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# A Study on the Ubiquitous Computing Service Design System

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## Abstract

This study proposes a methodology for Development of Ubiquitous Computing Services Design System under ubiquitous environment focusing on human basic activities and information related to home life. The main feature starts with the analysis of human life and ends with service development. The first step is to draw user's Basic Activities (BA) through analyzing user's everyday home life. Next, designers find the goals of users life and each goal has the set of Basic Activities. UC service will be developed based on these BA sets. This conceptual model defines the context comprised of 'object' and 'information', which is necessary for each activity. Through the analysis of 'object' and 'information', ideas of ubiquitous computing product can be found. Analyzing the connection of objects, information and human activity can be the first step of the new service design methodology in the ubiquitous computing context, and the methodology of UCS in this paper is valuable in this point of view.

## Keyword

Ubiquitous computing, Life model, Service design

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## 1. Introduction

The focus of computing has shifted from technology itself to the interaction between human and computer. Moreover, computing environment supporting human life has been the main concern. Ubiquitous technology helps computing resources used for human activity anytime and anyplace, and it will bring big changes in people's way of using computers. The most important matters about ubiquitous computing are how it coincides with human needs and how it supports human activity. Therefore, 'service design' should be ahead of technology.

Ubiquitous Computing means that computing is provided to people in anyplace, anywhere through anything. Some services via this ubiquitous computing have some preconditions; First of all, all the objects should have the computing ability inside. Second, network is essential to communicate with other object. Finally, the objects should be context-aware for being useful to users.

These conditions can be accomplished with various computing technologies, but many of them are under research. In this circumstance, 'Ubiquitous Computing Service(UCS)' can be a catalyst to build an initial environment of ubiquitous computing and to provide guidelines for user-friendly applications. However, the features and process of UCS have not been defined. Consequently, engineers and planners have troubles in designing services. In this paper, methodology for developing UCS will be discussed.

## 2. Ubiquitous computing service

There are many discussions about Ubiquitous Computing Service, but the further study of UCS is not the main concern. One of the aims of this paper is to promote the interest of the UCS. People who see 'UCS' first time do not know what it means exactly. And this confusing follows the concept and appearance of UCS. In this Paper, the necessity and the characteristics of UCS development will be discussed.

## 2.1 Necessity of Ubiquitous Computing Service

UCS is the service aiming user's maximum comfort using ubiquitous computing. UCS helps solve many problems due to current technology; it covers limits of spaces and provide each individual optimized service. And then, what this advanced services will be and how can we develop them? Answering these questions is necessary, because Ubiquitous Computing is at the step of developing, and we cannot know the future of it exactly. Therefore, conceiving UCS will boost engineers' creativity and enthusiasm and give businessmen clear vision.

## 2.2 Features of Ubiquitous Computing Service

### 1) Providing Right Information

UCS aims to provide users accurate, proper and immediate information. However, excessive offering of information would be frustrating abusing technology. Also the information by UCS should be appropriate and immediate. That is, users will expect the information which is 'ready-to-use' not 'waiting' in ubiquitous computing age.

### 2) Providing Natural Interfaces

Users tend to do something in the most natural circumstances. UCS is provided to users through the objects which users want. With familiar everyday things, users can obtain information easily and comfortably.

### 3) Providing User Benefit

As above, UCS gives appropriate information in the most natural way and maximizes user's convenience. To pursuit this goal of UCS, the service developer should focus on the user's needs. Especially, UCS can offer some needs which was invisible before ubiquitous computing age, and the needs should be more user-centered and efficient.

### 3. Conceptual model for Ubiquitous Computing Service Design

#### 3.1. Human Home life Conceptual Model

This study aims to develop UCS design systematically supported by ubiquitous technology, which considers human's whole activity as the interaction of information between users and outer objects. For user-centered UCS framework based on the understanding of human activity should be done first. Starting with this framework, methodology for modeling home life, human home life conceptual model, information architecture of real life will be followed.[Fig. 1] Here defines the constituents of human home life conceptual model.

