

Open Source Based M-Learning Application for Supporting Distance Learning

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Abstract

The concept of learning anywhere and anytime is unable to be fully implemented because user need to find comfortable place, which is required, to follow the study. User is unable to access learning material in a way that practical, easy to use and easy to access. Based on that fact, system or application for mobile device such as hand phone, PDA or smart phone is needed. The m-learning application is developed by Computer-Based System Engineering Method based on the principal of software engineering using development steps of System Development Life Cycle (SDLC). SDLC consists of the following steps, analysis, design, implementation, testing and evaluation. Trials as alpha-test, carried out to determine operability of m-learning system on handheld devices. Trial is taken by creating trial class followed by 25 students to receive feedback about the m-learning system. Feedback result shows almost 90% of respondents consider the m-learning system is easy to use.

Keywords: mobile learning, open source, distance learning

1. Introduction

Conventional learning activities still play an important role in the learning process, especially in terms of knowledge delivery effectiveness, communication and interaction among individuals. This kind of learning activities enables direct communication and interaction between students and faculty and among the students themselves. Under the condition, content delivery, feedback, question and dialogue may occur in a lively manner. Visualization clearly defined learning process through a variety of media. Visual, verbal, gesture or facial expression contribute to determine the understanding of the processes of learning activities that take place.

The main drawback of the conventional learning is the limited use of time. The limitation is associated with class room distribution and provision and also in creating class schedule for the professors or teachers. Since the activities involve various stakeholders, especially professors or teachers and students, it is necessary to have a shared commitment to conduct the learning activities at a specific time and place. The situation is considered inflexible which leads to the very limited amount of time for learning activities.

The rapid development of today information technology put it as the fastest and most effective data communication technology and information delivery technology. Moreover, the future of education will be determined by the information network that allows interaction and collaboration.

ICTs have enormous benefits in every field of life where it has been employed. The education sector has benefitted a lot from the ICTs in developed world whereas developing countries are on the way to fully integrate it into their education systems [1].

In 2013, Liao and Liu proposed an online coding framework named as Gmei, so that a student can edit his/her code in any browser, executes it, and then analyzes it. This newly proposed framework connects teachers, curriculum authors, and students in a unique social experience, tracking and streaming progress updates in real time. Especially, for the course of design and analysis of computer algorithms, through using this framework, the teachers can find interesting and unexpected input values that help students to understand what their codes are actually doing. The real fun starts with coding instances where students write code to implement the teacher's specifications about the typical algorithms in computer science, such as greedy algorithm, backtrace and dynamica programing [2].

In nowadays world of education, there are some development in e-learning system, that is a learning system that may conducted remotely, meaning not require face-to-face interaction

between teachers and learners. In line with the rapid advance of technology in the field of mobile and wireless, it created an opportunity for new research field, which is referred to as 'mobile learning' (m-learning) [3].

Mobile learning may be defined as a facility or service that provides general information electronically to the learner and the educational content which helps the achievement of knowledge without question the location and time [4]. The mobile learning system utilizes the mobility nature of handheld device / mobile, such as mobile phones and PDAs, to provide a learning function that can be performed anywhere and anytime.

The increasing number of wireless networks, types of services, and mobile devices is expected to encourage the development of m-learning systems in the future. Having a cell phone and a subscription to one of the mobile operators has become something that is affordable and often has become a lifestyle of people across societies. In addition, the features and functionality offered by the mobile phone is also more complete and sophisticated so that in the future mobile phone is expected to be an alternative to the use of a PC (Personal Computer). This is also supported by the faster network and connectivity that enables the interconnection of data and multimedia, not only limited to voice and text, in the higher speed of data transfer rate.

Compared to e-learning that requires users to deal with a stationary PC connected to the internet, m-learning allows users to interact with the system more easily. M-learning is easy to carry anywhere (portable), practical since learners are not bothered with the tools used, and easy to use for anyone who is not too tech savvy. Unlike e-learning, which is using PC, that has a fairly large computing capability, mobile devices have limited capability. This led to the development of m-learning applications that should be designed specifically and differently than the application of e-learning in general. Due to the limited computational capabilities, m-learning applications should be designed optimally, more effective and efficient than applications designed for PC.

