

The Implementation of Augmented Reality as Learning Media in Introducing Animals for Early Childhood Education

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Abstract— The early childhood education is the process of learning where the children are on the step to know and to be curious of their surroundings. It is also a time for children to grow and to explore the knowledge. Nowadays some schools of early childhood still use the old method such as of face-to-face or read book. Consequently, it makes the students of early childhood easily bored with this method and need the new method to make they are interested in. Hence, it needs an interactive learning media to make the children interest in. The selection of making media of introduction animal based on recognition of Augmented reality using Unity 3D because it supports Animated Augmented reality itself which contained by animations, the text, images, 3D, audio, and video as well as Vuforia mobile device SDK that enables the creation of Augmented reality. The FAST Corner Detection algorithm is used in this system for the purpose of speeding up computing time in real-time with the consequences of lowering the level of accuracy of detection angle. The Aim of this research is to give the detail information about the using of visual information about the animals interactively through the three-dimensional animation using the technology of Augmented Reality. The result of this research is the application of interactively learning media based on the augmented reality. It can help the teacher of the early childhood education (PAUD) to introduce the name, shape even sound of the animal to the pupils

Keywords— Augmented reality; The introduction of animals; Early Childhood Education Program; Algorithm Fast Corner Detection.

I. INTRODUCTION

Early childhood education (PAUD) is an activity of learning that focuses on child's age level with curriculum development in the form of a set of plans. It contains a number of experiential learning through games that is prepared by the education material. In the process of learning, the pupils of Early Childhood Education (PAUD) needs the fun and effective method. It means that, everyone can teach but it needs special ability to teach the early childhood.

Teaching the early childhood means that teaching the children who are in the golden age. The Golden age is the time for the children exploring the environment. It makes the children become curious to know their surroundings.

The learning activity on early childhood education is concretely applying a set of curriculum that based on the experiential learning through games related with the age and the potential of the children. The teachers have to master the information about their children's potential and know about the process of developing of their children in the purpose of gaining the competencies of their children.

Playing for the children is the basic needed for early childhood development. The kids are eager learning the knowledge through the unique learning method for example are the entertainment media and the environment 3D virtual that are suitable for the children to explore it. The children more learn through the experience of interaction between their teachers, friends, the people and the real object than they learn from the writing symbol that is seen by the children.

The children who are in range of three until four years old are classified as the play group. They still learn to master the symbol of words and also try to tell their experience although they cannot tell their story logically (pra logic). For this step they become egocentric. It means that, they focus only seeing something from their self (perception concentration) with only see something for only one trait while another trait is ignored. Moreover, the children who are in range three until four years old have ability to understand the purpose of the game that is given and to follow the rule of game. Now day's media learning through the smartphone are widely used to give learning activities. The reason is because it is portable , Moreover main aim of mobile-learning is that it can provide the knowledge and competence tests to the child so that it can be measured whether the kid understood or not [1].

The Augmented Reality (AR) is a technology that integrates a digital information with the user's environment in the real-time [2]. The use of AR (augmented reality) in classrooms for educational purposes is already a reality and its effects on the motivation and performance of students at different educational levels have been widely documented [3].

Augmented Reality (AR) is the technology combining the two or three dimensional virtual objects into a real three-dimensional and then projecting the objects into the virtual objects in real time. Unlike virtual reality which is completely replaces the existing reality, The Augmented Reality is simply add or complement a reality.

Virtual object displays the information that is not be caught by the user's sensory. It makes the Augmented Reality (AR) is appropriate as a tool to help the user making interaction with the perception and the real world. The Information that is displayed by the virtual objects helps users carry out activities in the real.

As the conclusion is augmented reality as the breakthrough to help the students of early childhood learn about the topics in the curriculum for early childhood education. Through this media, the children are expected understand the material that is given from their teacher. Now days, the method of learning focuses only reading the book or using the face to face method, consequently it makes children is easy to be bored. They need something new. They need making interaction between the things. Based on the problem happen, the aim of the research is to develop the learning media for introduction animal for the early childhood through the augmented reality. Through this media, the children will learn about the part of animal, the habitat of the animals even to know the food of the animal. Besides the children can make interaction between the characters of the animal through this media. Moreover, based on the problem happen the researcher make the application based on the former developer for the early childhood education using the technology of augmented reality as the method to deliver the information interactively. For the basic engine, the researcher uses the software of UNITY 3D and Vuforia Developer as the basic engine of augmented reality. Hopefully, through this media, it can help the children to know the kind of the animals.

