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An Application of Kansei Engineering to Community-base Collaboration

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Abstract: This paper presents a proposal to reconstruct some specific towns which were attacked and destroyed by Huge Tsunami, for example, in Tohoku region of Japan on the 11th of March, 2011. A collaborative approach have been employed to provide some trial proposal to reconstruct such damaged towns by means of Internet Community as follows. (1) Providing a proposal and pictures to reconstruct, especially offering visual design concept of living space for slope topography through Social Network System as an example of Internet Community, (2) Consulting and discussing the above proposal and pictures among specific Internet Community with analysis by Kansei Engineering, and (3) Improving an original proposal into more efficient and suitable one. The paper also explains detail of the senario to brush up the proposal by means of the above collaborative approach and some problems to be resolved in order to make it more fruitful.

Keywords: Collaborative Design, Information Sharing through Social Network, Evaluation by Kansei Engineering Approach

1. INTRODUCTION

Collaborative Design is one of the suitable and reasonable approaches to reach the temporal goal with help from related members and/or community in the relatively short period. Our research focuses on procedure for arranging or improving of residence through collaborative design methodology. One of key ideas is to utilize Social Network in order to achieve collaborative design. And other is to apply Kansei Engineering methodology to evaluation of procedure and decision making of results such a design has produced.

This paper includes concept for collaborative design in the next section, prototyping and improving of collaboration in the third section, evaluation and improvement by Kansei engineering in the fourth section, and summarized conclusion in the final section.

2. COLLABORATIVE DESIGN CONCEPT

It is difficult to decide the most efficient and/or effective element(s) for the relevant users in a short period. Especially, only one or very few persons cannot resolve several problems which one positively evaluate but at the same time another negatively does. Certain size of group can provide a lot of valuable ideas which can determine and adjust such problems into more acceptable solutions for wider range of human requests. Community-based approach will realize such valuable ideas and good design methodology.

Some people say Internet looks like one of huge communities. Of course, Internet itself provides loosely coupled human connectivity so that Internet users always want to have seamless access to LAN, WAN and/or global network in order to obtain several kinds of information, benefits, hints, idea and so on. But unfortunately Internet also includes a lot of evil-mind and ill-intention for a third party.

Whenever connected with Internet, its users have to confirm that information and/or ideas obtained from it are suitable and constructive for them at the glance. Therefore the users want to have not only access to Internet but also specific connectivity of Internet with trust and reliability. Social Network Systems in Internet, which is abbreviated as only SNS, can provide a suitable environment for the members to be safe and confortable in order to perform suitable collaboration for work, evaluation and discussion[1].

One user of SNS can work together with his/her other members in order to communicate one another, exchange each information, and discuss about common problems asynchronously (i.e. not in realtime) but directly (almost without misreading). With connectivity of SNS, users can show their concept/solution, obtain efficient criticism about them from others, evaluate them among their community, and rebuild/modify original concept/solution into improved ones.

3. PROTOTYPING OF COLLABORATION

3.1 A Draft Senario of Collaboration

First of all, we illustrates a draft senario of collaboration and implementation with SNS and then demonstrates an example of Collaborative Design[2] of living space for slope topography through "Facebook" as an example of SNS. Our attempt has been carried out with utilization of Facebook as a efficient SNS of Internet Community.

Reasons to employ Facebook connectivity as SNS are as follows;

- In Japan, there are some famous SNS's for several kinds of users as Internet Community. But almost all are not so famous for foreign countries and also not so convenient for foreign users of Internet Community. Currently, Facebook has a huge numbers of members who belong to several countries and it seems to bes one of most powerful and influential SNS's of the world.

• Even in the case of our personal experiences, Facebook is more affective and available for us to communicate with our friends and colleagues and exchange several kinds of information and ideas by means of multimedia than others. Users of Facebook must enjoy easy handling of Information, multimedia and computer programming.

Figure1 shows a scheme for data distribution by means of Facebook. It shows that it is convenient for users to distribute original design and idea into their friends and colleagues through a function of Facebook asynchronously and directly. This user wants to proposes his idea and detail of design, transfer the relevant set of idea/design to his colleagues and realize information exchange with utilization of engineering drawing and photos of prototype.

