AUGMENTED REALITY APPLICATION AS COMPUTER ASSEMBLY LEARNING BASED ON ANDROID MOBILE

Paper

Department of Informatics Engineering

Faculty of Communication and Informatics

Submitted by:

Veni Alfianita

Umi Fadillah S.T, M.Eng

DEPARTMENT OF INFORMATICS ENGINEERING

FACULTY OF COMMUNICATION AND INFORMATICS

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Prepared and compiled by:

VENI ALFIANITA
NIM : L200102002

Day : Wednesday
Date : 2 July 2014

Advisor

[Signature]

Umi Fadillah S.T, M.Eng
NIP : 197803222005012002

This Publication as one of the requirements for Getting a bachelor’s degree
Date : 21 July 2014

Know,
Head of
Department of Informatics

[Signature]

Dr. Heru Supriyono, S.T. M.Sc. Ph.D
NIK : 970
SURAT KETERANGAN LULUS PLAGIASI
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NIM : L200102002
Judul : AUGMENTED REALITY APPLICATION AS COMPUTER ASSEMBLY LEARNING BASED ON ANDROID MOBILE
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Augmented reality is a technology of merging the virtual world with the real world and show in real time, so as if the virtual object feels like real objects in the real environment. This application is made with the purpose of combining the 3D object that is a replica of computers component with augmented reality technology. Making an application begins with analyzing requirements of the system (information computer components and computer assembling process, software, and hardware), collecting the data, design the look of the system and the user interface, application systems development, and the last stage of testing the system to ensure that applications can run well. Design for 3D object using a blender 2.6.4 software. For construction of system use unity 3D 4.1.3f.then 3D object from blender 3D is inserted into the unity 3D. In implementation required the marker, here using six images to be used as a means of introduction of the system will display the 3D object. In image pattern recognition in QCAR used Natural Features Tracking with FAST Corner detection method is detection by finding the points (interest points) or corners (corner) on an image. Term of corners and interest points are often used interchangeably. First performed edge detection, then process edge analysis to get rapid detection angle. The result is an application that provides information about the components of a computer by using a predetermined marker developers. To guide the assembly of computer in the form of 3D animation video. This application has a size of 51.7 MB and implemented on the Android platform with a minimum operating system version 2.3 (Gingerbread) and has an internal memory of 170 MB unused.

Keyword: Android, Augmented Reality, Computer Assembly.
INTRODUCTION

Computers are an essential requirement for its function in contemporary times, almost every corner of the country use the computer as a tool to support effective and efficient performance in a variety ways, one of which is as a mean to support education. Importance of computers in education is demanding students and teachers have ability to operate a computer to know the outside world that can not to be reached directly. However, practical in schools tends to provide the knowledge to operate it without giving knowledge about way to assemble computer. Lack of media (Personal Computer) that can be used to study the assembly in the computer directly is one of the causes, so, we need a replacement media which is flexible as well as technologies that can bring an exciting learning environment.

One way that can be used to overcome the limitation of media that necessary in learning are with combine android platform and augmented reality technology. Android is a platform that can be contemporary trends, which is owned by almost every mobile phone and used by everyone. Applications that can be get for free makes it easy for users. Build and develop applications in android platform are also facilitated with a lot of tutorials and developers, because android is open source platform. Similarly, augmented reality technology, which is a merger between the real and the virtual world, where object virtual over layed on the real world and give effect to interesting application. Tools that can be used to build augmented reality technology also readily available.

That is the underlying thing that author wants to apply a method of assembling a computer learning with android media based on mobile phone and augmented reality technology. Where the mobile phone will make it easier and more flexible to be used, and with incorporate augmented reality technology that will provide interesting and fun effects when studying.

