

PERSONALIZED ADAPTIVE CONTENT SYSTEM FOR CONTEXT-AWARE MOBILE

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ABSTRACT

The rapid development of emerging technologies for mobile devices has enabled them to contribute strongly to the creation of new paths for learning. Mobile learning helps the user to learn at anytime and anywhere and also provides him a unique experience in terms of its flexibility. The problem in mobile learning is not the availability or quality of information, but is rather its relevance to a specific context of use. The quality of a mobile learning system therefore depends on its ability to provide learners with both pedagogical content adapted to their context and processes that truly guide them in their process of learning. This paper presents a new adaptive mobile learning architecture that supports the features of mobility and context in order to enhance the learning experience.

KEYWORDS

Context Aware, Adaptive Content, Mobile Learning, Personal Characteristics, Educational Needs

1. MOTIVATION

The growth of mobile computing has drawn the attention of researchers which are interested in studying how mobile devices can be exploited for educational purposes (Baccari et al., 2015). As a result, this has led to a research trend which is commonly referred to as mobile learning (m-learning) in which researchers and educational stakeholders have been concentrating their efforts so as to consider the affordances of wireless and handheld technologies in education (Chee et al., 2017). Briefly going through m-learning history (Dennouni et al., 2017), in its early days (mid 1990s) research and educational initiatives focused on taking the most of “mobile and wireless technologies within the classroom”. In this phase there was an interest on how devices, in particular PDA, laptops and mobile/cell phones, can be used for in an educational context for instruction and training. Then, in early 2000s, a second phase of m-learning focused on “learning outside the classroom”. Researchers’ interest was directed into highlighting the meaningful benefits that mobile technologies can bring to people outside institutionally framed educational contexts. This second phase includes field trips, museum visits, and personal learning organizers, among others. Finally, by mid 2000s, research initiatives began focusing on the “mobility of the learner” involving the design or the appropriation of learning spaces and on informal learning and lifelong learning. In this third phase, affordances of emerging technology, surrounding resources and availability of information to the learner’s situation and context can be distinguished. Through these three phases, we have moved from period when human activity must be adapt to the computer location (one computer, many people), to a period when the computer is the alter ego of the man (one person, one computer), and eventually to a period of human-centered activities in which the computers are serving the learning purposes (one person, many computers) (Elhamdaoui et al., 2011). Since the beginnings of third phase of m-learning, a new research trend has been emerging; this research leads us to assess how we can provide the user with the appropriate content to its context in a radical changing environment. This focal point relies on delivering personalized and adapted mobile learning experiences to learners with regards to: i) the mobile device with which they interact (i.e. Aspects of 1st phase of m-learning); ii) their individual needs and preferences in learning situations which are different from a traditional classroom (aspects of 2nd phase of m-learning); and iii) the surrounding resources (people, ambient technologies, physical objects, etc.). That may affect the interaction between learners with anytime-anywhere available information (aspects of 3rd phase of m-learning) (Gómez. S. E, 2013). The issue that can be raised regarding mobile learning is the issue of relevance to the learner’s specific context of use.

Personalization and adaptation of content is one of the fundamental aspects for developing m-learning activities (Soualah-alila et al., 2014). According to (Madhubala et al., 2017), it is important for students to have the information and educational resources in an adaptive way based on their context and needs.

2. RESEARCH QUESTIONS

During the past years, a challenging research has emerged with regards to involving ubiquitous use of mobile devices within learning strategies. Educational research initiatives has been focused on this ubiquitous characteristic combined with educational systems development, so as to offer important benefits to learning design and delivery processes, which could be summarized as follows) (Gómez. S. E, 2013):

- ✓ Supporting pedagogical models that are based on authentic learning by exploiting real-life context.
- ✓ Providing flexible, adaptive and personalized learning experiences by exploiting learners' contextual information.