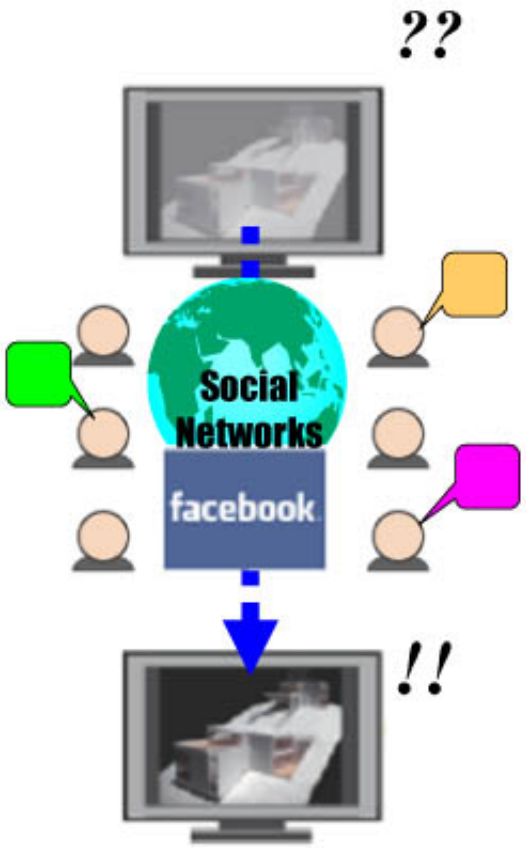

Fig. 1 Collaborated Degin among distributed Colleagues with utilization of benefit by Social Networks

With utilization of SNS, we will be able to expect some effects of Collaborative Design which realize a typical story as follows in Figure1;

1. One of the relevant user's colleagues obtained an original idea through Facebook as Internet Community.
2. He/She thought about such idea and had some different idea and relevant comments for it.
3. He/She sent such different idea and his/her comments to the relevant user for convenience and improvement.
4. The user obtained such useful idea and comments for the sake of his convenient and improvement directly and on-line.
5. Finally, the user can rebuild his original idea and reconstruct design based on the more useful concept and recognition.

With some benefits of Internet Community, we can prepare collaborative environment for efficient design methodology and discussion. We can expect direct communication with foreign colleagues although they are away from us and living in other countries. As the results of communication and discussion, we can obtain professional idea and criticism about our current problems asynchronously but smoothly. In the next subsection, we will demonstrate practical example of Collaborative Design for living space for slope topography through human connectivity of Facebook.

3.2 Example of Collaborative Design

We have been wanting to propose some specific idea to reconstruct living space and/or home for slope topography especially near the seashore for the sake of avoidance of Tsunami's damage. One of authors, namely Masatoshi Imai, has a lot of idea, design concept, and images of prototyping about living space and/or building for slope topography. He is in domain of design field and not so familiar with practical architecture for building and construction.

So he has been expecting that colleagues discuss his design concept, check and evaluate it and finally improve it into more fruitful new one together with himself. Because it is very nice for not only him but also people, who want to live in such a living space for slope topography without a fear about Tsunami, to propose more suitable design concept of living space/building for slope topography, he want to discuss his idea and perform collaborative design through Facebook as a creative environment of Collaborative Design.

We will introduce a practical design concept to build living space for slope topography on window of Facebook shown in Figure2. The relevant design concept displayed in Figure2 can be realized and explained by means of several multimedia information such as engineering drawing, some views of prototyping and physical images for beginners and experts(professional engineers).

Fig. 2 Design Concept to Build Living Space for Slope Topography on Facebook.

If someone has a glance at such URL, he/she can look at each information as precisely as he/she wants. In order to watch in detail, he/she can focus specific information, namely engineering drawing and/or three dimensional view of relevant building/living space. Figure3 is an example of three dimensional image which demonstrates other view as design concept.

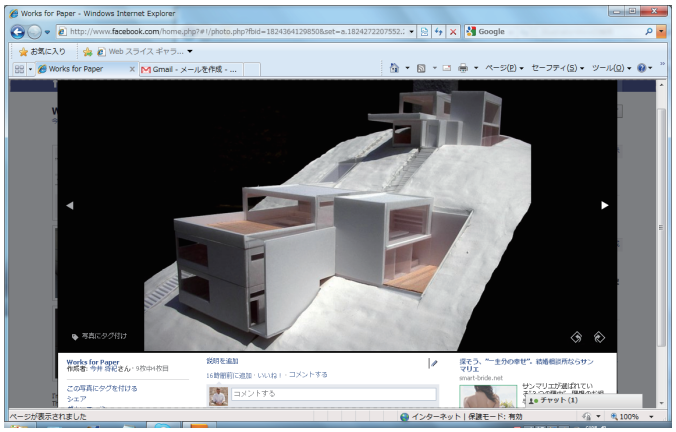

Fig. 3 Sample Three-Dimensional View as a Design Concept on FaceBook.