II. METHODOLOGY

A. *Augmented Reality*

The aim of augmented reality is to develop the latest technology combining between digital content in the real-time that is created by computer with the real world [4]. Through the Augmented Reality, the users can see the object of virtual two-dimensional or three-dimensional is shown in the real world. Augmented reality needs some hardware such as a computer or laptop, webcam, smartphone camera, and tracker or marker to identify where augmented reality will be projected. User can use augmented reality only by moving the camera to an object. After that the pattern of this object will appear in the screen. Another version to use augmented reality is the user can use headgear to show the object to the user's eyes. The distinction between augmented reality and virtual reality happen in the processing of the object from the virtual to the reality. The Virtual reality only focuses on the joining process of an object from the real into digital, while the augmented reality focuses on the process of merging the digital elements that is added into the reality. The adding of Digital element into the reality happens in the real time and it follows the reality condition.

B. *FAST Corner Detection*

FAST (Feature Form Accelerated Segment Test) is an algorithm developed by Edward Rosten, Reid Porter, Tom

Drummond. The aim of building a FAST corner detection is to speed up computing time in real-time with the consequences of lowering the level of accuracy of detection angle. FAST is an angular detection algorithm that is widely used in many AR applications because of its high reliability although it is a simple and fast algorithm. Needed to extract image features to match target objects correctly from many different images [3].

A fast corner detection begins by specifying a point p at coordinates (x_p, y_p) on the image and compares the intensity of the point p with 4 points in the vicinity. The first point is at coordinates (x, y_{p-3}) the second point located at coordinates $(x_p + 3, y)$, the third point is at coordinates $(x, y_p + 3)$, and the fourth point located at coordinates (x_{p-3}, y) .

To recognize the point p is the corner, firstly it should know the value of the intensity at the point p . When the intensity of point P has greater value or it is lower than the intensity at least three points were coupled with an intensity threshold (Threshold), then it can be said that the point p is a corner. After that point p will be moved to a position $(x_p + 1, y_p)$ and do the fourth intensity surrounding the point again. These iterations continue until all dots on the image already in comparison.

III. BACKGROUND

A. *Analysis of The Issue*

Analysis of the issue in question here was difficult getting media can introduce animal figure with sound on the books early childhood learning, due to the use of the media the book still can only shows one side or direct point of view and less Interactive in the lesson. The background of the problem in this research appears when the early childhood education is difficult to find the interesting media for introducing the animals to their pupils. They only use the book to give the knowledge. As the result, this method is not interactively. The pupils only read the book and know the animal from the picture. It makes the student easily to be bored. The researcher analyzes the use of augmented reality to solve the problem.

Nowadays the technology becomes cutting edge especially the technology of augmented reality. It can combine between the real-world objects with the virtual objects. Besides that, it can be the breakthrough to change the method of learning at the early childhood education. The development of AR (augmented reality) has transformed into many field such as the application of augmented reality using the web application, the application using PC desktop even the application of augmented reality using the smartphone. In this research, the researcher focuses only the application of augmented reality using smartphone. The reason of choosing the application of augmented reality using the smartphone because it is easy and portable to use. Hopefully, through the technology of AR (augmented reality) becomes the answer for the problem of finding the interactive media. Moreover, the augmented reality can use the multi marker to produce many object. The aim of this application can display the information using the real time in the form of virtual animal and the supporting sound with the technique of more than one marker

B. *Learning Early Childhood Education*

Early childhood education (PAUD) is an activity of learning that focuses on child's age level with curriculum development

in the form of a set of plans. It is containing a number of experiential learning through games that is prepared by the education material. In the process of learning Early Childhood education (PAUD) needs the fun and effective method. The learning activity on early childhood education is concretely applying a set of curriculum that based on the experiential learning through games related with the age and the potential of the children [5]. The teachers have to master the information about their children's potential and knowing about the process of developing of their children in the purpose of gaining the competencies of their children. The learning process of early childhood education should be suitable with the age. It means that the students can enjoy for the processing of learning, the main goal of learning can be reached and also it can give the challenge to students in the processing of learning. It must be appropriate with the age of the students [6].

