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House Sales Promotion Application Using Android-Based Augmented Reality Technology

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Abstract

Augmented Reality is a technology in the field of multimedia that can integrate 3D objects into real-world environments using a camera as the medium. Augmented Reality can also be applied to mobile Android devices. This research was conducted due to shortcomings or issues in house marketing, namely the lack of detailed information about the rooms in the houses being promoted. This occurs because brochures only display the exterior of the house and are still in a 2D format. Additionally, prospective buyers who live far from the promoted housing area are unable to visit in person and cannot view the interior details of the houses being promoted or sold. Therefore, an application will be developed to visualize both the exterior and interior designs in 3D by implementing Augmented Reality technology. This is expected to make the house sales promotion for the housing area more realistic and interactive. Additionally, prospective buyers can view the exterior and interior designs of the house in a realistic manner even without visiting the housing location directly. The house sales promotion application using Augmented Reality technology requires a camera as an input device. The application tracks and detects flat objects as markers, and after pressing the "start" menu, a 3D object that appears realistic will automatically be displayed. When the "stop" menu is pressed, the 3D image will automatically disappear. The home sales promotion application utilizing Augmented Reality technology achieved a positive respondent rating and a high success rate, with an average score of 94.5% based on the Likert scale. This application is expected to assist the marketing team in promoting residential properties to prospective buyers effectively.

Keywords: Augmented Reality, House, Promotional Media, Housing (or Housing Development), Markerless Detection.

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I. INTRODUCTION

In today's technological development, many companies are engaged in the property and consulting fields. These property and consulting companies are among the growing businesses today. However, the promotional media used currently mostly rely on traditional methods such as brochures, banners, and property exhibitions. The weakness of these traditional promotional methods is the lack of interactivity and difficulty in providing a realistic representation to potential buyers. Moreover, these traditional methods only display the exterior of the house in 2D images. The impact of using such ineffective traditional promotional media is the limited ability to attract potential buyers into actual customers. Therefore, there is an urgent need to develop promotional media digitally using Augmented Reality (AR). Augmented

Reality is a technology in the multimedia field that can integrate 3D objects into real-world environments using camera media, and this AR technology can be applied to Android mobile devices[1][2].

According to a journal published in 2023, the implementation of AR technology in property marketing can enhance promotional effectiveness and assist potential buyers in making decisions more easily[3][4]. Moreover, for prospective buyers who are far from the housing location and find it difficult to visit the property directly and see the interior details in a real and detailed manner, AR technology provides a solution. Therefore, this application visualizes the exterior and interior designs of the house in three dimensions using Augmented Reality technology. As a result, the house promotion process becomes more realistic and interactive[5]. However, to date, many housing developments have yet to utilize Augmented Reality promotional media, which would help distant consumers view the interior of houses realistically[6][7].

Augmented Reality in digital housing promotion media offers an innovative solution that can enhance the appeal and effectiveness of marketing. Research shows that the use of Augmented Reality in housing promotional media can provide a more interactive and immersive visual experience for potential buyers[8]. A study on Augmented Reality in the promotional media of Victory Land Housing also reveals the significant potential in increasing interest and engagement from prospective buyers by providing a realistic preview of both the exterior and interior[9]. Furthermore, research on Augmented Reality in housing promotion media indicates that this technology can help potential buyers experience the atmosphere and layout of a house virtually and in real-time. However, previous studies have not focused on housing promotion using Augmented Reality methods comprehensively[3].

Based on the issues outlined above, this research develops a house sales promotion using Android-based Augmented Reality technology for housing. The "House Sales Promotion Application Using Android-Based Augmented Reality Technology" is an innovative solution to improve the house marketing process. The need for consumers when searching for a home involves more detailed information about the room layouts. In developing this house sales promotion application using Android-based Augmented Reality technology, the application is created using Blender, EasyAR, and Unity. This Android-based Augmented Reality house sales promotion application features 3D, zoom in, and zoom out. Users can conduct virtual promotions with the 3D feature, allowing potential buyers to explore and experience a more in-depth and interactive visual representation of both the exterior and interior of the house.

