Designing and Developing a Mobile-Cloud E-Learning Application

by

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FINAL REPORT

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CERTIFICATION OF ORIGINALITY

This is to certify that I am responsible for the work submitted in this report, that the original work is my own except as specified in the references and acknowledgements, and that the original work contained herein have not been undertaken or done by unspecified sources or persons.

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CERTIFICATION OF APPROVAL

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A project dissertation submitted to the
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_____

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ABSTRACT

The mobile-cloud E-Learning application is an application software which can be downloaded into a mobile phone or a smart phone. This application software functions with the presence of a network, which is the Internet. The objectives of this project are to study on how the contents of the current existing E-Learning can be adapted to the mobile phones/smart phones which will then lead to designing and developing the contents of the mobile E-Learning application to suit the small screens of the mobile phones/smart phones using the cloud computing concept. This objective was made due to the problems identified during the research of the limitations of the current E-Learning system which are usability and accessibility problems. The scope of this study is to design and develop a mobile-cloud E-Learning application for the specifications of the BlackBerry OS 6 with the functions of viewing and posting announcements as well as downloading and uploading lecture notes by students, lecturers and management staffs respectively. The methodology used for the research are distributing online questionnaire and conducting interviews. On the other hand, the project methodology chosen is the prototyping method which requires users' participation. Finally, up to date, the distributed online showed positive response from the responders whereby they support the mobile version of the E-Learning system.

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CHAPTER 1: INTRODUCTION

1.1. Background of Study

This project is about designing and developing a mobile version of the E-Learning system while applying the concept of cloud computing. This idea of the Final Year Project has been inspired by the Universiti Teknologi PETRONAS (UTP) E-Learning system. The E-Learning system is a web portal whereby students and lecturers can upload and download files such as lecture slides or submission of assignments, and also post in any types of information in it. Besides that, this web portal is also used by other management staffs of the University whereby they post vital information in it. This is a very efficient and effective way of communication between all parties in the University; i.e. students, lecturers and management.

This E-Learning system is a very familiar system for all the Universities and Colleges both inside and outside the country. From my research conducted via the Internet and also querying from my friends from other Universities in Malaysia, this E-Learning system is only available as a web-based portal. This means that, this system is designed and developed specifically for the usage of users when they access to this system using a laptop, desktop, iPads and other devices similar to these stated. Yes, of course users can view this system using their smart phones if they are connected to the Internet. However, the view of the system is very limited and definitely not user-friendly. This is due to the difference in size of the screens of the devices; i.e. web-view versus mobile view.

For the purpose of the Final Year Project, this system will be developed based on the BlackBerry OS 6 device configurations, instead of developing a general platform for all mobile users. This decision is taken due to the constraints of time and also knowledge of mobile programming languages. The further research of this system will be to develop this mobile-cloud E-Learning system for a general platform of mobile devices such as Androids and iPhones.

This project will be the result of the combination of all the knowledge and experience learned and gathered from my study in this UTP. This combines the web application development and also the mobile application development programming techniques and languages.

In a nutshell, the mobile-cloud E-Learning application is an application software which can be downloaded into the mobile phones or smart phones. However, this application will not consume the device's memory but instead; its storage will be placed in the cloud. In better teams, the client will only view the application interface whereas the server, database and the processes will be stored conducted in the cloud.

1.2. Problem Statement

1.2.1. Problem Identification

The problems that are being faced by the users of the E-Learning system has been identified. All these problems sum up to two major problems, which is as stated below:

i. Usability

The current E-Learning system is specifically designed for the web usage purposes only. This means that, the view of this web portal looks and works perfectly fine when viewed with a laptop, desktop, notebook, iPad or anything else similar to these stated. However, when the same system is viewed using mobile devices; i.e. smart phones, the view are very limited as compared to viewing using devices with bigger screens. This is because the size and dimensions of the smart phones are much smaller than other devices like laptops and desktops. Besides that, the information which is fitted on the web portal are too much or too congested to be viewed using the smart phones, giving the users an unclear view and a user-friendly system.

ii. Accessibility

Another major problem is that lecturers, students and also other management staffs are always on-the-move. Sometimes, they might not have any other devices with them except for their smart phones. For instance, a lecturer has to go outstation due to job issues and do not have time to access to a desktop or laptop to post information that his/her class will be cancelled. So, what happens is that he/she only manages to send text messages to a few students and there are times

when many other students do not get the information that the class will be cancelled. Using the smart phone to view the E-Learning is also inconvenient because it gives a very congested view of the system. This limits what the users can see, update, etc.

1.2.2. Significance of the Project

This mobile version of the E-Learning system promotes to more functionalities and usages of the ubiquitous computing. Mobile devices are everywhere around us. So, it is efficient for us to fully use the devices for our own benefits. In this case, this system will benefit all the students, lecturers and management staffs of a University or College. They can and will be using the mobile E-Learning system wherever they are and whenever they need to without the need to have devices such as laptops, desktops, etc. but accessible with just a small smart phone.

This system will definitely solve the problems stated above; i.e. usability and accessibility problems. Users of this system can use this system anywhere and anytime using their smart phone devices and also get a clearer view of the system whereby only the vital functions will be screened on a mobile device, which suits the needs to users who are always on-the-move.

Besides that, the E-Learning system will be used more often than not by all students, lecturers and management staffs and it will become a very important and a very trustable source of two-way communication between the management (lecturers and staffs) with the students. Hence, there are less chances of miscommunications to occur among these three parties; i.e. students, lecturers and management. With this, work can be performed more effectively and efficiently.

The main advantage is that users do not have to download any specific application to get this system running. All they need is for their smart phone devices to be connected to the Internet. More often than not, all the lecture halls and academic blocks in a University or College are equipped with Wi-Fi access. Thus, lecturers can easily upload a file on the E-Learning and students can easily download the file from the E-Learning by just using their smart phone which has easier access to the E-Learning system.

1.3. Objective and Scope of Study

i. Objective of Study

The main objective of this project is to study on how the contents of the current existing E-Learning can be adapted to the mobile phones/smart phones. Besides that, this study is done to design and develop the contents of the mobile E-Learning application to suit the small screens of the mobile phones/smart phones. In other words, this system is to enhance the usability and accessibility of the E-Learning system for all the users of this system; students, lecturers and management staffs.

Another objective of this system is to promote and contribute to the ubiquitous computing by enhancing the functionalities of the smart phone devices. Smart phones are everywhere and are being used widely for many different purposes by all types of people. By storing the database and the server on the web and only using the application on the mobile device without having the need to occupy the memory space of the mobile device contributes to the effectiveness of the cloud computing concept.

ii. Scope of Study

This mobile E-Learning system will be developed based on the specifications of the BlackBerry OS 6 smart phone. This is to narrow down the scope from building the application for a general mobile platform to a specific smart phone

due to the time and knowledge constraints. The mobile version of the E-Learning will contain limited data and information which will be determined through various data gathering techniques such as interviews and surveys to find out what exactly the users need to view from the E-Learning system from their mobile devices. The most functions voted by the responders of the online questionnaire are to view announcements and download lecture notes.

1.4. Relevancy of the Project

This mobile E-Learning project is relevant to the problems and the objectives stated in the earlier part of this report. This project will be developed to solve the usability and accessibility problems of the current E-Learning system. And as the objective implies, this project will be conducted to study the contents of the current E-Learning system to be adapted into the mobile phones or smart phones while applying the cloud computing concept.

Besides that, this project is relevant to my major, which is in Software Engineering. It is relevant in terms of the courses taken and the knowledge learnt during my study here in UTP. I believe that any software that is created in order to enhance the usability and efficiency of a particular system and to reduce the complexity of the system when the end users are accessing it is a product of a good software engineering. Hence, this project definitely enhances the usability of the existing E-Learning system as well as will act as a user-friendly system for all its users. This project will be beneficial to all the students, lecturers and management staffs of any University or College as it makes their daily tasks much easier.

1.5. Feasibility of the Project Within the Scope and Time Frame

This project is very much feasible within its scope and time frame. The reason to why this Mobile E-Learning version is chosen to be developed only for the BlackBerry smart phone is due to the time constraint. Since only two semesters have been allocated for the Final Year Project, which is roughly eight months to complete this project, the scope of this mobile E-Learning application has been narrowed down. This, in which if I

am given a chance to further this research of mine, this mobile e-learning system will be developed for a general platform so that users of Android and iPhone smart phones can also access this application. I believe that with the proper planning of my time (as per the Gantt chart in Chapter 3 of this document) I am able to complete my project fully and deliver it the project in a good quality.

CHAPTER 2: LITERATURE REVIEW

2.1. The Advancement of E-Learning to Mobile E-Learning with Cloud Computing

E-Learning

The idea for the mobile-cloud E-Learning application was generated from the existing E-Learning system. But why design and develop the mobile version of the E-Learning system when the existing E-Learning system can already be viewed using the mobile phones or smart phones? This existing E-Learning system was designed specifically for the web view. Yes, of course it can be viewed using the various smart phones available in the market now, provided it is connected to the Internet. However, the view of the system on the mobile phone screens as compared to the devices such as laptops, desktops, etc., is very much limited and the information are congested which limits the clear viewing of the system by users and limits the actions that can be performed to it. Designing and developing an E-Learning application specially for the purpose and use of the E-Learning system for smart phones will increase the credibility of the whole E-Learning system whereby it shall become a more reliable source of communication and data sharing among the students, lecturers and management staff of this University.

In a journal written by Martin Ebner (2007), he mentioned that the possibilities to support teaching and learning with the aid of computers seem to be endless. Not few people promised a great future if we use e-Learning components in our educational educations. In the past, the term e-learning referred to any method of learning that used electronic delivery methods. With the

advent of the Internet however, e-learning has evolved and the term is now most commonly used to refer to online courses. A multitude of systems are now available to manage and deliver learning content online Teresa Monahan, Gavin McArdle, Michela Bertolotto (2006). From this, we can say that the E-Learning has been evolving much throughout the years to ensure that students and lecturers can communicate more efficiently. If this is the case, then the mobile E-Learning concept is sure to make things easier for both the lecturers and the students.

