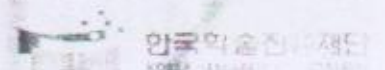
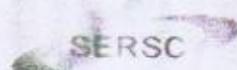


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User Behavior Analysis Framework (UBAF) : Mapping HCI with SE

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Abstract

This paper suggests to mapping HCI (Human Computer Interface) with SE (software engineering) for developing the new coming ubiquitous related systems or appliances against the current existing system developments.

To do this, we propose the user behavior analysis framework (UBAF) to develop the future ubiquitous products of new paradigm through the user behavioral analysis before the requirement stage of software development activities.

To illustrate the proposed approach we show one case study.

1. Introduction

In near future's ubiquitous environment [1], it will be very important issue to estimate user demands based on the user behavior analysis.

But we limit to use the user behaviors against satisfying the particular goals. Through analyzing behaviors with the user's particular goal, it will protect to be occurred some errors during developing new ubiquitous paradigm's product [2]. It may be applied with adding or improving functions of the new coming electric appliances.

Many researches are in progress to reduce a gap between SE(Software Engineering) and HCI(Human Computer Interaction).

So, it is necessary to unify a standardized common language to deal with comprehension of representation for these two fields [3]. There is more focused on modeling the system to represent the system structure in view of SE, while it makes clues of the application to disclose the behaviors of the system in view of HCI. Paula[4] suggests new modeling language to deal with

HCI-SE model with Interaction modeling language. We[3,5,7] also suggested the user behavior analysis methodology to develop products of new paradigm at the coming ubiquitous age. Through this methodology, we can analyze the user behaviors to achieve the same purpose within a particular system (or an environment), then extracting common behaviors, and identify objects on user behavior scenarios. With this information, we may model the system of new paradigm.

In this paper, section 2 describes related work. Section 3 mentions User Behavior Analysis Framework(UBAF). Section 4 shows one example to model u-Home Control System with our proposed approach. The last section mentions the conclusion.

2. Related Works

The User Process Based Product Architecture (UPPA) is focused on evaluating to represent the functional relationship between the user and the system [8]. Also many researches are in progress to reduce a gap between SE(Software Engineering) and HCI(Human Computer Interaction).

So, it is necessary to unify a standardized common language to deal with comprehension of representation for these two fields.

Paula[4] suggests new modeling language to deal with HCI-SE model with Interaction modeling language.

3. User Behavior Analysis Framework

In our research, we mention the user behavior analysis framework (UBAF)[9]. Figure 1 shows the User Behavior Analysis Framework (UBAF) consisted of four layered Architecture. In this section, we

describe the third layer of UBAF, that is, UML modeling area through mapping HCI and SE.

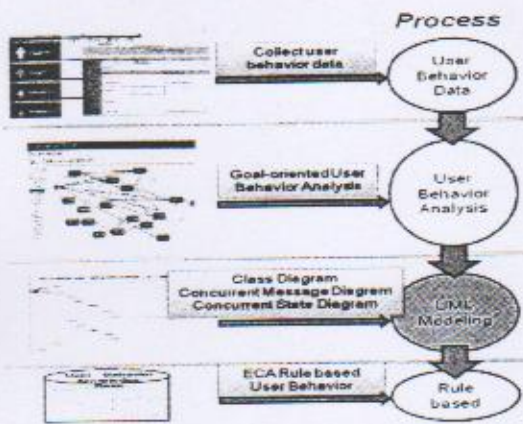


Fig. 1. User Behavior Analysis Framework

On the top layer, it focuses on collecting the bulks of user behavior data. On the second layer, we analyze the huge collected user behavior data with the tool, that is, the user behavior analyst (UBA) based on Goal-based user behavior analysis, then extract the user common behaviors and scenarios with the frequency/weight. On the third layer, we identify the functionality of user behavioral actions of(from) the human demands(or needs) on the particular environment or system. On the bottom layer, we also make rule based with the core common user behaviors. With UBA method, we can exactly to develop the new ubiquitous software products.