II. RESEARCH METHOD

In this research, the House Sales Promotion Application was developed using the Multimedia Development Life Cycle (MDLC) method. MDLC is a multimedia application framework that includes visuals, such as images, and Augmented Reality as one of its components. The MDLC method serves as an effective system design approach due to its structured nature, which enhances the system to deliver high-quality results [10]. Below are the structured stages of the system design, as illustrated in Figure 1.

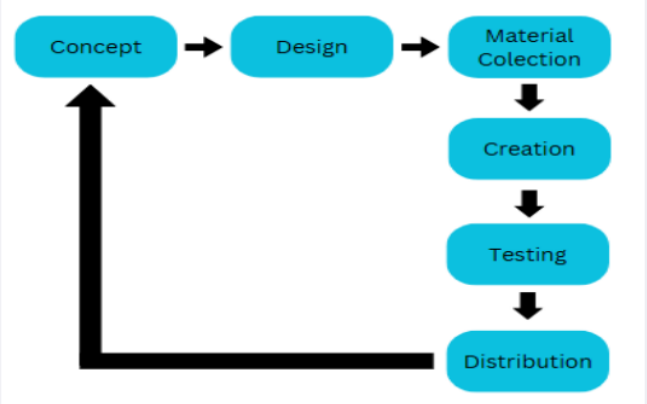


Figure 1 MDLC Diagram

III. RESULTS AND DISCUSSION

A. Concept.

In this research, the concept begins with determining the objectives and target of the application. This application is aimed at prospective buyers of homes, serving as a media preview for the exterior and interior of homes being promoted or sold.The research utilizes the Unified Modeling Language (UML) process to explain the steps and decisions, represented through a flowchart diagram. In Figure 2, the flowchart diagram outlines the stages using diagrams connected by lines or arrows. The use of a flowchart makes the process clearer, more concise, and helps reduce the risk of misunderstandings [10].In Figure 2**,** the process begins when the user opens the application, which leads to the main page. On this page, the user is presented with several menu options Start**,** About**,** User Guide**,** and Exit**.** The user is then prompted to select one of these available options to proceed. If the user selects the Start menu, they are immediately directed to the start page. From there, the user can choose an object menu to view or explore further. After the user selects the desired object menu, they are directed to the corresponding object detail page. On this page, the user can view a 2D image of the selected object along with a detailed description. After selecting the Scan feature, the user will be directed to the phone's camera. This feature allows the user to scan a surface or marker, triggering the Augmented Reality experience. Next, there is an About feature, which provides information about the Augmented Reality application itself. The following feature is the User Guide**,** where users can view instructions on how to use the Augmented Reality application, ensuring that they can navigate it without confusion. Finally, the Exit feature allows the user to close the application when they are finished using it.

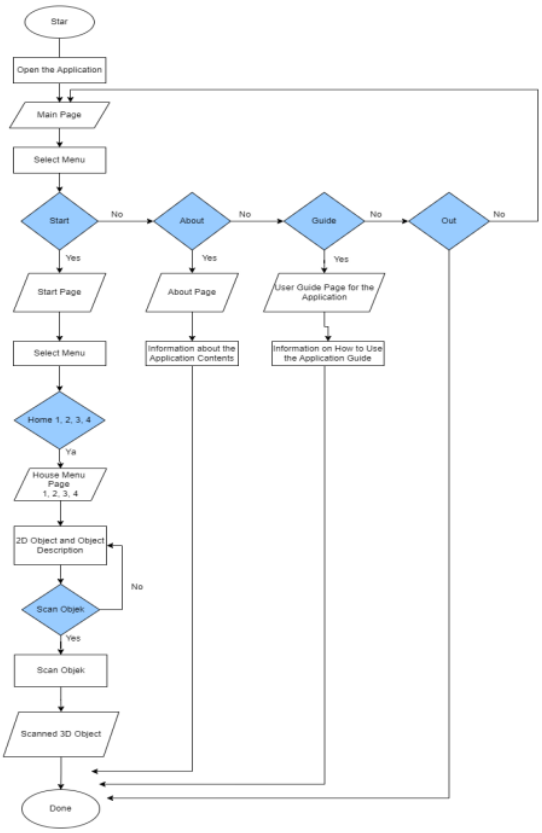


Figure 2 Flowchart Diagram

The next step is the Use Case Diagram**.** The Use Case Diagram is part of the modeling diagram that allows for the modeling of the behavior specification of an information system. This diagram illustrates the

