Design of Kansei Engineering Support System Using Fuzzy Multiple Attribute Decision Making

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Abstract – Kansei Engineering was adopted as a method to analyze the critical factors and elements design in developing a new product of software based on consumer’s emotions. However, most analysis in Kansei Engineering are using statistical analysis such as principal component analysis, factor analysis etc in order to evaluate the average data gathered from all respondents and explore product based on analysis result. This paper reports an attempt to discover the relationship between interface design of product and consumers’ emotion using fuzzy method rather than using statistical method. The objective of this research is to develop an Kansei Engineering system to support consumer’s decision for customer in online shopping, so consumer could choose the desired product. As first step, this research proposes general design of this module application to be implemented on any kind web based online shopping.

Key Words – Emotion; Kansei Engineering; Fuzzy Method; Online Shopping.

1 Introduction

Consumer is the central points on shopping whether in online or real shopping. Sometime consumer faces the conditions that need decision to choose which one product they have to select based on their needs and their passion. But most of system online or traditional lacks of facility of supporting their decision in shopping, so most consumers are still confused when they bought the product whether their decision is true or not.

Most of online shopping focuses on their system interface to facilitate the consumers. On the other hand, they are many kinds of products are delivered to the consumer, but the system lacks of supporting facility such as decision support system to buy the suitable thing they want based on their feeling or their emotion to the product. Kansei Engineering is one kind of approach is widely used in the research of product development based on emotion. Since, Kansei Engineering has an ability to translate consumer’s psychological feeling into a concept of emotion that is proposed to be adopted into developing online shopping with decision support component.

The aim of this research is to explore the relationships between consumer’s emotional factors (psychological feeling) with product using combination of Kansei Engineering method and Fuzzy Multi Attribute Decision Method (FMADM). The first target of this research is the general design of decision support system that could be used as guide of consumer during online shopping in making decision to buy a product based on the perspective of consumer’s psychological requirement.

2 Related Work

Many research have been performed adopting Kansei Engineering in diverse fields in product
emotion, which includes software systems. Example of past research includes emotion and entertainment [3-4], emotion and wheelchair [5], emotion and e-commerce [6-7], emotion and textile [8-9], emotion and fashion design [10], and many more. However, only little study is evident in the educational domain.

Among the many definitions of Kansei, the founder of Kansei Engineering, Nagamachi, defines Kansei as a state that implies psychological feeling and needs in mind [11]. Kansei is also referred to the state of mind where knowledge, emotion and passion are harmonized by [12]. Kansei Engineering was established as a discipline that brilliantly assimilates Kansei, psychology, engineering, and statistics [13]. The use of Kansei Engineering is targeted to enable development of products that win the heart and mind of the consumers. It has in its methodology, a systematic process to discover insights of consumers’ responses toward artifacts via several physiological and psychological assessment methods. These knowledge will then be translated into design characteristics, which then enable the formulation of new product design that embeds consumers’ implicit feelings and desires. It is evident that this methodology can be used to enable inclusion of emotion in e-learning, as positive emotion has been found to positively associate with learning [14-15].

This research put its focus of development of Kansei Engineering system as additional support of web based shopping system, in order to provide consumers to select a suitable product according to consumer’s emotion.

3 System Analysis

This research tried to adopt FMADM into Kansei Engineering Method especially in order to make a decision to select one from many alternatives. For example in online shopping many consumers always feel confused to select a really desired thing. It is psychological problem which one to be selected. Unfortunately this kind of function is not available in many online shopping systems to make consumers more comfortable during exploring what they need.

![UseCase Diagram](Usecase Diagram)

This research adopted the Kansei Engineering Method Type I (KE Pack) due to its simplicity and wide use in many kansei product development [2, 6, 10, 19, 20, 22, 23]. The following Table 1 and Fig. 1
show the basic functional requirements to be fulfilled in development of This Kansei Engineering Support System.

Basically this system requires six functions to perform kansei analysis based on FMADM such as select specimen, create SD scale, input data, evaluations, manage specimens, and manage kansei words.

Table 1. Usecase Description

<table>
<thead>
<tr>
<th>Usecase Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Select Specimen</td>
<td>Select the specimens to be evaluated by consumers according to elected Kansei Words.</td>
</tr>
<tr>
<td>Create Questionnaire</td>
<td>Create a questionnaire table to be inputted by consumers using five points SD scale.</td>
</tr>
<tr>
<td>Input Data</td>
<td>Consumers enter the value from 1 to 5 point for each specimens using data questionnaire, according to their emotional feelings.</td>
</tr>
<tr>
<td>Evaluation</td>
<td>Calculates the data of questionnaire, and calculates it’s to get its average. Performs FMADM to evaluate specimens, and then finds which product to be recommended as a good product.</td>
</tr>
<tr>
<td>Manage Specimen</td>
<td>Manage specimens stored in database whether to add, to delete, to edit according to the requirements.</td>
</tr>
<tr>
<td>Manage Kansei Words</td>
<td>Manage which Kansei Words to be used selected and used for evaluation.</td>
</tr>
</tbody>
</table>

5 System Design

This Kansei Engineering support system globally consists of two architectures, there are system architecture and data architecture.

