UX Scenario Development based on Chatting UI for IoT Home Appliances

Enhancing UX for LG HomeChat

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***Abstract*—Recently, many smart and network features are incorporated into electronic home appliances. As home appliances have becoming IoT products, usability issues are increasing because every home appliance has different platform and functionality. This research aims 1) to examine why the chatting-based UI has benefits of interacting with IoT home appliances: Laundry Machine, Robot Vacuum Cleaner, Refrigerator, and Micro-Oven, and 2) to propose UX scenarios reflecting challenges with IoT home appliances. Theoretical reviews were conducted to understand characteristics between GUI-based and chatting-based UI. Then, UX scenarios which can provide new services to users of using chatting-based IoT home appliances were developed and evaluated through FGI with 20 participants. This research will contributed how chatting-based UI can provide new UX services for diverse IoT home appliances.**

Keywords- IoT Home Appliances; Chatting UI; UX Scenario

I. INTRODUCTION

As smart network features are embedded into home appliances, the products work as independent communicable devices. With this development, new UX issues are emerging: 1) how users interact effectively with diverse home appliances, and 2) what are values to users of using such IoT home appliances.

LG HomeChat in Figure 1 is intended to envision how future home appliances and UI will be evolved. IoT featured appliances seem to have many potentials, but current features are limited in remote control and sensors related functions. These limitations should be extended by designing new digital service concepts considering human activities [1]. When designing UX for IoT, designers will face new challenges because 1) functionality is distributed across multiple devices with different capabilities, 2) the concept of direct manipulation must be reconsidered because of interaction in displaced time and space, and 3) IoT is triggered by data [2]. The HomeChat can play as a diligent housemaid who can take care of home affairs if users can utilize capabilities distributed across IoT home appliances. The HomeChat can manage home like a royal butler without direct manipulation by users. As data are accumulated, the HomeChat can be a smart assistant in your life. This research was conducted to find ways for these UX challenges for IoT.

Figure 1. Concept of LG HomeChat

This research aims 1) to investigate why a chatting-based UI can be introduced for enhancing usability, and 2) to propose UX scenarios that can extend usability for IoT home appliances.

II. HOMECHAT ANALYSIS

In order to utilize potentials of IoT, the HomeChat was introduced as a chatting UI platform as shown in Figure 2. A user can manipulate directly using the control panel on home appliances and control remotely with GUI in mobile applications. However, these UI methods have a limitation.

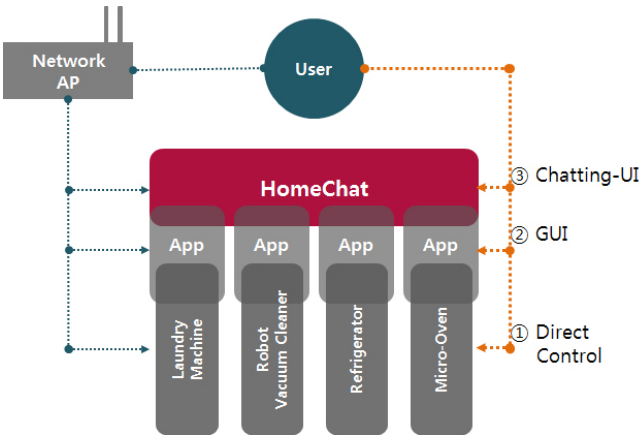

Figure 2. System Overview of HomeChat

The current version of the HomeChat is another version of GUI-based application, which means the HomeChat do not reflect the challenges of designing IoT devices. Users can control basic functions of home appliances as shown in Table 1. The functions of using the HomeChat are quite similar to those users can operate with direct manipulation methods. With GUI, users tap 'Status' icons to check current product status, and users type 'Status,' or 'Show me status' to do the task. It is very hard to say there are differences between these, so design strategy is required to go beyond the current implementation.

TABLE I. FUNTION LISTS OF IOT APPLIANCES

Function	**IoT Home Appliance**			
	laundry machine	***robot vacuum cleaner***	***refrigerator***	***micro-oven***
Common	- Quick - Status ***- Smart Diagnosis***	- Quick - Status ***- Smart Diagnosis***	- Quick - Status ***- Smart Diagnosis***	- Quick - Status ***- Smart Diagnosis***
Different	- Start - Off - Reservation ***- Option*** - Download course	- Start - Stop - Charge - Mode ***- Reservation*** ***- History*** ***- Monitoring*** ***- Smart Control***	- Temp. - Energy Save - Photo - Camera - Deodori-zation - Fast Freezing ***- Storage List*** ***- Shopping List*** ***- Recipe***	***- Recipe*** - Cleaning

III. DESIGN STRATEGY FOR HOMECHAT

Incorporating key attributes of a chatting UI is the first strategy to design home appliances in real IoT ways. As shown in Table 1, functionality is distributed across multiple devices with different capabilities. Each home appliance has its own functionality, so it is very difficult to design consistent GUI and for users to utilize each functionality in integrative ways. However, users can utilize the potential of IoT home appliances with Chatting-based UI, the HomeChat. For example, users can simply type "I will go for vacation" to set whole home appliances with the HomeChat without manipulating settings of home appliances individually.

