

Ontology Based Middleware for Ranking and Retrieving Information on Locations Adapted for People with Special Needs

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Abstract. Current leisure or touristic services searching tools do not take into account the special needs of large amount of people with functional diversities. However, the combination of different semantic, web and storage technologies make possible the enhancement of such search tools, allowing more personalized searches. This contributes to the provision of better and more suitable results. In this paper we propose an innovative ontology driven solution for personalized tourism directed to people with special needs.

Keywords: information retrieval, ontology, special needs

1 Related Work

Nowadays a great number of search tasks in complex information systems require the participation of multiple information sources. The information is usually scattered over the web in different sources implemented in different technologies and with different structures [1]. In the last years, there have been many contributions that employ ontology based semantic approaches to improve the access and the integration of heterogeneous information sources. Semantic Web [2] deployment is a slow but constant process, and there are powerful technologies in niche applications (healthcare, finance, publishing among others).

In the touristic domain, the scientific community has provided many relevant works which use ontologies to retrieve information. The REACH project implements an ontology based representation to provide enhanced access to heterogeneous distributed cultural heritage information sources [3]. Another good example can be found in E-Tourism project [4] that develops an ontology based system to improve information creation, maintenance and delivery in the touristic industry by introducing semantic technologies.

Focusing on accessibility, ontologies have been largely used in different domains for the definition of user interface behaviors [5]. But there are other applications, like the PATRAC project, where ontologies are used for the assessment of accessibility in cultural heritage environments [6].

2 In Context

Our work is based on the philosophy of PATRAC: not limiting the use of ontologies to adaptive interfaces, but bringing together tourism and accessibility in the context of restaurant business.

This work has been implemented in a software module that is integrated in an Interactive Community Display (ICD) service, which offers enhanced restaurant business searching capabilities for all kind of users. The proposed system (see Fig. 1), composed by different modules, employs user profiles (Profile Manager) that are adapted with feedback information (Feedback Manager) obtained from user interaction (Interaction Manager). These adaptive profiles store information about user preferences that are the input of the module responsible of accessing, filtering, integrating and ranking of the information requested by the user (Content Manager). The next section describes the Content Managers functionalities and implementation details (see Fig. 2).

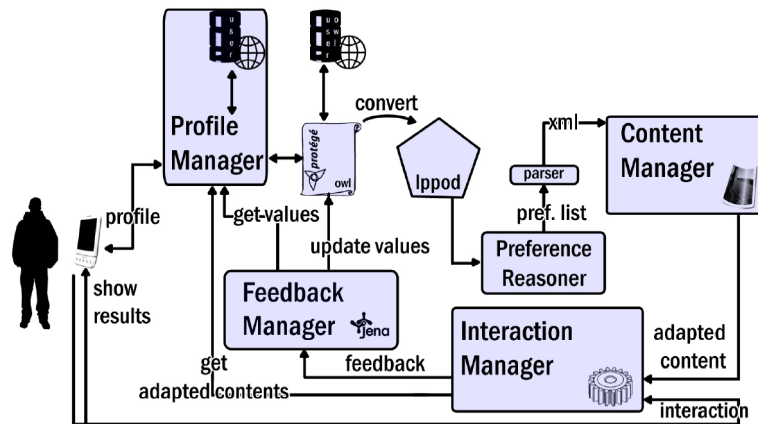


Fig. 1. System architecture

3 Content Manager

The Content Managers input/outputs are based on SOAP web services. The service request is composed by preferences which can be divided into two categories. The first one is related to the general preferences: actual search parameters and general profile parameters. The second one with the context aware preferences: type of disability (blind, deaf or reduced mobility), gastronomic requirements (vegetarian, diabetic or celiac) and so on.

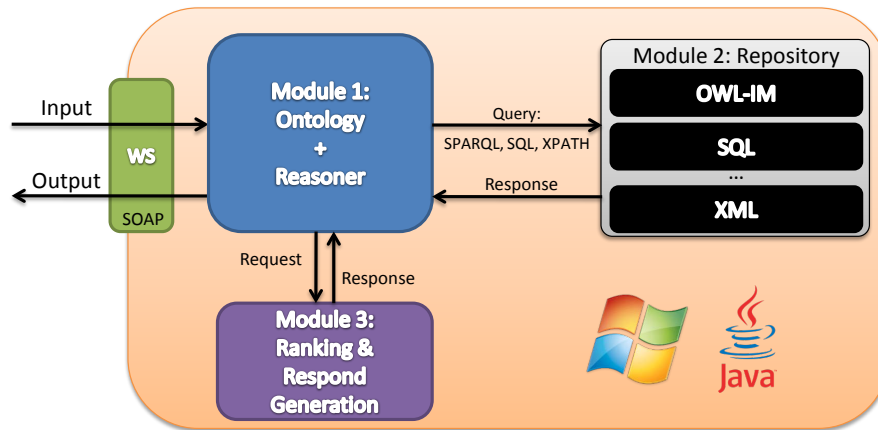


Fig. 2. Content Manager

The Content Manager is formed by three different modules: Ontology and Reasoner Module (Module 1), Repository Module (Module 2) and Ranking and Respond Generation Module (Module 3). Module 1 integrates an ontology with reasoning functionalities. This ontology defines the parsing options for every preference. In the context aware case, these preferences are not always related in a straightforward relationship with the stored information. For that reason, in order to allow the correct matching between the query and the stored information, a parsing process is launched. Due to information source heterogeneity (Module 2), the ontology guides the querying process, selecting the correct repository to send the query and the type of query to be built and its skeleton. This has been validated in three types of scenarios: SPARQL queries for semantic repositories like OWLIM, SQL queries for relational databases like MySQL and XPATH queries for XML repositories.

Module 1 sends several queries taking into account each preference. The outputs of these queries are analyzed and internally stored in a list of results. The rank position of the result will increase for every query accomplished. Finally, Module 3 generates the response, sorting the results according to the ranking that ultimately define the order in which they are displayed to the user.

A use case that sums up the Content Manager functionalities is the case of deaf people searching for a restaurant. Since the system is aware of his/her deafness, it will search restaurants with round tables and with staff who knows sign language. On the one hand, round tables allow deaf to be able to see everyone on the table, so they can read lips in easier way. On the other hand, staff with sign language knowledge offers communication facilities to deaf users. The output of the Content manager will firstly show restaurants that fit best the user preference and needs.

4 Results and Conclusions

The main contribution to the accessibility field is to allow people with disabilities to conduct searches in a system that will internally take into account their special needs. The content manager results have been successfully evaluated and validated by experts. The Content Manager processes based on information sources are performed almost immediately even though it also depends on the number of preferences received. During the ontology definition task, technical and accessibility studies, which involve experts and users, have been used. These studies have been realized by PREDIF¹ a non profit organization working for the integration of the people with special needs. The design of the ontology generalizes the query procedures, being ready to new storage and query technologies.

The whole system usability and accessibility evaluation will be carried out later on. It will help to improve ICD interface, used preferences and the weights given to each queries in order to upgrade the quality of the results.

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¹ <http://www.predif.org>