5.1 System Architecture

Kansei Engineering support system would be built based on client/server architecture and MVC (Model View Controller) framework. Main elements of system are described as follow:

- **Data Collection**
  Module to collect three kinds of basic data such as specimens, kansei words, and data questionnaires from consumers.

- **Evaluation**
  Module to make calculation such as average calculation of collected data from consumers, calculation using FMADM based on average data, and sorting priorities.

- **Display Decision**
  Module of interface to collect data and to show the calculation result to consumers. There are two kinds of interface such as for administrator, consumers.

Fig. 2 shows the system architecture of The Kansei Engineering Support System that divided into server side and client side.
Evaluation module used TOPSIS as FMADM method to make a decision by calculating gathered data from respondent as follows [24]:

- Makes a normalized decision matrix
- Performs weighted calculation to the normalized decision matrix
- Decides ideal positive solution matrix and negative solution matrix
- Determines the distance between the value of each specimen with positive ideal solution matrix and negative ideal solution matrix.
- Determines the preferential value for each specimen.

5.2 Data Architecture

This system consists of several entities to perform consumer’s emotions using Kansei Engineering and FMADM. Fig. 2 shows Entity Relation (ER) Diagram that describes required data to manage required data of this system. At least there are five main data entities to construct Kansei Engineering support system as follows:

- Specimens, the data of all specimens are collected, and shown to consumers during the questionnaire.
- Kansei words, collects all specific words related to specimens according to consumers emotional feeling.
- Questionnaire, constructed from combination of specimens and kansei words using SD Scale to evaluate consumers emotional feeling.
- Respondents, records consumer data as participants.
- Result, collected from data of questionnaire, calculate its average, and evaluate its average data using FMADM to get a decision to select a specimen.
Using these entities all consumers’ data could be stored, and reused again for future analysis to resume all data from consumer’s emotions. Table 2 shows the basic structure of each data entity including the main fields and table constraints.

Table 2. Data Entity Structure

<table>
<thead>
<tr>
<th>Data Entity</th>
<th>Field</th>
<th>Type</th>
<th>Constraint</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specimen</td>
<td>ID_Specimen</td>
<td>Char</td>
<td>Primary key</td>
</tr>
<tr>
<td></td>
<td>Name</td>
<td>Varchar</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Figure</td>
<td>Image</td>
<td></td>
</tr>
<tr>
<td>KanseiWord</td>
<td>ID_KW</td>
<td>Char</td>
<td>Primary key</td>
</tr>
<tr>
<td></td>
<td>Name</td>
<td>Varchar</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Description</td>
<td>Varchar</td>
<td></td>
</tr>
<tr>
<td>Questionnaire</td>
<td>ID_SD</td>
<td>Char</td>
<td>Primary key</td>
</tr>
<tr>
<td></td>
<td>ID_KW</td>
<td>Char</td>
<td>Primary key</td>
</tr>
<tr>
<td></td>
<td>Value</td>
<td>Numeric</td>
<td></td>
</tr>
<tr>
<td>Respondent</td>
<td>ID_Respondent</td>
<td>Char</td>
<td>Primary key</td>
</tr>
<tr>
<td></td>
<td>Fullname</td>
<td>Varchar</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sex</td>
<td>Boolean</td>
<td></td>
</tr>
<tr>
<td>Result</td>
<td>ID_Result</td>
<td>Char</td>
<td>Primary key</td>
</tr>
<tr>
<td></td>
<td>Calculation</td>
<td>Numeric</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Decision</td>
<td>Char</td>
<td></td>
</tr>
</tbody>
</table>

6 Conclusion

Kansei Engineering has been adopted in this research to analyze users’ psychological needs and desire
in a system. In this research, psychological factors could be set as variable of FMADM, dan calculated it to get a decision.

Further research is proposed to explore system detailed specification and design, then developed it using powerful server dan client’s device. This system have to support many kinds of client’s device not only desktop, but also smartphone, in order to access this system widely.

Acknowledgement

The authors would like to thank Mr. Fahmi Abdullah the graduate student of STMIK LIKMI Bandung for their great supporting in discussion and cooperation during this research.

References