TABLE II. KEY DIFFERENCES BETWEEN GUI AND NUI (HINMAN, 2012)

Defining Attributes of GUI	***Defining Attributes of NUI***
Mental Model of using computer as a tool	Mental Model of using computer as a media
Recognition, "What you see is what you get"	Intuition, "What you do is what you get"
Metaphoric, Containment and Place	Fluid, Unmediated, and Organic
Heavy Chrome, Icons & Buttons	Content is the Star
Experiences are anchored	Experiences Unfold

Table 2 shows the different attributes between GUI and NUI [3]. With a chatting UI, a type of NUI, users try to say what they really want to do. It is not a simple task because a user do not care how home appliances run command for the users' wants.

In order to come up with new design for IoT, the context should be considered carefully. Considering context is the second strategy to design home appliances in connected and user friendly ways. User history, community users belong to, connected appliances, other appliances users use, and service contents are context as shown in Figure 3. This is the real value of introducing IoT in home appliances.

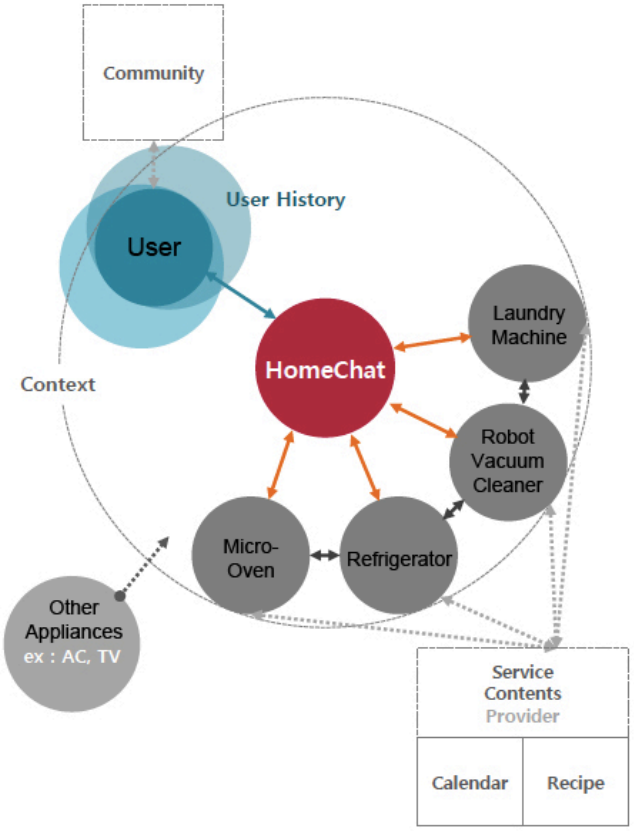

Figure 3. Context of using HomeChat

IV. UX SCENARIOS

UX scenarios for IoT have been developed to explore the potential of chatting-based IoT home appliances. Firstly, five target user groups are set: single person, just married couple, working mom, full-time house wife, and active senior. Each group has own needs as shown in Figure 4. Single person feels household affairs as troublesome. Just married couple hopes to handle household affairs easily and beautifully. Working mom wants to save time of doing household affairs. Full-time house wife is professional at household affairs. Active senior needs friends who take care of him/her. 20 participants (4 people per each group) are recruited for the scenario development.

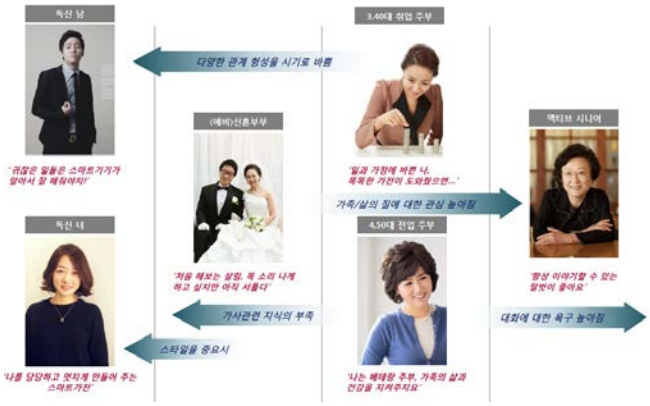

Figure 4. Persona Map

Scenarios have been developed with the format in Figure 5. Problems and target users' needs are described in the first page. The system configuration with context and IoT home appliances associated with for the problems are depicted in the second page. The triggering points when, how often, and where the scenario will happen and logics how this scenario will go are described in the third page. In the last page, real voices gathered through the interviews with the participant are quoted for reference purposes.

