

APPLICATION OF TECHNOLOGY AUGMENTED REALITY IN BROCHURES SMK GHAMA CARAKA DEPOK BASED ANDROID

Indarti^{1*}; Dewi Laraswati

¹Information System; ²Computer Technology
Faculty of Information Technology, Bina Sarana Informatika University
www.bsi.ac.id
indarti.ini@bsi.ac.id; dewi.dwl@bsi.ac.id

Abstract

The brochure is one of the important instruments for promotion to provide initial information for prospective students, but the currently used brochure is still fairly classic. Still using brochure leaflets on paper media and the information conveyed depends on the size of the printed brochure. If the school committee wants to provide more information by adding pictures with product details, the larger the brochure size that needs to be printed. The research used augmented reality to make interactive brochures based on Android. The steps involved are analyzing the software and hardware requirements to be used. The research method uses the case study method with a qualitative approach. As for the application development model using the waterfall model, which is a method in SDLC, the sequence of steps used in this research is system requirement analysis, design, program code making, testing, and support.

Keywords: Augmented Reality, Brochures, Android

Abstrak

Brosur adalah salah satu instrumen penting dalam hal promosi dengan tujuan untuk memberikan informasi awal bagi calon siswa, tetapi brosur yang saat ini digunakan masih terbilang klasik. Masih menggunakan selebaran brosur dengan media kertas dan informasi yang disampaikan tergantung pada ukuran dari besarnya brosur yang dicetak. Jika pihak sekolah ingin memberikan informasi lebih banyak dengan menambahkan banyak gambar dengan dilengkapi detail produk, maka semakin besar ukuran brosur yang harus dicetak. Penelitian yang dilakukan menggunakan konsep augmented reality dalam pembuatan brosur interaktif berbasis android. Adapun tahapan yang dilakukan terdiri dari analisis kebutuhan perangkat lunak dan perangkat keras yang akan digunakan. Metode penelitian menggunakan metode studi kasus, dengan pendekatan kualitatif. Sedangkan untuk model pengembangan aplikasi ini menggunakan model waterfall yang merupakan metode dalam SDLC, urutan langkah-langkah yang digunakan dalam penelitian ini adalah analisis kebutuhan sistem, desain, pembuatan kode program, pengujian dan pendukung.

Kata kunci: Augmented Reality, Brosur, Android

INTRODUCTION

The development of augmented reality in Asia is increasing released at pressrelease.kontan.co.id on 21 January 2020 (Daniel Rembeth, 2020) that augmented reality will increase the global economy to 1,4 trillion pounds in 2030.

In product promotion, augmented reality can be applied where a brand will do promotional activities by interacting nearer to the user. through various activities, Promotional purposes are introduced for the general public in a brand owned in the hope that buyers and consumers could be

interested in the products offered intertwining a good relationship with consumers.

The use of augmented reality in the form of interactive brochures made in brochures is implemented in the form of interactive brochures which can contain information about complaints submitted in the form of brochures that are presented in 3D and supported virtually through smartphones.

The source of literature used in this study is related to theory and material so the research made has a solid and scientific basis. Some previous research sources that can be adopted by the authors are as below.

Augmented Reality is the output generated from computer processes that display objects in cyberspace and the real world. The virtual display can be presented in various forms such as video animation text, and 3D models that are presented on real objects in the environment where we will display virtual objects.

Promotions are carried out conventionally one of which is to use brochures (Yuliati et al., 2014). The brochure usually contains several pages that will provide information about the products offered so that consumers are interested

Vuforia in research (Mustaqim & Kurniawan, 2017) is software that focuses on image recognition to support augmented reality technology.

According to (Rizal & Rusmin, 2018) explains that Unity 3D is a game engine that allows you,

both individuals and teams, to create a 3D game easily and quickly

(Adami & Budihartanti, 2016) explained that: "C # (read" C-Sharp ") is an object-oriented programming language, created by Microsoft (developed under the leadership of Anders Hejlsberg who also invented various programming languages).

