**Group B** : *Engineering Educations, Applications, and Techniques*

# Kansei-based Development Methodology on Robotics

**Aphichata Thongrak**

Department of Electronic and Telecommunication Engineering, Faculty of Engineering
Rajamangala University of Technology Phra Nakhon, Bangkok 10300
Email: sabannga766@gmail.com

and **Suchada Sitjongsataporn**

Department of Electronic Engineering, Faculty of Engineering
Mahanakorn University of Technology, Bangkok 10530
Email: ssuchada@mut.ac.th

Manuscript received June 6, 2014
Revised July 15, 2014

## ABSTRACT

***A Kansei-based product methodology is to use the responses from customers by translating the emotion, impression and feelings on products in order to determine the design parameters. This is a suitable methodology for product and engineering design called "Kansei Engineering", which aims to develop or improve products in business way. In this recent, many Japanese researchers on robotics have been developed on the combination ideas of "Kansei Engineering", and "Robotics" to become an emotional robot that can express its emotion and feelings. In this academic paper, the Kansei with robot is discussed in the various topics on robotics in Japanese and European researches. The authors describe with a general view of them in relation to knowledge based on engineering from the view points of own authors.***

**Keywords:** Kansei engineering, Robotics, *affective engineering, Kansei robotics, Kansei information processing, human beings, comfortable lifestyle.*

## 1. INTRODUCTION

In the recent, there are many products and services which have been made us possible to take a comfortable life. Therefore, it is important to create some new products and services to succeed in markets by making emotional impact on the customers. Impression of a product is the one of key word for the decision of purchasing by customers. This leads us to Kansei engineering which aims to develop or improve products or services by translating customer's feelings and demand on the product's design parameters in business way. This process allows you to model customer's instantaneous feeling and emotions for ensuring your product or service evokes desirable customer's emotional responses. It was developed in Japan in the early of 1970s and now is widely spread among Japanese companies.

In the early of 2000s, it has been new departures for Kansei engineering that is in the applied science linking with robotic intelligence, psychology and neural sciences. The recent trends of the combination of Kansei engineering and robotics have been presented in the rich variety of studies associated with the area of Kansei Robotics such as human robot interaction and emotional robot.

In this paper, a general view of definitions of Kansei and Kansei engineering are shortly described. History of development of Kansei engineering is given briefly. Some researchers developed using Kansei engineering are presented in various topics of Japanese and European lifestyle.

## 2. WHAT IS KANSEI ?

The definition and explanation of Kansei from various viewpoints such as in Japanese dictionaries, Japanese Society of Kansei Engineering and definition used in engineering are described in this section.

### A. Definition on Japanese Dictionaries

The term 'Kansei' in Japanese consists of typically two different Kanji-signs: 'Kan' and 'Sei', which means sensitivity or sensibility described in Fig. 1. According to the Dainihon Japanese dictionary [1], the definition of Kansei is the sensitivity of a sensory organ where

sensation or perception takes place in answer to stimuli from the external world.

Many dictionaries now define Kansei as 'sensitivity', that Kansei had the same meaning in classical literature. Unfortunately, 'sensitivity' is not complete as the meaning as Kansei. In [2], Kansei is defined as an internal concept with three basic of taste/sentiment, feeling and emotion.

### B. Definition on Japanese Society

*According to the Japanese Society of Kansei Engineering (JSKE), Kansei is the integrated function of the mind and various functions extist during receiving and sending signals [3]. The process of filtering, acquiring information, estimating, recognizing, modeling, making relationship, producing, giving information or presenting that are the contents of Kansei.*

### C. Definition used in engineering

The definition of Kansei engineering has been concluded that the definition used in engineering and business which should be considered to be a series of information processing for processes of sensation, perception, cognition, sentiment and expression on the basis of the definition of Kansei of information processing cognitive psychology [1]. More practically, Kansei should be thought to be a series of reactions from sensation to mental responses or sensation and sentiment. In [4], the definition of Kansei engineering has been given as Kansei is the impression somebody gets from a certain artifact, environment or situation using all their senses of sight, hearing, feeling, smell, taste as well as their recognition.

