

IMPLEMENTATION OF ANDROID BASED MOBILE LEARNING APPLICATION AS A FLEXIBLE LEARNING MEDIA

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Abstract

Computer technology has been experiencing a quite rapid development in which it, in turn, has also caused a change in human life style. One of technologies bringing an impact on such life style is in the use of computer technology embedded in mobile communication devices. Nowadays, a new trend in e-learning is known as Mobile Learning, the use of portable media such as smartphone.

This research uses the Development and Research method a research to build and develop m-learning that can be used as a flexible learning media. Meanwhile, for the design of software, this research uses waterfall method.

The result obtained from this research is that 95% of user from university students enjoy in using the application of mobile learning and it is only 5% does not enjoy. At last, it can be concluded that the use of the mobile learning application can make the learning process more flexible.

Keywords: *m-learning, flexible-learning, Android.*

1. Introduction

Computer technology has rapidly been improving. This, as a result, has made a change in human life style. One of technologies that have brought an impact on this life style is the use of computer technology embedded in mobile communication device. The use of this technology, in fact, can help human in obtaining the update information in many aspects, one of which is in educational aspect.

On the other side, the rapid development of science and technology in the form of information and communication technology (ICT) has brought an impact on any fields including in educational and learning field in which the information of learning can be rapidly delivered to all learners through internet. The features of internet technology include being always be accessible anywhere

and anytime and capable of involving many users either individually or in a group. In addition, this technology offers all its simplicities. For these features, internet has been becoming a very suitable media for the development of the next education. The implementation of Information and Communication Technology (ICT) in educational world, in turn, will improve the quality of the education itself.

The implementation of ICT in educational institution today has been a must since it can be one of indicators for achievement of an educational institution. Many teachers or lecturers use the advance of technology, in this case internet, as online learning also known as e-learning.

E-learning (electronic learning) is one of the aspects of the ICT implementation in educational institution. It is defined as a media of delivering the content of learning or experience in learning electronically with the use of computer of computer based media^[1]. According to international convention^[2], learning content can be distributed through web or CD/DVD. In addition to learning content e-learning can monitor the performance of the college students.

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

2. Literature Study

The term of information technology has been becoming popular in the end of 1970s. Previously, this term was commonly called computer technology or electronic data

processing. Information Technology is defined as technology of processing and transmitting data using hardware and software, computer, communication and digital electronic. The development of communication technology in Indonesia is always dynamic from time to time. As a developing country, Indonesia always adopts any information technology until it comes to an era where the use of internet will have started to be a daily consumption known as internet based technology.

The development of information technology highly influences communication technology. E-mail is a core key for the change of communication way. Only using one E-mail address, the user can follow any models of communication provided on internet such as: Forum, Mail list /Group, Social Network sites, Blog or Sharing File Sites.

The improvement of life quality has more required human to do any activities needed by optimizing the available sources. Information and Communication Technology (ICT) that has a rapid development indirectly has obliged human to use it in any activities.

The use of mobile learning cannot be apart from the development of mobile technology. For this reason, technology of mobile learning also needs supports from infrastructure from data communication system in mobile devices. Figure 2.1 shows the infrastructure of data communication system in mobile devices^[3].

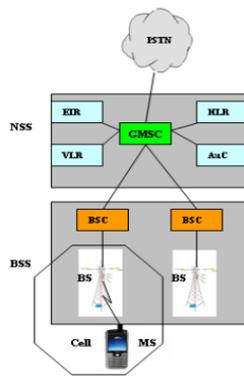


Figure 2.1 Architecture of Mobile Communication System

2.1. E-learning

E-learning stands for electronic learning a new way in the teaching and learning process using electronic media particularly internet as its learning system. Through E-Learning, it is possible for the learners to learn using computer in their own places, rather than physically attending the class for learning.

