DESIGN AND DEVELOPMENT OF MOBILE LEARNING APPLICATIONS USING DRUPAL

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Abstract

The growth of the mobile industry is an important aspect in the link of the global village. Another aspect is the Internet. The introduction of VoIP, video conferencing, emailing and TV reviewing also support the communication becoming much easier. The Internet becomes a reliable source of information; Users learn more from the Internet than anywhere else. Therefore, there are many educational institutions publishing their learning material on the Internet. So that e-learning becomes an essential learning method now days. Student can access the learning material everywhere, every time. While the mobile industry offers many 3G services, mobile operators still lack of the application that allowing users to access learning material while on the move. Mobile learning is an excellent solution to solve this problem. This will be supported by mobile features improvement, cheaper and faster data rates. This paper gives a simple idea of developing mobile learning where users can access learning material in similar way to blackboard via mobile devices, called blackboard mobile.

Keywords: e-learning, m-learning, Drupal, MySQL, Open source software

Abstrak

Pertumbuhan industri seluler yang pesat merupakan salah satu aspek penting dalam suatu komunikasi global. Aspek lainnya adalah Internet. Pertumbuhan VoIP, video conferencing, email dan TV juga sangat mendukung suatu komunikasi menjadi lebih mudah. Internet menjadi salah satu sumber informasi yang yang dapat dipercaya. Dimana pengguna lebih banyak belajar dari Internet daripada sumber-sumber lainnya. Oleh karena itu, banyak lembaga pendidikan mempublikasikan materi belajar mereka di Internet. Sehingga e-learning menjadi metode pembelajaran yang penting sekarang ini. Mahasiswa dapat mengakses materi kuliahnya dimana saja dan kapan saja. Sedangkan industri mobile menawarkan banyak layanan 3G, tapi operator seluler masih kekurangan aplikasi yang memungkinkan pengguna untuk mengakses materi belajar mereka pada saat bepergian. Mobile learning adalah solusi yang sangat baik untuk memecahkan masalah ini. Makalah ini memberikan ide sederhana mengembangkan mobile learning di mana pengguna dapat mengakses materi pembelajaran melalui perangkat mobile disebut dengan blackboard mobile.

Kata Kunci: e-learning, m-learning, Drupal, MySQL, Open source software

1. INTRODUCTION

The Internet has vastly changed the communications industry. It has been a major contributor in easing communications with people all over the world. This has led to the ideology that the world is shrinking with communication advancements being responsible for this. Nowadays, the world is referred to as a global village showing just how small it is viewed. The growth and advancement of the Internet has been encouraged by faster data rates and broadband speeds coupled with progression in computer capabilities. This has encouraged the growth of the web which contains millions of sites used for all purposes with even 3D and high definition graphics now available. Numerous social sites are on the rise as well as many applications used in live video conferencing such as Skype.

Learning methods have thus been affected by the Internet. Many people frequently access search engines such as Google, Yahoo and Wikipedia to seek information on various topics. Therefore learning has become much easier with a larger user knowledge database and people learning new things by the minute. This type of learning, regardless of the material, is referred to as e-learning. It involves the use of electronic devices for purposes of gaining better understanding on any topic.

Initially most web access was done via computers. However improvements in technology have made accessibility via mobile devices. Therefore mobile users are demanding similar services to those of computers. Mobile users can now chat to friends and seek information through

browsing while on the move. This is a more informal way of learning seen in industries (including job institutions) as well as learning institutions. This concept of anywhere, anytime learning while on the move is what is referred to as mobile learning referred as m-learning.

Blackboard has launched Blackboard Mobile Learn for Blackberry, Android and iPhone OS powered devices across Europe, the Middle East and Africa, bringing two-way teaching and learning to millions of students. Available as a free download, Blackboard Mobile Learn application is envisioned to recreate and enrich the course experience of online teaching and learning platform – Blackboard Learn. Using it, students can check grades and assignments, email their classmates and instructors, and add discussion board comments and blog posts and more. The company's existing Blackboard Mobile Central application (available for the iPhone and BlackBerry devices and through mobile web) already delivers a "mobile campus experience," including news, events, maps and sports amongst a range of student life and service options.

