An E-learning Support System based on Location-based Social Network

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International Journal of Advancements in Computing Technology Volume 3, Number 7, August 2011

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doi: 10.4156/ijact.vol3.issue7.8

Abstract

This paper presents an e-learning support system which constructs a social network among e-learning learners on the basis of the location information of the learner and the instructor obtained using GPS sensors, etc. For this, we suggest a mechanism that supports the construction of a social network service using the location information of the smart-phone in e-learning. Through this system, e-learners can get mentors who help their learning and create communities for collaborative learning off-line. The support of a location based social network service in our system would increase interactions among e-learners and improve satisfaction regarding their mobile learning environment.

Keywords: E-learning, Social Network, Location-based

1. Introduction

E-learning offers higher education the opportunity to expand the borders of classrooms to include distance learners. E-learning gives an attractive chance of learning to learners who have restrictions of time and space thus the number of e-learners has been increased. However, there is an issue about the high drop-out rate associated with online courses. While some e-learners thrive on the increased flexibility that the medium provides, others languish in isolation and struggle to get started [2, 9]. Therefore, colleges continue to attract new online students, at the same time, administrators are also trying to find ways to keep them enrolled.

Tinto [4] stresses that academic satisfaction is not enough for some students who suffer from isolation. The intensity and reciprocity of a social interaction can, together with other factors, result in such drastic measures as students dropping out of a course.

Carr [1] points out that anecdotal evidence and studies by individual institutions suggest that online course completion is much lower than in F2F (face to face) courses. A number of studies have found the retention of e-learners to be lower than the retention of on-campus learners. Interaction with classmates and the professor is a significant contributor to perceived learning in on-line courses [2, 3]. Students who report a high level of interaction report a high level of perceived learning in a course.

The social dimension of learning is also central to the idea of situated learning. Social interaction has always been of great significance to teachers, learners and others [4]. Learning is a function of the activity, context and culture in which it occurs, where social interaction is critical. Accordingly, it would be important to boost e-learners so that they can construct a social network among them. Through the social network service, students will have F2F meetings as well as on-line meetings. This social interaction would increase the student’s satisfaction with the course, increasing the probability that the student will not drop the course [11].

Mobile devices can facilitate social interaction and access to information resources anytime and anywhere [6]. Applications in mobile devices can also facilitate learning well with proper design. Currently, there are increasing demands and interest in location-sensing based services with advancements in smart-phones (which have GPS capability), PDAs, Bluetooth, dedicated GPS equipment and other devices (such as i-Pad, navigation devices, digital cameras and so on). Mobile social networking appears to the users as the result of social network services coming to mobile devices, especially smart-phones [16].
This paper proposes a system that supports the construction of a social network service using the location information of the smartphone in mobile-learning. This system provides a mechanism to form a social network among the students who take the same online course or have similar interests. Through this system, e-learners can create communities for learning and exchange help among them. That is, they can have F2F meetings as well as online meetings for collaborative learning by using location-based sensing information. This supporting of a location-based social network service in our system would increase interactions among e-learners and improve satisfaction regarding their mobile learning environment. Consequently, it would make e-learning course completion rates higher.

2. Related work

2.1. Advantages and disadvantages to e-Learning

Knowing e-learning advantages and disadvantages helps learners effectively use it as well as select proper online programs for their learning. Thus, it is important to know the merits and demerits of e-learning. E-learning has advantages and disadvantages. As the advantages of e-learning, we can consider the following things.

E-learning makes learners reduce travel cost and time to and from school and study wherever they have access to a computer and Internet. It supports an adaptive learning to learners. That is, learners may have the option to select learning materials that meets their level of knowledge and interest and work at their own pace. In e-learning, different learning styles are addressed and facilitation of learning occurs through varied activities. In addition, it can improve self-directed learning ability of learners. In other words, successfully completing online or computer-based courses builds self-knowledge and self-confidence and encourages students to take responsibility for their learning [1, 2, 3].

Disadvantages of e-learning are as follows. One disadvantage would be the fact that having a real live person that you can ask questions of, like in a real classroom, may not be available. The programs do offer assistance to any student that needs it, but the type of help may not be as helpful to learners if they are used to one on one and face to face assistance. This may be a little frustrating. In addition, unmotivated learners or those with poor study habits may fall behind. That is, learners who are short of self-directed learning ability may face tough conditions. Furthermore, learners may feel isolated or miss social interaction. Interaction between students and their peers as well as their instructors is a significant aspect of e-learning. Thus, social interaction seems to be the common denominator among strategies and practices aimed at retaining online learners. To enhance retention of online learners, there should be supports for forming social network between students [2, 3, 9].

