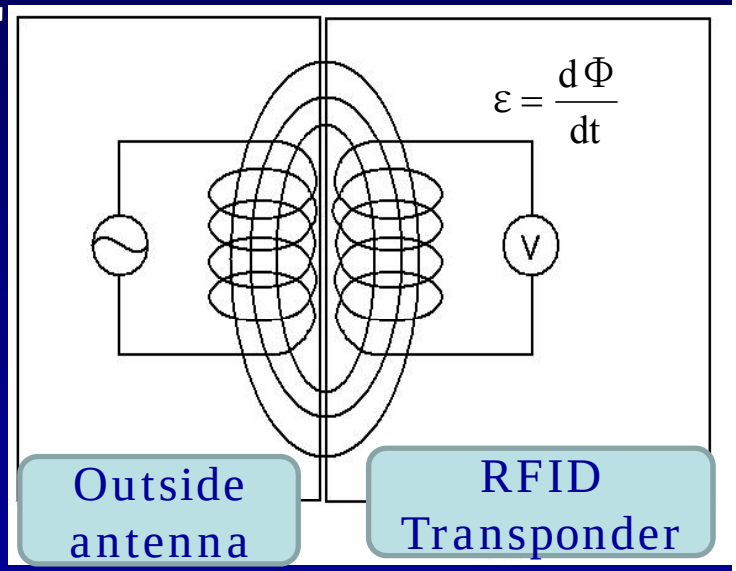
Antenna will set beside cheek or under chin

Niigata Institute of Technology, JAPAN

RFID

(Radio Frequency IDentification)

- RFID transponder has a IC
- IC has it's own ID code
- Electromagnetic induction through electric wave or electromagnetic wave

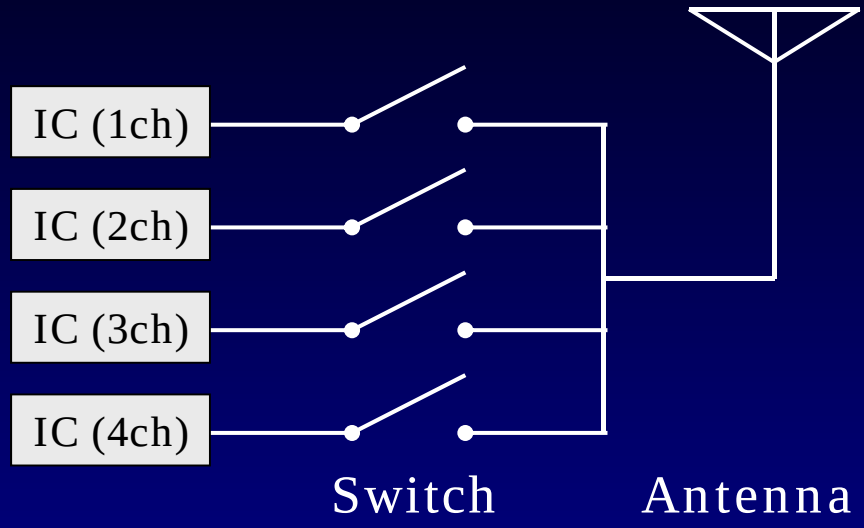


→it works without a battery!