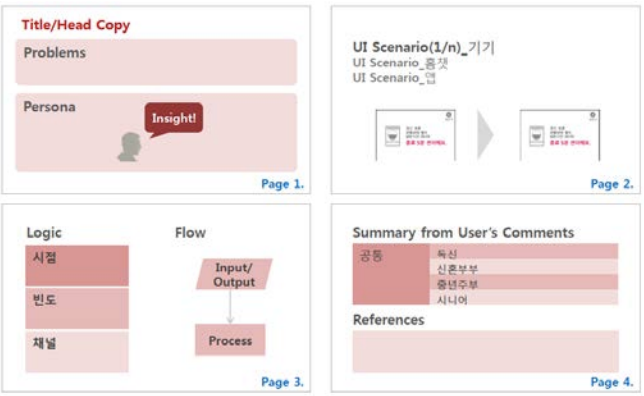

Figure 5. Scenario Format

Around 40 scenarios were developed, and the scenarios can be categorized with four groups: device sensor, context data, user history, and things at home. Scenarios with device sensor are about how the devices notifying system status from users' perspectives. Scenarios with context data can let users know when and how to devices effectively and wisely. Scenarios with user history are about customization. Users can experience in totally new ways with things at home. These are new challenges with IoT.

A. *Device Sensor*

IoT home appliances can changes users' behaviors by notifying current state of devices. By sensing how often users open a refrigerator door, the HomeChat show energy consumption daily and monthly with endangered species in the world as shown in Figure 6.

Figure 6. Scenario using device sensor in refrigerator

B. *Context Data*

The HomeChat recommend users to do specific task at time and/or places. If users do laundry every seasonal change, it would be great for their health and sanitation. Figure 7 is an example how IoT laundry machine recommend to wash an quilt.

Figure 7. Scenario using context data with laundary machine

C. *User History*

The HomeChat can remind what users usually had done at specific situation. For example, if users usually cook a Pha-Jeon (a Korean food) on rainy day, the HomeChat can remind this user's preference. There are many user history with home appliances: laundry time, shopping lists in refrigerator, dirty spots at home, etc. Figure 8 is an example of the scenario what are the preferred recipes on specific day.

Figure 8. Scenario using user history with micro-oven

D. *Things at Home*

Things at home are the part of users' life, so UX scenarios for IoT can be developed with these. One of interesting scenarios is pet care. Nowadays, many people raise pets, so they want to interact with each other while users are out of home. A robot vacuum cleaner is the only home appliances moving around home, so it can be a play partner for pet at home. User can say hello to pet and play. Figure 9 is the scenario for this situation.

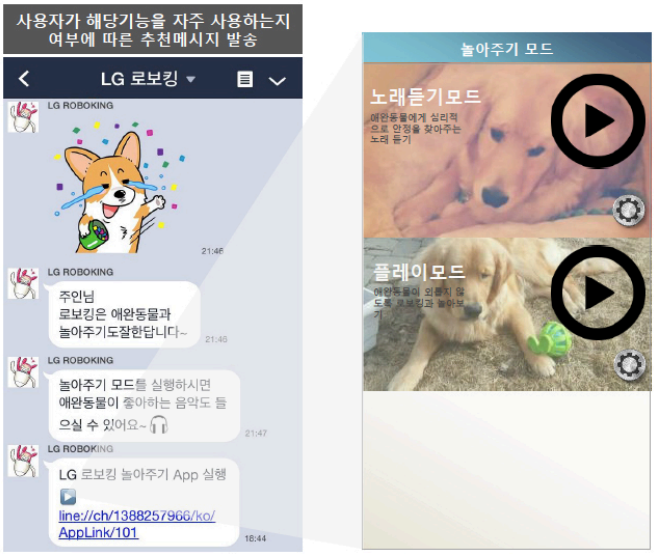

Figure 9. Scenariowith pets (living things) at home

V. CONCLUSION

When developing UX scenario for IoT, the flow what contents or services are delivered when and how is very important. This is the real challenged of design UX of IoT. From this research, design principles can be summarized to deliver the value of IoT home appliances to users.

- IoT device should work by itself (do not make users do something)
- Right timing considering users' situation (the quality of recommendation depends on timing)
- Information should be delivered deeply (users want wisdom for their life)
- Integrated thinking are required (try to design life itself)
- Emotion makes people moved (people tend to use contents or services they feel sympathy)

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