Empowering Learning Through Mobile Technologies

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Abstract

University Integrated Management System (UIMS) which was implemented way back in 2004 is the manifestation of the management's intention to provide comprehensive information system to UPSI netizen based on academic & student management system (MySIS), finance information system (MyFIS), human resources & administration system (MyHRIS), learning management system (MyGuru) and community portal (MyUPSI). MyGuru is a platform with various functions and features designed to support an online teaching and learning process. To provide a better e-learning environment, MyGuru approached cloud computing technology which emphasizes on high availability and stability rather than functionalities only. E-Learning requires student and lecturer to interact and communicate more often hence instant access in a comfortable manner is required. Moreover, today's students carry a vast array of mobile devices those operate across a massive fragmented and shifting market to be connected all-time. Motivated with this, UPSI came up with an idea of e-learning through mobile environment named MobiLearn. MobiLearn is aimed to students, staff and guardians. Modules like News, About UPSI, Location, Telephone Directory, University's anthem, FAQ, Staff & Alumni Directory are additional components of MobiLearn. MySIS and MyGURU's features like Private Message, Group Forum, Group Announcement, Group Member, Assignment, Lecture Notes, General Announcement, My Class, MyGuru Alert, Coursework and Exam Result are transformed to mobile outlook. MobiLearn is a web based mobile application to ease lecturers and students in UPSI to access UIMS for teaching and learning purposes. Developed using open web technologies such as HTML, CSS, and JavaScript, MobiLearn are capable to run across platforms and devices. Apple's Safari, the Android browser, Opera Mobile (and Mini) and IE9 on Windows Phone's support for HTML5 and increasing related modern web standards provide us some great new features to build a powerful web application. JQuery Mobile and PHP scripts play a major role in building. Users with a decent 3G or Wi-Fi internet, can access MobiLearn anywhere and anytime compared to accessing a full-fledged webpage using a mobile gadget.

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1. INTRODUCTION

Mobile learning, through the use of mobile technology, will allow citizens of the world to access learning materials and information from anywhere and at any time. Learners will not have to wait for a certain time to learn or go to a certain place to learn. With mobile learning, learners will be empowered since they can learn regardless time or place they want.

Recent times have seen the field of mobile technology grow exponentially, leading to institutions increasingly recognizing the importance of delivering content and services to users through their mobile devices. In many cases these can simply be delivered using the web, optimizing the websites for use on smaller screens. However, in some cases we may wish to deliver a service that takes advantage of the native capabilities of today's powerful smartphones, such as GPS for location based services and delivering features such as access to campus services like the library, timetabling, room bookings or local travel information are preferred.

University Integrated Management System (UIMS) which was implemented way back in 2004 is the manifestation of the management's intention to provide comprehensive information system for UPSI

netizen based on academic & student management system (MySIS), financial information system (MyFIS), human resources & administration system (MyHRIS), learning management system (MyGURU2 & MyGURU3) and community portal (MyUPSI). MyGURU is a platform with various functions and features designed to support an online teaching and learning process. To provide a better e-learning environment, MyGURU approached cloud computing technology which emphasizes on high availability and stability rather than functionalities only.

E-Learning requires student and lecturer to interact and communicate more often hence instant access in a comfortable manner is required. Moreover, today's students carry a vast array of mobile devices those operate across a massive fragmented and shifting market to be connected all-time.

Thus, to fulfill the needs, we came up with an innovative idea of converting a full-fledged webpage in a mobile gadget with a small screen layout. MobiLearn is a mobile application developed on open source based which supports most available platform and gadgets for UPSI netizens.

It is invented by customizing appropriate modules in UIMS into a simple and user friendly mobile environment. This application optimizes the features of smart gadget which are iconic-based interface and simple text.

1.1 Problem Statement and Objective

Students and lecturers need to interact and communicate more often hence instant access in a comfortable manner is required.

Desktops and notebooks have disadvantages in terms of mobility due to dependency towards power and network resources.

From the problems stated, we came out with the main objectives of this project as listed below:

- Enhance the Blended Learning modes currently used in UPSI
- Increase the flexibility of learning
- Encourage and support ubiquitous learning
- Integration with other main systems

To be more specific, the main objective of this project is to develop a dynamic and customized mobile learning application for the use of students and analyze how this approach will guarantee and accelerate the teaching and learning process through blended learning as practiced.

