"Design and Development of Mobile Learning Platform"

Aasim Zafar

Department of Information Systems, Faculty of Computing and Information Technology, King Abdul-Aziz University, Jeddah, Saudi Arabia, Email: azahmad@kau.edu.sa

Abstract – The ever increasing penetration of smart mobile devices in everyday life of people coupled with rapid development of wireless infrastructure has resulted in transition of e-leaning towards mobile learning (m-learning). This paper presents an account of developments in this direction and discusses architecture of m-learning system. The proposed m-learning tool could have a potential to add-value on the existing learning system if it is leveraged properly and help in distribution of courseware, user authentication and authorization, gathering of data relative to the user-system interaction, provisioning of mobile services, etc.

Keywords – M-Learning System Architecture, E-Learning Systems

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1. INTRODUCTION

In recent times, the number of mobile users has become 3-fold to the PC users. The ever increasing penetration of smart mobile devices in everyday life of people coupled with rapid development of wireless infrastructure have resulted in transition of e-leaning towards mobile learning (m-learning) (Trifonova and Ronchetti, 2003). The m-learning transition from e-learning has been marked by many researchers (Nyiri 2002; Sharma and Kitchens 2004; Evgeniya et al. 2005; Nyiri 2005) to make learning ubiquitous.

In the light of above developments, the proposed M-learning tool could have a potential to add-value on the existing learning system if it is leveraged properly and help in realizing the objectives of m-learning. Currently some of the higher institutions are using Mobile Learning Systems (M-LS) as a complementary to get aforementioned advantages. In addition, learning of Structured Programming course can be made more exciting and learners are able to learn enjoyably and more effectively. This is anticipated to enhance their interest and performance.

2. M-LEARNING APPROACH

The term m-learning approach is given to the delivery of learning materials by means of mobile devices that can be accessed anywhere and anytime. Taking into account the functionalities of e-learning system, we analyze the possibilities to extend it to provide services for mobile devices. Due to the varieties and limitations of mobile devices, there is no any conventional standard or specification to develop M-LS. Thus, there are various types of M-LS using different specifications that depend on the case study. Nevertheless, the proposed system would be evaluated according to their capabilities and services they support using some of the indicators which are specified in (Dye and Torstein 2008; Attewell 2005; Evgeniya et al. 2005; Naismith et al. 2005; Riaza & Fazilah 2010). These are: types of supported mobile devices; availability of content; supported types of data and tools used; and types of information.

2.1 Types of Supported Mobile Devices

The term mobile device includes not only mobile phones, smart phones and PDA, but also every portable device for instance, tablet PCs and laptops. WELCOME (Wireless E-Learning and Communication Environment) is a m-learning approach at the University of Regensburg which supports both PDA and Pocket PCs as a selected mobile device based on their capabilities and less constrained features (Lehner and Nosekabel 2002). Sharples et al (2002) developed HandLeR (Handheld Learning Resources) at University of Birmingham to provide learning resources and assist for all ages of learners in their personal learning using handheld devices which have fulfilled the requirements mentioned in (Sharples et al 2002). MobilP (Mobile learning platform) is a web based learning system which supports both mobile and non-

mobile computing devices (Yuen-Yan et al 2003). It aims at providing educational contents and communication services to teachers and students, anytime and anywhere. Devinder and Zaitun (2006) have developed M-learning application for wireless classrooms at University of Malaya which aims to facilitate the educational opportunities of teaching in a real time wireless classroom using Pocket PC, notebook and mobile phone as a learning instrument on Windows platform. Moreover, Anang et al. (2006) have developed M-learning management tool in campus-wide environment by using Microsoft.Net infrastructure which is Windows platform. WAP-Supported devices from a wapsite and website using WML based application was used in (Motiwalla 2007; Li He et al. 2009).

2.2 Accessing Content

At present, depending on the communication between M-LS and users there are three types of access methods (Evgeniya et al 2005). The first type requires permanent communication between system and users' mobile device. According to Niazi and Mahmoud (2008), there are two types of technologies which are supported online access method of the content: browse based and native technology. The next one is offline M-learning which means using communication temporarily to download the materials and used later weather there is communication or not (Anang et al. 2006). In the proposed research, it would be possible to get access using either from mobile phones or laptop/PC.

