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Development of Augmented Reality Portal for Medicininal Plants Introduction

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Abstract:

Augmented Reality Portal application of Human Herbal Medicinal Plants, it can be concluded that the AR portal application aims to visualize medicinal plants and as a means of knowledge and insight for the general public. That is by utilizing the sophistication of Augmented Reality Portal-based technology that can be accessed using an Android smartphone. The Augmented Reality Portal application of Medicinal Plants in the Insani Herbal Garden has been carried out in the trial phase, the results of the Structural Test show that the system is well structured, the results of the Functional Test show that every button on the system has functioned properly and the Validation Test includes distance testing with maximum results for objects to detect sound, which is 90 cm, slope trials with a distance of 90 cm, maximum results at 45 degrees with a time of 00.66 seconds, light level trials with object detection results faster when the sun is direct with time of 1 second, and testing the android specifications shows that the minimum operating system is android nougat 7.0 and supports AR Core.

Keywords: Augmented Reality, Medicinal Plants, Insani Herbal Garden, AR Portal, Android

1. Introduction

Medicinal plants are plants that have chemical properties that are efficacious in curing disease or preventing disease, meaning that they contain active substances that function to treat certain diseases or do not contain certain active substances but contain a resultant effect/synergy of various substances that function to heal. (Shakya, 2016) The problem that is currently happening is the lack of public knowledge of the efficacy and chemical content of medicinal plants, making it difficult for people to distinguish between types of medicinal plants, especially in the Depok Insani Herbal Park.

In research conducted by Kadek Artawan (2015) to find out the types of flowers it is easier when using Augmented Reality (AR) technology in this application to obtain detailed information on the types of flowers using the markerless method. The Situgede edutourism area is one of the places to find out the physical form of the species. Medicinal plants through AR using a marker-based tracking method. Based on the explanation that has been explained, it can be concluded that AR Portal technology can be used as a flexible information medium. So that research on the "Augmented Reality Portal for the Introduction of Medicinal Plants" by allowing application users to have a different experience about the introduction of medicinal plants. (Canter et al., 2005)

2. Literature Review

2.1. Medinical Plants

Medicinal plants are plants that either part or all of them have medicinal properties that are used as medicine in healing and preventing disease.

2.2. Insani Herbal Garden

Insani herbal Garden is the result of initialization from the owner Mr. Ir Mahendra who wants to combine the concept of an herbal garden with eco-friendly tourism for families, not only that this park was created as a means of introducing the public to the use of medicinal plants and their cultivation and processing methods in the city of Depok. In addition, the human herbal park provides several complete facilities such as swimming pools and getek rides and interesting selfie locations.

2.3. Augmented Reality

Augmented reality is the integration of digital information with the user's environment in real time. Augmented reality technology uses the existing environment in the real world and then adds new information on it. (Karundeng et al., 2018; Widiaty et al., 2021; Bawonosari et al., 2013)

2.4. AR Portal

AR Portal sends us to beautiful places around the world, where we can see new views in real time, built using Unity3D and Google's AR core augmented reality framework, one of its biggest priorities is making it feel like a portal that is actually in the room. and with objects around us, the creation of doors that lead to places around the world (places we always want to visit), this application places the door like a portal above the ground at the desired point. The AR portal method without using a frame marker as an object that detects and supports pattern recognition techniques (pattern recognition), then the use of a marker as a tracking object is replaced with the surface of a marker object as a tracking object. A 3D door object in which there is a room that can only be seen when the smartphone camera on the AR Portal application points into the 3D door.

2.5. Markerless Method

Markerless Augmented Reality is one of the augmented reality methods without using a frame marker as an object that is detected and supported by a pattern recognition technique (pattern recognition), then the use of a marker as a tracking object is replaced by the surface of a marker object as a tracking object. (Lee and Hollerer, 2009; Amin and Govilkar, 2015; Hatmojo et al., 2021)

2.6. Blender

Blender is a 3-dimensional (3D) processing software for creating 3D animations, which can be run on Windows, Macintosh and Linux. (Flor, 2011) Blender is also the same as 3D software in general such as 3DS Max, virtual and light wave, but also has quite basic differences such as work projects in Blender that can be done in almost all other commercial 3D software, the appearance can be adjusted at will, has a good physics simulation and using uv which is easier. Blender can also make games because it has a Game Engine.

2.7. Unity

Unity is an application that integrates with many tools and rapid workflows that are used to create interactive and multi-platform three-dimensional content.

