Development of Augmented Reality Application for *Canang* Education Using Marker-Based Tracking Method

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Abstract

The aim of this study is to develop an Augmented Reality application with marker-based tracking that use for Canang education. This application was developed with waterfall model. Data collection technique that I use in this study is surveys, interview and literature review. This application can pop up information about types of Canang, when you use that types, and an example picture of the Canang. This application use vuforia software development kit (SDK) for combine the reality object and virtual object use for smartphone with QR Code. The design for information and example picture of Canang is built in Adobe Illustrator and made to Augmented Reality in Unity. Method that use in this study is Marker Based Tracking which identifies marker patterns. This application applies multi-target marker-based Augmented Reality so that each type of Canang information is stored and ran on different markers. This application can be medium for education about Canang in general for Hindusm teen. This application has 3 functional activities that user can use and based on blackbox testing the functional can run as good as well from different smartphone.

Keywords: Augmented Reality, Unity, Vuforia, Canang, Android

1.   Introduction

Hindu is one of many religions is this world, Hindu in Bali have many religious activities. One of many religious activities in Bali is express gratitude to God with *Canang*. Use of *Canang* on relogious ceremony is for support the harmony of the environment and human. This is because, *Canang* used for religious ceremony comes from nature and because of the importance of the *Canang* for Balinese Hindu community, both those who still live on the island of Bali and outside the island of Bali, of course knowledge about *Canang* must be preserved [1]. Canang has many types and shapes in Bali but the most popular is rectangular *Canang*.

As long as time go, many people don't know about types of *Canang*. Based on survey that I do to on google form for more than 20 Hinduism teen that have age range from 16 until 21 years, and 52% Man and 48% Woman, most of them don't know what kind of *Canang* that I ask, for example is on first question I ask about "Did you know what is *Canang Ganten*?" 76% answer don't know, 20% know and the other is maybe.

On this era, technology growing so fast likewise with users. Technology that can be use on any situation, like for education or something else. One of the many technologies that can be used for education is Augmented Reality (AR), AR is merger of virtual object and reality object [2]. Augmented Reality can be medium for learn about something, like learn about types of *Canang*. Learning something using Augmented reality more interested than learn on website or article. Because in Augmented Reality there are an interaction between human and technology.

In journal [2] about Augmented Reality for learning solar system that use Marker Based Tracking and build on Android. In this journal Kusuma make 3D Object of solar system where the marker

is picture of solar system. Conclusion in this journal is application Augmented Reality about solar system that can make student more interested to learn about solar system. On this case of study, I can make conclusion that the interaction between human and technology can make someone not bored to learn something new and that is fun.

Based on study above, writer want to create an Augmented Reality Application that can make you learn about types, when to use, and the components of *Canang* in general use Marker Based Tracking. The information about *Canang* and the component of *Canang* I took from a book [3]. This research will focus on giving information about *Canang* and Augmented Reality will be built for Android.

1.1 Unity

Unity is application or software that use for process pictures, graph, voice, input and the other intended for make a game or something like AR and else. Unity is multiplatform game engine that can be published to Standalone (.exe), website based, android, IoS, XBOX, and PS3 [4]. Unity is paid platform but you can get free when you get it for personal, not company and installation is so easy like install other application, just click next and setup-setup for what u need. Make sure your connection is good when downloading and installing Unity, because Unity have a large size.

1.2 Vuforia

Vuforia is an Augmented Reality Software Development Kit (SDK) for smartphone to possibly make Augmented Reality. SDK Vuforia is also available for Unity, which is named Vuforia AR Extension for Uniy. Vuforia is SDK provided by Qualcomm for help developer to make application Augmented Reality (AR) on mobile phones (iOS, Android) [4].

1.3 Adobe Illustrator

Adobe Illustrator is a leading vector graphics editor program, developed and marketed by Adobe Systems. Adobe Illustrator is a drawing software program created by Adobe Systems using vectors. It was first created in 1986, and is designed to work with Macintosh computers [5]. I use adobe illustrator for design the information of *Canang*, example picture of *Canang* and the User Interface.