As described before, we are not professional engineers for architecture, so a chart of engineering drawing is not perfectly suitable to discuss our idea among professional engineers, but three dimensional image will be able to provide certain viewpoints even for nonprofessional persons. We want to obtain some comments and criticism for our draft proposal of design concept of living space for slope topography.

We think that beginners of architecture/landscape need some practical images in order to understand whether living space for slope topography is suitable or not even they want to avoid potential damage of disaster from Tsunami. So we have provide some three dimensional views of living space for slope topography and let the relevant people imagine as if they were living there more closely. Of course, we think that virtual reality and other visualization techniques are necessary for people who want to have more information about our idea. That must be another problem to be resolved by ourselves in future.

4. EVALUATION AND IMPROVEMENT

4.1 Evaluation procedure by Kansei Engineering

As is known, Kansei Engineering[3] is one of efficient approaches to "translate users' psychological (emotional) feeling about a product/image into perceptual (machine-understandable) design element/methodology" for the sake of efficient realization[4]. Our key idea to utilize Kansei Engineering for Collaborative Design are summarized as follows;

- One proposal may obtain a few comments and criticism which differ from one another. In such a case, we need smart strategy to accommodate the above comments and criticism for more suitable and allowable design, product, image and so on. Sometimes, comments and criticism are expressed in not quantitative but qualitative notation, so that we need some efficient mechanism to translate qualitative expression into qualitative one smoothly and suitably. Kansei Engineering is one of the most excellent methodologies to obtain quantitative (i.e. numerical and computer-oriented) parameters from psychological (emotional) expression or feeling.
- Kansei Engineering is one of the well-established methodologies founded in Japan and one of the most applicable procedures to analyze and classify multiple-parameterized input data, which sometimes differ each other for the unified targets. In the world, Kansei Engineering is utilized from car manufacturing to fashion design and available in many kinds of domains which include not only engineering but also several decision making.

For example, in the case of discussion about window size of living space for slope topography, we want to decide whether height and width of window size is suitable for relevant height and width of according wall or not and to obtain information about parameter to enlarge or reduce the height and width of window against the fixed size of wall. For the sake of realization of Collaborative Design, the problem is how to get and find such parameterized request in comments and criticism from colleagues of Internet Community.

4.2 Improvement procedure by Kansei Engineering

We have employed Kansei Engineering approach and its powerful procedure of attribute rating. In order to determine whether size of window should be remained, enlarged or reduced and obtain scale of parameterization for enlargement or reduction of window size, we will apply the following steps;

1. preparing some questionary investigation with 5 stepwise graduations, namely, "enlarge more", "enlarge a little", "remain (or keep this size)", "reduce a little", and "reduce more".
2. defining the maximal amplitude for enlargement and reduction.
3. comparing the result rating from the answer against questionary investigation with 5 stepwise graduations statistically.
4. calculating quantitative result with compared rating into the value from "enlarge more" to "reduce more".
5. mapping the above value into parameterized scale and get scaled amplitude to enlarge or reduce.

For example, we can define mapping function to translate emotional expression into rating of Kansei Engineering shown in "param."-column of Table1. Parameter 'f' in this table means a factor to specify how to enlarge windows or reduce ones for the adjustment according to request from colleagues from Internet Community. Therefore, when the value of 'f' is plus, we decide to choose an operation for enlarging of window. In contrast, when it is minus, we do for reducing

of window. And absolute value of 'f' specifies amplitude of factor for level of enlarging/reducing.

Table 1 Calculation of Parameterized Attribute with Emotional Expression from Internet Community

emotional ex.	param.	P_1	P_2	P_3	P_4	P_5	
enlarge more	$1.0f$	√	-	-	-	-	$1.0f$
enlarge a little	$0.5f$	-	√	√	-	-	$1.0f$
remain	0.0	-	-	-	√	-	0.0
reduce a little	$-0.5f$	-	-	-	-	√	$-0.5f$
reduce more	$-1.0f$	-	-	-	-	-	$0.0f$

If there are 5 numbers of emotional expressions as comments or criticism from Internet Community,namely from P_1 to P_5, we can try to calculate a parameterized attribute based on some criteria with such expression, which are demonstrated in the right side of Table1 and below numeral expression. And then we can obtain the precise factor to enlarge the relevant window by below calculation.

$$(1.0f + 2 * 0.5f + 0.0f + (-0.5f) + 0.0f)/5 = 0.3f$$

For example, assuming that default value of scaling factor is 10%, we can draw from the above result into enlargement by only 30% $\times f$ in this example. Of course, 'f' can play a role for characteristic constant for original designers to adjust their final decision to operate. If they want to keep their original idea, they should specify 'f' as small as possible.

