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Development of AR and VR Home Brochure Applications PT. Griya Pantura Mandiri Kendal Based on Android

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Abstract : *Based on observations, promotional media used at PT. Griya Pantura Mandiri Kendal is a brochure. The effectiveness of the brochure as a promotional media tool so far has not been enough to have an impact on the level of understanding of information and product visualization by the user. This research offers a solution to the use of Augmented Reality (AR) and Virtual Reality (VR) technology as an attractive visualization media promotion tool, users can see the object of the house according to the type scanned using an Android device, in addition they can visit the house according to that type in advance with virtual Android devices. The validity value of media experts was 3.8 which was declared feasible, while the validity value of material experts was 4 which was declared feasible, and product trials by users increased the understanding of information and visualization in the brochure from 28% initially to 88%. Based on the results of observations, the promotional media used at PT. Griya Pantura Mandiri Kendal is a brochure. The effectiveness of brochures as a promotional media tool so far has not had enough impact on the level of understanding of information and product visualization by users. This research offers a solution for utilizing Augmented Reality (AR) and Virtual Reality (VR) technology as an attractive promotional media visualization tool for users. can see house objects according to the type scanned using an Android device, apart from that they can visit houses according to that type first virtually with an Android device. The validity value from media experts was 3.8, which was declared feasible, while the validity value from material experts was 4, which was declared feasible, and product trials by users increased understanding of information and visualization in brochures from initially 28%, increasing to 88%.*

Keywords: *brochure, augmented reality, virtual reality, visualization.*

I. INTRODUCTION

KTechnological advances have brought major changes to human life, With this technology, humans compete to be the best, most modern and leading in various things. This can be seen, one of which is that the majority of people today have *smartphones* , apart from that, with advances in technology, 2-dimensional (2D) technology has developed into 3-dimensional (3D).

Many companies have implemented AR as a promotional tool. An example is a car company that wants to show their car products to potential buyers by using AR in the shape of a car that is designed to be similar to their car product. Unique efficiencies result from AR because salespeople don't have to carry large products, they only need to bring a brochure and *a smartphone* to *scan* in front of potential buyers.

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Implementing VR can save more costs and time compared to conventional methods. The advantages of VR can be applied as a visualization tool for housing promotion because users can interact with an environment simulated by a computer.

PT. Griya Pantura Mandiri is a housing *developer* in the Kendal area which was founded in 2015 with the aim of providing comfortable housing at affordable prices. The media used for promotional activities so far is brochures.

Table 1.1 Respondent Data on Brochure Effectiveness Level

Respondent	Yes	No
Average	5,6	14.4

The following is the calculation of the respondent data above:

Calculation of "No" answer:

$$T = \frac{\text{Rata−rata jawaban "Tidak"}}{\text{Jumlah responden}} \text{x } 100\%$$

$$T = \frac{14{,}4}{20\text{x}100}\% = 72\%$$

Based on the calculations above, it can be concluded that 72% of respondents do not understand the information and visualization in brochures. Therefore, for example, if there are 3D visuals in the brochure, the information provided is more detailed, from a promotional aspect it is more interesting because of the use of 3D AR and VR regarding the shape of the house and the rooms contained in it.

The brochures that have been implemented so far have not had enough impact on the level of understanding of information and product visualization by *users*, so this research aims to develop an Android-based AR and VR brochure application.

Visual media is a means of communication using the five senses of sight with the composition of colors, images and graphics. In this way, the information conveyed is packaged creatively to attract the eye's attention [1].

3D is a dimension that has space. Refers to a "3D object", meaning that the object has space and volume. 3D objects also have locations at coordinates and the left of the object can also be moved forward and backward (Z) [2].

Augmented Reality (AR) or in Indonesian translated as additional reality is a technique that combines two-dimensional and three-dimensional virtual objects into a real three-dimensional sphere and then projects these virtual objects in real time [3].

Virtual Reality (VR) in Indonesian, translated as virtual reality, is a technology that allows users to interact with an environment simulated by a computer. An environment that is actually imitated from the original environment or can also exist only in the imagination [3].

A brochure is a sheet of paper that contains a series of words and information about a product plus a few supporting images. Brochures are usually distributed free of charge to the general public in the hope that people will learn about certain products [4].

