Augmented Reality Using Vuforia for Marketing Residence

Dennise Adrianto
Computer Science Department
Bina Nusantara University
Jakarta, Indonesia
dadrianto@binus.edu

Monica Hidajat
Computer Science Department
Bina Nusantara University
Jakarta, Indonesia
mhidajat@binus.edu

Violitta Yesmaya
Computer Science Department
Bina Nusantara University
Jakarta, Indonesia
vyesmaya@binus.edu

Abstract*—The concept of Augmented Reality is a technology in which the interaction between the human-computer that can generate two-dimensional or three dimensional object in real time. Augmented reality can provide the necessary functions and information in its application. In this case the augmented reality (AR) just need a tool like a camera that can capture images by detecting the object without the marker coordinates from the surrounding environment to make real 3D objects. Augmented Reality application development is simple and easy to develop, so it can serve as a promotional tool or the provision of information. Therefore, the notion obtained separately develop AR applications that help the residence marketing department in the home market to show a 3D object of marketed house. So that prospective buyers get the information more interactive with real look 3D objects. This study use a software named Vuforia (QCAR) to implement augmented reality in mobile applications for marketing residence. Vuforia provides convenience to the Android mobile platform in the shooting in 3D objects.

Keywords— augmented reality; marketing residence; vuforia; real environment; markerless; android

I. INTRODUCTION

In the development of the emerging smartphone technology today makes various changes to the delivery of information in society. Submission of this information could not be separated from marketing by some companies in order to increase sales volume which is usually done by exhibitions, advertising, and demonstrations.

Augmented reality is one technique that can be used to improve marketing. Augmented reality as a real-world view that has been augmented with elements coupled with computer-generated imagery in real-time [2]. Comparison between augmented reality with virtual reality is augmented reality is the opposite of virtual reality. If the virtual reality allows interaction between the user by using the simulation of the environment generated by computer (computer simulated environment), then augmented reality combines virtual object and the real object and then project it in real-time [10]. In this case augmented reality simply need a tool like a camera that can capture images of the surroundings to produce a 3D object that is used as a promotional tool to improve marketing residence. So that prospective buyers get the information more interactive with real look 3D objects. This study use a software named Vuforia (QCAR) to build the augmented reality applications. Vuforia provides convenience to the Android operating system in a shooting in 3D objects.

This study was made to produce an application by applying Augmented Reality on the Android platform that is intended for marketing promotions of residence. With the application of the AR user can more easily obtain information about the home in the form of 3D models by aiming the camera at the relevant brochure. So that prospective buyers do not need to come to the location of the house to see a model home that you want to view.

II. AUGMENTED REALITY

Augmented reality is a new way to present something in the real world with technology [7]. Wherein the computer generates a real environment with information such as graphics, audio, or real object displayed on the screen. Augmented reality is a combination of technologies that allow a merger between the object generated by a computer with a real object displayed with the live video [3].

The following are an advantages of augmented reality technology [10]:

- Combining the real world with computer-generated objects.
- Allows interaction with objects in real-time.
- Men-track activity in real-time object.
- Know the image or object.
- Displaying information in real-time.

With the help of augmented reality technology real environment around us will be able to interact in digital form (virtual). Information about the object and the environment around us may be added to the augmented reality system which then displays the information layer above the real world in real-time as if the information is real. Augmented reality

can facilitate the lives of its users with virtual information. The most important aspect in this technology is to create a good technique for intuitive interactions between users with augmented reality applications [2].

Fig. 1. An example of the application of augmented reality in a supermarket environment [11].

III. MARKERLESS AUGMENTED REALITY

Markerless Augmented Reality is a method in Augmented Reality which does not require the marker to determine an object can be printed in 3D. The use of this method is usually done by using the coordinates of the object detection, for example, an object to be used as a trigger to display information about the object [6].