From the explanation above, it can conclude that the process of interaction of the children between the teachers is the part of the learning process. It can help the pupils learning that is adjusted by step of developing early childhood. As the result it can make the progression in the pupils. They can change their behavior for the better.

Through playing, the children can get many benefit from the developing aspect. Unfortunately, there is misconception from the principle of playing while learning at early childhood education. The misconception happens when assuming the learning process of early childhood education only playing without the purpose. But the fact that the process of learning by playing at early childhood education creates the pupils to develop their ability such as motoric, cognitive, language, art, social emotional.

C. Characteristics of Early Childhood Learning

Early childhood learning has the following characteristics, children learn through game, children learn how to build knowledge, children learn scientifically, children learn the value, it has meaningful, it should be interesting, and it should be functional [6]. Early childhood learning through playing activities that is prepared by educators. The materials of Early childhood learning can be divided into two age group namely the material for 3 years of age and the material for 3-6 years [7]. Each learning component has a characteristic or distinctive. Components of learning can be seen in the Fig.2.

There are so many components system of learning such as the purpose, the material, learning, method or the strategy of learning, media and evaluation [8]. While, there are so many component of the role model such as concept, purpose of learning, topic of discussion, procedure of learning, the tools or the source of learning and the evaluation technique. Furthermore, the purpose of learning is to help giving the fundamental of knowledge, giving the skill and creativity that is needed by the learner. Consequently, the learners have ability to adapt with his surroundings. Besides the learner can develop their ability to the next step of processing of learning [5].

The standards competence of early childhood education is the developing of the moral aspects, the values of religion, emotional social and self-reliance, language, cognitive, physically motoric, and the last is the art [7]. There are six aspects of developing early childhood namely awareness of personal, emotional health, social communication, cognitive, and motoric skills [5].

The content or the material of learning is the second component of learning component. The material of learning is the core for the process of learning. It meant that the source of learning can be from anywhere. While the exercises, the responsibility of the teacher and the setting of learner is not the source of learning [8].

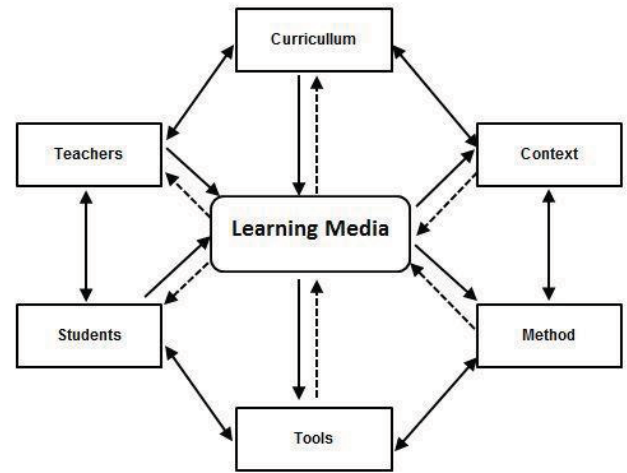


Fig. 1. The Components System of Learning

III. DISCUSSION

A. Flowchart System

The application of augmented reality of introducing the animal uses android system to run it. Besides, it is used by one user only. The user can use this application using the media marker that is already defined. The flow chart system figures out at Figure no 3.

Here is the flowchart system:

- The user opens the application through Android smartphone that's already installed this application.
- The application will display the splash screen for 3 seconds.
- The application will display the main menu where the user will select the button to start the camera, AR quizzes, or exit the application.
- If the user holds the button "AR camera" then application displays the camera mode. The user can direct the camera towards the marker that is provided and it. After that the program will bring up the animal along with the 3D object animation.
- The user can choose the quiz. The user presses the menu quiz button and the program will display the menu of the quiz. There are so many buttons such as play button, trophy button, about quiz, reset button and menu button.
- If the user presses the play button, the program will display the question mode. The user should answer the question.
- If the trophy button is chosen by the user, so the application will display the trophy that is won by answering the question.
- The user can get the information about how to play the quiz after the user presses the about quiz button
- The function of reset button is to reset the trophy. After the user chooses this button, the trophy becomes empty.