Brochures contain information or explanations of a product or service that are clear, concise and attractive to build a good image of the company or institution. Even though it looks traditional, in reality the use of brochures as promotional media is quite effective in attracting public interest.

Android is a Linux-based operating system designed for touch-screen mobile devices such as smartphones and tablet computers. Android was originally developed by Android, Inc., with financial support from Google, which purchased it in 2005 [5].

With the Android-based AR and VR brochure application, users will be helped to capture information and visualization more detailed with a pleasant atmosphere.

So this research aims to developed *Augmented Reality* (AR) and *Virtual Reality* (VR) brochures as home visualization at PT. Griya Pantura Mandiri and implemented *Augmented Reality* (AR) and *Virtual Reality* (VR) in brochures effectively.

II. DEVELOPMENT METHODS

This research uses research and development methods *(Research and Development)*, which is a research method used to produce certain products, and test the effectiveness of these products [6].

A. Research Methods

In this research, the problems that arise at PT. Griya Pantura Mandiri Kendal, namely the lack of information and visualization in the brochure that *users get* , this raises the question of how to create valid AR and VR applications for PT. Griya Pantura Mandiri Kendal.

The development model has the following steps:

1. Potential and problems
2. Data collection

3. Product Design
4. Validate the design
5. Design improvements
6. Test the product

B. Design Validation

Design validation is one of the development processes carried out to determine the level of effectiveness of the product. Validity testing involves media experts and material experts and product trials by users with assessments using questionnaires.

Table 2 . 1 Media Expert Validation Questionnaire

No	Indicator	1	2	3	4
1.	*Layout / background* layout, text and buttons				√
2.	The button function works well				√
3.	Clarity of narrative *sound*			√	
4.	Text readability				√
5.	Attractive color choices				√
6.	Image quality and resolution support				√
7.	Reading markers into 3D models works well			√	
8.	3D model rotation works fine				√
9.	*first person con* troller (FPC) movement (path)				√
10.	Total aesthetics of the app				√
	TOTAL SCORE			6	32
	TOTAL SCORES	**38**			

Table 2. 2 Material Expert Validation Questionnaires

No	Indicator	1	2	3	4
1.	The physical form of 3D type 30+ is generally close to the original form				√
2.	The 3D physical form of type 36 is generally close to the original form				√
3.	The 3D physical form of type 36+ is generally close to the original form				√
4.	The 3D scale of the model horizontally and vertically is close to the original				√
5.	The 3D model of the building is located according to the original plan				√
6.	The color/material of the 3D model is close to the original shape				√
7.	Sound narration type 30+ contains information according to the original				√
8.	Type 36 narrative sound contains information according to the original				√
9.	Type 36+ narrative sound contains information according to the original				√
10.	The product results can be a visualization tool				√
	TOTAL SCORE				40
	TOTAL SCORES	**40**			

Table 2. 3 Product Trial Questionnaire *(user)*

No	Indicator	1	2	3	4
1.	Is the initial appearance attractive?				
2.	Is it easy to operate?				
3.	What are the fun features?				
4.	Does the narration sound clear?				
5.	Do you get new experiences with technology through this application?				
6.	Is the real information and picture of the 30+ house types clear?				
7.	Is the real information and picture of house type 36 clear?				
8.	Is the real information and picture of the 36+ house type clear?				
9.	Interest in the types of houses offered				
10.	Opportunity to tell other people about the products offered				
	TOTAL SCORE				
	TOTAL SCORES				

The assessment is divided into 4 scores, namely:

1. Score 4: very good, very decent, very interesting
2. Score 3: good, decent, interesting
3. Score 2: not good, not worthy, not interesting
4. Score 1: not good, not worth it, not interesting

Validation calculations can be implemented with formula: $\mu = \Sigma x$.

Information:

μ = average value

Σx = total number of validation values

n = number of validators.