2.2. Social network for learning

Learning is a social network relation. It is a shared experience as colleagues explore a new area together and it is a common experience as students to attend classes and lectures together, gaining a similar view of subject areas. The importance of interpersonal interaction in learning is undoubted. Several learning theories put special emphasis on the effects of interpersonal interaction on learning outcomes [5]. For example, collaborative learning theory assumes that learning emerges through interactions of an individual with others [6]. Constructivism regards learning as a social process that takes place through communication with others. The learner actively constructs knowledge by formulating ideas into words, and these ideas are built upon the reactions and responses of others [7].

Learning communities also give students the opportunity to meet both social and academic needs simultaneously. Tinto [4] stresses that social affiliations serve as a vehicle through which academic involvement is engaged. This emphasis on the importance of the support provided by peers is seconded by Knununen and Malmi [15], amongst others.

In e-learning based on a distributed learning environment, a social network plays a more important role to support students’ learning. Through strengthening connections and inspiring communications among the learners, the learning of the whole community will be promoted. Wegerif [14] highlights the importance of the social side of learning when designing a course, more specifically in an
asynchronous learning network. Studies of social networks show that a social network exerts its effect on learning processes and effectiveness [12, 13, 14].

2.3. Social networks and location sensing information based social services

The provisioning of services using location information is known as location-based services (LBS). There are more and more location based experiences occurring in our daily lives such as location-based information services, location-based games, and location-based ubiquitous learning [7]. Mobile positioning is a technology of LBS, which can obtain the location of the mobile devices and their users. Mobile users can not only query their positions and request services based on their current locations but also receive the information that they would be interested in according to their current position [6]. For example, a passerby can query the information of a nearest coffee shop based on his current location, and the coffee shop can also push an advertisement to the passerby who is in a certain age range and near the shop. Recently, one of the emerging research topics is to utilize the location-awareness of mobile devices to further strengthen mobile-learning. Chen [7] proposed a personalized context-aware ubiquitous English vocabulary learning system which can exploit appropriate context-awareness based on a learner’s location. Mobile social networking appears to the users as the result of combining a social network service with smart-phones. In relation to mobile social networking, a few studies have been proposed. Zheng & et al. [17] proposed a GPS-data-driven social networking service where people can share life experiences and connect to each other with their location histories. Li & Du [5] proposed a dynamic social networking system which supports location-based services. The system enables the participants with a common interest to communicate and share information within a certain geographical range in a decentralized mode.

However, these studies have not considered an e-learning environment. In addition, they have not proposed a practical method to use a location-based social network service in a realistic situation. However, our study considers a location-based social network service to effectively support e-learning. Our system provides a mechanism to form social networks among the students who take the same on-line course. Accordingly, e-learners can make communities for learning and have F2F meetings for collaborative learning, based on the location information.

3. Construction of social network education based on location information

E-learning is a more flexible and innovative way of learning. As of now, e-learning has becoming so popular. However, it is difficult to provide interaction services real-time. The existing e-learning methods only provide bulletins for sharing the lectures or for the needs of study groups. They do not provide various methods for forming a community or a small group among the learners. In particular, it is inefficient compared with face-to-face offline meetings and discussions, and thus there exists limitations on collaborative learning.

For this purpose, in this paper, we will collect location-based information through the GPS sensor of a smart-phone and then combine it with educational content. That is, it will support a method that can construct a social education network based on the collected location information of the learners. This method will inform a mobile learner of the current location or location logging-information of other learners who attend the same online course or the instructor of the relevant course. Based on the location information provided to mobile learners, collaborative learning can be requested of other learners or the instructors. Furthermore, if other learners in the vicinity also attend the course, a learner may request them to meet at a specific place for discussion and collaborative learning. Fig. 1 explains the basic concepts of this system.
Figure 1. Construction of location-based social education network

In Fig. 1, Learner A executes the online course application on a smart-phone. Learner A requests educational content from the e-learning server. The e-learning server generates additional information from the location information of Learner A and provides it together with the educational content. At this time, the e-learning server searches for the enrollment and location information of learners who are near to Learner A. In addition, it searches for information such as the location information received from the smart-phone of the instructor of the educational content, i.e., the professor or the assistant of the course. By using the location information of learners or the instructor of the course received from the server, Learner A can search for the people who attend the same course or who may assist.

In particular, the location of Learner A is tracked by the GPS sensing capability of the smart-phone. The location information of Learner A is used to help him meet at a specific place other people who attend the same course if they are nearby. In this way, e-learning can be extended to face-to-face meetings. In other words, close social relationships between students and between students and instructors can be formed by using smart-phones. Learner A sends a message requesting collaboration to the mobile-learning server for a person in the local area who can assist on the course. The mobile-learning server sends the request message it received from Learner A to Learner B or the instructor. It realizes a real-time social network by receiving a response to the request message.

