Creative Experiment on Decorative Products for Condominium using Responsive Technology

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Abstract. Creative experiment on decorative products for condominiums using responsive technology has the purpose of creating decorative products using responsive technology which can improve the interior atmosphere which can be controlled by the user and adjusted according to their needs. The constraint of the design is the interaction between the two emotional states of normal (heart rate of 60-80bpm) and high stress level (heart rate of 80-100bpm). Another constraint of the design is the technological constraint, which can control the lighting, noise level, and temperature according to the users' needs. This research is conducted based on the previous one called “A Study of Interactive Media to Design and Develop Decorative Product in Condominium”. The knowledge gained from the previous research about incorporating technology into product design is utilized in this research to be experimented on decorative products with responsive technology. The results of this research can be divided in two parts. The first part is summarizing user behaviors in which the results are obtained from both primary and secondary methods. The results are then used to create product design constraints. The second part is the resulting product design which is aesthetically satisfying, suitably for the physical environment and the three factors which can be controlled by sensors include lighting, noise level and temperature lighting, which is controlled by, noise sensor and humidity sensor respectively. There are three resulting designs which have three levels of intelligence according to different usages of living room, dining room, and bedroom.

1. Introduction
Nowadays, the way of living of people around the world has changed. Whether it is caused by the development of technology, values, or culture that has changed according to the era. The increase and decrease in population depends on the physical and biological environments that are related to human life. In addition, the world is shifting towards globalization, things are linked together logically, can work together and communicate with one another using the characteristics on internationalization whether humans, environments, buildings, or even various products.

We may notice a general overview of human characteristics and their lifestyles. For example, accommodations are more urbanized with greater population density. As a result, it leads to more shared spaces. It means the area that used to be a detached house was transformed to a residential building in the form of shared building. There is a cohabitation among many households in one single building such as a condominium building or a small residential unit to meet the residents' needs to live in, not a typical house. Today, most families are much smaller than they used to be. Many people
would prefer to stay single, live on their own, and tend to raise pet animals like dogs, cats, hamsters and so on. The world has become smaller as a result of Internet of Things and the power of Big Data that can be processed and used anywhere, anytime. Whether it is use of teaching, marketing, various business including, construction, maintenance, architecture, interior design of the building as well. Humans are not the only creatures that can communicate and interact with technology, but also it is architecture, places, including products and appliances as if they were living. It is good for increasing the convenience of users anytime and anywhere. A new living culture will occur in the future in which humans can interact with objects. On the other hand, things can communicate and recognize emotions and human feelings. The researchers are interested in creative experiment on decorative products for condominiums using responsive technology which can be explained further from Diagram shown in Figure 1, research conceptual framework.

From the research conceptual framework can be explained the creative experiment on decorative products for condominiums using responsive technology caused by the design under the second part design specifications as follows; 1) physical components that can be adjusted within the condominiums 2) emotional behavior of users. Technology can be divided into 3 systems consisted of; light control system, sound control system, and smell control system which respond to the emotional state of the users consisting of normal and stress states.

2. Methodology
The methods used in this experiment is a Creative Research consisting of 7 steps, which can be explained as follows:

2.1. Analyze Behavior
Analyze behavioral conditions. The researcher studied the emotional expression and response to emotions which separated the emotions from the heart rate [1]. The researchers divided the emotional state into 2 conditions which are normal state at the heart rate of 60-80 bpm and the stress state at the heart rate of 80-100 bpm.

2.2. Analyze Technology
Analyze conditions in the application of technology by studying the physical characteristics that can be adjusted within condominiums which consists of light, sound, and temperature [2] by using 3 types
of technology, namely the light control sensor system, sound control sensor system, and humidity control sensor system.

2.3. Education
Education component working plan and the proportion of usage areas with 3 systems technology which are selected for emotional interaction with users, including the light control sensor system, sound control sensor system, and smell control sensor system. The researcher creates a working plan which the response system designs the external appearance of the product.

2.4. Interview
Interview real estate experts. Data collection used both primary data and secondary data. Data were analyzed by create image design concepts.

2.5. Conceptual Design
Present the concept of Mood Board design in 3 concepts consisted of: design ideas with geometric shapes, design ideas with shapes inspired by pets, and design concept with free shape.

2.6. Inquiry and Trial Design
Make an inquiry an expert to choose the best way to create a prototype. Then create trial design and checking the operation of technology.

2.7. Production
Create interactive decoration products, prototypes to be used in other to design applications in the future.

All process can be explained further by a diagram shown in Figure 2.

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Figure 2. Work Process Diagram.
3. Results

The research results are divided into 2 parts that is, the first part is gathering knowledge about behavior from primary and secondary data, which leads to the creation of product design specifications. The second part is the design of interaction decoration products that meet the needs of beauty and appropriate for the physical space of condominium.