In the Next Generation e-Learning journal, written by Assoc. Prof. Thanomporn Laohajaratsang, Ph.D**.,** he mentioned that the more add-ons eLearning platforms contain, the more complex they become. Some eLearning platform users are now facing difficulties locating where things are, or how to navigate to where they want to go within the platform. In the next-generation of eLearning, a more simplified navigation, in which related tools are grouped or linked, is needed. In addition, a more user-friendly interface design should be created and adopted in the next-generation eLearning platforms. In other words, a simplified version of the E-Learning should be created in which I believe the mobile E-Learning is one of the solutions to it whereby only important functions will be included in the application such as posting and viewing information and also uploading and downloading lecture notes.

(Paul Pocatilu, Felician Alecu, Marius Vetrici, 2010)E-learning is widely used today on different educational levels: continuous education, company trainings, academic courses, etc. There are various e-learning solutions from open source to commercial. There are at least two entities involved in an e-learning system: the students and the trainers. The need for education is increasing constantly and the development and the improvement of the e- learning solutions is necessary.

As mentioned by Xiao Laisheng and Wang Zhengxia in Cloud Computing: a New Business Paradigm for E-learning (2011), E-learning is an Internet-based learning process, using Internet technology to design, implement, select, manage, support and extend learning, which will not replace traditional education methods, but will greatly improve the efficiency of education. As e-learning has a lot of advantages like flexibility, diversity, measurement, opening and so on, it will become a primary way for learning in the new century. There exist two generations of e-Learning platforms. The first generation includes applications that were mainly

oriented toward the delivery and interoperability of content design within a particular platform. The second generation is focusing not only on sharing content, but also on sharing learning objects, sequences, and learner information. Developing towards the next generation, the current generation anticipates a new scenario where "users can build custom e-Learning platforms from a vast range of e-Learning services" in a dynamic way, "letting customers choose the right combination of services for their requirements" (Sidhant Rajam, Ruth Cortez, Alexander Vazhenin, Subhash Bhalla, 2010).

Mobile E-Learning

Arne Hildebrand, Thomas C. Schmidt and Michael Engelhardt (2007), came up with a conclusion that the mobile e-learning content is on demand. In their journal, they mentioned that student's views of life and dedications have equally changed. Spatial and temporal occupancies have undergone a major Paradigmatic shift, accessibility and trendiness play important roles in utilizing services and devices. Standard systems such as mobile phones or PDAs, but also specialized gadgets, i.e., MP3–players, gaming stations or dedicated professional equipment, must be increasingly considered as people's primary access devices to information, communication and entertainment. They all remain with us in unoccupied times and are particular candidates to serve for learning content feeds in every day's life. Through the usage of mobile E-Learning, students and lecturers can perform ubiquitous learning and information sharing. Meaning, they can access the E-Learning anywhere they are.

Besides having to only share resources and communicate through the e-learning, lecturers can also post in quizzes for students to complete using their mobile phone. In a journal written by Jason Haag, it is stated that time spent completing course using the e-learning version takes up about 45 – 60 minutes whereas using the mobile version takes up about 20 – 30 minutes only. Hence, doing quizzes using the mobile phone saves lots of time and is quick and efficient as well. As mentioned in the EDUCAUSE (2010), as learning management systems adapt to the mobile platform, m-learning may become a common tool for exploration by tech-savvy faculty. The use of mobile devices seems a natural fit for distributed learning and field activities in that

handheld technology can not only accompany the learner almost anywhere but also provide a platform that is rapidly evolving and always connected to data sources. In simpler lay-man terms, we can say that people nowadays from all over the world are always seen with their mobile phones. Hence, having applications in their mobile phones actually makes their daily lives much easier to be managed.

The availability of advanced mobile technologies, such as high bandwidth infrastructure, wireless technologies, and handheld devices, has started to extend e-Learning towards mobile learning (m-learning) (Sharples, 2000). However, some people may state that the size of screens on mobile devices is not so helpful when viewing information. As stated by Santally Mohammad Issack, Mussawir Hosany & Ramsawok Gianeshwar (2006), the size of the screen definitely affects the usability aspect, the range of features that can be supported, the organisation of the navigational structure and the pedagogical approaches that can be adopted. Although from the study, it seems learners are not against downloading and reading documents on their mobile devices, craming pages of text (and most probably images) in that small space is not so obvious from a technical perspective. From a pedagogical perspective, this implies a complete re-engineering of courseware to meet the constraints imposed by an m-learning environment. In any virtual learning environment the concepts of usability, pedagogy and technology form a balanced triad. On a Study of Mobile E-Learning-Portfolios by Hsieh-Hua Yang, Jui-Chen Yu and Lung-Hsing Kuo, Li-Min Chen, Hung-Jen Yang (2009), in this modern world where mobile technology dominates and all things communicate without hindrance, it is important that we determine what precisely we are trying to say. Thus, getting proper information to be displayed clearly on a mobile phone screen is as vital as developing a mobile version of a system. There is no point in developing a software that does not ease its users' daily tasks.

Hardware advances are one of two key components to the emergence of m-Learning, the other being networking. To be mobile technology, hardware had to advance to a point at which people would carry and access the device on a regular basis. Wireless networking is the second technological component contributing to m-Learning success. While some m-Learning resources can be utilized in a non-networked, offline environment, many depend on access to the Internet to exchange information and access up-to-date information. To serve this need, mobile devices

needed a way to access network resources without plugging into a land line connection (**Jason G. Caudill, 2007).**

Luo,Zhong, Qingji,Xue, Hua,Liu, Jingling,Yuan (2010) M-Learning is a novel learning mode following the emergence of E-Learning. It's achieved by effective integration mobile communication technology and based on E-Learning. However, the development of M-Learning restricted by the level of existing mobile communication technology to a large extent. The development of 3G technology and mobile communication speeds increasing make it possible for M-Learning. M-Learning based on 3G networks expands distance education and E-learning technology, which is the learning and educational mode in future. It crosses restrictions of time space and provides a wider world for learners. M-Learning has many features such as timely, ubiquitous and personalized.

Cloud Computing Applied in Mobile E-Learning

The concept of mobile E-Learning also contributes to the cloud computing concept. The Wikipedia source states that cloud computing is the delivery of computing as a service rather than a product, whereby shared resources, software and information are provided to computers and other devices as a utility over a network (typically the Internet). When talking about the cloud computing architecture, it would be helpful to divide it into two sections: the front-end and the back-end. They connect to each other through a network, usually the Internet. The front-end is the side the computer user, or client sees. The back-end is the cloud section of the system. The Figure 1 below shows the basic architecture of the cloud computing concept.

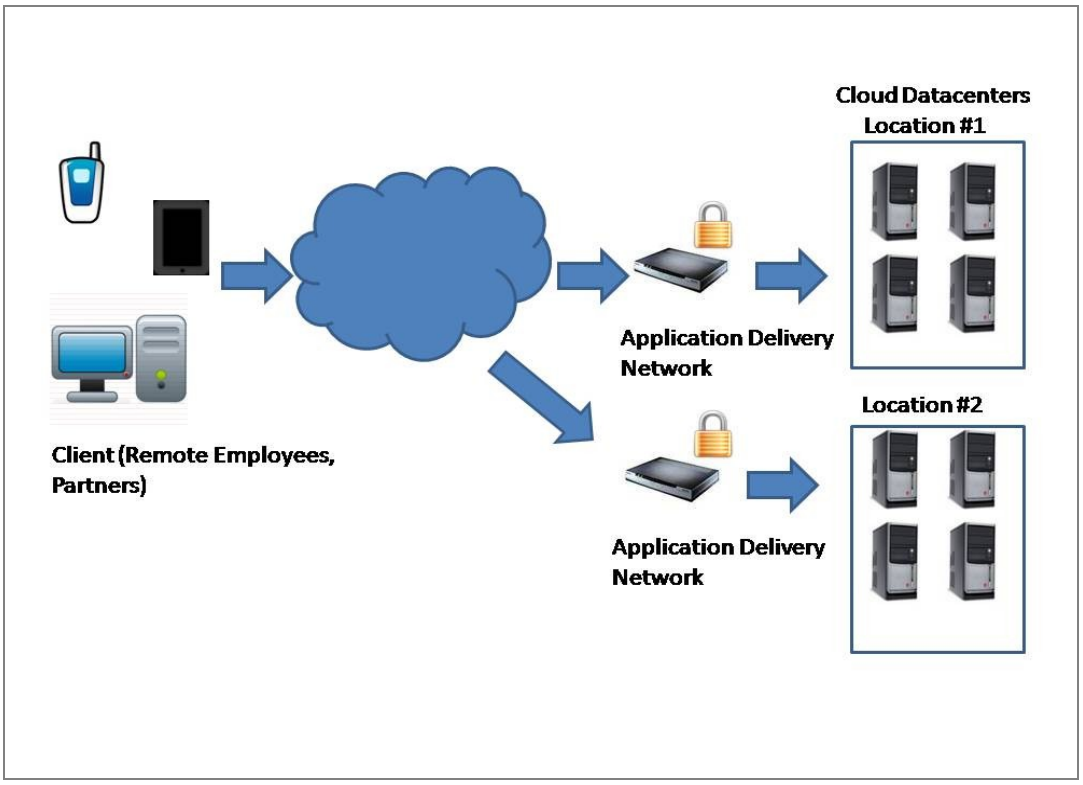


Figure 2.1 – Cloud Computing Architecture

M-learning is designed for the users to interact with instruction resources while away from their normal learning places– classroom and computer. Users can acquire IT infrastructures or software and platforms from computing Clouds and then run their own applications inside. Therefore, the clouds render users with accessing hardware, software and data resources as services, in a transparent way (Qin Shuai, Zhou Ming-quan – 2011). Educational institutions can take advantage of cloud applications to provide students and teachers with free or low-cost alternatives to expensive, proprietary productivity tools. Browser-based applications are also accessible with a variety of computer and even mobile platforms, making these tools available anywhere the Internet can be accessed (Mohammed Al-Zoube, 2009). This proves that the concept of cloud computing has significant effects on the education process in today's world.

Also, the e-learning systems need to keep the pace with the technology, so the new direction is to use cloud computing. In this context, a new type of service computing model---- cloud computing platform for E-Learning provides the required information technology, so good

compatibility for information technology; and the cloud computing platform also provides the necessary foundation for integration of platform and technology environment for a variety of scattered of teaching resources, under the existing conditions as much as possible to meet the demand of the teaching, research activities for resources (Zhang Guoli, Liu Wanjun, 2010).

