Mathematical Model of M-Learning Application for Android based Mobile Devices using Web Services

Kainjan Kotecha
Assistant Professor of Computer Department
SNJB's COE, Chandwad

Deepika Jain
B.E Computer
SNJB's COE, Chandwad

Aakash Chhajed
B.E Computer
SNJB's COE, Chandwad

Mahesh Sanghavi
Assistant Professor of Computer Department
SNJB's COE, Chandwad

Priya Tatiya
B.E Computer
SNJB's COE, Chandwad

Mahavir Shah
B.E Computer
SNJB's COE, Chandwad

ABSTRACT

Traditional E-Learning systems developed for laptop and desktop computers were based on individual software application or through websites and lack the ability to provide a complete ubiquitous learning environment. A ubiquitous learning environment based on early period mobile phones lack the handling power of laptops or desktop computers, low data transfer speeds and capacity. However, the capability to provide an entire ubiquitous learning environment on the 3G (3rd Generation) mobile device will offer powerful collaborative and interactive learning opportunities. Thus the main objective of the research work is to develop an interactive mathematical model of mobile learning application for Android base mobile devices using web services to facilitate the complete ubiquitous learning. This paper deals with the prototype development and mathematical representation of an M-Learning application for mobile phones running with Android platform using Web services.

Keywords

Ubiquitous Learning Environment, web services, Mobile learning, Android OS, 3G mobile.

1. INTRODUCTION

Educational Technology is constantly evolving and growing, and this progression will continually offer new and interesting advances in our learning environment. Long-established E-Learning systems i.e. Electronics learning developed for laptop and desktop computers were based on stand-alone software application or through websites but E-learning system had failed to provide a comprehensive ubiquitous learning environment means anytime anywhere learning environment [1]. A ubiquitous learning environment (ULE) is any setting in which students can become totally involved in the learning process. Ubiquitous learning provides the learner the freedom from geographical boundaries, devices and learning content format and rather emphasize on the constructivist learning process and cognitive development among learners. Using portable computing devices (such as laptops, tablet PCs, PDAs, and smart phones) with wireless networks enables mobility and mobile learning, allowing teaching and learning to extend to spaces beyond the traditional classroom. Since the mobile devices support the anytime, anywhere learning, m-learning i.e. mobile learning can foster the growth of the ubiquitous learning (U-learning). M-learning application framework enables the learner to access the learning object and interact with the instructor and other learner seamlessly from the tablet PCs while in class, from his mobile phone during traveling or from his laptop when at home[1].

Mobile learning is significant because it's a quickly growing trend. Compared to just a few years ago, mobile learning devices are become a solution of easy student computer interaction [2].

1.1 Mathematical representation of M - Learning: -

System S = *M-Learning system*.

System $S=\{C, T, Q, A, output\}$ [C=courses, T=tests, Q=quizzes, A=assignments]

1. Courses $C=\{S', L, O, T\}$ [L=Language, O=Operating System, T=Technical courses]

- $S' \in C$

  Where, $S'=\{v, t, a\}$ [v=video, t=text, a=audio]

If System S consist of Course C

$Output= \{(S' \wedge L)\ OR(S' \wedge T)\ OR\ (S' \wedge O)\}$

- $L \in C$ [L=languages]

  Where $L=\{$'C', 'C++', 'Java', '.Net'.$\}$

  $C = \{L1, L2, L3\}$. [L1=Level1 for Beginners]

  $C++ = \{L1, L2, L3\}$. [L2=Level2 for Intermediates]

  $Java= \{L1, L2, L3\}$. [L3=Level3 for Professionals]

  $.Net= \{L1, L2, L3\}$.

  If Course C consist of Language L

  $Output= \{(S' \wedge C)\ OR\ (S' \wedge C++)\ OR\ (S' \wedge Java)\ OR\ (S' \wedge .Net)\}$

- *O=Operating System* $O \in C$

Where O= {'windows', 'Linux', 'Android'}.

Windows= {'XP', '98', '2000', 'windows NT'}.

Linux= {'Unix', 'Red hat', 'ubuntu'}.

Android= {'1.x', '2.x', '3.x'}.

If Course C consist of Operating System O

Output= {(S' ∧ windows) OR (S' ∧ Linux) OR (S' ∧ Android)}

2. $T \in C$ [T=test]

Where $T=\{t_1,t_2,\ldots. t_n\}$.

$t1= \{ t_{11}, t_{12}, \ldots\ldots t_{1n}\}$.