OBSERVATION

Researchers use study of research from previous thesis on the problems related to the study entitled "AUGMENTED REALITY APPLICATIONS AS A MEDIA BASED LEARNING ANDROID MOBILE COMPUTER ASSEMBLY". This research study is also used as a comparison between the studies that had finished now and that will be designed by the researchers. Some of the research studies are:

Chandra (2010), entitled “SIMULASI PERKITAN KOMPETER BERBASIS JAVAFX”. Simulation program contains hardware introduction, assembly of computer, operating system installation, and
exercises. Interactive applications using software Netbean and JavaFX 6.8 IDE as a plugin, both of the software is open source and free software. Program comes with animation.

Sandjarjo (2013), entitled “PERANCANGAN APLIKASI PENGENALAN BEBERAPA BAGIAN CANDI BOROBUDUR BERBASIS AUGMENTED REALITY”. Discuss the making of an application that displays some parts of the Borobudur temple using a blender application as 3D modeling and implemented into augmented reality. Experiments using windows 7 and windows XP. Introduction of the Borobudur Temple object using streaming video taken from camera as an input source, then this application will keep tracking and detecting a marker by using a tracking system, after marker is detected, model object turn up the marker as if the model is real. To make 3D object using 3D blender 2.49 later changed its format to the format supported by this application. After testing system, system can detect the marker with distance limitations between about 6 and about 24 cm from camera, as well as the restrictions less than 50 means brightness for maximum approximately 200 means values for maximum light. System can detect a marker in frontal state with 100% accuracy and detection of time less than 0.5 seconds. System displays an object when a marker visible by camera and there are some tilt that can be recognized and unrecognized by the system. System can’t display an object when marker blocked of other object.

Research by Fajar (2012) with entitle “APLIKASI CARA MERAKIT DAN MERAWAT KOMPUTER BERBASIS ANDROID”. Discuss how to assemble and maintain a computer properly. Applications built using the JAVA programming language, JDK (Java Development Kit), XML (Extensible Markup Language) and android based IDE (Integrated Development Environment) Eclipse “Indigo”.

RESEARCH METHOD

1. Research Plot from this Application are Shown in Figure 1.

![Research Flowchart](image)

**Figure 1.** Research Flowchart
Description of Research Flowchart:

a) Requirement Analysis

The first stage before building the application is analyzing requirements what is needed to build the system. Analyze data, information, software, and hardware that needed to build an systems of augmented reality application as a computer assembly learning based on android mobile.

Information requirement analysis that will available to user are:

1. Computer component specification that will introduce in application are:
   a. Motherboard GA-B75M-HD3
   b. Processor Intel core i3 2.93GHz
   c. RAM Lenovo DDR3 4GB
   d. Hardisk Samsung SATA 500GB
   e. Heatsink
   f. Power supply Venom 400 watt

2. Computer assembly animation in form video with computer specification:
   a. Motherboard Gigabyte GA-B75M-HD3(rev. 1.0), with future:
      1. Support for Intel core i7, i5, i3, Pentium and Celeron. This processor in the LGA 1155 package
      2. L3 cache varies with CPU
      3. Intel B75 Express chipset

b. Processor : intel core i3

c. RAM : 4 GB

d. Harddisk : 500 GB

e. Disk drive : Lite on

f. Power supply : Venom 400 watt

3. Application Fiture:
   a. Zoom in and zoom out
   b. Rotation
   c. Object information
   d. Book marker (set of marker that used to display animation)

Software requirements to build application are:

1. Unity 4.13
2. Blender 2.64
3. Vuforia android SDK 2.6.10

Software requirements to run application are operating System Android 2.3.6 (Gingerbread).

