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A STUDY ON THE INTEGRATED SCENARIO FOR EVOLVING DIGITAL ENVIRONMENT

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ABSTRACT:

The smart home offers a new opportunity to enlarge people's lives with ubiquitous computing technology that provides increased communications, awareness, and functionality. Recently, a number of trends have increased the probability that the aware home can soon be popularized. Also we can predict that the IT companies will probably evolve into the total solution provider or a multi-affiliated provider that can serve to connect the household appliance to mobile device, or the information & virtual contents sticking to real product to online business. Because the present IT companies can't help being pushed out in a terrible competitive market without suitable innovation for digital convergence.

In raising these issues, we felt acutely the necessity of the advanced scenario fitting in a new digital round represented by ubiquitous and Web 2.0. In a new round, like that everything can be converged, the scenario should be integrated also.

We consider several approaches for developing our integrated scenario:

First, exploring a number of challenges from the technical, social, and pragmatic life with the vision of the smart products & services in ubiquitous context, posited by technical research for ubiquitous computing.

Second, foreseeing the potential needs for evolving users by ethnographic methods and contextual inquiry. We try to examine the new mixed categories of products through questioning solutions for daily actions from different context related to digital environments. In diverse situation, we assume the mental template. From the pragmatic, emotional, spiritual logic we can draw proper life quality status. The expanded structure based on these three logics can expand the sphere of understanding users.

Third, understanding the reality of work contexts and the perspectives of different stakeholders in new competitive market that every product can connect each other, and every service affiliate in the smart device. It would rather about the synergy or a brand new league than about conflicting stakeholder needs.

From all of it, we try to suggest the whole integrated scenario framework, and checklist matrix. Also we try to suggest the prototype service design through this scenario framework and the checklist. Later, these methods can be used as the tools planning the new service design for evolving digital life.

KEYWORDS:
Ubiquitous Computing, Smart home, User Scenario, Life Context, Emotional Persuasion

1. INTRODUCTION

1. 1. STUDY OBJECTIVE AND BACKGROUND

The smart home offers a new opportunity to enlarge people's lives with ubiquitous computing technology that provides increased communications, awareness, and functionality.

Today various studies regarding ubiquitous computing are actively conducted, but majority of them are focused on technology. It is true that the concept of ubiquitous computing is originated from technology, but in consideration of the fact that it brings comprehensive environmental changes, not only technological factors but also future life visions should be examined. Since the comprehensive environmental changes that ubiquitous environment will bring are likely to change the patterns of human life. it will be more and more important to understand and predict exactly what people need, and design services appropriate to such ubiquitous computing environment. To develop new technology, apply it in real life, and make common users to accept it, we should go beyond Chasm between technology and service valuable to users. In this situation, the scenario to develop design should be approached in more diversified perspective.

We consider several approaches for developing our integrated scenario:
First, exploring a number of challenges from the technical, social, and pragmatic life with the vision of the smart products & services in ubiquitous context, specially in Smart home situation.
Second, foreseeing the potential needs for evolving users by ethnographic methods and contextual inquiry. We try to examine the new mixed categories of products through user researches from specific context.
Third, we assume the mental template in diverse situation. From the pragmatic, emotional, spiritual logic we can draw proper life quality status. The expanded structure based on these three logics can expand the sphere of understanding users. From all of it, we try to suggest the whole integrated scenario framework, and guideline. Also we try to suggest the service design through this scenario framework and the checklist. Later, these methods can be used as the tools planning the new service design for evolving digital life.

1-2. STUDY METHOD AND RANGE

This study examined the existing study on ubiquitous environment and Smart Home based on literature research, classified users' desires in Smart Home environment, and analyzed life context at home. Based on insight drawn up from this process, the integrated scenario focused on life context and life vision is presented, and specific cases are used to clarify this. In the case study, the interaction among family members in real life is examined, and the future family life style is predicted based on this. All these study methods are to provide the basis for design that can support real life of the users in future intelligent home design. The presented integrated

framework is meant to be used as the guideline for user interaction design in future Smart Home design.

