

----- IARIA COGNITIVE 2012 -----

Support System for Elderly People in Daily Life

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Jichi Medical University
and The University of Tokyo)*



Contents of this presentation

- Introduction
- Purpose of this presentation
- Environments for elderly people
- A Requirement for a Production Design Specification
- A New Interface System for Elderly People in Home
- Experiments using this New System
- Concrete Case for effective use of this System
- Conclusion

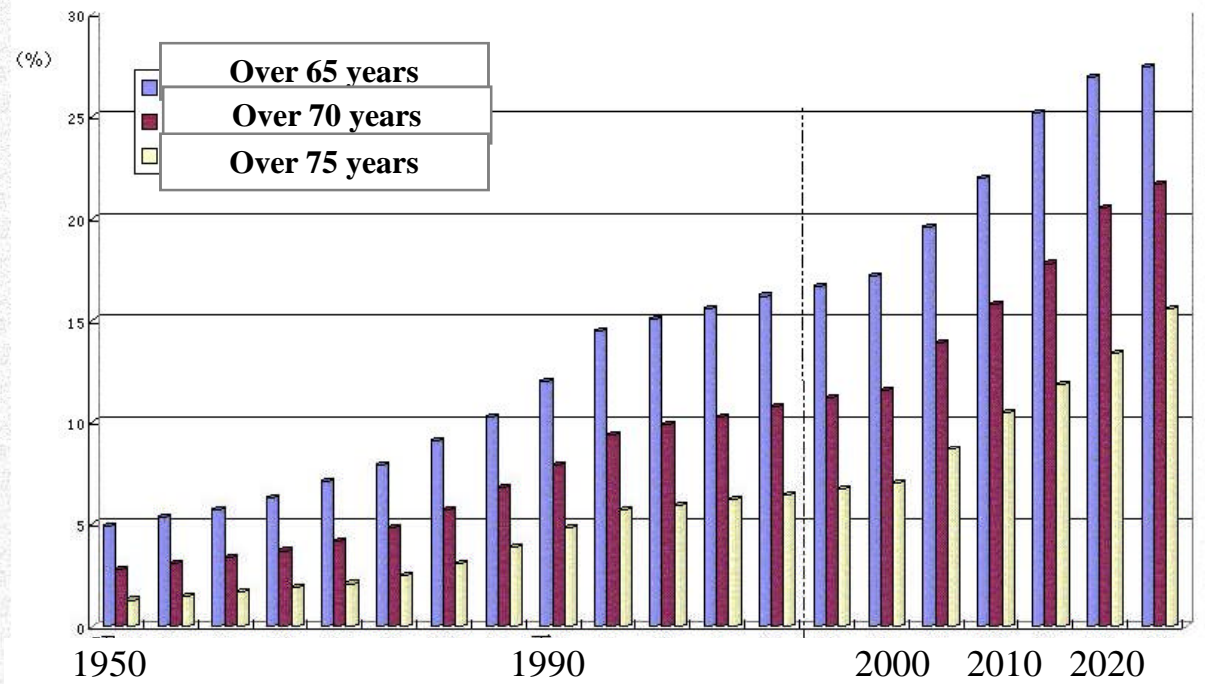
Introduction of today's Topics

1. Elderly people aged above 65 in Japan
18.6 millions in 1995 → 32.7 millions in 2020
2. Number of household
3.09 millions in 1995 → 5.30 millions in 2020
(Only married elderly couple)
2.25 millions in 1995 → 4.63 millions in 2020
(Solitary elderly people)
3. Political plan in terms of health and welfare for the elderly

From Data of Ministry of Health, Labour and Welfare 2000



Increase of Elderly People in Japan



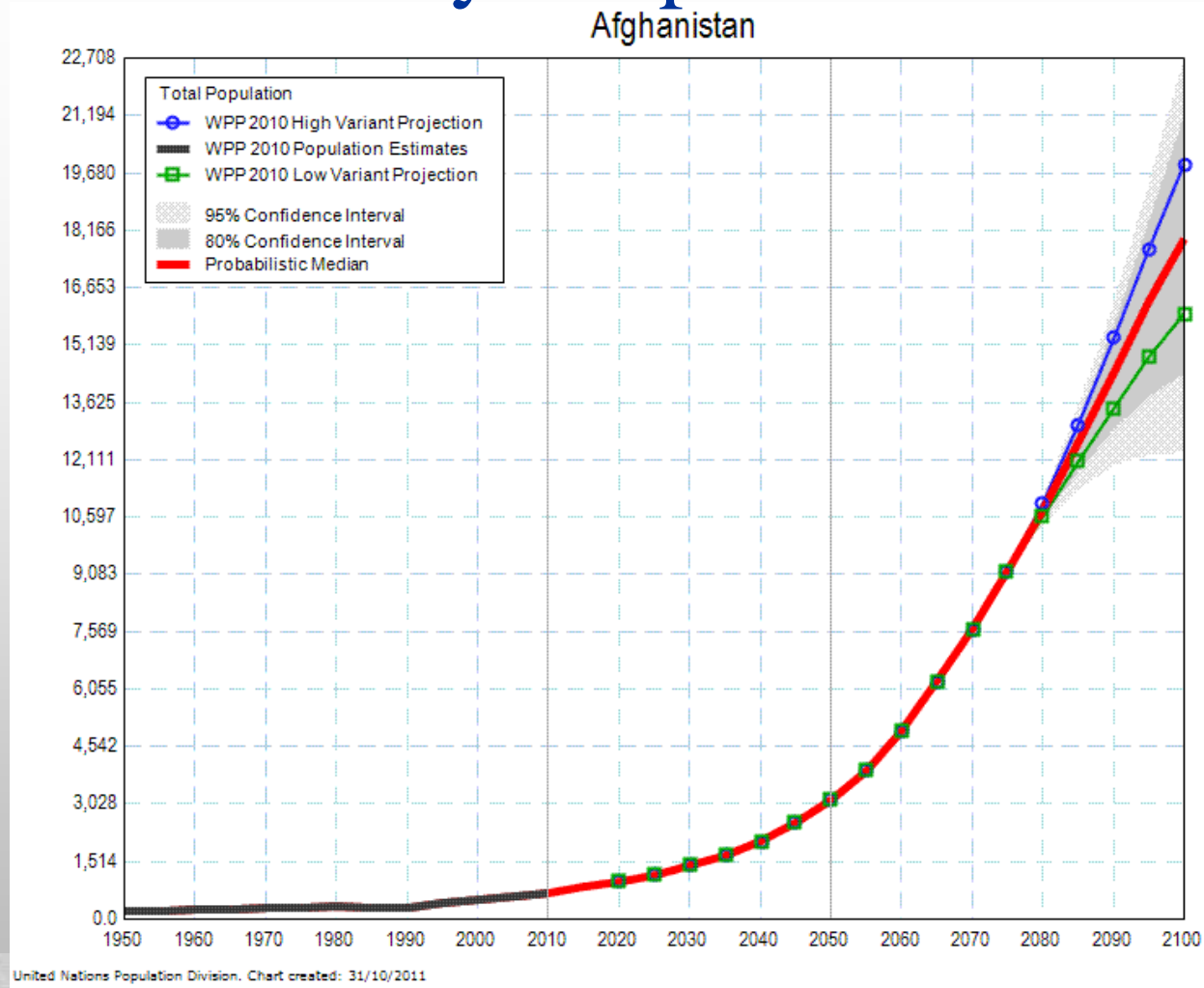
Population of Elderly people over 70 years old

1998 : 136.5 million person

2010 : 201.1 million person

2020 : 254.1 million person

Increase of Elderly People in France



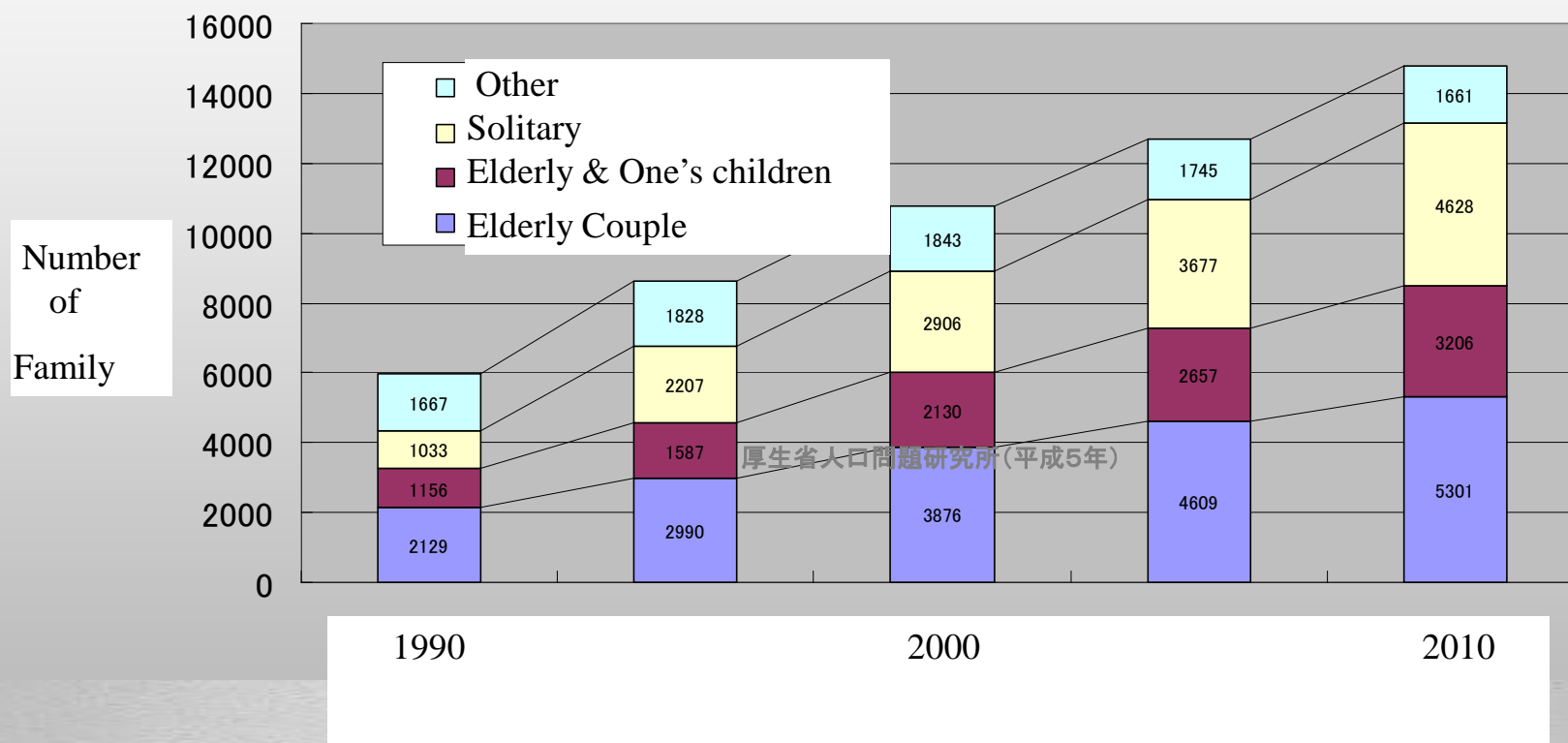
Probabilistic Projections: Population age 65 and over (thousands)

Population projections based on probabilistic projections of total fertility from the 2010 Revision

http://esa.un.org/unpd/wpp/P-WPP/htm/PWPP_Population-Age_65Plus.htm

Composition of the family included elderly in Japan

From Change of amount of elderly
(From Ministry of Health, Labour and Welfare in Japan)



