

A Study on Smart Home Service Prototyping

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Abstract: Current Smart Home System provides services in various areas which are not limited to housekeeping activity since the information technology has been introduced at residential space. According to recently technology development, the scenarios on Smart Home environment becomes too many without any limitation. In this thesis, Smart Home service based on user experience will be suggested, so we recruited 15 users in Communication, Health, and Commerce parts centrally which can be extended from Smart Home. And we investigated those users with User Diary and Contextual Inquiry methodology. Grasping the needs of the users and their behavior pattern became possible through the analysis on the data obtained from the inquiry. As arranging them, we deducted 14 core issues and made the 5 Persona of behavior pattern based on the issues. And it led to develop various scenarios especially on 5 Personas. Moreover, we verified effects of the suggested scenarios through Prototyping. This would be expected to become the fundamental study which extends the service range of Smart Home based on UX.

Key words: *Service Design, Prototyping, Smart Home System, User Experience*

1. Introduction

In these 2~3 years recently, there were many cases when smart system has been introduced to the real life internally and externally. We can also see the examples that the smart technology has applied to the electronics in Home. Intelligent building with automatic system like lights in the house, controller of temperature, door and window, and secure system, etc. are one of the examples. And the other example is IT house which has controller of home theater, automatic and effective air conditioner, anti-crime system, and health care system's connection. This is the thing that ubiquitous technology is applied to Home, the basic environment of the human. It becomes the background which makes the home appliances appear with more intelligent functions. To be specific, home management system which was used independently begins to connect with wired and wireless network and provides more developed smart home environment. Smart home means a kind of home environment in which the objects and house itself are intellectualized focusing only human.

Catching up with such technology development, many manufacturing enterprises are suggesting and predicting the futuristic scenarios about Smart Home. Such various scenarios are showing infinite possibility from the

feasible one to the creative one which is not limited to the present technology. But it is unknown which services among those numerous scenarios will be realized practically and have positive effects on the users.

In this thesis, near futuristic scenario based on UX will describe Smart Home and be checked if it, as Prototyping, can give any positive possibility to the users. Health, Commerce, Communication are 3 sections chosen among the wide Smart Home services. Below chart establishes the range of 3 sections' services.

Table 1. Range of Smart Home Service

Communication		Health		Commerce	
Space	Internal, External	Objective	Prevention, Administration, Treatment	Actual Purchase	Point of purchase, Cycle of purchase
Time	Communication frequency time for Communication	Subject	Him or Herself, Family	Sharing Information	Himself(herself) = Sender Himself(herself) = Receiver
Objective	When the goal is only for Communication (conversation), When communicating through other subordinate things (communication itself is not the goal)	Way(means)	Rest(stability), Diet management, Workout, Checking health	Management	Writing family budget plan in each period, Writing only details of expenditure
Subject	When treating people or mechanics.	Attitude	Passive, Active	Consumer Attitude	Intentional, Impulsive
Media	Text, Image, Voice, Video call function, Video	-	-	Expense agent	Household, Family members individual

2. User Analysis

2.1 Methods: User Diary & Contextual Inquiry

This research focused on 3 parts including Health, Commerce, and Communication among various services that can be suggested in Smart Home. We carried out the user research in order to develop the new concept about 3 of the services above. We had the users who had their own know-how in each of 3 sections of Health, Commerce, and Communication at home as the subjects. We also included the Extreme Users who could utilize home appliances well at home. We recruited 15 Users both male and female and their age ranged from elementary school student to 50s. This is for including all the subjects using home appliances at home and for obtaining valuable data from each user. In this user research, we selected the context, and inquiry methodology with the goal of understanding a certain situation or context at the environment at home and home service process of users. This is how researchers observe certain actions of users by ethnographic technique. One of the main reasons of carrying out contextual inquiries is for the researchers not to miss details that may be easily forgotten in typical Focus Group Interview. Users for the most part speak their minds more comfortably in familiar environment. Also, it is possible to obtain various perspectives by doing the inquiry and observing the users. This reflects that the contents we discover while doing the inquiry are just as much valuable as users said in the inquiry.