2. THE VALUE OF UBIQUITOUS ENVIRONMENT IN USERS' VIEW

This chapter summarizes various perspectives on what features ubiquitous environment should have in order to be valuable to users.

2-1. HUMAN-CENTERED UBIQUITOUS SERVICE

Ubiquitous related technologies and services ultimately contribute to the pursuit of 'more convenient and satisfactory life' and improvement of human life quality. This is the very purpose that was clearly presented by Mark Weiser who initially proposed the concept of ubiquitous computing. However, even in the case of facilities related to home automation systems, the representative of ubiquitous service, the usability and utilization are being questioned.

When it comes to the study on human-centered ubiquitous environment, while the pursuit of human technology including IT has been individual function and use in relatively independent areas, this study suggests that now human life itself should be designed. U-service should grasp the general context of human life, provide human with correlated various products and services with discernment. If the context information recognized by the service provider is not needed by users or does not accord with the value of users, it can be said that the genuine ubiquitous environment has been achieved. If human should take further effort to be accustomed to the environment provided by new technology, and thus such technology cannot provide more convenience and better solution, some might doubt that this environment will be able to bring meaningful changes in our life. To develop good sensors, intelligent agent technology, Web2.0 and new Input/Output does not always mean to develop human 'life' itself. Only when all these are provided in accordance with human's complicated, various and changeable values, the value pursued by U-service can be realized.

2-2. PERSUASION COMPUTING AND CHASM THEORY

Persuasion technology involves certain types of interactive systems or applications, designed to intentionally change human life patterns and attitudes. B. J. Fog stated that facilities suitable for persuasion technology are specialized, embedded, and formed as a network. [1]This range of technology is called 'Netsmart device,' and recognized with the concept similar to that of ubiquitous computing, or deep computing.[2] Such Net-Smart technology is expected to come into our life naturally, and there are high possibilities that these facilities will be more persuasive than common ones when the interactive technology is specialized. Specialized technology not only can stay a step a head in designing, but also can mentally attract users. Study has already proved that people tend to like certain technologies a lot more than other common ones.[3]

The term 'Embedded Computing' indicates the situation where instead of the confusing flood of technology with high-functional gadgets all around us, the smart units are embedded in things and environment. Rather than creating new objects that did not exist around us before, replacing existing objects with smarter new objects is the trend. Studies on this trend expect that technology becomes a natural part of life, and people handle normal things with embedded technology in natural environment. In addition, these units will form a network in which the newest information, new requirements, customized information to cope with specific situations, and corrected information among various people are provided, and thus such network has social influence beyond merely providing information. Such technology that has huge potential of social influence will affect our thinking and behavior. [4]Thus, it can be said that the responsibility to make use of new technology in a way to provide help to individuals, family, and society is on designers who should create various contexts and values needed to users.

When users meet a smart unit or service that presents new functions for the first time in evolved digital environment, values required in a more specific way are needed in order to make people convinced that 'the new technology will create new values and new life style.' This involves such questions as 'whether that is actually useful to human,' 'whether it will be a solution that can satisfy comprehensive values in my work and life more than existing ones, and further, 'whether it can satisfy the user's life and various sub-relations in terms of social relationship.' Many products and services are focused on the stated technology and performance so much that solution,

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[1] B. J. Fogg, Persuasive Technology: Using Computers to Change What We Think and Do (San Francisco, CA: Morgan Kaufmann Publishers / An Imprint of Elsevier Science, 2003).
[2] Weiser, M. 1993. Some computer science issues in ubiquitous computing. Communications of the ACM 36(7):74-84
[3] Reeves, B., C.Nass. 1996. The Media Equation: How people treat computers, and New media like real people and places. New York: Cambridge University.
[4] B. J. Fogg, Persuasive Technology: Using Computers to Change What We Think and Do (San Francisco, CA: Morgan Kaufmann Publishers / An Imprint of Elsevier Science, 2003).

convenience, and social value are likely to be neglected. Moore stated that neglecting these factors make 90% of all end up with failure, and that Chasm takes place when the market does not pass on to the public from early adaptors. These persuasive computing and Chasm theory present important points to be taken into consideration when design should be developed in ubiquitous environment.

