Mobile-Based Learning Design with Android Development Tools

Oky Dwi Nurhayati
Lecturer in Computer Engineering, Diponegoro University
Prof. H. Soedarto, S.H., Semarang, Indonesia
oky_0210@yahoo.co.id

Kurniawan Teguh M
Lecturer in Computer Engineering, Diponegoro University
Prof. H. Soedarto, S.H., Semarang, Indonesia
k.teguh.m@live.undip.ac.id

***Abstract*—Mobile learning as an intersection of Mobile Computing and E-Learning providing resources that can be accessed in anywhere has capability in an excellent searching system, rich interaction and full support towards an effective learning and performance-based assessment. In addition, it has a characteristic of not being dependent on time and space.**

The application of mobile learning can be used through the android operating system that is chosen in consideration to that android has been dominating the Smartphone market and is an open-source operating system that is easily developed. In this case, the versions of android supporting this application are Version 2.2 to Version 4.2. To ease the users to access M-learning, jQuery mobile framework is applied as its display, in addition to its attractive features, is able to adjust the screen from mobile equipment.

This application will be implemented in three types of user: *admin* that will use the web-based application on the desktop and *lecturers* and *college students* that will use android mobile tool-based application. In this case, the function that will be given is by processing the materials that will be uploaded by lecturers and can be downloaded by the college students, task and quizzes given by the lecturers to the college students and the function to show the score from the college students.

Index terms: mobile learning, android operating system, *jQuery* Mobile, e-learning

I. INTRODUCTION

Learning achievement of university students is often indicated with the learning problem among them in understanding the materials [4][5].

This indication, probably, is given in view of the learning factors among the university students that are less effective, even not being motivated in following the lecture in class. As a consequence, this has made the students lack of or even do not understand the difficult materials given by the lecturers. The tendency of this uninteresting learning is something common to be experienced by the educators that do not understand the needs of the students either in characteristics or in the science development. At this point, an educator as the science developer plays a very essential role in selecting and implementing the suitable and efficient learning – not merely conventional based learning - for the learners. A good learning can also be supported from good learning circumstance and communication between educators and learners [7].

An interactive and interesting learning, by adding visualization with animations, texts, pictures and voice, is something to make learning more interesting and not monotonous. A fact reveals that delivering multimedia can increase the memory in learning since the audio-visual material is easier to be captured and human physiologically is to be more sensitive using his or her sense. Given the application of this interactive learning, it is expected to add the interest of learning among university students to use computer since the existence of this technology recently has been widely used by society as a consequence of the advance of information and technology [5][12].

A new trend in e-learning nowadays is known as Mobile Learning the use of portable media such as Smartphone either using the Android system, IOS or Windows Phone. The use of Mobile Learning to support the teaching-learning process is considered important to add the flexibility in the activity of teaching and learning. Thus, the learning process can be done anywhere and anytime. The aim of this research is to introduce the mobile learning based information by means of Android, IOS and Blackberry OS as learning media [8].

II. THE UNDERLYING THEORY

A. Mobile Learning

M-Learning is often defined as E-Learning through computerized devices. Mobile Learning also defined as a means to deliver the electronic learning materials to mobile computerized devices in order to be accessible in anywhere and anytime. Commonly, mobile devices are in the form of digital cellular phone and PDA. But, more commonly, it can be defined as any devices that are small, automatic and portable used in daily life and can be used for a number of learning forms. The small devices can be seen as a means to access the content either to be locally saved in devices or to be reached through interconnection. Referring to the connectivity, M-Learning is not equal to E-Learning that is assumed to have an always connected connection. M-Learning can be delivered through three ways; in this case, schematically able to be mentioned as pure connection, pure mobility and the mix of both [7][10].

The interest in mobile learning in traditional classroom settings is motivated by a search for more effective

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educational and instructional approaches, especially in areas where current methods are viewed as lacking.

The use of this m-learning technology is aimed to assist the university students or society to be able to access the lecture materials or information anytime, anywhere and in any conditions. Table I shows the emerging research architecture in m-learning and Fig.1 shows the architecture of mobile learning.

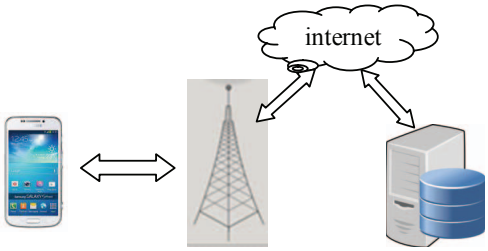

Fig.1. Architecture of m-Learning

Table I. Emerging research architectures

Emerging research architectures		
Feature	**M-learning**	**C-learning**
Paradigm	Lecture, seminar	Hands on projects, collaborative groups
Use of medium	Media designed to deliver information	Tools designed to support inquiry
Student input	Writing free form text	Constructing graphs, animations, questions
Communication	Mostly online discussion with little support from shared non-textual referents	Face-to-face discussion supported by shared attention to data, drawings, graphs, and text

B. Mobile Operating System

Similar with Jquery on the desktop, JQuery Mobile is a framework of JavaScript. However, its use is particularly targeted for mobile devices such as iPad, iPhone, Blackberry, Symbian, or Android. Through jQuery Mobile, it is possible to make multi-platform web application without any dependence upon certain hardware. JQuery Mobile has also supported the application of touch screen, enabling it to optimize the existing devices [11].