All the learning contents can be hosted in the clouds, in the remote servers, that instructors don't need to maintain their own software and hardware (Xin Bai, 2010). This type of computing provides many advantages for businesses—including low initial capital investment, shorter start-up time for new services, lower maintenance and operation costs, higher utilization through virtualization, and easier disaster recovery—that make cloud computing an attractive option (Karthik Kumar and Yung-Hsiang Lu, 2010). This means that implementing the cloud computing concept in a mobile E-Learning application makes this system much more reliable as the device's memory (in this case, the mobile phone) will not be consumed since the storage of the database and the server is on the cloud.

In order to combine the advantages of new technology and advanced education concept, after studying the development and key features of mobile learning and cloud computing, Shaoyong Chen, Min Lin, and Huanming Zhang (2011), introduces a mobile learning system based on cloud computing, and presents the functional design and system architecture framework design of the system. At present, mobile learning based on the support of cloud computing is still in the preliminary exploration stage, but the advantages in the cloud computing indicate that the field of mobile learning based on cloud computing has a great development potential.

Andreas Klein, Christian Mannweiler, Joerg Schneider and Hans D. Schotten (2010) - Research indicates that Mobile Cloud Computing will additionally help to make visions of context-aware services become reality. However, Mobile Cloud Computing concepts rely on an always-on connectivity and will need to provide a scalable and - when requested - high-quality mobile access. Mobile Cloud Computing (MCC) will help to overcome limitations of mobile devices in particular of the processing power and data storage. It might also help to extend the battery life by moving the execution of commutation-intensive application 'to the cloud".

From all the works of other people stated above, the E-Learning concept has evolved very much throughout the years, especially contributing and adapting to the current technology - the cloud computing concept. Hence, creating a mobile version of the E-Learning is sure to contribute to the advancement of the technology through ubiquitous computing. Even though many might say that the current UTP E-Learning can already be viewed from their smart phones, which I do not deny, but how effective is it? Because, the congested amount of information when viewed using the smart phone limits the view and actions to be performed. Besides that, due to the excessive amount of information and function that needs to be loaded on a smaller screen as compared to the desktops and laptops, it takes a longer time to load on a smart phone. Thus, having a separate application – simple and adequate information and functions included for the purpose of the smart phone will definitely help the users of the UTP E-Learning, especially students and lecturers in making the communication among them easier and more reliable, due to its accessibility anywhere and anytime.

2.2. Related Works

There are two existing projects in which I found them related to my project, the mobile-cloud E-Learning application. The first project is entitled Mobile Software Development for An Open Source E-Learning Platform. This was done by a MSc. I.T. student from Queen Mary and Westfield College University of London, Ms Erline Cut-Hennies under the supervision of Dr. Alan Pearmain. The aim of this project is to add a Wireless Application Protocol (WAP) presentation interface to the Open University Support System (OpenUSS), which is categorized as a Learning Management System. The objective of this project is to design a mobile access that provides OpenUSS users with information retrieval via mobile devices from the universities that use OpenUSS system.

The second project is entitled Courier: A Collaborative Phone-Based File Exchange System. This was done by Amy Karlson, Greg Smith, Brian Meyers, George Robertson and Mary Czerwinski. It is a part of the Microsoft Research (One Microsoft Way, Redmond, WA 98052, USA). This Courier system leverages the storage capacity and communication capabilities of the mobile phone to facilitate the viewing and exchange of PC-based documents when users are away from their desks.

The similarity with both these existing projects and the mobile-cloud E-Learning application is that both these projects provide a mobile version of the existing system in order to ease the tasks of its users. Hence, it can be concluded here that in this modern era of technology whereby people are always on the go, they usually would want the advancement of technology to make their daily tasks much easier to be handled.

CHAPTER 3: METHODOLOGY

3.1 Research Methodology

The research methodology requires gathering data from various journals of existing systems which are relevant to my project, the UTP Mobile E-Learning. From these journals, I get to compare and contrast these existing projects with my very own idea and work on how my project can be improved in order to suite the users of the current UTP E-Learning system. Apart from that, another data gathering technique is to get more feedback from the all students, lecturers and staffs in UTP regarding this project by distributing survey questionnaires and also through interviews which will be conducted to randomly selected residents of this University. From this investigation, a summary on what the people of this University think and respond to this idea of the mobile e-learning can be provided. Also to decide on what specific functions to be included in this application that they wish to access as they are on-the-go.

The tools that will be used to carry out this research is by posting online surveys to all of UTP residents, which includes the students, lecturers as well as the management staffs. The online survey distributed is the closed-question type whereby answers will be given in terms of multiple choices and hence, the people answering the surveys need to select the best choices that suits their situation or interest. Besides that, interviews will be conducted face-to-face with the random selected people in whom no tools are needed for this particular method. Interviews will be conducted in order to get open-ended answers from the interviewees regarding the current E-Learning system and its limitations as well as improvements to be made to the current E-Learning system. Also, to get their feedback if a mobile E-Learning application were to be introduced. On top of that, the internet was also very much helpful in helping me to search for more information regarding this mobile computing and other things related to my project.

Thus, with these methods stated above, gather abundance of information has been gathered and still gathering before starting off with the Design Phase and the Prototyping Phase of my project. All these methods are the necessary ones needed to perform in order to know the needs of the users, so as to create an application which can help them settle their uncertainties whereby they are sure to appreciate the advantages of the ubiquitous computing nowadays.

3.2 Project Activities

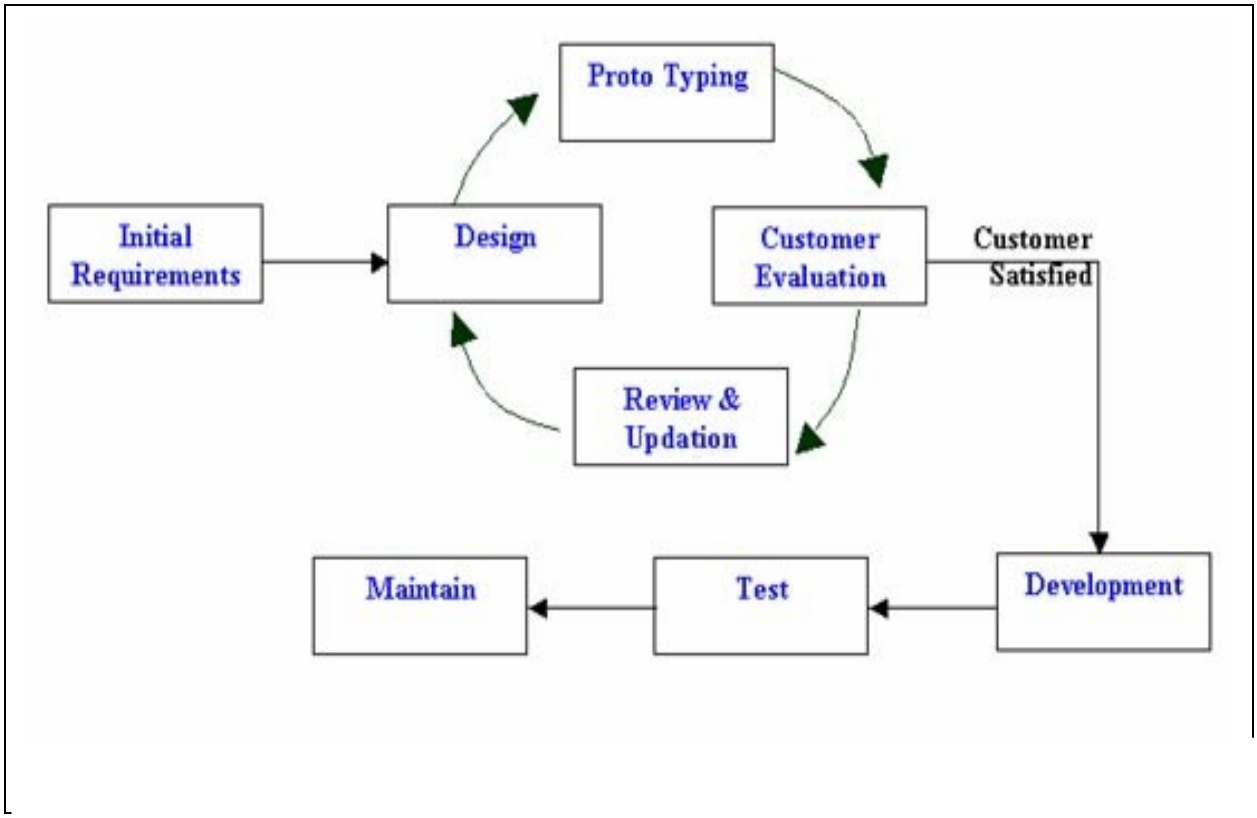


Figure 3. 2 – The Prototyping Model

The Figure 2 above shows the chosen prototyping model for the development of this mobile E-Learning application. This is because this application involves the user and thus, it is necessary to develop and improve the application software as based on the users' reviews and feedbacks. There are five different phases of my project as according to this prototyping model in which I believe will be efficient and necessary in order to plan my project development and to make sure the project is completed within the time specified. The project activities for the four main tasks are as follows:

i. Initial Requirements

- Gathering feedback from users of the UTP E-Learning regarding this mobile application to figure out the important functions to be included in the mobile version of the UTP E-Learning.
    - Online survey, in form of questionnaire was distributed to all students, lecturers and staffs of UTP to get their feedback on the current E-learning system and to know how they would react if an E-learning mobile application were to be created.
    - Conduct interviews with randomly selected students, lecturers and staffs to get their open-ended feedback regarding this mobile E-learning application – whether it would benefit them or not, what important functions should be included in the application, the limitations of the current E-learning system, etc.

ii. Looping Phase

- This phase contains of four sub-phases which are the Designing Phase, the Prototyping Phase, the Customer Evaluation Phase and the Review and Updating Phase. All these four phases will continue to loop until the prototype developed gains the users' full satisfaction.

a) Designing Phase

- Design on how the application should look like; i.e. layouts, pages, etc.
- Draw a rough sketch of the screen of the application.
- Decide on the software and the languages to be used to develop the application.
- Decide on the technology that suits the mobile application better; i.e. PHP or JSP or ASP, etc.
- Decide on how to execute and run the application.

b) Prototyping Phase

- Developing the application one module or one function at a time for the purpose of getting feedback from the users of the application.

c) Customer Evaluation Phase

- Getting the prototype developed to the users of the application I order to get their review and feedback on this application.
- Take note on how the users would like the application to view and perform like.
- Also, note the things that attract the users and the ones that repel the users.

d) Review and Updating Phase

- Updating and improving the prototype that was developed earlier as to what feedback and reviews the users have given.

iii. Development Phase

- Combine all the individual modules develop in the Prototyping Phase into a single program.
- Creating and connecting the database connections.
- Specify all the specifications; i.e. XML documents, etc.

iv. Testing and Quality Assurance Phase

- Testing the application in all possible devices; i.e. all BlackBerry smart phones using OS 6 and OS 7.
- Checking and comparing prototype with other available similar projects.
- Asking a few users (randomly selected) to test the application to get their feedback regarding the user-friendliness of the application.

v. Maintaining Phase

- Trying to improve and amend all unsatisfactory feedbacks and results from the Testing and Quality Assurance Phase.