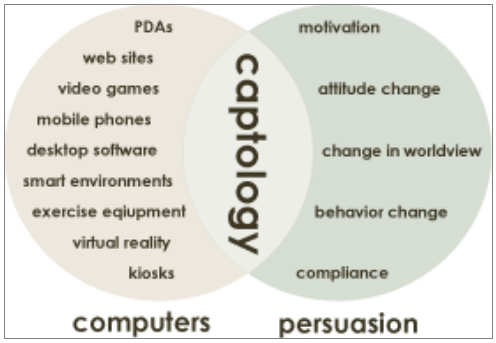


Figure 1: An Overview of Captology (Computer as Persuasive Technology)[5]

2-3. SMART HOME IN SOCIAL RELATIONSHIP

Although the concept of the smart home was well established by the end of 1990s, to date only a small number of expensive “small homes” have been built and sold on the commercial market, in contrast to the rapid diffusion envisaged.

Gann et al. (1999) suggest a number of reasons for the slow uptake of smart home technology. The principal barriers to uptake are that: The high initial investment required from the customer, and the uncertainty of the benefits at first, the lack of a common protocol, little evaluating the usability and a narrow “technology push” approach adopted by the suppliers and little attention to understanding the needs of users.[6]

In addition, note that many studies on intelligent home have focused on home control technology for a single user. This sort of study trend has been the main stream not only in Korea, but also abroad such as in the Georgia Engineering College Aware Home Study, and Texas MavHome study. However, home life includes various activities beyond the control of residential environment. Home is the organization of parents and the children who are living in the same area, and their

[5] http://captology.stanford.edu, Stanford University Persuasive Technology Lab
[6] Richard Hapter et al., Inside The Smart Home (Springer-Verlag London, 2003

living place, which means that home is the very place of social relationship of the family members. Therefore, intelligent home design should consider the situations with various social aspects that the family members may actually face. Unless the situations and needs that users face in real life are not reflected in design, intelligent home study can not be expected to play the useful and practical roles in future home.

3. INTEGRATED SCENARIO DESIGN: CASE ANALYSIS OF FAMILY NOTES IN SMART HOME

Once the general concept of service is drawn up, the service that embodies this concept and thus actually can be realized should be presented.

In this study, “Service Design for Communication in Smart Home Environment” is the subheading of the case for the integrated framework study from the user research to scenario development. The whole process of this case study is shown in (Table 1).

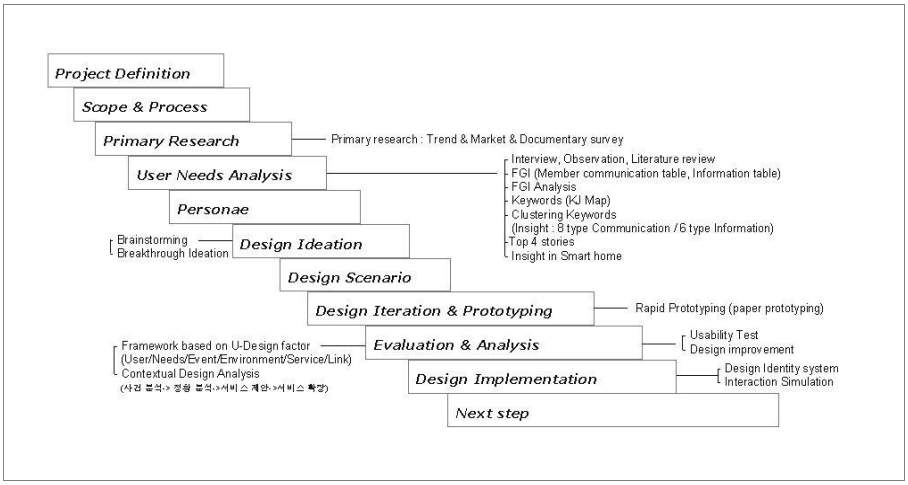


Table 1: The whole process of case study

3-1. USER RESEARCH FOR SMART HOME BASED ON LIFE CONTEXT

This chapter analyzed home life context based on the view of ubiquitous environment considered earlier. Before the user research step, the desire types at Smart Home based on the type analysis on existing human desires can be classified as in (Figure 2)

3-1-1. SELECTION OF DESIRE TYPES IN SMART HOME

Focusing on the areas developed on the two axes of [Personal-Social] and [Time using-Time saving], the various situations that could happen were classified with keywords. The upper areas of desire types are divided to several Emotional Needs area, and again to the Efficient Needs area.

