From e-Learning to m-Learning: Context-Aware CBR System

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Abstract. Mobile learning extends e-learning, from indoors to outdoors by giving learners opportunities to improve their skills when and where needed. By this way, the mobile device can be a powerful tool for learners to acquire information and knowledge. However, one of the biggest challenges in mobile learning is addressing the needs of a varied learner type across a wider variety of devices in different contexts. These new needs faces us to take into account not only users' preferences and devices capabilities but also environmental characteristics. Our main focus in this article is to discuss issues related to e-learning versus m-learning and the design of a mobile learning system based on Case-Based Reasoning approach taking into consideration context-aware of device added to users' preferences and devices' capabilities.

Keywords: m-learning, mobile device, Case-Based Reasoning, content adaption.

1 Introduction

In the e-learning systems developed along the last two decades, developers focused on the user characteristics in order to adapt the proposed content to the user needs and preferences. All the information about learner preferences, knowledge and behavior is accumulated and treated in a user model which is a kind of repository about the user and forms the heart of a learner centric and adaptive system. User model issued to drive instructional decisions in order to make an adaptive e-learning system for individual students [5].

When coming with the mobile learning, the wide variety of technical characteristic and standards of devices (notebook computers, cellular phones, Personal Communication System (PCS), Personal Digital Assistants (PDAs)…) leads us to take into account new features in the adaption process: the device "preferences". So, delivering tailored contents tend to adapt to not only learner's needs and preferences, but also to mobile device used.

Moreover, mobile learning is not only addressing the needs of a varied learner type across a wider variety of devices but also is dealing with different contexts. These

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face us to take into account not only users' preferences and devices capabilities but also environmental characteristics. We talk about context awareness applications.

With the mobility of applications, context awareness gets attraction by researchers. Although there is no unified definition of context , most of researchers agree on definitions of [13] and [7] who first introduced the term of context as any information that can be used to characterize the situation of entities that are relevant to interaction between a user and an application. The entity can be a person, place or object. If application senses changing of any information relevant to behavior or attribute of entities, the application is called context aware application. The sensibility of changing entities can be categorized into three types of context:

- Computing context: available processors, user devices, network capacity, communication cost and communication bandwidth
- User context: user profile , location, collection of nearby people and social situation
- Physical context: lighting and noise, traffic condition, temperature, time.

In this context, to achieve adaptive and smart systems, our hypothesis is that Case-Based Reasoning (CBR) is a promising way. Many works have clearly shown the potential of CBR. Ma et al. [10] use CBR for adapting the behavior of smart homes to users' preferences. In [6], using CBR techniques is twofold: on one hand, it allows to minimize the number of questions to ask to the student. On the other hand, it minimizes the time for finding a new solution (personalized course) by adapting previous ones.

In this work, we study how CBR can be a suitable method for achieving a context aware adaptive system. We propose architecture for mobile learning where we integrate the user model, the device characteristics and the environmental features.

The paper is structured as follows: in the second section, we carry out a comparison between e-learning and m-learning. The third section presents the system architecture. In fourth section, details on modules of proposed system are given. Finally some conclusions and future work are remarked.

2 Differentiating Electronic Learning from Mobile Learning

In the literature, the most recurrent definitions of mobile learning are: "mobile learning is the intersection of mobile computing and e-learning: accessible resources wherever you are, strong search capabilities, rich interaction, powerful support for effective learning, and performance-based assessment. E-learning independent of location in time or space" [12] and "Because mobile devices have the power to make learning even more widely available and accessible, mobile devices are considered by many to be a natural extension of e-learning" [4].

But we believe that it makes more sense when we consider that m-learning is complementary to e-learning as it was e-learning for traditional learning. Indeed, m-learning can enhance e-learning. For example, without an access to computers and Internet, m-learning permits learners improving their already learned courses (in