- 1) Human home life is consisted of Basic Activity, which has its own purpose.
- 2) Basic Activity accompanies Information and Object.
- 3) Information and Object are defined as context.
- 4) Basic Activity can be compounded by Sub-goal.
- 5) Sub-goal is to accomplish the goal

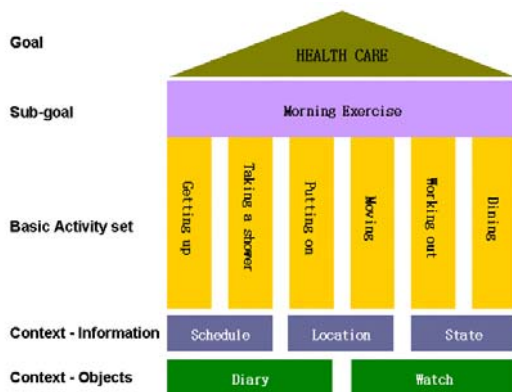


Fig. 1. Human Home Life Conceptual Model

Through the conceptual model describing general human activity at home, the goals and categories of human activity, information and its flow for those activities, states of action including various objects can be figured out. The Conceptual model was made through classifying human home life into several domains and setting process and information of activities in each domain. Analyzing particular process of main activities, extracting common elements, and the correlation between these were done for developing information architecture about real human life.

#### 3.2. UCS Conceptual Model

[Fig. 2] shows the conceptual model of UCS. The main feature of this model is it starts with the analysis of human life and ends with service development. Also in this model, each object and activity connects variously. Therefore, this methodology is different from other product or subject-oriented ones. The first step is to draw user's Basic Activities (BA) through analyzing user's everyday life. Next, designers find the goal of users life and each goal has the set of Basic Activities. UC service will be developed based on these BA sets. This conceptual model defines the context comprised of 'object' and 'information', which is necessary for each activity. Through the analysis of 'object' and 'information', some ideas of ubiquitous computing product can be found.

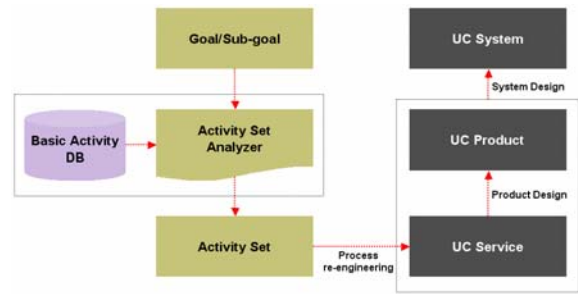


Fig. 2. UCS Conceptual Model

### 4. UC Service design development process

#### 4.1. Flow Chart Structure

First of all, 56 human basic activities were extracted from home life and described by flow chart.. In this research, human home life was categorized into 7 domains - Self Management, Housework, Caring family members, Safety, Entertainment, Education and Relationship/Communication. Human activities should be matched to one of these domains and the activities range from complex and serial ones to simple contents or motions. Total 56 activities were extracted from psychology literature reviews, user observation and interview. This was named 'Basic Activities'. Therefore, Basic Activities(BAs) can include human home life for various goals. Next, the process of each basic activity was described into detail based on the way of users' searching information. Flow charts explaining human home activity based on the user observation was used to depict each process, and the objects which user need were listed[Fig. 3].

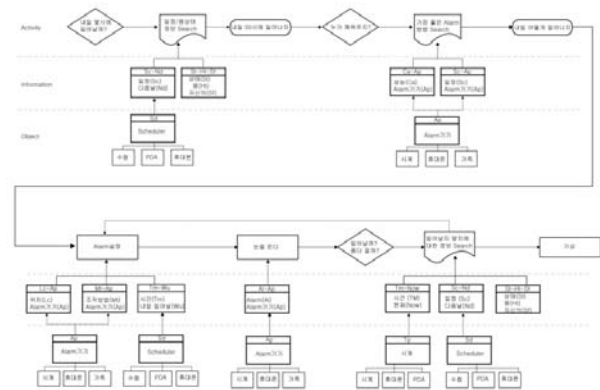


Fig. 3 Activity Sequence Flow Chart

After arranging the process of each BA, some insights were found. - 1) similar patterns in searching and using information. 2) necessity to group related objects according to the purpose of users' action. Based on these findings, to be more consistent, the whole process of each BA was re-designed analyzing 'Man', 'Information' and 'Object'.