For realizing manufacturing and information service, "Kansei" is an important perspective should appeal to each individual consumer [6]. This perspective is supported by the human-centered science and technology of "kansei engineering," or affective engineering

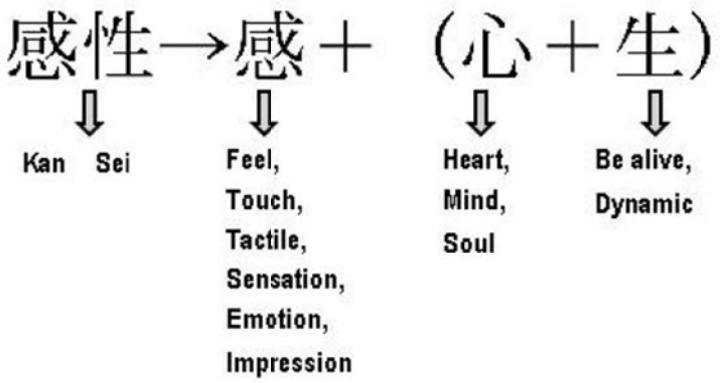


***Fig. 1** Linguistics of Kansei [5]*

## 3. WHAT IS KANSEI TECHNOLOGY AND ROBOTICS ?

Kansei Engineering is an important product development methodology [12]. First, it translates customer's impression, feelings and demands on the existing products in order to design especially solutions and parameters of these products. Second, it presents how Kansei can be translated into this design [7]. So that the design links to customer's emotional response to the products by Kansei engineering parametrically. According to information technology, the human communication is related to the Kansei information processing in order to treat human emotion by applying computer technology [8]. This leads on the affective information processing and human-robot interaction. In the future, robot will be operated and suited for human residential environments in order to perform with human more smooth and flexible work.

## 4. ROBOTICS BASED ON KANSEI INFORMATION PROCESSING

In this section, some examples of robotics based on Kansei information processing are presented such as a robotic Kansei communication system, the eye movement and facial expression in human-robot communication and a mobile robot operation, respectively.

### A. Robotic Kansei Communication System from Japanese Research

In the near future, these robots are necessary for supporting human and need to have not only intelligence but also KANSEI to make natural or human communication. The robotic emotion was trained to human emotion with the method of a vector field of dynamics. The robotic facial expression using a communication robot was realized dynamically based on the robotic emotion [9]. The main idea of this work is to find the interaction technique which makes a comfortable state through adjusting the communication field. The structure of the proposed communication system is shown in Fig. 2. The system consists of recognition, emotion generation and expression parts. In the recognition part, the voice analysis software is used to recognize the emotions from human voice. In the emotion generation part, the robotic emotion is determined using human emotion. The expression space generates the facial expression of robotic facial expression using a communication robot based on the state of the characteristics quantity. The communication system configuration is shown in Fig. 3. The results of this work confirmed that this method could utilize human-robot communication to keep a comfortable state.

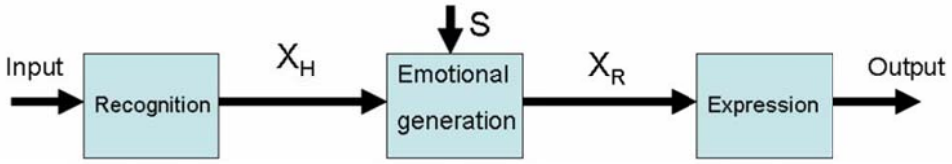


***Fig 2*** *KANSEI communication system based on emotional synchronization [9]*

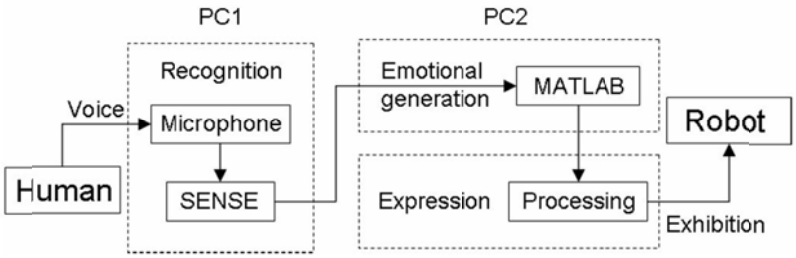


***Fig. 3*** *Block diagram of the communication system [9]*

### B. Eye Movement and Facial Expression in Human-Robot Communication from European Research

This study of eye movement and facial behaviors presented in [10] has been in the development of a computational facial communication model of human-human conversations to develop more comfortable and effective models of human-robot communications The experimental design is shown in Fig.4. The webcams were used to display an image of speaker and participant faces to each other on PC screen placed in front. The results suggest that there are many levels in face-to-face human conversational interaction. Further work is required to show a correlation between speed and distance of these motions.