III. RESULTS AND DISCUSSION

A. Development Results

The results of the development of this research are AR and VR brochure applications developed with SketchUp , *Corel* Draw , and Unity 3D .

final result of this AR and VR application has *an application package file* (.apk) extension that can be *installed* on an Android *smartphone as shown in the following image:*

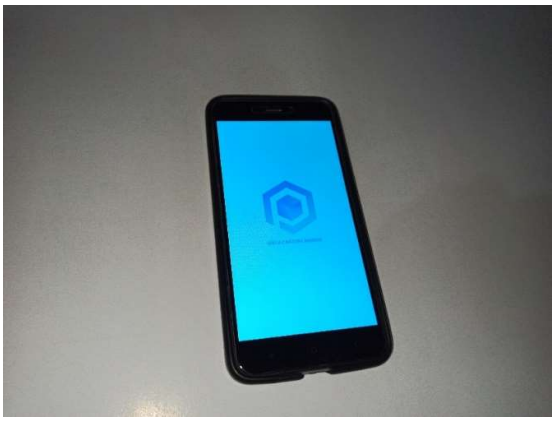

Figure 3 . 1 *Splash Screen Scene* Results

The splash screen scene functions as an application opener and as a display of company identity.

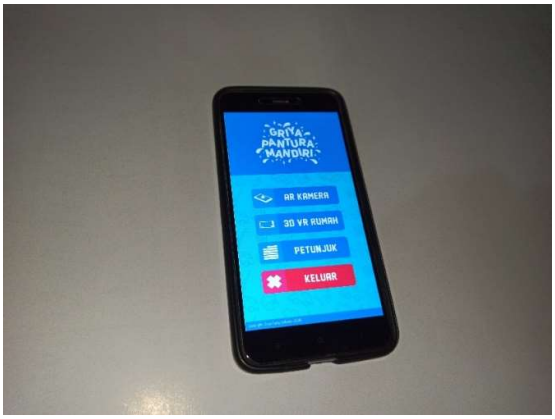

Figure 3. 2 Main Menu Scene Results

scene functions as *a home* to go to other *scenes* which can be accessed using the buttons contained in it.

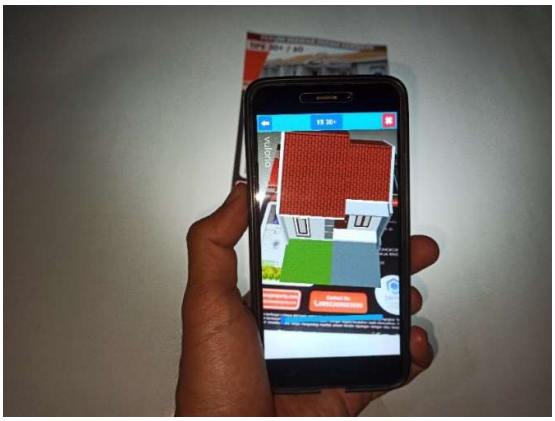

Figure 3. 3 AR Camera *Scene* Results

Scene AR Camera is used to utilize AR by *scanning markers* in the form of brochures which use the camera on *the smartphone* to display a 3D model of the house according to the brochure type. Voice narration appears at the same time as the 3D model appears, apart from that the slider is used to rotate the 3D model of the house.

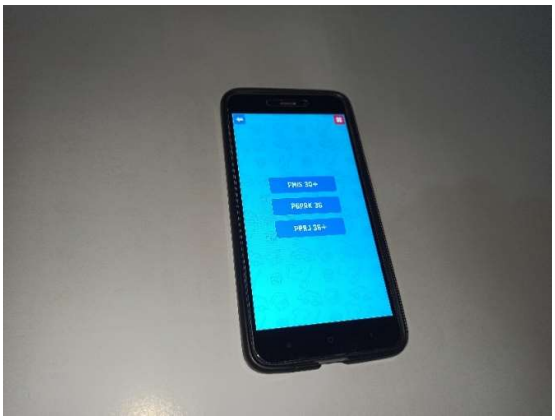

Figure 3. 4 VR Menu *Scene* Results

scene menu functions as *a home* VR, in it there is a button to go to the home VR scene according to type.

Figure 3. 5 Home 3D VR *Scene* Results

scene functions as a virtual tour of the home according to the type previously accessed in the VR *scene* menu. This *scene* has navigation buttons and a *look around button*.

