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Effectiveness of Ubiquitous Learning Log System

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Abstract. This paper proposes a ubiquitous learning log system called SCROLL (System for Capturing and Reminding of Learning Log). Ubiquitous Learning Log (ULL) is defined as a digital record of what you have learned in the daily life using ubiquitous technologies. It allows you to log your learning experiences with photos, audios, videos, geography data, QR-code, RFID tag, and sensor data, and to share and to reuse ULL with others. Using SCROLL, you can receive context-based and personalized quizzes. In addition, you can navigate and be aware of your past ULLs supported by augmented reality view.

Keywords: Ubiquitous and mobile learning, Ubiquitous learning log, life log.

Introduction

CSUL (Computer Supported Ubiquitous Learning) is defined as a technology enhanced learning environment supported by ubiquitous computing technologies such as mobile devices, RFID tags, and wireless sensor networks [1]. CSUL takes place in variety of learning spaces, e.g., classroom, home and museum. Also it provides the right information using the contextual data like location, surrounding objects and temperature.

The fundamental issues of CSUL are: how to record learning experiences that happen at anytime and anyplace and how to share and reuse them in future learning. To tackle these issues, LORAMS (Linking of RFID and Movie System) [4] was proposed. By scanning RFID tags, LORAMS shows the user the video segments that include the scanned objects. Although this system is useful in certain environments, it is not easy to be applied in practice at any place at the moment. Therefore, we started more practical research called "ubiquitous learning log (ULL)" project in order to store intentionally what we have learned as ubiquitous learning log objects (ULLOs) and consequently reuse them.

How do we learn from past learning logs? Taking notes is a usually way we do, e.g., when we learn foreign language we may record new vocabularies, idioms, sentences. Whereas, the notes will not remind us of what we have learned, or the situation where the knowledge was used. We think this process can be enhanced by using mobile devices. Therefore, this paper proposes a system called SCROLL (System for Capturing and Reminding of Learning Log), which supports the learners to record, share and reuse ULLOs with mobile devices. The design, implementation and initial evaluation of SCROLL have been introduced [5].

Regarding related works, life-log is a notion that can be traced back at least 60 years [6]. The idea is to capture everything that ever happened to us, to record every event we have experienced and to save every bit of information we have ever touched. For example, SenseCam [7] is a sensor augmented wearable stills camera; it is proposed to capture a log of the wearer's day by recording a series of images and capturing a log of sensor data.

MyLifeBits [8] stores scanned material (e.g.: articles, books) as well as digital data (e.g.: emails, web pages, phone calls, and digital photos taken by SenseCam). Ubiquitous Memory system [9] is a life-log system using a video and RFID tags. The most common idea of those projects is to use life-log data for memory aid, however, SCROLL aims to utilize life-log data for the learning process.

Originally, the term "learning log" was used for personalized learning resources for children. The logs were usually visually written notes of learning journals, which could become an integral part of the teaching and learning program and had a major impact on their drive to develop a more independent learner. Research findings indicated that journals were likely to increase meta-cognition and reflective thinking skills through students who become more aware of their own thought processes [10, 11, 12]. Our approach focuses on how to enrich learning log and to promote retention and meta-cognition by using mobile, ubiquitous and context-aware technologies.

1. SCROLL

SCROLL is a client-server application, which runs on different platforms including Android mobile phones, PC and general mobile phones.

ULL recorder

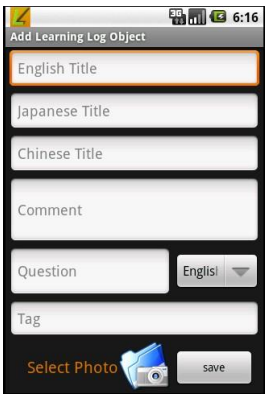
This component facilitates an easy way for the learners to upload their ULLOs to the server whenever and wherever they learn. As shown in Figure 1(2), in order to add a ULLO, the learners can take its photo, ask questions about it and attach different kinds of meta-data with it, such as its meanings in different languages (English, Japanese and Chinese), comments, tags and location information. Also the learner can select whether the new ULLO can be shared or not.