3.3 Key Milestones

The following are the key milestones for both FYP1 and FYP2:

No.	MILESTONE	WEEK(S)
1.	**Data Gathering and Requirements Phase** ▪ Researching previous existing projects and researches ▪ Distributing online questionnaires ▪ Conducting interviews	**6 weeks (February – March)** Week 4 – 6 (12/2/2012 – 3/3/2012) Week 7 – 8 (4/3/2012 – 17/3/2012) Week 9 (18/3/2012 – 24/3/2012)
2	**Software Designing Phase** ▪ Designing the application	**5 weeks** Week 10 – 14 (25/3/2012 – 28/4/2012)
3.	**Software Development Phase** ▪ Developing the application	**5 weeks** Week 15 – 19 (20/5/2012 – 23/6/2012)
4.	**System Testing Phase** ▪ Testing the application ▪ Getting feedback from potential users ▪ Re-implement the system	**4 weeks** Week 20 (24/6/2012 – 30/6/2012) Week 21 (1/7/2012 – 7/7/2012) Week 22 – 23 (8/7/2012 – 21/7/2012)
5.	**Software Delivery**	**Week 24 onwards (22/7/2012)**

Table 3.3 – Key Milestones

3.4 Gantt Chart

The Gantt Chart for the project development is as follows:

● - Milestone

ACTIVITY	FYP 1														FYP 2								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	1	2	3	4	5	6	7	8	9
Choosing Project Title and Determining Scope ●																			=				
Researching Journals and Methodology -Researching related works ●																			=				
Data Gathering and Discussion -Distributing questionnaires and conducting interviews ●																			=				
Designing System -Designing the application ●																			=				

Coding Phase -Developing the application	=	
Improvement Phase - Getting feedback from the users -Re-coding the application	=	
Testing and Quality Assurance -Testing the application	=	

3.5 Tools

i. Software Tools

Among the software tools which in be used for the development of my project are Macromedia Dreamweaver 8, Java Eclipse IDE, BlackBerry simulator, Apache Tomcat 7 localhost server and the MySQL open source relational database.

ii. Hardware Tools

There are only two hardware that will be used for the purpose of my project development. Those are my laptop and also the BlackBerry smart phone with OS 6.

3.6 System Architecture

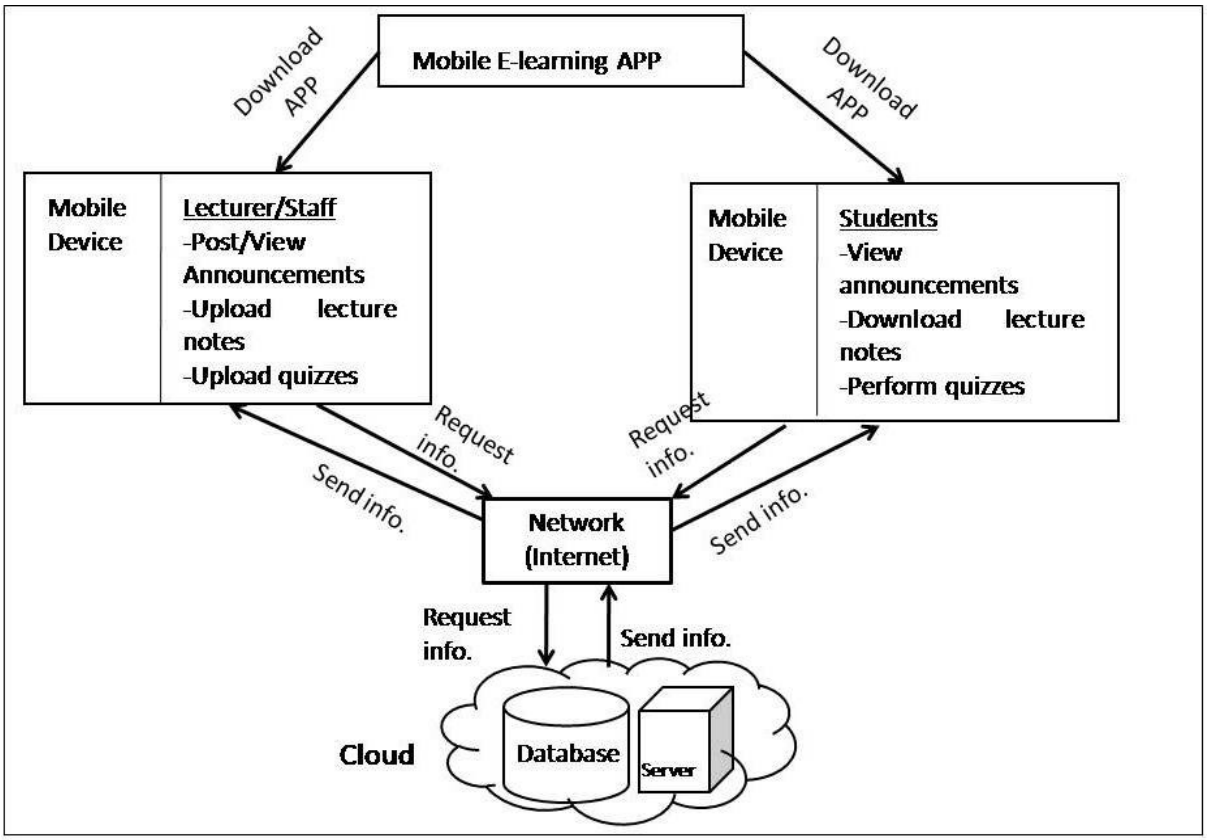
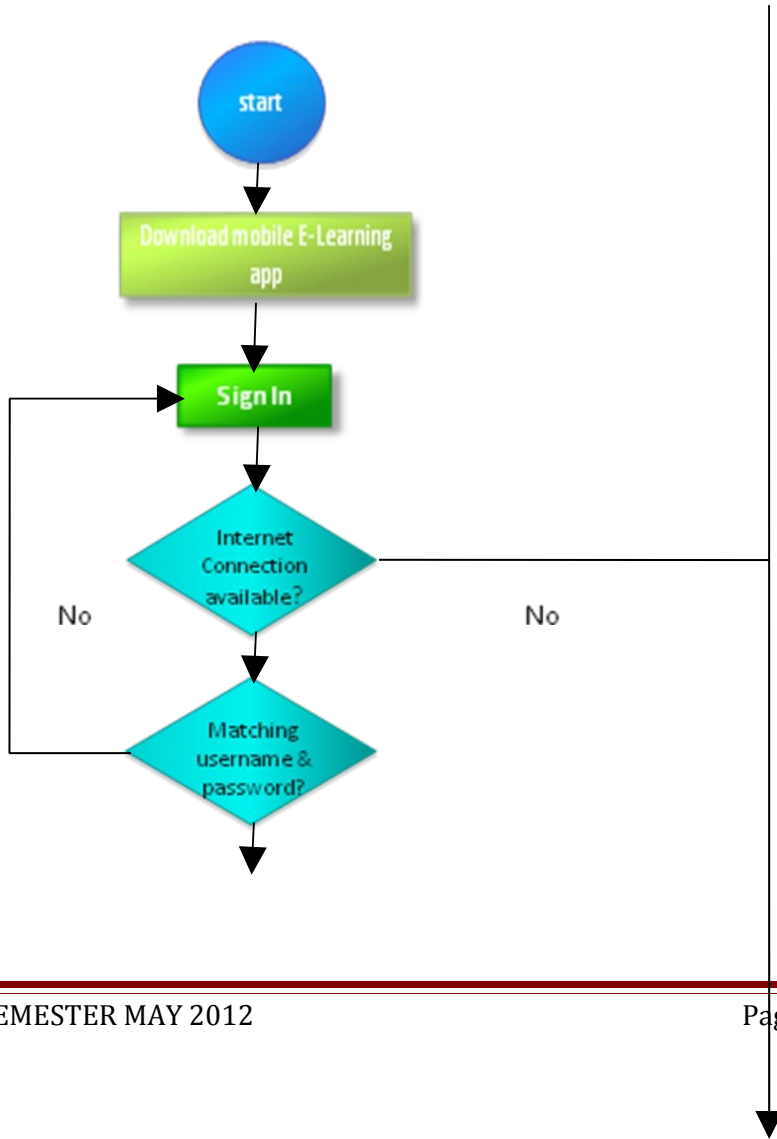


Figure 3.6a – System Architecture of the Mobile E-Learning Application

The general steps to how the Mobile E-Learning Application will function are as follows:

1. The mobile E-learning application needs to be downloaded into the mobile phone.
2. To access the E-learning system, the user's username and password will be directed through the network and connects to the database which is located on cloud.
3. The cloud server and database then sends back the information through the same network and displays information on the mobile device.
4. Users can then enjoy the mobile E-learning application's services anywhere and anytime.

The following flowcharts depict all the specific functions available in this application for both the distinct users; students and lecturers/staffs.



