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COLLABORATIVE CREATION OF AUTHENTIC EXAMPLES WITH LOCATION FOR U-LEARNING

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ABSTRACT

Giving examples to students or letting students give examples is important in ordinary instruction. However, it is difficult for teacher to provide work-out examples to students since the proper examples are depending on the contexts and varying with students' life experiences and knowledge. In order to deal with the limitation of ordinary classroom, the study develops a collaborative example-creation platform for students to generate, explain and share their own examples of learning concept by mobile devices. Additionally, the sources of the generated examples are derived from real world, that is, every example is authentic example and presents a specific instance of the theoretical concept. Through the creation and share of authentic examples, students can not only elaborate their existing concepts but also construct their concepts from single or multiple work-out examples. Except for the collaborative creation platform, we have also implemented a Learner Agent residing in students' cell phones for assisting students to create authentic examples. With the agent, a created authentic example is attached with its location information, which indicates where the authentic example happened, and other students can learn something form the example with location information or go to the location to experience the example if they are interested in that. It can help the students easily understand the learning concept.

KEYWORDS

Authentic example, Collaborative creation, Learner agent, Location awareness, Mobile learning.

1. INTRODUCTION

Based on the objectivism, it is important for instructors to provide examples to students in order to explain new concepts of curricula. Through the examples, students could understand the concepts by connecting with their previous experiences. On the other hand, as per constructivist approach, it is essential to let students raise appropriate positive or negative examples for demonstrating their understanding of a concept. In the manner, students will not only be assisted in conceptual understanding but will also help instructors assess their learning process.

Example could be formed in many shapes, which depend on the different applicative contexts. In 1979, Kant proposed two discernible uses of example. The first is theoretical, an example is a particular of matter of logic which under a broader concept. The second is practical, that is, the example plays a particular instance of a practical rule (Lovlie, 1997). When we put the example in learning context, the example would profit students by either objective or constructive manner(s). In objectivism, for example, Reder and

Anderson (1980) found that the manual with examples is the most effective way to teach student to manipulate a personal computer. LeFevre and Dixon (1986) observed that students prefer to use the examples when learning procedural tasks. Moreover, VanLehn (1986) found that most systematic errors in arithmetic could be explained by example-driven learning processes. From the constructive viewpoint, students who benefit more from worked-out examples, usually elaborate examples actively and deeply (Chi et al., 1989; Stark, 1999). In addition, when learning examples, students who can monitor their comprehension failures and successes accurately, usually also have better academic performance (Brown et al., 1983; Chi et al., 1989).

Even though using of example in teaching is beneficial, the traditional e-learning approach, using asynchronous on-line curricula, lacks just-in-time and properly examples given by instructors, which usually results in students taking extra time to seek supplementary materials. In addition, these materials are rarely well-organized and even hardly shared with other students. To overcome the problem, this research aims at implementing an on-line collaborative creation platform, where students could provide their own authentic examples from real-world as the supplementary materials to the curricula. The platform will especially be designed by taking a pervasive and ubiquitous learning environment into account. Here is a very simplistic example scenario to understand the proposed approach: At a ticket window, a student looks at peoples buying tickets in line, which may remind her of the concept of queue in the data structure course. She could then take a picture or record the sight as a video by her PDA phone and write a short description to it as an authentic example of queue concept. Subsequently, she can upload her GPS location and the authentic example as a positive example for the concept to the collaborative creation platform, so that other students can then access the authentic example on-line and subsequently go to the location to experience it.

In this work, we have implemented a Learner Agent for students' cell phones and one blog-based collaborative creation platform over the current learning environment. In particular, the Learner Agent is designed for assisting students with creation of authentic examples, as well as minimizing the interaction between students and their cell phones. In addition, each curriculum in the current environment will be associated with a blog, where students can contribute their authentic examples to sprout the concepts of the curriculum, similar to how Moodle (Moodle, 2008) works.

The target user of this system is the Athabasca University's students, who locate at all over the Canada and even other countries. In addition, the students have different backgrounds and working experiences. Therefore, this research focuses two major issues over entire system: the location awareness and the experience sharing. Firstly, the location data indicate where the student is and where she experiences the authentic world. Secondly, by sharing the authentic example, the tutors, the peers, and even the student herself can know how she understands the theoretical concepts. Moreover, students through learning with theoretical concepts associated with authentic examples, they may obtain the generalization from examples and that is what they should learn from textbooks.

The remainder of this article is organized as follows. In Section 2, we describe the learning scenario of our system while explaining the mapping between the design concept and educational theories. Subsequently, the system architecture and implementation issues are introduced in Section 3. Finally, we sum up this study in Section 4.