Flow Chart describing 'Man' is composed of basic step including 'question', 'searching', 'decision', 'acting'[Fig. 4]. Some steps, which automatically progress, may not have information or only can include only 'decision' phase. And when the various information searching is necessary for one action, this action is placed only after



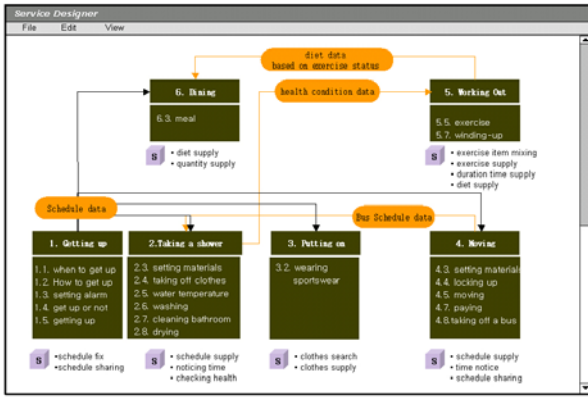


Fig. 8 Analyzing the connection of BAs.

### 3) Searching new objects

To provide information, objects are necessary. However, in some cases, information does not have appropriate objects in current situations. Also, through the analysis of step level, some steps can be deleted, modified or extended in the UCS context. These two cases, new objects should be defined.[fig. 9]

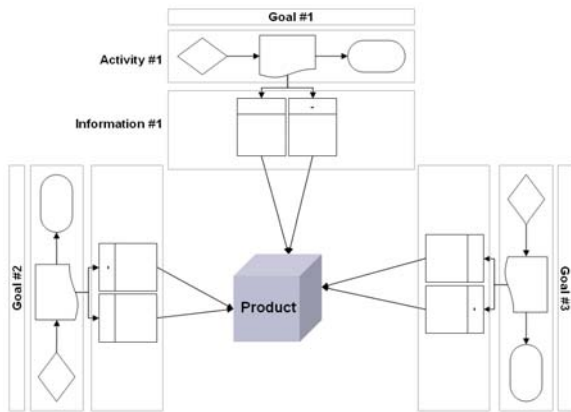


Fig. 9 Searching new objects.

### 4) Finalizing the new BAs

Current BAs can be modified with the new objects, and these BAs can describe the human life by UCS.

## 4.5 Visualization Tool Development

Visualization tool is composed of four modules as below. [Fig. 10]

### 1) Basic Activity Manager

First module serves users in drawing flow chart of new basic activity easily when the ubiquitous computing service area is extended. Basic Activity Manager makes it possible to Re-engineering could be carried out in this stage by retouching flow chart. [Fig.11, 12]

### 2) Activity Set Analyzer

Designer writes out basic scenario. Then related human home life information could be figured out by extracting Basic Activity data source. [Fig.13]