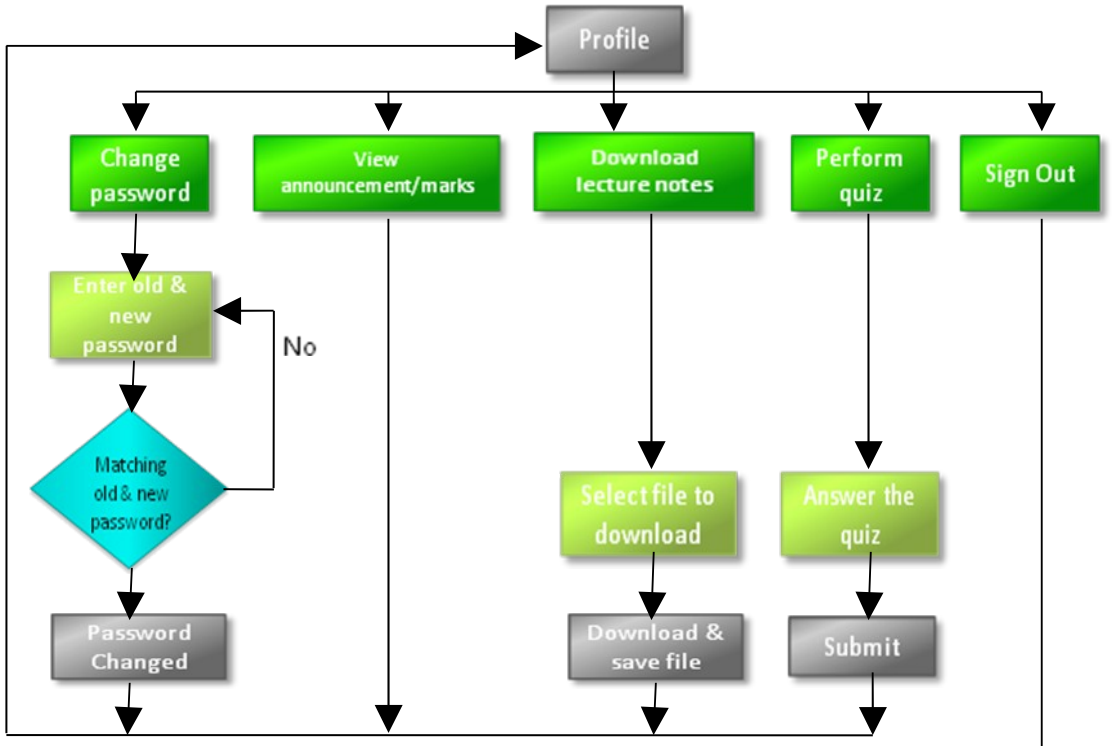
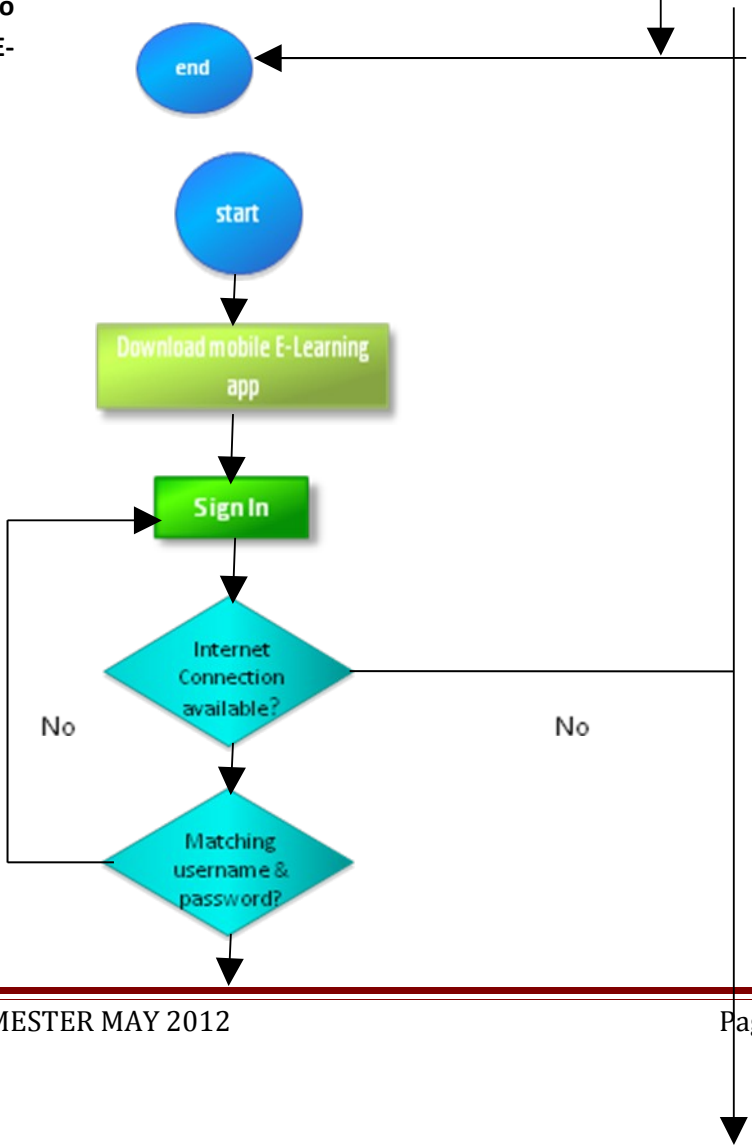


Figure 3.6b – Services offered to the Students in the Mobile E-Learning app



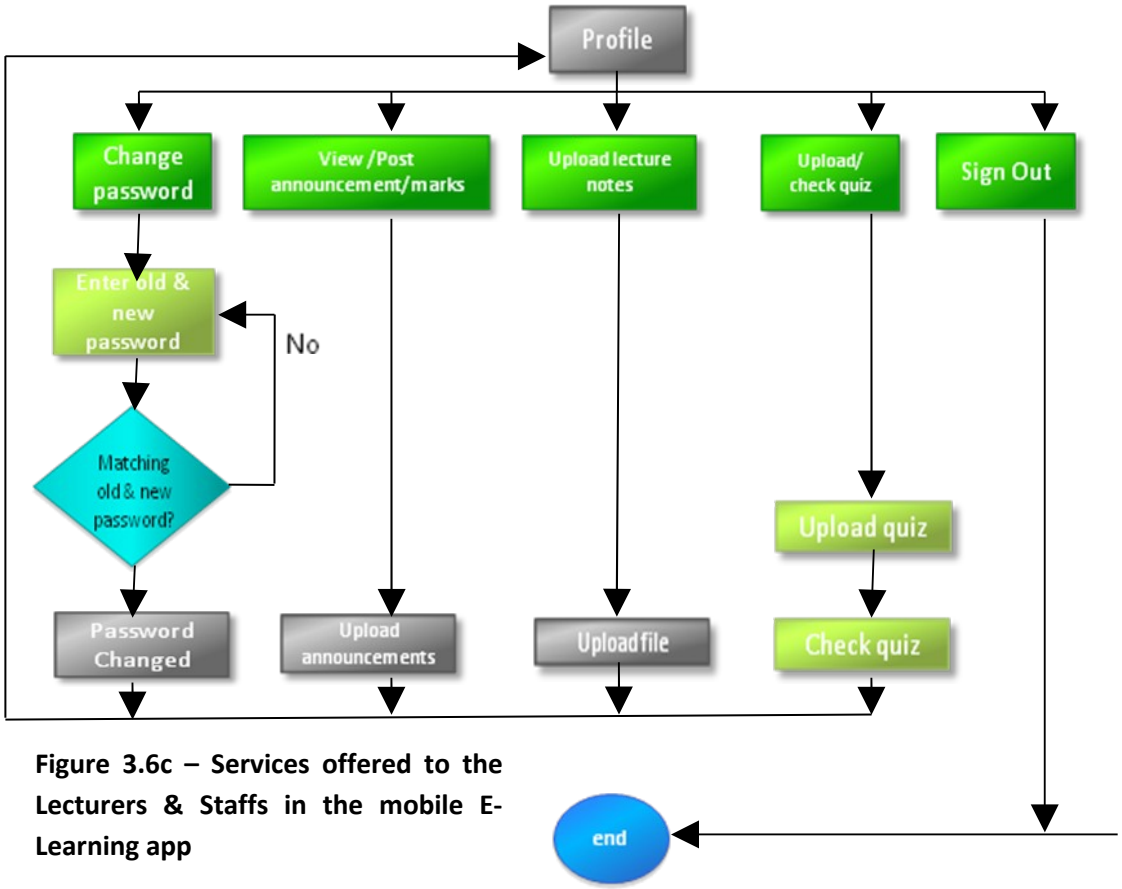


Figure 3.6c – Services offered to the Lecturers & Staffs in the mobile E-Learning app

The Flowchart labeled Figure 4 and Figure 5 above shows the steps and processes of the mobile E-Learning application for students and lecturers and staffs respectively. The students are able to change their password, view announcements, download lecture notes, perform quizzes and also sign out. On the other hand, the lecturers and management staffs are able to change their password, view and post announcements, upload lecture notes, upload and check quizzes and also sign out. The similarities between this two users are the change password and sign out function.

This is how the mobile-cloud E-Learning application works. In order to access the mobile E-Learning system, the mobile E-Learning application software must be downloaded into the users' mobile phone (smart phone). So, whenever the user wants to access the E-Learning through their mobile phone, all they need to do is to ensure that their mobile phone has connection to the Internet. Once available, the user can connect to their E-Learning profile using their username and password.