Consequently, different educational activities have been proposed by teachers to enhance teaching and learning experiences and to introduce learners with a ubiquitous m-learning initiative including: using multimedia to stay engaged in a learning environment, for example videos, podcasts, audio as well as access to bite-sized learning, or micro learning on the go, engaging learners towards the establishment of online learning communities so as to produce collaborative projects, uploading videos with explanations about how to use tools in real situations to ensure learners can recall instruction on different process when and where they need it, making field trips to engage learners in active experience, and providing learners with supportive mobile systems that guides them through visits, among other activities. Therefore, on the plethora of teaching/learning strategies and use cases that users can be typically engaged in, Our approach is particularly focused on considering educational scenarios which may benefit from the use of mobile and wireless technologies and learners' contextual information, so as to re-think and implement them in a formal learning design that can be suitably delivered to the learners. From this stems the first research and development question of this work is:

Q1: How can adaptive and personalized learning design process, which is based on the learner's contextual information, be designed and delivered?

With the growing impact of distance learning and open educational resources, constructivist pedagogical approaches are increasingly being studied by different researchers in order to define and apply suited pedagogical theories for contextual and m-learning experiences. Accordingly, this leads to a research challenge within this research work, that is, defining optimal ways on how educational scenarios and resources can be suitable delivered to different learners according to diverse contextual information such as the characteristics of the learning place and its physical conditions, the spare time used to learn, the contributions of the surrounding people and the individual learning interests, preferences and needs in a particular moment, including the capabilities of the learners' mobile device at hand (Gómez. S. E, 2013).

In m-learning environments, providing personalized educational sequenced activities and educational digital materials (resources, tools, services, etc.) while taking into account limitations of the mobile devices such as limited screen sizes, limited memory available for page rendering and limited types of content supported may cause the loss of information for learning and the failure to achieve the learning objectives if adaptation processes are not well designed and implemented. This leads to our second research and development question:

Q2: How can educational resources, integrated in a procedural learning design, be adapted considering learner's contextual information?

Within this research work, it was important to consider the study of adaptation mechanisms based on learners' context characteristics that can be integrated into the learning process and that enable suitable delivery of educational digital materials appropriately adapted to learners' mobile devices.

3. OBJECTIVES

In a broad sense, context is (Dey, A.K., 2001) “any information which can be used to characterize the situation of an entity, an entity is a person, a place or an object which is relevant for the interaction between a user and an application including the user and the appropriate applications”.

In this paper we consider some characteristics that are necessary when modelling context: Learner's profile (personal characteristics such as knowledge, skills, attitudes and individual features such as mood, preferences, needs, interests, etc), other people that influence the learning process with their role, relationships, contributions, digital devices (mobile technologies, ambient intelligence technologies, etc.) and non-digital resources (books, documents, etc) and characteristics of the status of a learning situation such as time, physical conditions of the place (such as illumination level, noise level), cultural and social milieu, among other characteristics.

Research in recent years has made considerable progress in understanding the phenomenon of context and in exploring the potentials of context-awareness. However, there are still several issues to be solved before context-aware functionality can be rolled out on a large scale. This work aims to address those issues by the following objectives:

O1: Defining Taxonomy of contextual elements for designing context-aware educational scenarios (Learning designs) and for being processed by a mobile delivery system so as to provide learners with adapted learning activities and resources.

O2: Implementing context-aware and adaptation mechanisms for both design and delivery phases of the learning design.

O3: Designing and creating a number of predefined context-aware and adaptive mobile educational scenario so as to explain and present how possible adaptations, that are realized based on learner's contextual information, can be incorporated.

O4: Developing a mobile delivery system aiming to address delivering pedagogical-enhanced and structured adaptive and context-aware educational scenarios on mobile devices.

4. SYSTEM ARCHITECTURE

In order to achieve these objectives, a client-server based architecture is developed.