- j. When the user presses the menu button, the program will display the menu of the application.
- k. To end the game, the user can press the exit button.

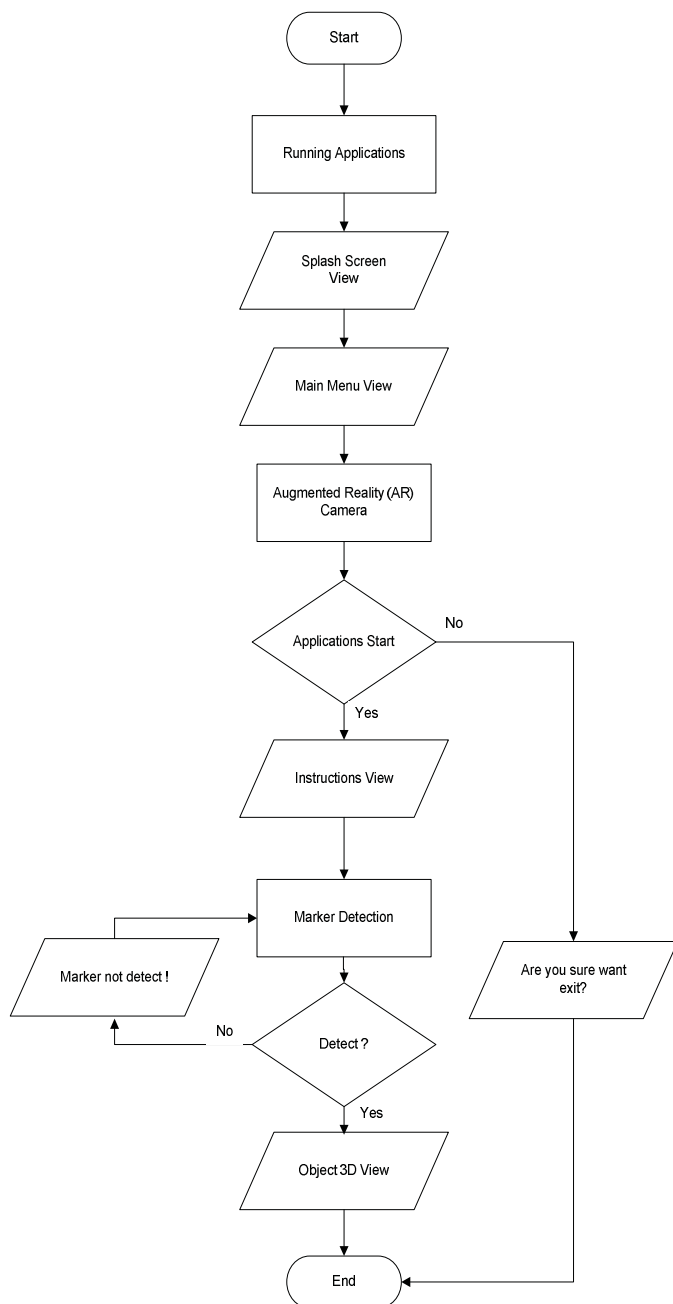


Fig. 2. Flowchart of The System

B. Use Case Diagram

Referring to the flow chart system, so it can make the user case diagram. Firstly, the user opens the program of introducing animal's name based on the android augmented reality. After that, the user will see the splash screen for a while and then the application will display the main menu. The main menu contains the AR Camera Button, quiz and exit. The user can see the button and can choose the menu. After that, the user chooses the AR camera button. After the user chooses the camera AR button, the application will direct the user to the camera mode. In the camera mode contains with the search marker and find the 3D object.

C Main Menu Augmented Reality

On the main menu there are three sub menu options namely Quiz, AR Camera and exit. On the sub menu Quiz, it uses for training students. In this part the student study about the animal through this application. The Quiz menu has five menus there are the play button, the Trophy room, the menu about the quiz, the Reset button, and the button of menu. On the sub menu AR cameras, it uses to display animals in 3 dimensions. The user uses the camera directly to the marker object. After that, the user can see the 3D object of animal through this application. While the exit button uses for closing the application.