Since the term of e-learning contains a very broad meaning, many experts define e-learning from any perspectives. e-

Learning refers to the use of internet technology to send a series of solutions that can improve knowledge and skill^[4]. From this definition, it can be concluded that e-learning is a deliverance of learning content electronically distributed through web (Internet and/or Internet) or through CD/DVD (offline) and it is equipped with evaluation components inside^[5]. Based on technology that is used, e-learning can be divided into bases of technology including:

1. CBT (Computer based training)
2. LMS (Learning Management System)
3. Application of Web-based Learning

2.2 M-Learning

Mobile Learning is a learning model that is done inter place or environment using portable technology regardless of space and time. With its potencies and excellences, Mobile Learning is expected to be one of alternative learning sources that can enhance efficiency and effectiveness of learning process for human.

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. Education requires an alternative learning model typically not dependent on time and space. It is also expected that the alternative model can facilitate knowledge sharing and knowledge visualization in order to make knowledge more interesting and easy to understand^[6].

The use of information and communication technology in education has been always being developed in any various strategies and expected patterns. e-Learning system as a learning form that uses a set of electronic devices and digital media or mobile learning (m-Learning) refers to a learning form particularly using mobile devices and communication technology. 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.

Figure 2.2 shows the architecture of mobile learning.

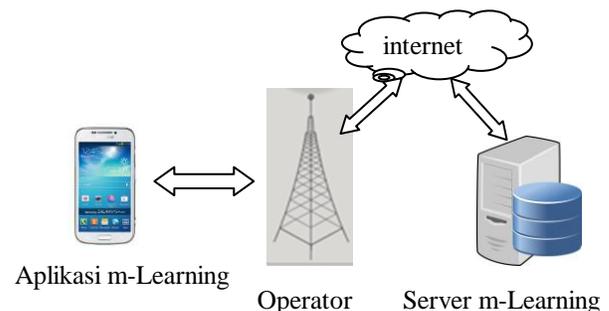


Figure 2.2 Architecture of m-Learning

The application of mobile learning can be developed using a variety of mobile technologies and platforms^[7]. Each implementation of mobile learning has a different characteristic. The application of mobile learning consists of:

1. Mobile Devices
2. Software
3. Content of application

In a learning activity (classroom instruction), mobile learning plays 3 roles:

1. Optional supplement
2. Complement
3. Substitute

3.2. Mobile Programming

Android operating system is one of new types of operating system in mobile communication device. This operating system has a Linux base. Android provides an open platform for developers to create their own applications to be used by any varied mobile devices. The update features and specifications of OS Android include application framework, Dalvik Virtual Machine, integrated browser, optimized graphic, SQLite, media support, GSM telephone, Bluetooth, EDGE, 3G, WIFI, camera ,GPS, compass, and accelerometer.

Operating system of Android principally is based on 2.6.x version Linux kernel that is a monolithic kernel. This kernel consists of driver used to hardware on mobile devices such as screen, keyboard, and camera, USB, WiFi and Bluetooth. The kernel also provides interface on hardware and memory management. The Library available in this kernel also supports the 2D and 3D graphic display, multimedia, security and WebKit used in browsing. Figure 2.3 shows the architecture of Android operating system.

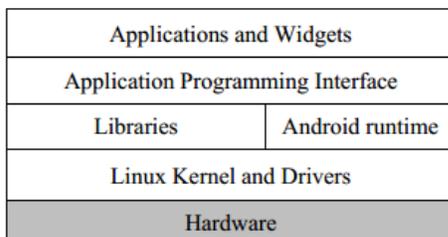


Figure 2.3 The Android Architecture

Android Run Time Layer is a layer that makes the application of android able to be run in which in its process, it can be done using the Linux implementation. Dalvik Virtual Machine (DVM) is a machine that forms the basic frame of Android application. Android runtime is divided into two parts:

1. Core Libraries: The application of Android built in Java language. Meanwhile, Dalvik is functioned as its virtual machine not Virtual Machine Java. Thus,

a library is required to translate Java language, which, in this case, is handled by Core Libraries.