2. Reseach Methods

This study use SDLC (System Development Life Cycle) method with a waterfall model. Waterfall is the traditional model of the SDLC. Waterfall model is easy to use and understand but you need to complete a stage before you can move to next stage [6]. The application waterfall model will be described as follows:
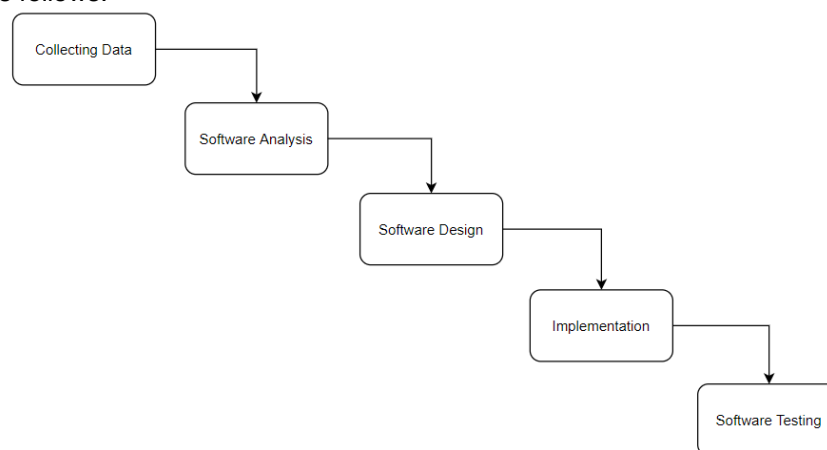

Figure 1 Waterfall Model

2.1 Collecting Data

Collecting data process that use in this study is surveys to more than 20 Hinduism teens in Bali with google form, about knowledge of types and component of *Canang*, interview with people who usually made *Canang* and collecting information from literature review that I have been read.

Where the data is QR Code for marker, object display that contains image and information about *Canang*.

2.2   Software Analysis

After get the data, now we move to software analysis. Software analysis is the stage where what requirements are needed to the application. Where software analysis includes software requirements, software input output and software limitation. The software analysis will be described at below:

a.   Software Requirements

This application build using an Augmented Reality (AR) technology and the type of Augmented Reality used is multi-target marker-based because each type of *Canang* is defined by one marker. The application is displaying a 2D model of *Canang* and some information about the direct *Canang*. The information and the model are pop up together to make reader can imagine the *Canang*. This application is made on android platform, in this case software that will be used for develop the AR is Unity Engine Game Software with the AR library named Vuforia. Vuforia is easy to use and Vuforia has multiplatform support.

b.   Software Input and Output

This application also has input that are needed to make software work and output that can make you learn or know something. The require input for this application is a QR code marker, which this QR will be scanned in front of camera and the AR object will be displayed. And the output of this application is a visual object that displays an image of *Canang* and information about the direct *Canang*.

c.   Software Limitation

This application has some limitations that are very important to know, because if you use this application before know the limit, this application maybe not able to work. The limitations of this software are the information type of *Canang* is only 5 types which that is *Canang Gantal, Canang Tubungan, Canang Gental, Canang Burat Wangi Lenga Wangi, and Canang Pabersihan*. This application only runs on an android operating system at least version 4.4 Kitkat and above.

2.3   Software Design

Software design is the stage where the developer starts to design the software to be able to meet each of the requirements. The form and design model for this application are as follows:

a.   Software Technology

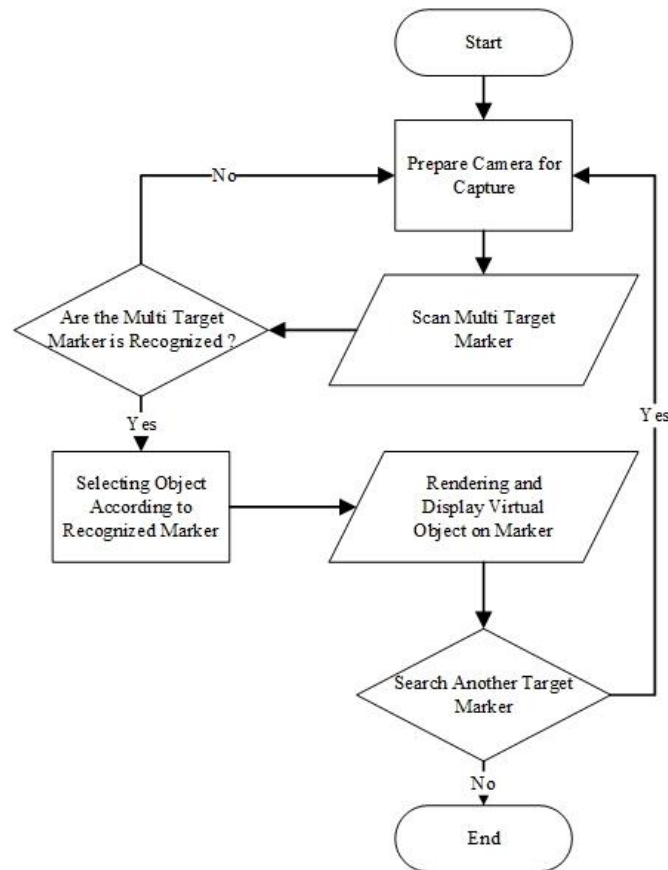Based on software analysis, the design of the software technology are as follows:

Figure 2 Flowchart Design of Multi Target Marker AR

In this flowchart, the multi target marker-based works like a normal AR process. The step of the process is beginning with prepare camera for capture the marker. After marker has been captured, marker will be identified and if marker is recognized, process will continue to selecting object that will be displaying on screen based on marker, if marker not recognized it will be back to scan marker with camera. After object displayed, if user want to scan another target marker, then he will back to prepare camera, if not the application is end.

b.   Software Functional Model

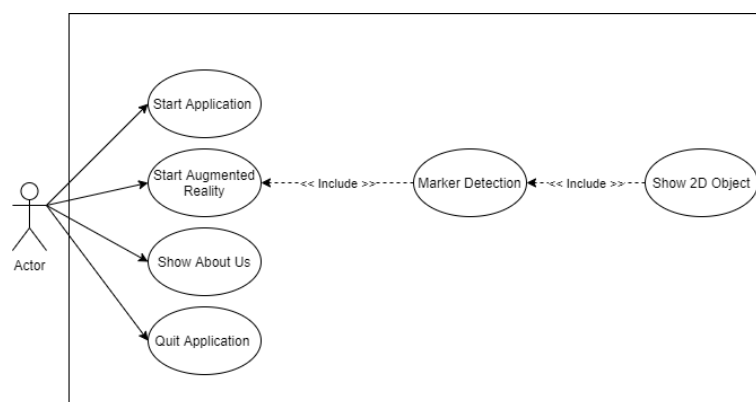Use case diagram of this application are as follows:

Figure 3 Application Use Case Diagram

Based on Figure 3, there are 6 processes that occur in the application including start application, start augmented reality, marker detection, show 2D object, show about us, and quit application. After we make the use case diagram, the next step is determining the activity diagram to describe more processes and activity. The activity diagram of this application are as follows:
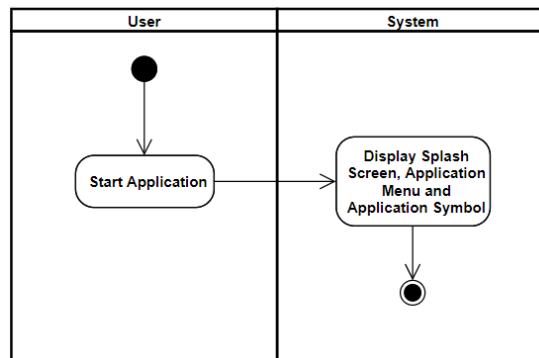

Figure 4 Activity Diagram Start Application Phase

Diagram in Figure 4 describes about the process when user open the application. After user click the application, the system will display a splash screen and go to the application menu, on menu page there are 3 buttons namely *Mulai, Tentang Kami,* and *Keluar*.
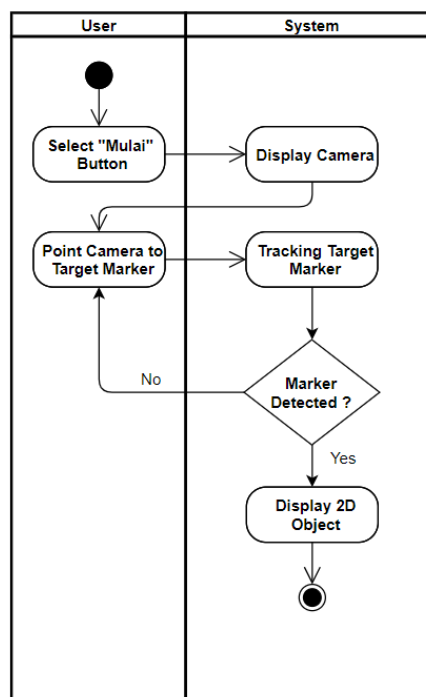