interaction between one or more actors and the system to be developed [10]. The Use Case Diagram is used to identify the elements within the information system and the people who are authorized to use it [10]. Figure 3 is the Use Case diagram of the application, which explains how the user can access the Augmented Reality housing application. The user can access the start menu, where they can select from several desired house objects. For each house object menu, the user can find a 2D image and a description or information about the housing object, and the user can visualize the object by scanning it, which will then display the 3D model of the object.

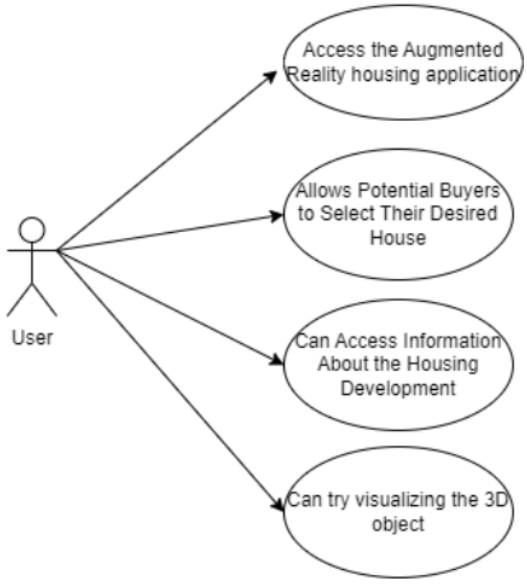


Figure 3 Use Case Diagram

B. Design

The next stage is the process of creating the application interface design. This interface design is used to illustrate the flow and processes within the application. The design of the interface for the housing sales promotion application is tailored to meet the needs of the application. This interface design includes several menus, as shown in Figure 4, including the start menu, which is used to begin exploring the application as a preview and promotional media for the housing project. Inside the start menu, there is another menu option, which is the house object menu for the houses being promoted and sold in the housing project. After selecting one of the house object menus, a 2D image and a brief description of the object will appear. Then, on this page, there is a "view object" menu, which contains a camera scan feature to visualize the object in 3D. When scanning the object, the camera is directed at a flat surface, and the house exterior object will automatically appear in 3D. After the house exterior object appears in 3D, there is a "view interior" menu, which will then direct the user to scan again to display the interior house object in 3D. Additionally, there is a "About" menu containing information about the application, and a "Guide" menu that provides instructions on how to use the application, ensuring that users who have never used the application before will not be confused when using it.

Figure 4 User Interface

C. Data Collection.

The next stage is data collection, which involves gathering the data or documents that will be used for the research. The steps for collecting data and documents include analyzing the user and system requirements. The user requirements that need to be analyzed are the equipment that the user must prepare, such as a laptop or PC browser, the creation of menu buttons, and the development of 3D objects. Figure 5 shows the data that will be used for the research. In figure (a), it is a brochure for the Victory Land housing project, and figures (b), (c), (d), and (e) represent images of the house objects that will be promoted and sold.

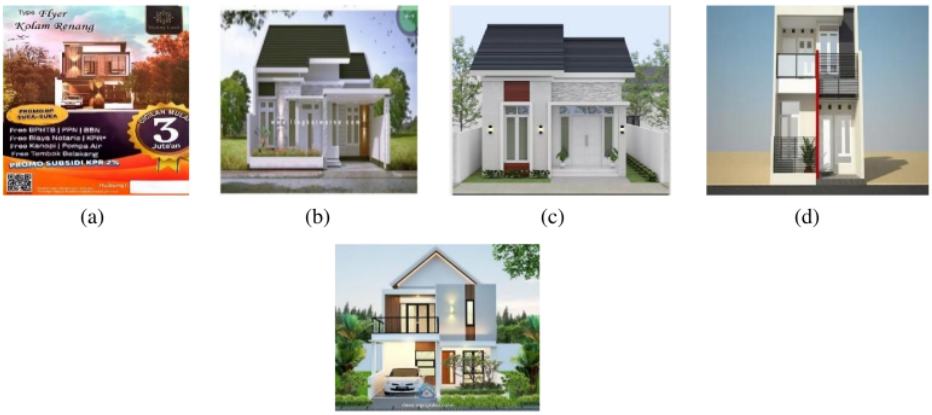
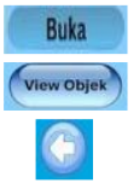


