

Chapter 13

Ubiquitous Multi-Agent Context-Aware System for Enhancing Teaching– Learning Processes Adapted to Student Profile

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ABSTRACT

The need for ubiquitous systems that allow access to computer systems from anywhere at anytime and the massive use of the Internet has prompted the creation of e-learning systems that can be accessed from mobile smart phones, PDA, or tablets, taking advantage of the current growth of mobile technologies. The aim of this chapter is to present the advantages brought by the integration of ubiquitous computing-oriented along with distributed artificial intelligence techniques in order to build student-centered context-aware learning systems. Based on this model, the authors propose a multi-agent context-aware u-learning system that offers several functionalities such as context-aware learning planning, personalized course evaluation, selection of learning objects according to student's profile, search of learning objects in repository federations, search of thematic learning assistants, and access of current context-aware collaborative learning activities involved. Finally, the authors present some solutions considering the functionalities that a u-learning multi-agent context-aware system should exhibit.

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INTRODUCTION

In the last decade, the main contribution that has occurred to virtual university courses development is the adaptation capacity. Diverse kinds of adaptation have been mainly used on the following issues (Brusilovsky et al., 2004): instructional plans (Duque, 2006, 2009), knowledge level assessments, educational contents, student-centered selection of learning objects from repository federations (Rodríguez et al, 2012), among others. In addition, the growth of digital information, high-speed computing, and ubiquitous networks has allowed for accessing to more information and thousands of educational resources. This fact has led to the design of new teaching-learning proposals, to share educational materials, and also to navigate through them.

The context-aware adaptive learning systems, as defined by Wang & Chun-Yi Wu (2011), must actively provide learners with the appropriate learning assistance for their context to complete their e-learning activity. In the traditional e-learning environment, the lack of immediate learning assistance, the limitations of the screen interface or inconvenient operation means the learner is unable to receive learning resources in a timely manner and incorporate them based on the actual context into the learner's learning activities. The result is impaired learning efficiency. Through context aware technology, the system can sense the user's context and automatically adapt it to the known context in order to provide immediate services and applications.

The aim of this chapter is to highlight the advantages of integrating relevant approaches such as ubiquitous computing, context-aware systems, student-centered selection of learning objects, pedagogical intelligent agents, adaptive and collaborative learning, among others, to propose a model of a ubiquitous multi-agent context-aware system for enhancing teaching-learning processes adapted to student profile.

The rest of the chapter is organized as follows: In Section 2, the background that includes the theoretical framework and related works are presented. While Section 3 describes the model proposed, the development methodology, and the system architecture, Section 4 presents the results based on the Ubiquitous Multi-Agent Context-Aware System functionalities. Finally, Section 7 displays the main conclusions and future research directions.

BACKGROUND

This section first provides main definitions about learning planning, adaptive evaluation, multi-agent systems, learning objects, context-aware systems, computer supported collaborative learning, among others. Then, a literature review through related works is presented to demonstrate the relevance on trends on ubiquitous, context-aware, adaptive, and intelligent e-learning system development.

Learning Planning

Learning planning (Duque, 2006, 2009; Arias, 2010) comprises one of the most important tasks within the educational systems allowing students to attain adaptation purposes of their instruction. A learning planning strategy is applied using the virtual course's structure given by (Ovalle et al., 2011) which is composed of following elements: modules, topics, learning activities, learning goals (LGs), learning objects (LOs). In addition, a learning planning strategy is based on the artificial intelligence planning basic concepts described as follows:

- **Problem:** Formulation that expresses the knowledge associated to topics of a specific course that the students try to acquire.
- **Initial State:** The student has basic concepts in the field, which will help him/her to acquire new concepts.

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