ARBANTENOTONAN: A LEARNING MEDIA BASE ON AUGMENTED REALITY TRADITIONAL BALINESE BIRTHDAY CEREMONY EQUIPMENT

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ABSTRACT

Yadnya ceremony is a important thing in Bali. This *yadnya* ceremony is worth to be preserved through ICT. It is due to its meaning, function and specified purposes which are influenced by the exotic culture and local values of Bali itself. Otonan ceremony is an important implementation of *manusia yadnya* which is the part of *yadnya* itself. It is a ceremony that is held in order to celebrate one's birth date based on Balinese *Wuku* Calender. It is being held once every 210 days or once in 6 month on purpose to purify one's body physically and spirituay. The production of *Banten Otonan* has been significantly being forgotten by the young generation due to the limited information as well as the difficulties that ones may face during the process. The process of making *Banten Otonan* and *Sampian* are wrapped in form of Augmented Reality based educative application on android based smartphone. It is expected to be able to help users in recognizing, realizing and understanding the whole process of making *Banten Otonan* and *Sampian*. This application is using 3-dimensional animation model as well as 3D animation video. The result that is obtained by this application can give us the information in form of multimedia of how to make *Banten Otonan* and *Sampian*.

Keywords: *Augmented Reality, Banten Otonan, Balinese Birthday Ceremony, Hindu Religion*

1. INTRODUCTION

The implementation of Hinduism in Bali cannot be separated from the implementation of *Yadnya*. *Yadnya* is sacred offerings that is done with sincere heart for the creator of the universe or Ida Sang Hyang Widhi Wasa. Hinduism consists of 5 types of *Yadnya* which are called *Panca Yadnya namely; Dewa Yadnya*, *Rsi Yadnya*, *Pitra Yadnya*, *Manusia Yadnya* and *Bhuta Yadnya* [1]. Yadnya ceremony in Bali is one of crucial aspects of Balinese culture that is worth to be preserved [2].

Upakara is the medium that is used in a ceremony. The term *Upakara* terminologically consists of 2 morphemes namely; "*upa*" and "*kara*". "*upa*" means surrounding or everything that is related. While "*kara*" means hand [3]. *Upakara* in Hinduism has its own meaning, function and specified purposes that are influenced by the culture as well as the local values of Bali [4]. One important implementation of *Manusa Yadnya* which is the part of *Yadnya* itself is the *Otonan* ceremony. It is a ceremony that is held in order to celebrate one's birth date based on Balinese *Wuku* Calender. It is being held once every 210 days or once in 6 months on purposes to physically and spiritually

purify one's body. *Otonan* ceremony is Hinduism traditional ceremony in celebrating one's birth date.

ARBantenOtonan Application using Augmented Reality Technology. Purpose of that Application is motivated the people to figure out how to make *Banten Otonan*. Another purpose is provide the information about *Banten Otonan*.

Augmented Reality Technology is one of the magnificent progress in ICT aspects. It is the combination of digital 2D and 3D object which is projected to the real world with real time display [5].

Augmented Reality Technology that introduces the existing local culture is being implemented in DewataAR application. DewataAR is used for promoting the tourism destinations that exist in Bali especially Tanah Lot Temple [6]. Another example is the Application of Basic Balinese Dance using Augmented Reality on Android which is an educative application about basic dancing movement of Balinese dance. It is aimed as an alternative media for the general society especially the children in order to start learning Basic Balinese Dancing movement [7]. Augmented Reality for Chemical Elements: PeriodikAR is application to learn periodic table of elements. This application

can run dynamically to give information about elements in form of animation video. The information involves name, atomic number, boiling degree, melting degree, density, atomic mass, oxidation, elements symbols, elements types, characteristic of elements, electron structure as well as how to do electron configuration [8]. Learning Media of Balinese Script Writing based on Augmented Reality is application about Balinese letter of the alphabet/ script. This eduational learning media applicaton can give us the information of how to write Balinese alphabets in form of 3D animation that is also supported by the sounds and explanation of the usage of its implementation as well as the example of every words of the respective letters [9].

Instructional Learning Media to Create Upakara for Nyiramin Layon Procession based on Android explains about the whole process of *Nyiramin Layon* which is the process of bathing the corpse or the dead body which is called wawu lampus in Hinduism *upakara*. This application is in 3D form which involves photos, videos as well as the process of making *upakara* or *eteh-eteh* that is clearly and comprehensively illustrated [10].

Implementation of Tree Structure and Recursive Algorithm for Balinese Traditional Snack Recipe on Android Based Application explains about how to make the dough of Balinese traditional snack. This application is android based and using tree structure. The information that is provided is about the process of how to make Balinese Traditional snacks [11].