Figure 5 Brochure Data and House Objects

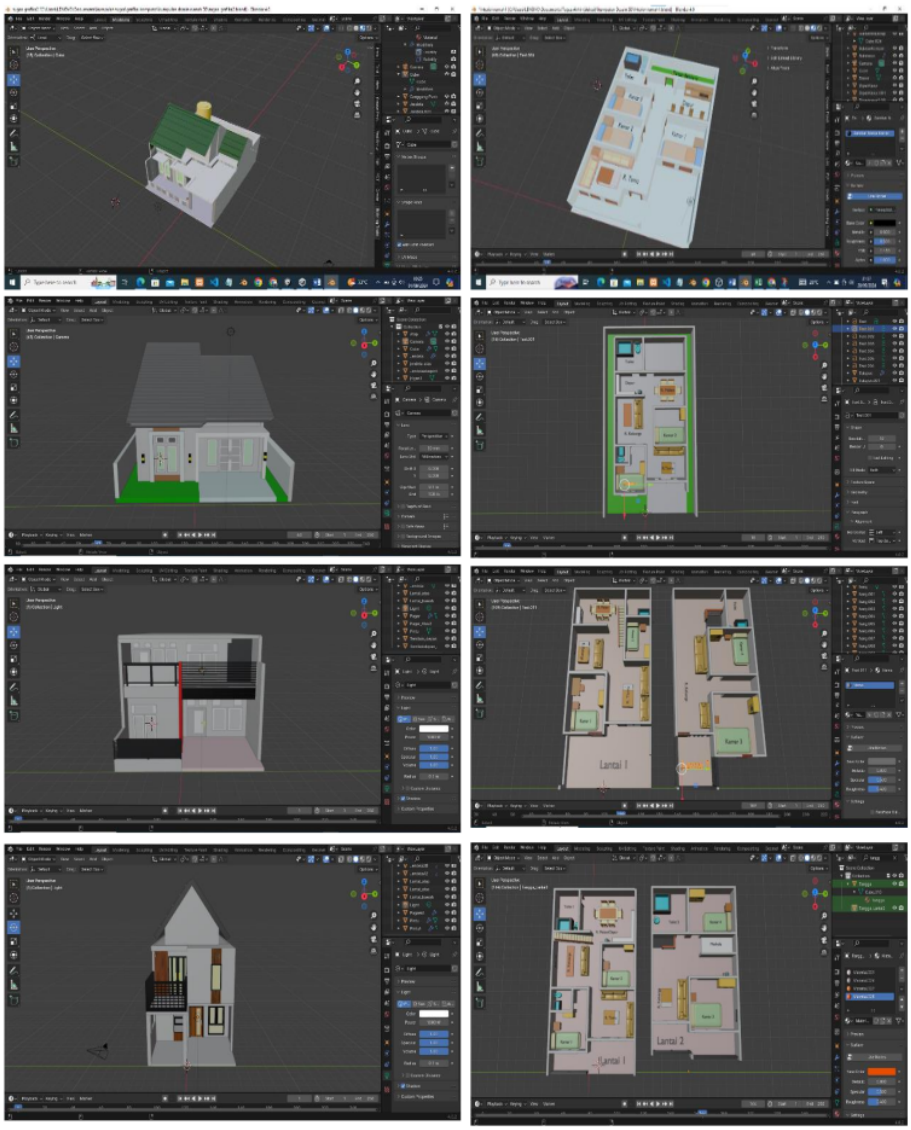
The next stage is the process of creating the menu buttons available in the application. The menu buttons are designed to serve as instructions for executing the desired commands. Designing the buttons with creative and attractive models will enhance the overall appearance of the application. Below is a table of these buttons.