Research on augmented reality is currently widely discussed and utilized in various fields ranging from the use of technology in the fields of education, health, and media promotion tools. Below are some of the previous studies on the use of augmented reality technology and researchers using materials to get the theory used to obtain materials used to make materials from research that is made. Below can be seen an explanation of the initial studies, namely:

Table 1. Literature Research

Author	Research Problem	Method	Research Results
Tri Yuliati, Ema Utami, Hanif Al Fatta (Yuliati et al., 2014)	Promotional media is still conventional (Yuliati et al., 2014)	IMSDD mobile <i>Augmented Reality</i> (Yuliati et al., 2014)	Mobile applications using the Android platform with Augmented Reality technology are expected to be able to display brochures that are presented in an interesting and real-time manner. (Yuliati et al., 2014)
Dedy Abdullah, Alkausar Sani, Amir Hasan (Abdullah et al., 2019)	Lack of information and promotional media that is not interesting and not interactive causes the number of visitors to this location to be very low. (Abdullah et al., 2019)	<i>Incremental Method</i> (Abdullah et al., 2019)	The results showed the augmented reality application system of Bung Karno's residence could run well. (Abdullah et al., 2019)
Ilmawan Mustaqim and Nanang Kurniawan (Mustaqim & Kurniawan, 2017)	Teachers will be more difficult to explain to students about the various types of pneumatic components and their use. (Mustaqim & Kurniawan, 2017)	Experimental research methods (Mustaqim & Kurniawan, 2017)	The results of research in the form of the development of instructional media using augmented reality are useful as teaching materials in virtual form. (Mustaqim & Kurniawan, 2017)
Muhammad Rizal and Muhammad Rusmin (Rizal & Rusmin, 2018)	In promoting property there are still many companies using marketing media in the form of brochures and websites. At present, the media is considered less effective and less attractive with limitations in displaying the marketed property models. (Rizal & Rusmin, 2018)	SDLC agile method (Rizal & Rusmin, 2018)	Generating an application that runs on the Android platform is one of the activities undertaken to market products offered with attractive and effective media using only the smartphone that has the information received and represents what is being sold. (Rizal & Rusmin, 2018)
Sari Indah Anatta Setiawan (Setiawan, 2011)	There are still many people who do not know about the functions and benefits of Google SketchUp in the use of 3D modelling software (Setiawan, 2011)	Experiment Method (Setiawan, 2011)	This research aims to introduce Google SketchUp to the people of Indonesia, especially academics so that they can utilize this software as an alternative tool in 3D modelling. (Setiawan, 2011)
Feby Zulham Adami and Cahyani Budihartanti (Adami & Budihartanti, 2016)	How to apply augmented reality technology on android-based learning media. (Adami & Budihartanti, 2016)	Data collection methods used are observation methods, interview methods, and literature study methods. The software system development methodology that researchers use is the Waterfall model. (Adami & Budihartanti, 2016)	Producing a learning application using augmented reality technology using a smartphone. (Adami & Budihartanti, 2016)
Indarti (Indarti, 2017)	The learning process at Pondok Pinang 10 Morning Elementary School with the process of students listening to explanations	Literature Study Methods. (Indarti, 2017)	Generating an application that contains an introduction to national heroes on the island of Java which is intended for students based on

Author	Research Problem	Method	Research Results
	from the teacher and seeing and reading books that might lead to boredom in students. (Indarti, 2017).		Pondok Pinang 10 Pagi Elementary School based on Android. (Indarti, 2017)
Bonny A Suryawinata (Suryawinata, 2010)	Existing home marketing media is still conventional (Suryawinata, 2010) and 2D in form so it is less attractive to buyers and difficult to imagine the condition of the house.	Literature Study Methods. (Suryawinata, 2010)	Design an application that can display 3D images via the internet by utilizing augmented reality technology (Suryawinata, 2010), so that potential homebuyers can access this application anytime and anywhere.

The purpose of the research carried out by researchers to develop software in the distribution of school brochures is to be able to help visitors find the location of the school or class by utilizing augmented reality technology based on Android.

RESEARCH METHODS

In this study, the authors used the case study method. By investigating Caraka Depok Vocational High School, particularly in the area of school promotion, a problem was discovered. This research was conducted by researchers using a waterfall model. This model provides a sequential or sequential software life cycle approach, which is:

1. Communication (Initiation Meeting and Requirements)
Communication in studies is technical work and is needed by users to achieve goals with the results of project initialization that analyzes problems in AR research to facilitate the process of introducing schools or company profiles and is useful for users in knowing school facilities and infrastructure created by researchers.
2. Planning (Estimating, Scheduling, Tracking)
The planning stage of the researcher is to make software features by describing facilities and infrastructure in the school, the risks that will arise when creating Augmented Reality School Brochures, the resources needed by researchers to create brochures using Augmented Reality, the products to be produced under analysis and drafts that are made and work schedule for making this Augmented Reality brochure.
3. Modeling (Analysis & Design)
The model that will be used at this stage is adjusted to the design that has been made by researchers and adjusted to the final appearance of the brochure with Augmented Reality. In the model stage consists of 2 namely analysis and design, each of which has a picture, namely:
 - a. Analysis