Fig. 2. Markerless Augmented Reality

Augmented reality has been quite widely applied in daily life, industrial activities, even in the military [1], such as:

a) Medical: Imaging technology is needed in the world of medicine, such as surgery or simulation for simulating the manufacture of vaccines and so forth.

b) Entertainment: Augmented reality is also used in the world of entertainment, for example in the film or game industry. This technology was also recently applied to a newspaper or magazine, where readers can either scan marker in magazines to display the content.

c) Military: Examples of the application of augmented reality in the military for example simulated war where soldiers can participate in it as an exercise.

d) Engineering: Augmented reality can simulate repair heavy equipment or machinery, for example cars or aircraft.

e) Robotic: In the field of robotics, the robot operator to use visual imagery through augmented reality to control the robot.

f) Consumer Design: Augmented reality has been used in promoting the product. For example, a developer using virtual brochure to provide complete information in 3D, so that customers can know clearly the products offered.

g) Promotion Augmented reality for product marketing produces beneficial results. Through AR users can view 3D models of the products they buy and get detailed information about the products that are being sold. Display of products is also visualized significantly.

IV. QCAR (VUFORIA)

QCAR (Vuforia) is a product of Qualcomm Connected Experiences; Inc. QCAR is a software platform that is best for augmented reality applications with real-world environment. QCAR provides capabilities for mobile applications to be able to see the augmented reality. QCAR is software that is superior, stable, and technically efficient to introduce computer-based image and makes it easy for developers to determine the features and capabilities without the limitations of the technique. QCAR software can be used in various mobile platforms such as iOS, Android, and Unity3D [4].

QCAR vuforia using Computer Vision technology to identify and to track the target and three-dimensional objects, allowing the user to adjust position of a virtual objects with real world images that displayed through the smartphone screen in real-time. The virtual object will track the position of the image in real-time so that the view of the object and its environment can be in accordance with the user's view in the applications, which create virtual objects that appear similar to the real world.

In the Vuforia software not all images can be used as target. At the beginning, images that have been uploaded will be evaluated first by the Vuforia web developer. Value target will be scored to define how well an image can be detected and tracked using Vuforia SDK. Assessment is done by using rating, the score of an image that will be used as a target range of 0 to 5. The more the stars, the stronger the detection and tracking capabilities are obtained.

Attribute of the assessment criteria referred Vuforia feature. Vuforia featured are a sharp corners in the uploaded image. Vuforia image analyzer will display the results of the detection feature with a small yellow cross. For example assessments, can be seen in the image below.

Fig. 3. Examples of poor image to be targeted by Vuforia [9].

In Fig. 3. is an image that is not good to be used as target for Vuforia. Where the yellow cross marks indicate a very little features. This is due to two factors, the lack of or poor distribution of features in the image and poor image contrast. Images are well used to being targeted by Vuforia is an image that has sharp corners that detail and the amount of features that much.

Fig. 4. Example of images of simple shapes that judged by Vuforia

Fig. 4. is the result of assessment by Vuforia, in first image we see a square shape have four yellow mark on every corner, that shows the Vuforia detect the sharp corner of the shapes. But in the middle image, circle shape doesn't show the yellow mark because Vuforia cannot detect any sharp corner in the circle shape. Then in the third image, we can see only the sharp corner has the yellow mark. Another example is like we can see in this picture:

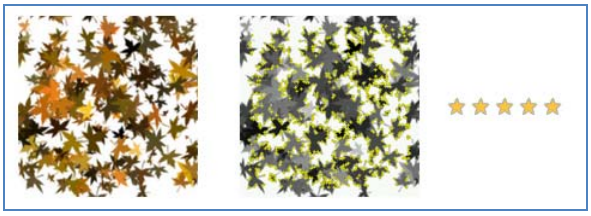

Fig. 5. Examples of good image to be targeted by Vuforia[9].

In the Fig. 5. Vuforia can detect many sharp corner thus give the five star rating to the image.