The design of JQuery Mobile is classified into three parts: header, content and footer. The part of header functions to make toolbar in the upper part of page and used to save the title and button. The part of content, meanwhile, contains the main content of page such as texts, pictures, button, list,or form. At last, the part of footer is to make toolbar down part of page used for things such as button [9][11].

Android is an operating system on hand phone that is open and based on the operating system of Linux. Android was taken over by Google in 2005 from Android, Inc as a part of strategy to meet the market of mobile operating system. In this case, Google has taken over all of the results of work of Android including the team that has developed android. Android is available openly for the manufacturers of hardware for the modification in accordance with the needs. The main benefit of Android lies on its integrated application approach. The development is merely concentrated on the application that can be applied in various devices as long as they are still powered by Android [12].

III. MATERIALS AND METHODS

When building a good software system, a mature design is required [2]. A good and structured design should be suitable with the existing needs. Hence, in this mobile learning design, need analysis and structured design are necessary started from designing database, functions to interface of system. An application made will consist of client and server in which the client can be accessed through the mobile devices and the server can be accessed through web [3][4]. A network is needed to operate the application of *M-Learning* as the application later is put in a server. For the side of client, the programming language of JQuery Mobile is used and only applied on Android devices. Meanwhile, for the side of server, the programming language of JavaEnterprise Edition (Java EE) is used along with the assistance of the framework of spring MVC and Hibernate ORC. Here, MySQL is the database that is used [8][9][11].

The specifications of the hardware used in building the application of this M-learning are listed as follows:

1. Notebook Intel® Core™ i3-2310M (2.10 GHz)
2. 4 GB Memory (RAM)
3. 500 GB Hard disk
4. Monitor with 1280x800 pixel

Meanwhile, the software used is listed as follows:

1. Windows 8 operating system
2. Apache Tomcat 7
3. Php MyAdmin
4. Eclipse IDE for Java EE Developers
5. Android Development Tool
6. Browser: Mozilla Firefox and Google Chrome

IV. RESULT AND DISCUSSION

Testing as a critical element of the quality assurance of software presents the main analysis on specification, design, and coding. The essence of the software testing along with its application referring to the software quality cannot be emphasized since it involves a series of production activities in which it is highly potential to emerge human error and because of the incompetence of human to do and to communicate perfectly, the development of the software must be accompanied with the activity of quality assurance. In this research, the black box testing has been done to ensure that the application of *M-Learning* can run in accordance with its function.

Table II below presents the list of *Smartphone* that will be used for the testing of M-Learning.

Table II. List of *Smartphone*

No	Type	Screen Resolution	OS
1	Samsung Galaxy Young	320 x 240 pixel	Ginger-bread
2	Lenovo A390	1024 x 600 pixel	Ice cream
3	Acer Z3	720 x 1280 pixel	Jelly Bean

The testing was divided into 3 phases:

1. Identification of the number of functions
   From this phase, 6 main functions were found to be tested for their working.
2. Checking the interface form
   The checking was performed to user interface to see the program feasibility in use, in this case, for the comfort.
3. Checking the function of each form
   It was to see if the tested functions have run as expected

The phase of m-learning application testing includes:

1. User installs the application of m-learning on the mobile communication devices.
2. User does login based on the level given
3. User runs application

The testing on the m-learning application performance uses the Black Box testing. This testing is used to test the functionality of each component in the m-learning system. The Black Box testing showed in Table II. Table II also presents the assessment criteria [6].

The scenario of this testing was conducted by selecting the user as university students. Some functions of user management were provided here including *add*, *edit* and *delete*. For the *delete* function, it was done by pressing the button X to delete the users.

Meanwhile, the function of material management consisted of 4 parts: to add materials, download materials, manage the task (add task, edit task, delete task and submit task) and delete the materials.

The scenario of this testing was conducted by selecting the materials that would be downloaded by the university students in which the list of the materials were previously displayed in menu of materials as shown in Fig.2. The results of the downloaded materials would be directly sent to the saving memory from the devices using this application. Fig.3 presents the download process.