2. MOBILE LEARNING
2.1 Introduction

Since the commencement of the Internet age, different projects have been undertaken by various individuals towards the realisation of m-learning. Some either succeeded or provided a stepping stone towards successful implementation while others failed. An example of an experiment was done by a group, in 2002 [1]. Though the research involved analysing a Handheld Learning Resource prototype (HandLeR) for children aged between 9-11 years old, the same technology was applied to a universal m-learning application and device, which relied mainly on active user participation and interaction of an individual with the learning resource. The technology allowed the user to interact with the environment and capture material in form of pictures and notes. These materials would then be further researched on at a later time where more information about the material could be gathered from books, journals and the Internet. This technology would encourage learning throughout an individual's life introducing the idea of lifelong learning.

Though the idea was brilliant, technology was limited and relatively primitive at the time. Hence the authors (researchers) concluded their research saying the technology use should be postponed until further advancements were made in the communications industry. This was because the data transfer rates at the time were limited to mainly GPRS with slow access to Wireless LAN. This resulted in a slow and expensive method of accessing the Internet by public. The types of devices used for this type of learning were also mainly pen tablet PC's. Tablet PC's were

expensive and fairly complicated to use. These were some of the constrictions hindering further development of m-learning at the time.

However, in terms of Internet technology used at the time, there was similarity to presently used Internet protocols consisting of XTML based sites with HTTP though slightly primitive [2]. The users required a database server to create a web based environment and PHP was also popular. Later, Internet technology introduced graphics which could not be supported by the previous mobile phone versions. Therefore much progress needed to be made in order to support m-learning.

2.2 Future Mobile Learning

However, this was not a blow to m-learning according to surveys the research group carried out; many individuals liked the idea of learning in a virtual learning environment away from the physical classrooms where discussions with a wider range of activities were available [3]**.** This is also supported by another author, who carried out a similar survey among individuals ranging from managers to students in Ireland [4]. This was through questionnaires discussing the effects and importance of m-learning and was done in conjunction with the Ericsson mobile company. Majority of the participants (averaging about 72% compared to over 50% in the HandLer survey), indicated that m-learning was a fun, easy and relevant source of learning, which they felt increased the learning and knowledge of individuals through interactions with the web and recommended m-learning as a future means of education in all sectors. However similar problems were discovered in both cases. Many (about 55%), felt that navigation through the resources using the available devices was still complicated. Cost of communication such as browsing and sending messages was still difficult and expensive. Therefore the type of devices used and cost of communications was a problem a few years ago that was needed to be overcome to encourage development of m-learning, which was gaining popularity.

Currently, a range of technologies are available to support m-learning, including emails, video communication, social chatting, faster data rates, advanced mobile devices and the introduction of 3G technology. The most important of these in initiating m-learning is the capability of the mobile device itself. Factors that need to be considered in mobile devices, to allow mobile learning to take place are as follows [5]:

- *Screen size*: Where a smaller screen with lower resolution has minimal capability therefore requires simpler text based learning material for support. Better resolution displays allow the use of even video material in m-learning.
- *Types of navigational buttons*: Most mobile devices use a small size keypad to allow

interaction with the screen and explore content. However many rising mobile devices offer touch screen capability and smart phones use the QWERTY type keyboard system making it easier to navigate through information.

- *Method of communication*: Communication methods of mobile device are an important feature. Mobiles which allow video interaction such as video conferencing enable easy access to data in a relatively faster method compared to audio and text capability only.
- *Type of memory, processor and operating systems used*: Larger memory capability allows storage of more data in a device. A fast processing system allows faster access to data and an operating system that is able to support software available.
- *Availability of software and support*: That is able to support video content, emailing, pictures and web browsing. It makes easier to implement mobile learning, for example, most software used in mobile devices is in Java format.
- *Battery life*: A longer battery life allows longer access to learning content. This enables longer and continuous learning to take place. Longer battery life means that content that uses up more battery such as video may be allowed to run for longer.

These features, when in their most advanced state and converged together appropriately provide support for various virtual learning scenarios [6]. Though the authors mainly focus on e-learning, the same fundamental principles are transferable into a mobile environment with available technology. A virtual learning environment as mentioned involves distance learning and is mainly online based. In m-learning, a problem noted by these authors is the method of content delivery to be used by tutors.