Hardware Requirements in design are personal computer with specification:

1. Processor Intel Core i3-2310M, 2.10 GHz
2. 500 GB hard drive
3. 2 GB RAM

Hardware Requirements to run application are mobile phone with specification:
a. System on Chip Mediatek MTK 6575 with Processor cortex A9 speed 1GHz
b. GPU PowerVR SGX531
c. RAM 512 MB
d. Internal Memory 170 MB
e. Camera primer resolution 5 MP
f. Screen resolution WVGA LCD 480x800 pixel, 4.3 inch.

b) Collecting Data
This stage is stage of collecting the data system which needed after the requirements analysis done.

c) Design User Interface
After all of the data is completed, the next stage is designing a user interface that will be a reference in the construction of the display in the system.

d) Build Application
On this stage all the data completeness implemented into the system. Creating 3D object of computer component and computer assembly animation video with blender software, then insert it into unity 3D and create display applications.

e) System Testing
Trial to execute this simulation is Information Engineering Muhammadiyah University of Surakarta with networking concentration.

f) Create Report

After the application can be run with the appropriate, then the last stage is to make a report.

2. Flowchart in this Application as shown Figure 2.

According to Figure 2 stage from flowchart can describe below:

1. prepare a mobile phone with android OS and make sure it installed with "aplikasi.apk" and print marker

2. Run application

3. when application running, splash screen appeared firstly
4. Then main menu showed and contains 5 buttons (introduction, assembly, download marker, about, and exit) that have their own functions.

5. If the introduction button selected, our phone camera activated and notification tells that the marker hasn't detected, so we need to prepare the marker and arrange the camera to it. When the marker had been detected, 5 buttons showed up (scale up, scale down, rotate right, rotate left, and info) and the object also appeared depends on detected marker.

6. If the assembly button selected, a sub menus contained with 6 button (play video processor, heatsink, ram, hardisk, power supply, and play video finishing computer assembly) will appear, each of them will show different videos.

7. If the download marker button selected, it will be redirected to internet browser and then we could download a marker there.

8. If the exit button selected, a box that contains some texts to ensure if a user really wanted to close the application will appear.

RESULT AND DISCUSSION

Results achieved from this research are the introduction and computer assembly application using augmented reality technology that implemented on android platform. The result is as follows:

1. Display of Splash Screen Page

![Figure 3. Splash Screen](image)

Figure 3 is an initial view that appears when the application is run.

2. Display of Main Menu Page

![Figure 4. Display Main Menu](image)

Figure 4 is display page of the main menu which consists of five menu buttons namely: introduction, assembly, download
marker, about and exit buttons. Main menu will refer to a sub-menu that is inside.

3. Display of Sub-Menu Introduction when marker has not been detected condition.

![Undetected Marker](image)

**Figure 5. Undetected Marker**

Figure 5 is a display when the button introduction is pressed and the camera does not detect the marker.

4. Display of Marker

![Marker](image)

**Figure 6. Marker**

Marker (target image) there are provided six markers and each will show different 3D objects. Figure 6 is display markers which provide for the introduction menu.

To implement the marker (the target image) QCAR in augmented reality environment, a marker needs to register first by:

1. Preparing marker (here is using image)
3. Choose target manager and create database.

![Create Database](image)

**Figure 7. Create Database**

4. Upload an image to be used as a marker, by opening a database that was created and select add targets. The contents of all components in the form. Because who wants to be a marker is image then select single image and select browse to retrieve the desired image, then add.

![Add New Target](image)

**Figure 8. Add New Target**
5. After all process is complete, select the image you want to be downloaded, then select download selected targets and a dialog box will appear as shown in figure 9. Then select the Unity Editor and create.

![Download Selected Targets](image1.jpg)

**Figure 9. Download Target**

In the registration process, images are uploaded automatically given a rating. This is where rating that determines the quality and quantity of images that will be the target of augmented reality images. The higher rating is better quality in its detection. The result of this process is a unity package which is then exported to a 3D unity with double clicks.

5. **Display of Introduction Sub-Menu when detected marker condition.**

When the camera detects the marker, then the object will appear and the 5 function button. And the fifth button will disappear when the camera does not detect the marker. Button was scale up, scale down, rotate left, rotate right, info.

