Architecture of a Mobile App Recommender System for People with Special Needs

María Isabel Torres-Carazo, María José Rodríguez-Fórtiz, María Visitación Hurtado, José Samos, and Vanesa Espín

ETSIIT, Dpto. Lenguajes y Sistemas Informáticos, University of Granada, Granada, Spain
{Misabeltorres,vespin.martin}@gmail.com,
{mjfortiz,mhurtado,jsamos}@ugr.es

Abstract. International initiatives promote the development of software applications and technologies which are suitable for people with disabilities or special needs. Although there are currently various apps to assist, facilitate and support different kinds of activities for these users, app repository search mechanisms are rigidly categorized and do not take into account the disabled user's profile or context when recommending the most suitable apps available. The aim of this paper is to define an architecture of a new platform supporting an ontology-based recommender system on the features of the apps available in app stores.

Keywords: Apps, Repository, Searching, Architecture, Ontology, Recommender System, People with Disabilities.

1 Introduction

New technologies are increasingly prevalent in our daily lives and mobile devices now enable information to be accessed by considering user profiles and ubiquity. As a result, disabled people are able to access the information by themselves in the same way as other users.

The advance of assistive technologies such as screen readers and voice input has possibly already demolished barriers, enabling users with special needs the same access as anyone [1]. However, many mobile devices or applications are not always easy to use and possible access barriers might even result in a digital gap to the exclusion of the disabled.

In order to solve this problem, various companies and organizations are working on the development of more accessible mobile devices and apps. However, most potential users are unaware of them or do not know how these can fit their requirements and needs.

Our research into the functionality of app repositories (Google Play, iTunes Store and Windows Store) identified that relevant information for disabled users was often hidden in the description section, was missing or was mentioned on another web page. The complexity, lack of clarity and the small print of app descriptions made searches particularly difficult for the disabled user. Almost every app repository provides

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classification in certain categories such as games or books. They also enable a search to be made based on age, price, relevance or keywords. None of the stores takes into account the user's profile or other context information (with the exception of the user's location in one app store) when the application search is performed. For this reason, the proposal of this paper is to define an architecture that includes a new app called m-RECACC, which is based on a semantic-based recommender system grounded on various app features, user profile and context.

The remainder of the paper is organized as follows: Section 2 describes the proposed architecture and Section 3 provides a summary of our conclusions and future lines of research.

2 Architecture of the App Recommender System

2.1 Purpose of the System

The process of recommending apps to users requires an app domain expert to study and classify apps in repositories according to different criteria. This expert also categorizes different levels and types of disability and the contextual information that can be considered and categorized. The result of this process is the knowledge base used by the m-RECACC app.

At the core of our proposal is the special m-RECACC application. This is installed and configured by the users with disabilities or their assistants. Configuration of m-RECACC involves the creation of a specific profile (personal details and disabilities) for each device user. The recommender system considers this profile and the knowledge base when recommending the most suitable apps available. The user can then either decide to install the recommended app or not.

2.2 Architectural Components

In view of all the factors involved in the search and recommendation processes, we propose the system architecture shown in Figure 1.

Application Environment: This environment is represented by the apps located in the app repositories, such as, for example, Apple Store, Google Play or Windows Store.

User Environment: In the same way as [3], recommender systems can use context by means of mobile device services or sensors.

Server Application Knowledge Base: This knowledge base contains a data store and an editor to manage it. The data store includes the user profile, context and app features. These are stored as ontologies in order to provide classifications with a sematic meaning and a more detailed taxonomy. In the case of the user profile, an ontology based on the AEGIS ontology [4]. The knowledge base also consists of the relationships and rules relating the information of the ontologies. We have also conducted an

exhaustive study into various app repositories such as iTunes Store and Google Play. Focusing only on visual impairment, we have compiled and classified about 80 apps. The characteristics that have been considered for the classification of these apps include category, language, operating system, price, voice synthesis, vibration, sounds and colours. In terms of user environment, the system records information about the user's location, noise level, brightness, timestamp or any data provided by mobile devices or obtained using body or environmental sensors.

The knowledge base manager can use the data store editor to perform modifications. The main advantage of the use of the knowledge base lies in its independence in terms of the m-RECACC app: a change made to the knowledge base does not necessitate a modification to the mobile app.

