Prototyping of Task-Oriented Mobile Navigation System with Real Scale Mobile Services

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ABSTRACT
Because present methods for mobile service navigation are insufficient to guide users efficiently to the services they need, the authors have been investigating a task-oriented menu, which enables users to search for mobile internet services by what they want to do and not by category. Construction of the task-oriented menu is based on a task ontology modeling method which supports descriptions of user activities, such as task execution and defeating obstacles encountered during the task. Since an initial prototype menu system within a limited domain and task proved its efficiency for navigating novice users, this paper introduces the next step toward the realization of the new task-oriented menu system with real scale services. We have built task models of the mobile users which covered about 97% of the assumed situations of mobile internet services. Then we reorganized "contexts" in the model and designed a menu hierarchy from the view point of the task. We have linked the designed menu to the set of actual mobile internet service sites included in the i-mode service operated by NTT DoCoMo, which consists of 5016 services. Among them, 4817 services are properly connected to the menu. This poster introduces some findings in the process of the prototyping real scale task-oriented menu system.

Categories and Subject Descriptors
H.3.5 [**Online Information Services**]: *Web-based services, improvement of usability of mobile internet services.*

General Terms
Design, Human Factors.

Keywords
Mobile internet services, Ontology, User modeling

1. INTRODUCTION
While they provide many mobile internet services via mobile handsets in Japan, such as online shopping, mobile banking, and news services, current methods for mobile service navigation have proven insufficient to guide users efficiently to the mobile internet services they need. To solve this problem, the authors have been investigating a task-oriented menu which enables users to search for services by "what they want to do" in certain problem-solving situations, instead of by "name of category" [1]. Fig. 1 shows the process of service selection using a task-oriented menu on the prototype system [1]. First, the most abstract task candidates are shown on the mobile phone (Fig. 1 left). A user selects one of them (e.g. "Go to a department store") to solve his/her current problem (e.g., "need to buy clothes"). Then, tasks and/or subtasks associated with each task are unfolded and displayed under the task nodes (Fig. 1 center). Finally, services associated with the task selected by the user are shown, and each of them leads to access to the actual service (Fig. 1 right). On this system, Naganuma proved that the task-oriented menu system has ability to navigating novice users to the mobile services they want faster than conventional domain oriented menu system. The prototype system, however, was a limited one. In terms of task and domain knowledge, the prototype assumed only limited situations, thus limited services were built in the menu system.

To extend the prototype menu system to the real scale one, we need to investigate two issues. The first one is how to enhance scalability. The second one is how to develop menu system with real scale on the basis of the investigation about the scalability. The authors discussed these two issues and developed a new menu system with real scale for navigating users to the mobile services they want, which is linked to a real scale of mobile services consisting of about 9,000 services. This paper describes our discussions and current state of the prototyping.

2. CURRENT RESEARCH STATUS
For realization of task-oriented menu system in real scale, we have to tackle two issues: (1) Scalability of the system and (2) Building a task-oriented menu system with real scale. For the first issue, the authors have identified four kinds of scalabilities to be satisfied [2]: (a) Coverage for domains of mobile services (b) Granularity of user modeling (c) Coverage for mobile services in real world (d) Coverage for mobile users' situations in which they rely on mobile services. For the item (a) and (b), we have already proposed a new ontology-based modeling method which is named OOPS (abbreviation of "Ontology-based Obstacle, Prevention and Solution). We have designed and developed an ontology which

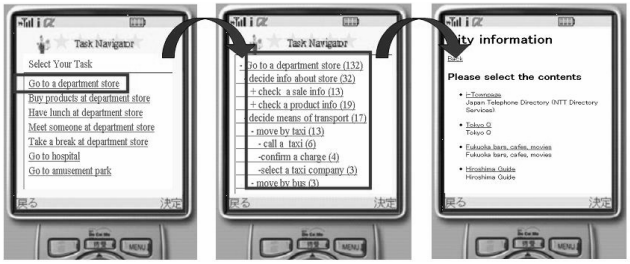

Fig.1 Task oriented menu (prototype)

Fig.2 Environment for developing task-oriented menu

covers users' daily tasks and necessary domain knowledge. Modeling method based on the ontology solves complicated domain modeling (i.e., (a)) and gives guidelines for granularity of the task modeling (i.e., (b)). The modeling method supports descriptions of users' activities and related knowledge, such as how to solve problems that the users encounter and how to prevent or solve them on the spot. By experiments, OOPS modeling method showed performance that promotes generation of idea for modeling users' daily activities. Further details are described in [3].