Table 1 Button Menu Table

No	Image	Menu	Explanation
1		1. Start 2. About 3. Guide 4. Exit	1. The Start button is used to enter the menu page of the promoted houses and to begin using the application until the house preview. 2. The About button functions to enter the information page about the application. 3. The Guide button functions to enter the guide page, which explains how to use the application so that users can use it without confusion. 4. The Exit button is used when the user no longer wants to use the application or wishes to exit the application.
2		1. Open 2. View Object 3. Back Arrow Image	1. The "Open" menu is used to navigate to the description page. 2. The "View Object" button is used to enter the camera page to view the exterior object in 3D. 3. The "Back Arrow" button is used to return to the previous page.
3		1. View Interior 2. Stop 3. Start	1. The "View Interior" button is used to access the next camera page, which allows the user to view the 3D interior of the selected house. 2. The "Stop" button is used to stop the 3D image. 3. The "Start" button is used to initiate the 3D image.
4		1. Exit	1. The exit button is used to return to the first page.

D. Development.

In the next stage, which is the development stage, all the collected data and materials will be refined and modified. Figure 6 illustrates the application development process, starting with the creation of 3D objects of the house, including both its exterior and interior. The application development process is carried out using Blender and Unity software.



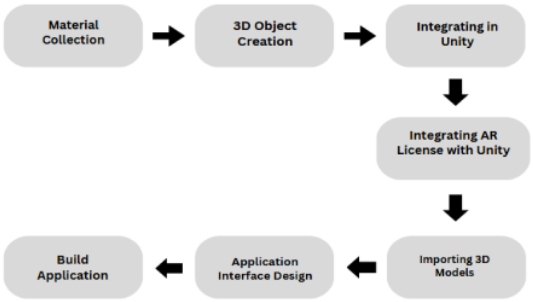


Figure 6 Workflow Diagram

The results of the implementation in the development flow stage include the use of the application. Displaying 3D models of the house's exterior and interior being promoted serves as the basic concept of this application. Figure 7 shows the exterior and interior outcomes from the camera scan for house sales promotion. (a) 3D images of the exterior and interior of House 1, (b) 3D images of the exterior and interior of House 2, (c) 3D images of the exterior and interior of House 3, (d) 3D images of the exterior and interior of House 4.