Some colleges are now implementing distance learning system using electronic learning (e-learning), in which all the course material can be accessed from off campus by using a computer, even tests also available online. Minimum requirement that must be met in the implementation of distance learning is a set of computer or notebook for accessing the e-learning system. In this manner, the concept of learning anywhere and anytime could not be fully implemented, since the learning activities require user to find a comfortable place to study. User unable to access learning material in practical, easy to use and easy to access manner. In order to achieve it, a system that allows learning anywhere and anytime through mobile devices such as mobile phones, PDA or SmartPhone is needed.

Mobile learning or m-learning often defined as e-learning over mobile computing device. Ally et al [5] defines m-learning as provision electronic learning material on mobile computing device in order to get accessed anywhere and everywhere. In general, mobile devices considered are PDA and digital cellular phone but in wider perspective the device is any kind of device that considerably small, works independently, able to be on our side on daily life and may access some of learning form. The small device acts as tool to access content, either locally stored on the device or reached through interconnection. Device becomes tool to interact with other people, through sound and message exchange in the form of text, image and video.

The terms mobile learning (m-learning) also referred to the usage of handheld and mobile IT devices such as PDA, cell phone, laptop and PC tablet in tuition and learning [6]. M-learning is a unique type of learning since student may access learning material, guidance and application associates with the course whenever and wherever. It will raise attention to learning material, makes learning more attractive and pushing motivation to student to lifelong learning. Compared to conventional learning, m-learning makes more opportunity to collaborate in ad hoc and interact informally among students [7].

Based on research on m-learning project in England, Italy and Sweden [8], the benefits of m-learning are

1. Gives learning at any given place, any given time and personalized.
2. Use to bring excitement or put variation on conventional learning method.
3. May be used as a means to eliminate formality which is considered unattractive or scary to non-traditional learners and may make the study more attractive.
4. Helping give and support literacy, numerical and language study.
5. Facilitate learning experience individually and collaboratively.

6. Helping against rejection of ICT usage by giving a 'bridge' between low technology adoption of cell phone and PC.
7. Observed helps young learner to stay focus longer
8. Helps improving confidence and self assessment in study.

2. Research Method

The m-learning application is developed by Computer-Based System Engineering Method based on the principal of software engineering through the development steps based on System Development Life Cycle (SDLC). SDLC consists of several steps that are analysis, design, implementation, testing and evaluation. Those steps may be done in overlap and cyclical way.

2.1. Requirement Analysis

Requirement analysis conducted to obtain input, for designing purpose, in the form of a data flow diagram of the application to be developed. The diagram contained systems engineering requirements that include software, hardware, servers and networks that are required in the design and implementation of the m-learning applications.

The system developed in this study called ProVisi Mobile Learning (PVML). The system is divided into two sub- systems, named PVML Provider and PVML Client. PVML Provider is a PVML sub-system that run on a web server that provides the service of m-learning that can be accessed and run by the other sub-system, PVML Client, in the form of smart phones, via HTTP . The design of the two sub-systems using Object Oriented Design reference (OOD) so that the design can be implemented on the platform script which support object-oriented approach.

PVML learning architecture refers to the architecture of Learning Technology System Architecture (LTSA) proposed by the IEEE 1484 Learning Technology Systems Committee (LTSC). This standard covers a wide area of the system , commonly known as learning technology , technology education and training , computer -based training (CBT) , computer assisted instruction , intelligent tutoring , metadata , and so on . This standard is pedagogically neutral, neutral to content, culturally neutral and neutral to platform.