$t2= \{ t_{21}, t_{22}, \ldots\ldots. t_{2n},\}$.

:

$tn = \{ t_{n1}, t_{n2\ldots\ldots\ldots}, t_{nn},\}$.

If System S consist Test T

Output= {T}

If test =submit

Let, F(M) = $\sum_{i=1}^{n} t_i$ [M=marks]

If *F(M)<=10* then

R=Fail. [R=result]

Else

R=pass.

Output={R, M}

3. *Q=Quizzes* $Q \in S$

$Q= \{q_1, q_2,\ldots\ldots,q_n \}$

$q_1= \{ q_{11}, q_{12,}\ldots\ldots, q_{1n}\}$

:

$q_n = \{ q_{n1}\ q_{n2},\ldots\ldots, q_{nn}\}$

If System S consist of Quizzes Q

Output= {Q}

If Q=submit

R=result

Output={R}

4. *A=assignments* $A \in S$

A= {A1, A2,....An}

A1= {A11, A12,....A1n}

:

An= {An1, An2,....Ann}

If System S consist of Assignments A

Output= {A}

If A=submit

R=result

Output={R}

2. RELATED WORK

Application development for mobile phones is not uncommon. For example, users nowadays can easily read news, e-mails etc using mobile phones.

In several e-business applications using mobile technology such as PDA's and mobile phones are discussed [5]. These mobile applications are used for various business activities such as hotel check-ins, insurance quotations request and registering, online railway reservation.

In healthcare environment several mobile applications have already been developed and used. For example in [6] a mobile phone application known as patient-centered assessment and Counseling mobile energy balance (PmEB) is used to allow it's user to do self monitoring of their caloric balance in real time. Basically the user of the application would enter their calories consumption and physical activity for the day and the application is then calculate their caloric balance. Whereas in a mobile application that can give verbal motivation and encouragement to obese teenagers to be involved in physical activities is proposed.

As for University domain, several projects have been developed for mobile devices, such as 'Moodlbile: Extending moodle to the mobile on/offline scenario' which were developed by Marc Alier Forment and Mª José Casany Guerrero from the University Catalunya (Spain) [3].

This system was developed for mobile scenario for the most popular Free Open Source Software (FLOSS) learning management system i.e LMS: Moodle. The main goal of the project was to extend to mobile devices the most commonly used activities of a Moodle course: forum, calendar, wiki, glossary and internal mail, in a way that the mobile user may work online as well as offline.

Moodle(Modular Object Oriented Dynamic Learning Environment) is LMS software, and also an Open Source community of more than 350.000 members that releases the FLOSS LMS leader in the market worldwide. Founded in 1999 by Martin Dougiamas, nowadays Moodle is available in 75 languages with registered installations used by more than 15 million students worldwide.

This project delivers an operational prototype of integrated web-based learning and mobile-learning environment. This leads to a whole field of experimentation and research on real classrooms, considering that there already exists a wide base of J2ME enabled terminals. Marc Alier Forment and Mª José Casany Guerrero proposed that by fall 2009 it should be developed in the Android version as well

Other paper was titled 'Quality characteristics and metrics related to m-learning process' which were developed by Paul Pocatilu and Catalin Boja from the university Bucharest Academy of Economic Studies, Romania[4]. This paper was representing certain quality characteristics that were defined by both developers and users for mobile learning applications.

The following quality criteria taken into account:

- Loading time:

  Loading time represents the time the user waits for the page to be downloaded on mobile device and

to be interpreted by the browser. For mobile learning applications that do not render multimedia content and that do not contain large components, the loading time should not be greater than a few seconds.

- Path length:

  To search resources is equivalent with the graph shortest path or the minimization of tree height. The path dimension is represented as the number of open pages or forms until desired information is reached. It is considered that each mobile learning application has a single start page, or homepage.

- Homogeneity degree of input data process:

  The way users interact with the application must be the same for each component. For example, selecting a single option is implemented in the whole application using a combo-box or radio buttons.

- User required information level:

  If there are used forms that require users input data, there must be an appropriate indicator of the required and optional fields, and local data validation must be implemented.

- Continuity of human – application interaction:

  There are avoided situations when users reach a dead-end path without having any possibility to select next page to view. Despite the fact each Web browser allows users to go back to previous visited page, developers must plan to include controls and links that will offer multiple choices to select next page or to return to a particular one.