Types of Supported Data

The content of the system is a fundamental part of M-LS. Audio and video files (O'Connell and Smith 2007) need much memory and high processing speed of mobile devices. Most researchers are using graphic and text (Tan-Hsu Tan and Tsung-Yu Liu 2004). For text, previous M-LS supported data types are HTML, XHTML (Niazi and Mahmoud 2008) XML (Devinder and Zaitun 2006). In this research, we propose to use boyh J2ME midlets, and XML text file formats.

3. SYSTEM ARCHITECTURE

The objective of the proposed research is to build a robust m-Learning platform which will provision courseware delivery both in m-Learning (online and offline) and e-learning methodology. The proposed platform is envisaged to composed of course content and its mixed variety of modules for wide variety of device delivery - like Smart-phones, Tablets/iPads, PDAs, feature phones (with GSM-GPRS) and also for PCs and Desktops as e-Learning courseware. The courses will be rendered over mobile devices both as online and offline mode with limited connectivity. In the limited connectivity environment the courses and their modules are delivered on the devices. The modules will be delivered for users to work with mobile devices with limited connectivity and their performance is captured and updated on first available connectivity scenario. The online delivery of courseware is delivered over browser based rendering of courseware where chunked and offline courses are delivered through mobile based classroom application designed with built in Offline Course management toolkit, User performance tracking, P2P connect, and online Sync of Device Data and Course Content (over Devices) on first found connectivity basis. To achieve the objectives of this research, we propose 3-tier architecture including mobile phone devices and PCs as the client tier, servlets that support LMS functions as the logic tier, and the database as well as metadata and XML file as the data tier. The proposed system supports both e-learning (PC platform) as well as m-learning (mobile phones). Figure 1 depicts the architecture of the proposed system.

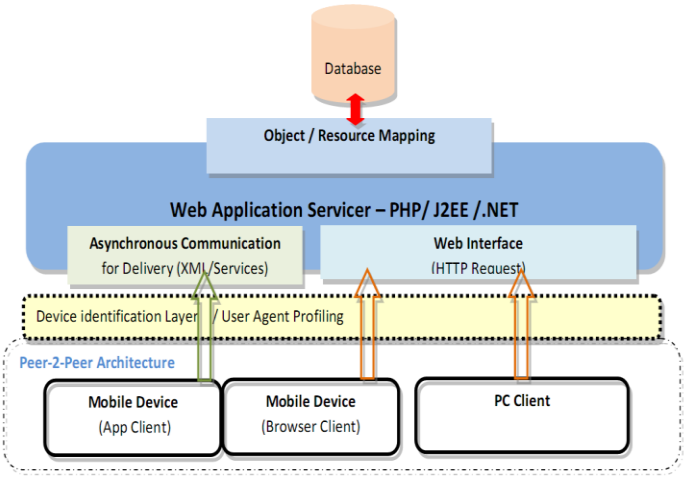

Figure 1: Architecture of the proposed system

As one of the objectives of this research is to evaluate the m-learning system using a structured programming course in java, the proposed system also provides facilities to compose and compile java programs using mobile phone. We will integrated Mobile Applications (on Smart Phones) with Open Java IDEs for Mobile level code composition and compilation and also integrate with cloud based Open IDEs for online learning environments for browser based delivery on mobiles and e-learning delivery over internet on PCs and Desktops. A Peer-2-Peer compilation or Cloud based compilation will be created for user with feature or low-end devices like Nokia S-40 and S-60 series for code compilation and running using peer devices or cloud based compilation environment.

The administrators will have access to develop course content using variety of multimedia components like, Images Objects, Video Objects, Simulations, Animations, Info-Graphics and Text. The learning objects are stored in learning objects repository managed by the Learning Resource Management Module of the platform. The Course can be developed by the Course Developers and/or Administrators using the Course Authoring Module of the platform. The learning objects of the platform will be made available for cross sharing on the LMS.

3.1 Delivery Method

The Course is delivered both as Asynchronous and Synchronous methods over the air. For PC and browser based Mobile delivery the GUI is designed as Responsive Design to fit the mobile screen and the content and the components of the courseware are delivery on runtime.