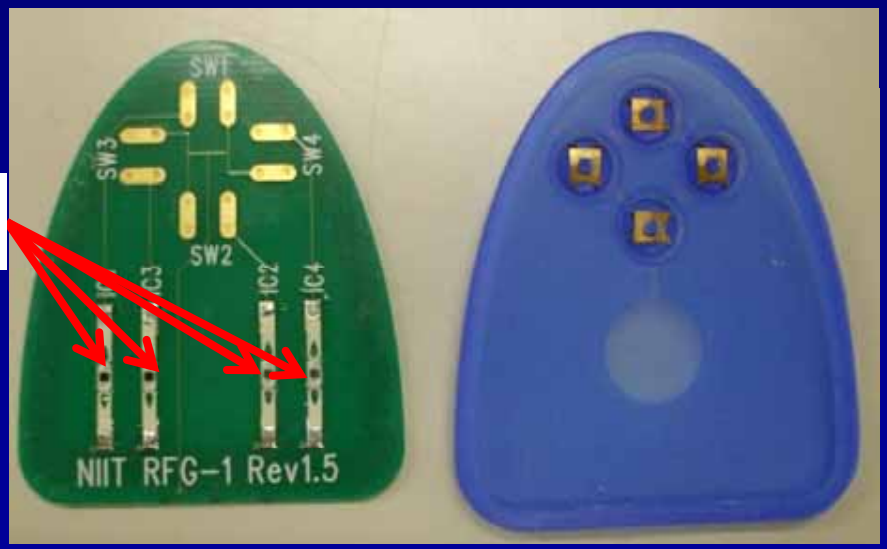
Remote Controller (2nd)