Figure 5 Activity Diagram of Tracking the Augmented Reality

Diagram in Figure 5 describes about the process when user press *Mulai* button on menu page. The system will display camera, after camera displayed user must point the camera to the target marker and if the marker detected there will be pop up a 2D object, if not user must point camera carefully to the marker.
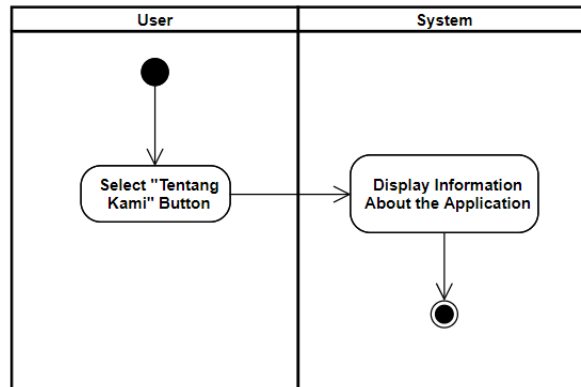
Figure 6 Activity Diagram of "Tentang Kami" Button

Diagram in Figure 6 describes about the process when user press *Tentang Kami* button on menu page. Then user will be redirected to a page containing about the application.
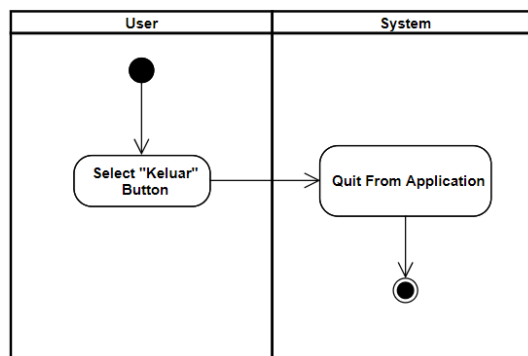

Figure 7 Activity Diagram of "Keluar" Button

Diagram in Figure 7 describes about the process when user press *Keluar* button on menu page. Then that will make user exit the application.

2.4   Software User Interface Design

After we design the system, we need to design the user interface of system that can make our more attractive. User interface has an important role in effectiveness of an information, making the user interface aims to make information technology easy to use by users or user friendly [7]. Interface on this application will be shown like a menu and icon of the application. Interface that use on this application is made on Adobe Illustrator and have a ratio 16:9 (portrait) because this application is mobile-based with 1920x1080 pixel. The interface design for this application are as follows:

Figure 8 Interface Design of the Application

3.   Result and Discussion

In this section, will be discuss and shown about the implementation of the application also with the software testing. As for the sub-sec is:

3.1.   Implementation of the Application

In this sub-sec will be shown the result of implementation of the application form screenshot of the program. As for the section is:

   a.   Main Menu
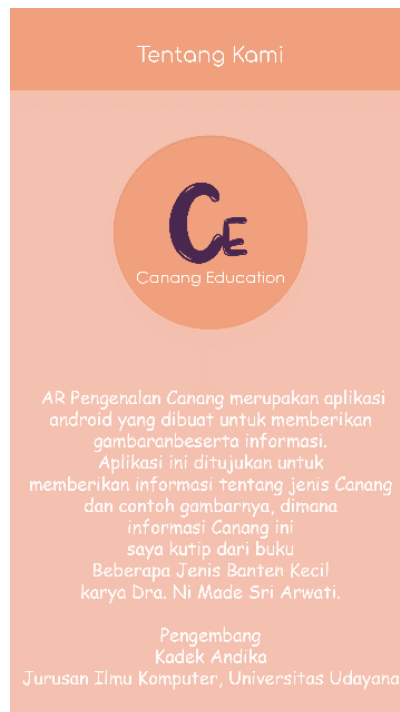
Figure 9 Main Menu

b. About Us.