2. Dalvik Virtual Machine: Register based Virtual machine optimized to run the functions efficiently in which this is a development that is able to make Linux kernel to do threading and low-level management.

The development of application in android operating system can be done by using two types - native language or web base. The use of native language is the earliest way in which the development of this android operating system based application uses Java Programming Language as a base programming. The development of android application uses a number of basic components as follows:

1. Activities (**Activity** base class),
2. Service (**Service** base class),
3. Content Provider (**ContentProvider** base class),
4. Broadcast Receiver functioned to receive and run the message to application (**BroadcastReceiver** base class) and
5. Message (**Intent** class).

The following figure is a cut of program to design the layout on the Android application.

```

<?xml version="1.0" encoding="utf-8"?>
<LinearLayout
xmlns:android="http://schemas.android.com/apk/res/android"
    android:orientation="vertical"
    android:layout_width="fill_parent"
    android:layout_height="fill_parent"
    android:background="@color/myColor">
    <EditText
        android:id="@+id/EditText01"
        android:layout_height="wrap_content"
        android:layout_width="fill_parent"
        android:inputType="numberSigned|numberDecimal">
    </EditText>
</LinearLayout>
```

Figure 2.4 Design layout on Android application

2.4. JQuery Mobile

JQuery Mobile is a platform of jQuery development. Specifically, JQuery mobile is to develop the application or web on mobile platform. Some platforms that have been supported by JQuery Mobile include Android, Blackberry, iOS, and Windows Phone^[8].

The JQuery Mobile commonly is used as the one to support the design of the User Interface application of web mobile. This application can be built as a native application (installable application) with the help of PhoneGap framework.

```

<meta charset="utf-8" />
<meta name="viewport" content="width=device-width,
initial-scale=1" />Arsitektur Komputer<link
href="css/themes/default/jquery.mobile-1.3.2.min.css"
rel="stylesheet" /><script type="text/javascript"
src="js/jquery.js"></script><script type="text/javascript"
src="js/jquery.mobile-1.3.2.min.js"></script></pre>
<div id="home" data-role="page">
<div data-role="header" data-position="fixed">
<h1>Fungsi Kmputer</h1>
</div>
<!-- /header -->
<div data-role="content"></div>
<!-- /content --></div>
<pre>
    
```

Figure 2.4 User Interface application of web mobile

2.5. Blackbox Testing

The test of Black Box treats software as “Black Box” without any knowledge about the internal work and it only examines the fundamental aspects of the system. While during the test of black box, the tester must find out the architecture system and will not have any accesses to the code of the sources [9]. Black-Box Testing tends to find out the following points:

1. Error or unavailable function
2. Interface errors
3. Errors on data structure and access of database
4. Performance errors
5. Error in initialization and termination