Difference ARBantenOtonan Application with another Augmented Reality Application is ARBantenOtonan provide two learning feature, in this case is how to make *Banten Otonan* and how to make *Sampian*. That application also have feature to show both of 3D animation model and 3D animation video.

Augmented Reality Based Educative Application *Banten Otonan* Maker is designed for users to be able to recognize, realize and understand the process of making *Banten Otonan*. This application can be used in Android based smartphone. Marker that is used in the processs of making *Banten Otonan* and *Sampian* is functioned as a mark. Furthermore, this applicaton is expected to be able to give sufficient information of how to make *Banten Otonan* and *Sampian* in form of 3D animation model and 3D animation video.

2. RELEVANT STUDIES

2.1 Augmented Reality (AR)

Augmented Reality is the combination of digital 2D and 3D object which is projected to the real world with real time display [5].

The explanation of Augmented Reality according to Ronald T. Azuma (1997) is the combination of concrete object and virtual object in real world which is operated interactively, real timed and co-integrated between the 3D objects. According to Stephen Cawood & Mark Fiala on a book entitled "Augmented reality: a practical guide" Augmented Reality is a antural way of exploring 3D objects, data and the combining concepts of Virtual reality with Work reality [12].

2.2 Blender

Blender is an open source 3-dimensional project under licensed of GNU GPL (General Public License). Blender supports the creation of 3D modeling, rigging, animation, simulation, rendering, compositing, motion tracking, video editing as well as game production [13]. Blender is cross platform which can run well in Windows, Linux and Macintosh Computer. Its Interface is using OpenGL which gives constant experience.

Blender is a free and open source software that can be used for creating 3-dimensional object. Its features can be acquired freely, therefore, the developing of the program can be done by anyone, either amateur or professional users of Blender [14].

2.3 Vuforia

Vuforia is library that is used in creating Augmented Reality and Virtual Reality based application. Developer can add the functionality from computer vision of the library of Vuforia to possibly recognize a picture or objects which is further reconstructed into the real world.

Vuforia can develop a game as well as product marketing. The main feauture of library of Vuforia involves its ability to recognize and track picture, objects, texts, markers and further reconstruct it into the real world [15].

2.4 Banten Otonan

Banten Otonan is a ceremony of celebrating one's birth date based on the Balinese Wuku Calendar which is being held once every 210 days or once in 6 months in order to physically and spiritually purify one's body according to Ida

Wayan Asta [16]. The purpose of the purification is to balance the sins that have been commited because no humas are free from mistakes [17]. "*oton*" comes from morpheme "*metu*" which means birth while "*odal*" comes from "*medal*" which means out or outside. *Otonan* or *odalan* for human is a celebration of birth date which is special because everyone has their own birth date which are of course different one to another [16].

3. TABLES AND FIGURES

3.1 System Design

General view consists of the general view of the prototype of Augmented Reality Based Educative Application *Banten Otonan* maker which is application that illustrates 3-dimensionally the process of making *Banten Otonan* and *Sampian*, the sounds or narration of every steps of the process as well as the information related to *Banten Otonan* and *Sampian*.
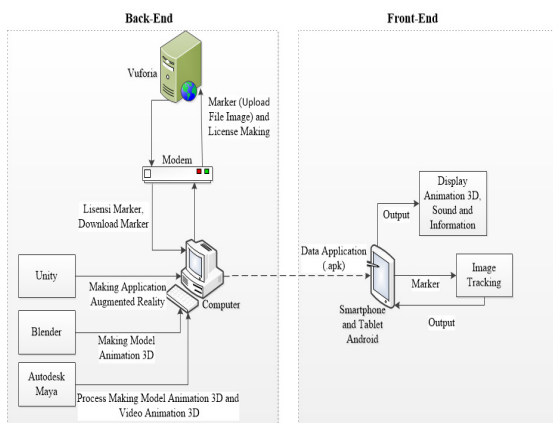

Figure 1: System Design

Figure 1 shows the general view ARBantenOtonan which consists of 2 process namely; back-end process and front-end process.

The first process, the back-end process involves the process of the creation of 3D model using Blender Software. The creation of 3D animation model and 3D animation video is done by using Autodesk Maya Software. The creation of license key and database marker is using Vuforia Library. The creation of license key is done in order to identify every application that are made and to give the access based on Vuforia platform.