We also consider the integration of MobiLearn with the existing Learning Management System as a major prerequisite for operating an efficient and effective large scale online learning system. [1]

1.2 Innovation

Implemented in UPSI since 2004, UPSI is now moving forward with mobile application invention for smart gadget such as Apple Mobile Devices and Android.

The current UIMS user-friendly interface is optimized for Desktop Computer. Therefore, smart gadget users will encounter interface restriction while accessing UIMS. UPSI Mobile Application is developed to provide maximum satisfaction and efficiency for users accessing UIMS through smart gadget overcoming the namely issue.

MobiLearn is a customization of University Integrated Management System specifically developed for smart gadget user. MobiLearn consists of 3 main user components; students, staffs/lecturers & guardians. **Table 1** shows the modules provided in MobiLearn.

MobiLearn is accessible via smart gadget such as Apple Mobile Devices and Android through the URL http://m.upsi.edu.my.

Table 1: Modules in MobiLearn

Modules	Staff	Student	Guardian
News	✓	✓	✓
Location	✓	✓	✓
Contact	✓	✓	✓
Directory Staff	✓	✓	✓
About	✓	✓	✓
Profile	✓	✓	✓
My Course	✓	✓	✓
My Class	✓	✓	✓

Account	✓		
Pay slip	✓		
Attendance	✓		
Student Profile			✓
Student Course			✓
Exam Result		✓	✓
Change Password		✓	✓
Media	✓	✓	✓
FAQ	✓	✓	✓
Alumni	✓	✓	✓

2. METHODOLOGY

2.1 System Analysis

MobiLearn development is based on the discipline of System Development Life Cycle (SDLC). We started with analyzing the user requirement. Input from users comes via the direct question and answer and the response from the ICT services provided. User consists of lecturers, tutors, students and system analysts. We also carry out a needs analysis based on study and observation of other mobile applications like social network.

The findings show that this project is derived from these factors:-

- The rapid increase in mobile gadget usage
- Instant information access
- Quick responds in e-learning
- The domination of eBooks.
- Mobility convenience
- User centered approach on implementing E-Learning

We designed the application using data flow diagram as shown in **Figure 1**.

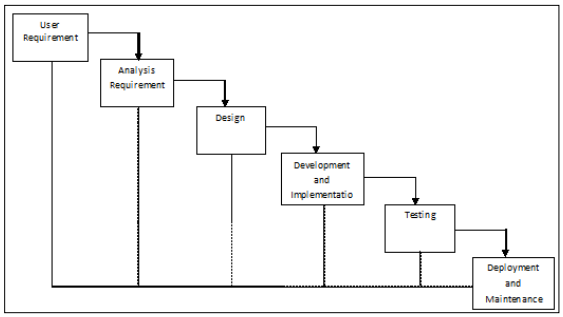

Figure 1: The development of MobiLearn is based on SDLC

3.2 System Design

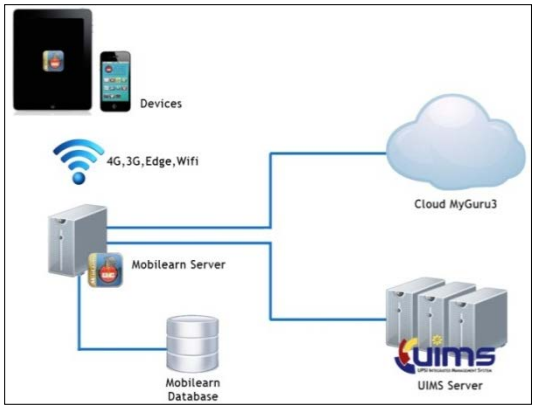

Figure 2: MobiLearn Infrastructure

We designed the system based on requirements from the users and capability to integrate and synchronize the available learning and teaching data. The MobiLearn's server maintains the database for contents and other information. Though it has its own database for stand-alone purpose, MobiLearn's server will be synced with other servers such as MyGURU, MyFIS, MySIS and MyHRIS for data integration.

3.3 Users

The external entities of the application can be stated into three (3) categories which are Lecturers, Students and Guardians. Lecturers can practice MobiLearn as a flexible and portable communication tools for teaching and learning purposes. Apart from providing notes and updates, MobiLearn is a medium for continuous interaction with students through forum, private message, chat and video conferencing. They can also conduct online assignment and testing

through mobile which able to gain quicker response from the students.

Students can access the resources given by their lecturers for learning and teaching purposes such as notes, announcements, assignments, forums and many more. Besides, they can access the results of their examinations, latest profile, mentor mentee information, e-portfolio and so on.