V. IMPLEMENTATION

Below are the specification of the device used to tests this application :

- Device Name : Samsung Galaxy Tab P7300
- Camera : 3.15 megapixel
- RAM : 1 GB
- Display : 8.9" (800x1080 pixel)
- OS : Honeycomb 3.0
- Processor : Cortex 1 GHz Cortex-A9, 2) Chipset Nvidia Tegra 2 T20

Once the planning process is complete, the testing process is starting. The augmented reality marker by visual code that has been determined before is tested. The encoding process is carried out at this stage using Unity authoring tools. Database applications are also made at this stage by utilizing Vuforia QCAR SDK. In this phase, the construction of asset model is starting too. Using Autodesk 3Ds Max, the 3D residence object is created. By using Autodesk 3Ds Max, the coloring process (on the wall / object), re-implantation texture (on the roof, terrace, car port floor, and doors) made to the model homes as it has been designed for residence marketing. These models will be used to be the 3D model displayed as augmented reality using visual code marker.

For the visual code marker, we use the residence brochure that show the landscape of the houses. The picture below is a snippet from a page brochure marketing office Residence which is used in the application.

Fig. 6. Brochure Pabuaran Residence.

On the brochure, there are four types of homes that will be displayed its 3D models, the T.38-Sapphire, T.42-Ruby, T.48-Emerald and T.100-Diamond. The drawings of these houses will be use as a target via the API Qualcomm's augmented reality on the Vuforia website. By uploading the pictures, API Qualcomm detect whether the images are eligible to become a target for augmented reality applications. Compatibility of the image becomes the target will be assessed with a star (stars). More and more of its star, the better the image to be used as target shooting. Then will appear the 3D model from the list of house plans that are used as the target of the camera shots.

Here is one of the types of housing (T.100 - Diamond) taken from a marketing brochure on residence. Objects are displayed in 3D.

Fig. 7. T.100-Diamond Target.

There are 2 relevant techniques that should do to get good 3D object from marker.

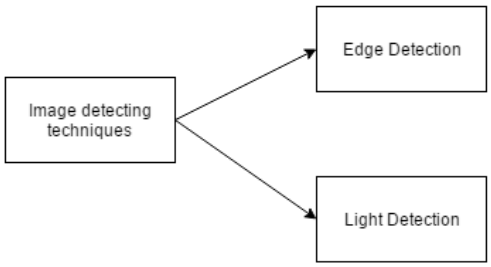

Fig. 8. Image detection techniques.

A. Edge detection

Edge detection technique is one of the structural techniques that affect the camera to catch the object become augmented reality[8]. These some severals test that already done, this test based on smartphone camera to determine what optimal edge should be detected to defined the 3D object.

TABLE I. TESTING OF EDGE DETECTION

Perspective Of The x-axis	Result
90° degrees	3D Object show perfectly
45° degress	3D Object show perfectly
30° degress	3D Object show perfectly
10° degrees	3D Object not show.

Distance is one of the factos that affecting edge detection process to get good 3D object. Distance have also integrated a *snap-to-object* mode which is useful if a minimal two objects are desired[5]. There are severals testing have done based on several specific distances between camera and target. The distance tested have been done in centimeters.

TABLE II. TESTING OF DISTANCES

Distances in centimeters	Time detection	Result
50 cm	0	3D object not show
40 cm	2	3D object appear with a long time, and rendering object are not perfect.
30 cm	2	3D object appear with a long time, but the result is quite perfect rendering object.
20 cm	1	3D object quickly appeared with a little time, and the result is perfect rendering.
10 cm	1	3D object appear with a fast time, and the result is perfect rendering object.

B. Light detection

Light intensity is also affecting the edge detection during the process to detecting 3D object. In order to get a better result of the detected object needs to be calculating the distance of the light source. Below are the light intensity testing in bright light condition, dim light condition, and dark condition using flash light or not.

TABLE III. TESTING OF LIGHT DETECTION

Light Intensity (Dark, light dimmer, Bright)	Result
Dim light, without flash.	3D object are not detected.
Bright, without flash.	3D object can be detected.
Dark, with the lights flash.	3D object can be detected.
Dim light, with flash.	3D object can be detected.