In this research, we concentrated on the issue (2) as well as scalability issues of (c) and (d). For testing the coverage of mobile services and mobile users' situations (item (c) and (d)), menu system with real scale is definitely needed. To make such a system, analysis of the user activities in a wide range of domains is required. For such analysis, we have applied the OOPS modeling method to "Tourism" domain which covers a broader spectrum of actions from traveling around and consuming money to staying at a hotel. We have evaluated the coverage of the OOPS model by comparing situations assumed and represented in the model which we developed on tourism setting with those situations assumed to be supported by current mobile services.

We have tested coverage of the model by a full set of mobile services which are available at the official sites of NTT docomo

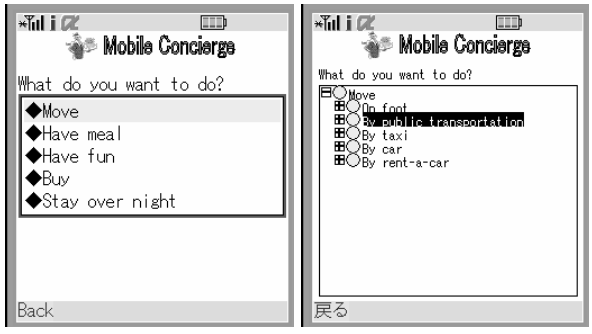

Fig.3 Task menu with full scale of services (part)

in 2004. Among about 5,000 officially authorized service sites, excluding entertainment services sites (Games, ring-tone downloading, etc), there are 2,732 sites that consist of 9,162 specific services inside. We analyzed a situation for each of the 9,162 services. Among them, our OOPS user model covered about 98% of the typical situations assumed by the mobile service sites, and just 199 services (2.17% of the 9, 162 services) were not covered by the situations represented by our model.

Based on the OOPS user model, we developed a menu system with real scale. The menu hierarchy contains 445 tasks such as "Move", "Have meal", "Draw cash", "Buy things", and so on. The menu consists of 5 layers at the deepest level. The first layer of the menu consists of 5 tasks ("Move", "Have meal", "Have fun", "Buy" and "Stay overnights"). The second layer has 17 items, the third has 97, the fourth has 112 and the fifth has 445 tasks. Then we implemented the menu system and assigned all of the officially authorized service sites, except mobile banking services and entertainment services which are just for killing time of users. As a result, 5,016 mobile internet services were allocated to the menu with real scale properly.

Fig.2 depicts our environment for developing the task-oriented menu, which is based on an environment by NTT docomo for building i-appli (applications for i-mode mobile handsets). Fig.3 shows two screen shots of the developed system. In this scenario, suppose a user want to go to a shop by public transportation system. The user selects one of them (Fig.3., left e.g. "Move") to achieve current goal (e.g., "go to a shop"). Then, five methods which can achieve the task "Move" are unfolded. By selecting the second item among the menu (Fig.3 Right, e.g., Move "By public transportation"), tasks and/or subtasks associated with each task are unfolded and displayed.

Although the entire menu contained 445 tasks, no mobile service is allocated to 100 tasks. If we develop a new mobile service for such tasks, it will be a new business opportunity. The issues on usability still remain. For example, 11 % of task menu items are linked to more than 50 services. A cause of this is that today's mobile services are biased to limited tasks like "know weather forecast", "get movie information", and so on. We plan to do other usability tests without limitations of task and domain.

3. REFERENCES

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Brief explanation about demonstration

We would like to demonstrate a newly developed menu system with real scale, as well as ontologies and a user model behind the system.

Firstly, we explain about ontology-based user modeling method to realize a scalable menu system for variety of domains. We have applied the OOPS user modeling method to "Tourism" domain which covers a broader spectrum of actions from traveling around and consuming money to staying at a hotel. We will explain this point with our user model for the tourism domain as well as details about OOPS user modeling method.

Then we will explain our development process of the menu hierarchy. Analyzing the OOPS model, we identified five basic activities and several methods to achieve their goals. Fig.S1 shows the top three layers of the menu. The task "Move", for example, is achieved by the five methods including "On foot", "By public transportation", and so on. With further analysis on the OOPS model, we have developed the whole menu system with real scale which consists of five layers and 445 tasks at the deepest level.