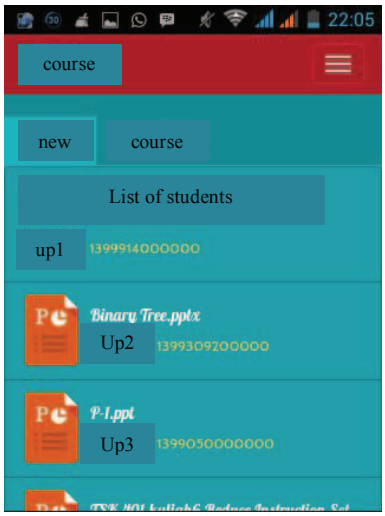

Fig.2. List of Materials

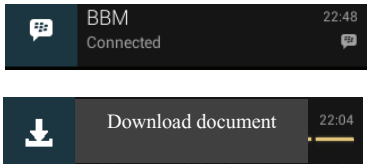

Fig.3. Process to download material

From the simulation/testing, it can be seen that all testing classes were suitable with the expected function. Thus, the application of M-learning has fulfilled the requirements of the defined software. From the result of M-learning application test, it can be observed that this system has fulfilled:

1. *Login* function
2. *User* management function
3. Material management function
4. Task management function
5. Quiz management function
6. Function for seeing the scores

The test to the android devices with various brands is shown by Fig.4 below.

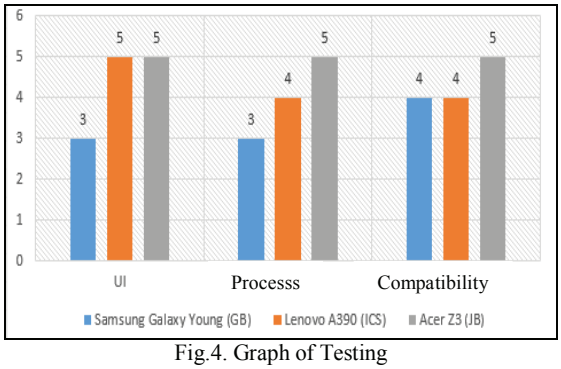

Fig.4. Graph of Testing

Fig.4 presents a graph of testing result in three different Android devices similar with Operating System of each Ginger Bread, Ice cream Sandwich and Jelly Beans.

From the testing graph in Fig.4, some different testing results could be found in Android devices as seen in Table III.

Table III. Table of testing result in various devices

No	Types	OS	Remarks
1	Samsung Galaxy Young	Gingerbread	Running well
2	Lenovo A390	Ice cream	Running well
3	Acer Z3	Jelly Bean	Running well

Table IV shows that the application of m-learning work well on all three types of devices are samsung galaxy young, lenovo A390 and Acer Z3. This application has been tested by several Operating Systems of Andoid.

The difference results of this research with previous research on mobile learning is the use of the Android operating system and its supporting programs such as Hibernate and JQuery. The previous research using J2ME to design the application.

Table IV. Table of Testing Criteria in Devices

Score	Criteria		
	User Interface	Process	Compatibility
1	Many buttons, texts and forms are cut and unclear both in portrait and in landscape.	Application runs slowly and requires some pressings on the button to start the process. In addition, it often gets a hang.	Application cannot enter to *login*menu / requiring longer time for login
2	Many buttons, texts and forms are cut and unclear in *portrait* but cut in *landscape*	Application runs rather slowly, requiring some pressings on the button to start process	Feature of page *translation* does not run and *Smartphone* is turned to the position of *portrait*/*landscape* back to the menu *login*.
3	Buttons, texts and forms are clearly seen and not cut in *landscape*	Application can be accessed rapidly	Feature of *page translation* can run
4	Buttons, texts and forms are clearly seen and not cut in *landscape*. Not in *portrait*	Application can be accessed rapidly but occasionally must press the button for several times to run the process	Feature of *page translation* cannot run
5	Buttons, texts, and forms are clearly seen and not cut both in *landscape* and in *portrait*	Application can be accessed rapidly	Feature of *page translation* can run

V. CONCLUSIONS

The several conclusions are :

1. *Mobile Learning* is developed for the mobile devices to be accessible at anytime as long as the users brings the mobile devices and internet connection is available
2. This *Mobile Learning* is developed using Bootstrap for the mobile device in which it is supported with Javascript and CSS as its basic display that can be used for further needs
3. Hibernate is the *Object-relational mapping library* for Java programming language in which it involved 3 main components: Connection Management, Transactional Management and Object-Relational Management.

4. Based on the testing to some Android versions, it can be concluded that the application of *M-Leaning* can run in Android version 2.3 (Froyo), Android 4.0 (ICS) and Android 4.2 (Jelly Bean).
5. For further research, it is suggested to conduct that *m-Learning* to make it applicable in other *platforms* such as Blackberry and IOS.
6. There is a need for further research related to m-Learning to be fully integrated with SIA of Diponegoro University.

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