2.3   Mobile Learning Methods

A few types of learning methods that may be used in content delivery as follows [7]:

- *Didactic learning*, which involves the giving of information by the tutor through electronic books and notes where the students are able to just read the information therefore limiting the learning process to only viewing material and not changing it. The tutor and student may then meet and discuss the material provided at a later date.
- *Discursive learning*, this involves the coming together and interacting of the students provided with the material through discussions, forums and online chats. This may hinder further face to face contact but allows a larger and active participation by the parties involved.

Though not sure on the best method of content delivery, the author in both cases [6] and [7] propose a 'blend' of the two methods, which is decided upon by the tutor. This is referred to as 'Blended learning'. This helps create the idea of collaborative learning

where developing an actively managed virtual learning environment with material availability such as lectures, courses, quizzes and discussions is a better way of handling m-learning. This is the main concept in this project.

2.4   Presentation of Contents

The method of presenting learning material in a mobile environment also needs consideration. For the HandLer experiment, a cartoon based interactive avatar was used which contained a range of menus on its sides to allow access into options offered [8]. This avatar was used because the audience was mainly young. It was simple, straightforward and easy to use according to the students.

In websites, presentation is everything and the most successful websites are those containing a less complicated navigation. A balanced site is one which contains both text and imagery in a simplified design. This better conveys the information to a user and throughout the book; the author stresses the importance of simplicity in content [9]. Pictures help in better presentation of data and keep user interested. Therefore in all audience environments the method of content presentation is essential in successfully conveying the learning material.

In a mobile environment, the device capability is also considered when presenting content with availability of a simple text based option for lower bandwidth and version users.

3.   OPEN SOURCE SOFTWARE
3.1 Introduction

Open source platforms are commonly and widely used by many developers of dynamic websites. Open source means that the coding of the particular application is available for the general public free of charge, to be modified and distributed [10]. Though this has raised complaints from the public about the security and interests of such use, this is called the general public license [11].

Open source allows any user or developer to easily modify certain software code existing in the application without actually developing the whole code, and only editing parts to well suit the particular requirement. They are designed in a way to support collaboration with other software and developers. It helps in saving both time and resources as many developers share their packages and modifications with each other.

Many of these platforms are easily accessible via the web and increasingly becoming popular due to the growth of the Internet. They are considered user friendly that can be accessed using most of the available browsers and operating systems. The source code may be viewed in PHP and HTML formats and java. Some open source platforms are used in web designing. Although some may contain inbuilt

modules and themes, they allow users who may wish to develop their own themes and modules.

3.2 Drupal

Drupal is known as an open source platform that is categorised as a content management system (CMS). This means that it can be modified, once downloaded and installed, to suite the purpose of web designing [12]. Once downloaded its various features can be accessed and used to modify the application to better suit the developers' requirements. Some of the features to be modified include the modules, themes, blocks, user roles and menus. Through its user friendly GUI, all this can be done without the need for expertise programming.

A web server and database server are required. The database server is used to store the developing websites information such as user names, passwords and also influence the behavior of its templates. Database server used by Drupal is MySQL, PostreSQL and others. A web server may be an internal such as localhost computer or an external allowing access from the Internet.

Drupal supports HTML viewing, java and CSS. The main languages used in its scripting and template developments are HTML and PHP. They may be used to modify some of the main features described above such as themes. However with the increasing of using XHTML for enhancing websites, the application has begun enabling XHTML as well. This is a slightly more advanced form of HTML.

The application is also available for numerous operating systems such as Windows, Linux, Mac and Solaris. This enables its users to operate the software without the need to change an operating system. Therefore it also saves a lot of money for its users and can be said to be economical. It can also be accessed from any of the available browsers hence not browser restricted. Therefore, it supports current technologies suitably.

3.3 Web server application

A web server application is software mainly used to provide HTTP services to a client such as another computer. The most common is the open source Apache which is the world's most popular HTTP web server that is used in almost 50% of the world's busiest and active sites [13]. Other web server applications used include; Microsoft server, Google server and Sun System provided by Java.

3.4 PHP Script

PHP is the shorter version of Hypertext Pre-processor, a scripting language that is mainly used to provide a computer language for writing mainly web scripts that are displayed as HTML files. PHP software is free and can be obtained from www.php.net. Its project initially started in 1995 by Rasmus Lerdorf has become popular ever since. It is

responsible for generation of web pages [14]. It can be used on all operating systems and different versions of the original software have been released to offer more functionality to many of the current websites available on the web.