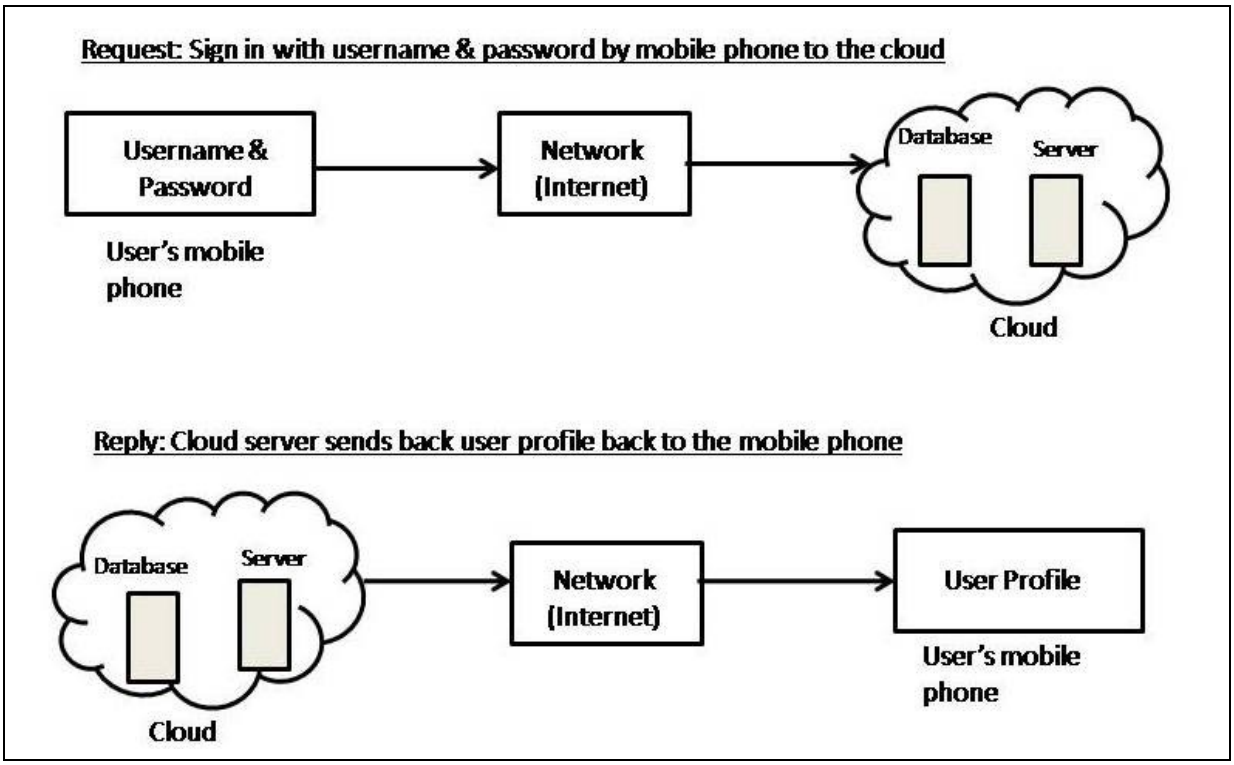


Figure 3.6d – An example showing how the data is retrieved from the cloud through the Sign In function

The request of the connection is then sent through the network (Internet) and connects to the cloud where the server and the database are stored. Hence, we can say here that the processes too occur in the cloud. Once connected, the server and the database sends back information based on the respective user profile through the network (Internet) again and back to the user's mobile phone. So each time the user's mobile phone sends a request, the Internet connects to the server and database stored in the cloud and sends back information from the cloud server back to the user's mobile phone.

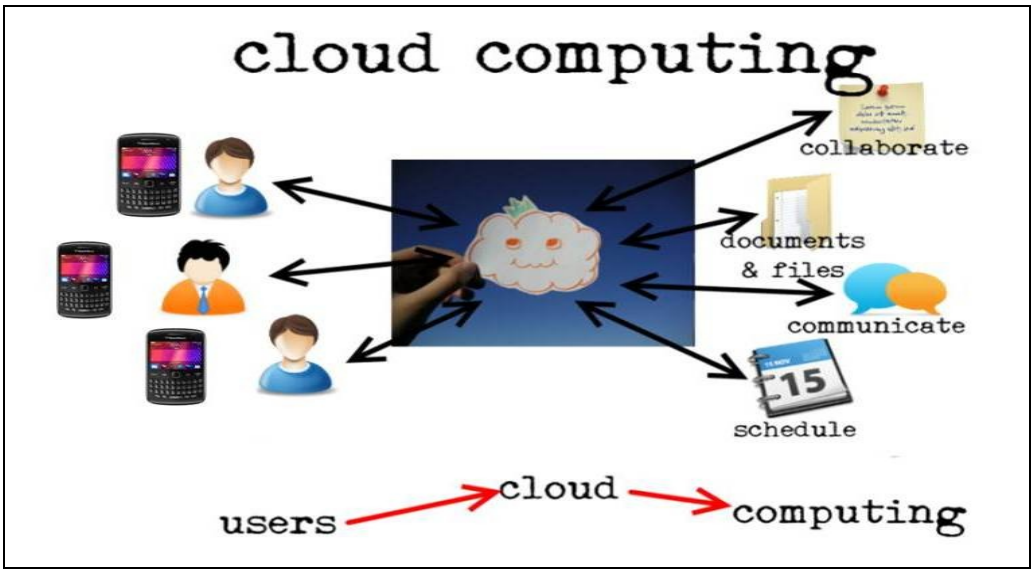


Figure 3.6e – How the cloud computing concept is applied in this mobile E-Learning application

In a nutshell, the mobile phone will only contain the mobile E-Learning application interface/software. However, all the information, the processes, the server and the database are all stored in the cloud and the network connecting the cloud and the user's mobile phone is the Internet. Through this, the mobile device's memory will not be consumed, saving the memory space for other usage of the mobile phone.

CHAPTER 4: RESULTS AND DISCUSSION

4.1 Data Gathering and Analysis

There are three ways in which the data gathering process has been conducted. They are online questionnaire, interview and also online journals. The following are the further elaboration regarding this data gathering phase.

Firstly, the online questionnaire was distributed to random students, lecturers and staffs of UTP (UTP being my reference point). As of 2nd July 2012, a total of 43 people have answered this survey. This is a close ended survey whereby answers are given for each questions and the responders will have to choose from the given choices.

Next, the interview was conducted with randomly selected students and staffs in UTP. This part of the data gathering phase is done so as to get an open opinion of the staffs and especially the students of UTP regarding the existing E-Learning system and also the mobile E-Learning application. Since the answer for this interview is not restricted, the interviewees are encouraged to express their opinions and thoughts freely.

Finally, searching for the online journals for topics and projects regarding this mobile E-learning application project is done so as to get an overview of the existing projects done which are more or less related to this project. From the journals, an analysis can be made in order to obtain a guide in developing this mobile E-Learning application.