ULL finder

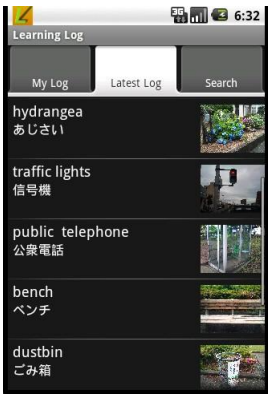
If learner registers a new ULLO, the system checks whether the same object has been already stored or not by comparing the name fields of each object using a thesaurus dictionary. Also, the learner can search ULLOs by name, location, text tag and time. Using this function, learners can understand what, where and when they learned before. In the future works, the visualization of the ULLOs will be developed.

ULL reminder

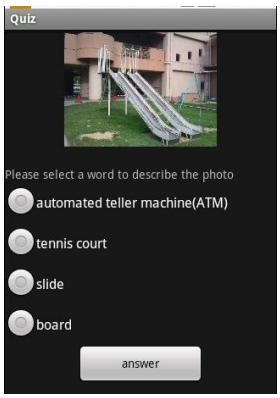
The system generates simple multiple-choice quizzes based on the meta-data of the stored ULLOs. For example, the idea of "quiz with image" is to ask the learner to choose a word to describe the image given by the system. The system immediately checks whether his answer is correct or not. These quizzes are generated according to his profile, location, time and the results of past quizzes and help the learners to recall what they have learned.



(1) Add ULLO



(2) ULLO list



(3) Quiz

Figure 1: SCROLL Interface of Android mobile phone.

ULL Navigator

LL navigator provides mobile augmented reality that allows the learner to navigate through the ULLOs. It provides the learner with a live direct view of the physical real-world environment augmented by a real time contextual awareness of the surrounding objects. While a learner is moving with his mobile phone, the system sends an alert on the phone as soon as entering the region of ULLOs according to the GPS data. This view is augmented, associated with a visual compass, and overlapped by the nearest objects in the four cardinal directions (figure 2, left). Also, it provides the learners with a list of all surrounding objects. When the learner selects one or more of these objects, the Google map will be retrieved, and marked with the learner's current location and the selected objects. Moreover, the system shows a path (route) for the learner to reach to the objects locations (figure 2, right).

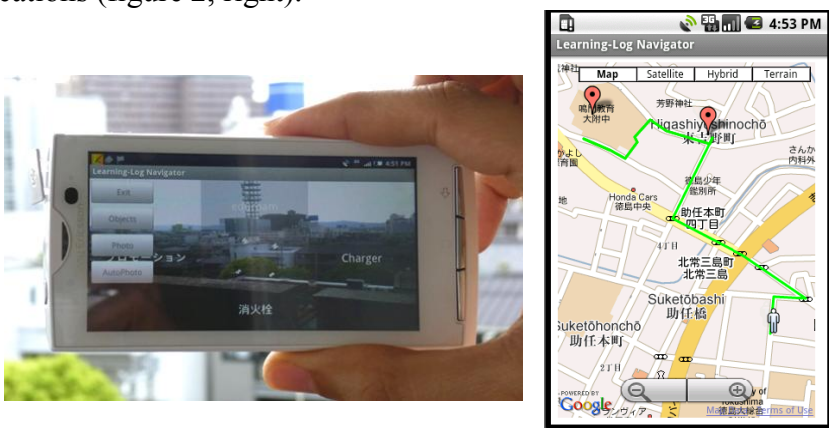


Figure 2: Learning log navigator (camera view(left); path to ULLOs(right)).

2. Evaluation

2.1 Method

The aim of this experiment is to validate whether our system can work better than the paper notes and invest whether different client affects learners differently and whether learners have better user experiences supported by the personalized learning and context-aware learning model than only the user-customized way. Therefore we designed that the participators would use paper, SCROLL system based on PC and digital camera (PC+DC), Android SmartPhone (Sony-Ericsson Xperia) client of SCROLL system without personalized learning and context-aware learning (SP-P), and Android client of SCROLL system with personalized learning and context-aware learning (SP+P) each one for a period. The study group consisted of 20 Japanese students including undergraduates and graduate students.