### C. Mobile Robot Operation from Japanese Research

Operation of mobile robot with instruction of neck movement using laser point has been presented which a mobile robot follows the laser spot movement projected on floor using laser pointer attached at the human head is considered in [11]. In this research, the function as a broad Kansei transfer function is introduced between the instruction point of laser spot and the position of mobile robot in order to follow the laser spot. So, the robot motion parameters change with the value of Kansei transfer function. The results confirm that the effectiveness of this system can be used an existing mobile robot.

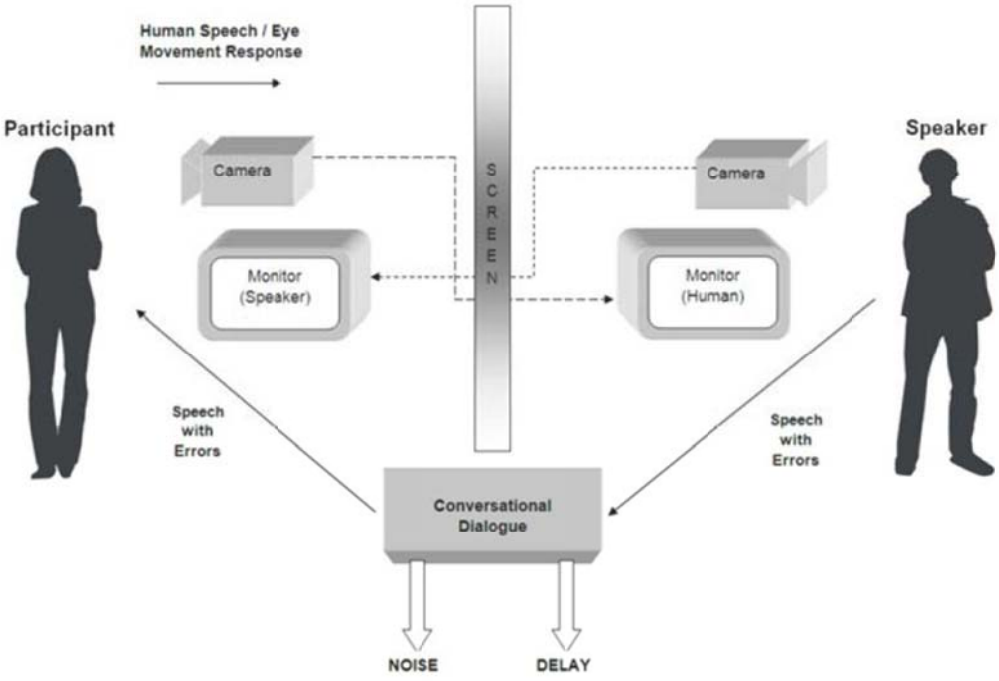


***Fig. 4*** *Experimental design [10]*

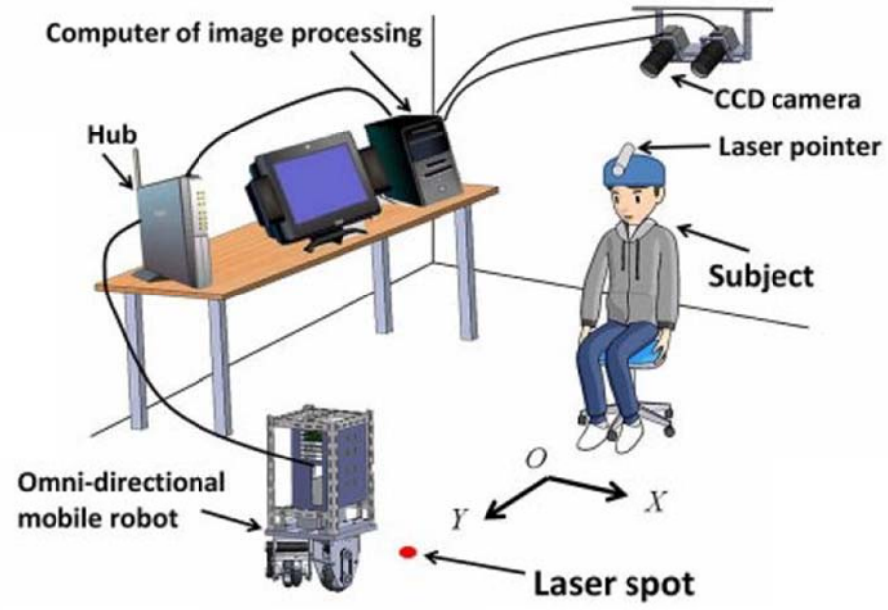


***Fig. 5*** *a setup of system of mobile robot [11]*

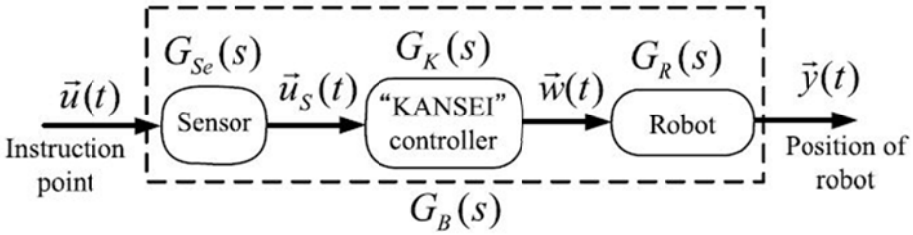


***Fig. 6*** *System including Kansei controller [11]*

## 5. CONCLUSION

In this paper, Kansei information processing based on robotics was discussed in the various topics in Japanese and European researches. While referring to Kansei-based development methodology on robotics and their trends were related to smooth communication and to perform flexibly the cooperative works with human in the near future.

## REFERENCES

[1] S. Nagasawa, "Kansei and Business", *Kansei Engineering International: International Journal of Kansei Engineering*, vol. 3, No. 3, pp. 3-12, 2002.

[2] Y. Shimizu, T. Sadoyama, M. Kamijo, S. Hosoya, M. Otani, K. Yokoi, Y. Horiba, M. Takatera, M. Honywood and S. Inui, "On-demand production systems of apparel on basis of Kansei Engineering", *International Journal of Clothing Science and Technology*, vol. 16, pp. 32-42, 2004.