4.2 Results and Discussion

Online Questionnaire

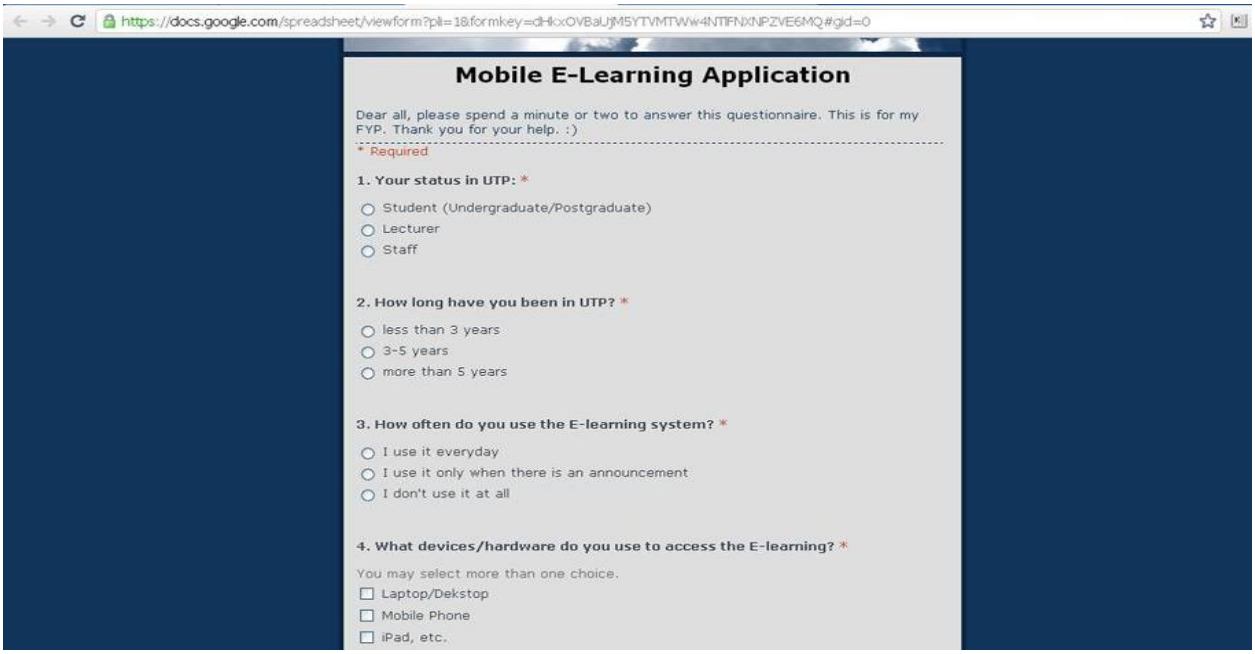


Figure 4.2a – Questions 1 – 4

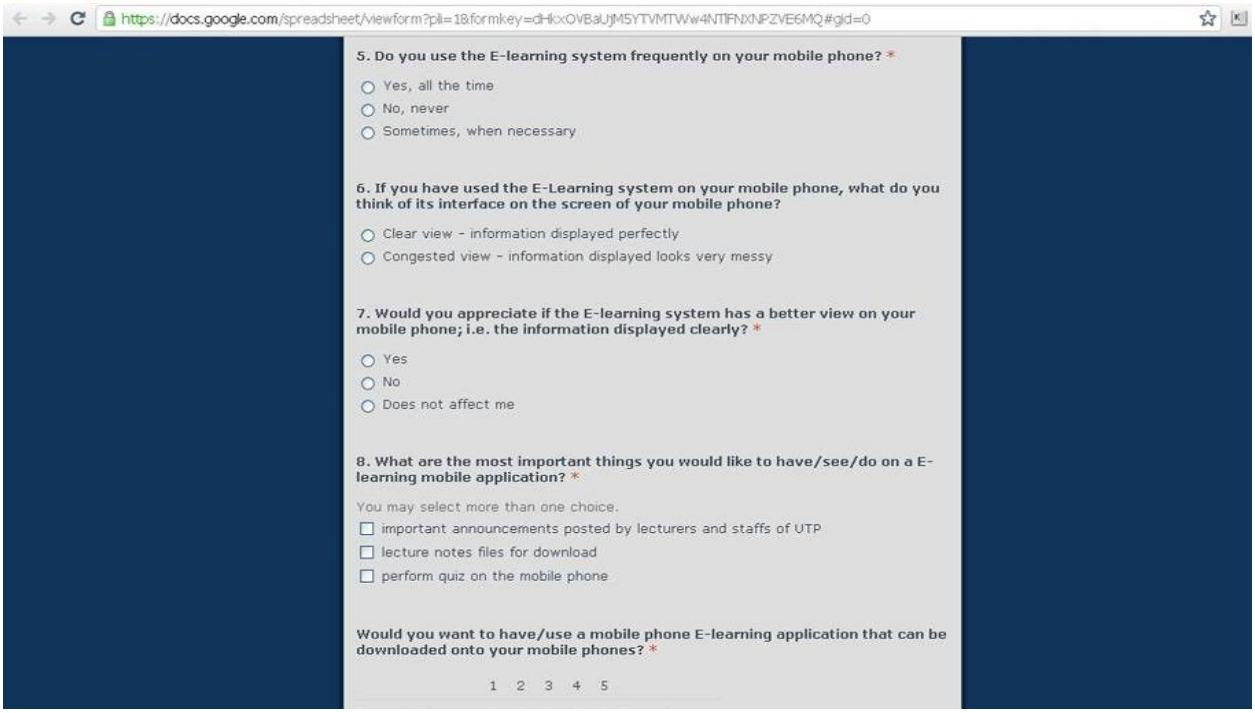


Figure 4.2b – Questions 5 – 9

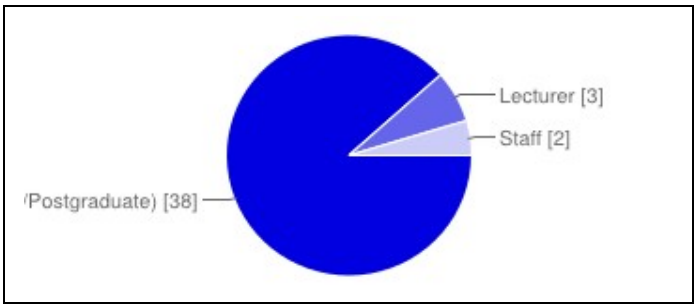


Figure 4.2c - Question 1: Your status in UTP

A total of forty-three people answered this survey. The responders consist of thirty-eight students (Undergraduate and Postgraduate), three lecturers and two management staff. Hence, the students contribute 88% of the survey, the lecturers 7% and the staffs 5%.

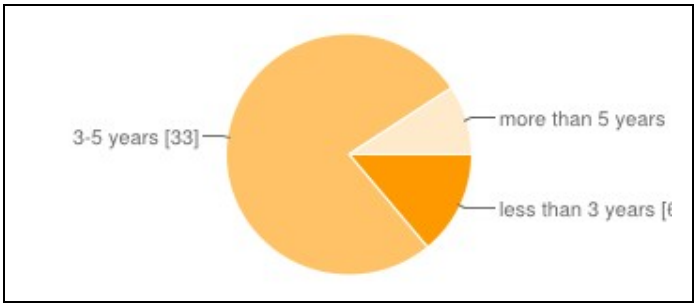


Figure 4.2d - Question 2: How long have you been in UTP?

For the second question, thirty-three responders have said that they have been in UTP from three to five years, contributing to a total of 77%. Six responders answered that they have been in UTP for less than three years which contributes to a total of 14%. The rest 9% which consists of four people answered that they have been in UTP for more than five years.

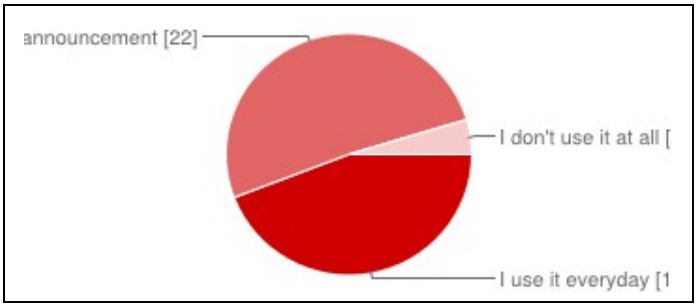


Figure 4.2e - Question 3: How often do you use the E-Learning system?

A total of 51% consisting of 22 responders answered that they only use the E-Learning system when there is an announcement for them to check. However, 44% consisting of nineteen

people answered that they use the E-Learning every day. But, two people which makes up to a total of 5% answered that they do not use the E-Learning at all.

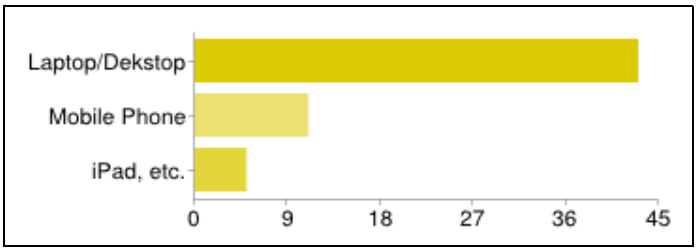


Figure 4.2f - Question 4: What devices/hardware do you use to access the E-Learning?

For this question, the responders may choose more than one choices, hence, the percentages may add up to more than 100%. A total of 43 people which sums up to a 100%, answered that they use laptops or desktops to access the E-Learning. Eleven people which contributes to 26% access the E-learning using their mobile phones and five people which contributes to 12% access the E-Learning using iPad and other devices.

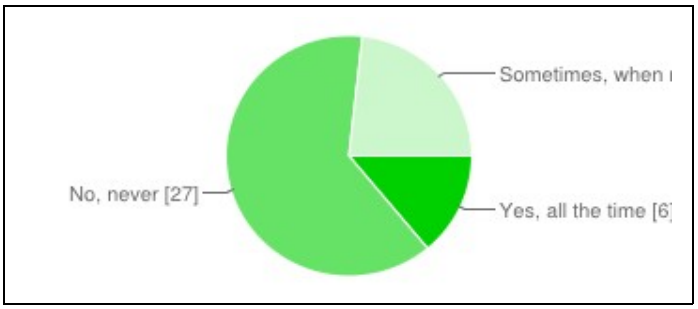


Figure 4.2g - Question 5: Do you use the E-Learning system frequently on your mobile phone?

For this question, twenty-seven people which contribute to a total of 63% do not use the E-Learning frequently on their mobile phone. However, ten people of a percentage of 23% uses the E-learning on their mobile phone when necessary and another 14% consisting of six people use their mobile phone to access the E-Learning all the time.

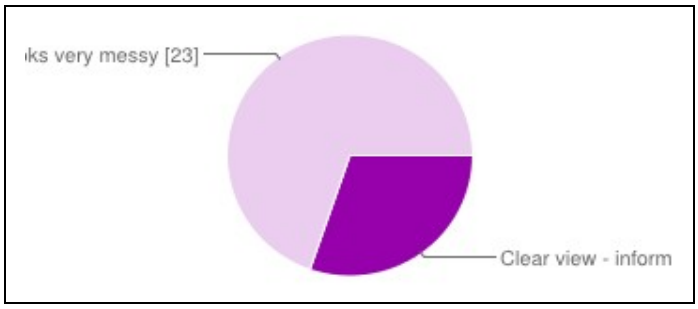


Figure 4.2h - Question 6: If you have used the E-Learning system on your mobile phone, what do you think of its interface on the screen of your mobile phone?

A majority of the responders consisting of twenty-three people which contributes to 53% answered that the view is very congested and that the information displayed looks very messy. On the other hand, ten people consisting of 23% answered that the view looks clear to them.

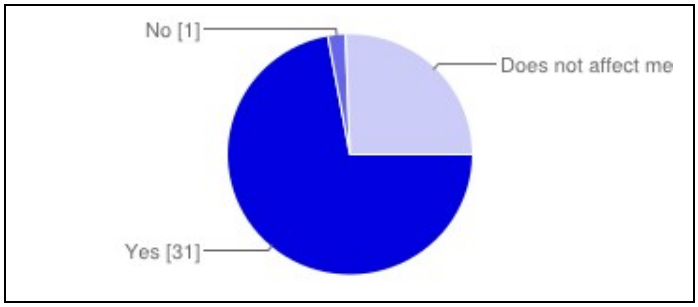


Figure 4.2i - Question 7: Would you appreciate if the E-Learning system has a better view on your mobile phone; i.e. the information displayed clearly?

For this question, a total of thirty-one people consisting of 72% answered that they would appreciate it. However, eleven people contributing to 26% answered that it does not affect them and one person answered that the effort will not be appreciated.

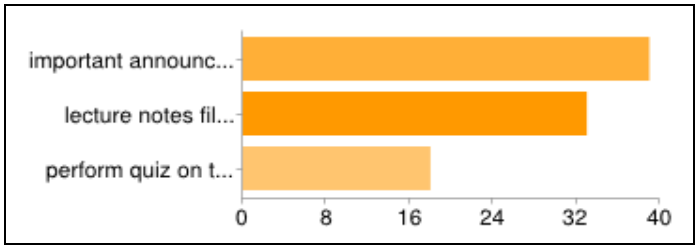


Figure 4.2j - Question 8: What are the most important things you would like to have/see/do on a E-Learning mobile application?

For this question, the responders may choose more than one choices, hence, the percentages may add up to more than 100%. A majority of the responders consisting of thirty-nine people answered important announcements which contribute to a total of 91%. Thirty-three people contributing to 77% answered lecture notes file for download and the eighteen people contributing to 42% answered to perform quiz on the phone itself.

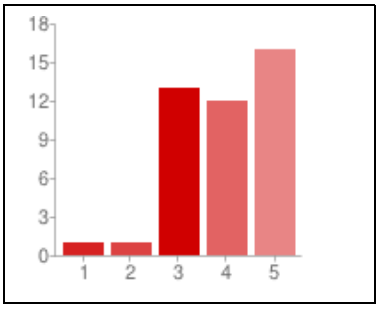


Figure 4.2k - Question 9: Would you want to have/use a mobile phone E-Learning application that can be downloaded onto your mobile phones?

