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Implementation of Semantic Information Retrieval System in Mobile Environment

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Abstract

Currently, due to the development of Ubiquitous and IOT techniques, research on the context awareness techniques that offer useful information has been conducted. Also, the context awareness recommender service which recognizes the current user's location and offers appropriate information has been researched. Therefore, most users prefer searching for the personalized information using more convenient and dynamic mobile information retrieval services than using existing desktop PC services in the limited space. Therefore in this paper, we implemented semantic mobile information retrieval service using ontology.

Keywords: Semantic Information Retrieval, Mobile information, Ontology

1 Introduction

Thanks to development of information retrieval method with mobile devices, it

is possible for users to retrieve the information that they want anytime and anywhere. However, not only in the existing information retrieval system but also in the mobile information retrieval system, as users ask for the information, there is a lot of information that the users don't want rather than the exact and useful information.

The research on the context awareness recommender service has been conducted using user's location and context. Also, thanks to development of wireless internet environment, it is possible to provide the personalized search result appropriate to users' request anywhere and anytime, considering mobility and portability of mobile users.

Therefore, in this paper we developed the context awareness ontology model to predict the user's interest based on the context awareness and forecast which location and which search results the users want. Also the model can provide more exact and precise information to the users according to the mobile device.

In this paper we propose the mobile information retrieval system using ontology technique to provide multitude of information to user's query. It also offers more exact and precise results to the user's request and helps to find out location of information than the existing information retrieval system, providing map service with the user's request results using Google map APIs.

2 Related works

[1, 2] explained that ontology comprised concept, relation, hierarchy, and function. Ontology means defining the rules that can perform the inference about the basic primitives or class components. [3, 4, 5] defined that ontology is the formalized and specified specification about the shared conceptualization as the data representation method for analyzing and integrating a scattered data by web and provider. Also, in this paper they explain RDFS, RDF, and OWL as the elements for representing ontology in detail. [6] constructed XML web service using PARA(Place-Attraction-Resource-Activity) ontology with tour information based on the regional context such as what, where, when and so on.

[7] proposed the context recommendation system, OCARCH(Ontology based Context-Aware Recommendation system using Concept Hierarchy) that determined the information level appropriate to the user's context using the ontology hierarchical model and then recommended the information. [8] implemented the retrieval system of phoneme unit used in the wired internet environment in the wireless internet environment and also proposed the retrieval system including the location information in this paper.

[9] proposed the framework that improved the retrieval results referring to the click logs of related other keywords semantically using the ontology. [10] designed and implemented the recommendation system for personalized and customized in mobile environment in the paper, using Hybrid filtering method combined with the strengths of each information filtering method.

3 Ontology construction of tour

To construct tour ontology we followed next steps.

Figure 1 shows the procedure constructing the context ontology in the range of the specific tour site. First, the ontology domain was determined to construct the ontology. We collected the information about the tour sites each area after finding out the tour site information. Second, classes were structured about each major concept, which was made up of hierarchical structure with superclass, subclass, and so on. It was assigned root class as the top, and then the lower classes were generated using each area assigned as the subclass. The subclass relationship was assigned more specifically about each area and then the tour ontology with hierarchical structure was constructed.

Third, using the attributes of the data made up of each class, relationship and characteristics of each data were defined. The attribute relationships between classes were assigned using the characteristics of each area composed of each class, the famous restaurant in each place, or the descriptions about each tour site and so on. Fourth, tour site in each class was assigned the attributes using the characteristics of each tour site and then the tour instances were generated.

Fifth, consistency checking was performed whether newly constructed tour ontology agreed to the axiom or the attributes of ontology. Sixth, the constructed ontology was used for information retrieval for the user.

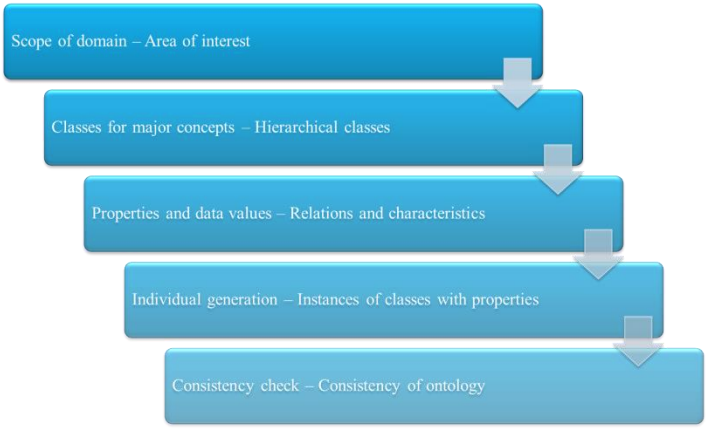

Fig. 1 Ontology Construction Procedure

We constructed tour ontology, tour.owl using OWL (Web Ontology Language), RDF, RDFS and so on by protégé_4.0.2 to infer the ontology. To construct tour ontology, we assigned subclasses under each area and the class of the smaller group in each area. The tour names are assigned as subclass below. To retrieve the information using the synonym or initial about each area or tour sites, we assigned equivalent class relationship meaning the synonym process. As the users entered

the search words about the tour sites, and to prepare for using similar words or synonym or abbreviation, we assigned the equivalent class relationship. To provide the exact information retrieval results we assigned equivalent class.

4 Implementation of Mobile information retrieval system

Through preprocessing of refining the collected information we developed the database using MS SQL Server 2000 Personal version to construct the relational database. The database was composed of several fields such as id, val_1, val_2, val_3, val_4, val_5, tour_site, syn, lat, and long. The fields such as val_1, val_2, val_3, val_4, adde_5 represented the address composed of each tour sites. In addition, tour_site meant the name of the tour sites, and syn was the name of the field for processing the synonym or initial. Also, lat and long meant the latitude and the longitude for assigning Google map respectively.