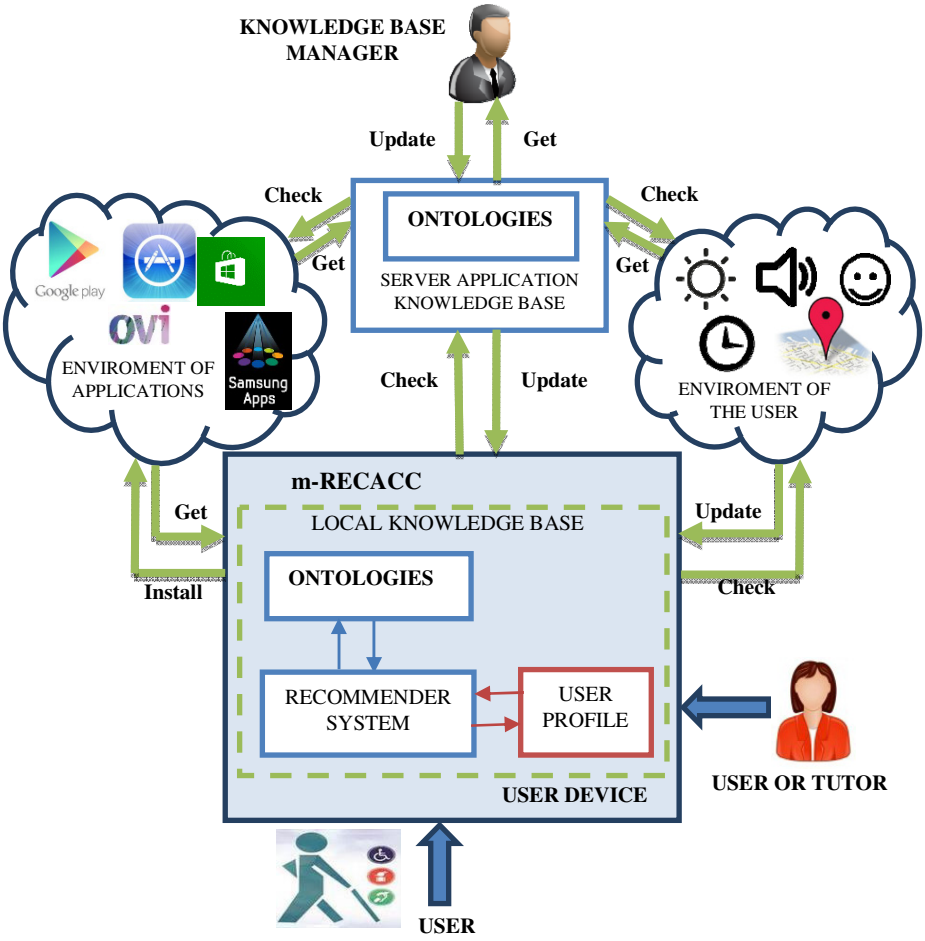

Fig. 1. System Architecture

Mobile Search and Recommendation Application: The users should first install the m-RECACC app on their device. In order to improve efficiency, a local copy of the knowledge base is stored on the device. m- RECACC app includes the user profile and the recommender system. The user profile is configured by the user's tutor and contains all the features relating to each specific device user. The system is therefore able to obtain the most suitable individual recommendation for each user.

The recommender system considers the information gathered by means of ontologies about the user profile, their context and the app features. It provides filtering strategies based on semantic reasoning techniques that discover relevant relationships between the users' preferences, context and items to be recommended.

3 Conclusions and Future Lines of Research

Traditional app store browsers are unable to refine individual searches to user needs or context, and classification of app searches is limited to certain prefixed parameters. Furthermore, app descriptions do not normally indicate whether an app might be suitable or useful for a person with special needs.

In this paper, we have proposed an architecture that includes a recommender system using a knowledge base which is formalized by means of ontologies. A recommendation strategy for suggesting the most suitable apps to disabled users has been designed on account of user profile, context information, apps features and user interests.

By way of future work, the recommender system will be completed with filtering strategies based on semantic reasoning techniques and the mobile app included in the architecture will be implemented.

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