Having specifications of user requirements, among others:

- 1) The scope of information describes a data processing, both the data displayed, and the features that will be displayed in the brochure.
- 2) Functional Scope describes the functions of the features that will be displayed to the Augmented Reality Brochure users.
- 3) The Scope of behavior describes the events caused by features that have been created using the Augmented Reality brochure.
 - b. Design
Various specifications are arranged in the making of this Augmented Reality brochure, which starts from the software structure, components, and appearance of the Augmented Reality brochure to the user.
4. Construction (Code & Test)
This construction phase adds the creation of program code and application testing of Augmented Reality applications that have been made by researchers utilizing unit testing, integration testing, validation testing, and acceptance testing.
5. Deployment (Delivery, Support, Feedback)
Submission of the system found by the makers of three (3) components, namely, sending messages in the making of this Augmented Reality brochure, providing facilities in using the Augmented Reality brochure and feedback to users in using this Augmented Reality brochure more easily and efficiently without opening directly to the school to inspect facilities and infrastructure in the school.

Types of research

This research uses a qualitative approach. The approach taken by the author is by making observations (direct observation) at SMK Ghama Caraka Depok and conducting interviews especially in the field of a school promotion.

Time and Place of Research

SMK Ghama Caraka was established on December 12, 2018, under the Ghama Educational Institution's d'Leader School. The school, which is

located at Jalan Raya Grogol No. 3, Grogol Village, Limo District, Depok City, has only one department or one package of expertise, namely in the field of Broadcasting, with Television Program Broadcasting Production Expertise Competency (PSPT).

Research Targets / Subjects

At the beginning of the founding of SMK Ghama Caraka, namely the 2013-2014 Academic Year to date, the registered students are listed as follows:

Table 2. Student Recapitulation on SMK GHAMA Caraka Depok

SCHOOL YEAR	SMK GHAMA CARAKA			TOTAL
	INNOVATION			
	L	P	JLH	
2013/2014	26	43	69	69
2014/2015	34	36	70	70
2015/2016	18	28	46	46
2016/2017	27	23	50	50
2017/2018	50	13	63	63
2018/2019	36	20	56	56

Source : (Yayasan Pendidikan GHAMA d'leader school, 2018)

Over time, competition between schools with television broadcasting majors has experienced a very significant surge with the establishment of

competitor schools, there are even some courses that open broadcast competency packages in the City of Depok. This is a challenge for SMK Ghama Caraka to continue to show its existence, with a variety of strategies that have been carried out by this school, but with the student admission data above, schools must provide different experiences to each prospective applicant to become a brand image of the broadcasting school.

RESEARCH RESULTS AND DISCUSSION

The results in this study are based on the waterfall model used by the author in developing a software application as follows:

A. Communication

Analysis of the system requirements of researchers using the Android platform based on interviews with the marketing team Most applicants and employees use the Android platform. Analysis of system requirements used in the development of this system:

1. Users can scan brochures
2. Users can display the virtual object above
3. Users can register new students

B. Planning

At this stage table 3 can be seen planning software development activities, as follows:

Table 3. Activity Plan

No	Activities	January				February				March				April			
		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
1	Determine user needs																
2	Analyze costs and benefits																
3	System Analysis																
4	Creating an Application																
4	Testing																
5	Evaluation																

C. Modelling

The design carried out by researchers is to create virtual object modeling designs such as school buildings, then create database designs where this process is created using Vuforia, the contents of the database are target markers or images that will be recognized by the application. Besides making software architecture, where researchers use State Transition Diagrams (STD), Use Case Diagrams, and Structure Navigation.

