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Context-awareness Mobile Learning Activity Generator

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Introduction

In the traditional learning, students get learning information and materials prepared in advance by the teacher, typically according to some textbook. Students do not have possibility in such environments to control the way of learning or get motivated in learning. In recent years though, computer technologies and internet have widely penetrated the educational processes and are being used to assist teachers' teaching and students' learning, which is called e-learning (Brodersen, Christensen, Dindler, Grønbæk & Sundararajah, 2005).

As mobile technology is getting mature, mobile devices are becoming a good facility for learning. The way in which mobile phones, PDAs, smartphones, and any devices with mobility are being used to learn can be seen as mobile learning and it has at least three benefits: (1) learning in real environment, (2) getting rid of the wired connection by using wireless connection, and (3) learning activities no longer limited by the place and can happen in the real world rather than being restricted to the classroom (Chen, Kao, Yu & Sheu, 2004). Mobile learning has potential to improve the students' learning motivations and learning performances by allowing them to use mobile devices to observe the real learning objects in the real world. In mobile learning, many unsolved questions still exist, for examples, how to enable students to enjoy the outdoor observation activities and be active in finding the knowledge which they prefer to learn. In other words, in most of cases, students still learn just because they have to.

Ubiquitous learning paradigm refers to education that is happening all around students and they may not even notice that they are learning. Ubiquitous learning can deal with the weakness of mobile learning. For example, mobile learning only provides specific domain knowledge in the specific learning environment (Chen, Hsieh & Kinshuk, 2006; Chang, Wu & Heh, 2008). It is important to recognize that the learners are not just passive receivers of the learning materials from teachers during learning. They have the abilities to learn the concepts, knowledge and skills by interacting with real-life objects in their surrounding environment (Vygotsky, 1978). Brown, Colins, & DuGuid (1989) argue that the concepts and knowledge are situation-based, and the learning is influenced by a combination of teaching activity, situation and interactions, called situated learning. The research in ubiquitous/pervasive learning aims to exploit this dimension (Thomas, 2005).

Generally speaking, the personalization can be achieved via two adaptive approaches: (1) the learning service can adapt to learners' characteristics such as learning styles, requirements, status, performances, preferences, and profiles; and (2) the learning service can adapt to the context surrounding the learners. The first approach is easy to understand, for example, the learning service can deliver multimedia materials to learners with a visual learning style or provide step-by-step instructions to the learner who has difficulty in solving specific problems. The second approach applies context-awareness ability to the learning service, for example, it will probably be useless for a learning service to deliver botanical materials to the learner who is inside an art gallery.

This paper uses context-awareness knowledge structure to generate personalized learning activities for learners according to the learning objects and relevant domain knowledge that exist in the surroundings of the learners.

Context-awareness Activity Generation Process

The context-awareness activity generation process is composed of two phases, as shown in figures 1 and 2. The first phase of information preprocessing has two steps: the knowledge structure construction step (step 1) and the preferred feature selection step (step 2). Step 1 adapts the learning service to the context of the learner's surroundings. Step 2 adapts the learning service to the learner's preferences. The second phase of personalized learning experience has three steps: the personalized learning activity generation step (step 3), the activity realization step (step 4), and, the personalized experience update step (step 5).

First of all, it is common for the real world to have a lot of learning objects that belong to various topics and knowledge domains in different areas/floors. When a learner visits a place, the learning service must have some idea about what learning objects are in the learner's surroundings, and what characteristics do the learning objects have that are suitable to be used by learning activities. This is part of 1st phase - the information preprocessing. Figure 1 shows two steps in phase 1. The system first discovers the characteristics of the learning objects by using context-awareness knowledge structure and rough set. The context-awareness knowledge structure is typically analyzed and designed by the pedagogical experts for storing and retrieving multidisciplinary knowledge and relevant learning objects (Wu, Chang, Chang, Liu, & Heh, 2008). After the system has constructed the knowledge structure about the learning objects that are available in the vicinity of the learner, the system then offers the learner some relevant features that the learning objects may have and let the learner select his/her preferred ones.

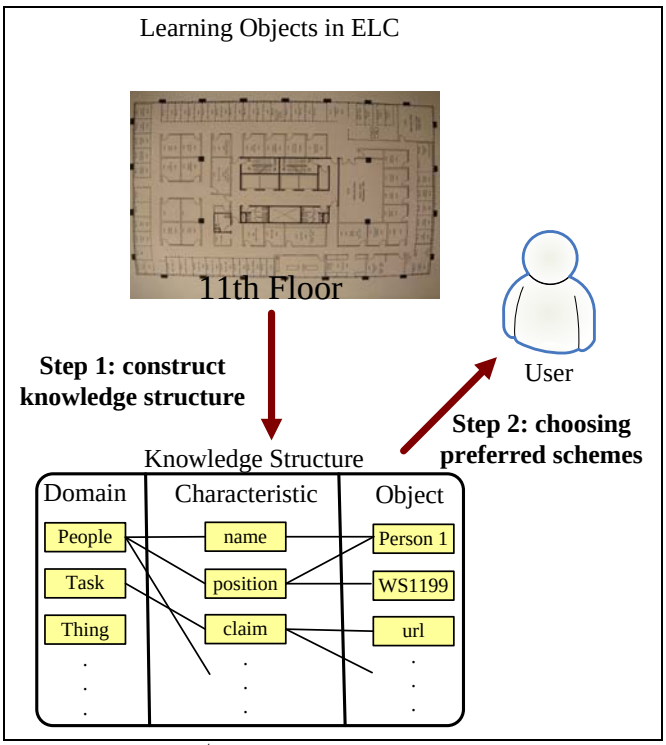


Figure 1. 1st Phase - Information Preprocess.