The following is the result of augmented reality in the form of a 3D object that has been taken from the brochure in Fig. 7.

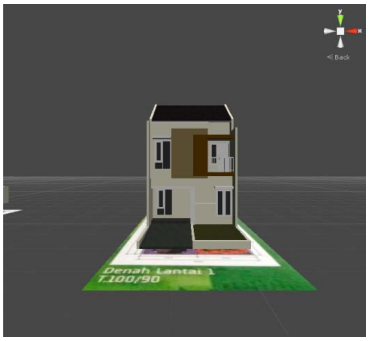

Fig. 9. Display of T.100-Diamond models.

Results of the match image into the target that has been converted by QCAR vuforia resulting star targets as follows:

TABLE IV. TARGET SCORE.

Target Name	Star
T38	**4**
T42	**4**
T48	**5**
T100	**4**
Average	**4.25**

If the camera captured image to the right floor plan in the brochure, the 3D model of the house will appear. Screen display will change as shown in Fig 8.

Fig. 10. Display of the screen after an object is detected.

Here are the current display information button is selected. Then it will pop up a text box that contains information about the existing facilities in the house displayed its 3D models and specifications of the object of the house.

Fig. 11. Display of text box that informs the object specification facilities and homes.

VI. CONCLUSION

In this study, have been developed Augmented Reality applications that used to facilitate the residence marketing. Where this research applied Markerless Augmented Reality, using QCAR Vuforia software applied to the mobile platform (Android). An image with a good feature will have a minimum probability of error when Vuforia generate the target image into a 3D object. To get a good 3D Object, edge detection and light detection have become the main factor in image processing. The results of this research is to facilitate the marketing department of housing in the provision of facilities and specification information about the object home and present the products of brochures resulting visualization of 3D objects using augmented reality technology is applied to the mobile platform Android.

REFERENCES

[1] A. Andriyadi, Augmented Reality With AR Toolkit, Jakarta: Nulisbuku, 2011.

[2] B. Furht, Handbook of Augmented Reality, USA: Springer, 2011.

[3] T. Mullen, Prototyping Augmented Reality, USA: Sybex, 2011.

[4] H. Peng, "Application Research on Face Detection Technology based on OpenCV in Mobile Augmented Reality," *International Journal of Signal Processing, Image Processing and Pattern Recognition,* vol. 8, pp. 249-256, 2015.

[5] Bernhard Reitinger, Alexander Bornik, Reinhard Beichel, Erich Sorantin, Georg Werkgartner, "Augmented Reality Based Measurement Tools for Liver Surgery Planning," dalam *Conference: Bildverarbeitung für die Medizin 2004*, Berlin, 2004.

[6] Aer0metrex_admin, "Augmented reality – 3D objects in context – Part 1," aerometrex, 18 January 2013. [Online]. Available: http://www.aerometrex.com.au/blog/?p=646.

[7] "Augmented Reality," multidots, 6 April 2015. [Online]. Available: http://www.multidots.com/augmented-reality/.

[8] H.S.Prasantha, Dr.Shashidhara.H.L, Dr.K.N.B.Murthy, Madhavi Lata.G, "Medical Image Segmentation," *IJCSE - International Journal on Computer Science and Engineering,* vol. 02, no. 04, pp. 1209-1218, 2010.

[9] "Natural Features and Image Ratings," vuforia, [Online]. Available: https://library.vuforia.com/articles/Solution/Natural-Features-and-Ratings.

[10] L. Madden, Professional Augmented Reality Browsers for Smartphones: Programming for junaio, Layar and Wikitude, West Sussex: John Wiley & Sons, 2011.

[11] H. James, "6 Great Examples of Mobile Integration," E-Commerce, April 2013. [Online]. Available: http://thisisretail.com.au/blog/6-great-examples-of-mobile-integration/.