1. Use Case Diagram

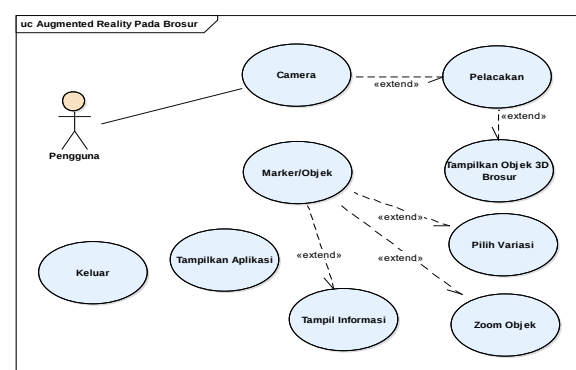


Figure 1 Use Case Augmented Reality Diagrams on the Brochure

The use case diagram in the picture above can be explained in the Scenario table for the "User" use case as follows:

Table 4. User Use Case Scenarios

Use Case Name	:	Use Case Augmented Reality Diagrams on the Brochure
Use Case Description	:	Users can apply the camera to the brochure
Actors	:	User
Pre-Condition	:	AR application on Android phone
Post-Condition	:	Activate the Camera and scan the Marker on the Brochure
Main Scenarios	:	Serial Step

	No.	
Actor	1	AR Camera
	2	Marker / Object
	3	Showing Application
	4	Exit

	Access
Extensions	1a Tracking
	1b Show 3D Brochure Objects
	2a Select variations
	2c Object Zoom
	2d Information displayed

2. Activity Diagram

a. Activity diagram Activity Diagram Display 3D Object Brochure

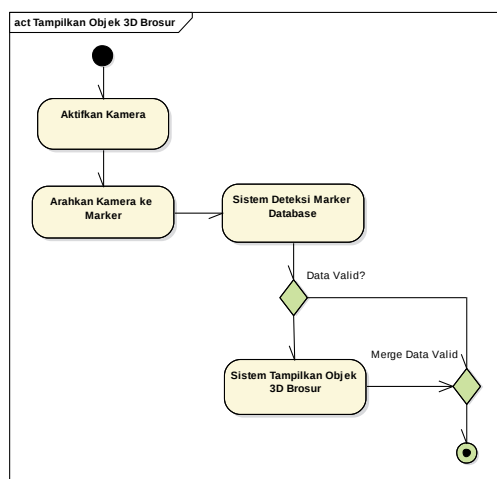


Figure 2 Activity Diagram Show 3D Objects Brochure

Figure 2 above illustrates the activity diagram of the user (user) for displaying 3D brochures with augmented reality technology.

a. Activity diagram of the Object Zoom process

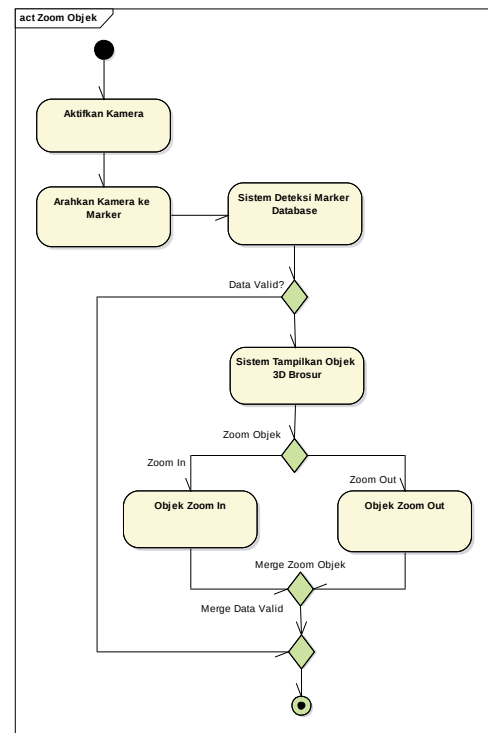


Figure 3 of the Object Zoom process

In Figure 3 above illustrates the activity diagram of the user (user) to display Zoom In or Zoom Out with augmented reality technology.

3. Application Flow Chart

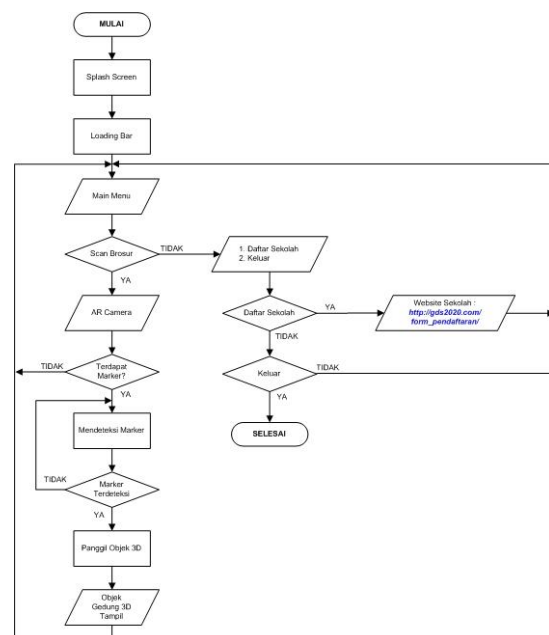


Figure 4 Application Flow Diagram

In Figure 4 above we can find out the order of the course of the interactive brochure application.