2.8. AR Core

AR Core is Google's platform for building augmented Reality experiences using different APIs. AR Core allows our phones to experience their environment that understands the world, and interacts with information, AR Core uses three main capabilities to integrate virtual content with the real world as seen through your phone's camera:

1. Motion tracking allows the phone to understand and track its position relative to the world.
2. Environmental understanding allows the phone to detect the size and location of all types of surfaces, horizontal, vertical and inclined surfaces such as the ground, coffee table or on the wall.
3. Light estimation allows the phone to estimate the current lighting conditions in the environment.

Basically, AR Core does two things tracking the position of the mobile device as it moves and building its own understanding of the real world. AR Core motion tracking technology uses the phone's camera to identify points of interest called features and track how those points move over time, with a combination of the movement of the dots and readings from sensors from the phone.

2.9. Android

Programming Mobile Applications for Smartphones and Tablet PCs based on Android, several other sources state that Android is a mobile operating system based on the Linux open-source code created by Andy Rubin which was later developed by Google. In developing android applications, it provides an Android SDK that provides tools and APIs for application developers with the Android platform.

3. Research Methods

The research method used in the study entitled Application of Augmented Reality Portal for Introduction of Medicinal Plants in the Taman Herbal Insani area is MDLC (Multimedia Development Life Cycle).

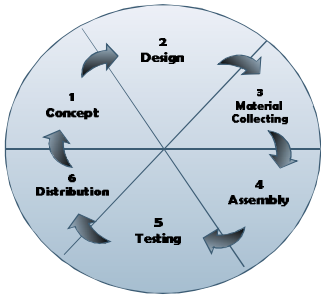


Figure 1. Multimedia Development Stage

3.1. Concept

The concept stage is the stage to determine goals which include the purpose of identifying the application including user identification (audience identification), application form (interactive presentations, etc.), general specifications (application size, design basis, targets to be achieved, etc.)

3.2. Design

Design is the stage of making specifications regarding the display style of the application in detail, the specifications are made as detailed as possible so that at the next stage, it can be determined what must be done in making it according to the flowchart design, menu navigation structure and storyboard design.

3.3. Material Collecting

The collecting material stage can be done in parallel with the assembly stage. This stage is carried out through the preparation and collection of materials that will be used in making applications that will be developed, such as data, images and other media.

The methods used in the collection include:

1. Direct observation by seeing directly how the location of the human herbal garden is to collect data on medicinal plants in the human herbal garden.
2. Interviews to find out firsthand how the development of medicinal plants in the competition, and how much public interest in knowing the benefits of medicinal plants.
3. Literature is a collection method to obtain data in a ready-made form, namely those obtained from examples of journals related to augmented reality, literature, as well as obtaining other literature such as information data and knowledge about how to build augmented reality applications related to medicinal plants, all of these things will later become the core of the application that will be built.

3.4. Assembly

The Assembly stage is the stage where all multimedia objects are created. Applications are made based on storyboards, flowchart interfaces, navigation structures or object diagrams originating from the design stage, in this stage several applications are used such as Unity3d, AR Core, Blender, Audio city and the C# programming language used.

3.5. Testing

The testing stage is carried out after the manufacturing stage is complete where this test aims to test the application whether there are still errors or not, at this stage there are three stages of testing, namely:

1. Structural testing is to find out whether the system that has been made has been structured properly and correctly according to the design.
2. Functional trial is a test conducted to test the functions of the Augmented Reality Portal whether it is functioning properly or not.
3. Validation trial is a process where testing on a system that has been tested and gets valid or invalid results before publication, validation trials include distance trials, tilt angle trials, light level trials, and smartphone device trials.

3.6. Distribution

Distribution is the final stage of the MDLC (Multimedia Development Life Cycle) flow. This stage can be called the evaluation stage for the development of the finished product so that it becomes better. The results of this evaluation can be used as input for the concept stage of the next product, at this stage the application that has been finished and succeeded in each trial will be compiled into apk form, namely the android application format.

4. Results and Discussion

4.1. Results

At this stage, we will discuss the results of the Augmented Reality Portal development application for the introduction of herbal garden medicinal plants that have been made. The trial stages that have been carried out are Structural, Functional and Validation. In the Validation trial, there are several trials that have been carried out such as the distance test on the plain, the trial on the slope angle on the plain, the light level test and the android specification test.

4.1.1. The Main Menu

The main menu display contains the features of the medicinal plant introduction application which includes ar portal, about, guide and exit. When the AR portal button is selected, it will enter a page that will display a portal in which there are plant objects, then the about button is a page about application information, the guide button is a page about how to use the application, and the exit button is to exit the application.