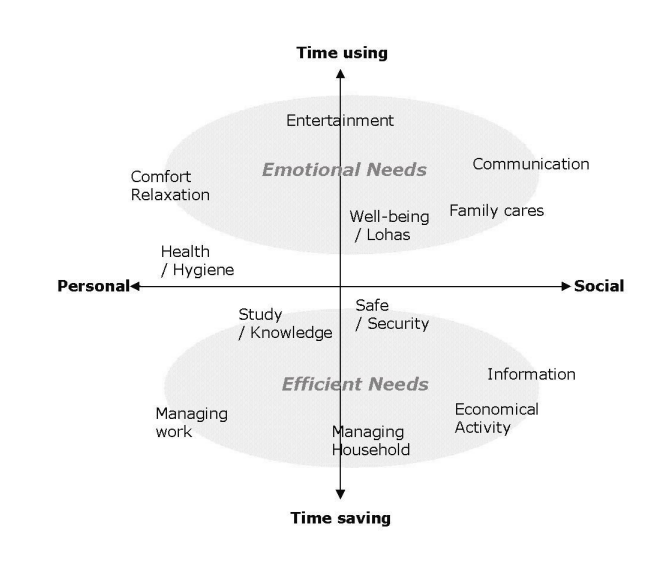


Figure 2: Map of Desire Types in Smart Home

3-1-2. METHOD OF USER RESEARCH

Unlike the general trend so far, the concept of ubiquitous computing should be a life design based on people's life context, which justifies the idea that users' real life should be systematically and comprehensively investigated in a more diversified perspective. However, the framework to examine and analyze users and their life context should be newly complemented in consideration of the facts that users' mental model about the new concept of ubiquitous environment has yet to be established, and that a brand-new paradigm is to be formed integrating and interacting all facilities through links, convergence, and networks. In ubiquitous environment, the use context of a certain user is of special importance, in which objective information, user mentality, behavior steps are included. Among various situations users might face, the time and space in which U-service should be realized are selected, and service should be developed according to each situational features.

Analyzing the activities which take place within a home may also be a useful means of understanding the home life context. There are several possible frameworks to use in conducting such an analysis. : Spatial framework, Temporal framework, Goal-oriented framework, and Communication framework. Based on these factors, we prepared the Interview sheets and table for user research to understand their communications in their house. (Table 1, Table2, Table 3, Table 4)

Inside

Time	Place	F-M	M-C	F-C	C-C	F-X	M-X	C-X
Morning ~Afternoon	Kitchen							
	Living room							
	Personal room							
	Bath room							
	Entrance							

Time	Place	F-M	M-C	F-C	C-C	F-X	M-X	C-X
Evening ~Night	Kitchen							
	Living room							
	Personal room							
	Bath room							
	Entrance							

Table 1: Time-Place-Actor Table (Inside)

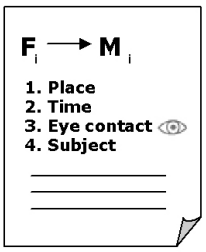


Table 2 : Conversation Sheet (Inside)

We make the tables according to the time, place, member to know the conversation happening between family members in a home on the base of raw data came from user investigation. And each conversation script can be reorganized into briefly describable memo sheet according to the send/receipt, eye contact, subjects and is positioned on proper table and surveyed on the whole.

In case of Outside table, to understand the conversations between a family member out of home and the other member in a home, we make the tables according to the receipt & addresser.