4. State Transition Diagram

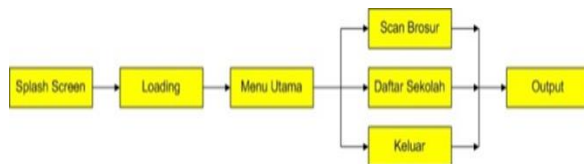


Figure 5. State Transition Main Menu Diagram

From Figure 5 above, it can be seen that the design of the software designed in this paper is related to an interactive brochure application with augmented reality technology.

4. Application Navigation Structure

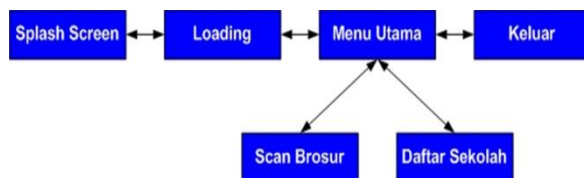


Figure 6. Mixed Navigation Structure

In Figure 6 above, it can be seen from each of the elements in the Android-based interactive brochure application that have links to one another.

5. Graphical User Interface Design

a. Splash Screen Display

It is a graphical control element consisting of a window containing an image, logo, and software version. A splash screen usually appears the first time the application is run. As in figure 7 below.



Figure 7. Splash Screen Interactive Brochure

The Splash screen created is the initial display of the application created which estimates interactive brochures using augmented reality technology.

b. Main Display Menu



Figure 8. Main Menu Interactive Brochure

In Figure 8 above the main menu, users can scan brochures that can display three-dimensional images of buildings, users can also click the school list button and the application exit button.

c. AR Camera Display

In the Augmented Reality display on the user's smartphone, the Android will ask permission to access the user when the application is first installed on the smartphone, as shown in Figure 9 below.

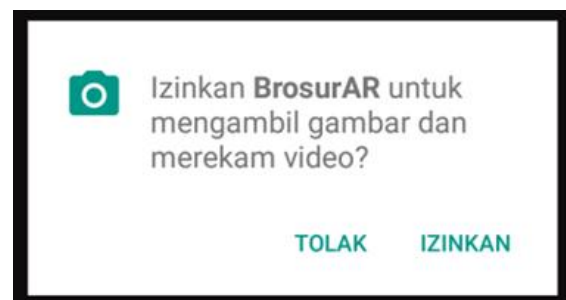


Figure 9. Android Notification Display

After the user chooses to allow, the application will automatically activate the camera to capture the Marker that has been created and a three-dimensional object will appear virtually above the brochure that has been created.

d. Augmented Reality Display



Figure 10. AR Camera Display

In Figure 10 above you can see the camera scan process by the user in the existing brochure.

e. Marker display detected

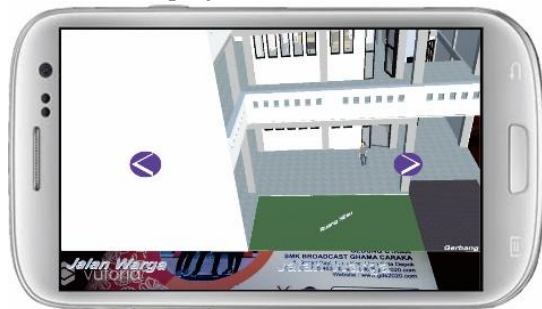


Figure 11. Marker display detected

In Figure 11 above when the marker display is detected, then the three-dimensional object that has been previously designed will call a virtual object that will appear above the brochure.

f. Registration Display Form



Figure 12. Display Registration Form

In the application that has been made, when the user selects the school register button, the application automatically redirects to the new student registration page.