Meanwhile for guardians, the Guardian Information System displays achieved results for their offspring as well as courses that are being taken and the response from the academic advisor.

3.4 Modules

We classify MobiLearn into 3 types of users. The lecturers and students will have the privilege to access My Profiles, My Course, My Class, Alerts, and Course Work. Student can access their examination result, and so are their guardians. Guardians are also allowed to access their offspring's profiles and courses taken.

Meanwhile Common modules such as News, About, Location, Staff's Directory, FAQ and Alumni can be accessed by anyone in search for general information on the entities related.

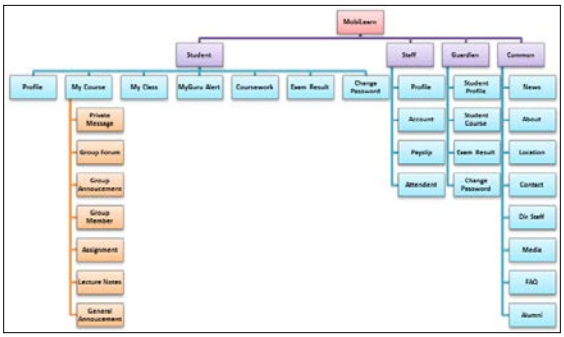

Figure 3: Decomposition diagram depict MobiLearn features as a whole

3.5 User Interface Design

The mobile Web is different, but the design process is similar enough for Web designers to ease into mobile design works. Designing a perfect mobile website is an impossible task even for experts, but by using an interactive user-centered design process can help create the best experience for the users.

The most significant difference between a mobile device and a desktop is the screen size. Mobile phone's screen sizes have increased over the years, but are still small in comparison to a standard desktop screen design. This gets more complicated when we consider the range of screen sizes used by the mobile users. [4]

Even though many smartphone browsers today can miniaturize desktop websites, they inadvertently break the user's experience by making them zoom in and out, which makes us to the traditional approach of creating a separate website for mobile devices.

Table 2: Comparison of Native Apps and MobiLearn in terms of UI

Native Apps	MobiLearn
Each mobile application development platform (e.g. iOS, Android) requires its own development process	Runs in the mobile device's web browser and each may have its own features and quirks
Each mobile application development platform has its own native programming language: Java (Android), Objective-C (iOS), and Visual C++ (Windows Mobile), etc.	Mobile web apps are written in HTML5, CSS3, JavaScript and server-side languages or web application frameworks of the developer's choice (e.g. PHP, Rails, Python)
Standardized software development kits (SDKs), development tools and common user interface elements (buttons, text input fields, etc.) are often provided by the manufacturer of the platform	There are no standard software development kits (SDKs) that developers are required to use to make a mobile web app
There are tools and frameworks to help in developing apps for deployment on multiple mobile OS platforms and web browsers (e.g. PhoneGap, Sencha Touch 2, Appcelerator Titanium, etc.)	

3. TECHNICAL SPECIFICATION

System development or coding is carried out after the design process. Platform selection takes into consideration these three aspects: Easy to use, rapid development and open source. PHP has been used as the main coding language based on its reputation as fast, stable, secure, easy to use and open source language. The detail specification noted as follow:

- Programming Language: PHP, HTML5, JavaScript
- Database: MySQL
- Frameworks: JQuery Mobile
- Platform Supported: iOS, and Android devices
- Mobile Browser Supported: Safari and Chrome

3.1 Database

MySQL 5.0 is selected because of these features:

Scalability and flexibility - MySQL database server provides scalability, supporting the capacity to handle embedded applications with a footprint of only 1MB to run massive data and hold terabytes of information.

High performance and availability - A unique storage-engine architecture allows database professionals to configure MySQL database server specifically for particular applications.

Robust transactional support - MySQL offers one of the most powerful transactional database engines on the market. Features include complete ACID (atomic, consistent, isolated, durable) transaction support, unlimited row-level locking, distributed transaction capability, and multi-version transaction support.

Web and data warehouse strength - MySQL is the de-facto standards for high-traffic web sites because of its high-performance query engine, tremendous fast data insert capability, and strong support for specialized web functions.

Strong data protection – MySQL offers exceptional security features that ensure absolute data protection.

Manageability - MySQL offers exceptional quick-start capability with average time from software download to installation completion is less than fifteen minutes.

Low total cost of ownership - By migrating current database-drive applications to MySQL, UPSI enjoys cost saving in licensing and database maintenance.