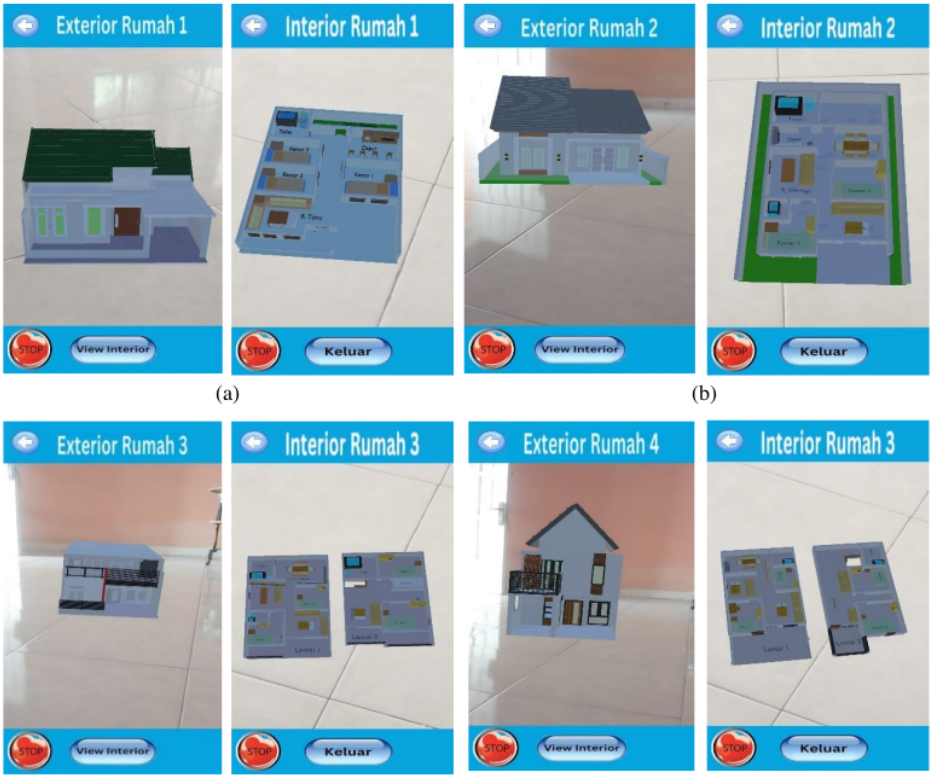


Figure 7 3D House Object

E. Testing.

In the next stage, which is the testing stage, the application tester evaluates the effectiveness of the developed application model. Below is the table of the testing results.

Table 2 Testing Table

No	Test Items	System Response			Deskription
		Baik	Kurang	Tidak	
1.	Start Button	√			
2.	Tutorial Button	√			
3.	Guide Button	√			
4.	Exit Button	√			
5.	Back Button	√			
6.	Open Button	√			
7.	View Object Button	√			
8.	View Interior Button	√			
9.	Start Camera Button	√			
10.	Stop Camera Button	√			
11.	Exit Button	√			

Table 2 shows the results of the testing on the buttons and menu of the house sales promotion application, including the Start button, Tutorial button, Guide button, and Exit button, all located on the main page. These buttons are used to navigate to the desired menu. The Back button is used to return to the previous page. The Open button is used to access the description page, which displays the features of the selected house. The View Object button is used to view the 3D exterior of the house, while the View Interior 3D button displays the interior. Finally, the Exit button on the View Interior page is used to return to the menu page.

Table 3 Application Testing Results

No	Device	Version	RAM	Description
1.	vivo Y20s	11	8	Application Running
2.	vivo 1820	8.1.0	2	Application Running
3.	vivo Y16	12	3	Application Running

The results of the application testing on different device versions are displayed in Table 3 The first test was conducted on a Vivo Y20s phone, Version 11, with 8GB RAM, and the application ran smoothly without any issues. The second test was performed on a Vivo 1820 phone, Version 8.1.0, with 2GB RAM, and the application also ran smoothly without any problems. The third test was conducted on a Vivo Y16 phone, Version 12, with 3GB RAM, and the application ran smoothly as well.

This house sales promotion application, using Augmented Reality technology, will be published and used as an interactive promotional media for housing projects. The application will be tested by prospective homebuyers and those managing the housing sales promotion, as the target audience for this application includes potential homebuyers as well as marketers involved in the housing promotion. Feasibility testing will be conducted based on predefined evaluation categories. Table 3 presents the scoring category table. In this table, score number 1 represents the "very poor" category, the lowest rating, while score number 5 represents the "very good" category, the highest rating.

Table 4 Score Categories on Likert Scale

No	Percentage	Description
1	0% - 20%	Very Poor (VP)
2	21% - 40%	Poor (P)
3	41% - 60%	Fair (F)
4	61% - 80%	Good (G)
5	81% - 100%	Very Good (VG)

Feasibility testing is carried out by distributing a survey to respondents, including potential homebuyers and marketers in a housing development. The survey includes questions about the application's appearance, functionality, and benefits. Afterward, respondents are asked to complete the evaluation.