Then we constructed the tour ontology applying the attributes and the relationships between each data in the relational database. We used Protégé_4.0.2 version to construct the tour ontology database and infer the relation between data. Also we used to represent the ontology using the ontology language, OWL(Web Ontology Language), RDF, RDFS and so on to construct the ontology, tour.owl.

In addition, for the implementation environment for developing the mobile information retrieval system, we used [11] Android 4.3 version and Google APIs 4.3 for implementing Google map. In addition, for developing the mobile information retrieval system we used HTML5, CSS3, JavaScript and so on, and also for the database and the server we utilized Node JS server, which is used in mass database. Also, as Android programming is based on Java, we constituted the implementation environment using Jdk1.7.0_05. In addition, we used [12] WebStrom_7.0.3 version as the editor for developing the information retrieval system in mobile environment.

The tour database were composed of the fields such as id, val_1, val_2, val_3, val_4, val_5, tour_site, syn, lat, long, and so on. Here, val_1 was composed of the areas such as “Jeju Province”, “Busan City”, and val_2 was made up of areas such as “Seoguipo city”, “Jeju city” in case of Jeju Province. In addition, val_3 was appointed the areas such as “Aewoleup” in Jeju city. Also, val_4 was assigned “Aeworlhang” in Aewoleup, Jeju city, in Jeju Province and so on. Also, val_5 was assigned house number such as “364” in Aewoli, Aewoleup, Jeju City, in Jeju Province, and so on.

The list in Figure 2 was the retrieval results, when the user input the search word like ‘Jeju city’. However if the user input the other values which has the subclass of ‘Jeju city’, the system will offer more specified retrieval results. Also Figure 3 shows the map result from the query which searches tour sites in Jeju city using Google Map APIs.

Fig. 2 Retrieval result from search word

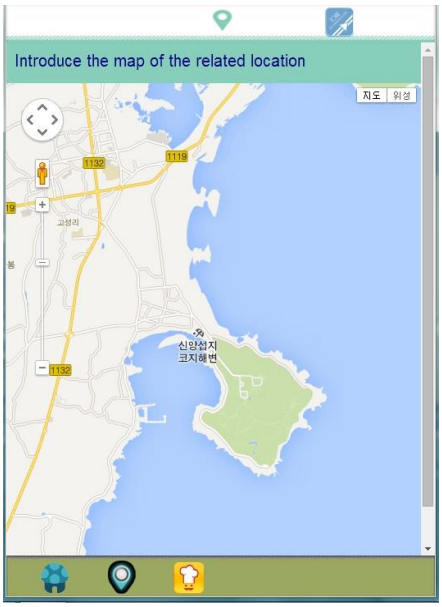

Fig. 3 Map result from search word

5 Conclusions

In this paper, we researched the mobile information retrieval system using the context ontology in mobile environment. The information retrieval method has the strength that it can provide the information anytime and anyplace compared with the existing information retrieval method using the desktop PC. Therefore, in the modern society where the users move fast and do a lot of activity, it is essential to develop the mobile information retrieval system using the mobile devices. Also, it has another strength that can provide the user's current location as well as the location information that the users want to the users, using Google map function equipped in the mobile devices. We constructed the implementation environment based on Android programming and developed the mobile information retrieval system to provide the information retrieval service in mobile environment.

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References

[1] A. Maedche, *Ontology Learning For The Semantic Web*, Springer US, 2002. http://dx.doi.org/10.1007/978-1-4615-0925-7

[2] P. Sajoon, Expert Retrieval System based on Specific Ontology in Semantic Web, *Journal of The Korea Knowledge Information Technology Society*, **1** (2006), no. 1.

[3] M.F. Uschold, R.J. Jasper, A Framework for Understanding and Classifying Ontology Applications, *Proceedings of the IJCAI-99 Workshop on Ontologies and Problem Solving Methods* (KRR5), (1999), 1-12.

[4] G. Fischer, J.L. Ostwald, Knowledge Management: Problems, Promises, Realities and Challenges, *IEEE Intelligent Systems*, **16** (2001), no. 1, 60-72. http://dx.doi.org/10.1109/5254.912386

[5] H.S. Hwang, J.Y. Lee, A Study of a Knowledge Inference Algorithm using an Association Mining Method based on Ontologies, *Journal of Korea Multimedia Society*, **11** (2008), no.11, 1566-1574.

[6] Y.W. Lee, A semantic web service for tourism information over the mobile web, *Journal of the Korean Geographical Society*, **42** (2007), no. 5, 788-807.

[7] M.H. An, J.H. Kwon, Ontology based Context-Aware Recommendation System using Concept Hierarchy, *Korean Society for Internet Information*, **8** (2007), no. 5, 81-89.

[8] K.J. Lee, J.W. Song, J.S. Han, S.B. Yang, Location-based Keyword Recommendation System For Mobile Device, *Conference of Korean Institute of Information Scientists and Engineers*, 2(D), **34** (2007), 427-430.

[9] H.J. Song, T.H. Lee, H.J. Kim, Enhancing Accuracy of Collection Order Using Ontology in Mobile Aggregated Search, *Korean Institute of Information Scientists and Engineers*, **18** (2012), no. 3, 187-196.

[10] J.M. Ko, D.H. Nam, Development of Hybrid Filtering Recommendation System using Context-Information in Mobile Environments, *The Korea Institute of Inteligent Transport Systems*, **10** (2011), no. 3, 95-100.

[11] http://www.android.com

[12] http://www.jetbrains.com/webstorm

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