Figure 2. Main menu page

4.1.2. The Main Menu

The main menu display contains the features of the medicinal plant introduction application which includes ar portal, about, guide and exit. When the AR portal button is selected, it will enter a page that will display a portal in which there are plant objects, then the about button is a page about application information, the guide button is a page about how to use the application, and the exit button is to exit the application.

Figure 3. Menu AR portal

4.1.3. AR Portal Menu Display

The Ar portal menu functions to start the application that has been provided showing features for the introduction of medicinal plants in the form of 3D objects and audio and text regarding object information about the properties and chemical compounds contained in plant objects.

Figure 4. Menu About

4.1.4. Display Menu About

This menu contains information from the application

Figure 5. Menu Guide

4.1.5. Discussion

The Augmented Reality Portal application on Medicinal Plants was built as an alternative medium to introduce medicinal plants located at Taman Herbal Insani. The advantages of the AR Portal Application of Human Herbal Medicinal Plants:

1. A 3D door object in which there is a room that can only be seen when the smartphone camera on the AR Portal application of plants leads into the 3D door.
2. The 3D object of medicinal plants displayed is very interesting because there is information about the properties and chemical compounds contained in the object
3. If the smartphone camera on the AR Portal application points to a plant object, it will display a sound of information in the form of the scientific name of the plant, the benefits and also the chemical content in the plant object.

Disadvantages of AR Application Portal of Human Herbal Medicinal Plants:

1. The specifications needed to use this application are Android with Operating System (SO) 7.0 Nougat and support AR Core
2. To display this application the user needs a wide plain so that the resulting display in this application does not float
3. Display of 3D medicinal plants that are made less natural

4.2. Testing

Testing is the stage that is carried out after completing the manufacturing stage by running an application or program and seeing whether there are errors or not. There are several types of testing, including:

4.2.1. Structural Trial

It is a suitability stage to find out whether the application has been structured properly in accordance with the design plan that has been made. After testing each menu, it can be seen that the structural validation in this application

Table 1. Structural test

No	Scene	Page view	Information
1	Main menu page	About Guide AR Portal Exit	Accordance
2	About Page	About Page Back to main menu	Accordance
3	Guide Page	Application guide Back to main menu	Accordance
4	AR portal page	3D object AR camera Information Voice Back to main menu	Accordance

A). Functional Trial

This functional testing phase of each button that will be run, to find out whether the button works or not on this application. Below is a functional test table

Table 2. Functional Trial

No	Scene	Button	Function	description
1	Main menu page	About	Show about application information	Function
		Guide	Displays the application user guide	Function
		AR Portal	Displays 3D plant images, an information of the scientific name, properties and chemical content of the plant object	Function
		Exit	Menu to exit the application	Function
2	About Page	About the app	Displays a page about application information	Function
		Back	Back to main menu	Function
3	Guide Page	About the app	Displays a page about the application usage guide	Function
		Back	Back to main menu	Function
4	Ar portal	Camera AR portal	Displays 3D plant images, an information of the scientific name, properties and chemical content of the plant object	Function
		Back	Back to main menu	Function

B). Validation Test

Validation test is a stage which is checking information data from an object whether it is in accordance with the data that has been previously collected at the collecting material stage, in other words, validation is here to ensure whether the application made is in accordance with user expectations or not.

a. Distance Trial against portal objects

Table 3. Distance Trial

No	Test description	Picture	Time	Conclusion
1	Scan on the initial distance of 150cm, then you have to walk towards the door to enter the room		04.45 seconds	Object detected

2	Scan at a distance of 50 cm, the door is not open yet, so you have to walk towards the door object so you can enter the room		01.75 seconds	Object detected
3	Scan at a distance of 10 cm the door is open, then you have to walk in order to enter the room		00.93seconds	Object detected

b. Test distance to 3d objects

Table 4. Test distance to 3d objects

No	Test description	Picture	Time	Conclusion
1	Scan at a distance of 120 cm, looks at the explanation of drug information but the sound is not detected		-	Plant object not-detected, no sound appears
2	Scan at a distance of 90 cm, looks at the explanation of drug information but the sound is not detected		00.70 seconds	Plant object detected; plant information sound appears
3	Scan at a distance of 50 cm, looks at the explanation of drug information but the sound is not detected		00.50 seconds	Plant object detected; plant information sound appears