2. LEARNING BY AUTHENTIC EXAMPLE

To create an authentic example is relatively easy. Whenever a student takes a picture by her cellular phone camera, the Learner Agent will automatically attach location information into the picture and instantly upload the picture to server. It will create an initial the authentic example on the learning platform. Following that, the student only need to specific the title, category, and description to the picture and to decide if the authentic example should be published to peers. However, the preparation of creation is more important and difficult. It is because that before one student generating a work-out example for a specific learning concept, she has to understand the original abstract concept first.

The follows explain how to perform learning by authentic example over the collaborative creation platform.

– *Create authentic example:* As mentioned before, if a student want to create an authentic example to a learning concept, she should understand the concept first. When her trying to create the authentic example

for the concept, she is also trying to describe the concept in a comprehensive way. Such action contains serial of important learning behaviors: rehearsal, elaboration, and organization. In addition, to explain one abstract concept into an instant with certain context also complements the insufficient parts of textbooks. Since abstract or theoretical knowledge which be addressed on textbooks usually do not tell the student when and how to use them to solve practical problems (Simon, 1979; Chi et al., 1989). Consequently, the example creator not only enhances the concept impression in her mind but also enrich the content of the concept.

– *Read or feel authentic example:* According to explanation-based theories, the generalization can be derived from a single or a few examples (Elio and Anderson, 1981; Kieras and Bovair, 1986; Mitchell et al., 1986; Lewis, 1988). Based on such fact, when a student does not completely understand a learning concept stated in an online course, she can try to understand the concept by generalizing the common facts from several work-out authentic examples. Furthermore, sometimes the fragment data available in the authentic example is not enough to fulfill the student's learning demands. The student can go to the place where the example came from by taking the advantage of the example's location awareness, which may help the student to think deeply and explore further.
– *Comment authentic example*: In our platform, students are allowed to comment on peers' authentic examples. The comments could make the example reformulate in better statement as well as improve its quality. Moreover, the unsuitable example may also be corrected and it also helps the creator to build the right link between learning concept and the example simultaneously.

3. SYSTEM ARCHITECTURE AND IMPLEMENTATION

In taking consideration of limitations of user interface on mobile devices, we intended to minimize the interactions between students and their cellular phones. Moreover, we also want to simplify user interface to avoid the students to fall into the information overload situation (Eppler and Mengis, 2004; Mulder et al., 2006). Thus, we have utilized the multi-agent technology to implement the system. According to Desharnais et al. (2002) and Agarwal et al. (2004), the agents have seven characteristics. The first, an agent is *Autonomous*, that is, it can make decisions by itself and function independently. The second, an agent is *Persistent*, namely, it can run continuously, in the meanwhile, an agent can also adapt its behavior to accommodate to the changing environment (*Reactive*). Subsequently, an agent is *Proactive* and *Personalized*, that is, it is goal-oriented and also can be taught what to do in particular situations. Additionally, an agent has *Social Behavior*, it can interact and collaborate with other agents to achieve its goal. Finally, an agent is *Trustworthy* and only does something what its owner ask it to do. With these characteristics, we have designed three agents in our system. According to Figure 1, there are three agents work and interact in the learning environment: a Learner Agent, a Location-aware Agent, and a Resource Agent. In this study, we will especially focus on the Learner Agent, which is installed into students' cellular phones and responsible for reporting students' location information to the Location-aware Agent, as well as cooperating with the Resource Agent to manage the authentic examples.

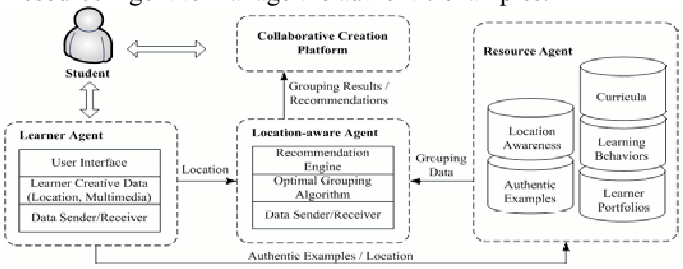


Figure 1. Multi-agent system architecture

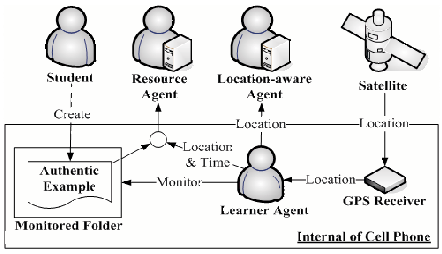


Figure 2. The detail task of the Learner Agent

In this work, we have developed the Learner Agent in J2ME programming language, and the agent program can run on any GPS-enabled phone with a Java Virtual Machine (JVM). Hereinafter we are going to introduce the Learner Agent in related to agents' characteristics.