- The server side:

In this part, a taxonomy of contextual elements and a set of pre defined values for those elements are defined, these elements are proposed for designing context-aware educational scenarios (Learning design) and for being processed by a mobile delivery system (Client side) so as to provide learners with adapted learning activities and resources. Moreover, it integrates an adaptation engine level 1, which produces multiple formats of the same domain model (educational scenario) according to the predefined instances of certain contextual information (mobile device capabilities, learner's profile) and pedagogical activities model used to create different forms of learning flow (canevas) based on personal characteristics (knowledge, skills and needs). These scenarios are stored on the server, and then are dynamically selected to match the contextual information captured in real time by the client side (the delivery system).

- The client side:

It is represented by the delivery system, which let deploying context-aware adaptive educational scenarios on it and executing learning activities and context-aware adaptation rules without internet connection. This is important because mobile devices are not constantly connected to the internet. The delivery system allows the contextual information acquisition (time, place, physical conditions, devices capabilities...) in real time, these information will be the entry of the adaptation engine level2, which occurs on an existing learning design created in the design phase (server side) or on a new learning design created by calling the adaptation engine level 1.

Figure 1 shows each objective in the proposed system

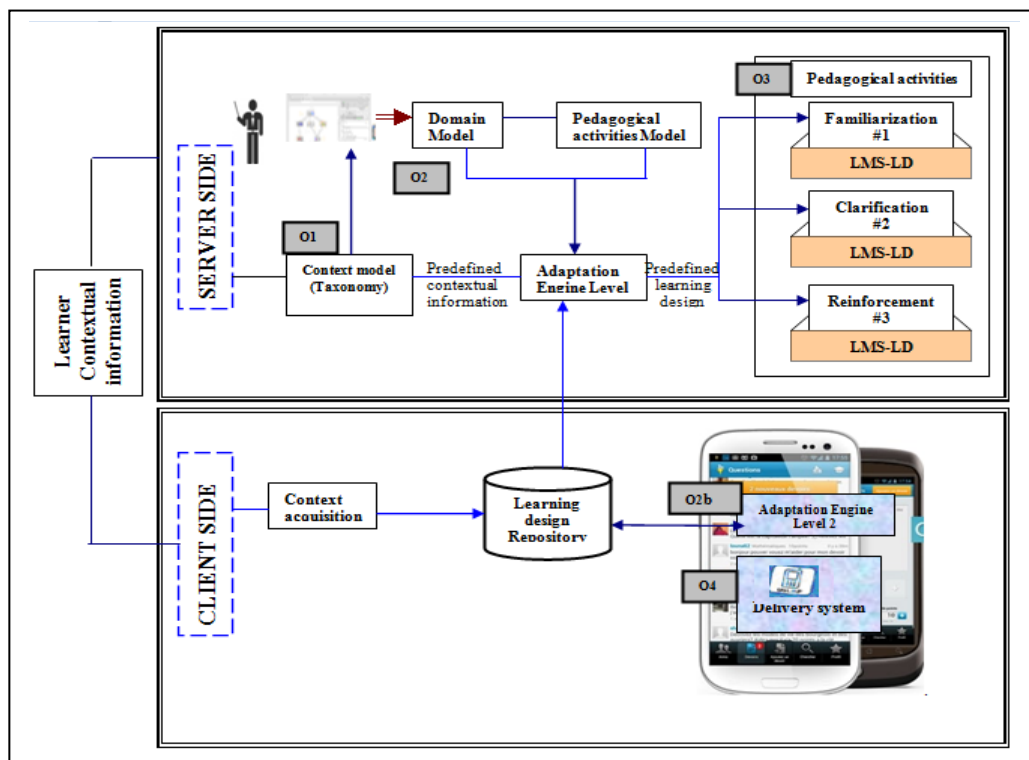


Figure 1. Proposed system architecture

5. CONCLUSION

This work provides an overview on the main facets of the research. First, we describe the research problem and express the motivation to work on it. Then, general questions for the research are introduced and discussed in brief. After that, the defined objectives and research proposal is described and the system architecture is explained. The detail implementation of the system will be published in upcoming paper.

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