Purpose of this presentation

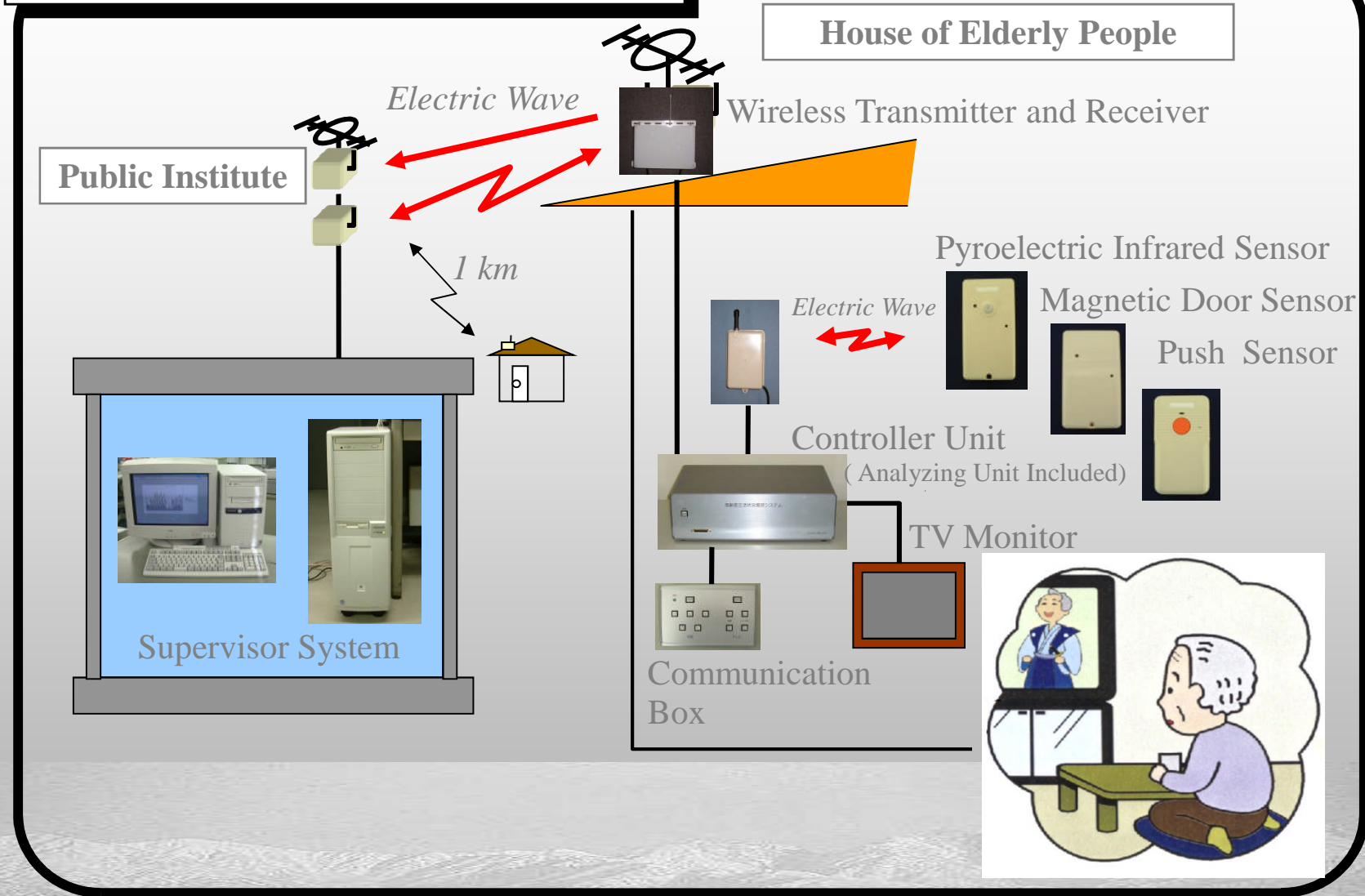
The purpose is to propose the new Interface system that is not able only to analyzes human behaviors and motions in older to detect changes for the physical condition of an elderly human in own house, but have communication.



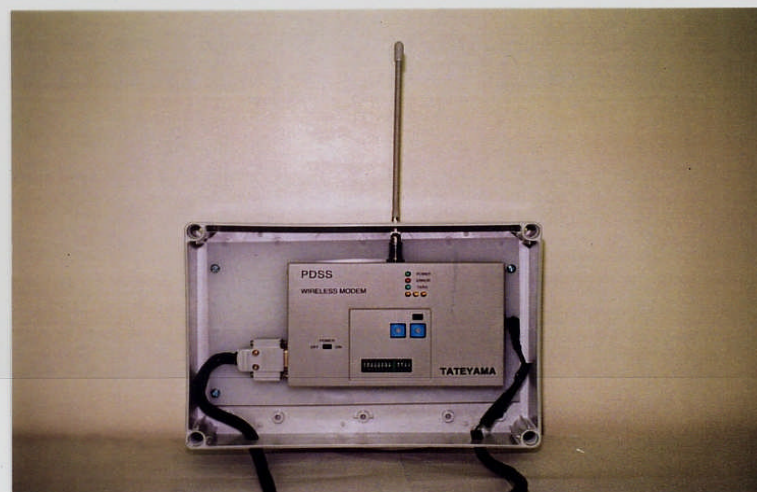
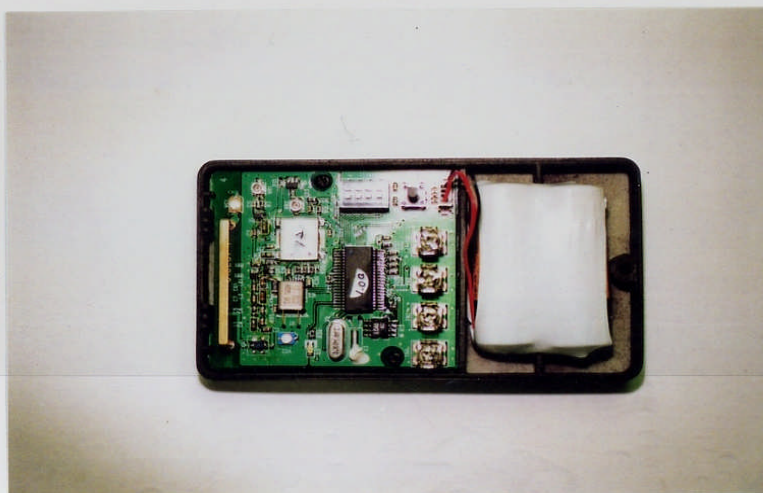
*Environment for Japanese
Elderly People's House*



A New Interface System



Elements of the new interface system



Experiments using the new interface system

Two experiments were executed. The kinds of experiments are followed.

- Transmission of Measuring Data
- Analysis of Measuring Data

These experiments were carried out to evaluate the new.

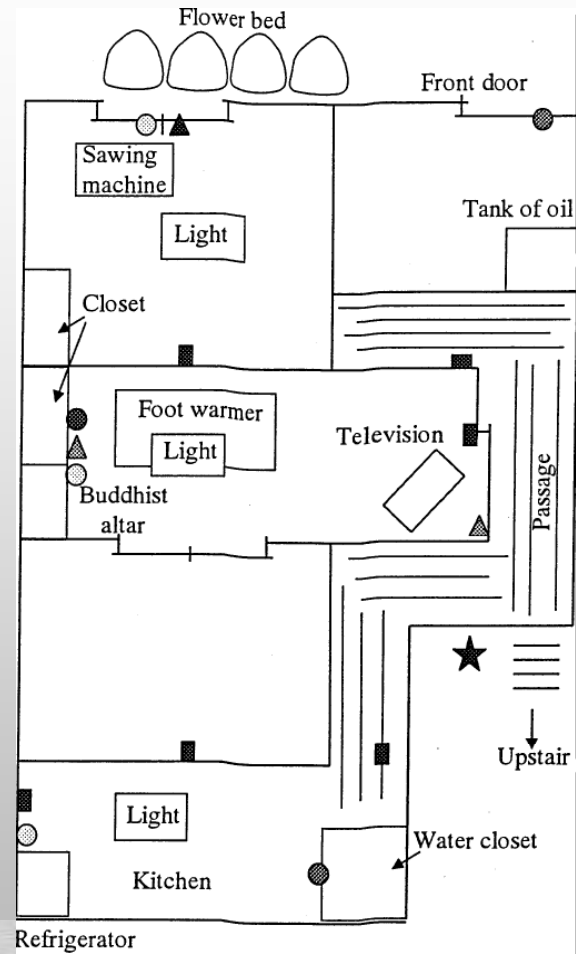


*Methods of the Experiment for
transmission of Measuring Data
using the monitoring system*

- In the experiments, several sensor units and a controller unit with two antennas were disposed in the houses of solitary elderly people.
- The subjects were 8 elderly people.
 - 4 subjects in Takaoka city
 - 4 subjects in Oyama town.
- A supervisor unit was located at a public institution within 1 km away from subject's houses at each area.



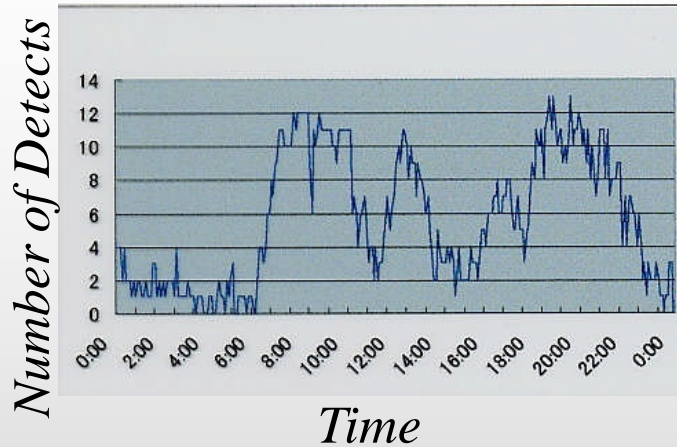
Deposition of sensor units



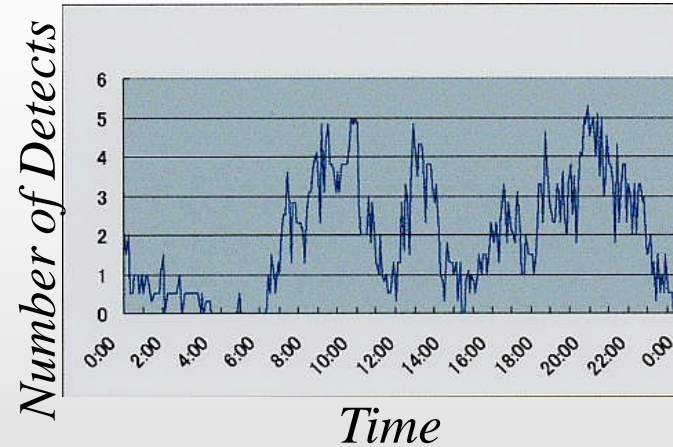
- ★ Controller unit(an upstairs room)
- Pyroelectric sensor
- ▲ Electric current sensor
- Magnetic door sensor
- ◐ Light sensor
- ▲ Illuminance sensor



