Context-Awareness Technology for Location Based-Service for Ubiquitous Learning

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U-Learning을 위한 위치 기반 서비스로서의 상황 인식 기술

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Abstract   In this paper, we defined constructivism and ontology theory and associate it in Location Based Service ubiquitous learning. And this paper aims to provide a clear vision about location based service (LBS) ubiquitous learning. The typical ubiquitous learning involving the Context Aware Intelligent system was presented. Also the Architecture for learning environment including the key idea and technical concept is being presented in this paper. Guided with these principles and with the advancement of information and communication technology the context-awareness based on Artificial intelligence for Location based Service for ubiquitous Learning was conceptualized. U-learning for Location Based Service is presented here and the concept behind this new learning paradigm. The learning environment architecture which comprises the entire component is illustrated here.

요 약   본 논문에서는 위치 기반 서비스로서의 U-Learning에 적용할 수 있는 구성 및 온톨로지 이론을 정의하였다. 또한 본 논문에서는 위치 기반 서비스로서의 U-Learning에 대한 확실한 비전을 제공하고자 하였다. 상황 인식을 적용한 전형적인 U-Learning을 소개하였으며, 핵심 아이디어 및 기술적 개념을 포함한 학습 환경 구조도 소개하였다. 고급 정보통신 기술의 원리를 적용하여, 위치 기반 서비스로서의 U-Learning을 위한 인공지능 기반 상황 인식 개념도 정리하였다. 본 논문에서 언급하는 위치 기반 서스비로서의 U-Learning 및 하위 개념들은 새로운 패러다임을 제공할 것이며, 학습 환경 구조에 포함된 하위 요소들도 모두 제안하였다.

Key Words : Ontology, Constructivism, Artificial Intelligence, Context-awareness, Ubiquitous learning, Location Based Service

1. Introduction

The close cooperation between the artificial intelligence community and researchers studying context-aware mobile and ubiquitous applications will be indispensable for the future success of context-aware applications. The context-awareness can be supported by the concept of AI and Location Base Service for ubiquitous learning.

Ubiquitous learning is the next step in performing e-learning and by some groups it is expected to lead to an educational paradigm shift, or at least, to new ways of learning. The potential of ubiquitous learning results from the enhanced possibilities of accessing learning content and computer-supported collaborative learning environments at the right time, at the right place, and in the right form. Furthermore, it enables seamless combination of virtual environments and physical spaces [3-6]. The location-based optimal grouping service is to group geographically nearby students to together to create ad hoc online learning groups. In this service, the positioning accuracy

is not critical [7].

To sum-up, ubiquitous learning needs a concrete platform guided all the needed idea since technology is already possible. Only the concrete learning architecture is need to be design. In this study we proposed a typical ubiquitous learning architecture and a learning environment which was formulated based on the current trend of communication and information technology with the underlying learning theories applicable for ubiquitous learning.

2. Ontology, Constructivism and Artificial Intelligence Definitions

Constructivism is a theory of knowledge (epistemology) that argues that humans generate knowledge and meaning from an interaction between their experiences and their ideas. During infancy, it is an interaction between their experiences and their reflexes or behavior-patterns. Piaget's theory of constructivist learning has had wide ranging impact on learning theories and teaching methods in education and is an underlying theme of many education reform movements. Research support for constructivist teaching techniques has been mixed, with some research supporting these techniques and other research contradicting those results.

Artificial intelligence (AI) is the intelligence of machines and the branch of computer science that aims to create it. AI textbooks define the field as "the study and design of intelligent agents"[5] where an intelligent agent is a system that perceives its environment and takes actions that maximize its chances of success.

Ontology is the concept behind the idea of context-awareness. It is something that should be consider in designing a learning module. Directly saying, this philosophical study is strongly applicable in LBS ubiquitous learning. The existence of matter around us will contribute in determining the environment we are presently at. And of course with the sensor devices the context of everything around us will be known. This is a big help in LBS because everything in LBS is comprises from location information and environment. The context is generated and it is being transmitted via wireless technology and is being processed with the AI and

appropriate response to the learner will be send. Ontology also is the philosophy behind the groupings. In learning there should be the process of grouping, the level of the capacity of the learner will be evaluated based on their profile and their previous learning status.

