Task Ontology-Based Framework for Modeling Users' Activities for Mobile Service Navigation

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1. INTRODUCTION

We can get many kinds of mobile services via mobile handsets in Japan. According to an annual report by NTT DoCoMo [1], Japan's premier mobile communications company which manages mobile internet services and occupies about 58% of the market, we have more than 89,000 service sites today. On the other hand, a large number of services cause difficulties in searching, finding and selecting suitable services for consumer's needs.

One of the reasons for the difficulties is that menus of the current mobile services are organized from the viewpoint of the domain. Users have to learn the menu system to access the services; hierarchical structure of the menu, relation between name of the category and services in the category. If a user wants to catch the last train, for example, such a domain-oriented menu will guide him/her as follows: "menu", "latest information", "traffic", "train information", "timetable" and "input start station name". The user follows the menu and finally reaches the service that provides information about timetable. As this example shows, users have to translate "what they want to do" to "name of the menu" before getting mobile services they want.

On the other hand, there is another type of menu which we call "task-oriented menu" [2]. The goal of this research is to realize a task-oriented menu system which enables more efficient mobile service navigation. Result of the experiment shows that task-oriented menu is more efficient for retrieving information [2]. By task, we mean users' problem solving activity in the real world. In the task oriented menu, the users seek for services by the name of the directory which represents a task they are involved in rather than the name of category which might be unfamiliar to them. Users select a menu that is most resemble to what they want to do; "get on the train", "draw cash", for example. It has potential of providing useful information for mobile service users quicker than that of a domain-oriented menu. Value of information depends on the quality of contextual information that contains. By quality, we mean whether the information corresponds to the needs of the users or not. Necessity of information lies in a task, not in a domain. You seek for information when you face a trouble, which is difficult to get over with knowledge at hand, on your way of achieving a task. Such a situation is the context and origin of the necessity for the information.

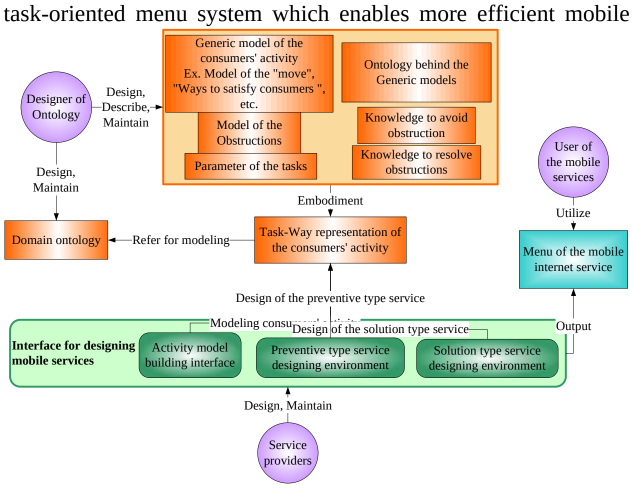

Figure1. Framework for designing task oriented mobile service

With backgrounds discussed above, this article proposes a task ontology-based modeling framework for mobile service navigation. Fig.1 depicts the framework of our system where rectangles represent knowledge, rectangles with round corners represent modules and circles represent people. "Service providers" in Fig.1 design users' activity models and mobile internet services through the interface module. Its output is the menu of the mobile internet services that is used by the "User of the mobile services". Although the service providers usually have implicit business models about their own mobile services, they do not have generic task models for representing users' activities. Generic models and task/domain ontologies which are designed by "Designer of Ontology" are referred to by the service providers to obtain concrete models by instantiating the generic models.

"Designer of Ontology", an important role of the authors, designs and maintains ontologies. The authors are specialists for building task ontologies [3], and have experiences of its application to the real world problem solving [5]. Although there are huge numbers of "tasks" in the real world, those have be solved by mobile handset users are small, since they are limited to daily-life tasks done out side home. Furthermore, to organize task concepts is easier than that of domain concepts, because it is independent of domain, is able to be decomposed into subtasks and has a generality in the abstract space. For example, a task concept "buy a ticket for a movie" consists of two task concepts, "buy something" and "receive service (Including model of queuing)". Both concepts can be applied to modeling similar tasks in various domains. Task concept thus has a generality in its nature and hence we can organize its structure at a high level of abstraction.