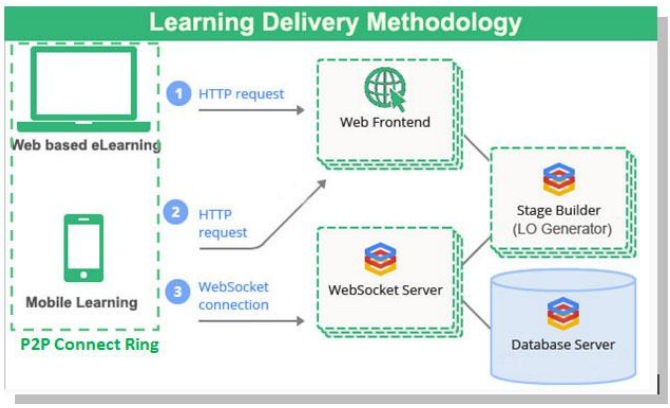

Figure 2: Proposed Delivery Methods

The mode of access is HTTP connection using WIFI /DSL/ broadband. In Case of Mobile devices with limited connectivity, the courseware is delivered asynchronously using Socket Connection over GPRS or 2G or 3G connectivity. Here the course components are downloaded on Mobile devices (SD-ROMs) and a local database is created to deliver content and capture usage and performance. The local database syncs with the server end database on first connectivity basis thereby updating the user tracker, user performance and related information.

3.2 P-2-P Connect Ring

This framework is developed for the students to share content and information. This is designed like a Social media component as information exchange within the students' networks. Here the students can share their Projects, LOs, Test Performances and also use the P-2-P connect for communication.

3.3 Code Compilation

As the platform is developed for students of Programming and Commuter science, it is important that they are able to compile, run and test programming scripts. Also this layer will be available in 3 different modes for 4 different types of device access, namely Synchronous Web based for PCs, Synchronous Mobile based for Browser based learning, Asynchronous Mobile application Base Delivery, Asynchronous Low-resource Devices Code Compilation. The 3 ways of integrating Code Compilers and Runners are:

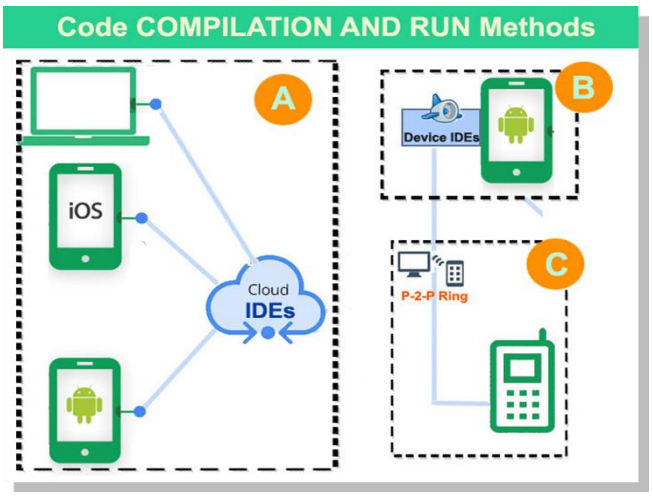

Figure 3: Compilation and Run Module

A. **Establishing Cloud based Open-IDE** for Code Compilation and Running for Web based and Mobile Browser-based users.

B. **Integrating Open-Mobile IDEs** for Code Compilation, Running and testing on the device. This will be done by integrating the Mobile App with Open – IDEs for Mobile like **JM-Mobile** and **AIDE** (Android Integrated Development Environment), **Ada**- Android Integrated Development Environment.

C. **Peer-2-Peer Code Runner Method** – We will build special Code Compilation interface for low-end devices like S-40 and S-60 series and run the code on Peer-2-Peer network devices (type B or type A). Here the code will be sent to a peer device or to the cloud and response of the runner is received with output of the code snippets. This is done specially for low-end and low-resource devices which do not support possibilities of establishing Code Compilation IDEs at device level.

3.4 Proposed Technology for Development

The M-Learning platform comprises of variety of Backend and Frontend tools. Content Management System, LMS, Student Registration Modules and Administrative Modules will be developed in PHP/ MySQL using Jscript, Jason and XML technologies.

The front end Tools will be developed using HTML5/ Java Script / Jason and XML for universal App for large variety of Mobile devices. The Native M-Learning application will be developed for variety of Mobile device delivery like using Java for Android phones and Tabs, Java VC or C# application for Windows Mobile or Objective-C for iPhones and iPads, Java/J2ME for Low end Java devices.

4. CONCLUSION

This paper discusses the transition of e-learning from to m-learning and the supporting technology and devices which makes it possible. The design and development of m-learning platform has been discussed specifying the course delivery methods and code compilation techniques for learning programming under such environment.

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