In the contextual inquiry, it would be possible to not only understand about the perspective about user, physical environment surrounding the service, users and electronic products, but also interactions at home service as well. As for the research process, we distributed the User Diary (or Work book) before contextual inquiry and made users write about the use of electronic products for 5~7 days. And we observed user actions of basic electronic products of users through collected diaries. After then, it was possible to ask them questions and hear answers by visiting their houses and closely observe actions by situations. Through this, we obtained qualitative data about the actions of users. And we were able to find the meaningful data and needs for user actions through analysis.

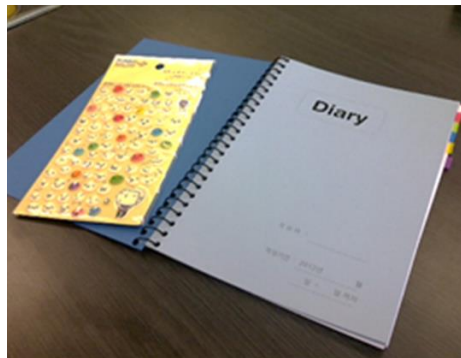


Figure 1. User Diary



Figure 2. Contextual Inquiry

2.2 User Research analysis

We found Key Findings on 15 users with the facts of each user through the research. User Needs and Insight based on the experience value about each service are deducted. And among them, it was possible to pick out Key Context of Use which had been showed similarly or contrastively in each user's behavior. Based on these datum of good quality, Affinity Diagram [figure4] is created. We progressed 'Ideation' through this diagram and deducted 14 core issues.

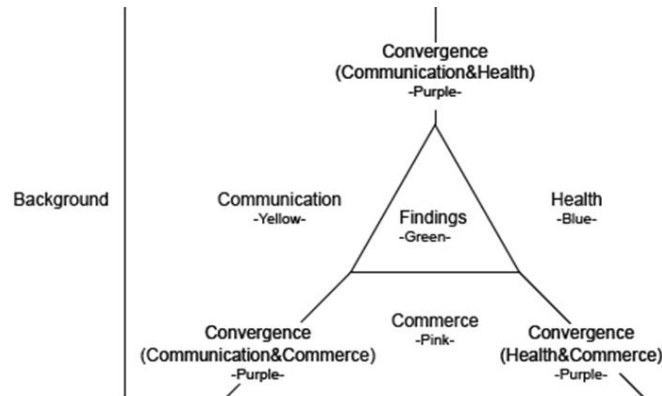


Figure 3. Affinity Diagram Guide



Figure 4. Affinity Diagram

*14 core issues - Identification, Different ways and means depending on the communication subjects, Customization for lifestyle, Curation of information, Network between acquaintances, Family Gathering, Grouping, Context Aware, Main Device, Information visualization, Comparison target, Timing, Advisor=supporters, more device more convenience

3. 5 Persona followed by 5 behavior pattern

We progressed each user's Behavior Pattern Mapping with Context Factor components discovered by User Research. Context Factor was arranged and separated mainly in 3 parts, Communication, Health, and Commerce. And we set the range which can represent each user's behavior relatively within the Context Factor. User's behavior analyzed by this standard is indicated in the range by element. So we could draw the common pattern as indicating such 15 users' every behavior. It led to produce 5 Persona for each type by separating 5 main patterns being mapped.

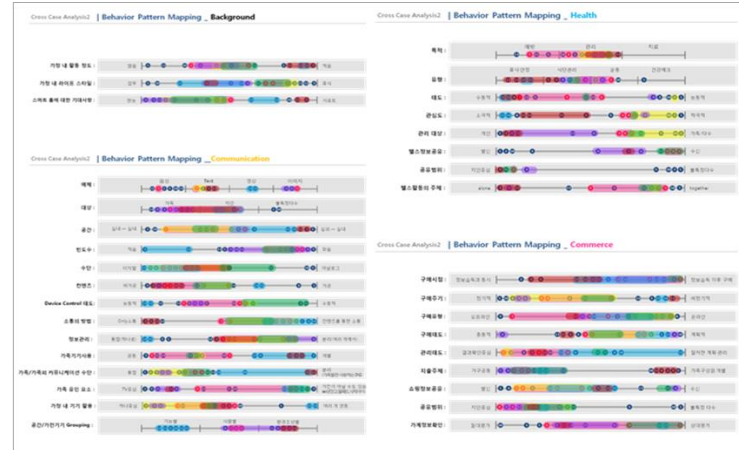


Figure 5. User Behavior Pattern Mapping

First persona is female in the late 20s who has a job and high use rate of smart phone. Second persona is full-time housewife in 30s who has young child. Third persona is 40s men who have strong needs for communication with his wife because they are long-distance couple. The fourth is 30s men who live alone with being independent of his parents. The last one is men in 60s whose plan is healthy and joyful old age.