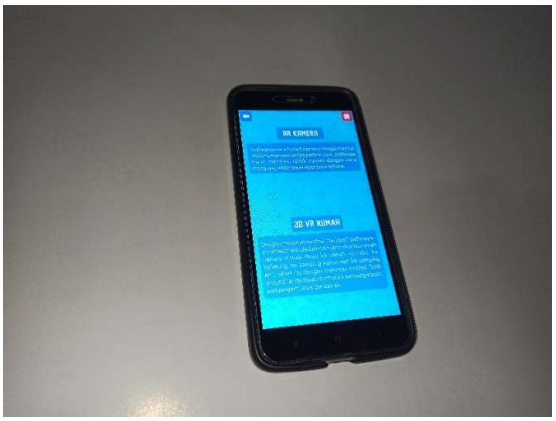

Figure 3. 6 Instruction *Scene* Results

Scenes are used to provide instructions for using AR and VR.

B. Final Product Discussion

Determining the feasibility of applying AR and VR to brochures as promotional media tools for PT. Griya Pantura Mandiri Kendal is measured based on validation assessments from experts, namely media experts, material experts and validation from users in product trials. The suggestions contained in the instrument are used as consideration for further improvement of promotional media tools. The following are the test results from each validator:

B.1. Media Expert Validation

In table 3 .1 below are the validation results expert media a

Table 3 .1 Media Expert Validation Assessment

Mark	Validity Criteria
3.26-4.00	Very Valid
2.51-3.25	Valid
1.76-2.50	Invalid (revised)
1.00-1.75	Invalid (total revision)

From the test results via a questionnaire totaling 10 questions, the values obtained:

a. Less (1 x 0) = 0
b. Simply (2 x 0) = 0

c. Well (3 x 2) = 6
d. Very good (4 x 8) = 32 +
38

So the validation value can be calculated: $\mu = \frac{\sum x}{n} = \frac{38}{10} = 3{,}8$

Based on the calculations above, it is known that the validation results from media experts are 3.8. This criterion is between 3.26 – 4.00, which is classified as very valid. So this application can be said to be suitable for use.

B.2. Material Expert Validation

From the test results via a questionnaire totaling 10 questions, the scores were obtained.

a. Less (1 x 0) = 0
b. Simply (2 x 0) = 0
c. Well (3 x 0) = 0
d. Very good (4 x 10) = 40 +
40

So the validation value can be calculated: $\mu = \frac{\sum x}{n} = \frac{40}{10} = 4$

Based on the calculation above, it is known that the validation result from the material expert is 4. This criterion is between 3.26 – 4.00, which is classified as very valid. So this application can be said to be suitable for use.

B.3. Product Trial *(User)*

Product trials by users were carried out with a sample of 20 Kendal community respondents with 10 questions.

Based on data from 20 respondents with 10 questions, the values obtained are as follows :

Table 3 . 2 Product Trial Questionnaire Value

Respondent	Mark				Amount
	1	2	3	4	
1.	0	0	15	20	35
2.	0	0	18	16	34
3.	0	0	9	28	37
4.	0	0	15	20	35
5.	0	0	12	24	36
6.	0	0	21	12	33
7.	0	0	21	12	33
8.	0	0	12	24	36
9.	0	0	9	28	37
10.	0	0	9	28	37
11.	0	0	12	24	36
12.	0	0	18	16	34
13.	0	0	9	28	37
14.	0	0	15	20	35
15.	0	0	21	12	33
16.	0	2	9	24	35
17.	0	0	9	28	37
18.	0	0	12	24	36
19,	0	0	18	16	34
20.	0	0	18	16	34
	TOTAL SCORES				**704**

From the test results via a questionnaire totaling 10 questions, the scores were obtained.

a. Less (1 x 0) = 0
b. Simply (2 x 1) = 0
c. Good (3 x 94) = 282
d. Very good (4 x 105) = 420+

704

So the validation value can be calculated:$\mu = \frac{\sum x}{n} = \frac{704}{20} = 35{,}2 \quad \frac{35{,}2}{10} = 3{,}52$

Based on the calculations above, it is known that the product trial results by *users* are 3.52. This criterion is between 3.26 – 4.00, which is classified as very valid. So this application can be said to be suitable for use.