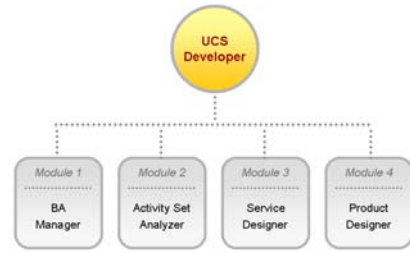


Fig. 10 Ubiquitous Computing Service Developer

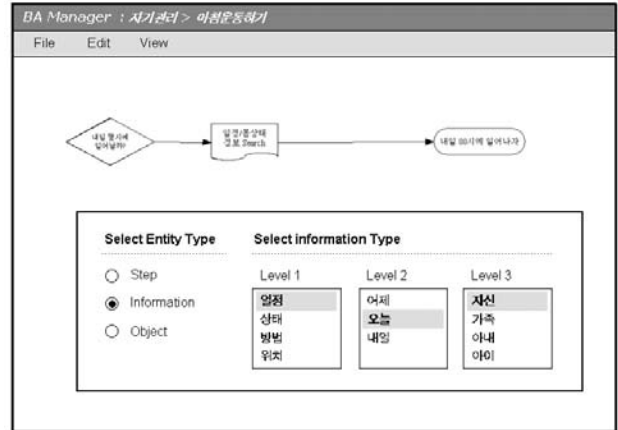


Fig. 11 Basic Activity Manager

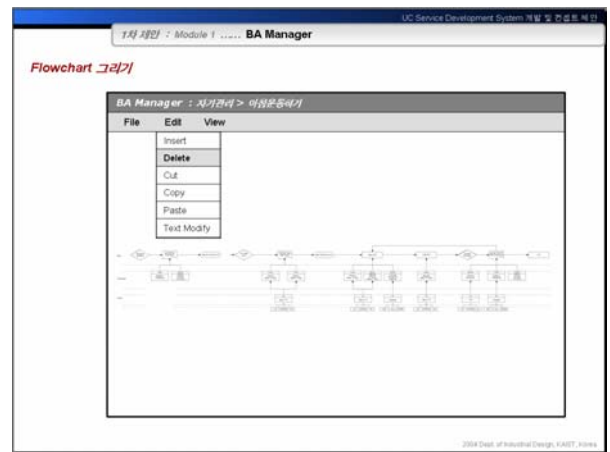


Fig. 12 Basic Activity Manager

### 3)Service Designer

While designer sees through flow of information with input, output stage, he finds out information of same from activity set. Then he does real design work such as remove, change, addition, or transformation new service and function proposed through process re-engineering. [Fig.14, 15, 16, 17]



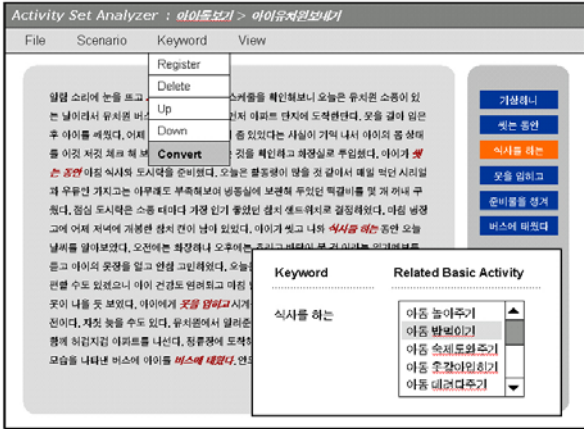


Fig. 13 Activity Set Analyzer

notepad is added.[Fig.18]