The experiment was conducted for 6 weeks. We take one week as a phase during the experiment. In the first week, all the students underwent an initial test and based on the scores they were divided into two groups. Then, they were asked to spend the second week on getting used to the SmartPhone. In the left 4 weeks, two groups used paper, SCROLL system based on PC+DC, SP-P and SP+P each one week in different order. Finally, they are asked to finish the questionnaire. All the students need to study at least five unknown English words each day. And if they use SCROLL system, they also need to take the photo about the learning context of the word. For example, if they learned the word like "ladle" "stapler", the photos of these things should be taken. After each phase, a post-test

was conducted. The tests are composed of the English words each student learned in that week. Besides writing the Japanese meaning, students are also asked to fill out the remember state of each word.

Four levels of remember states are provided which are remember, know, guess and unknown. The remember level means learner can both remember the meaning and the used context of the word. The know level means learners know the meaning of the word but forgot how to use it. The guess level means that learners remember the situation in which the word is used but forgot the meaning. The unknown means that learners forgot both the meaning and the situation.

3.2 Results

Table 1 shows the learners' average scores of the post-tests after each phase. Table 2 illustrates how much the learners retained the context or the situation of the ULLOs they learned. During the experiments, all the participators had learned 2275 ULLOs and finished 4419 quizzes. The correct rate of the quizzes is 91%. For their own ULLO quizzes the correct rate is 95% while for the ULLOs owned by the other learners, the correct rate is 87%. In the week without personalized learning and context-aware learning supported, the learners received the recommendation messages 56 times according their customized setting. They responded the recommendation 28 times and had 179 recommended quizzes. We can see that 50% recommendation messages are responded and for one recommended message, 6.39 quizzes are finished. In contrast, in the week with personalized learning and context-aware learning supported, the learners received recommendation messages 472 times from the system. 101 times are responded and 845 recommended quizzes were taken. It is easy to see that for one recommendation message 8.36 quizzes are finished but only 21.4% messages are responded.

By analyzing the results of the questionnaires, we learned that all the participators thought comparing with writing in paper, it was more helpful to recall the situation or context of what they learned by using SCROLL system with GPS data and photos. About the four kinds of 35% of them enjoyed the week of using SP supported by personalized learning and context-aware learning and 30% liked the two weeks of using SP. Note that 15% of participators liked paper best for they feel it easier to take note with paper.

From the questionnaire, we also got that all of them have their individual preferred study location and time such as in the morning at home or in the afternoon in the lab. More than 60% of the learners told us they responded the recommendation messages in their preferred study location and time.

Table 1 Average scores of post-test and recall percentage in Group A and B.

Group	Post test				Recall percentage			
	Paper	PC+DC	SP-P	SP+P	Paper	PC+DC	SP-P	SP+P
A	44.70	70.68	71.22	70.00	60.05%	74.22%	80.30%	74.89%
B	25.58	55.09	70.47	75.48	53.75%	67.76%	75.35%	82.15%
Ave.	35.14	62.88	70.84	72.74	56.90%	70.99%	77.82%	78.52%

We also received many useful messages from the learners. For example, one learner told us that y looking through other learners' ULLOs, he learned a lot of words occurred in our daily lives such as vending machine, ashtray. Two of them sent us the similar opinions that by using SCROLL system, they attached the consciousness of thinking the around things in English. Some of them also pointed out several problems for us. For example, one

learner concerned that his GPS data could be seen by the others. Some of them also complained that they did not get used to the interface.

From table 1, we can find that different tools affect learners differently and in the two phases of using SP learners scored best and can recall the context or situation of the words used most among the three tools. In other words, the SCROLL system can not only help the learners retain what they have learned but also is very useful for them to recall the context or situation of the words used.

3. Conclusion

This paper proposes a ubiquitous learning log system in order to enhance sharing and reusing past learning experiences. The system runs on Web browser, Android and email platform. According to the initial experiment, SCROLL was proved to be effective in learning English vocabulary. Since this system is intended to be used in general domains and for life- long learning, we will apply it in other application domains, e.g., math, physic, and science education and conduct a long-term evaluation with an enough number of subjects in the future work.

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