3.2 Application

MobiLearn uses JQuery Mobile as the development platform as it is a touch-optimized web framework currently being developed by the JQuery project team. The development focuses on creating a framework compatible with a wide variety of smartphones and tablet computers, made necessary by the growing but varied tablet and smartphone market. JQuery Mobile is the right choice for MobiLearn's framework because:

- Compatible with other mobile app frameworks and platforms such as PhoneGap and many more.
- Compatible with all major mobile platforms as well as all major desktop browsers, including iOS, Android, Blackberry, WebOS, Symbian, Windows Phone 7, and more.
- Built on top of JQuery core so it has a minimal learning curve for people already familiar with JQuery syntax.
- Theming framework that allows creation of custom themes.
- Limited dependencies and lightweight to optimize speed.
- The same underlying codebase will automatically scale to any screen. - HTML5-driven configuration for laying out pages with minimal scripting.
- Ajax-powered navigation with animated page transitions that provides ability to clean URLs through pushState.
- UI widgets that are touch-optimized and platform-agnostic.

3.3 Operating System

For the server and back-end solution, we are using Red Hat Enterprise Linux for operating system.

3.4 Web Server

Apache is used as the web server for this project based on these advantages:

- Supports a wide variety of operating systems.
- Can be customized for the needs of MobiLearn.

3.5 Design specifications

Open source integrations. Linux, MySQL, Apache

Uses industry standard open protocols. HTTP, Extensible Markup Language (XML)

Horizontal scalability. Load balancer to distribute workload into 3 different servers with cluster technology for the database.

Browser based client interface.

4. RESULT AND DISCUSSION

During the deployment period, we made an observational study on MobiLearn and native application. Our findings are illustrated in Table3, Table 4, and Table 5:-

Table 3: Comparison of Native Apps and MobiLearn in terms of delivering methods.

Native Apps	MobiLearn
Downloaded onto a mobile device	Accessed through a mobile device's web browser
Installed and runs as a standalone application (no web browser needed)	No need to install new software
Users must manually download and install app updates	Updates are made to the web server without user intervention

Table 4: Comparison of Native Apps and MobiLearn in terms of versioning

Native Apps	MobiLearn
Some users may choose to ignore an update, resulting in different users running different versions of the app	All users are on the same version

Table 5: Comparison of Native Apps and MobiLearn in terms of strengths

Native Apps	MobiLearn
Typically perform faster than mobile web apps	Have a common code base across all platforms
App stores and marketplaces help users find native apps	Users don't have to go to a store or marketplace, download the app and install the app

We implemented MobiLearn to the users after conducting the internal testing process. From February to June 2012, 1,976 users have used MobiLearn application with 5,574 hits as depicted in Figure 4. 53.07 % is new visitor where the others is returning visitor.

Students are the major contributors in MobiLearn's usage statistics as they need to access the coursework and examination result through mobile.

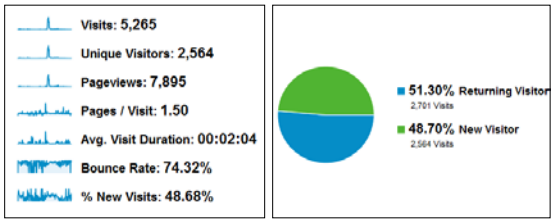

Figure 4: MobiLearn Usage from February - July 2012 (6 Month)

Number of access increased significantly from May 13 until May 27 as it is the period of examination result as depicted in **Figure 5**.