Outside

발신 \ 수신		F		M		C1		X	
		In	Out	In	Out	In	Out	In	Out
F	In								
	Out								
M	In								
	Out								
C1	In								
	Out								
X	In								
	Out								

Table 3: Actor-Actor Table (Outside)

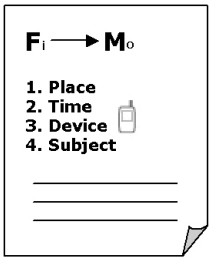


Table 4 : Conversation Sheet (Outside)

The conversation scripts arranged on table sheets can be clustered according to each goal. Through these stages, we try to understand the conversation pattern in family and detailed contextual situation. By the interview sheets prepared like this, we conduct focus group interview. The five families who selected by family members' ages except married children made up the focus groups.(Table 5)

User	Family 1	Family 2	Family 3	Family 4	Family 5
F	Jjung Hoo Young /63 /Merchant	Lee Yong Soo /46 /Public Officials	Ha Jin Soo /60 /Transportation business	Ganbaatar /45 /Office worker	Sykhee /42 / Office worker
M	Yoo Ok Soon /61 /House wife	Jung /39 /Nurse	Kim Mi Ja /57 /Restaurant Owner	Nara /44 /Researcher	Bayarmaa /40 /Researcher
C1	Jung Yu won /31 /Office worker	Lee Jae Hyeok /14 /Student	Ha Bong Jin /32 / architect	Kang Yoo Jung /11 / Student	Mandakh /22 / Student
C2		Lee Chae Eun /12 / Student		Kang Yang Soo /8 / Student	Tuvshin /7 /Preschooler

Table 5: The selection of users.

3-2. ANALYSIS OF FAMILY MEMBER'S COMMUNICATION

Classifying the communication contents that is happening in the inside or outside of the home through KJ MAP into the following 8 items and marked the relation according to the key word with line. (Figure 3)

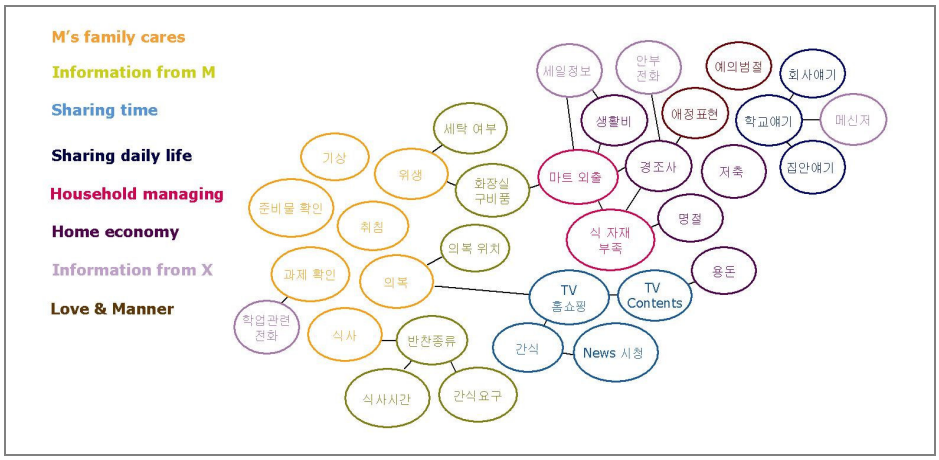


Figure 3: Clustering the Keywords: Analysis of Information Types at Home

Through KJ Map, the information happening in the home is classified into the following 6 items. 4 important stories could be considered on the basis of the analyzed documents for Life Context in home. (Figure 4)

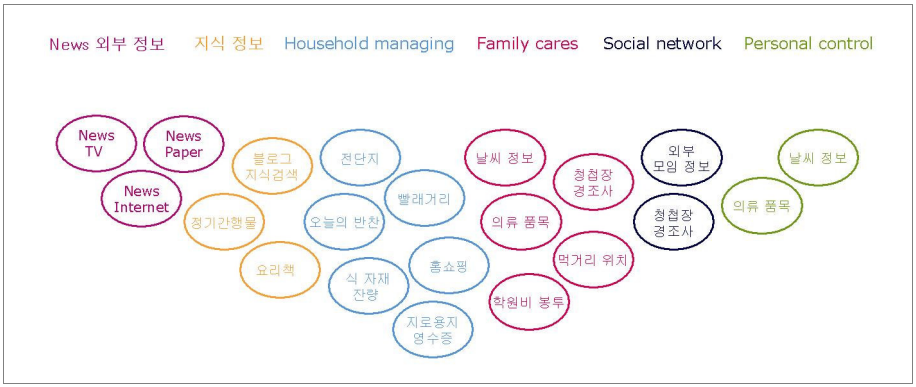


Figure 4: Clustering the Keywords: Analysis of Communication Types at Home

3-3. TOP 3 STORIES

On the basis of analyzed materials about Life-context that is focused on communication and Information in family, we could draw out the 3 important stories.