2. PROPOSED SOLUTION

Trainer

1. Start
2. Register for application
3. Set courses, assignments, quizzes and test papers
4. Check assignments, quizzes and test papers
5. Give feedback to trainee in terms of marks
6. Stop

Trainee

1. Start
2. Register for application
3. Select courses, assignments, quizzes and test papers
4. Submit papers
5. Give feedback to trainer
6. Stop

Administrator

1. Start
2. Login into application
3. Develop application framework
4. Update information of trainee and trainer
5. Delete information of trainee and trainer
6. Stop

Algorithm(Algorithms for M-learning system)

The challenge addresses by mobiles are:

- The ability to get an instance response by prospective learners and contact them immediately or at least within the same day.

- The ability to provide a comprehensive ubiquitous learning environment on the 3G (3rd Generation) mobile device.

- The ability to provide the respected videos for particular courses. Pointed out from the research there are many applications but there are some issues related to Moodle [3].

- The first big issue is the fact that Moodle is not fully developed to cope with big projects. While it may be useful for colleges or universities of small to medium size, the system might not work efficiently with larger schools or organizations.

- This can be troublesome for students when they are trying to take quizzes or tests, or just simply trying to access the course content. The website can also shut down on occasion, blocking the opportunity for students to access course materials.

- Assessment abilities are limited in Moodle, and there are some space issues.

  According to research papers many problems can be addressed but mention above are the major issue so one should try to solve problem related with Moodle, deliver and ULE.

  Surveying the different literatures one can include the following to develop a robust system.

3. Experimental work

The prototype m-learning application developed consists of four activities:

- Login Selection
- Course Selection
- Assignment Selection
- Quiz Question & Answer Choices

3.1 Login selection

Login form provides authentication facility. Only the authenticate users will have the permission to access the M-learning application. In case of wrong username or password it displays an ERROR dialog box.

3.2 M-Learn selection

After successful login this main form will be displayed. This form displays information about courses. Learner can select quizzes, test papers and assignments. There are three levels such as beginners, intermediates and professionals. Information will be displayed in these three levels Learner can select any level according to his learning ability.

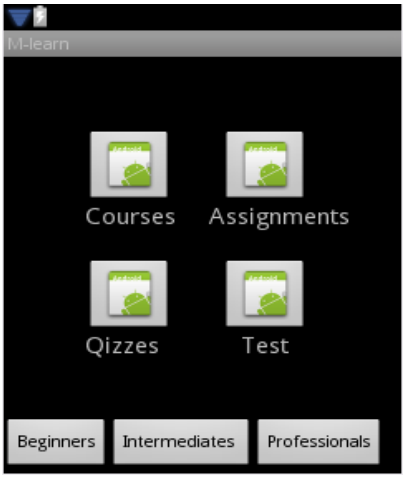

Figure 1 M-learn form

3.3 Quiz selection

This form displays general knowledge, multiple choice questions. Learner can select next question with help of next button or can submit answers. After submitting answers learner will get feedback in terms of marks.

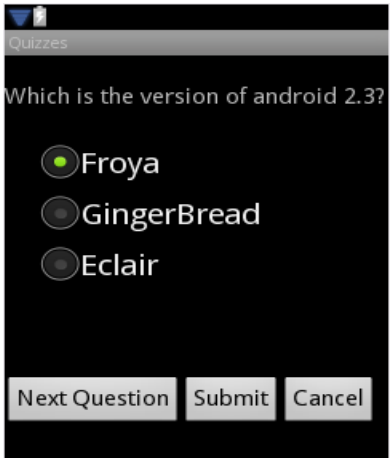

Figure 2 Quiz form

4. CONCLUSION

The ubiquitous learning environment (ULE) evolves more on perspective data than E-learning. Besides the domains of E-Learning, U-Learning may use more perspective understanding to provide most adaptive contents for learners. M-learning application based on 3G mobile devices nicely fits into U-Learning model. Education is happening all around the student but the student may not even be aware of the learning process in the ULE. A ample range of platforms are available to choose to develop M-learning applications. The Ubiquitous Learning environment emphasizes the learner-centric curriculum and content. Among the ample range of choices the open-source nature and rich user interface that even supports sensor hardware and multitasking makes Android a desired platform for designing m-learning application.

Regarding the presented mobile application, the following development directions are considered in order to provide a basis for a working M-learning application.

- New functionalities.
- Interface enhancement.
- Server communication.
- User organization.
- Modules integration.

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