B.4. Discussion Analysis

The analysis carried out shows that there are problems in the media used as promotional tools. Before there were AR and VR applications on brochures , agencies still used a promotion system using brochures only . The use of brochures has previously proven to be ineffective, the impact is that the information obtained by potential buyers is less than optimal and the visualization is limited.

There were problems that arose and after data collection was carried out , this research offered a solution in the form of developing AR and VR applications on brochures. After the 3D house model design was completed, the application UI design was created, then AR and VR applications were created using Unity 3D. The next step is validation by media experts, material experts and *users* . This validation step is carried out to assess whether AR and VR applications are suitable or not before being used in society. After validation by media experts, material experts and *users* , agencies are given AR and VR applications for product trials. By being given these promotional media tools , consumers will understand more about the products being offered, will be interested in the products offered in the brochure and will be more interested and encouraged to buy the product.

validation showed a result of 3.8 or 95% with the revision of the sound of footsteps on the 3D VR page being removed because the sound did not sound constant, but it could be said to be suitable for use. Media expert validation shows results of 4 or 100%, nothing needs to be revised, suitable for use. Product trials by *users* showed results of 3.52 or 88%, which can be said to be suitable for use.

Based on the data from the questionnaire results before using the product, the effectiveness level of the brochure was obtained (OS) 28% and after using the AR and VR brochure application product, the result (OA) was 88%, so the effectiveness of the brochure as a promotional media tool increased with AR and VR technology. developed. The following is a comparison diagram of the effectiveness of brochures before and after using the product in percent, which can be seen as shown in the following image :

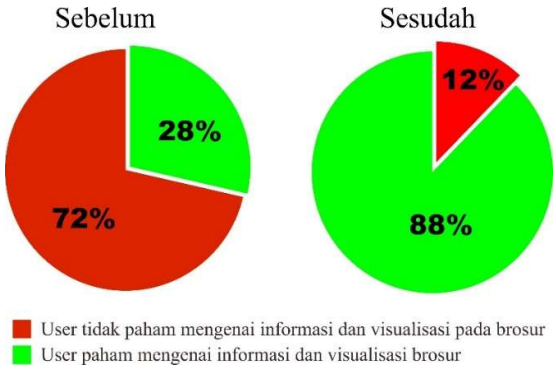

Figure 3. 7 Comparison Diagrams Before and After Use

Based on the percentage diagram above, it can be concluded that the increase in the percentage value of brochure effectiveness is 88% - 28% = 60%. Thus, this product can be said to be effective because *the user's understanding of the information and visualization obtained* from the brochure increases.

IV. CONCLUSIONS AND SUGGESTIONS

A. Conclusion

Based on the results of research, development and testing of PT. AR and VR brochure applications. Griya Pantura Mandiri Kendal can draw the following conclusions:

1. Problems that occur at PT. Griya Pantura Mandiri Kendal, namely the media used, still uses brochures, so the visualization and information provided is less detailed.
2. To assess the level of effectiveness of the brochures available at PT. Griya Pantura Mandiri, a questionnaire was created with 10 questions by taking a random *sample of 20 Kendal community respondents with the result that 72% of respondents did not understand the information and visualization in the brochure.*
3. To test the validity of the product being made, validation is carried out by media experts and material experts. Validation from media experts obtained a result of 3.8, which means the product is very valid, validation from material experts obtained a result of 4.0, which means the product is very valid to be used as a promotional media tool.
4. Testing the product by *users* with 20 respondents from people around Kendal, obtained a result of 3.52, which means the product is very valid for use.

B. Limitations of Research Results

Based on the results of designing and developing AR and VR applications in brochures contain shortcomings, including:

1. AR and VR brochure applications only display *buttons* on the smartphone screen.
2. AR and VR brochure applications only display *first mode person character* (FPC).
3. AR and VR brochure applications can only be run via an Android *smartphone*.

C. Suggestions

Based on as a result of the research, discussion and conclusions above, the suggestions given in this research are:

1. Further development of AR and VR applications can be provided *virtually button*.
2. further development of AR and VR applications, *third person character* (TPC) mode can also be added.
3. Further development of AR and VR applications can be run via iOS *smartphones*.

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