The creation of database marker has function to list markers that are used during the creation of Augmented Reality based application. The process that is done after creating license key and database marker is the process of downloading database marker in form of Unity Editor or unity Package

File. The creation of Augmented Reality based application needs Vuforia SDK which later on is used in Software Unity by importing that Vuforia SDK. Unity is one of softwares that is used in creating Augmented Reality based application. The result of creating Augmented Reality based application by using Unity will be in form of .apk file which later on can be installed in android based smartphone.

The second process, front-end part, involves the installing process of the.apk file in android based tablet or smartphone. The Augmented Reality based application that has been installed can run and do tracking image on image by fiiting the existing data marker from the .apk file with the pictures or marker that is being tracked by using camera of the smartphone. The result will be in form of 3D animation model, 3D animation video, sounds or narration as well as information related to the process of making *Banten Otonan* and *Sampian*.

3.2 Use Case Diagram

Use Case Diagram is the display of the functionality that is expected from the application or an interaction between users with the application [18].
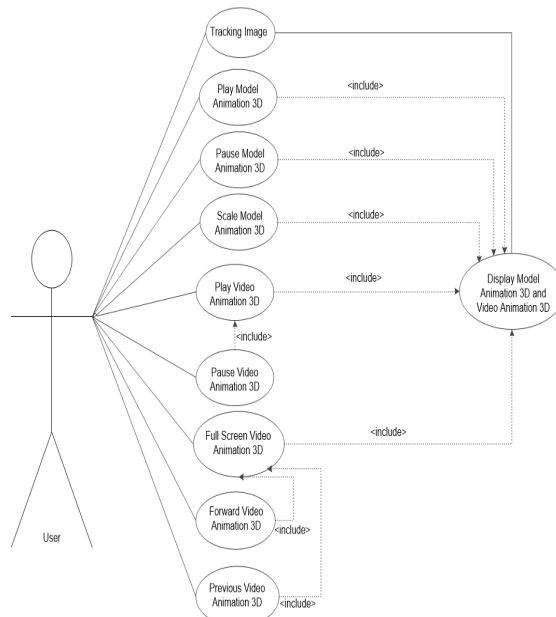

Figure 2: Use Case Diagram

Figure 2 shows use case diagram of ARBantenOtonan application. Figure 2 shows the features that are used in doing the process of ARBantenOtonan application.

3.3 Activity Diagram

Activity Diagram is aimed for showing the working diagram of ARBantenOtonan. Activity diagram can help user in using this application.
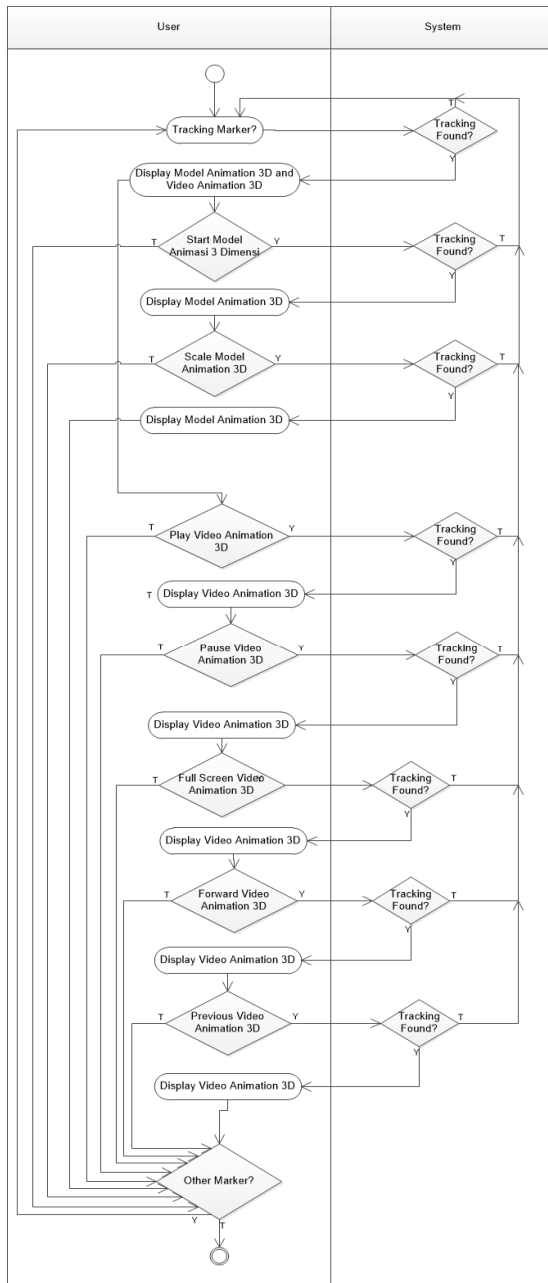

Figure 3: Activity Diagram

Figure 3 shows activity diagram of ARBantenOtonan application. Figure 3 is the working diagram from ARBantenOtonan application on purposes to ease users in doing the process from users to systems.