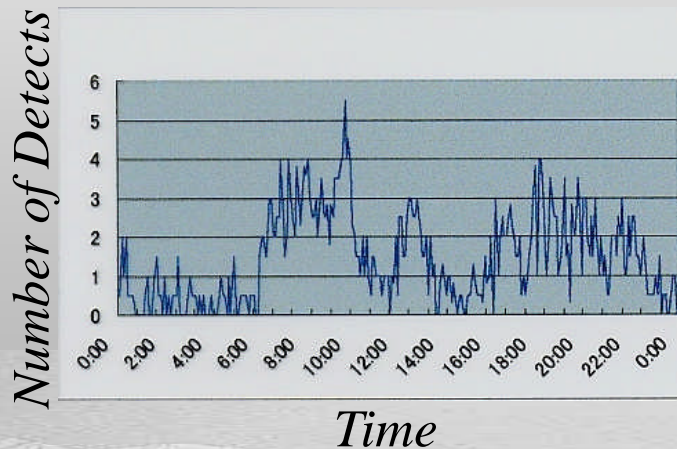
Measured data using infrared sensors



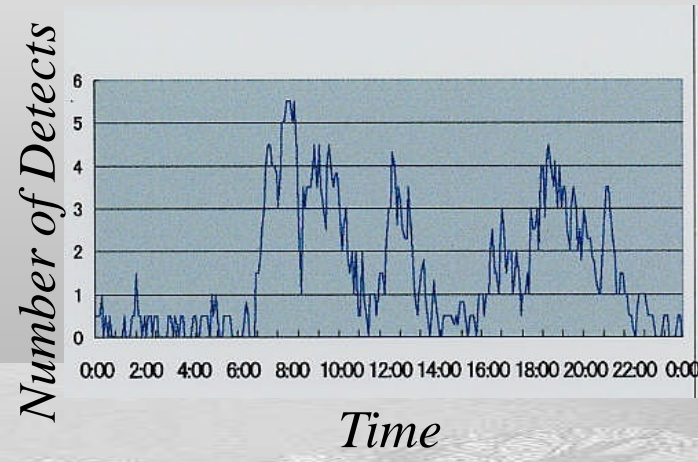
(a) Sum of all sensor's data



(b) Sensor's data in Living room

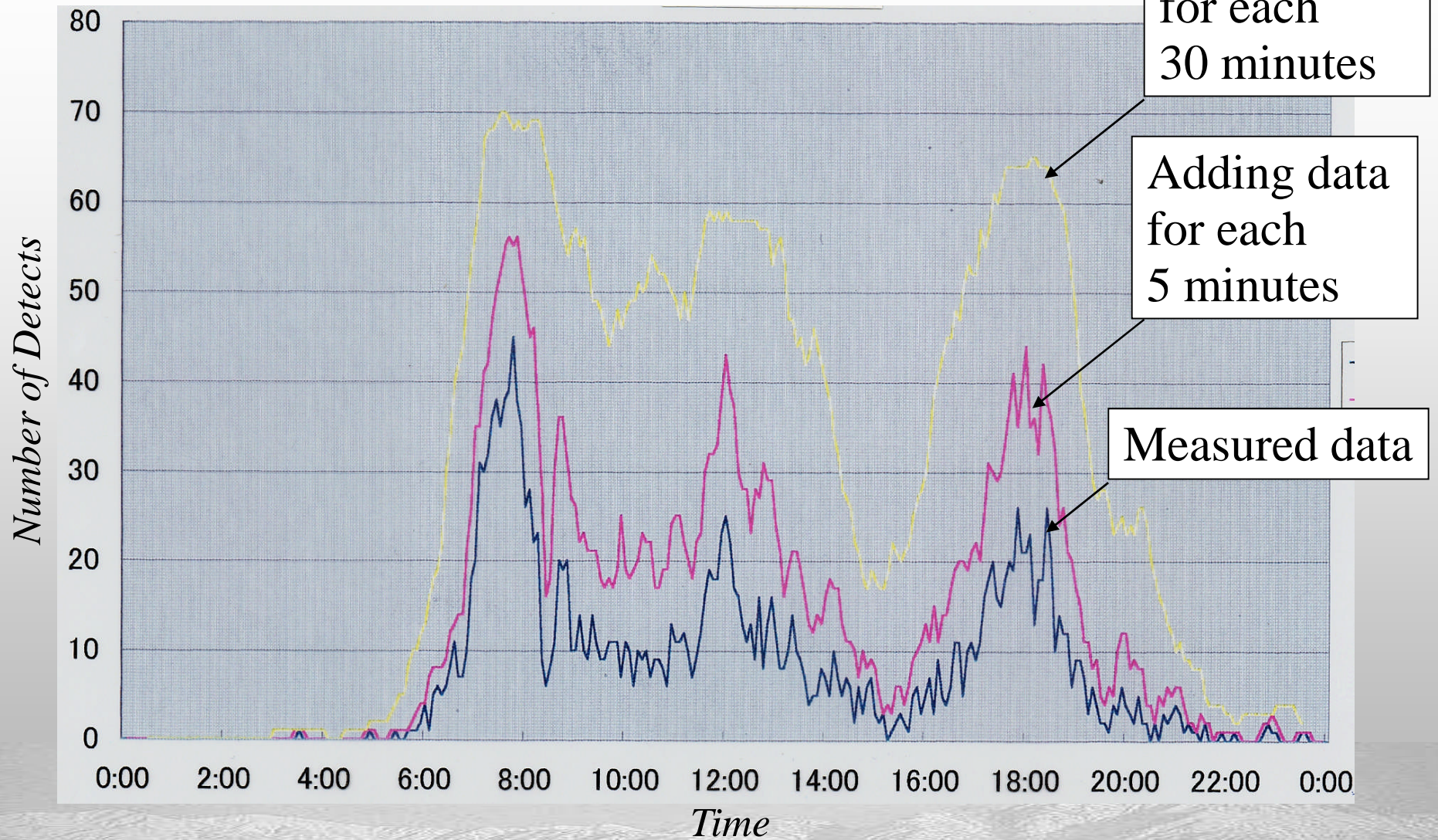


(c) Sensor's data in Bed room



(d) Sensor's data in Kitchen

One of the measured data using the system



The results of the Experiment for transmission of Measuring Data

- Using this system, it was possible to measure and detect human motions like moving from a room to another one and actions like turning on/off the switch of a television.
- It was possible to watch closely the condition of the elderly people at a distant public institution by a supervisor unit.



Methods of the Experiment for Analysis of Measuring Data using the monitoring system

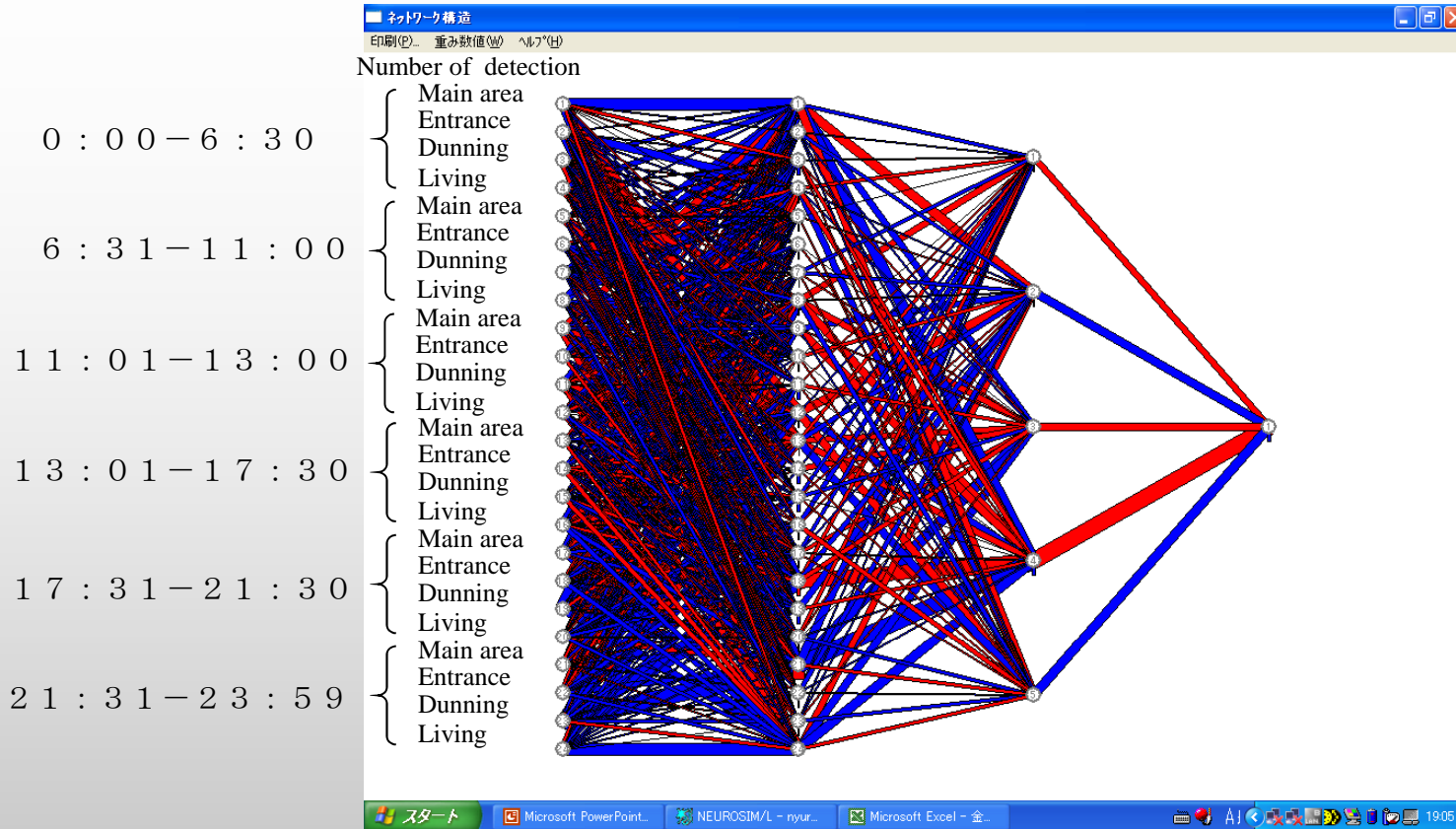
- This analysis executed using the measured data and the results of the questionnaire. Then, using the results of the analysis, the system conjectures for one elderly people's behavior of the day that is not taken to analyzing.
- The subjects were 4 elderly people.
 - 3 subjects in city area
 - 1 subjects in down town area.



Daily questionnaire are concerned to consciousness of health and busyness.

		健康状態				活動		
		とても 良い	やや良 い	やや 悪い	悪い	忙しい	やや 忙しい	忙しくな い
10月19日	金		○				○	
10月20日	土		○				○	
10月21日	日	○					○	
10月22日	月	○					○	
10月23日	火	○					○	
10月24日	水		○				○	
10月25日	木	○					○	
10月26日	金		○				○	
10月27日	土		○				○	
10月28日	日		○				○	
10月29日	月		○				○	
10月30日	火		○				○	





学習

初期化(O) 表示(D) 誤差複写(E) ヘルプ(H)

追記設定 追記学習 通常学習 加-ス*

学習回数 2000 許容誤差 0.1 表示周期 1

補習回数 0 回数 2228 / 2228

入力層 中間層1 中間層2 出力層 学習範囲設定

s 0.0 0.0 0.0 0 → 85

ε 5.0 5.0 5.0

α 0.4 0.4 0.4

β 0.0 0.0 0.0

重み固定 重み固定 重み固定

しきい固定 しきい固定 しきい固定

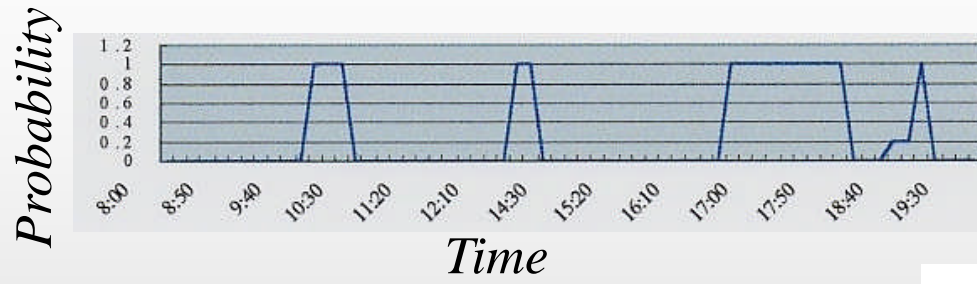
教師データ入力は、9/11から11/25までの各センサの検知回数を集計し正規化したもの、出力は、アンケート結果

入力層 24点 中間層1 24点 中間層2 5点

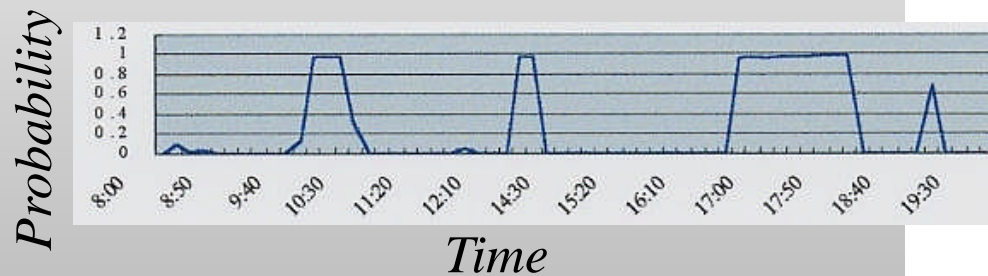
出力層 1点

学習回数 2228回で収束 (許容誤差 0.1)

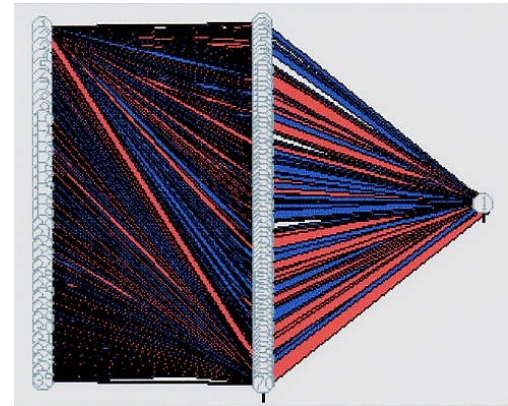
The probability that a subject has gone out



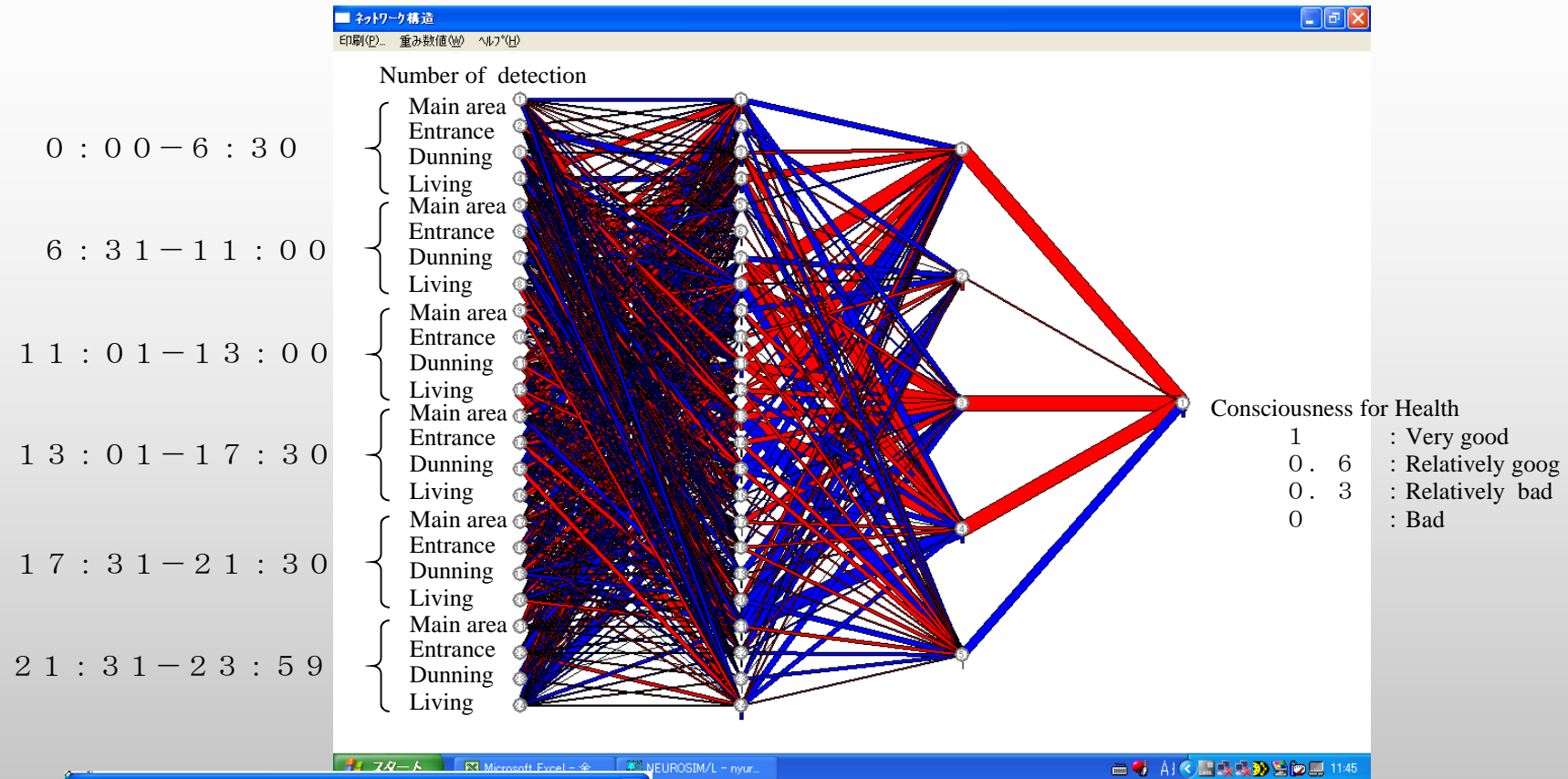
(a) The probability from a questionnaire