D. Construction

In software testing applications we can do in several ways namely, functionality testing, compatibility testing, usability testing, and performance testing. At this writing, the author tries to measure compatibility testing. Where compatibility testing is done by using installation on the device and running the application on the device. Here there are 40 devices available. The

results of the test can be seen in the following table:

Table 5. Compatibility Test Results

No	Testing	Walk	Failed	Score
1	Installation on an Android device	40	0	40
2	Approve the application on Android devices	40	0	40
Total		80	0	80
Percentage		$\frac{80}{80} \times 100\% = 100\%$		

From the results of compatibility testing in the table above, it produces a 100% percent when the device is installed and does not cause an error. You could say the brochure application with AR technology meets the aspect of compatibility.

Table 6. Testing of Mobile Devices

No	Mobile type	Mobile Specifications	Information
1	Acer Liquid 23	RAM 512 MB Camera 3 MP Android 4,2 GHz Dual Core 1 processor	Application Not Installed
2	Nexus 7	RAM 1 GB Camera 5 MP Android 4,2 Jelly Bean 1,3 GHz Quad-Core Processor	Application Is Installed and Running with Clear 3D Object Results
3	Samsung Galaxy Grand Prime	RAM 1 GB Camera 5 MP Android 4,4 Kitkat 1,2 GHz Quad-Core processor	Application Is Installed and Running with Clear 3D Object Results
4	Oppo Find Clover R815	RAM 1 GB Camera 8 MP Android 4,4 Kitkat 1,3 GHz Quad-Core processor	Application Is Installed and Running with Clear 3D Object Results
5	Smartfren Andromax C3	RAM 512 MB Camera 5 MP Android 4,4 Kitkat 1,2 GHz Dual-Core processor	Application Installed But Not Running
6	Oppo Finds Mini	RAM 1 GB Camera 8 MP Android 4,4 Kitkat 1,3 GHz Quad-Core processor	Application Is Installed and Running with Clear 3D Object Results

Table 6 explains the specifications of an Android-based mobile phone that can be used for the AR Brochure application. And of the six cellphones used by researchers to implement the AR Brochure application, there are only 4 (four) that support, Nexus 7, Oppo Find Clover R815, Samsung Galaxy Grand Prime and Oppo Finds Mini.

Table 7 Results of Device Application Testing

No	Component	Testing Results					
		Device 1	Device 2	Device 3	Device 4	Device 5	Device 6
1	Opening the Application	Functioning	Functioning	Functioning	Functioning	Functioning	Functioning
2	Look at the Splash Menu	Functioning	Functioning	Functioning	Functioning	Functioning	Functioning
3	Look at the Main Menu	Functioning	Functioning	Functioning	Functioning	Functioning	Functioning
4	Open the Help Menu	Functioning	Functioning	Functioning	Functioning	Functioning	Functioning
5	Open the Variation Menu	Functioning	Functioning	Functioning	Functioning	Functioning	Functioning
6	See Zoom In / Zoom Out	Functioning	Functioning	Functioning	Functioning	Functioning	Functioning
7	Open the Exit Menu	Functioning	Functioning	Functioning	Functioning	Functioning	Functioning
8	Open the AR Menu	Functioning	Functioning	Not functioning	Functioning	Not functioning	Functioning
9	3D Brochure Object	Functioning	Functioning	Not functioning	Functioning	Not functioning	Functioning
10	Brochure Animation	Functioning	Functioning	Not functioning	Functioning	Not functioning	Functioning
11	Sound	Functioning	Functioning	Not functioning	Functioning	Not functioning	Functioning

Table 7 above relates to table 6 which discussed the specifications of mobile phones, so in table 7, researchers explain the functions that can be used by several mobile phones in this AR Brochure application.

Table 8 Minimum Distance Testing Results

No	Distance (CM)	Marker		
		Marker 10 cm x 10 cm	Marker 13 cm x 13 cm	Marker 18 cm x 18 cm
1	100	X	X	X
2	90	X	X	X
3	80	X	X	X
4	70	X	X	V
5	60	X	V	V
6	50	V	V	V
7	40	V	V	V
8	30	V	V	X
9	20	V	V	X
10	10	V	X	X

In addition to testing devices and testing mobile devices, the AR Brochure application this is also very necessary for testing the Minimum

Distance between the camera and the Marker (Object).

Table 9 Test Results of Mobile Device Angles to Markers

No	Distance (CM)	Marker		
		Marker 10 cm x 10 cm	Marker 13 cm x 13 cm	Marker 18 cm x 18 cm
1	100	V	V	V
2	90	V	V	V
3	80	V	V	V
4	70	V	V	V
5	60	X	X	V
6	50	X	X	X
7	40	X	X	X
8	30	X	X	X
9	20	X	X	X
10	10	X	X	X

Table 9 above the test results compared with table 8, the greater the distance used, and the greater the marker, the more visible the object is.