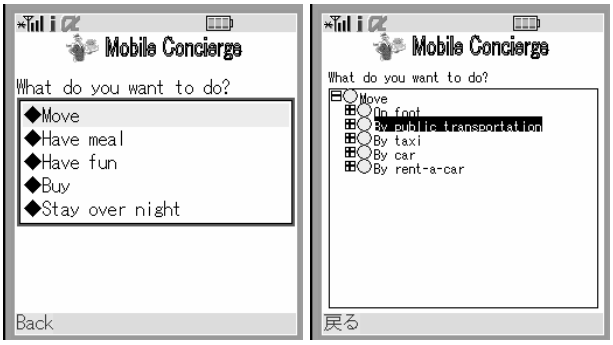
With the design process of the menu hierarchy, we will explain our ontology behind the system design as well as how the ontology contributes to the scalability issues. As mentioned in Section 2, the OOPS modeling method is supported by the ontology. Each of the tasks and methods are defined in the ontology, the user modeling process is just selecting and combining the concepts in the ontology. At the same time, we will explain our design policy of the ontology with scalability issues. Since we carefully designed the ontology to cover mobile users' activities with necessary domain concepts, this menu system is scalable in terms of tasks and domains. Furthermore, as described in Section 2, we analyzed coverage of the OOPS model for a real mobile internet service, i-mode service by NTT docomo, which consists of 9,162 services (in 2004). The coverage ratio was about 98%. With some data and statistics, we will explain about ontologies.

Lastly, we will demonstrate how our menu system works. We implemented the menu system and assigned all of the officially authorized service sites, except entertainment services which are just for killing time of users. Among 9162 services, we assigned 5016 services to the menu. Although we excluded banking services and general entertainment information services, we have prepared the menu for the services. Although implementation is not finished, we can say that our menu system with real scale is scalable for real mobile internet services.

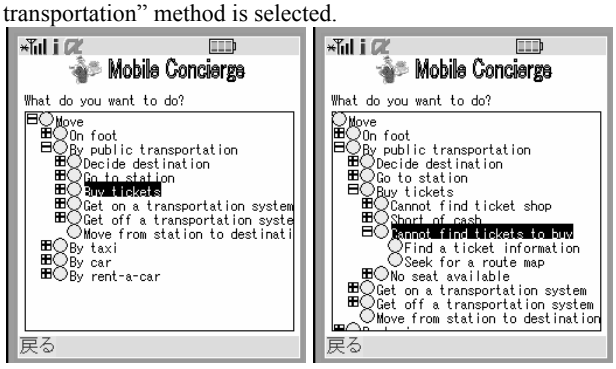
Fig. S2 depicts a sample process of service selection using screen shots of the menu system. First, the most abstract task candidates are shown on the mobile phone (Fig. S2 Upper-left). In this scenario, suppose a user want to go to a shop by public transportation system. The user selects one of them (e.g. "Move") to achieve current goal (e.g., "go to a shop"). Then, five methods which can achieve the task "Move" are unfolded (Fig. S2 Upper-right). By selecting the second item among the menu (e.g., "By public transportation"), tasks and/or subtasks associated with each task are unfolded and displayed under the task nodes (Fig. S2 Lower-left). Selecting tasks further, plausible obstacles for the subtasks and their solution tasks are unfolded (Fig. S2 Lower-right). Finally, services associated with the task selected by the user are shown, and each of them leads to access to the actual service.

Menu top
- Move
  - On foot
  - By public transportation
  - By taxi
  - By car
  - By rent-a-car
- Have meal
  - At a shop
  - Take out
- Have fun
  - By sight seeing
  - By playing at a theme park
  - By watching sports/play/etc.
- Buy
  - In a town
  - By internet shopping
  - By auction
- Stay over nights
  - Stay at a hotel
  - Stay at friends

Fig.S1：First three layers of the menu with real scale



(Left)Top menu: "Move" task is selected by user.
(Right) Five methods for "Move" are unfolded and "By public transportation" method is selected.



(Left)Subtasks of "move by public transportation" are unfolded.
(Right) Plausible obstacles for the subtasks and their solution tasks are unfolded.

Fig.S2： Sample screen shots