Section 1: Knowledge used to design specifications

3.1. Study of usage behavior and elements that create the condominiums atmosphere and the physical characteristics of condominium can be explained with Table 1.

Table 1. Shows usage behavior, atmosphere composition, and physical characteristics of condominiums.

| Behavioral conditions | Technological conditions | Physical of condominium conditions |
|-----------------------|--------------------------|-----------------------------------|
| Emotional state with heart rate 2 conditions | 3 Technology systems | Divided the minimum usage space of condominium into 3 parts |
| 1. Normal state (60-80 bpm.) | 1. light control sensor system | 1. living room |
| 2. Stress state (80-100 bpm.) | 2. sound control sensor system | 2. dining room |
| | 3. humidity control sensor system | 3. bedroom |

From the table can be explained that preliminary design specification study results divided into 3 parts as follows; behavioral condition: a study of factors that indicate the mood of the user [1] that is heart rate which can be divided into 2 conditions such as normal state at the heart rate of 60-80 bpm., and stress state at the heart rate of 80-100 bpm. In addition, technological conditions; the indoor environment can be adjusted by users [3] consisted of light, sound and temperature leading to the selection of 3 systems technology, namely light control system, sound control sensor system, and humidity sensor system that used in decoration of the condominium interior consists of 3 parts, which are the living room, dining room and bedroom.

3.2. The study of consumption characteristics, tastes and preferences of real estate consumers. Primary data from the interview with 3 real estate experts and secondary data about the Central Business District real estate project can be explained with table 2.

Table 2. Data from the interview 3 real estate experts / 3 companies [4-6].

| Questions | Answers |
|-----------|---------|
| Suite type Exterior design and the interior Area | There are studio room, 1 bedroom suite, and 2 bedroom condominium No relationship due to the exterior design is the design of the architect but the interior design depends on the residents which have different identity. 25-56 Sqm. |
Questions | Answers
--- | ---
Consumer group and favor | Group 1 People aged 40-50 years are high-end consumers, interested in spacious and comfortable condominium with large areas. It meets the needs of long stays and suitable for the elderly. The selection of furniture emphasize individuality preference to be used for a long time.  
Group 2 People aged 22-39 years whose high incomes of parents, interested in luxury and comfortable residential units. Large areas are not necessary because most of the accommodation is only to sleep at night. For this group should focus on the common area, activity area because they tend to be bored easily therefore they often change furniture and decorations.
Price / square meter | 150,000-300,000 Baht / sqm.
Opinions about the application of technology in design and decoration. | Interesting and very much agree. At present, the real estate business in Thailand focus on technology using in terms of system management and building inspection, security and convenient. If technology usage is expanded to decorate the building will be regarded as adding aesthetic benefits to the project and able to motivate consumers to become more interested in buying.

3.3. Design and create working plans of technology in 3 systems to 3 different decorative products by describing the 5 types of features which are the usage area interaction characteristics. Core patterns of technology using and the level of each technology intelligence divided into 3 levels which are lowest, moderate and maximum.

Table 3. Working plan 3 technology styles to 3 decorating products

| Various features | Model 1 | Model 2 | Model 3 |
|---|---|---|---|
| Space Interaction characteristics | Living room Response to the emotions 1. Heart rate sensor 2. Light control sensor | Dining room Strengthen the atmosphere 1. Sound control sensor 2. Bluetooth, MP3 3. Wireless charging system | Bedroom Respond to the environment 1. Humidity control sensor 2. Light control sensor |
| Core technology | | | |
| Pattern of use | It is a decoration that responds to user mood through heart rate measurement which divided into 3 color light in 3 phases such as: red at the initial stage, green for normal mood (60-80 bpm.), and blue for stressful mood (80-100 bpm.) | It is a decoration that enhances the living atmosphere. There are 2 main functions consisted of wireless mobile charger and speaker. The inside consists of bluetooth and Mp3 allowing users to control music playback. | It is a decoration that responds to the environment which accommodate sleepy atmosphere. When power on, it will humidify and will be a bright lamp automatically. When the light is off at night, it will be an automatic bright lamp with blue light to create a relax atmosphere. |
| Levels of intelligence | Maximum | Lowest | Moderate |
All of Technology Systems inside shown in Figure 3.

Section 2: The design of interactions decoration products with responsive technology for condominium.

This section is an explanation of the exterior design work caused by the extension of use from Table 3. After presenting 3 design concepts, namely geometry shape that has been inspired by pets and free shape. The data from discussing with the experts, it was found that design using shapes that are inspired by pets is the most suitable method for further development as prototypes because consistency and visual which linked to the deep inner feelings of each person. The researcher designed by using the concept of pet into 3 products that was inspired by dogs, cats and fish. The results of the design and interaction experiments shown in Figure 4-8.
**Figure 6.** Form Design Model 3 using 3DSMax.

**Figure 7.** Decoration Product Prototypes.
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