(b) The probability conjectured by analyzing unit

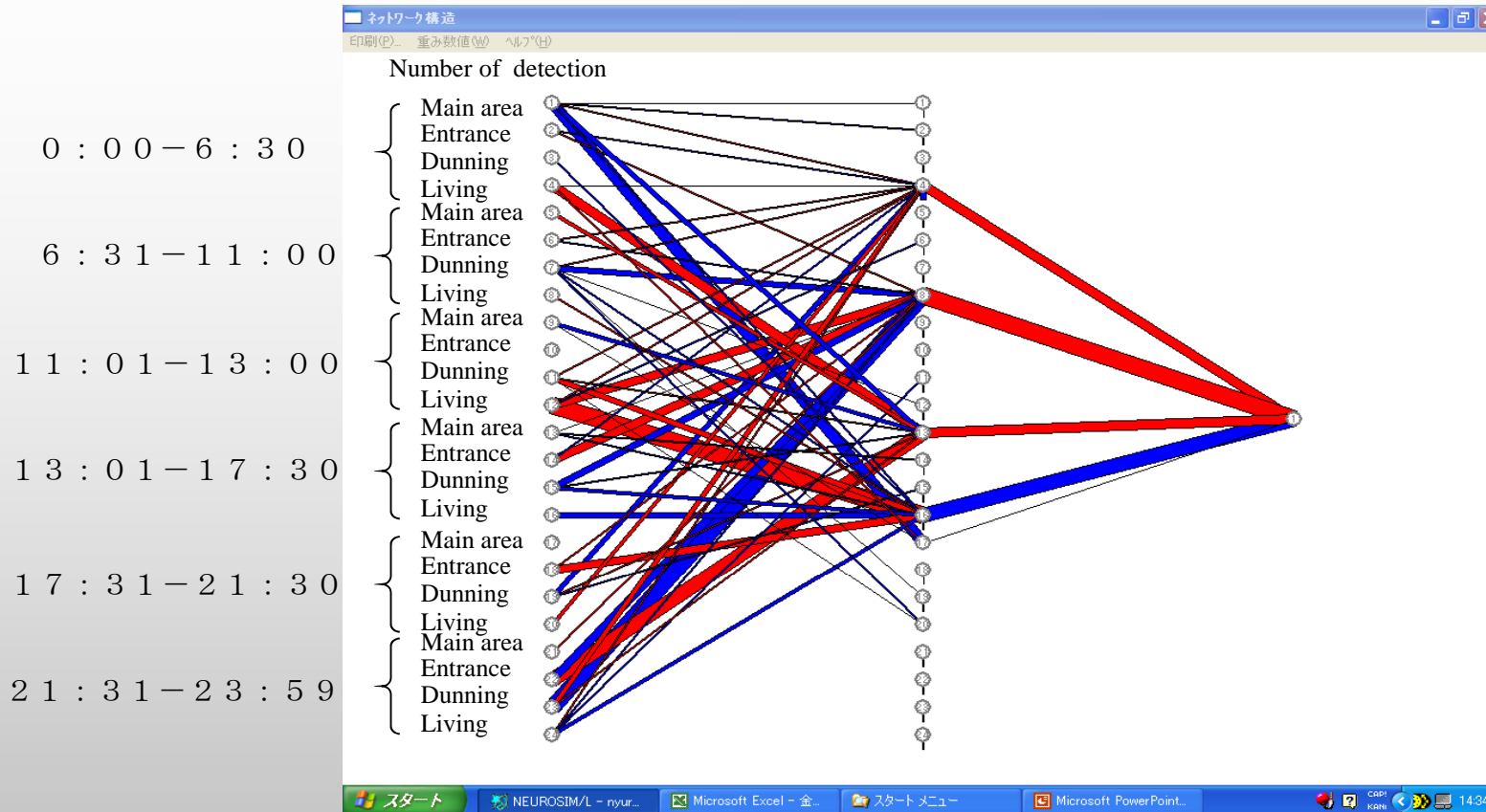


Between Consciousness of Health and Detection of Movement 1



Using data from Sept. 11 to Nov. 25, Detection of movements were measured by Interface system, and consciousness of health were recorded by daily questionnaire.

Between Consciousness of Health and Detection of Movement 2



学習

初期化 表示 誤差複写 ヘルプ

追記設定 追記学習 通常学習 クラス

学習回数 1 許容誤差 0.1 表示周期 1

補習回数 0 回数 12738 / 12738

入力層 中間層1 出力層

s 0.001 0.001

ε 5.0 5.0

α 0.4 0.4

β 0.0 0.0

重み固定 重み固定

しきい固定 しきい固定

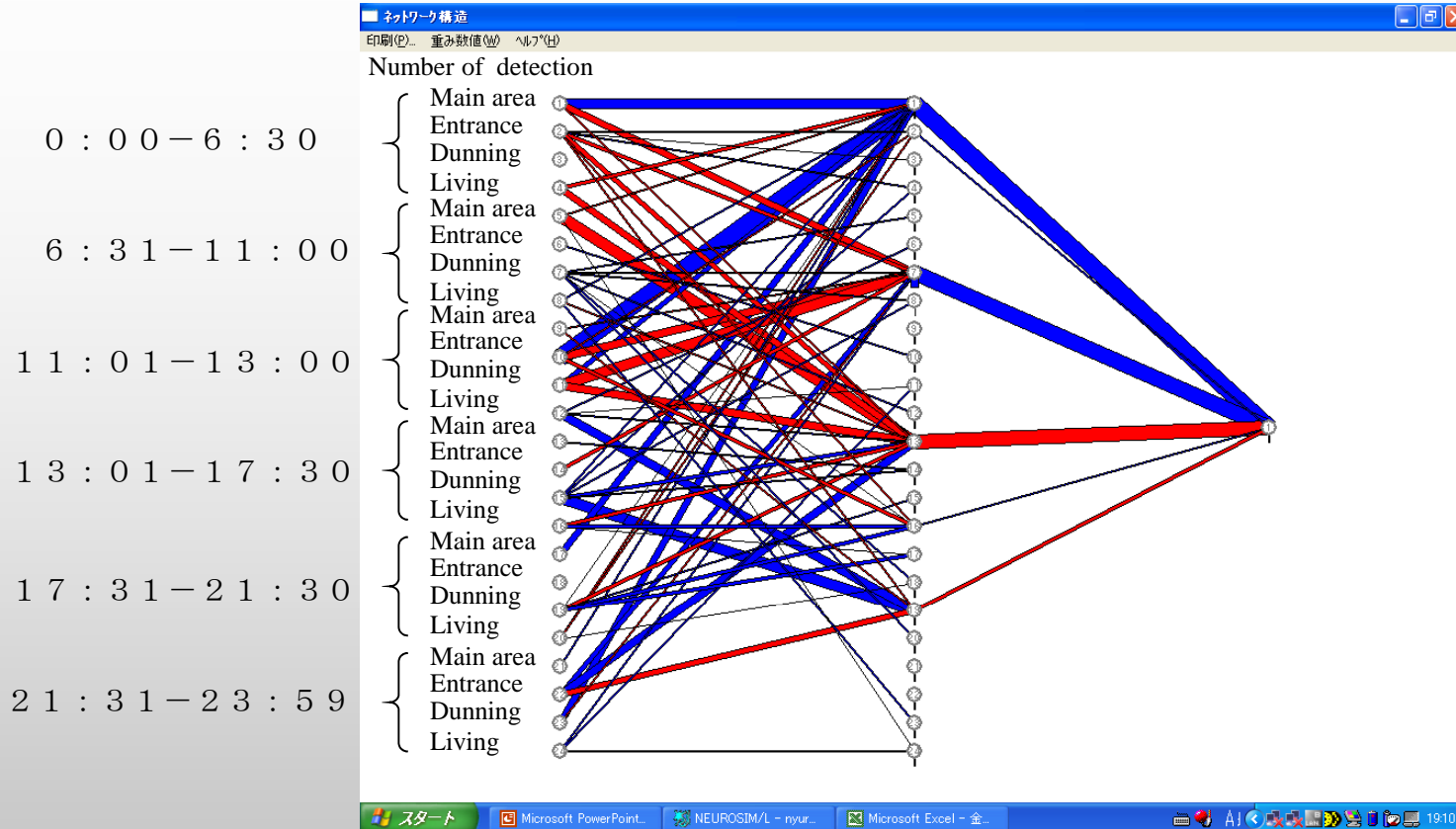
学習範囲設定

0 → 85

0
1
2
3
4
5
6

In this case, behaviors of elderly people are influenced to consciousness of health.

What are influenced to busyness ?



学習

初期化(C) 表示(O) 誤差複写(E) ヘルプ(H)

追記設定 追記学習 通常学習 コース

学習回数 0 許容誤差 0.1 表示周期 1

補習回数 0 回数 6289 / 6289

入力層 中間層1 出力層 学習範囲設定

s 0.001 0.001 0 → 85

ε 5.0 5.0

α 0.4 0.4

β 0.0 0.0

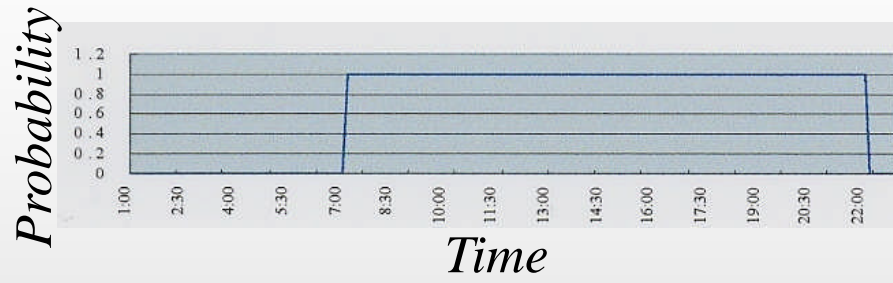
重み固定 重み固定

しきい固定 しきい固定

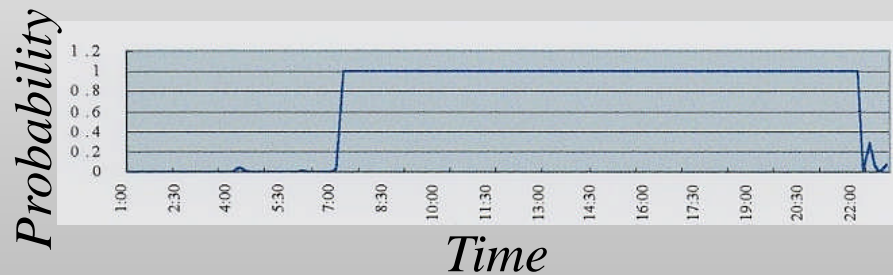
What are influenced to busyness ?

Behaviors of Elderly people from late night to noon are influenced to consciousness of busyness.