Table 10. Brochure Voter Questionnaire Results AR

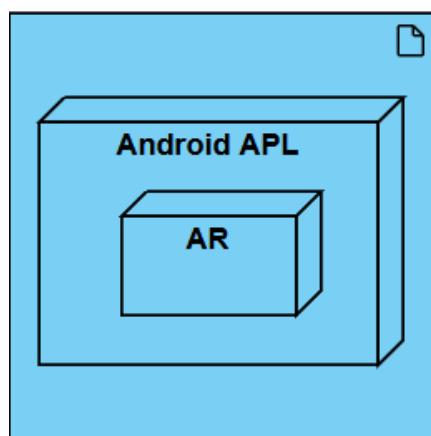
No	Software Engineering Aspects	Response				
		1	2	3	4	5
Software Engineering Aspects						
1	Ease of Running the Application	0	0	6	59	35
2	Disadvantages of Running an Application	0	0	7	62	31
3	Ease of Access Application Features	0	0	9	60	31
4	Accuracy in Object Position	0	0	16	53	31
5	Complete Application Features	0	0	21	73	6
Total		0	0	59	307	134
Functionality Aspects						
6	Process Performance See Object Details	0	0	7	70	23
7	Navigation Process Performance	0	0	17	55	28
8	Process Performance Place Objects	0	0	12	60	28
9	Open Process Website Performance	0	0	13	59	28
10	The ease that AR provides in recognizing objects	0	0	11	44	45
Total		0	0	60	288	152
Virtual Communication Aspects						
11	Application Interface	0	0	27	51	22
12	Laying Information	0	0	15	63	22
13	The type and size of the letters used are readable	0	0	6	58	36
14	AR brochure combination on application	0	0	13	60	27
15	Smoothness Brochure AR	0	0	10	55	35
Total		0	0	71	287	142

Information :

5: Very Good - 3: Enough - 1: Not Good
4: Good - 2: Not so good

This questionnaire was distributed by 100 respondents who were connected with AR Brochure users in the search for information about existing facilities and infrastructure at SMK Ghama Caraka Depok.

D. Deployment Diagram



Gambar 13. Deployment Diagram

In Figure 13 above illustrates the architecture used on the system designed. To support the

application, hardware and software are needed. There are 2 (two) hardware devices used by researchers in developing this application including Mobile (Hp), researchers use Xiaomi Redmi4 Mobile to run applications, with CPU (Quad-Core Max 1.4GHz), 2GB RAM, Android version 6.0.1 (Marshmallow) and Computers for all phases of application work with CPU (Intel Core-i5 2GHz), 2GB RAM, 500GB HDD. For Smartphone Specifications, at a minimum have the following specifications:

Table 11 Smartphone Hardware Specifications

Specification	Remarks
Chipset	Qualcomm MSM8917 Snapdragon 425
CPU	Quad-core 1.4 GHz Cortex-A53
GPU	Adreno 308
Versi Android	6.0.1 (Marshmallow)
RAM	2 GB

Code Making Program

The C# programming language and the tools used already have a Graphical User Interface (GUI) that provides user usage programming in making this system is included in object-based programming.

CONCLUSIONS AND SUGGESTIONS

Conclusion

The need for innovation in marketing each product by changing conventional brochures into augmented reality technology brochures. The design of virtual objects becomes a very high value by using a three-dimensional (3D) display and allows not only static but can also be displayed in motion. The ease of use of this application makes prospective registrants interested and understand using it so that it is easier to use (User Friendly). The AR Brochure application can run well on devices with minimum RAM specifications (1.5 GB). This application can test the input and output from the AR menu, the AR input menu is a 3D Brochure marker, while the AR menu output is an animated 3D object and sound. The aspects used in the questionnaire consisted of 3 namely Software Engineering Aspects with user selection at point 4 (four) with a total of 307 out of 5 items, User selection functionality aspects at point 4 (four) with a total of 288 out of a total of 5 items and Aspects Communication The selection of virtual users is in point 4 (four) with a total of 287 out of 5 items.

Suggestion

It is recommended that SMK GHAMA Caraka can use this application to get more prospective students or prospective applicants every year. Virtual objects that are displayed can be changed according to their individual needs.

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