PVML design has several characteristics that distinguish the e-learning system is the use of mobile devices used by the learner (student), such as to access learning content or the interaction between the learner and the coach (lecturer). Physically, PVML architecture is divided into two parts, named PVML Provider and PVML Client. Exchange of messages between PVML Provider and Client PVML uses XML-based protocols, XML – RPC, which is simple and has been implemented in many languages. This protocol is selected so that the development of the sub-systems can be conducted loosely coupled. The XML - RPC protocol implementation itself is quite light so that the resulting application can be relatively small, the data being transferred is relatively small and the speed is higher than similar protocols. While the transport protocol uses the HTTP protocol over GPRS is already quite stable (well established) and widely accepted.

2.2 The design of m-learning applications

The design phase is taking the result of the requirements analysis. This phase will result in the m-learning application specification and design. The system has 3 types of users, learner (student), coach (lecturer) and system administrators. Learning scenario in general used on PVML system is as follow :

1. Learner registers to the system. Successful registration will give a set of username and password.
2. Using the given username and password, learner may log into the system. If the login attempt is successful, user will receive a session ID which acts as unique identity of each learning session. The session ID is used every time the learner enters the system and remains active until the learner decide to log out.
3. After logged in, the learner will meet course list offered by the system. Learner chooses one from the courses offered. If the course request is approved or the course is under free to

follow category (means approval of the system or pre-test is not required) then the course will be added to course list that followed by the learner.

4. Learner may choose one of the courses from the followed course list. Under the chosen course, learner may download course material from the server, store it in their handheld devices and start to learn.
5. Learner may follow the final examination to test the level of understanding. If the learner passed the exam, passing grade/assessment data will be included into learner portfolio.
6. During the course, the learner may discuss with fellow learner who followed the same course or with the coach by sending text questions or comments to the forum.
7. Learner who completed a learning session may log out from the system. The process will reset the registered session ID in the system.

Based on the processes from the previous section, the application requires a connection to the server only on some occasion, i.e. log in, view course list and server content, download content, send answer and send message.

2.3 Design Implementation

M-learning application built by using PHP and Java as a programming script that runs on the Apache web server. The procedures used are coded and documented. The processed data stored in database which using MySQL database. The application implemented using open source tools which is free from license fee.

2.4 Test

System tests carried out by the following procedure:

1. White-box and black-box test

M-learning application test is held by white-box and black box testing method through the execution of the built sub-system modules. The entire links tested orderly from root to leaf so that every node is covered. To determine the effectiveness and functionality of every links, the result is put on a table.

2. Trial

Trials, as alpha-test, carried out to determine whether m-learning application able to operate via handheld devices such as mobile phones, PDAs and smart phones. Every functions / sub- system modules is tested on the devices. To achieve it, a trial class must be set up to obtain feedback from the aspect of cognitive, affective, and psychomotor. The result will comes in some possible values, i.e. ugly, moderate, good and very good. The results stored in a tabular manner.

3. Interpretation and inference results

Interpretation and inference made based on the aspects of the m-learning applications itself and the evaluation result from the members of trial class.

a. M-learning application aspect

M-learning application test conducted on all existing links in order from root to leaf. It produces a result table. Conclusion made based on the result table. If the entire links serve their function properly, not even a single link failed, the application meets the standard of success.

b. Aspect of Evaluation in the Domains of Cognition , Affection and Psychomotor

Result grade and analysis of the evaluation table will determine whether the application feasible and eligible to implement. The source of evaluation table values is feedback in the domains of cognitive, affective and psychomotor. If the result is good or very good then the application considered feasible and eligible to implement.

3. Results and Discussion

3.1. Support System Requirements

Support system requirement in the mobile learning (m-learning) includes hosting and domain requirements and user requirements.

1. Hosting and Domain

The m-learning system is uploaded into web server so many users can access it. Table 1 are information about hosting and domain used in currently built m-learning system.

No	Specifications	Description
1	Domain	http://pvml.net
2	Web Hosting	http://idwebhost.com
3	The storage capacity	2 GB
4	Bandwidth	59 GB per month
5	Platform's Operating System	CentOS Server
6	Web Server	Apache
7	Database	MYSQL

2. Supporting requirements for users

Supporting requirements for users are requirements that must be provided by user in order to access the m-learning system. Users should use smart phone to access m-learning system.