Niigata Institute of Technology, JAPAN

Schematic diagram of remote controller



Over View : with cover



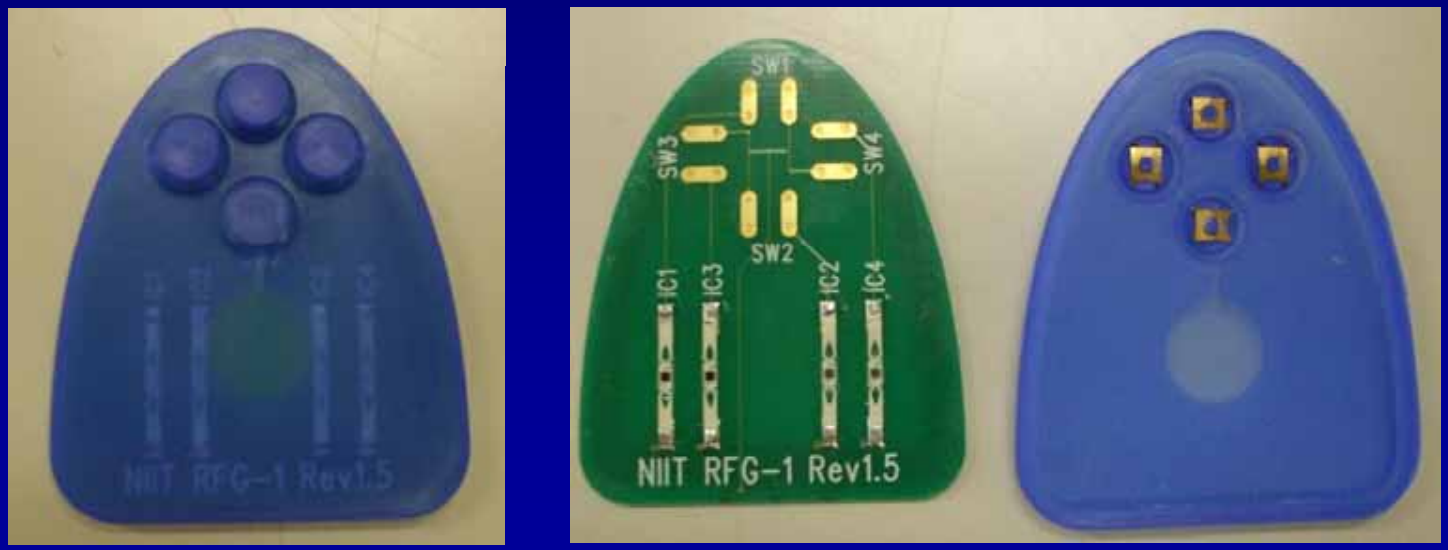
Inside View : without cover

Object

Niigata Institute of Technology, JAPAN

Investigate the characteristics

of the remote controller

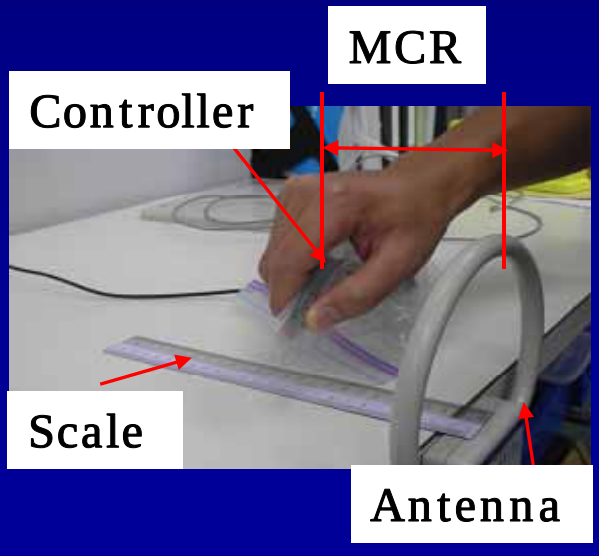


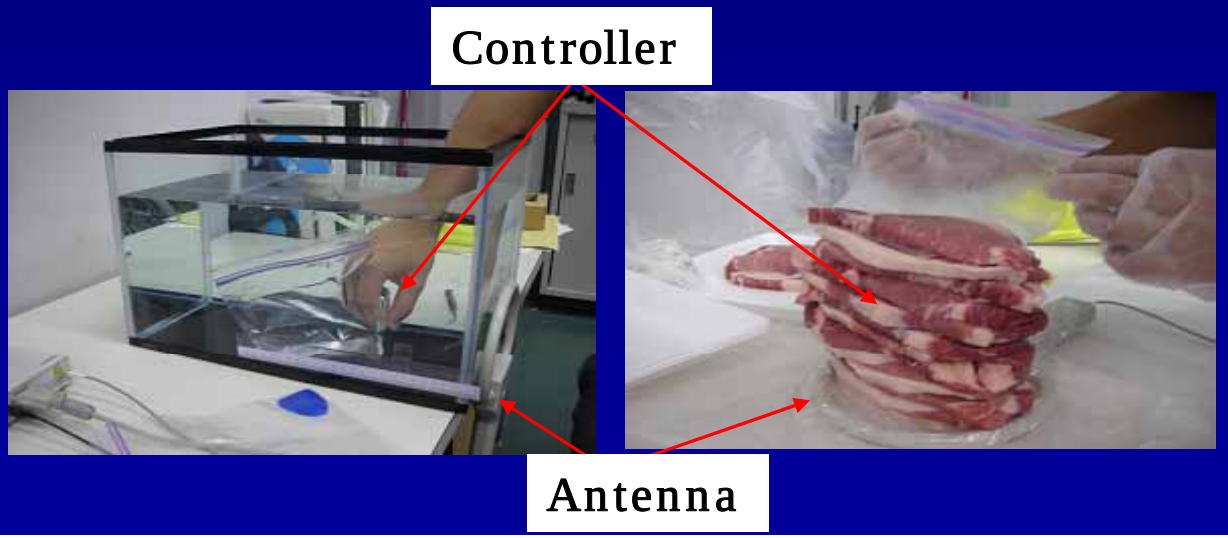
Experiment (1)

Niigata Institute of Technology, JAPAN

In vitro test :

- Measure the **M**aximum **C**ommunication **R**ange [mm] only while steady communication
- MCR is the distance of between the remote controller and the antenna
- To know the influence of water, skin and/or fat
- Set 3 Conditions : Atmosphere, Water and Meat