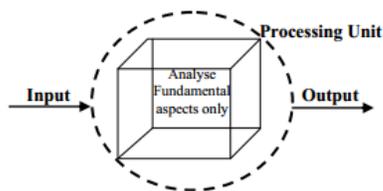


Figure 2.4 Black Box testing

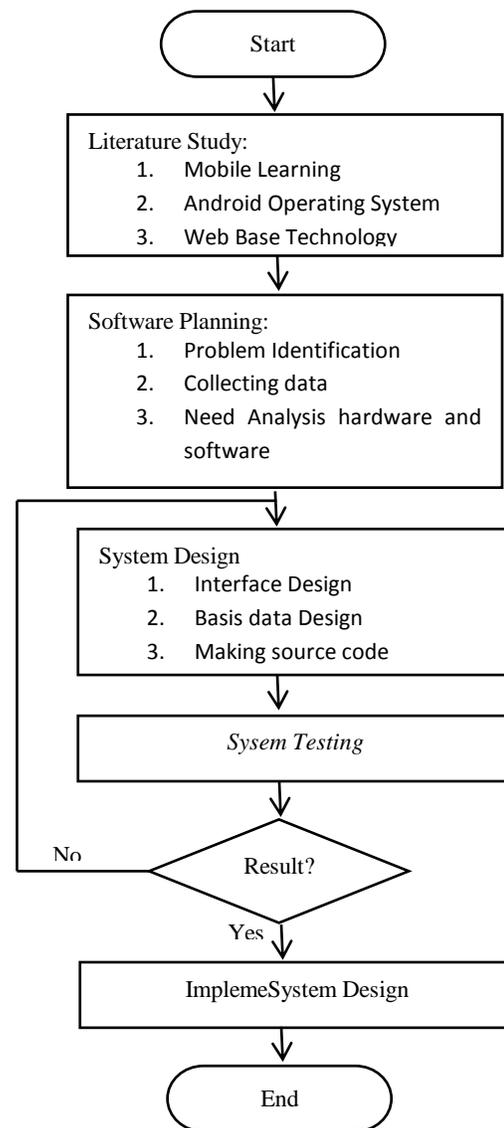
Black Box testing is designed to answer the following questions:

1. How are these functions tested to be valid?
2. What kind of input that can be a good testing case material?
3. Is the system sensitive to certain inputs?
4. How can a group of data be isolated?

5. How much data on average and how much data that can be handled by the system?
6. What effect that can make the combination of the data handled specifically on operating system?

3. Research Method

The research method in this research used Development and Research Method, a research to build and develop m-learning that can be used as a flexible learning media. The steps of the research that can be done are as follows:



Further, the method used in software design used Waterfall method, a method suggesting a systematic and sequential approach available in SDLC. This method emphasizes on an order in the process of software development.

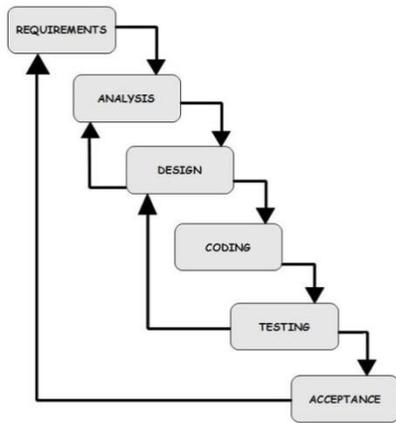


Figure 3.1 Waterfall Method

The needs of hardware used to develop the application of m-learning includes as follows:

1. Computer :
 - a) Intel® Core™ i5-3330S Processor (2.7 GHz, Cache 6M)
 - b) RAM DDR 3 2 GB PC-10600
 - c) HDD 320 GB
 - d) Monitor LCD 20"
2. Android Device
 - a) Samsung Galaxy ACE 3
 - b) Samsung Galaxy S4

Meanwhile, the needs of software used to develop the m-learning application include as follows:

1. IDE Notepad ++
2. JQuery Mobile
3. Phonegap
4. Beta.appinventor.mit.edu

The needs of users on this application consist of system administrator, lecturers, and college students. The Software built will be used by three types of user. Table 3.1 shows the detail of the type.

Table 3.1 The Needs of User

User	Rights of Access	Responsibilities
Administrator	<ol style="list-style-type: none"> 1. Adding the lecturer users 2. Managing system display 	Managing the system comprehensively
Lecturers	<ol style="list-style-type: none"> 1. Adding the materials for lecture 2. Making questions for evaluation 3. Managing the 	Managing the process of online learning

	scores for students	
College Students	<ol style="list-style-type: none"> 1. Downloading the materials for lecture 2. Doing evaluation 	Following the process of lecturing and doing the learning evaluation

The design of interface is aimed to provide the description about the application that will be built. Thus, it can be easy to implement the application. Additionally, it can ease the making of user friendly application. This application can be implemented to be an intact and accessible program. Figure 3.2 shows the design of application interface:

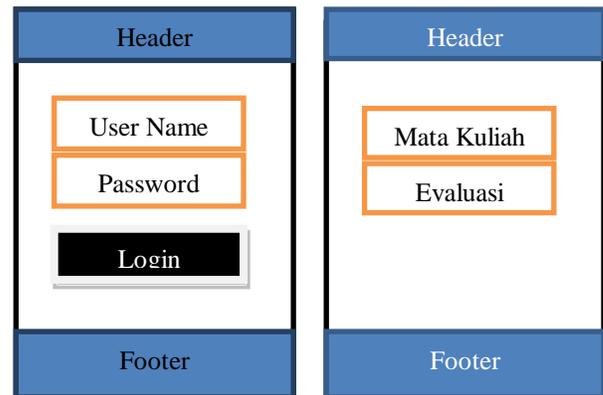


Figure 3.2 Design of Application Interface

The application test using the Black Box testing is used to find out the functionality of the system whether it works properly with the design or not. Meanwhile, the implementation testing of the system is conducted using questionnaires that are distributed to 30 college students.

4. Testing And Implementation

This part is related to the testing and evaluation of software and implementation of software application. This software is tested based on functionality and performance in the environment of testing at Study Program of Computer System in Diponegoro University.

4.1 Testing of Administrator System

The first testing is to test the page of administrator on the system of application. Figure 4.1 shows the display of dashboard from the page of administrator.

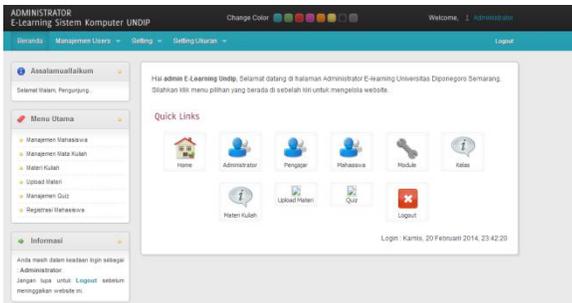


Figure 4.1 Dashboard Administrator

The next phase is to test the menu of the instructor (lecturers). This is aimed to find out the functionality of the menu that has been developed. Figure 4.2 shows the result of the testing.

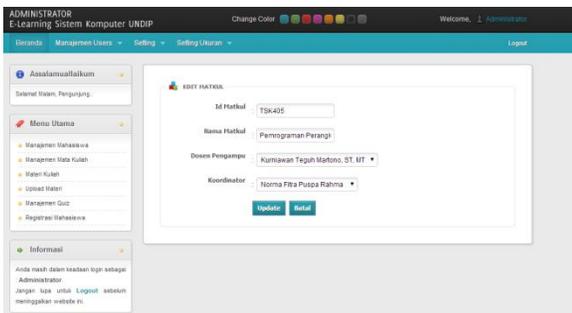


Figure 4.2 Menu of Instructor (Lecturer)

4.2 M-learning Testing

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. Table 4.1 shows the result of the testing.

Table 4.1 Functionality Testing

Test Component	Expected Results	Test Result
Login Page	<ol style="list-style-type: none"> 1. User and password are correct, so it is allowed to go the next page 2. User and password are incorrect so the message for the incorrectness will appear 	Suitable

Menu Page	Showing the menu that can be accessed by the users	Suitable
Lecture Page	Showing the list of lecture, lecturer and GBPP	Suitable
Download Material	User is able to download the lecture material	Suitable
Evaluation Page	Showing a number of questions in accordance with the evaluated subjects	Suitable
Score Page	Showing a number of scores obtained from the evaluation results	Suitable

The result of the application test covering the login page, menu page, material download page and lecture page can be seen in Figure 4.2