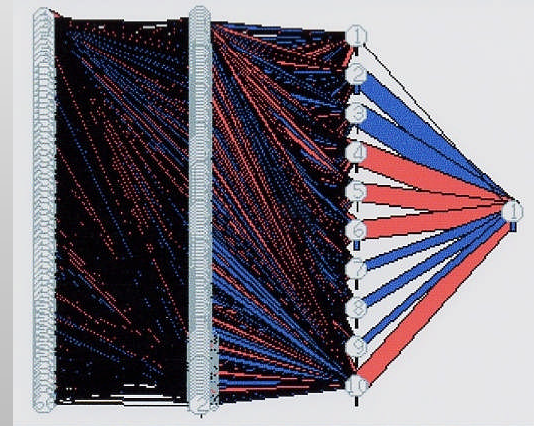
The probability that a subject has gotten up



(a) The probability from a questionnaire



(b) The probability conjectured by analyzing unit

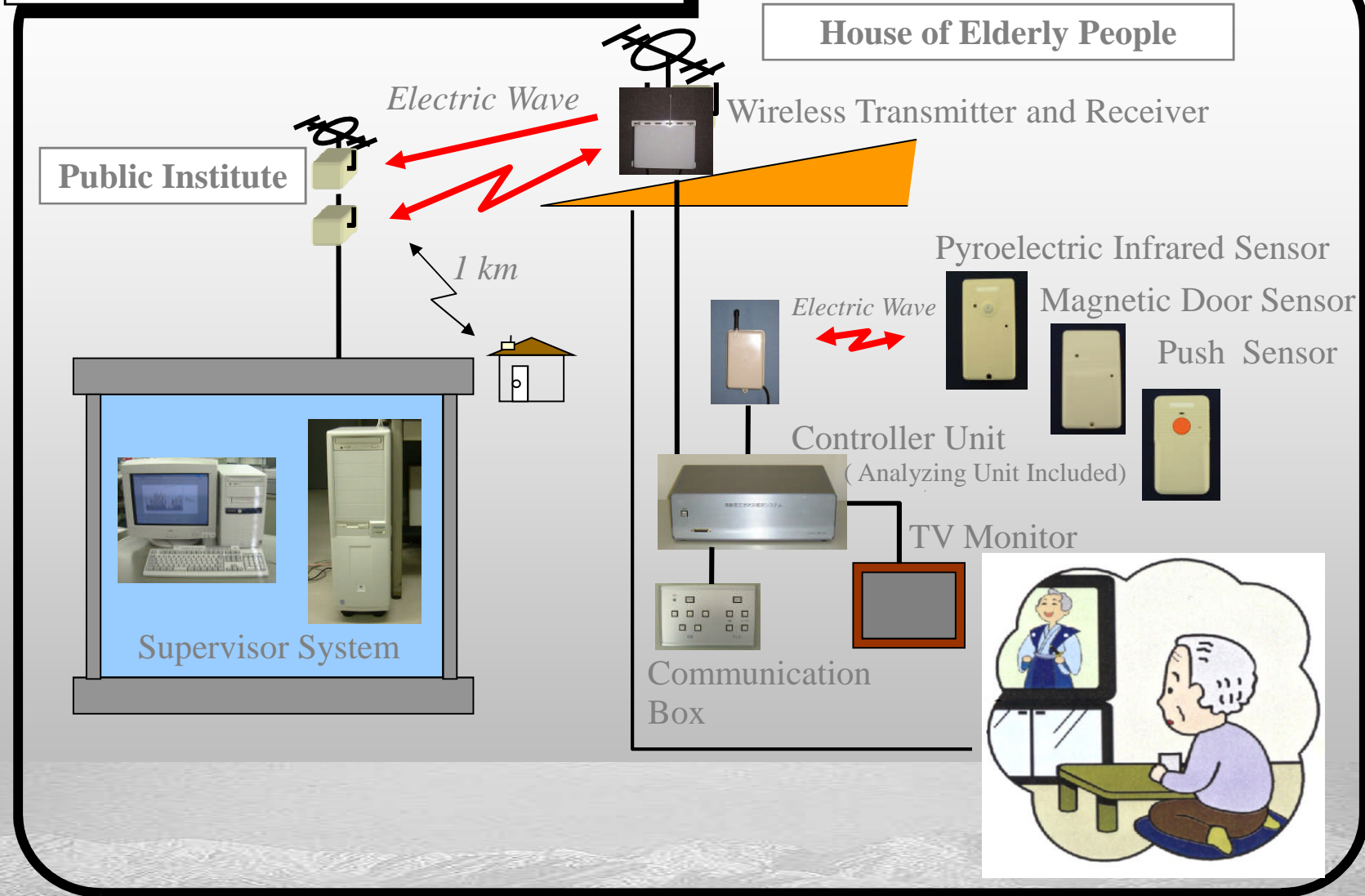


The results of the Experiment for Analysis of Measuring Data

- In this experiment, a new analytic method was proposed and an experiment and a questionnaire were carried out to establish an analyzing system.
- Analyses were executed using the measured data and the results of the questionnaire. Then, using the results of the analysis, the system conjectures for one elderly people's behavior of the day that is not taken to analyzing.

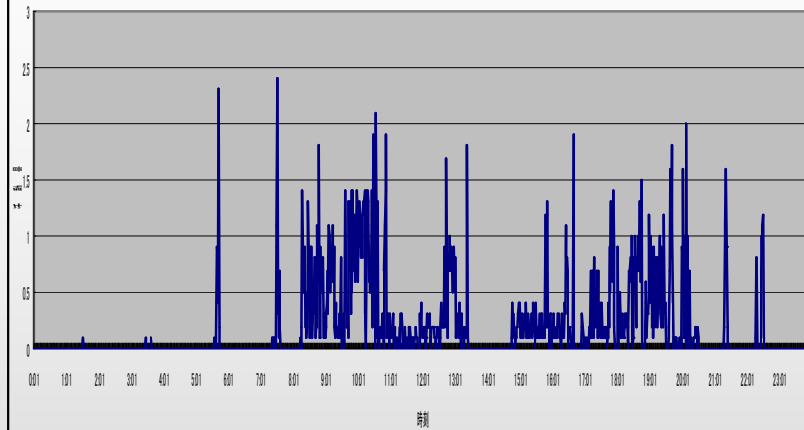


A New Interface System

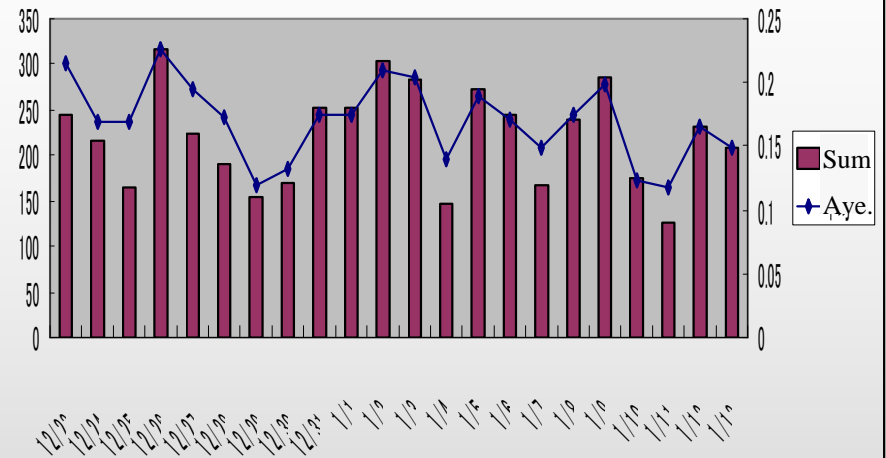


Examples of data analyzed using the New Interface System

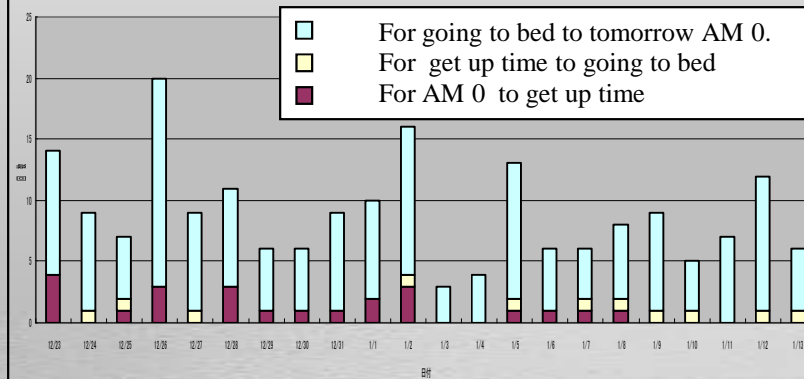
Detected data using sensors



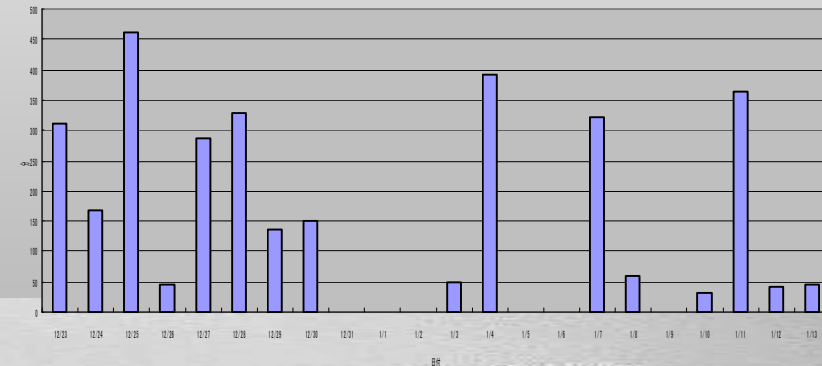
Sum of detected data by day



Number of going to the rest room



The time that elderly people go out, wake up and go to a bed.



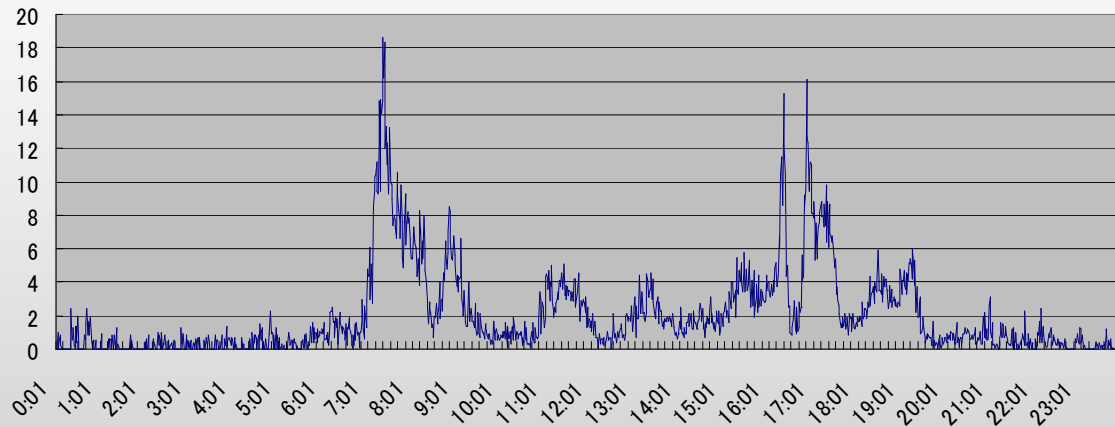
Date	12/23	12/24	12/25	12/26	12/27	12/28	12/29	12/30	12/31	1/1	1/2	1/3	1/4	1/4	1/6	1/9	1/10	1/11	1/12	1/13
Wake up	7:22	8:02	7:22	7:05	5:55	8:02	7:46	7:53	5:38	7:56	6:19	8:33	7:12	7:12	7:16	6:10	8:11	8:26	8:35	7:45
Go to bed	20:22	21:24	23:48	19:40	21:51	23:37	-	19:22	-	-	22:46	20:12	21:39	21:39	20:48	?	20:05	19:31	19:20	21:32

Concrete Case for effective use of this System



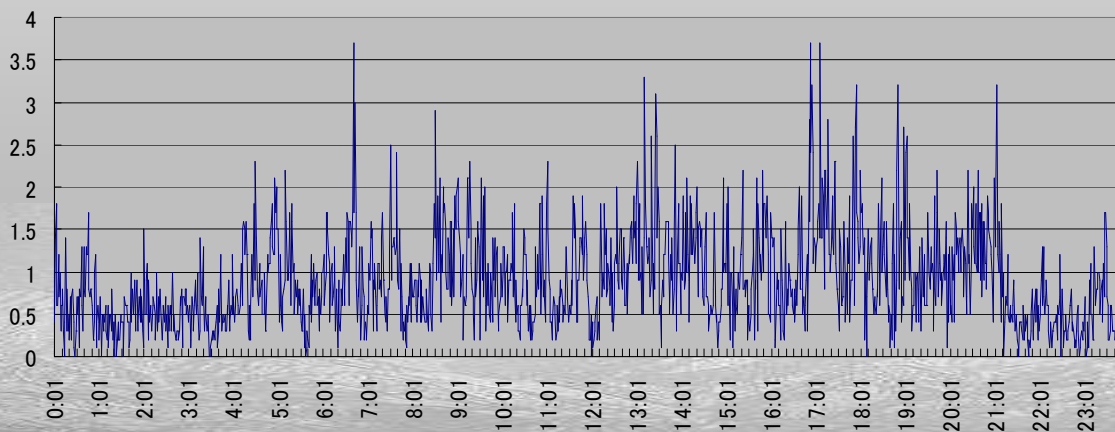
Ex. for changing a health condition No.1