3.4 Marker Designing

Marker that is used in ARBantenOtonan is book about *Banten Otonan*. Marker has function to help the application in the process of tracking to show the 3D animation model as well as the 3D animation video.

Figure 4: Marker of Banten Kurenan

Figure 4 shows the marker of *Banten Kurenan*. Marker of *Banten Kurenan* later on is used as marker to show 3D animation model.

Figure 5: Marker of Banten Guru

Figure 5 shows marker of *Banten Guru* which is used as marker to do tracking image from the camera of android based smartphone.

3.5 Testing

The testing of ARBantenOtonan is highly needed to be done in order to inspect the rate of success in creating the application. The trial is done by using android based smartphone.
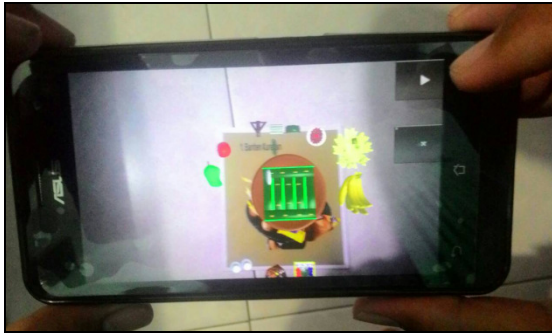
Figure 6: The Result of 3D Animation Play Model

Figure 6 shows play 3D animation model that is aimed for running the 3D animation model and sounds in creating *Banten Otonan* especially *Banten Kurenan*.

Figure 7: The Result of Scaling 3D Animation Model

Figure 7 shows scaling 3D animation model. Scale animation is aimed for changing the size of the 3D animation model by using the scale button. Scale button is supported by event tonggle which can be used for giving true and false value when the event toogle button is being touched. If Event tonggle values true means that users can do scaling process for the 3D animation model. On the other hand, if Event toogle values false means that users cannot do scaling process for the 3D animation model.
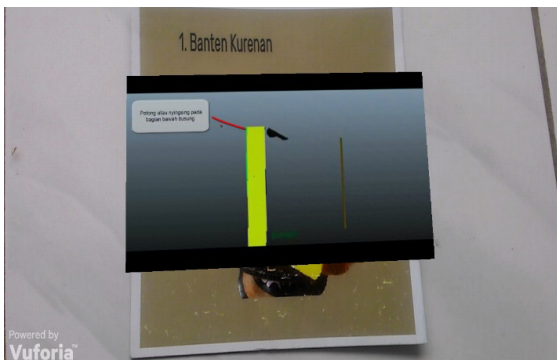

Figure 8: The Result of 3D Animation Video

Figure 8 shows 3D animation video of making *Sampian Banten Otonan*. This video later on is functioned to tell the process and steps in making *Sampian Banten Otonan*.
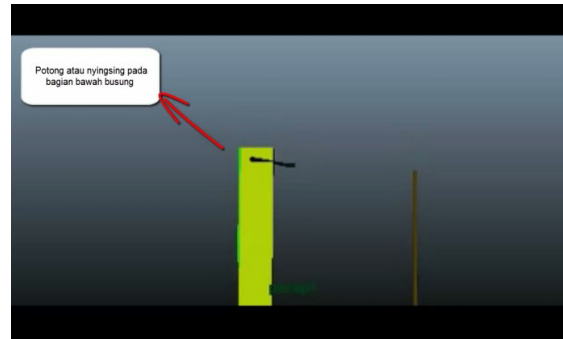

Figure 9: Full Screen Model 3D Animation Video

Figure 9 shows the full screen mode of 3D animation video. Full screen features is used for easing users in learning step by step the process of making *Sampian Banten Otonan*.
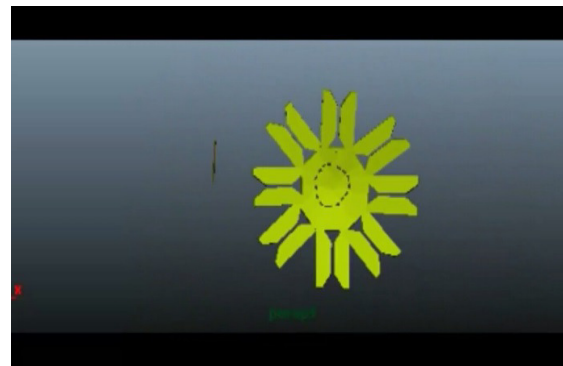

Figure 10: The Final Result of The Process Making Sampian Banten Otonan

Figure 10 shows the final result of the process of making *Sampian Banten Otonan*. That result is acquired from every step starts for the step of nuas busung till the process of nyait.