Based on the results of the 3D distance test, the maximum distance for sound to be detected is 90cm.

c. Test the distance to a 3d object with a slope of 90 degrees (Landscape)

Table 5. Test distance to 3d objects

No	Test description	Picture	Time	Conclusion
1	Scan at a distance of 120 cm with a slope of 90 degrees (Landscape), it looks like the explanation of drug information but the sound is not detected		-	Plant object not-detected, no sound appears

2	Scan at a distance of 90 cm with a slope of 90 degrees (Landscape), see an explanation of medicinal plants and sound is detected		1.66 seconds	Plant object detected; chili plant information sound appears
3	Scan at a distance of 50 cm with a slope of 90 degrees (Landscape), see an explanation of medicinal plants and sound is detected		1.56 seconds	Plant object detected; chili plant information sound appears

Based on the results of the trial distance with a slope of 90 degrees (Landscape) the maximum distance is 90cm and the best distance is at a distance of 70 cm with a time of 1.56 seconds

d. Tilt Test

Table 6. Till Test

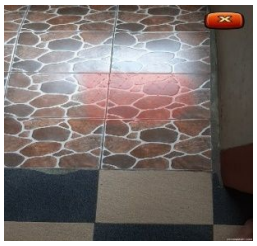
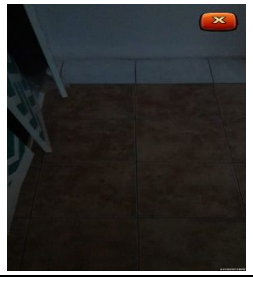
No	Test Description	Picture	Time	Conclusion
1	Scan at a distance of 90 cm with a slope of 30 degrees		00.73 second	Plant object detected; chili plant information sound appears
2	Scan at a distance of 90 cm with a slope of 45 degrees		00.66 seconds	Plant object detected; chili plant information sound appears
3	Scan at a distance of 90 cm with a slope of 60 degrees		00.78 seconds	Plant object detected; chili plant information sound appears

4	Scan at a distance of 90 cm with a slope of 90 degrees		1.66 seconds	Plant object detected; chili plant information sound appears
5	Scan at a distance of 90 cm with a slope of 180 degrees		1.68 seconds	Plant object detected; chili plant information sound appears

Based on the results of the tilt angle trials that have been carried out on the plains, it can be concluded that the AR Portal scan function works, objects can be detected from a tilt angle of 30 degrees, 45 degrees, 60 degrees 90 degrees, 180 degrees, with the best slope of 45 degrees with a time of 00.66 seconds.

e. Light Level Trial on pattern

Table 7. Light Level Trial on pattern

No	Light level	Picture	Time	Conclusion
1	Outdoor trials with a light value of 744 lux are calculated using the Lux meter application		1.09 seconds	Object detected
2	Tests in the room with lamps with a light value of 46 lux are calculated using the Lux meter application		3.22seconds	Object detected
3	Testing in a room without lights with a light value of 0.1 lux is calculated using the Lux meter application		-	Object not detected

Based on the test results that the AR portal function functions and is detected when outdoors, indoors with the help of lights, with maximum results when outdoors with a time of 1.09 seconds.

C). Android Specs Trial

The android specification test is a test on Android to find out to what extent the performance capabilities of the AR Portal plant application are on each specification on the android system.

Table 8. Android Specs Trial

No	Spesifikasi	Application Performance
1	• 1.2 GHz octa-core CPU • 3GB RAM • Android operating system marshmallow 6.0 • 13MP rear camera	Application not installed
2	• 1.4GHz Quad-core CPU • 3GB RAM • Nougat 7.1.1 android operating system, • Support ARCore • 8 MP Rear Camera	The performance of the application on this cellphone is smooth, buttons can interact quickly, the camera can read objects with a maximum distance of 90cm in approximately 1-2 seconds
3	• 2x2.2 GHz octa-core CPU • RAM 4GB • Android Oreo 8.0 operating system • Support ARCore • 4GB Rear Camera	The performance of the application on this cellphone is smooth, buttons can interact quickly, the camera can read objects from a distance of 90 cm in approximately 1-2 seconds.

Based on the test results, the Minimum Android Operating System Specification is Nougat 7.0 with AR Core support.

D). Usability Trial

At this stage the application has been completed. Usability testing is done by surveying the audience. The purpose of this test is to measure the level of system quality. The survey view looks preset in every aspect for application improvement requirements.