Direction [Table.2] are deducted by 5 types of Persona above suggested.

Table 2. Idea Direction followed by 5 Persona's service types

Persona 1(Main Target)	Persona 2(Main Target)	Persona3
Communication 1)Family Communication Service for family bonding 2)Procured space only for individual 3)Providing the environment of product by recognizing the common use of individual and family Commerce Plan and management different from each member's consumption	Commerce Consuming life considering family health Commerce & Communication Appropriate way for consumption different from each member Health Health care and sharing activity	Communication House Communication in each situation /What can help communication with wife outside, Space for chores when alone Commerce 1)Smart suggestion for consumption which grasps own consuming pattern 2)Easy way to systemize and make the consuming information more specific
Persona 4	Persona 5	
Commerce Smart Home like mother Commerce & Health Community platform Health Service for helping the health management	Health The thing that increases attention on Health (Health care, Workout checking system) Communication Communicating with child and grandchild distant	

4. Concept & Scenario

4.1 Concept

Common features are discovered by 5 types' Persona above mentioned. Every user made their own behavior pattern and they wanted it is provided automatically for them. Put another way, the records listed every time they use become Data and it adjusts the product itself to the environment on the next use. It can recognize the user so

the environment adjusted to the user wanted the environment which can be provided for itself. Concept is established as 'Patina' as collecting and gathering such needs of the users.

Table 3. Concept

Concept: Patina (It makes our life marks to the significant Data)		
Communication	Health	Commerce
Intimate Share Making intimate bonding between the family members	Bridge(Between Care & Cure) Providing the connection bridge between care and cure	Re-purposing Repurposing Data for Commerce
Identification(Mode) Environment in which common smart home is used separately or together	Nudge(Motivation) Encouraging the voluntary activity through the Motivation	

4.2 Scenario

Persona's scenario is compromised focusing on the fixed concept. For developing the scenario, we did Idea Sketch [figure6] with Direction [Table3]. 182 ideas in total are deducted in each user according to the 3 services, Communication, Health, and Commerce.

Table 4. Example 1 of Scenario

<p>Scenario(Personal) 20s woman who has a lot of use in Smart machines</p> <p>Persona : Ji yoon, Kang</p> <p>Family relationship : father, mother, brother, herself(4 people in total)</p> <p>Housing style : apartment</p> <p>Every family members of Ji yoon, Kang, a college student, has very busy life. Dad works in trade company, and her mom goes to lecture. Brother is also college student and she is working at the company for 2 years now. So it is difficult to gather and have time to eat together. They talks through smart phone mainly rather than gathering in the living room. They exchanges photos or makes family's room in smart phone messenger. But the conversation is stopped when they are busy or can not concentrate on their smart phone. She had to turn off the phone because her mom called in the middle of the class. At that time, her mother feels sad.</p> <p>Her brother, businessman, is late for coming back to the home. In spite of the late time, he sleeps after watching the soccer game. I have to try a lot of effort to find the channel that I want to see because the soccer channel appears every morning. It is so hard for me to think checking the weather on the morning news and collecting the issues important.</p>
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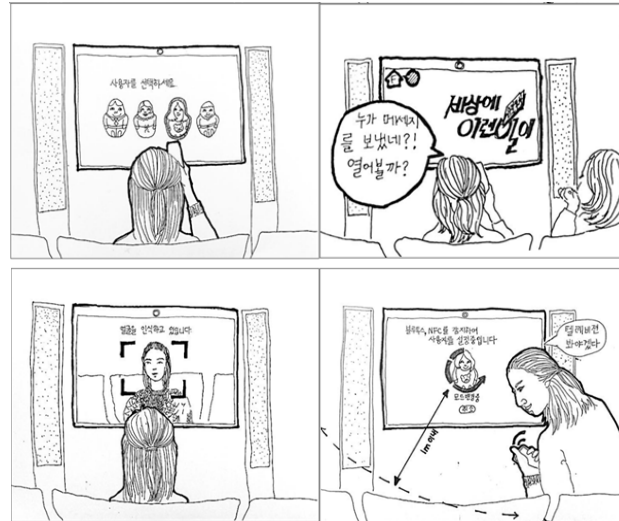