- In usual morning time, most of house wives have many thing to do.
For the working housewives, they are very hectic due to the preparation of breakfast, cloth, childeren' school beside their own preparation for work. Is it useful integrating too much information for mom to remember?

- Is there some method to support effectively to help house wife's family cares and house hole managing ? Is there know-how of house wife? If so, what method is it to get this?
Does this exist in a different way according to home?

- Everyday chores could not be recognized even though spent time and effort for them.
How could we compensate this house wife's endeavor?

3-3-1.DESIGN CONCEPT FRAME WORK

Design Concept	“Memo note” for family member’s care showing their affection to each other naturally	“Home planner” which dispend many information and work to the family members effectively
Benefit for User	Mom’s image : talkative mom-> pleasant and smart planner	Mom’s underestimated house chores and family care could be equivalent position as same as office work and upgraded into mom’s pleasant privilege
Design Ideation	The extent of communication between family members/ The emotional visualizing of effort and result for mom’s family care	Each memo pose could be displayed through the filtering option after its being detailed.

Table 6: Design concept framework

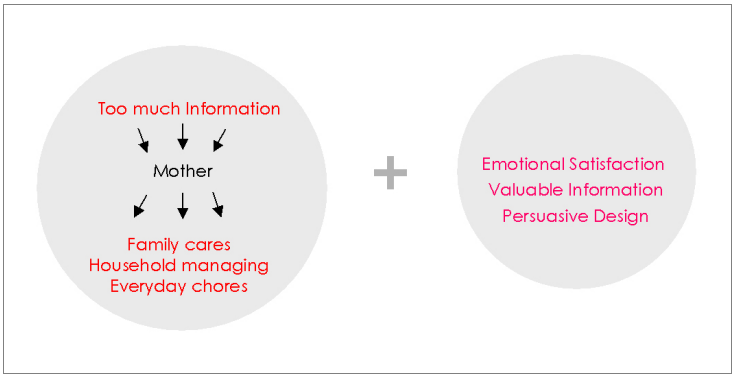


Figure 5: Too much Information around Mom

“Memo note” for family member’s care showing their affection to each other naturally.
“Home planner” which dispend many information and work to the family members effectively.The design point is below.

- Each memo pose could be displayed through the filtering option after its data processing.
  ex) The extent of communication between family members/ The emotional visualizing of effort and result for mom’s family care

- Mom’s underestimated house chores and family care could be equivalent position as same as office work and upgraded into mom’s pleasant privilege

ex) Mom’s image talkative mom-> pleasant and smart planner

The emotional item that could be used as decoration staff.

3-4. USER'S SCENARIO

We draw up the persona on basis of design opportunities above.

It starts on the women's life style troubled with too heavy work.

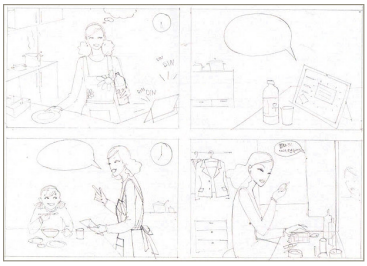
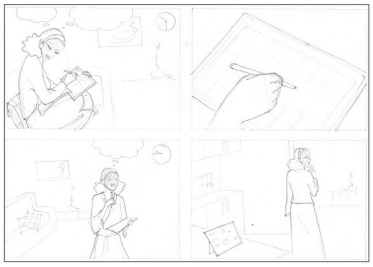
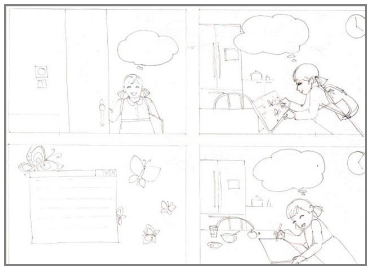
Scene	Description
	[AM. 7:00] Mom, Preparing breakfast, give notice of pay for the last daughter's lesson. Handing the money to her, finish the make-up during the other family preparing going to the work checking voice informer and smart calendar
	[PM. 10:40] During the spare time after dinner, Mom check the tomorrow's schedule and set the voice alarm massage pack wrapped on her face
	[PM. 3:40] After school, child confirm mom' absence. She checks out message board. And then she eat the prepared meal