3.5 Host server

A host server is a system providing hosting services for web content. This content is accessed via HTTP requesting by use of a URL address of the server. Examples of servers include the web where hosting services are available allowing hosting of up to terabytes of data. Another example is a local host which may be a user personal computer. The only requirement for this to occur is availability of storage space for hosting material.

3.6 Database server

A database server is a server used to provide database services such as storing information used in a site development. Some of this information includes; site blocks, themes, configurations and settings, tabulated data of the site, user information, user roles and any passwords available. The most commonly used database is MySQL. However others are available depending on the nature of content including PostgreSQL.

3.7 XAMPP

With the advancement of technology and the rise in number of web developers, simplifying the development of web applications and making them easier to use has become a reality. This is due to development of a number of software referred to as cross-platforms, which combine PHP, MySQL and Apache [15]. An example of such software is XAMPP. It is an open source software, which offers a user friendly GUI and easy use of PHP, Apache and MySQL. Instead of the hectic downloading and solo installation of each of these applications, XAMPP provides an already compacted version combining all of them to produce a user control panel where a user is able to turn each on and off as required. It also offers FTP server software which allows FTP transfer of data to an external host server. XAMPP allows its users to make their localhost a web server after installation. The software is available from www.apachefriends.org for four operating systems, namely: Solaris, Mac OS X, Windows and Linux.

4. DESIGN AND DEVELOPMENT

Drupal is used to develop and design a blackboard mobile. The application can be used by student who looking for information on various courses and discussion material. In order to operate these applications, modification of the core of Drupal will be require.

4.1 Installation

The steps of installation can be explained as follows:

Installation Page: Assuming PHP and Apache have installed and MySQL database has created. Drupal is downloaded from www.drupal.org. It is available in a tar.gz format where the latest, most stable version is used. After downloading and extracting the files, the unzipped folder is moved to the htdocs folder of the xampp directory. Drupal folder is installed by accessing it through a web browser. The URL used in accessing is http://localhost/blackboardmob. With the XAMPP control panel on and both Apache and MySQL running, entering the above URL gives the welcome screen.

Database Configuration: Clicking the 'install Drupal in English' option gives a requirements problem. It is important to note that the copy of the file is renamed, not the original file. The new file is then given write permissions. On refreshing the browser, the next page is displayed prompting the database username, password and name of the database created at the beginning to be entered.

Site Configuration: On the site configuration page, the name of the site is required. This site is called Blackboard Mobile. The administrator user account and password is also set up here. The account is given a strong password which prevents hacking and hence loss of information. Information given on this page is also essential as this user will be referred to as the super user, having all privileges to the site which include changing settings and modifying all elements of the site.

Welcome page: The welcome page to the new site appears with the sites name next to the blue druplicon. Drupal has been installed on the user localhost.

4.2 Site Building and Configuration

The site is built by configuring and modifying the following;

Administration and User configurations: To start the journey towards running a successful mobile site, the settings on the administer page are modified. Because the 'super user' account has access to all settings, it is easy to modify settings for other roles. There are two default roles excluding the Administrator that are Authenticated user and Anonymous user. The registration method to Blackboard Mobile as it is now called is important. New members will require administration approval before being accessing to the site. Permissions are also given on the administration user management page as to who has access to certain modules and blocks. Blackboard Mobile will allow mobile users to add content to their pages and also publish stories, which other users can view and comment on. These pages are viewed by only authenticated users.

However, for demonstration purposes all content will be viewed by anyone.

Themes: Site building involves changing the display and appearance of content available for Blackboard Mobile users. Due to the site mainly provides educational purposes, the themes and menus on Drupal are modified to better support and create a learning environment.

Modules: To create a mobile site from Drupal, a module that simplifies XHTML content to mobile friendly material is required. Though mobile phones are advancing and continue to advance, a module and theme that caters for both 2G and 3G phones is used. The small screen size in mobile phones is a factor also considered. Blackboard Mobile will be made easier to navigate by users using a module by the name Switchtheme. This will allow a user to switch between themes to a simplified HTML text based version of the site if required. The module gives a block which is renamed to Go Mobile in Blackboard Mobile.