[3] [Online]. Available: http://www.jske.org

[4] M. Nagamachi, "Workshop 2 on Kansei Engineering", in *Proceedings of International Conference on Affective Human Factors Design*, Singapore, 2001.

[5] S. Lee, A. Harada and P.J. Stappers, "Pleasure with Products: Design based Kansei", *Pleasure with Products: Beyond usabitlity*, W. Green and P. Jordan (eds.), Taylor & Francis, London, pp. 219-229, 2002.

[6] [Online]. Available: http://www.yomiuri.co.jp/adv/chuo/dy/research/20100430.htm

[7] S. Schütte, "Engineering Emotional Values in Product Design: Kasei Engineering in Development", Ph.D. dissertation, Department of Mechanical Engineering, Linköpings Universitet, Linköping, Sweden, 2005.

[8] S. Hashimoto, "Kansei Technology and Robotics: Machine with a Heart", *Kansei Engineering International*, vol. 8, no. 1, pp. 11-14, 2009.

[9] T. Usui, K. Kume, M. Yamano and M. Hashimoto, "A Robotic KANSEI Communication System Based on Emotional Synchronization", in *Proceedings of IEEE/RSJ International Conference on Intelligent Robots and Systems*, France, pp. 22-26, Sep. 2008.

[10] C.C. Ford, G. Bugmann and P. Culverhouse, "*Eye Movement and Facial Expression in Human-Robot Communication*", in *Proceedings of International Conference on Kansei Engineering and Emotion Research (KEER)*, pp. 717-730, March 2010.

[11] S. Shibata, T. Yamamoto and M. Jindai, "A Mobile Robot Operation with Instruction of Neck Movement using Laser Pointer", *Kansei Engineering International*, vol. 11, no. 2, pp. 51-58, 2012.

[12] S. Sitjongsataporn and M.Kasuga, "Kansei Engineering: Development Methodology", Engineering Transactions, vol. 16, no. 1 (34), pp. 45-50, Jan. - Jun. 2013.