– *Proactive*: The Learner Agent's goal can be divided into three sub-tasks: 1) Monitoring the change of the folder in which the authentic examples are placed; 2) Attaching the location information and time stamp

to a new incoming authentic example, and then uploading it to the Resource Agent on the server; 3) Periodically reporting student's location to the Location-aware Agent for further analysis. The detail task of the Learner Agent is shown in Figure 2.

- *Personalized*: The three sub-tasks of Learner Agent can be turned on and off individually. Moreover, the student can specify any folder in her cellular phone for the agent to monitor and register the student to any server that is ready to support collaborative creation service.
- *Persistent*: Generally speaking, the Learner Agent will run continuously until it to be turned off.
- *Reactive*: Wireless connection and GPS data receiving are highly power consuming in a cellular phone. Depending on different learning contexts, the Learner Agent can automatically adjust the GPS receiving interval and the location reporting interval to prevent power drop.
- *Social Behavior*: The Learner Agent will interact with the Location-aware Agent and the Resource Agent while exchanging data. Whenever the Resource Agent obtains authentic example from the Learner Agent, the Resource Agent will downsize it. Furthermore, whenever the Location-aware Agent obtains one student's location data, it will compare the new location data with previous stored location data to provide more accurate location information to the system.
- *Autonomous*: The Learner Agent will carry on its duty automatically and continuously in the background. The entire process does not need a student to involve except for initial installation.
- *Trustworthy*: A student can always anticipate and believe that the Learner Agent will only do the things that she wants it to do.

Except for the Learner Agent, the other major contribution of this work is the implementation of the mobile web-based collaborative creation platform. On the platform, students can publish their own authentic examples, and other peer can browse these examples simultaneously. Additionally, the platform is also responsible to display the feedback information (such as learning and grouping suggestions) from the Location-aware Agent to students. Figure 3 shows the snapshots of the Learner Agent and the Collaborative Creation Platform.

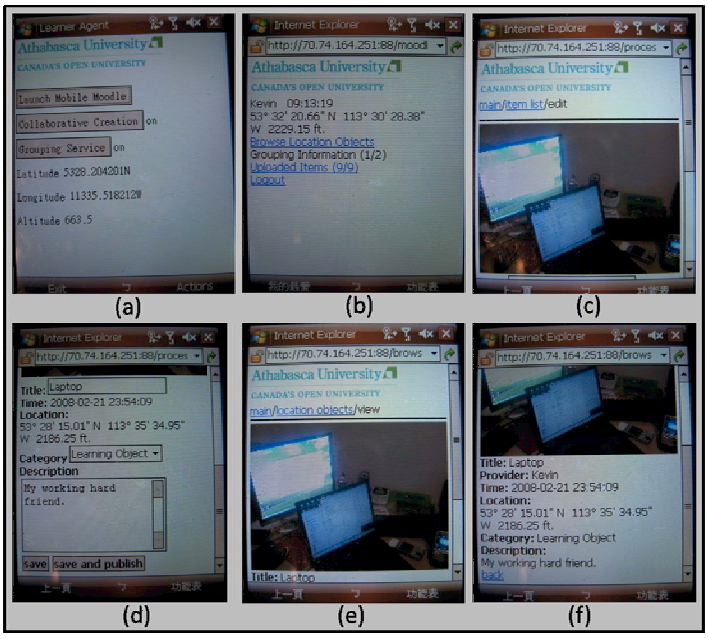


Figure 3. The snapshots of the Learner Agent and the Collaborative Creation Platform. (a) The Learn Agent; (b) The portal of Collaborative Creation Platform; (c)(d) Upper and lower parts of an authentic example editor screen; (e)(f) Upper and lower views of the edited example.

4. CONCLUSION

Owing to the example-based learning is difficult to realize in e-learning environment. This study develops a collaborative creation platform for students to raise and share their own authentic examples. Students who

create the authentic example are also doing rehearsal, elaboration, and organization of what they learnt. Over the platform, the students can not only create but also read, feel, and comment the authentic examples provided by peers. Learning online courses as well as reading or even viewing the corresponding work-out authentic examples, the student may derive and obtain the generalized learning concept from examples. Moreover, to comment peers' authentic examples is also benefit. Students who comment others' examples are also doing rehearsal and concept generalization; and students whose examples to be commented are also providing the opportunity for students to correct their unsuitable concept connections. By utilizing mobile device's location information, the system successfully associates location information with authentic examples, which will greatly enhance students' learning capability in mobile learning.

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