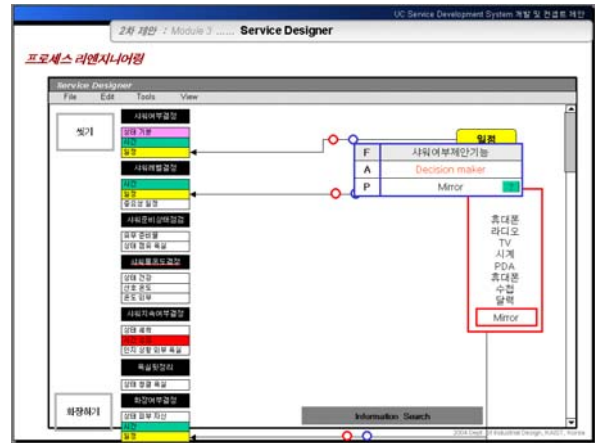


Fig. 16 Service Designer

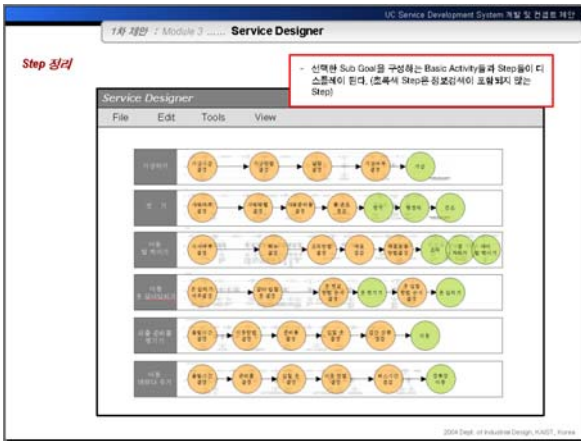


Fig. 14 Service Designer

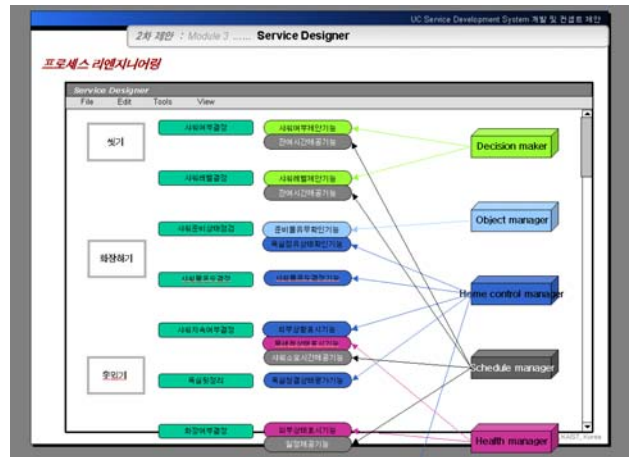


Fig. 17 Service Designer

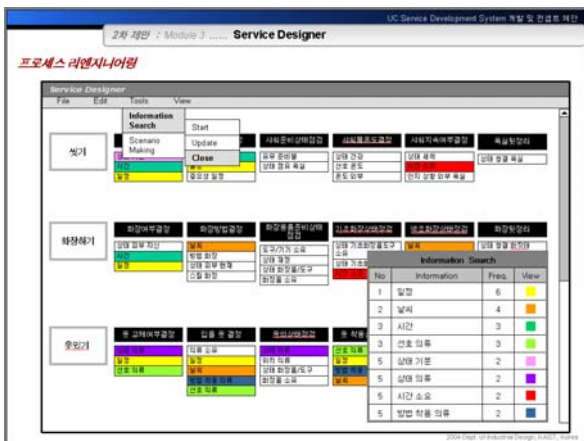


Fig. 15 Service Designer

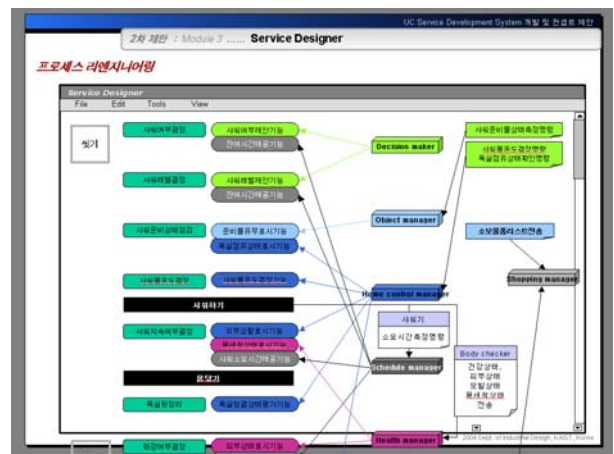


Fig. 18 Product Designer

4)Product Designer

New information can be found from the sub-goal related steps based on each product. And the requirement speculations of each product can be defined through analyzing the flow of service including information. Consequently, to-be scenario can be written beyond current scenario with re-composed map. Also the feature of

## 5. Conclusion

Ubiquitous Computing is an on-going technology not a fixed one. To make this technology come true, the market area for the upcoming technology should be confirmed. And various UCS should be designed to target the markets. UCS cannot be designed perfectly with current service design methodology, because in ubiquitous computing environment, the basic characteristics of objects would be changed. Analyzing the connection of objects and human activity can be the first step of the new design service methodology in the ubiquitous computing context; the methodology of UCS in this paper is valuable in this point of view.

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