3. Context Awareness

Context awareness is defined complementary to location awareness. Whereas location may serve as a determinant for resident processes, context may be applied more flexibly with mobile computing with any moving entities, especially with bearers of smart communicators. Context awareness originated as a term from ubiquitous computing or as so-called pervasive computing which sought to deal with linking changes in the environment with computer systems, which are otherwise static. Although it originated as a computer science term, it has also been applied to business theory in relation to business process management issues [1].
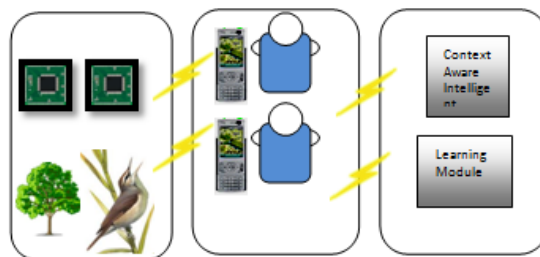

[Fig. 1] context-aware u-learning

To address the context-aware u-learning activities in more detail, a learning environment with several illustrative examples, Figure 1 shows the context-aware u-learning environment with RFID sensors and wireless networks. Each target plant has an RFID tag attached to it which records the identification data of the plant and each student is equipped with a PDA with an RFID reader which can read the data from the tag if the student is close enough. Once the u-learning system identifies the plant and animals, relevant information can be read from the database in the server via wireless communications [12]. While the learner is on his/her way walking technology such shown in the figure above is working

and transmitting data to the server via mobile devices and the learner response to the questions or direction given via mobile device.

4. Location Based Service

A location-based service (LBS) is an information or entertainment service, accessible with mobile devices through the mobile network and utilizing the ability to make use of the geographical position of the mobile device LBS can be used in a variety of contexts, such as health, indoor object search, entertainment, work, personal life, etc. LBS include services to identify a location of a person or object, such as discovering the nearest banking cash machine or the whereabouts of a friend or employee. LBS include parcel tracking and vehicle tracking services. LBS can include mobile commerce when taking the form of coupons or advertising directed at customers based on their current location. They include personalized weather services and even location-based games.
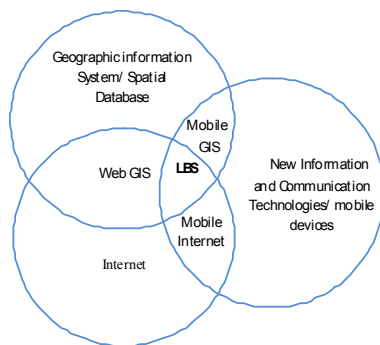
[Fig. 2] LBS as an intersection of technologies (Brimicombe 2002).

This is what comprises LBS in technical aspect, the integration of Geographic information System, New Information and Communication Technology and internet. The integration of this three (3) important component forms a foundation for Location Based Service which is the concept of ubiquity.

Activities during mobility, however, will often have spatially related actions embedded. These actions result out of user questions or desires. The most obvious question is to know where the user himself of somebody

or something else is (locating). Users may search for persons, objects or events (searching) and they ask for the way to a location (navigating). Other questions ask for properties of a location (identifying) or they would try to look for events at or nearby a certain location (checking) [11].

Ubiquitous learning is anywhere, even in park museum or while on vacation. Information on animals, plant, IC tag, information on nearby areas, wireless markers, navigation features, multilingual display, ubiquitous communicator (mobile devices) is making it possible. Location Base service ubiquitous learning is "anytime, anywhere" learning service. People in the park, museum, in the house or in any public area that learning is needed like for example in finding a certain store you can use your mobile phone to locate the exact location by answering series of questions and with the help of the positioning system.

5. U–learning as Location Based Service

Ubiquitous learning applied to location based service is very interesting research and opened the eyes of many into making it possible with the help of promising technology. Location based service as defined is applied to different areas, like business, health, and etc. and now in ubiquitous learning. This is exactly the idea that is worth working with. A lot of researches have been made and some countries are already trying to adopt this new location based service ubiquitous learning. With the help of mobile devices and other technology it is easy to integrate learning into technology and bring this in "anywhere and anytime". Global Positioning System is very helpful in the success of location based serviced ubiquitous learning. The geographic location is no longer hindrance in learning and its support mobility. Geographic information System (GIS) is already available in mobile devices and it's a big help in the location determination and in sending and receiving of information.

Context-awareness is also a big part of location based service. This change like temperature, humidity which can be detected by RFID sensor devices is transmitted to the mobile devices via wireless technology or other

transmitter is something very important component of location based service. In the next pages, the components of LBS for ubiquitous learning are discussed.

[Fig. 3] Global Positioning System

If we do not consider the manual input of the position as a location method a general classification of positioning methods can be done into two groups: The first group is called network-based positioning.