Just like the above procedure, we can obtain other parameterized requests for Window's size as well as Window's position (namely, XY-position means Width and Height) and some suitable information for Collaborative Design among Internet Community. With Kansei Engineering methodology, we can determine which sensory attributes express particular subjective requests and draw conclusion about which perceptual elements are responsible to enhance emotional decision, for example in Figure4. It is convenient for us to realize Collaborative Design based on Internet Community precisely and sufficiently.

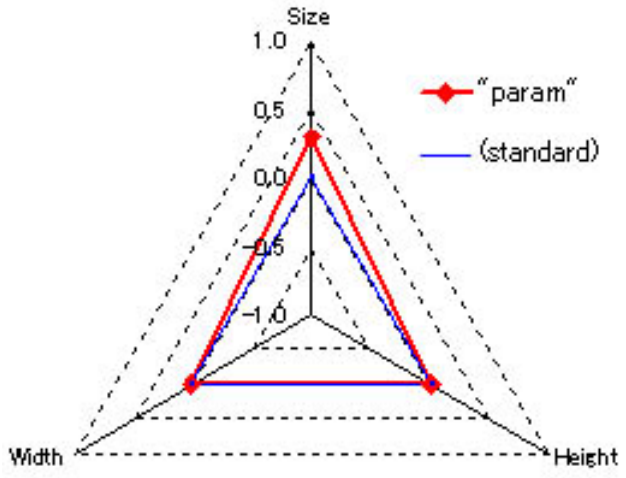

Fig. 4 Radar Chart of Parameters' Value for Improvement.

5. CONCLUSION

This paper describes an example approach of Collaborative Design through Internet Community, which is implemented to provide an idea to reconstruct some living space and environment for people who had been attacked by disaster such as Earthquake and especially Huge Tsunami. We want to provide a visual design concept of living space for slope topography, which is normally seemed not to be suitable for ordinary living but to be of advantage for avoidance of disaster near from sea shore especially.

With our approach, we can conclude as follows;

1. It is necessary to discuss more suitable design concept and/or idea for people who want to have temporary or permanent living environment because they have been damaged by disaster. We decide to employ efficient and effective approach which can be faster and more flexible than usual.
2. It is suitable and convenient for people to provide their idea for some domain by means of Internet Community such as Social Network System. Utilization of "Facebook" as SNS is to obtain several comments and/or messages from Community.
3. Kansei Engineering is good enough to evaluate proposals and analyze their comments, notices and criticism from Community, because of being qualitative ways and data.

As one of our future works, we will develop new information server system to provide an efficient environment for Collaborative Design and analyze in-bound comments and criticism for specific idea and design concept by means of Kansei engineering methodology. We want to communicate with people who consider to live where they are really afraid of potential damage of Tsunami and discuss about our original plan/design concept of living space for slope topography through SNS and/or Internet Community in near future.

REFERENCES

[1] Wang, Y., Yang, J.: Relation Based Service Networks for Reliable Service Selection. In: Proc. of IEEE Conference on Commerce and Enterprise Computing (CEC 2009). pp.209–214, 2009.

[2] Steimle, J.,Brdiczka, O., Mühlhäuser, M. : CoScribe: Integrating Paper and Digital Documents for Collaborative Knowledge Work. IEEE Transactions on Learning Technologies, Vol.2, No.3, pp.174–188, July-September 2009.

[3] Nagamachi, M.: Kansei Engineering: A new ergonomic consumer-oriented technology for product development. International Journal of Industrial Ergonomics, Vol.15, No.1, pp.3–11, January 1995.

[4] Bouchard, C., Lim, D., Aoussat, A.: Development of a KANSEI ENGINEERING SYSTEM for Industrial design: Identification of input data for KES. http://citeseerx.ist.psu.edu/viewdoc/versions?doi=10.1.1.100.7761