![Detected Marker](image2.jpg)

**Figure 10. Detected Marker**

6. **Display of Assembly Sub Menu**

Figure 11 is display of sub menus when the button assembly is pressed. Here are six sub menus, which are: play video motherboard, processor, heat sink, ram, hard drive, and power supply.

![Assembly Sub Menu](image3.jpg)

When the button in assembly sub menu is pressed, will display video that automatically run, and when the video is finished running within two seconds the display will return to the sub menu assembly. In the video has three function
buttons there are play, pause, next and previous buttons.

![Figure 12. Video Running](image)

7. Display of Menu About

Figure 13 is display when the button about is pressed. Function button about of this contains the version of application and developer. User can zoom in and out this page with touch the screen.

![Figure 13. Display Menu About](image)

8. Display of Download Marker

Figure 14 is display when the button download marker is pressed, which will refer to the browser place where the marker uploads.

![Figure 14. Display when user clicked download marker button](image)

9. Display of Exit Menu

Figure 15 is display when the exit button is pressed, function to exit the application. Another way to exit the application can also use the escape key on the mobile phone.

![Figure 15. Display Exit Application](image)

**Analysis and Discussion**

System testing is done to determine whether the system is running appropriately. Black box testing is done by simply taking into account input into the system and the output from the input. System testing is done on the android platform with three different specifications. Tests on augmented reality applications as follows:

1. Testing of Splash Screen Page

   A test of display splash screen is a test page to display an image in splash screen page.

   Tests of displayed a splash screen page generates display responsible in any android platform.

2. Testing of Main Menu Page
Testing of main menu page views is testing the functionality to display some menu buttons that refer to other pages. Testing of main menu page view generates display responsible in any android platform.

3. Testing of Displayed Menu Assembly

Tests of display menu assembly page are testing functionality to display six button menus that serve to display computer assembly animation videos. Testing Assembly menu page view generates displayed responsible in any android platform.

4. Testing of Playing Video

This test used to display animated 3D video computer assembly. Tests of run video produces responsible displayed in any android platform, each video can work well, but need to pay attention to the memory of the android platform used. Videos can only run on the android platform that has an internal memory that is not using at least 50 MB.

5. Testing of Menu Introduction Displayed

Testing on this menu introduction using two conditions, which is when the condition marker undetected and the marker is detected.

a. Undetected Marker

Testing of introduction page displayed when the marker was not detected produces a displayed responsible in any android platform.

b. Marker Detected

Testing of introduction page displayed when the marker is detected produces a displayed responsible in any android platform, that is display applications adjust to the screen size that are used.

6. Testing of Comparison Time with Light Intensity

This test is used to measure how fast the application in detecting markers in bright light intensity conditions.

The results of comparative tests of time and light intensity are used when detecting the marker on the menu introduction, that the better quality of the light intensity when detecting marker, objects will appear more quickly than when the intensity of light used is dim, it will take a longer time.

7. Testing of Views Page Menu About

Testing of Views Page About Menu Testing of about views page is testing to display information about the application and developer.

Testing of about views page display generates responsible in any android platform.

8. Exit Application Testing
Testing of exit app by pressing exit button of the augmented reality application.

Exit application testing produce display responsible in any android platform and applications come out well.

CONCLUSION

The conclusions of the research are augmented reality application as computer assembly learning based on android mobile were built with unity 3D 4.1.3f, vuforia library 2.6 and software blender 2.6.4. The result of application is an application that can use to introduce computer component and assembly computer process in form of video. Size of this application is 50 MB. Contains of application are:

a. Assembly: contains, assembly computer process in form of video
b. Introduction: contains introduction of components, this needs marker to display object and button function.
c. About: contains information of developer and application
d. Download marker: if this button is selected, it will be direction to browser where marker can be downloaded.
e. Exit: for close application

This application can run in android mobile with minimum specification:

a. Operating System: versi 2.3 (Gingerbread)
b. RAM : 400 MB
c. Internal Memory Space: 170 MB
BIBLIOGRAPHY