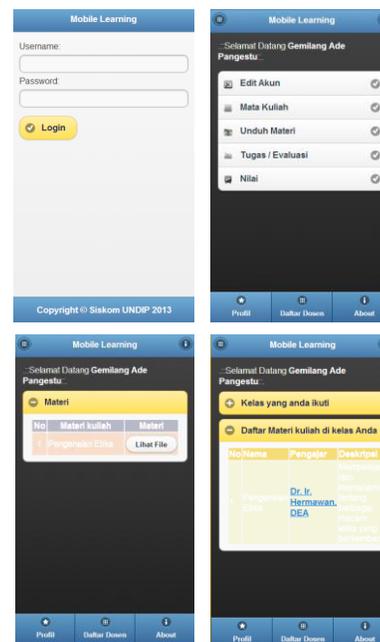


Figure 4.2 Display of m-learning application

4.3 Implementation

The application of mobile learning can be accessed at <http://elearning.ce.udip.ac.id> using the android mobile communication device. To test this application, 30 college students have been involved as the users. The parameters of this test include:

1. Acceleration in accessing the page
2. Acceleration for the login to the system
3. Acceleration for downloading the file of lecture material in PDF form
4. Delivering quiz/evaluation of the lecture
5. Layout of module and material on layout
6. Clear writing size (caption, texts, and typography)
7. Simplicity in the use of navigation
8. The display of interface website design layout for the learning media
9. The displayed features are in accordance with the need of lecture.

Of the parameters of the test given, it is found from the result that 95% of the user feels comfortable and satisfied in using the application of mobile learning. 5% of the user, on the other hand, feels uncomfortable in accessing the application of mobile learning. It is due to the problem in telecommunication network used in accessing the mobile learning.

5. Conclusion

Some conclusions below can be drawn from this research:

1. The application that is made is in accordance with the need of the user
2. Based on the result of the test using the case of Black Box, it is found that the software can find out the functions that are incorrect or missing, interface errors, performance error, initialization, and termination error. Functionally, the test has given the result as expected
3. 95% of user of college students state that they are satisfied in accessing the application and it is only 5% of them feel uncomfortable
4. By using the application of mobile learning, the learning process can be more flexible since it can be done anytime, anywhere and in any conditions.

References

[1] Smaldino., S. E. et. a., *Instructional Technology and Media for Learning*. New Jersey: Pearson Prentice Hall, 2005.

[2] Davidson-Shivers, *Web-Based Learning: Design, Implementation, and Evaluation*. New Jersey: Pearson Prentice Hall, 2006.

[3] Wilayat. K and Habib. U, "Authentication and Secure Communication in GSM, GPRS, and UMTS Using Asymmetric Cryptography.," *International Journal of Computer Science*, vol. 7, no. 3, 2010.

[4] M. Rosenberg, *E-learning: Strategies for delivering knowledge in the digital age*, New York, NY: McGraw-Hill Companies, Inc. 2001, pp. 185–188.

[5] Novi Hidayati, "Sistem E-Learning Untuk Meningkatkan Proses Belajar Mengajar: Studi Kasus Pada Sma Negeri 10 Bandar Lampung," *Jurnal Telematika MKOM*, vol. 2, no. 2, pp. 153–170, 2010.

[6] Nurhayati., O. D., "Design of Information Technology in Enhancing the Quality of M-Learning -Based Learning at Diponegoro University," *International Journal of Computer Science*, vol. 10, no. 6, pp. 190–195, 2013.

[7] Pocatilu, P "Developing Mobile Learning Applications for Android using Web Services.," *Informatica Economica.*, vol. 14, no. 3, pp. 106–115, 2010.

[8] P. Dutson, *Praise for Sams Teach Yourself jQuery Mobile in 24 Hours*. Indianapolis, Indiana, 46240 USA: Sams Publishing, 2013.

[9] Mohd. Ehmer Khan and Farmeena Khan, "A Comparative Study of White Box , Black Box and Grey Box Testing Techniques," *International Journal of Advanced Computer Science and Applications.*, vol. 3, no. 6, pp. 12–15, 2012.

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