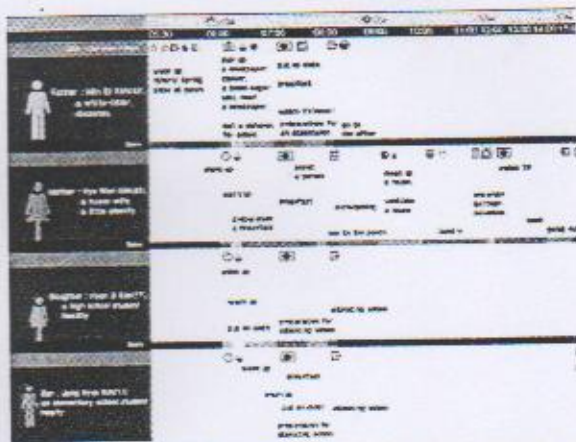


Fig. 2. The collection of User Behavior Data [3]

3.1. The Collection of User Behavior Data

Figure 2 shows the basic raw data collection of the observed user behaviors. That is, it represents to

record daily life of a family. From Interaction Design Lab., The Graduate School of Techno Design, Kookmin University, we get the collection of user behavior data.

Figure 2 shows that each family member behavior is different from each human role, place, and time. It is very hard to modeling with UML based on these raw huge data of the user behavior and to extracting the user common behavior and/or pattern. Therefore we try to analyze the user behavior data which are satisfied with the particular goals.

3.2. Goal Oriented User Behavior Analysis

We develop the tool of user behavior analysis to optimize the huge observed data[6]. Figure 3 shows to analyze the user behavior with the analysis tool, that is, User Behavior Analyst (UBA).

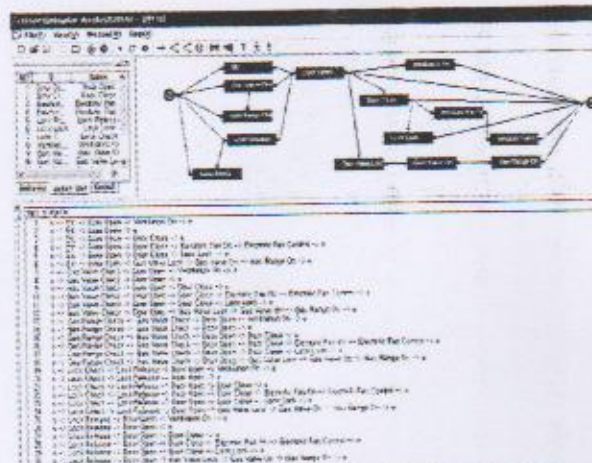


Fig. 3. User Behavior Analysis with the automatic tool (UBA)

3.3. UML Modeling

On the UML[9,12] modeling of the third layer we follow the user behavioral modeling process (UBMP) to model u-Home Control System.

Like figure 4, at the first step, "Define Domains" classifies some domains of the particular system with Domain Chart. At the second step, "Capture Requirements" represents detail within the classified domes with Use Case Diagram. At the third step, "Specify Classes" identifies classes/objects from information of "Capture Requirements", and represents with Class Diagram. At the forth step "Define Class Interfaces" represents to interact among objects based on class diagram, and assigns the role of each object on Concurrent Message Diagram. At the last step, "Specify Behavior" represents the dynamic behavior of

the particular control object with Concurrent State Diagram.

