Chapter 2
Visualizing Knowledge Awareness Support in Ubiquitous Learning

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ABSTRACT

The aim of this research is to provide the learner with knowledge awareness support according to his current need and location. Therefore, we presented a ubiquitous learning environment in order to support the learners while doing tasks; this environment is called PERKAM (PERsonalized Knowledge Awareness Map). PERKAM allows the learners to share knowledge, interact, collaborate, and to exchange individual experiences. It utilizes ubiquitous technologies to detect the learner’s environmental objects and location, and then recommends the best matched educational materials and peer helpers in accordance with the detected objects and the current location. This environment provides the learner with Knowledge Awareness Map, which graphically displays the knowledge awareness support. The experiment and the questionnaire results indicated that Knowledge Awareness Map is helpful to understand the learner’s situation and it efficiently visualizes the recommendations.

INTRODUCTION

Ubiquitous computing is a new information and communication technology that utilizes a large number of cooperative small nodes with computing and/or communication capabilities such as handheld terminals, smart mobile phones, sensor network nodes, contact-less smart cards, and RFID (Radio Frequency Identification)…etc (Sakamura & Koshizuka, 2005). The RFID system (Klaus & Rachel, 2000) consists of a tag, which is made up of a microchip with an antenna, and an interrogator or reader with an antenna. The reader sends out electromagnetic waves. The tag antenna is tuned to receive these waves. A passive RFID tag draws
power from a field created by the reader and uses it to power the microchip’s circuits. The chip then modulates the waves that the tag sends back to the reader and the reader converts the new waves into digital data.

Computing becomes ubiquitous. The knowledge workers use, in computing and communication services, is less limited to solitary moments at an office desk. Instead, it is extended in multifaceted ways to all aspects of the life, both public and private (Yoo & Lyytinen, 2005). The challenge of the future computer systems is therefore not to provide information at anytime and at anywhere but to say the right thing at the right time in the right way to the right person (Fischer, 2001; Fischer & Konomi, 2005). Ubiquitous computing evolution has recently been accelerated by improved wireless telecommunications capabilities, open networks, continuous increasing in computing power, improved battery technology, and the emergence of flexible software architectures. With those technologies, an individual’s learning environment could be embedded in his or her daily life (Ogata & Yano, 2004). Almost on a daily basis, handheld devices are becoming cheaper for a wide range of people. Meanwhile, mobile devices are now being introduced as learning devices and some researches use them as collaborative tools (Cole and Stanton, 2003). The main characteristics of a Computer Supported Ubiquitous Learning (CSUL) environment are shown as follows (Chen et al., 2002; Curtis et al., 2002):

- **Permanency**: Learners never lose their work unless it is purposefully deleted. In addition, all the learning processes are recorded continuously every day.
- **Accessibility**: Learners have access to their documents, data, or videos from anywhere. The information is provided based on their requests.
- **Immediacy**: Wherever learners are, they can get any information immediately. Thus, learners can solve problems quickly.
- **Interactivity**: Learners can interact with experts, teachers, or peers in the form of synchronous or asynchronous communication. Hence, the experts are more reachable and the knowledge becomes more available.
- **Situating of instructional activities**: The learning could be embedded in our daily life. The problems encountered as well as the knowledge required are all presented in their natural and authentic forms.

Moreover, a computer supported ubiquitous learning environment could be a Computer Supported Collaborative Learning (CSCL) environment (O’Malley, 1994) that focuses on the socio-cognitive process of social knowledge building and sharing (Yoo & Lyytinen, 2005). Ubiquitous computing environments strongly support collaborative and situated learning approaches. The use of ubiquitous computing tools within a situated learning approach is recommended to facilitate the students’ attainment of curricular content, technology skills, and collaboration skills (Lin et al., 2005).

Many teachers and learners believe that *learning by doing* (Schank, 1995) is the best way for learning. In *learning by doing* model, the teachers identify a specific set of skills to teach, embed that skills in a task, an activity, or a goal that the student will find interesting or motivational, then the teachers can evaluate the learner’s understanding and skills according to how much the learner succeed to reach to the goal. While the learner is practicing to reach to the goal, he usually looks for some knowledge. There are two logical ways to obtain the desired knowledge; one way is to refer to one or more of the educational materials that match the learner’s needs such as books, journals, or video lectures. The other way is to ask for an aid from other learners who have enough knowledge about the learner’s request. In the latter...