Here a tracking and evaluation of the user location is done by using the base station network. Therefore the mobile device sends either a signal or is sensed by the network. The second positioning group is called terminal-based positioning. Here, the location is calculated by the user device itself from signals received from base stations. The most famous example for a terminal-based system is the use of the Global Positioning System (GPS). The base stations for the GPS system are the GPS-satellites. Finally a third group of positioning techniques emerges from combination of network and terminal positioning techniques [11].

6. LBS Ubiquitous Environment Architecture

The figure 4 shows the LBS Ubiquitous architecture. Context awareness through LBS is a perfect concept for ubiquitous learning. In order to give the proper learning program for a student in ubiquitous environment first is to locate the learner's location information through GPS then information sent via mobile devices in Context Aware Intelligent System. Then after the analysis of the data received it will be send back to the student via mobile phone including the possible program that is suited for him/her.

GPS embedded mobile devices have become more and more popular; therefore, the client agent has to be able to work with this type of mobile devices. Though GPS technology also has drawbacks, that positioning is not available inside the building, it also increases battery consumption, it is very important to sufficiently use the GPS location data to update the cell geographic location information database and to enrich and correct the existing location database, eventually to enhance the overall location accuracy and the grouping performance. There are software program which can do this job.
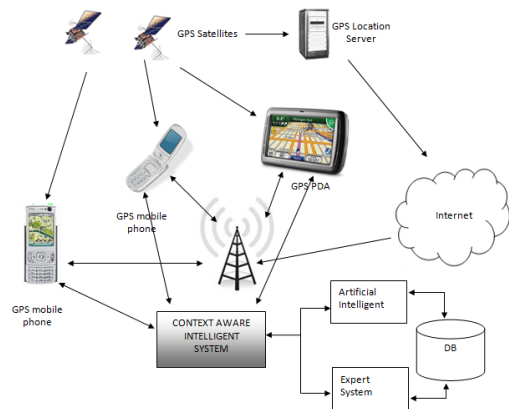

[Fig. 4] Ubiquitous Environment Architecture

7. Context-triggered Actions

Figure 5 shows the sample flow chart in which the learner ask a series of questions until he/she can identify the plant using his/her mobile phone. The context-aware intelligent system response to the learners answer and present questions related to the learners current status. The learners learn through answering the series of questions until they can reach to the next phase of. Learners have an option either to continue or not. If he/she chose to stop then his/ her level will be recorded according to what they have finished or end up to. The

next time around if they want to continue then they will start to where they had stopped. Feedback from the learner via the mobile learning device: includes the observed or sensed data of the target items (such as environmental temperature and acid value of water, air pollution, shape and color of a tree, machine status after performing an operation), acquired photos or interactions with the learning system (e.g., the answers to the test items or the log for operating the system).

Personal data retrieved from databases: includes the learner's profile and learning portfolio, such as the predefined schedule of the learner, expected starting time of a learning activity, the longest and shortest acceptable time period of a learning activity, the learning place, the learning paths or sequences of a course, the constraints or prohibitions of a course of learning activity, etc [12].
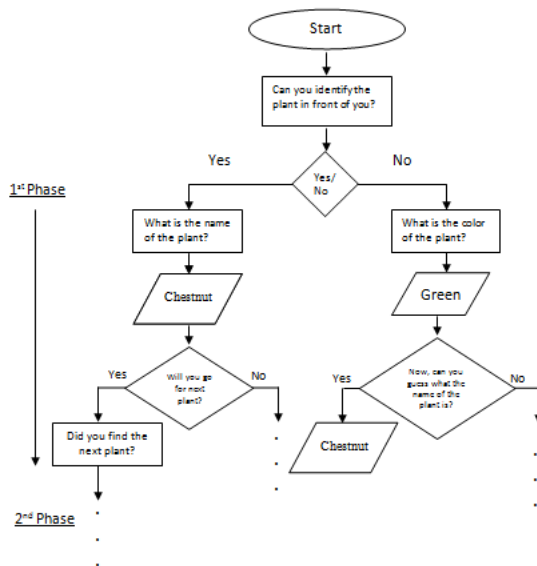
[Fig. 5] Context Triggered Learning Flow chart

8. Conclusion and Future Works

The advancement of information and communication technology brought many opportunities in any field of science and technology research. Along with these advancements, the perspectives in learning become pervasive. Applying the concepts of Constructivism theory which the underlying idea is "humans generate knowledge

and meaning from an interaction between their experiences and their ideas", the new concept which is "Context-awareness" in learning become new model for ubiquitous learning. Plus the idea of artificial intelligence, knowledge base and expert system the ubiquitous learning will have more defined model. In the future we are going to study more complex architecture for the Location Based service and context-awareness for ubiquitous learning.

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<Research Interests>
E-learning, U-learning, Security application for education system, privacy issues for teachers and students