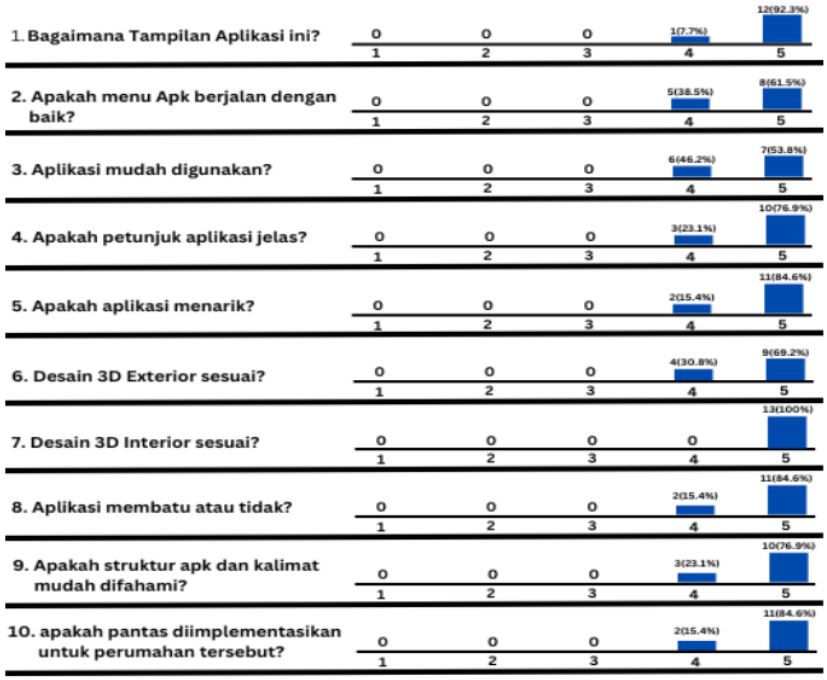


Figure 8 User Response Questionnaire

The results of the user response questionnaire, as a feasibility test, are shown in Table 4. The score will be calculated using the Likert scale. The symbol X represents the highest score on the Likert scale, which is 5, categorized as "very good." This value of 5 will be multiplied by the total number of questions given to users or developers, so X = 5 x 10 = 50. The expected score, symbolized by Y, is calculated by multiplying the user and developer ratings, which is determined as Y = 50 x. The assessment formula for

users and developers of the AR house sales promotion application consists of ratings and ten questions, which can be formulated as follows:

Description:
f = Total value of question frequencies
T = Total rating
Pn = Likert score
P = Feasibility percentage
Y = Expected score

Therefore, the result of calculating the user satisfaction level is:

$$f = T \times Pn$$
$$P = f/Y \times 100\% = P\% \quad (1)$$

Thus, the result of the user response calculation in Figure 8 is:
f = (102 x 5) + (26 x 4)
f = (510 + 104)
P = (614/650 x 100%)

The feasibility percentage is 94.5%. The house sales promotion application has a score of 614 for the questions and achieves a feasibility percentage of 94.5%, indicating that the application is excellent and feasible for use.

F. Distribution

This research successfully designed and developed a house sales promotion application using augmented reality, aimed at assisting housing developers and prospective buyers as a promotional medium and a preview of the exterior and interior of houses for potential buyers. With the application available on the Play Store, accessibility has significantly improved, allowing potential buyers to conveniently view and explore houses, examining the exterior and interior in detail and in real time without needing to visit the housing site. As shown in Figure 9, this is the application distribution testing stage conducted with housing marketers/developers and prospective buyers.

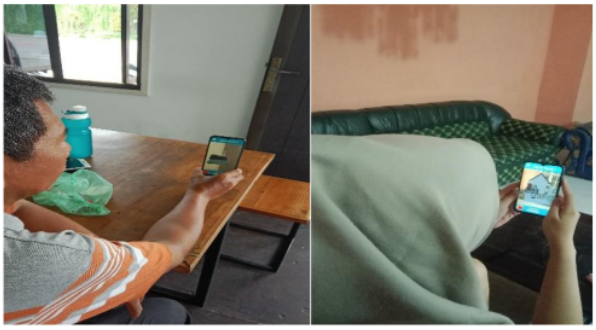


Figure 8. Application Testing

IV. CONCLUSION

Based on the research outlined above, this study successfully designed and developed a home sales promotion application using Augmented Reality technology, specifically tailored for marketing teams and potential homebuyers. The application received a score of 94.5% during testing conducted with prospective buyers and housing marketers. This result indicates that the application effectively facilitates potential buyers in viewing both the exterior and interior of homes and is user-friendly. Therefore, the testing demonstrates that the application is interactive, easy to understand, and suitable for use as a promotional tool in the real estate sector.

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