Elderly people No.1 from March 14 to April 29 in 2000



Well controlled and regular living life

Elderly people No.1 from May 1 to May 26 in 2000

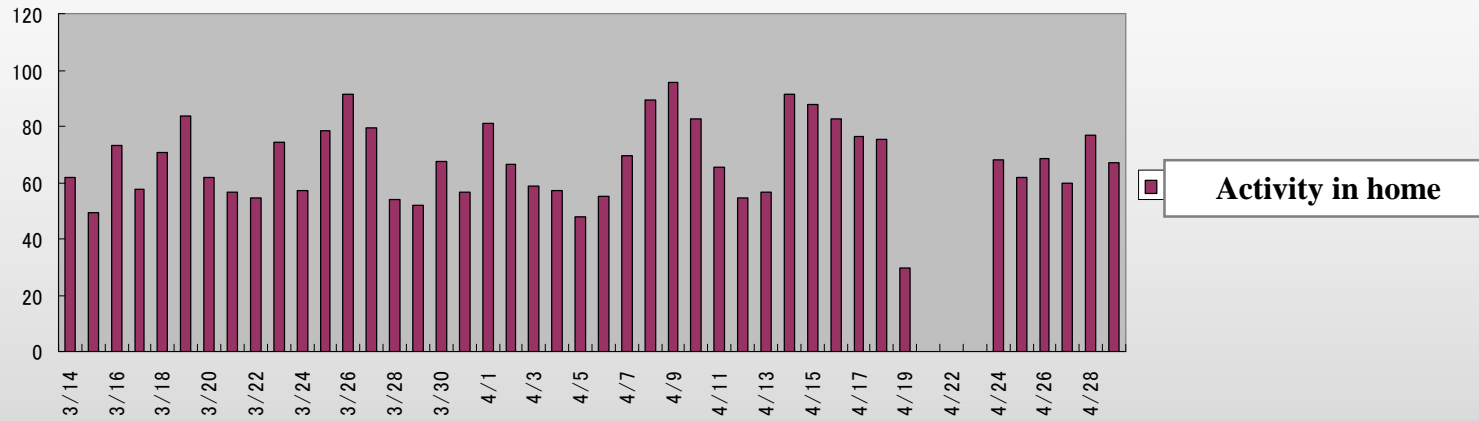


Not be able to detect above pattern in life cycle

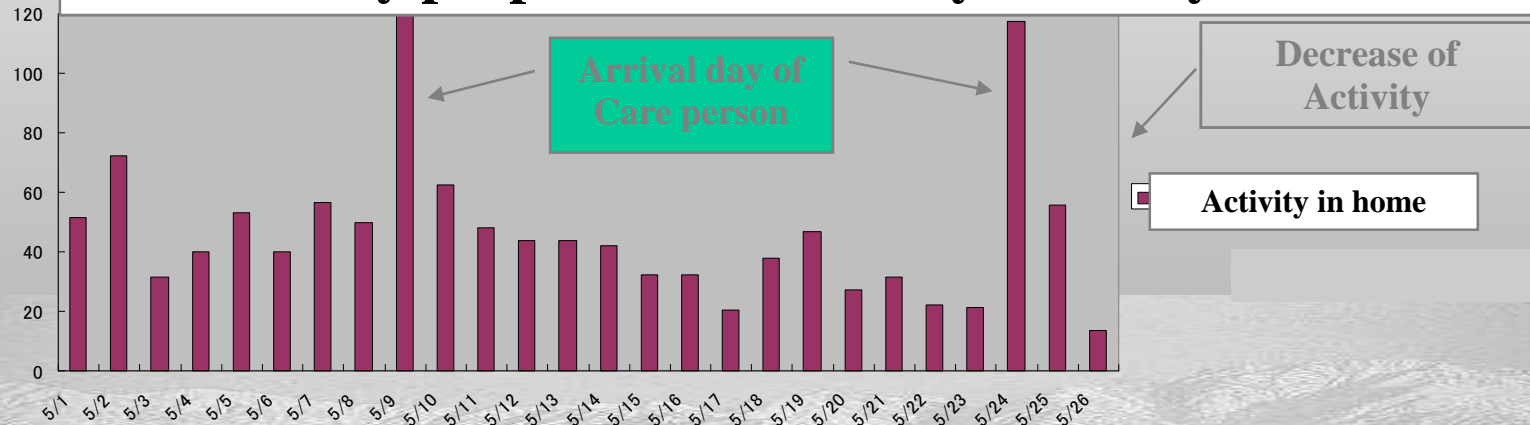
Elderly people was hospitalized in May 26 2000.

Ex. for changing a health condition No.1

Elderly people No.1 from March 14 to April 29 in 2000

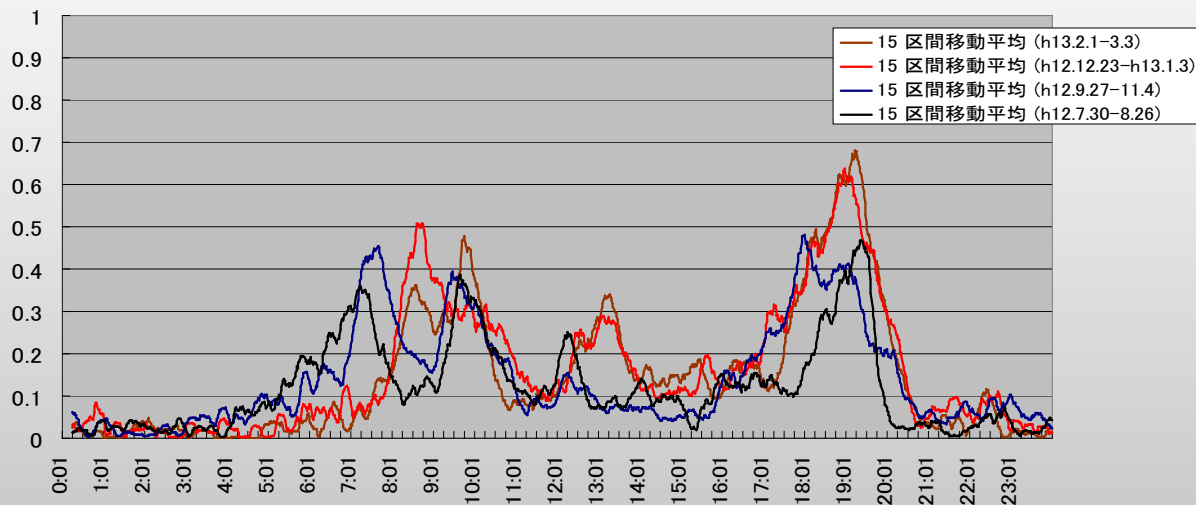


Elderly people No.1 from May 1 to May 26 in 2000



Ex. for changing a health condition No.2

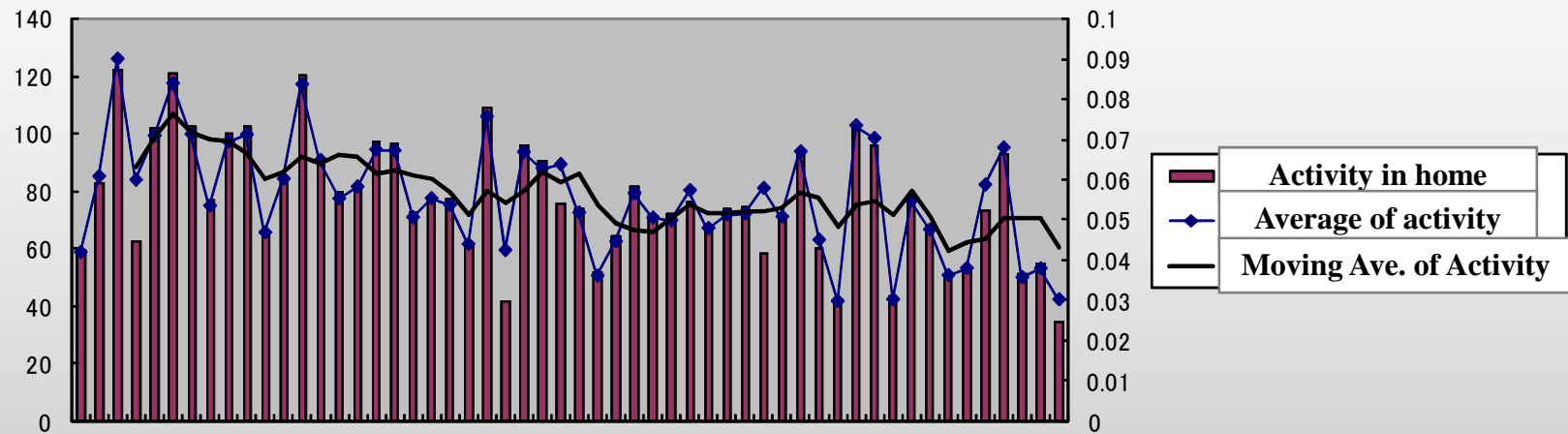
Elderly people No.2



・平成13年より、夜間、屋内で動き回ることがわかる。ヘルパーさんへの暴言等あり、痴呆が進み、独居に耐えられないとの医師の判断により、入院

Ex. for changing a health condition No.3

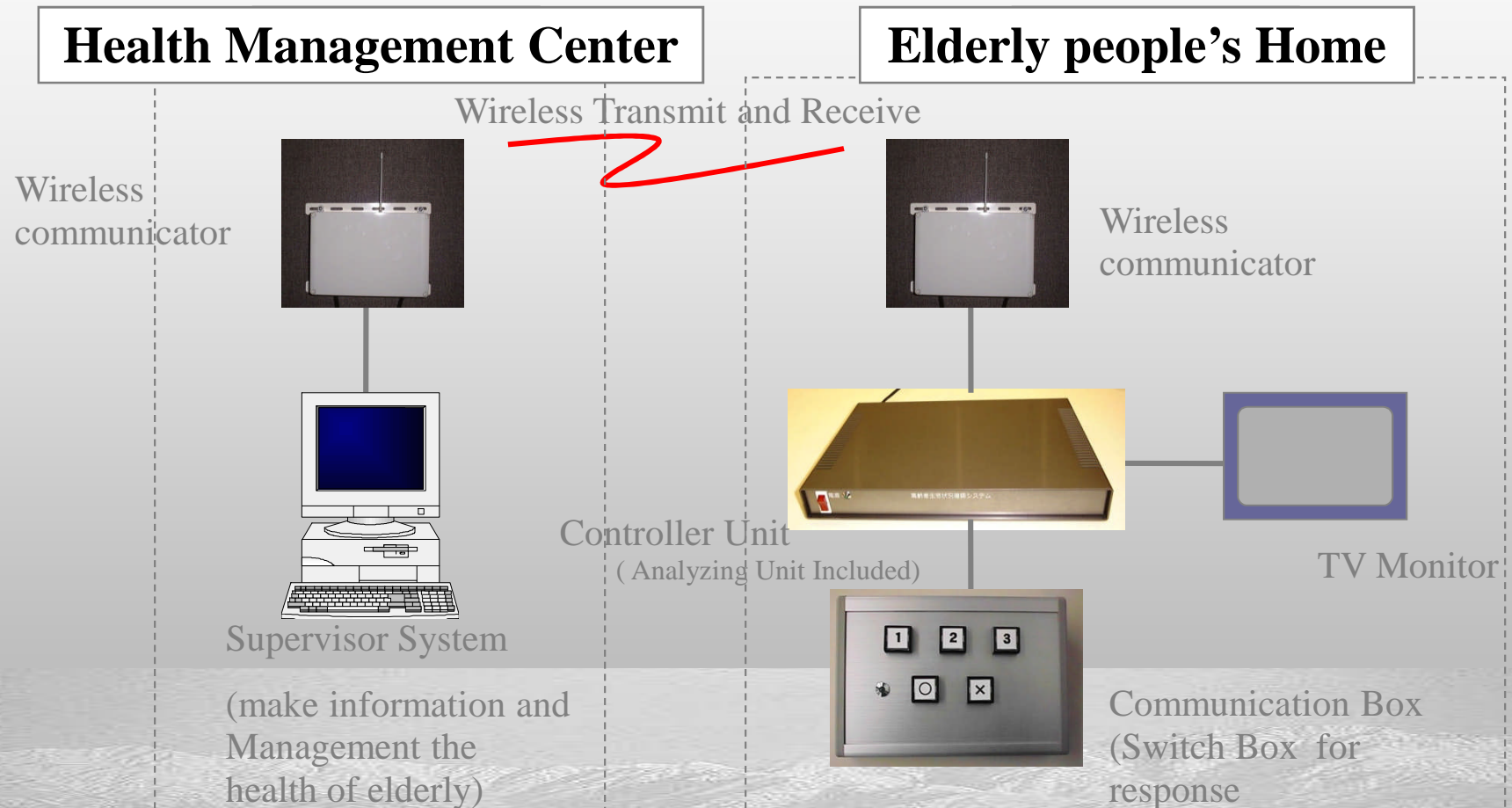
Elderly people No.3



- ・平成12年、暖かくなってきたにもかかわらず、屋内での活動量が減少 5/6 部屋の 中で動けなくなっているところを発見、入院。

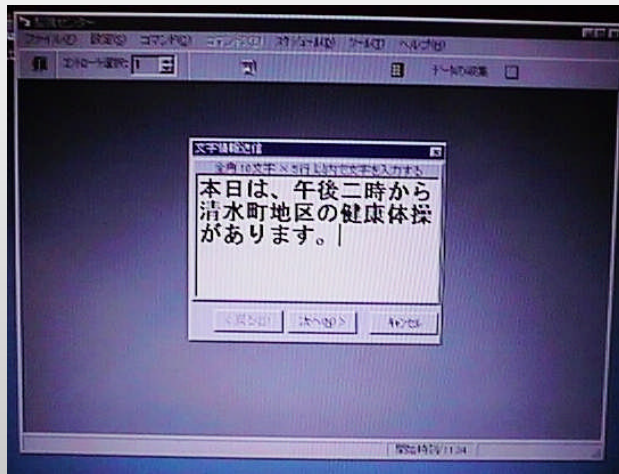


Function of Tele-communication - Display of the Information from a Health Management Center -



How to put up the Information from a Health Management Center to the Display

Health Management Center



Elderly people's Home



Support System for Elderly People

Conclusion

- The purpose is to propose the new support system.
- We were executed to evaluate the Monitoring Function of Living Situation of Elderly.
- The system was capable to transmit the measured data and to certify that an elderly human has past one's daily life.
- And it was ascertained this monitoring system could analyze behavioral pattern of elderly people.
- These results indicate that the system was useful for an elderly people life.