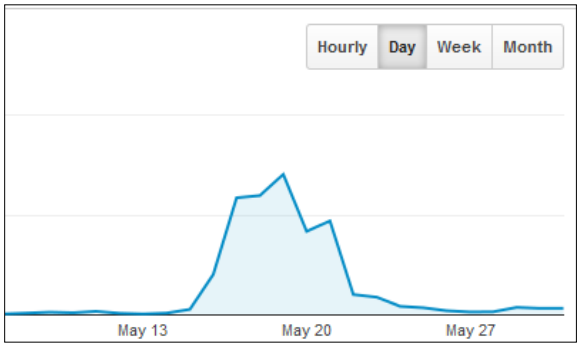

Figure 5: The usage trend of MobiLearn

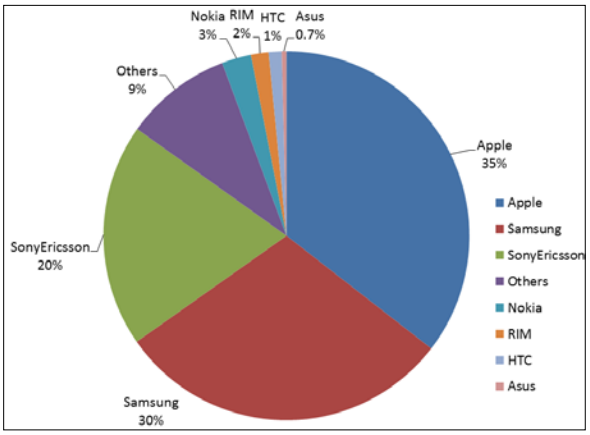

Figure 6: Mobile device branding from February - July 2012 (6 Month)

Figure 6 shows the trend in mobile devices selection by MobiLearn users where Apple, Samsung and SonyEricsson cover almost 85% from the total amount.

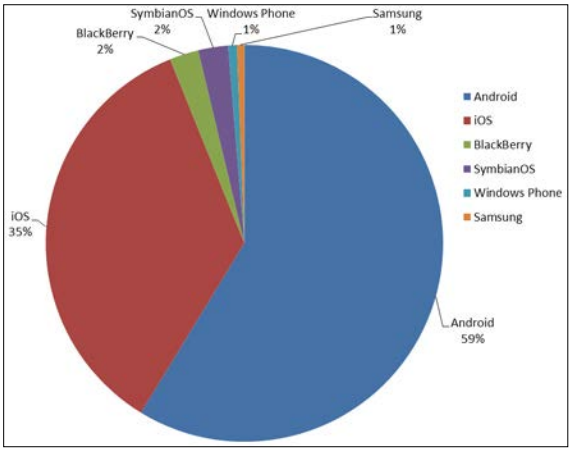

Figure 7: Mobile Operating System from February - July 2012 (6 Month)

Though Apple dominates the device branding, Android is the most preferable mobile operating system by MobiLearn users as shown in **Figure 7.** This is because many mobile device manufacturers chose Android as their operating system. The combination of iOS and Android cover almost 95% of MobiLearn user's operating system.

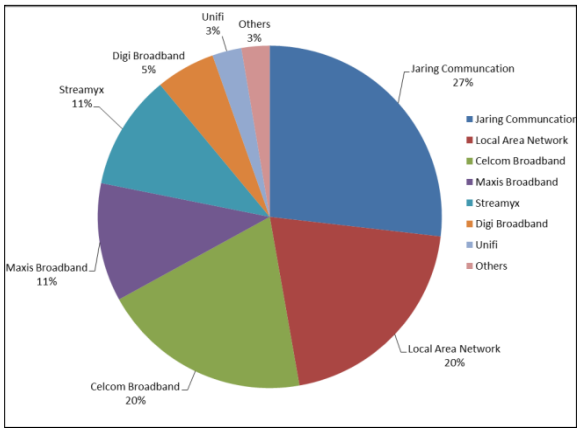

Figure 8: ISP Statistics from February - July 2012 (6 Month)

Figure 8 shows that Jaring and LAN are the main provider as they are located in UPSI. Both cover 47% of overall service provider. The significant usage of 3G Broadband (Maxis, Celcom, Digi) proves that MobiLearn is compatible with any wireless network.

5. CONCLUSION AND FUTURE WORKS

This paper covers the implementation of MobiLearn based on requirement analysis, development and deployment. The findings show that the number of usage increases even after few months of implementation of MobiLearn. JQuery speeds up the development process and facilitates the integration with other applications.

MobiLearn has been beneficial to the development of learning and teaching process as follows:

- Students can now study anytime and anywhere.
- Green technology.
- MobiLearn enables students to connect with their peers, lecturers, distant partners, and even interest groups worldwide.
- MobiLearn is accessible via 3G broadband or Wi-Fi.

The rapid development of mobile technology in Malaysia also offers a wide prospect for commercialization. There are millions of mobile users among university students.

In addition, with the emergence of Generation Y that is more open and sophisticated, it is possible that one day, all web applications are also available in the mobile platform.

Future Enhancement

For the future enhancement, we plan to upscale the applications to predict the student's trends and behavioral patterns and cater for them with live updates based on these trends. Lecturers can also monitor their student's activity and learning approach with this pattern. [6] Therefore, lecturers can understand the trends and best approach to deliver lesson to the students individually.

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