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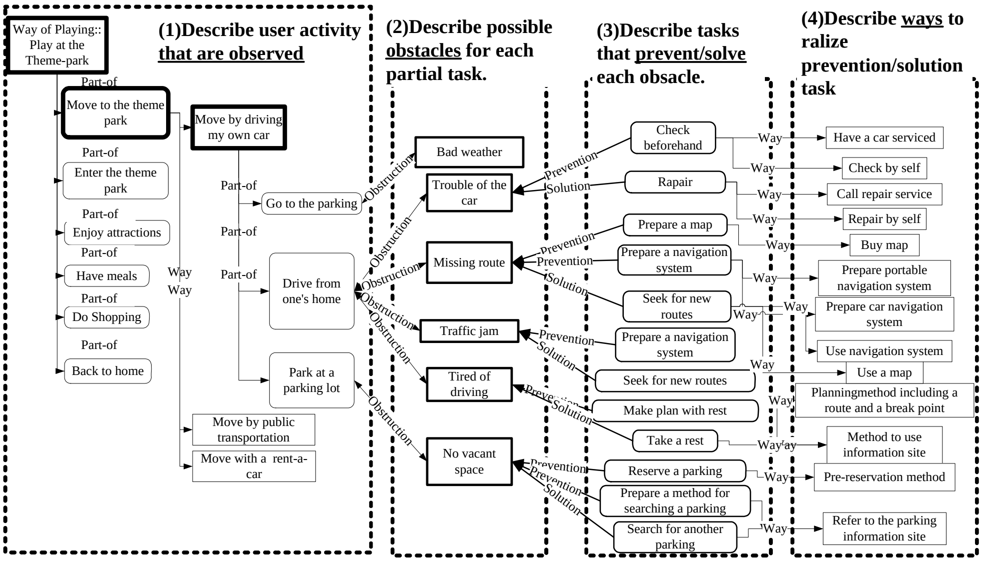

Figure2. An example of modeling process

The authors are investigating reorganization of the mobile services from the viewpoint of task. The approach based on task ontology enables service providers to describe users' activity models in terms of generic task vocabulary which are detached from the domain model. Furthermore, specification of the modeling process based on categorization of users' activity provides them with guidelines. Based on the task ontology, our method contributes to building homogeneous and generic models.

2. Framework

Fig.2 represents a process of building a task-way representation model of users' activity. A dotted rectangle with number (1) corresponds to the basic model of users' activity. It is described by instantiating generic models and/or ontology. Description starts from the task at the level of coarse granularity. Next, ways to achieve the task are linked, and each of the ways is decomposed into a sequence of sub-tasks. Our "way" is similar to "method" of CommonKADS [6] or "how to bundle" of the Business Process Handbook [7] to some extent. Following this process, task of the coarse granularity is decomposed into sub-tasks via a few ways. The area with number (1) represents that a task "Move to a theme park" is achieved by three ways. One of the ways "Move by driving one's own car" is decomposed to three sub-tasks such as "Go to the parking lot", "Drive from one's home" and "Park the car at the parking lot".

An important guideline in this framework is that the model of daily activity is described based on the observation of physical activity on the spot. Cognitive activities such as "plan to move more efficiently" or "learn traffic information beforehand" are not described in the model.

The guideline and modeling process based on decomposition of the task contribute to making modeling process easier and output models more objective. To realize a coherent task-oriented menu structure with a large scale problem, transfer of the modeling technology is important. If we allow modeling non-observable activities, quality of output models varies according to the skill of each model builder. The less knowledge about the task and/or domain he/she has, the worse output models will become. In such a case, process of modeling becomes implicit and we cannot transfer the method to others.

Models of how to prevent/solve problems are described in three steps. Firstly, the designer describes possible obstacles for each partial task. For example, the task "Drive from one's home" has four possible obstacles: "Trouble of the car", "Incomplete route", "Traffic jam" and "Fatigue of driving". Building models of possible troubles is a unique feature compared to previous researches like [2][6]. Since the most valuable mobile service is to solve such problems that occurred, our modeling method copes with obstacles on the spot. Next, the designer describes prevention/solution tasks for each of the obstacles (Fig.2(3)). Lastly, the ways to achieve the tasks are modeled (Fig.2(4)).

Since models of obstacles are described for the task with fine granularity, we can imagine more tasks for their prevention/ solution than conventional modeling methods. In Fig.2, for example, to generate preventive ideas for obstacles about the task "move to theme park" is more difficult than that for the "Park at the parking lot", because the former task is abstract and contains many obstacles according to its interpretation. Based on the decomposition of the task models, our method helps generation of new prevention/solution ideas. With a similar reason, generating ideas about the ways to achieve the prevention/solution tasks is supported by our modeling method.

3. Research Status

The authors are currently building task ontologies and models on the proposed framework. Task model of the activities related to the theme park has been building at the high level of abstraction, and we plan to apply the ontology to other domains (cf. Chap1). At the same time, we are conducting several experiments to evaluate the proposed framework in terms of (1) supports for generation of ideas about mobile services (2) relationship between given ontological information and the quality of the user models output (3) efficiency of the modeling with our guideline, and so on.

4. REFERENCES

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