Figure 6. Example 1 of Idea Sketch

4.3 Verifying the value through Prototyping

We tried to check if the deducted scenario would have value of suggesting the directions for Smart Home Service from now. For this, Prototyping on Home Service was progressed. We needed Prototyping way which can represent in quickly time and small cost, at small space and short time. That's why we chose paper prototyping method which can obtain the thinking of users in quick time compared to the investment.

This is why we choose the paper prototyping methods:

- * **Save time and money** - solve key problems before implementation begins and able to cut off price
- * **Get user feedback early** - use it to focus the development process
- * **Communicate better** – make users understand the service
- * **Provide real world examples of paper prototyping at work**
- * **Delves into the specifics of what types of projects paper prototyping is and isn't good for.**
- * **Powerful technique to develop service** that are more useful, intuitive, efficient, and pleasing

We printed out the service idea cut in actual image and attached it on the wall in the testing space for Prototyping. User assessment is started by letting the participator come in that virtually made space and checking how Smart Home System is provided. Evaluation subjects are totally 9 members, 3 people of 20s, 3 in 30s, and 3 in 40~50s.

Evaluation standards are 4 areas such as Usability, Clarity, Differentiation, and Convenience. In communication service part, using services in direct with user's number was turned out to be more effective than recognizing users through the individual mobile. It had more usability and clarity according to the evaluation results. And when using the Health service, entering the accurate figure on touch screen made users little uncomfortable. Interaction way to enter the accurate number is needed. In Commerce service, mobile device and managing through the screen in home have satisfied the usability part especially. But adjusting and checking the graph inside the mobile gives discomfort again so adjustable service on the size of mobile screen becomes necessary.

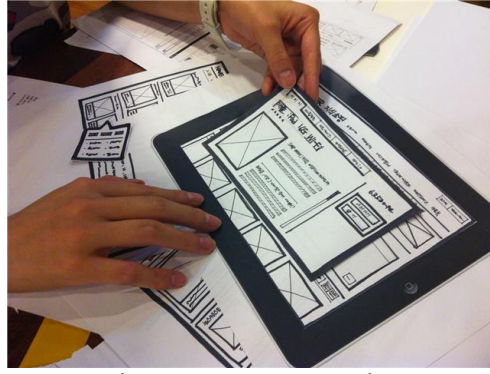


Figure 7. Paper Prototyping

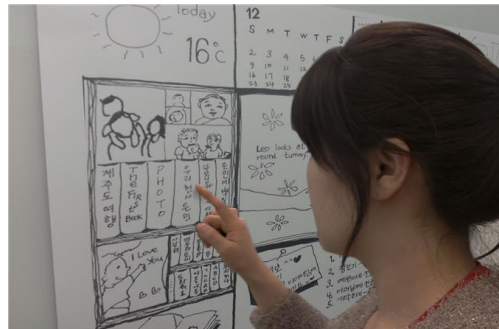


Figure 8. Appearance of Paper Prototyping

6. Conclusion

Through User Research, we developed 5 persona different from the behavior pattern and was able to suggest the scenario which is fit with that. Also prototyping made that be checked if it has possibility as the futuristic scenario. As a result, it is deducted that 3 service components, Communication, Health, and Commerce, have to be not individual but combined platform focusing on Communication. When realizing that, it can have more value. In Health area, prevention which helps illness and services in workout management has to be provided instead of diagnosis service which was existed. Moreover, in Hardware area, the service which can be provided for any Device should be introduced rather than standard Device-oriented service.

To conclude, this thesis suggested suitable service to the persona and it was deducted by user experience and their behavior pattern. Also it has a lot of meaning in terms of verifying the possibility of the suggested service through Prototyping. This will contribute to discover the real service on Smart Home environment from now.

7. Acknowledgement

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