As Figure 2 shows, the second phase enables personalized learning experience. In this phase, there are three steps. Step 3 follows step 2 where the learner has selected preferred features. Different learning topics involve different learning objects in the place and these learning objects may have the feature(s) the learner is interest in, hence, the learning service can take the learner's preferred feature as the learner's preferred topic to generate personalized learning activity. The system picks suitable learning objects from the context-awareness knowledge structure and puts these learning objects into the activity generation engine in order to get different activity series, as shown in the "Topic" box in Figure 3.

In step 4, the learner can choose and undertake one of the learning activities that are generated by the activity generation engine in step 3. Each activity has one or more missions which the learner needs to complete, and every mission has descriptions to indicate the mission goal. The learner has to find out the learning objects required by the mission by observing or touching them on the device interface. When the learner accomplishes a mission, he/she gets permit to take the next mission in specific activity. The difficulty levels of missions get increasingly harder; the next mission being more difficult than the former one. Finally, the learning service records and updates the learner's progress into personal experience database in step 5.

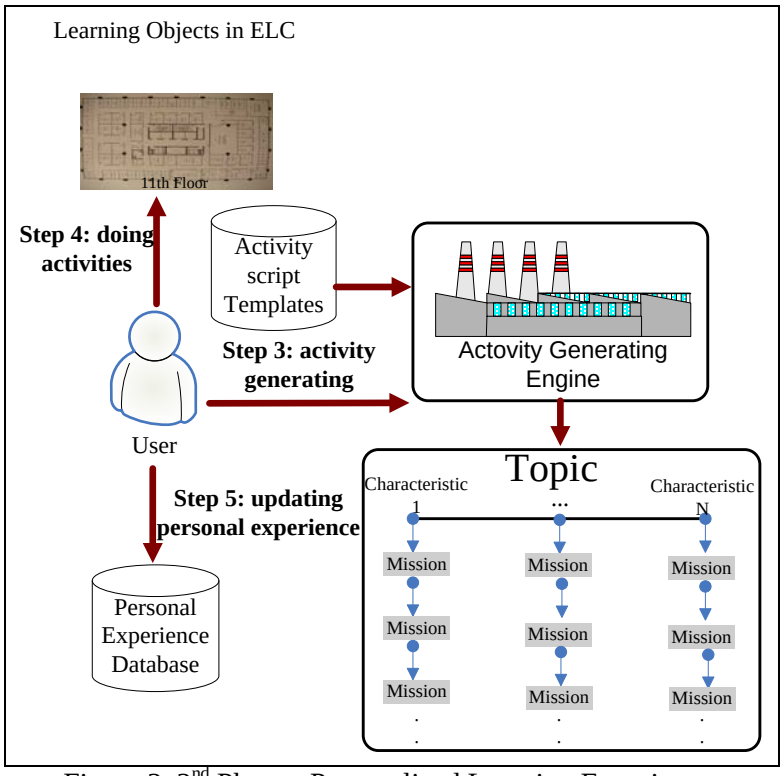


Figure 2. 2nd Phase - Personalized Learning Experience.

Scenario and Activities in Mobile Role-Playing Game

Game-based learning takes the digital games to the front of the students to improve and facilitate the learning process (Pivec, Dziabenko & Scinnerl, 2003). Some educational mobile games use Global Positioning System (GPS) to locate the students' locations and to give the appropriate tasks, i.e. the game will never ask the students to "find a book" in a zoo and "identify a plant" in a historical museum. For example, Frequency 1550 is a GPS-supported educational mobile game and students can learn Amsterdam's history by playing the game (Admiraal, Raessens & Van Zeijts, 2007).

We are developing a mobile educational game and putting the learning activity generator into the game as the kernel. The game world is based on the 11th floor of Edmonton Learning Centre (ELC), Athabasca University, in Edmonton. There are different types of learning objects: (1) people, e.g. Associate Vice President of Research, researchers, staff, and visiting scholars; (2) places, e.g. workplace, drop-in, iCORE space, kitchen, washroom, and meeting rooms; (3) things, e.g. printer, coffee machine, poster, and chart. In the game, the learners can play two different roles, new employee and visiting researcher. By playing the mobile role-playing game, the learners can get themselves familiar with ELC and also get themselves the necessary information and knowledge. The learning activities generated by the game will be different according to the roles the learners have chosen. For examples, if a learner plays the role of new employee, he/she may have an activity like "where can I get signature for an institute support letter?" If a learner plays the role of a visiting researcher, he/she may have an activity like "I printed a paper from my laptop, where can I pick it up?"

Current Progress and Plan

This research has designed and developed the theory and algorithms of context-awareness learning activity generation. We are focusing on the educational mobile role-playing game and would like to have experiment on it. The learning activity generator mainly focuses on allowing people to do informal learning when they want. The experiment will be taken by several international researchers and new hired staffs at 11th floor of ELC. The participants will play different roles and pick-up series of related learning activities. After they completed all learning activities, a post-test and questionnaire will be sent to them in order to get their learning achievements and

feedback. An obvious plan is how to make the series of learning activities much more like a story. We want to bring the narrative elements and interactive storytelling into our research.

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