For this question, responders were asked to do a rating based on the question. A majority of the responders consisting of sixteen people which contributes to a total of 37% strongly agreed to have/use a mobile phone E-Learning application. On the other hand, thirteen people contributing to 30% voted for moderately agreed and one person voted for strongly disagree.

Hence, from this online survey, it is somewhat proven that the current E-Learning system has got accessibility and usability problems, just as has been stated earlier in this report. Thus, from the feedback of the responders, it is believed that this mobile E-Learning application will definitely benefit the students, lecturers and management staffs of UTP (since the survey is conducted with the residents of UTP).

Interview

Three representatives were selected for this interview. They consist of two students and a management department. Since the majority users of this E-Learning are the students, so more priority is given to the students.

The two students interviewed are Mifrah Ahmad and Thenmoli a/p Pakeanathan. From the interview, I can conclude a few things which were stated by them. The following is the summary of their opinions.

i) They frequently use the mobile phone to access to the E-Learning website, especially when they are already in the class and the lecturer is not in – to check for announcements.

ii) One major problem is that, not all the features are visible clearly when they access the E-Learning using their mobile phone causing uneasiness and time delay.

iii) It would be useful if an application is ready to be used on the mobile phone to access the E-Learning so as to have a much pleasant view of the E-Learning on the mobile phone.

iv) It would be convenient if there is a mobile E-Learning application because they can access the E-Learning anytime and anywhere without having to worry of the screen size and such.

On the other hand, the management department interviewed was the Exam Unit. From the conversation with them, one major problem they seem to face is that the information they post do not seem to reach the students on time for various reasons. Hence, if there exists a mobile E-Learning application, there is no chance for this problem to exist because students can view all the information posted by lecturers and staffs clearly and on time.

4.3 Experimentation/Modelling

All the experimentation for this mobile E-Learning application development are done using the Java Eclipse which is embedded with the BlackBerry Research In Motion (RIM) simulator. The purpose of the usage of this BlackBerry simulator is to do the coding, debugging as well as the testing of the project. Almost all features that are available in the BlackBerry device are also available in this simulator. Besides that, different models of the BlackBerry simulator are also available as according to the different models of the BlackBerry devices.

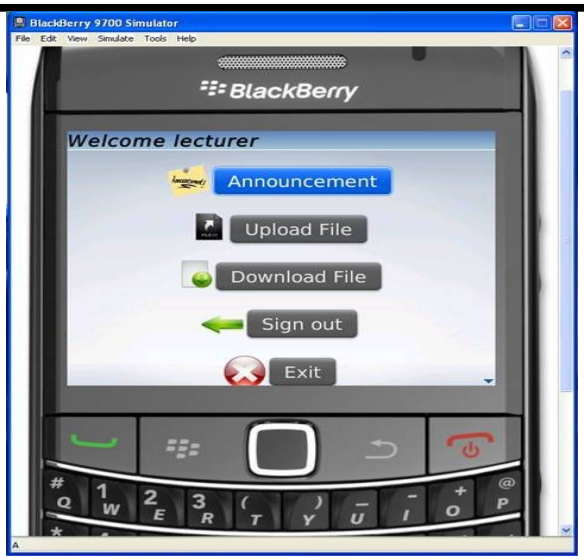
Figure 4.3 – The BlackBerry Simulator

Hence, upon completion of the coding, debugging and testing of the mobile E-Learning application, this application will be downloaded into a real BlackBerry device with a OS 6 to further check its functionality and view on the screen. If there are any dissatisfaction upon giving the users to try to use this application, then the necessary modification will be done using the BlackBerry simulator and Java Eclipse.

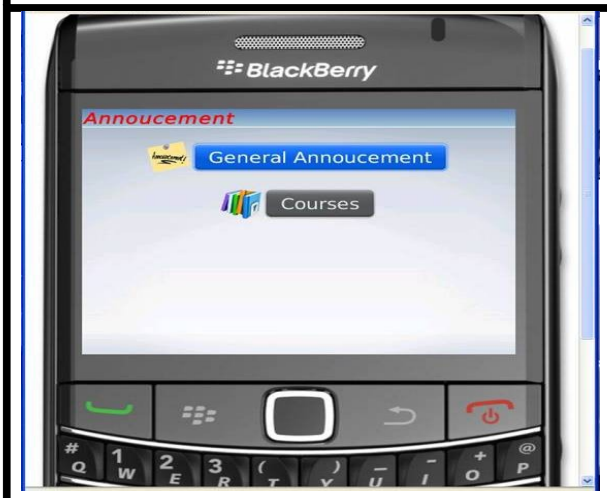
4.4 Project Deliverables

The following Table 4.4 are the screen shots as the outcome of the project. However, there is one more function to be updated, which is the uploading and downloading of lecture notes and such.

1. **Sign in Page for Lecturers/Staffs.**



2. **Lecturers/Staffs homepage.**



3. **Announcement Page with two options for both Lecturers/Staffs and Students: General Announcements & Courses Announcements.**

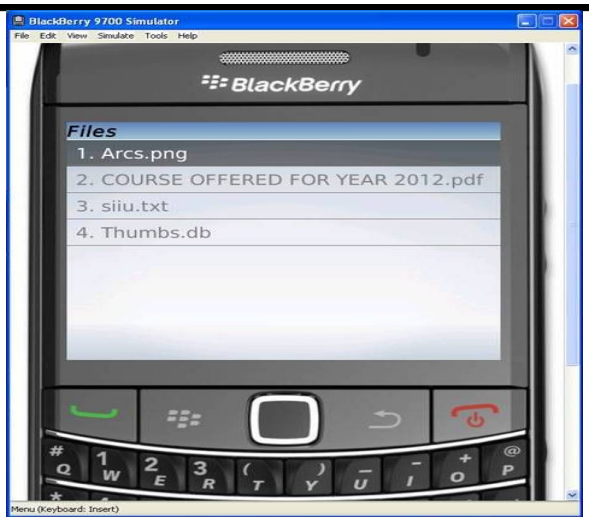
4. **General Announcement Page: Lecturers/Staffs can view, add and delete the announcement.**

5. **General Announcement sample: Lecturers/Staffs who uploaded the announcement can update it.**

6. **Courses Announcement Page: List of courses registered.**

7. **Course Announcement sample: Lecturers/Staffs who uploaded the announcement can view, add and delete it.**

8. **Upload Sample: Lecturers/Staffs can upload files from their mobile phones.**



9. Download Sample :

10. Sign in Page for Students.

11. Students homepage.

12. **General Announcement Page: Students can only view the announcements.**

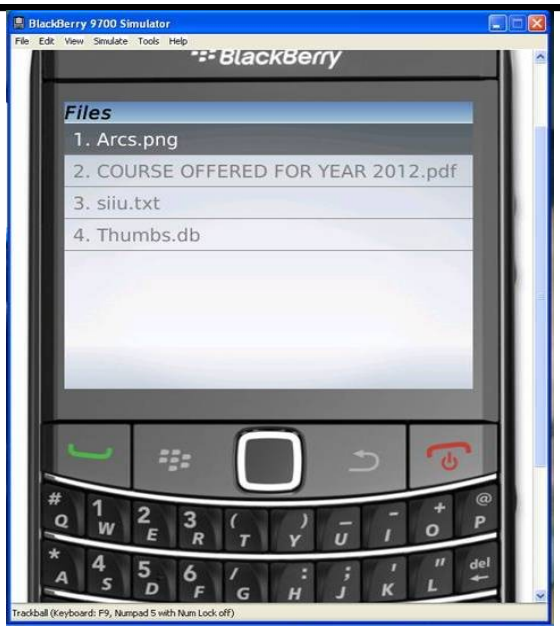
	
13. **Course Announcement Page: Students can only view the announcements.**	14. **Download Sample: Students can download available files to their mobile phones.**

Table 4.4 – Screen shots of the Prototype

CHAPTER 5: CONCLUSION and RECOMMENDATIONS

5.1 Relevancy to the Objectives

There are two objectives of this project that has been explained earlier in this report. The main objective of this project is to study on how the contents of the current existing E-Learning can be adapted to the mobile phones/smart phones. Besides that, this study is done to design and develop the contents of the mobile-cloud E-Learning application to suit the small screens of the mobile phones/smart phones. The second objective of this system is to promote and contribute to the ubiquitous computing by enhancing the functionalities of the smart phone devices.

The mobile-cloud E-Learning application is relevant to the objectives stated above due to a couple of reasons. The first is that surveys and interviews are conducted in order to study the limitations of the current E-Learning system so as to decide on the important functionalities to be added in the mobile version of the E-Learning system. Not only that, once this issues have been sorted out, the designing of the mobile-cloud E-Learning application will be done in order to check the suitability of the information displayed on the small screens of the mobile phones; in other words what to be added and what not to be added in this mobile application.

The second reason to why this project and all its activities are relevant to the objectives stated above is that the mobile-cloud E-Learning project works hand-in-hand with the cloud computing concept which then relates back to the second objective stated above. This is because only the mobile E-Learning application will be downloaded into the mobile phone. However, the servers, database as well as the processes occurring will be connected through a network; the Internet and performed in the cloud.

Hence, based on both the reasons stated above is why I can strongly say that the mobile-cloud E-Learning application and all its activities are relevant to its objectives.

5.2 Recommendations

The mobile-cloud E-Learning application which will be developed for the Final Year Project purpose will only be developed for the specifications of the BlackBerry OS 6 smart phone configurations and settings. The scope is narrowed down to this due to the time constraint.

However, there are a few suggestions that I would like to point out here which will be kept in view for further expansion of this idea. Firstly, the mobile-cloud E-Learning application should be developed for general-platform mobile phones. In other words, this application must be developed for the Android and also the iPhones as well. This is so that everyone who has access to the Internet through their mobile phone can use this application.

Secondly, more features and functions should be included in the mobile-cloud E-Learning application. For example, allowing students to upload their assignments or reports through their mobile phones, allowing students to participate in the forum through their mobile phones and also perform online tests using this mobile-cloud E-Learning application as well as performing evaluation for the lecturers through this application.

These are a few of the suggestions that can be done for the further expansion of this project which will definitely be put under consideration upon the completion of the Final Year Project or sometime in the future.

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APPENDIX

TECHNICAL PAPER