4. Location-based Learning Support System

Mobile-learners provide information to the e-learning support system through sensing such as the smart-phone’s GPS. It constructs a social education network based on the provided location information. The system helps collective intelligence to be formed naturally by supporting collaboration on the course among the learners.

Generally, from the perspective of the client-server, the system consists of the smart-phone for the learner and the education contents server. For detailed modules, it consists of a Data Sender/Receiver Module, a Course Content Management Module, a Location-based Information Management Module, and a Learner/Instructor Management Module. The following explains in detail the relationship between the module functions in Figure 2 above and the client-server relationship.

4.1. Smart-phone for the Learner

Learners subscribe to the online education service. Registered learners have already saved unique smart-phone information in the server. In particular, they may designate specific online educational content that will be automatically received when moving to a specific place. In requesting the service, the smart-phone for the learner sends the user identification information, such as the user ID, to the contents server. Also, the smart-phone for the learner sends the location information of the smart-phone to the contents server. The learner obtains his location information by using GPS (Global Positioning System) or a mobile telecommunication system.
The smart-phone of the learner receives the location-based education information of other learners and provides it to the learner through an application. The location-based information displayed by the smart-phone of the learner will appear as an overlay on the map or in the form of a list. Depending on the need, the general location and identification information of the smart-phone concerning the course can be displayed as AR (Augmented Reality). After reviewing the location-based education information and the location of the learners, a real-time request for an educational collaboration can be sent to other learners by DM (Direct Message) or by marking information activated online.

4.2. Location-based Learning Support System

A location-based learning support system generally consists of the four modules (Data Sender/Receiver Module, Course Content Management Module, Location-based Information Management Module, and Learner/Instructor Management Module) and three DBs (Course Content DB, Location based Information Content DB, and Learner/Instructor Content DB).

Data Sender/Receiver Module
First, the Data Sender/Receiver Module receives the request for content from the smart-phone of the learner. Second, it sends the request for the content to the Course Content Management Module. Third, it sends the course content provided by the Course Content Management Module to the smart-phone of the learner. Fourth, it receives the location information of the smart-phones related to the educational content, for example, the smart-phone of the learner or the instructor, and sends the location information to the Learner/Instructor Management Module and the Location-based Information Management Module.

Course Content Management Module
The Course Content Management Module generates the location-based educational content and saves the generated educational content in the Course Content DB. In particular, the Course Content Management Module converts the existing educational content generated in order to provide the content to a PC into mobile educational content that can be displayed on a mobile device such as a smart-phone, UMPC (ultra mobile PC), PDA (personal digital assistant), tablet PC, i-Pad, etc.

The Course Content Management Module obtains from the Course Content DB the educational content requested by the user’s smart-phone and provides them to the user’s smart-phone.

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Figure 2. Composition of each DB

Learner/Instructor Management Module
The Learner/Instructor Management Module collects the user’s information relevant to each item of educational content. The collected information is saved in the Learner/Instructor content DB and the Location-based Information Content DB. Where there is a request from the learner or the instructor, it provides the saved information to the smart-phone of the user. In other words, the Learner/Instructor
Management Module conducts matching between each item of educational content and the information of the user relevant to each item of educational content, for example, the information of the learner who studies the educational content or the information of the instructor who teaches the course related to the educational content, and saves it in the Course Learner/Instructor Information DB. The Learner/Instructor Management Module can save the identification information of the instructor, for example, as well as his smart-phone’s MAC (Media Access Control) information GPS receipt information, etc., in the Course Learner/Instructor Information DB. Figure 3 shows the composition of each information DB. Figure 2 helps with understanding the saving format of each DB and realizing the link between each DB.