Already, above system have sold and have used at about 30,000 elderly people. Now, Our laboratory, Suwa Medical and Health Device Research Society and Japanese Red Cross Society Suwa Hospital execute to develop the system to Medical use.

Much more how to care a Health of Elderly people and Patients in their Home

- Develop New sensor and devices system for the support system.
- Build and Modify Social system and Community not only for the support system but also other system etc.
- Change the Limitation by law.

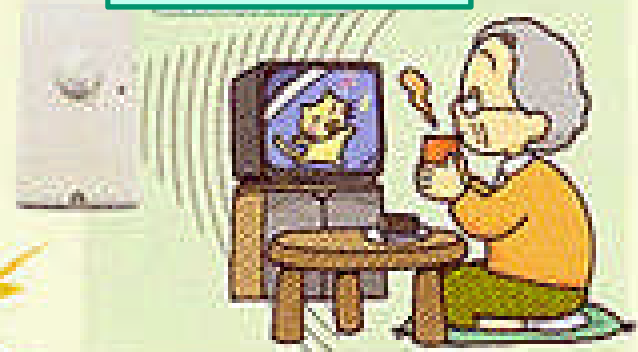


Elderly people's home

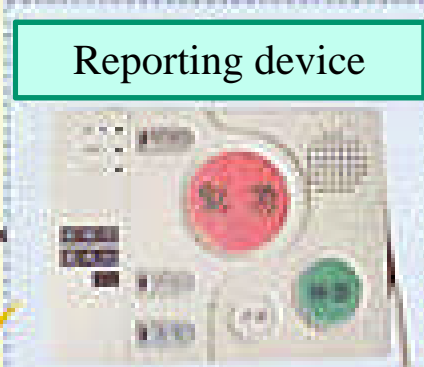
Fire sensor



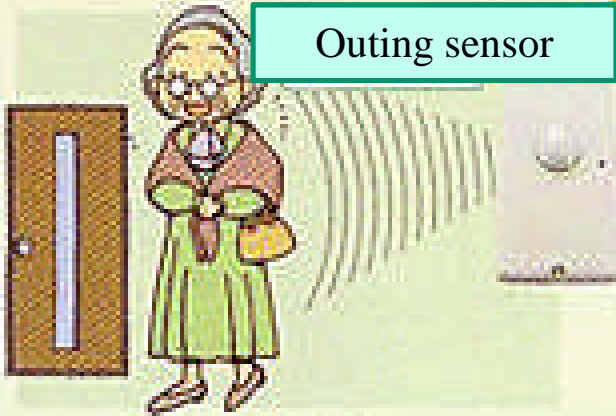
Safety sensor



Reporting device



Outing sensor



Home Controller



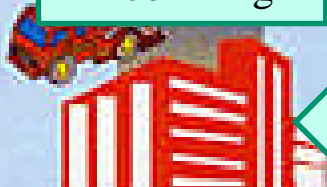
Pushbutton to ask for help



Existing phone



mobilizing



Fire department
Ambulance

Reporting and review



Health Management center

Checking the status



Collaborator and Family

Requesting for stimulus

Requesting of visiting

Reporting device

Night



夜

Daytime



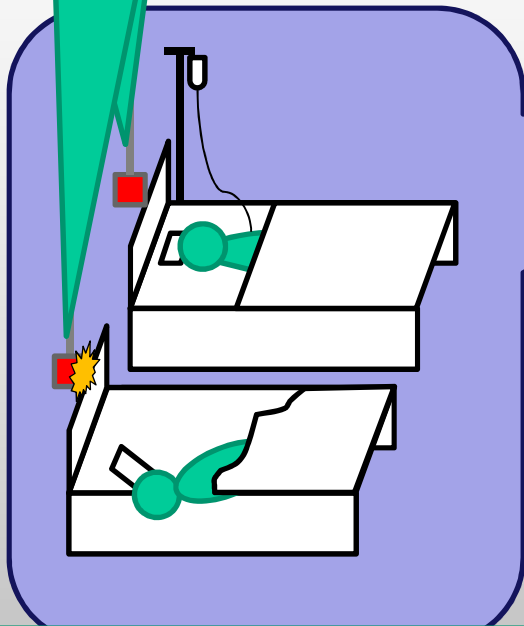
昼

Advisement

Emergency



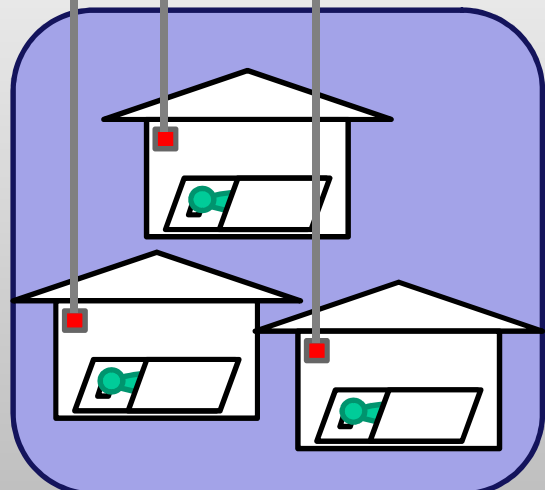
New Sensor



Hospital room



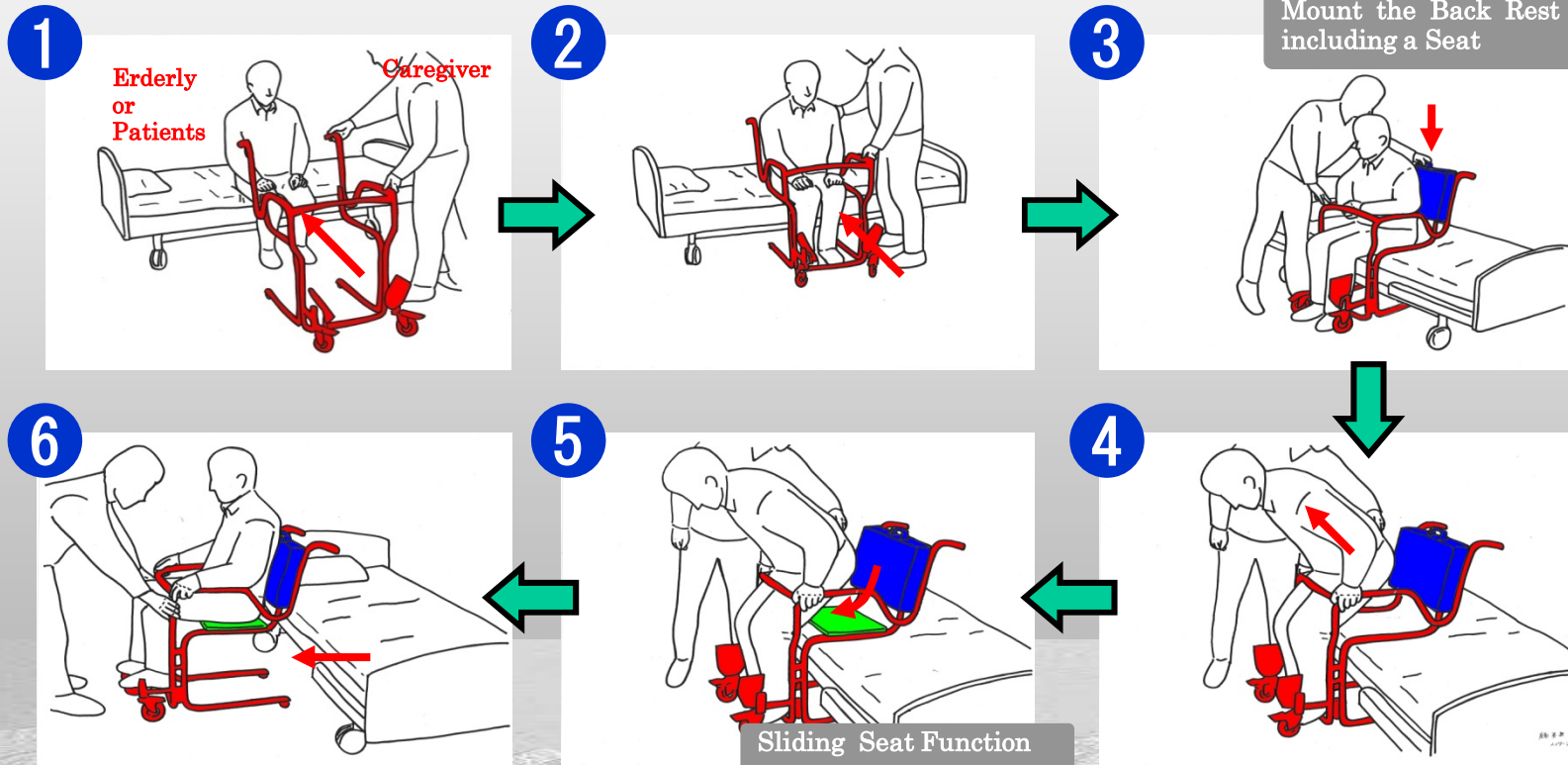
Health management center



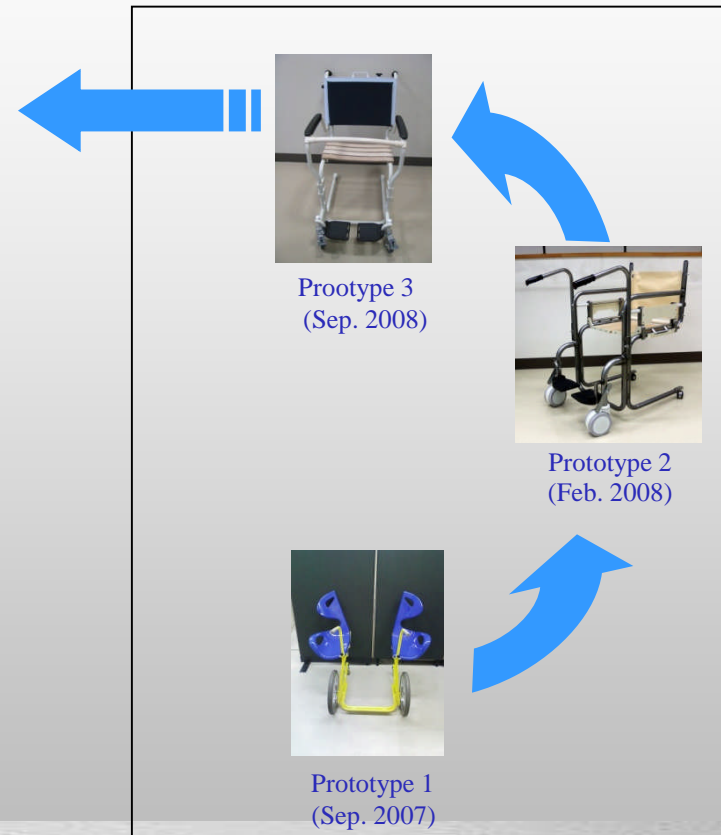
Individual elderly homes

New Assistive System for Patient and Elderly People 1

Concept of the Welfare System



New Assistive System for Patient and Elderly People 2

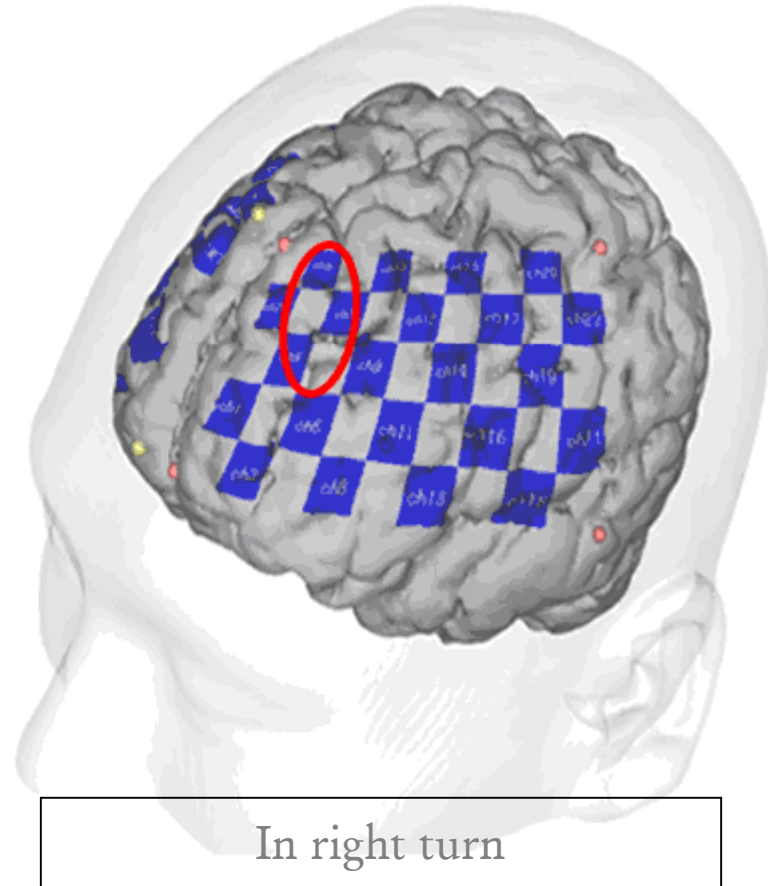
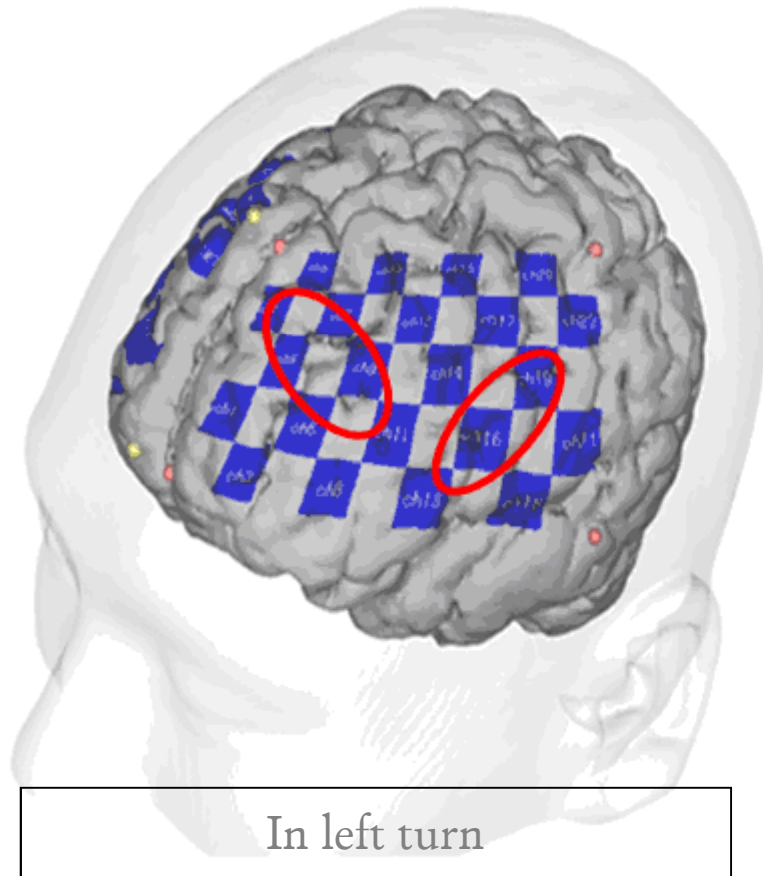


Now selling the welfare system.

「BRAIN INFORMATICS」

～ For Development New Medical and Welfare System 1 ～

Statistical T-test



「BRAIN INFORMATICS」

～ For Development New Medical and Welfare System 2 ～



Fig.1 Setting Probes



Fig.2 Setting Markers

