Chapter 4

A Voice-Enabled Framework for Recommender and Adaptation Systems in E-Learning

A. A. Azeta
Covenant University, Nigeria

C. K. Ayo
Covenant University, Nigeria

N. A. Ikhu-Omoregbe
Covenant University, Nigeria

ABSTRACT

With the proliferation of learning resources on the Web, finding suitable content (using telephone) has become a rigorous task for voice-based online learners to achieve better performance. The problem with Finding Content Suitability (FCS) with voice E-Learning applications is more complex when the sight-impaired learner is involved. Existing voice-enabled applications in the domain of E-Learning lack the attributes of adaptive and reusable learning objects to be able to address the FCS problem. This study provides a Voice-enabled Framework for Recommender and Adaptation (VeFRA) Systems in E-learning and an implementation of a system based on the framework with dual user interfaces – voice and Web. A usability study was carried out in a visually impaired and non-visually impaired school using the International Standard Organization's (ISO) 9241-11 specification to determine the level of effectiveness, efficiency and user satisfaction. The result of the usability evaluation reveals that the prototype application developed for the school has "Good Usability" rating of 4.13 out of 5 scale. This shows that the application will not only complement existing mobile and Web-based learning systems, but will be of immense benefit to users, based on the system's capacity for taking autonomous decisions that are capable of adapting to the needs of both visually impaired and non-visually impaired learners.

INTRODUCTION

Over the last decade, there has been a change of focus from Web-based learning systems that merely turn pages of content to systems, which present learning materials in such a way as to satisfy the needs of learners. This change of focus is especially important in modern learning methods, which places strong emphasis on learners' previous knowledge. The uniqueness of a learner is met by making the Web-based learning content adaptive (Oboko et al., 2008). The increasing number of Learning Management Systems (LMS) for online teaching, quiz, assignment delivery, discussion forum, email, chat, et cetera, means that dynamic educational online services will be needed for efficient management of all educational resources on the Web. Selecting and organizing learning resources based on learner's interest is cumbersome (Gil and García-Penalvo, 2008). The process of selection may be easier with the normal users, but for certain category of learners with a visual impairment, navigating a Voice User Interface (VUI) for the desired learning content is a strenuous task. Web-deployed VUI applications for educational purposes provide user accessibility to content via telephone. One of the tools used for developing VUI applications is Voice eXtensible Mark-up Language (VoiceXML or VXML).

VUI applications are primarily developed to cater for the visually impaired (Raghuraman, 2004), to address the problem of Web accessibility associated with the use of m-Learning. The major problem of Web access is that the services of reusable learning objects currently available to Internet-connected users are not available for the visually impaired (Holzinger et al., 2006), for reasons of constraint in their navigation abilities. Thus, the voice-based Web applications mainly designed for the visually impaired lack adequate quality of using recommender and adaptable system for learning, which is a major requirement for this category of users as a result of

their visual impairment. Recommender systems are software agents that recommend options for users. These agents can be very useful in an E-Learning environment to recommend actions, resources or links (Zaiane, 2005). The services provided by recommender systems are generally referred to as recommendation services. Adaptive Web system monitors particular user's behavior and characteristics. Based on them, the system compiles document from larger universal source document and then produce adapted document to users (Bures & Jelinek, 2004).

The goal of adaptive voice-based Web learning is to adjust the content of the learning objects to suit user's knowledge level, whereas recommendation services provide the most appropriate learning objects to users through voice. The inability of existing E-Learning voice applications to meet these requirements has some far reaching implications such as limited accessibility for certain users especially the visually impaired, and usability issues as a result of lack of features for reasoning, adaptation and recommendation. A significant contribution would be to introduce the concept of reusing learner's previous experiences which is often neglected in existing voice-based E-Learning systems, to make them more adaptable and provide recommendation services to users' needs. Thus, we have to further take into account that the reference guidelines for developing existing voice-based E-Learning applications, which although important, lack intelligent component services to approach the problem. One of the ways of enhancing existing voice-based E-Learning applications is to adapt their content to the needs of each student.

The needs of users differ when accessing learning content, such needs may require the ability of the system to reason, make decisions, be flexible and adapt to divers requests during interaction. These needs have placed new requirements in voice application development such as the use of advanced models, techniques and methodologies

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