Location-based Information Management Module

The Location-based Information Management Module receives the location information of the smart-phone registered in the mobile-learning server through the Data Sender/Receiver Module. The received location information is saved in the Location-based Course Information DB after matching this data with each smart-phone user. Also, the Location-based Information Management Module collects the location information of the smart-phone when the educational content is provided. It can generate location-based education information based on the collected location information or location log. Location-based education information includes the information concerning the area and location where the educational content is being used. For example, it includes the information concerning how many times the educational content is used in a specific place such as a café, restaurant, library, park, classroom, etc. In particular, it may include the information on the specific address of each location (latitude and longitude by GPS as well as information on the administrative district). If the educational content is used frequently in a location, it means that the location is likely to become a place which is appropriate to use the educational content. Therefore, the learner can use the educational content more conveniently by finding a place where the educational content is frequently used through such additional information based on the location. Alternatively, the learner can attend the course at a specific place or check whether it is an appropriate place to take a quiz, mid-term or final-term examination.

```c
/* c_l_i DB : Course Learner/Instructor DB */

Get a Request_id
If (the Request_ID == Terminal_ID in course Learner/Instructor DB) then
  Get the Terminal_location and Course_ID of Request_ID
EndIf
For each record in c_l_i DB Where (record.Course_ID == Request_ID.Course_ID)
  Compute the Relative_location of the Terminal_ID
  If (the Relative_location <= θ) then
    Get the Terminal_IDs
  EndIf
EndFor
If {Terminal_IDs} ≠ null then
  For each Terminal_IDs where (Relative_location <= θ)
    Send a request for social network to each Terminal_ID
  EndFor
EndIf
If ∃ (acceptance signals for social network from the Terminal_IDs) then
  Send signals with detail location information to the Request_ID
EndIf
```

Figure 3. Location-based Information Management Module’s execution algorithm

When there is a request from a smart-phone, the Location-based Information Management Module provides to the smart-phone the location-based education information saved in the Course Contents DB. This Location-based Information Management Module sends the signal to the Data Sender/Receiver Module to transmit the education collaboration request received from the smart-phone of the learner to the smart-phones of the other learners or the smart-phone of the instructor, who is requested. When a
response approving the collaboration request is received, the detailed location information of the requested user’s smart phone is sent together with the response to the learner’s smart-phone through the Data Sender/Receiver Module. Figure 3 shows the algorithm that executes this process.

**Execution process of the system**

The execution of the system supporting a social network based on location sensing information using smart-phones is as follows.

The execution of the system consists of three stages in general – the stage in which the learner requests the course from the server, the stage in which the location information received from the smart-phone is shared, and finally the stage in which social collaboration between the learners is formed based on the location.

First, the smart-phone of the learner requests the online educational content from the mobile-learning server. The mobile-learning server analyzes the identification information of the user, the identification information of the educational content and the location information of the learner’s smart-phone and determines whether the user is eligible for the relevant educational content. Also the system shares the location information of the smart-phone of other learners who are related to the course that the user is attending or has requested. In this way, the location information of the instructor’s smart-phone located within the pre-set distance from the learner’s smart-phone is searched for and the location-based additional information, including the searched location information, is generated. Figure 4 is the flowchart of the signals that shows the process of the SNS (Social Network Service) using online education content.

Second, the learner’s smart-phone provides a real-time service of the received location-based education information to the learner. The service is made in a social display form combining AR (Augmented Reality) and the location information. The learner selects, among the displayed locations of other learners’ smart-phones or the instructors’ smart-phones, those learners with whom he wants to attend the course together or the instructor from whom he wants assistance on the course. To the selected people, a message requesting education collaboration, etc., is inputted to the learner’s smart-phone. The Course Content Server sends the education collaboration request received from the learner’s smart-phone to the smart-phones into which collaboration is requested. The learner of the smart-phone which received the collaboration request may send a response accepting the collaboration request to the Course Content Server, but may decline the request depending on the circumstances.

The third is the process that forms the social relationship based on the location. The system sends the response to the education collaboration request to the learner’s smart-phone. If the response to the education collaboration request is acceptance of the request, the Course Content Server sends the
detailed location information of the accepting smart-phone to the smart-phone of the learner. In other words, the location information and the location-based education information are shared between learner and learner and between learner and instructor. The locations of the instructor and the learner can be easily recognizable on Google Maps (http://maps.google.co.kr/), Naver Map (http://map.naver.com/), or Daum Map (http://local.daum.net). Therefore, a face-to-face meeting between an instructor and a learner who are nearby is possible. Furthermore, the additional information on the frequency of education collaboration or the frequent learners at a specific place (café, restaurant, library, park, bookstore, etc.) is shared. Educational collaborations helps form social relationships through twitter (www.twitter.com), facebook (www.facebook.com), me2day (www.me2day.net), yozm (http://yozm.daum.net), etc.

6. Conclusions

Distribution of smart-phones provides a mobile education environment. Mobile education is the realization of personalized education utilizing GPS, Ambient light sensors, Approximate Sensors, gravity-sensors, Gyro sensors, Magnetic Field Sensors, etc., equipped in a smart-phone. At the same time, since social network services are used widely, online education is transformed into social mobile education. This paper proposes a method for combining the location-based information of smart-phones and e-learning, and realizing an e-learning support system based on location-based social network. The proposed system helps the location-based information be transformed into information for social network. The support of a location based social network service in our system would increase interactions among e-learners and improve satisfaction regarding their e-learning.

7. Acknowledgements

This work was supported by Woosuk University(2011).

8. References