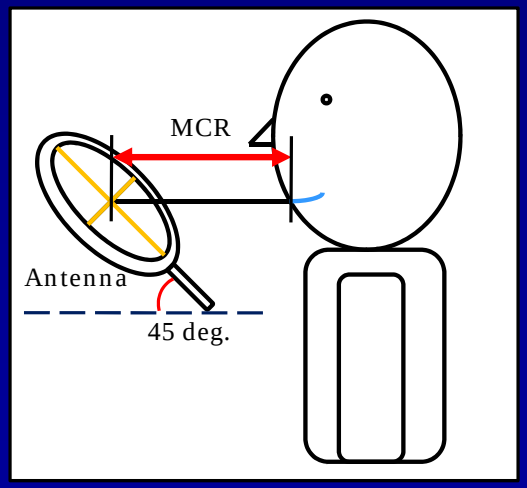


Experiment (2)

Niigata Institute of Technology, JAPAN

In vivo test :

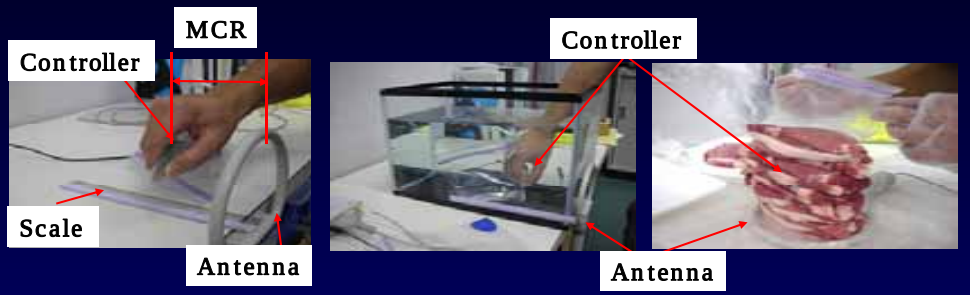
- Controller was inserted into users' mouth
- To investigate the characteristic and
  to know best antenna position
- MCR was measured
- Set 3 positions: Frontal antenna, Beside cheek, Under chin
- 10 subjects (10 times each)



Results & Discussions

Niigata Institute of Technology, JAPAN

In vitro test



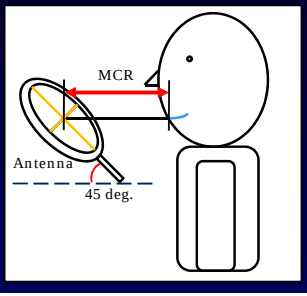
Condition	MCR (mean ± S.D. [mm])
Atmosphere	112.9 ±11.8
Water	129.7 ±18.9
Meat	119.4 ±14.5

This result leads;

- It would be able to work
  in the condition of humans' mouth.

Results & Discussions

In vivo test



	Frontal Antenna	Beside Cheek	Under Chin
MCR [mm] mean±S.D.	31.1±9.5	31.5±8.9	31.7±15.1

This result leads;

- The trial remote controller has enough performance
- Beside cheek antenna would be the best position

Trial operation

- To make sure the ability of this system
- Tried to operate an electric powered wheelchair on the market

Setup:

- Powered wheelchair (Suzuki, MC-16)
- RFID Identifier system
  (Takaya, TR3-MD001E)
- Controller
  (National Instruments, NI 9263, cRio 9014)

Conclusions

1) We developed a new type of mouthpiece remote controller with RFID.
2) The trial remote controller has enough performance.
3) Beside cheek antenna was the best position .
4) We controlled an electric powered wheelchair on the market, by operating the tongue.
5) It was suggested that this system can be applied for disability people.

Acknowledgments

Niigata Institute of Technology, JAPAN

This study was supported by following projects.

- The Ministry of Education, Culture, Sports, Science and Technology. (2005~2008:18700480, 2009~2011:21500524)
- Japan Science and Technology Agency.(2006:05-021)
- Joint research funding of NIIT. (2006-02, 2008-01)

Thank you !
有り難う！
Vielen Dank !
Merci !
Muchas gracias !
Grazie !
谢谢！
고맙습니다！
Obrigado !
Köszönet !