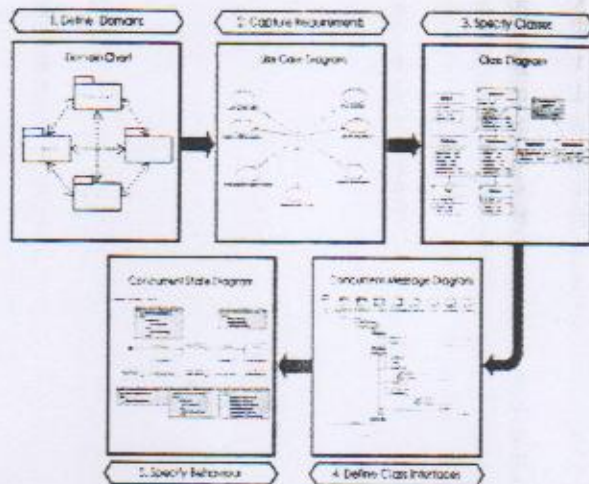


Fig. 4. The User Behavioral Modeling Process (UBMP)

3.4. Rulization of User Behavior

In this last step, we extract behavior/ condition/ service from the user behavior based on ECA(Event/Condition/Action) and then make rulization for the autonomous system.

4. Case Study

We shows one modeling example of "u-Home control System" with our extended UML.

4.1. Modeling User Behavior in u-Home

Define Domains: u-Home consists of four sub-domains of u-Home, such as Communication, Safety&Security, Well-being, Energy-saving, based on the data of the user behavior analysis[2]. In this paper, we just describe Safe&Security, one sub-domain of Domain chart of u-Home.

Actually, we could collect 1,843 task types which are 446 take types from 'Safe and Security', 461 from 'Healthcare and Wellness', 479 from 'Energy Saving' and 457 from 'Communication' [2,11].

Capture Requirements: Figure 5 shows the use case diagram of Satefy&Security. We mention just 'Fire prevention' use case of the whole Use case Diagram. In this use case, we extract objects during

"capture requirement". This step is very important role to model the u-home Control System.

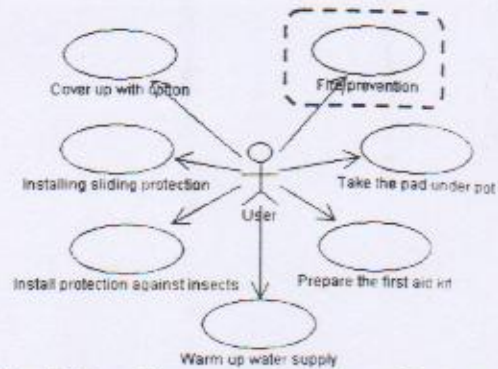


Fig. 5. User Use case diagram of Safety & Security

Specify Classes: Shows the static modeling of u-Home Control System based on 'Fire prevention' use case scenario. In this class diagram, the system controller is important to control the u-Home environment. The Controller has the association relationship with Beeper, GasRange, PowerSupply, and Sensor class. The controller class controls all devices in the system.

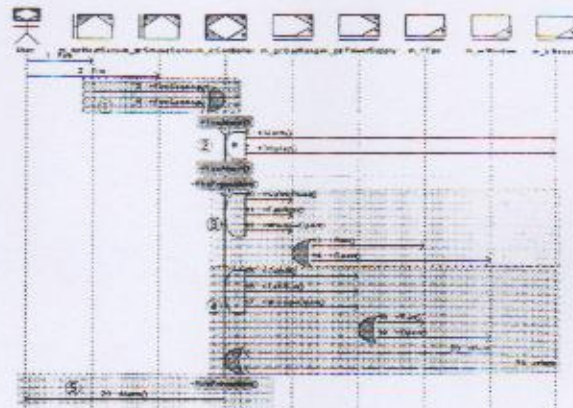


Fig. 6. Concurrent Message Diagram of u-Home

Define Class Interfaces: Figure 6 shows the dynamic modeling of u-Home Control System based on 'Fire prevention' use case scenario. In this step, we use CMD(Concurrent Message Diagram)[10]. For example, when happen a fire in the u-Home, HeatSensor and/or SmokeSensor will sense the symptom of a fire, and send this information to the controller. In figure 6, ① means to receive one message from either one sensor or other one, that is, the mechanism of OR gate. Then send this message to the controller. ② means that the controller makes a