Fig.3 Main menu of the application

In Figure 4 shows the result of pressing the AR Cameras on the main menu. The processing of the 3D occurs when the scene detection marker is activated by the camera device automatically. After that, the detection marker performs the identification the object marker. Finally, the result of detection of the object marker will appear in the user's the camera device (smartphone).



Fig. 4 The display of Application 3D Animal AR Camera

D. Testing

1. Black Box Testing Scenarios

On Black Box Testing, the function of the button is tested. Every button and link will be tested to get the information about the error and the accuracy of the application. The result is shown at Table I.

TABLE I
TESTING OF APPLICATION BUTTONS

Scenario	Part Tested	Step Testing	System Function	Desired Result	Status
Main Menu	Button AR Camera	Click Button AR Camera	To display Marker AR Detection	If valid Will display 3D object	Success
Main Menu	Quiz Button	Click Quiz Button	To go to the Quiz Main Menu	If valid will go to the main menu of Quiz	Success
Main Menu	Exit Button	Click Exit Button	To exit the application	If valid will exit from the application program	Success
Main AR	Back Button	Click Back Button	To go back to the main menu while want to get out from AR	If valid will back to main menu	Success
Quiz Menu	Play Button	Click Play Button	To start Quiz Game	If valid will go to the Question Menu	Success
Quiz Menu	Trophy Button	Click Trophy Button	To display a trophy that has been obtained	If valid will go to the place of trophy	Success
Quiz Menu	About Quiz Button	Click About Quiz Button	To display procedures About Quiz	If valid will go to the About Quiz Menu	Success
Quiz Menu	Reset Button	Click Reset Button	To reset the Trophy	If valid will reset the place of trophy	Success
Quiz Menu	Menu Button	Click Menu Button	To go back to the Quiz Menu	If valid will back to main menu of Quiz	Success
Question Menu	Answer Button	Click the Answer Button	To go to the next questions	If valid will go to the next questions	Success

After testing by black box method and running the application augmented reality, it can get the result that every parts and every function can run well by the design. As the result that it can be used.

2. Testing of Distance and Angle

The test will be performed against the distance and angle in the application. The test scenario is in Table II.

TABLE II
TESTING OF DISTANCE AND ANGLE

Scenario	Part tested	Number of tests	Results obtained	Status
Distance	10 cm from marker picture	5 times testing	AR appears because it can still read the image as a marker	Success
	20 cm from marker picture	5 times testing	AR appears because it can still read the image as a marker	Success
	30 cm from marker picture	5 times testing	AR appears because it can still read the image as a marker	Success
	40 cm from marker picture	5 times testing	AR appears because it can still read the image as a marker	Success
	50 cm from marker picture	5 times testing	AR appears because it can still read the image as a marker	Success
	60 cm from marker picture	5 times testing	AR does not appears because it can still read the image as a marker	Failed
Angle	10 cm from marker picture	5 times testing	AR appears because it can still read the image as a marker	Success
	20 cm from marker picture	5 times testing	AR appears because it can still read the image as a marker	Success
	30 cm from marker picture	5 times testing	AR appears because it can still read the image as a marker	Success
	40 cm from marker picture	5 times testing	AR appears because it can still read the image as a marker	Success
	50 cm from marker picture	5 times testing	AR appears because it can still read the image as a marker	Success
	60 cm from marker picture	5 times testing	AR appears because it can still read the image as a marker	Success
	70 cm from marker picture	5 times testing	AR appears because it can still read the image as a marker	Success

3. Test results the distance and angle

The result after testing the distance and angel for five time is there is a minimum distance from the marker is 10 cm and the maximum distance is 60 cm. while for the minimum angel is 10 degrees and the maximum angel is 60 degrees from the marker picture.

IV. CONCLUSION

The implementation of augmented reality in the learning media of introduction animal can give the visual information interactively. This media can show the 3D animation of animal through the augmented reality and the marker. The function of the marker is to give a marker of the 3D visual that

resembles its original form. Through the android system, this application can display the object from many angles and it can see clearly in detail. The application of introduction animal using the augmented reality is the breakthrough from the media learning of early childhood education. It is also the alternative solution from the learning method to introduce the animal for the early childhood. This application is so fun, because the children can make the interaction and get the knowledge through this application. Besides, the pupils are easy to understand because the application provides the information creatively.

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