Table 9. Maximum score

Answer	**Score**	**Maximum Score (Score* Number of Respondents)**
Strongly agree	4	120
Agree	3	90
Quite agree	2	60
Do not agree	1	30

After that, the percentage of each answer can be given by using the formula:

$$Y = \frac{TS}{Skor\ Ideal} \times 100\%$$

Where:

Y = Percentage value

TS = Total score of respondents = score×respondent

Ideal Score = Score x number of respondents = 4 x 30 = 120

The score criteria for the percentage value can be seen in Table 10.

Table 10. Scoring Criteria

Answer Category	**Information**
0% - 40%	Do not agree
41% - 60%	Quite agree
61% - 80%	Agree
81% - 100%	Strongly agree

(Source: Juliyana,2017).

The following is the result of the percentage of each answer whose value has been calculated. This questionnaire has been tested on 30 respondents.

Table 11. Usability Trial

No	Question	Strongly agree	Agree	Quite agree	Do not agree	Percentage value %	Information
1	Can the application button be used properly?	10	19	1	0	82.50%	Strongly agree
2	Is the application display easy to understand?	14	15	1	0	85.83%	Strongly agree
3	Is the application display not boring?	7	15	8	0	74.16%	Agree
4	Do 3D objects already represent real objects?	11	17	2	0	82.50%	Strongly agree
5	Is information about plant objects easy to understand?	15	12	3	0	85.00%	Strongly agree
6	Is this application portal with Augmented Reality technology interesting?	15	11	4	0	84.16%	Strongly agree
7	Was the in-app guide really helpful?	8	18	4	0	78.33%	Agree
8	Has the AR portal technology been used correctly for learning media?	13	16	1	0	85.00%	Strongly agree
9	Is the text and sound clear in this application?	14	14	2	0	85.00%	Strongly agree
10	Can this application help for learning media?	14	15	1	0	85.83%	Strongly agree
	Average					82.48%	Strongly agree

information on the efficacy and chemical content is feasible to use to help learning for the general public who want to study it, because it can increase interest and interest.

Table 12. 3D Medicinal Plant Usability Trial

No	Question	Strongly agree	Agree	Quite agree	Do not agree	Percentage value %	information
1	Is the shape of the 3D plant in accordance with the original form?	6	9	0	0	85.00%	Strongly agree
2	Is the size of the 3D plant in accordance with the plant?	0	9	6	0	65.00%	Agree
3	Does the 3D object view already represent the real object?	3	10	2	0	76.67%	Agree
4	Is the 3D crop object created correctly?	5	10	0	0	83.33%	Strongly agree
	Average					77.50%	Agree

From the results of usability tests with plant experts, natural medicine experts, medicine dispensing experts, agricultural experts at Taman Sringganis Cipaku Bogor and students, it can be concluded that 3D medicinal plants are feasible to use with an average percentage value of 77.50% with a statement agreeing.

5. Conclussion and Suggestions

5.1. Conclusion

The results of the discussion of the Augmented Reality Portal application of Human Herbal Medicinal Plants, it can be concluded that the AR portal application aims to visualize medicinal plants and as a means of knowledge and insight for the general public. Android.

Making this Augmented Reality Portal application using Unity 3D Software, AR Core, Blender in building 3D medicinal plant objects, the method used is marker less based tracking, namely the user must point the Augmented Reality Portal camera to the ground to bring up 3D objects in this application.

The AR Portal application allows users to be in a portal that seems to be in the real world, this portal displays a 3D door object in which there is a room that can be seen clearly when the user points the AR Portal camera into the room.

Inside the room there are 3D objects in the form of medicinal plants along with information about medicinal plants in the form of plant scientific names, plant properties and chemical content in plant objects, and when the AR camera points to a plant, a plant information sound will appear.

In the Augmented Reality Portal application of Medicinal Plants in the Insani Herbal Garden, the trial phase has been carried out, the results of the Structural Test show that the system is well structured, the results of the Functional Test show that every button on the system has been functioning properly and Validation Test includes a distance test with the maximum result for the object to detect sound, which is 90 cm, a tilt test with a distance of 90 cm, the maximum result at a 45 degree slope with a time of 00.66 seconds, a light level test with the object being detected faster when the sun is direct. with a time of 1 second, and testing the android specifications shows that the minimum operating system is android nougat 7.0 and supports AR Core.

5.2. Suggestions

This Augmented Reality Portal application of Human Herbal Medicinal Plants can still be developed by displaying the environment and 3D medicinal plants that are made like real ones to make them look more attractive and look more natural

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