3.2. System Implementation Result

All files in the m-learning system uploaded into the specified web hosting. The m-learning system consists of three main view, student page view, teacher page view and administrator page view.

1. Student Page

Student page view is the view that displayed to the student as user of the m-learning system. Student accesses m-learning system via mobile browser found on smart phone. While accessing the m-learning system, student needs to log in to the system at first. Student required to login by filling username and password. User without account must take registration to the administrator. The login page is shown in Figure 1.



Figure 1. Login Page

Successfully logged in student will meet student home page. This page displays courses that followed by the student. Student has option to choose in order to access another page such as content, news, discussion, assignment, exam and result. This page has logout button which will bring the user getting out of the m-learning system. Content page displays learning material in PDF format, so that students can read and download these materials, as shown in Figure 2.



Figure 2. Content Page

Exam page is a page that contains exam questions in multiple choice. Student answers the questions by selecting the correct answers as shown in Figure 3.



Figure 3. Exam Page

2. Teacher Page

Teacher page gives teacher ability to manage courses, such as enrolling student to the class, uploading content, making the news or announcements, managing discussion, creating assignment, creating exam questions and check student results. Teacher may access the m-

learning system using mobile browser that available on smart phone after logged in to the system. After successfully logged in, teacher will reach the teacher home page. In the page, teacher may see courses that managed by their self. The teacher has options to access other pages such as content page, news page, discussion page, assignment page, examination and the examination result. Log out button works when the teacher getting out of the m-learning system. Content Upload Page used by teacher to upload learning material in PDF format. Each material made for each chapter of the course. Student may see or download the uploaded material later.

3. Administrator Page

Administrator uses the administrator page to manage user and course. Administrator accesses m-learning system using mobile browser that available on smart phone after logged in first. Successfully login administrator will go to the administrator home page. At the current page, there are two setting options, i.e. user setting and course setting. Logout button will be needed when user need to leave the m-learning system. On User-Add page, administrator may add user that will use the m-learning system. Administrator also needs to determine the corresponding right for user. Available rights are administrator, teacher or student. Administrator uses Course-Add page to add course that will be delivered in the m-learning system. While adding course, administrator needs to determine teacher for the course.

3.3 System Testing

System testing on m-learning system runs under black box method. Black-box testing is software testing based on software functionality. Black-box method has purpose to find software malfunction.

3.4 Trial

Trials as alpha-test, carried out on whether the m-learning system is able to be operated via handheld devices such as mobile phones, PDAs and smart phones. Trial is taken through various functions / sub- system modules that have been formed. Trial is taken by creating trial class that followed by 25 students in order to receive feedback about the m-learning system. Result from the feedback shows that almost 90% of respondents tell that the m-learning system is easy to use.

Based on student feedback grade, here is the discussion: in online learning material parameter, the system generally classified as good (78%). User satisfaction parameter includes likely to use is good (54%) and often use is quite good (54%) and interest classified as good (83%). Easy-to-use parameter includes easy-to-use classified as good (81%), menus classified as good enough (67%) and colors classified as good (86%). Content parameter includes concept delivery classified as good (81%), code completion classified good (76%). Those parameters are important to determine quality of online learning.

Most of the participants agree that m-learning increases access to learning. On the negative side is, of course, that access to technology is still lacking. In these trials, we assumed that the learning could take place in an always-online environment with free access.

4. Conclusion

Based on the results and discussion of designing open-source based m-learning system, the conclusions can be drawn as follows:

- a. Mobile learning system able to manage distance learning or course.
- b. Mobile learning system may upload, reads and downloads learning material / content.
- c. The system may give announcements to students online.
- d. Student may upload assignment given by the teacher using the system.
- e. The mobile learning system may evaluate learning process in the form of exam.

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