Figure 10 About Us

c. Example of AR Object Display

Figure 11 Object Display

3.2. Application Testing

Application testing is performed with blackbox testing. Blackbox testing is one of most testing methods for software that easy to use because it just needs lower limit and upper limit from hoped data, blackbox testing is just focus with functional of the application without see how the process [8]. This testing is performed on Samsung A10, Samsung A7, Samsung J7 Prime and Asus Zenphone MAX 3. From testing process that we get the data as follow:

No	Testing	Result	Information
1	Install APK	Installation process is success but there is any warning that the application is from untrusted develop because this application didn't official yet.	Success
2	Running Application	Application running is success.	Success
3	Press "*Mulai*" Button	When button "*Mulai*" pressed the application will lead to scan marker with camera.	Success
4	Marker Detection	Marker has been success detection if you have good focus and enough brightness.	Success
5	Pop Up Display	Application has been success to pop up display picture that there are information and illustration of the *Canang*.	Success
6	Press "*Tentang Kami*" Button	When button "*Tentang Kami*" pressed the application will lead to Tentang Kami page.	Success

7	Press "*Keluar*" Button	When button "*Keluar*" pressed the application will lead to exit the application.	Success

Table 1 Blackbox Testing

4. Conclusion

The Augmented Reality application of *Canang* education is built for learning and increase knowledge about types of *Canang*, when it used, and the component information. This application is use 5 case study *Canang* which is *Canang Gantal, Canang Tubungan, Canang Gental, Canang Burat Wangi Lenga Wangi, and Canang Pabersihan*. Technology of the application is applied multiple target marker-based Augmented Reality where the input is multiple QR Code marker with output is Augmented Reality 2D of the *Canang* and the information. This application is made with game engine unity software and development library AR which is Vuforia. This application use SDLC (System Development Life Cycle) method with a waterfall model. This application has 3 functional activities that user can use and based on blackbox testing the functional can run as good as well from different smartphone.

References

[1] I K. Kertayasa, N. M. M. Hariani and N. G. A. P. Ermayanti, "PENGGUNAAN CANANG SARI UNTUK MENINGKATKAN HASIL BELAJAR AGAMA DAN IPA DI KELAS V PASRAMAN JAGADNATHA PALU" *Jurnal Ilmiah Pendidikan, Agama dan Kebudayaan Hindu*, vol. 8, no. 2, p. 30-38, 2017.

[2] S. D. Y. Kusuma, "PERANCANGAN APLIKASI *AUGMENTED REALITY* PEMBELAJARAN TATA SURYA DENGAN MENGGUNAKAN MARKER BASED *TRACKING*" *JURNAL INFORMATIKA UNIVERSITAS PAMULANG*, vol. 3, no. 1, p. 33-38, 2018.

[3] D. N. M. S. Arwati, Beberapa Jenis Banten Kecil, City: Denpasar, 2003, pp. 7-9.

[4] A. Nugroho and B. A. Pramono, "APLIKASI MOBILE AUGMENTED REALITY BERBASIS VUFORIA DAN UNITY PADA PENGENALAN OBJEK 3D DENGAN STUDI KASUS GEDUNG M UNIVERSITAS SEMARANG" *JURNAL TRASFORMATIKA*, vol. 14, no. 2, p. 86-91, 2017.

[5] Y. A. Iyanleba, "APLIKASI PEMBELAJARAN PENGENALAN PULAU DI INDONESIA BERBASIS WEB MENGGUNAKAN MULTIMEDIA INTERAKTIF", SEKOLAH TINGGI MANAJEMEN INFORMATIKA DAN KOMPUTER AKAKOM YOGYAKARTA, 2018.

[6] S. Barjtya, A. Sharma and U. Rani, "A detailed study of Software Development Life Cycle (SDLC) Models" *International Journal Of Engineering And Computer Science*, vol. 6, no. 7, p. 22097-22100, 2017.

[7] F. N. Pambudianto, "ANALISIS DAN PERANCANGAN DESAIN ANTARMUKA APLIKASI PENJUALAN MAKANAN SEHAT PADA RSI JEMURSARI SURABAYA DENGAN METODE *DESIGN SPRINT*", INSTITUT BISNIS DAN INFORMATIKA STIKOM SURABAYA, 2019.

[8] D. Setiawan, M. A. Fadhillah, A. Wibawa, I. Sugiarto, A. Mulyana and I. Kusyadi, "Pengujian Black Box pada Aplikasi Perpustakaan Berbasis Web Menggunakan Teknik Equivalence Partitioning", *Jurnal Teknologi Sistem Informasi dan Aplikasi*, vol. 3, no. 2, p. 95-99, 2020.