Table 7: User Scenario

3-5. EVALUATION TABLE

Classifying the design concept into each items (User, Life context, Service & Function, Link, live vision) and check it out again.

User	Specific Needs	Life context	Service & function	Link	Life vision
	Notice of preparing list for work	Frequently, back in the entrance for something forgot.	Voice Alarm	Mobile, PC	Helper for Mom's remembrance.
	No problem without Mom	All family members find Mom every times.	Alarm, Message	Mobile, PC	Guarantee of Mom's spare time
	Easily Managing Family cares	Scheduling according to members. Backup alarm instead of mom	Calendar, Alarm, Voice Alarm	Mobile, PC	Bright Mom~!
	Visualizing Everyday chores	Nobody helps Mom. Nobody knows the hardness of chores.	House keeping data	Mobile, PC	The status of Mom's chores elevated,
	Revitalization of Family Communication	Affectionate word to each other.	Message	Mobile, PC	Pleasant family's conversation habits

Table 8: Design evaluation table.

3-6. DESIGN ITERATION

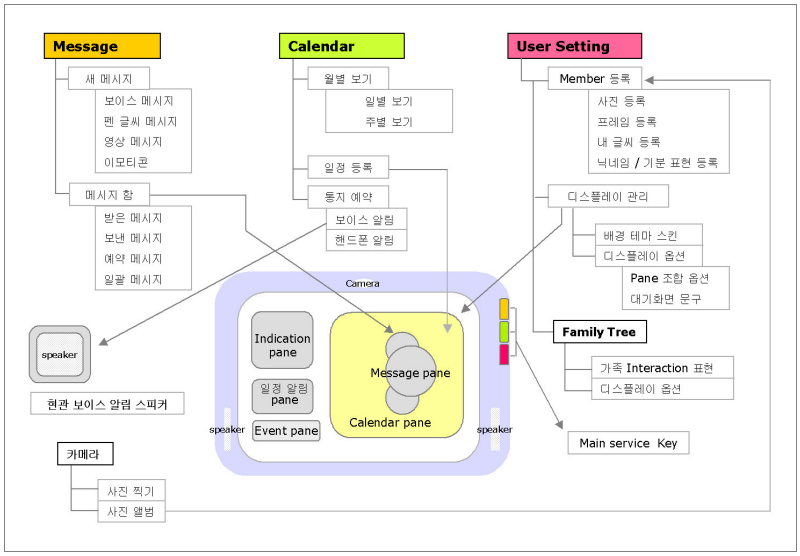


Figure 6: Contents & Function Framework.

Figure 7: Interface example (Input the new message)

Figure 8: Interface example (Input the new schedule)

5. CONCLUSION

In this study, the characteristic concept of ubiquitous computing environment for the development of future ubiquitous computing service scenarios were examined, and what approach the service in ubiquitous computing environment should take toward people was summarized. Through this, the differences among various concepts of future ubiquitous computing services that are now discussed, and the important perspectives for ubiquitous computing service development in design were presented.

Besides, the expanded meaning of 'Home' and the possibility in evolving digital environment was investigated, the various development cases and experimental studies on Smart Home in terms of the usability were examined, and especially life context related to communication and information issues were examined through case study by classifying them in terms of the goal, member, and

space. The user needs were also considered by means of user research with more sincere care. Based on the insight drawn up from this research, the integrated framework for communication & information service at Smart Home was presented, which is expected to become the design development guideline for related services.

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