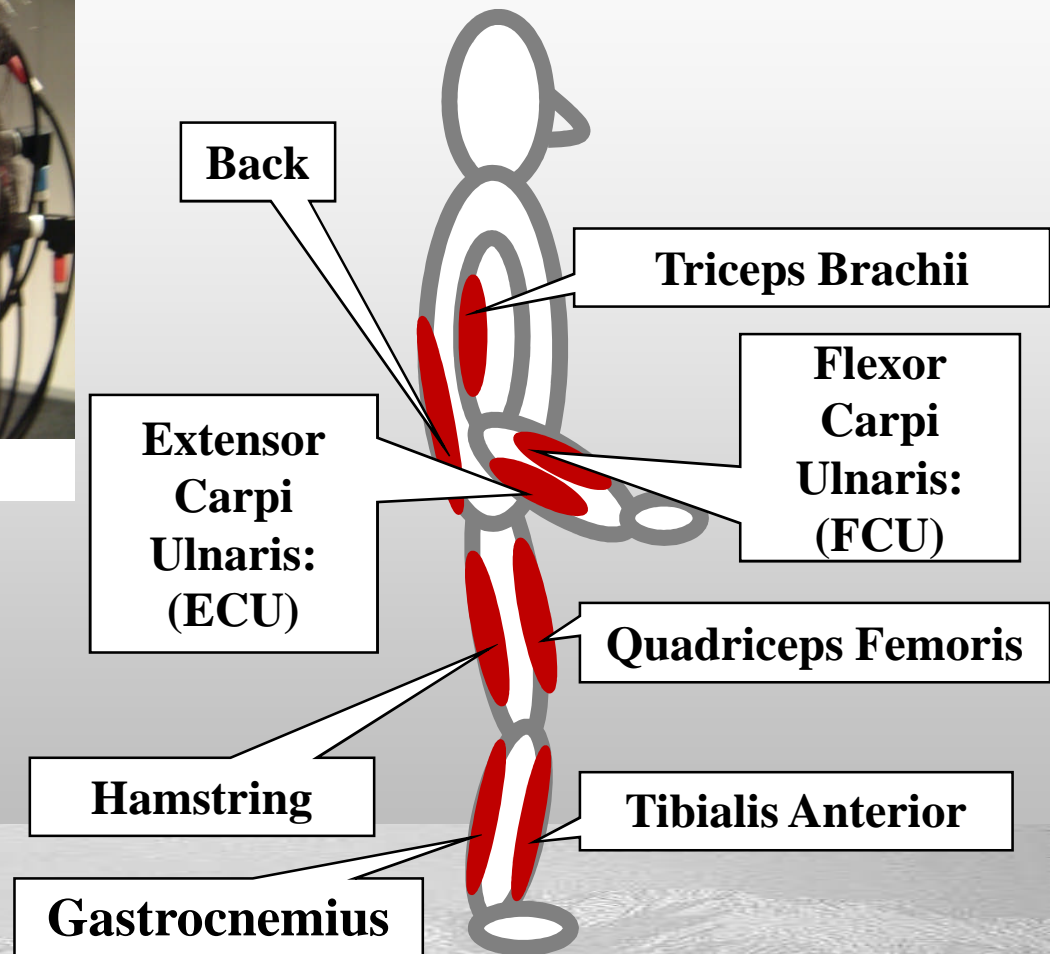
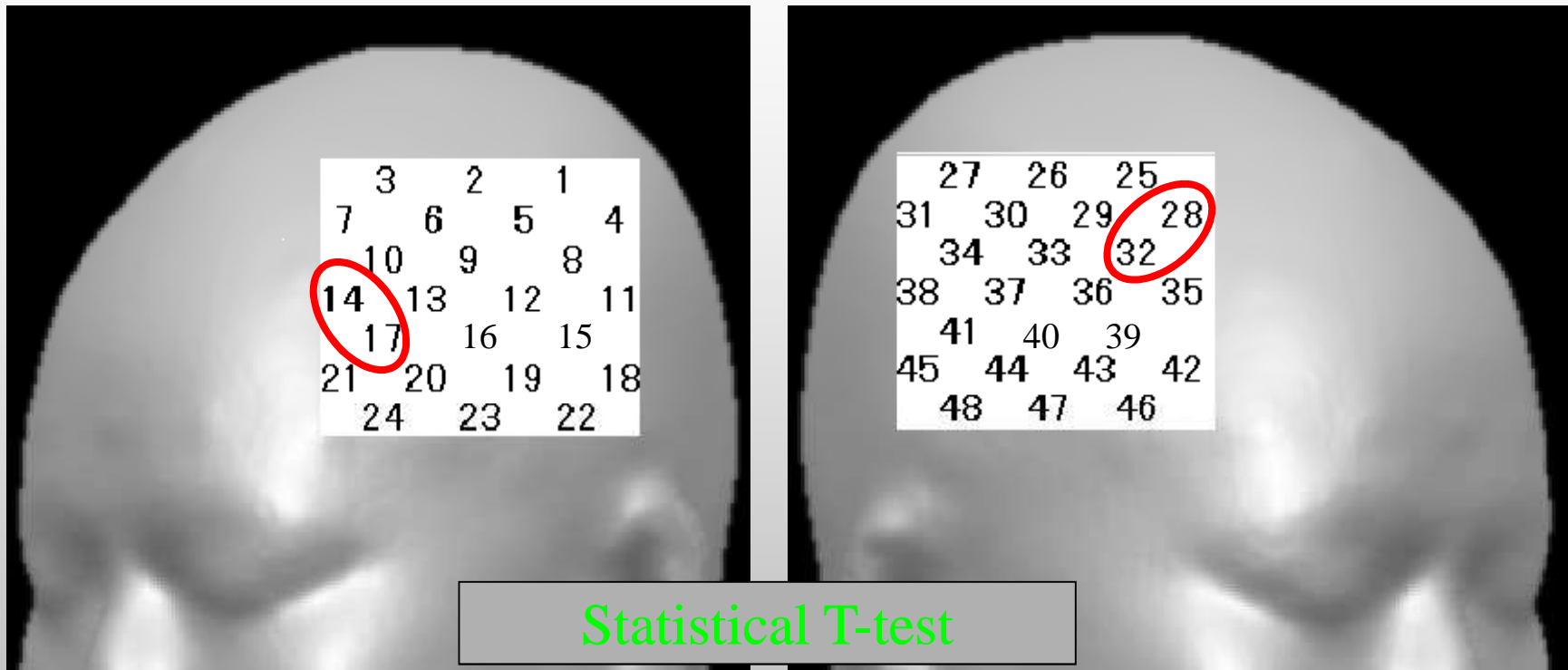


Fig.3 Measuring muscles

「BRAIN INFORMATICS」

～ For Development New Medical and Welfare System 4 ～



Now, our laboratory and Hokkaido Univ. etc have collaborate in researching based on KEIROKA - Technology with JST fund.

Innovative *KEIROKA* Technology Concept



Smart Suit



Smart Suit Light



UD Shovel

KEIROKA technology =
Technology to reduce fatigue and
effort

*Is it good to just become
comfortable?*

3S Assist Proposal

- **Secure** Secure assistance
- **Sustainable** Assistance to maintain bodily functions
- **Subliminal** Not dull the senses, unaware assistance



Farming labor assistance



Snow shoveling assistance



Nursing assistance


Research and Development Image

Research and Development Image

3S KEIROKA Technology



- Actuator Development
- Suit Shape Development

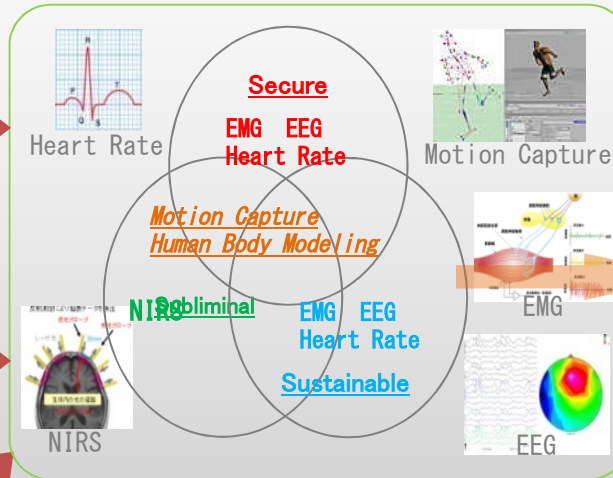


- UD Shovel

Next Generation KEIROKA Technology

- PAS Bicycle
- Motorized Bed
- Walking Aids Equipment

3S Evaluation System



Heart Rate

Secure

EMG EEG Heart Rate

Motion Capture

Motion Capture Human Body Modeling

Subliminal

EMG EEG Heart Rate Sustainable

NIRS

EEG

Various Biological Measurements

- NIRS
- EMG
- EEG
- Heart Rate (RRI)
- Motion Capture

Virtual Design Technology

Design Optimization

Real Field

《Work》

- Agriculture
- Construction
- Nursing



《Life》

- Snow Shoveling





Acknowledgment

Kazuo Yoshida Tateyama System Laboratory Co., LTD.

Kaoru Iketani Tateyama System Laboratory Co., LTD.

*Hideto Taya National Ins. of Advanced Indus. Science and
Tech. (AIST)*

*We are grateful to NEDO and JST. This research was supported
by Project of Ministry of International Trade and Industry and
Ministry of Education, Culture, Sports, Science and Technology
in Japan.*

Thank you !!!