Upload module is to allow users post and publish stories. The comment module allows users to make comments on published material. An audio module is enabling audio posts of either music or lecture. Blue droplet Video module is also installed to allow video posting. This will reduce the monotony in Blackboard Mobile of using one media source making users able to choose preferred method of broadcasting information. Therefore users with camera and video enabled mobile devices can capture information while they are 'mobile'. Mailsave and Mail handler modules which are allow users to post content via e-mail on mobile phones. The modules also allow users to view their email via Blackboard Mobile without leaving the site. The network operators will allow a client to send material via MMS to Blackboard Mobile.

Menus and Blocks: The available menus and blocks are modified and renamed to fit well in the site. New menus are also created making the site more organised. This allows easy navigation between materials on the site. For Blackboard Mobile, a course/module/subject menu is created. This will list the names of the available topics and subject discussion areas such as Telecommunication Management Network, Mobile Communication Systems, etc. Menu settings are also changed where in Blackboard Mobile, the default pages such as home page, welcome page and external links are listed on the primary links menu. Other menus added include; site news and latest news menus. The site news menu gives information about the sites development. It will also provide any latest information concerning mobile learning developments in the world. Another menu is forums. This allows users to create posts for discussion which will be displayed to all users. The discussions are grouped and may involve any topic chosen by a user.

The switch theme block will be available on all pages. Some blocks are also only available to authenticated users. These include the courses block.

Site configuration: Modules are configured based on user settings. Some modules will be available to all users. This allows the user also take part in site building. Other settings made are on the type of input formats for the web pages. The options available are filtered or full HTML. Filtered allows only text while full HTML permits display of pictures and video material. The display is set to Full HTML for Blackboard Mobile.

The sites performance is also a feature of site configuration. Because mobile users are the main target market, page compression is enabled. This helps save on bandwidth and improves information download at the same time. Block caching is enabled to prevent the reconstruction of blocks during each page load. This saves browsing time and increases accessibility to pages at all times.

Creating Content: All settings and configurations have been done so that contents can be created. Blackboard Mobile offers a range of content types which include the following; Stories, Web Pages and sub pages, Audio and Video content, Forums and RSS Feeds. Titles are given for various web pages, which will provide links to the content contained on the pages. For audio content to be created, the audio module is enabled. Pages and sub pages are also developed for different topics and some video content is also embedded. Videos are obtained from locations such as You Tube.

The front pages and published stories are all arranged appropriately on the website in a manner that can be viewed by users. Some pages also have embedded RSS feeds based on the subjects they fall under. An example is an RSS feed for the Mobile Communication Systems page only. This gives information on latest news and discoveries in Mobile Communication Systems. Feeds are added and managed to display and display on the selected pages. The feeds are set to update after approximately 15 minutes hence keeping up to date with information.

Most of the content developed for Blackboard Mobile is in Full HTML therefore pictures will be displayed well. The size of photos and videos is also reduced to allow better view on lower resolution devices. Forums are available for comments and criticism. This will promote social discussions on Blackboard Mobile. An external link page is also developed that provides a link to a social networking site for mobile learners.

Updates: During site development, regular updates of the sites modules are made available. To perform updates, the site is placed on offline mode. The content is then backed up together with the databases in case anything goes wrong. The downloaded updates are then unzipped and placed in the folder which contained the Drupal files. While doing this, a prompt appears on whether to overwrite existing files. This is accepted. The site is then placed back into running mode and back up files restored. To restore the files, they are returned to the Drupal directory in the htdocs folder of XAMPP.

5. CONCLUSION

Mobile enabled site has been designed and discussed. The application can be used by student who seeking information about various courses. Collaborative learning is also promoted though the chats, discussions, forums and quizzes available where mobile learners can interact and get more information on the courses and share ideas. This also promotes communication between users in a wider area network. The content can also be modified by anyone without the need for programming. This encourages more users to get involved in the developing of a community based mobile learning environment.

The content created could become more interactive through the use of interactive games, 3D graphics and activities which make learning fun and encourage participation by larger groups. This becomes possible while mobile industries keep developing and offering faster broadband speeds for mobile devices. Mobile devices need to be cheaper and better designed to access the web and support higher resolution graphics, with a fairly larger viewing screen size. Those are important in promoting and encouraging the development of mobile learning applications.

For the future, modules and themes should be better developed in the CMS's to support mobile learning environments. Development of mobile themes and modules will be essential in supporting mobile learning.

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