3.6   Result of Application Test

Trial is needed to acquire the expected output of the software. The trial by using Android based smartphone with specified specification is shown on table 1.

Table 1: Specification of Smartphones

No.	Type Device	Specifi-cation	Detection Time	Mini-mum range	Maxi-mum range
1	Device 1	Android Version : 4.4 (Kikkat) Processor :	2 seconds	12 cm	50 cm

		Dual-core 2.0 GHz RAM : 2 GB Camera : 8 Mega Pixel			
2	Device 2	Android Version : 4.0 Processor : Dual Core 1.5 Ghz RAM : 1 GB Camera : 12 Mega Pixel	2 seconds	12 cm	48 cm

Table I shows the specification of smartphones that are used in trial process. The trial of the application is done by using several comparing parameters.

The average time of detecting target object is 2 seconds which is acquired by calculating the detecting time using device 1 which is 2 seconds and device 2 which is 2 seconds as well.

The trial of minimum distance of marker detection and quality tester of 3D animation is aimed for determining the minimum distance between the smartphone with the target object in the process of marker detecting. The minimum distance of marker detecting by using device 1 is 12 cm with the quality that is displayed is categorized good. Meanwhile, the minimum distance of marker detecting by using device 2 is 12 cm with good quality 3D animation display. The device specification influences the minimum distance of marker detection.

The trial of maximum distance of marker detection and quality tester of 3D animation is aimed for determining the maximum distance between the smartphone with the target object in the process of marker detecting. The maximum distance of marker detecting by using device 1 is 50 cm with the quality that is displayed is categorized good. Meanwhile, the maximum distance of marker detecting by using device 2 is 48 cm with good quality 3D animation display. The device specification influences the maximum distance of marker detection.

3.7 Analisys of The Output of Augmented Reality based Application

The comparison of the application is aimed for comparing the result or output of ARBantenOtonan application with the other Augmented Reality based applications. The comparison is divided into 2 namely; the comparison of 3D animation model and the comparison of 3D animation video.

3.7.1 Analisys of the output 3D animation model application

The analysis of the comparison of 3D animation model of ARBantenOtonan with other Augmented Reality based applications are shown by Table 2 below.

Table 2: Analysis of The Output 3D Animation Model Application

Augmented Reality application name	Detection Time	Mini-mum Range	Maxi-mum Reange	Application Size
Augmented Reality-based Educational Application of Banten Otonan Making	2 seconds	12 cm	50 cm	157 mb
Learning Media of Writing *Aksara Bali* based on Augmented Reality	2 seconds	6 cm	55 cm	125 mb

Table 2 shows the comparison of Augmented Reality applications in terms of time detection, minimum distance, maximum distance and the size of the application. Based on the table, it can be concluded that the minimum and maximum distance are affected by the number of resources and the size of the markers that are used.

3.7.2 Analysis of the output 3D animation video

The analysis of the comparison of 3D animation video from ARBantenOtonan application with the other Augmented Reality based application is shown by Table 3.

Table 3: Analysis of The Output 3D Animation Video

Augmented Reality Application Name	Time Detection	Minimum Range	Maximum Range	3D animation video size
Augmented Reality-based Educational Application of Banten Otonan Making	2 seconds	10 cm	35 cm	15,1 mb
Augmented Reality For Chemical Elements : PERIODIKAR	2 seconds	6 cm	25 cm	12 mb

Table 3 shows the comparison of Augmented Reality based applications in terms of time detection, minimum distance, maximum distance and the size of 3D Animation Video. As for the result, the minimum and maximum distances that are shown on Table 3 are affected by the number of resources.

4. CONCLUSIONS

ARBantenOtonan is created by using Augmented Reality technology. This application is developed for Android platform by using Vuforia Library.

The result of the trial that has been done shows that ARBantenOtonan application has run well. The result of the trials namely;

- The minimum or maximum distance to successfully display animation is determined by the process of marker tracking.
- 3D animation video of making sampian that is produced through tracking marker process has a good quality of video.
- 3D animation model of making *Banten Otonan* which is produced through marker tacking process is in a good quality.
- All functions and features that ARBantenOtonan has run well.
- The average time for detecting object is 2 seconds.
- ARBantenOtonan Application can be develop to dynamic augmented reality application.
- ARBantenOtonan can only to run in Android platform.

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