Journal of Informatics, Information System, Software Engineering and Applications (INISTA)

House Sales Promotion Application Using Android-Based Augmented Reality Technology

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Abstract

Augmented Reality (AR) is a technology in the field of multimedia that integrates 3D objects into real-world environments using a camera as the medium and can also be applied to mobile Android devices to enhance interactivity and visualization. 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 realistically, 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" button, a 3D object that appears realistic will be automatically displayed. When the "stop" menu is pressed, the 3D image will automatically disappear. The home sales promotion application, which utilizes Augmented Reality (AR) technology, has received positive responses from respondents, achieving a high success rate. Based on the Likert scale, the application obtained an average score of 94.5%, demonstrating its effectiveness in enhancing housing promotion for potential buyers. Testing was conducted to assess the impact of AR technology in enhancing the marketing appeal and facilitating potential buyers' understanding of both the exterior and interior designs of the house more interactively and realistically.

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I. INTRODUCTION

Nowadays, technological advancements have led many companies to engage in the property and consulting fields. These property and consulting companies are among the growing businesses today. However, the promotional media currently mainly used rely on traditional methods, such as brochures, banners, and property exhibitions. The weakness of these conventional promotional methods is the lack of interactivity and difficulty in providing a realistic representation to potential buyers [1]. 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[2]. Therefore, there is an urgent need to develop promotional media digitally using Augmented Reality (AR). Augmented Reality (AR) is a technology in the multimedia field that integrates 3D objects into real-world environments using camera media. Technology can be applied to Android mobile devices [1],[3]-[5].

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 [6],[7]. Moreover, for prospective buyers who are far from the housing location and find it difficult to visit the property directly and inspect the interior details in person, 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 [8],[9]. However, to date, many housing developments have yet to utilize Augmented Reality promotional media, which would help distant consumers view the interiors of houses realistically][11].

Augmented Reality (AR) 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[12][13]. Studies on Augmented Reality in housing promotional media reveal significant potential to increase interest and engagement among prospective buyers by providing realistic previews of both the exterior and interior of a house. For instance, research shows that inserting quantitative data, e.g., 'AR-based media increased buyer engagement by 90% compared to traditional methods [14]. 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[6][5].

Based on the issues outlined above, this research develops a house sales promotion utilizing Android-based Augmented Reality technology for the housing industry. 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 capabilities, allowing users to zoom in and 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 [15]. Below are the structured stages of the system design, as illustrated in Figure 1.
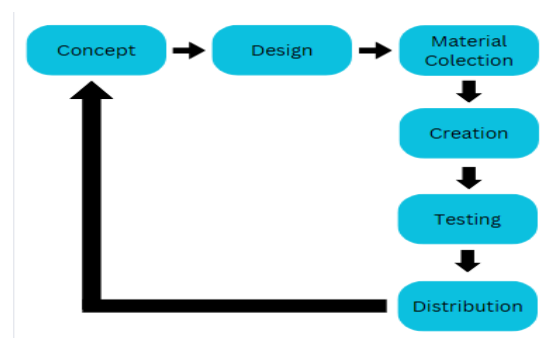

Fig. 1.   MDLC Diagram

III. RESULTS AND DISCUSSION

A. Concept.

The conceptualization of this research begins with determining the objectives and target users of the application. This application is designed for prospective homebuyers, serving as a preview medium to visualize the exterior and interior of houses being promoted or sold. The development process involves

several key stages, including the creation of a 3D House Design using Blender to model the house, which is then imported into Unity for further setup and configuration. Subsequently, the EasyAR software is downloaded and integrated into Unity to enable Augmented Reality (AR) features. The application is then modified and tailored to meet user needs, followed by integration into mobile devices to ensure easy access for users. Finally, the application is displayed as the final product ready for use. This process is explained in detail through a flowchart diagram, ensuring that each stage of development is clearly understood, as illustrated in Figure 2.
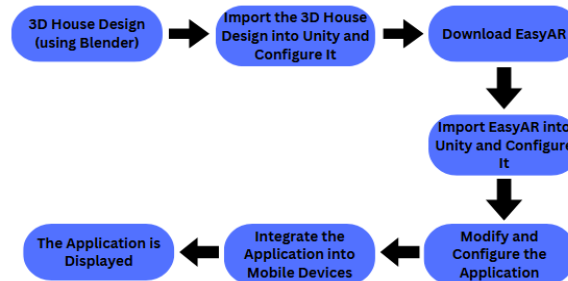

Fig. 2.   Concept Diagram

B.   Design

The next stage is the process of designing the application's user interface, which is used to illustrate the flow and processes within the application. The user interface for the housing sales promotion application is tailored to meet its specific needs and includes several menus, as shown in Figure 3. Figure (a) represents the main screen of the application, which contains several buttons, including Start, About, Guide, and Exit. Figure (b) shows the About page, which provides information about Augmented Reality (AR), while Figure (c) illustrates the Guide page that contains instructions on how to use the application to prevent user confusion. Figure (d) displays the housing object menu page, allowing users to select their desired house, and Figure (e) represents the house object description page, where users can view information about the house for sale. Figure (f) is the camera page for viewing the exterior in 3D, featuring a Stop button to pause the display and a Start button to begin viewing. Figure (g) shows the camera page for viewing the interior in 3D.
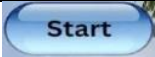

(a)   (b)   (c)   (d)

(e)   (f)   (g)   (h)

Fig. 3.   User Interface
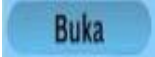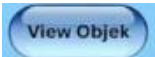
C. Data Collection.

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 4 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.

(a)   (b)   (c)

(d)   (e)

Fig. 4.   Brochure Data and House Objects

The next stage involves 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. Table I of these buttons.

TABLE I.   BUTTON MENU TABLE

No	Image	Menu	Relevance in Research
1	Start / Tentang / Panduan / Keluar	1. Start Button 2. About Button 3. Guide Button 4. Exit Button	These buttons enable primary navigation within the application, allowing users to start exploration, view application information, access the user guide, and return to the main page or exit the application.
2	Buka / View Objek / (back arrow)	1. Open Button 2. View Object Button 3. Back Arrow Button	Used for 3D object exploration, including opening object descriptions, viewing external appearances, and returning to the previous page.

No	Image	Menu	Relevance in Research
3	View Interior STOP START	1. View Interior Button 2. Stop Button 3. Start Button	Supports exploration of the object's interior in 3D, allowing you to stop, restart, or continue the simulation, as well as explore both the interior and exterior.

D. Development.

In the next stage, known as the development stage, all the collected data and materials will be refined and modified, as shown in Figure 5. Figure 6 illustrates the application development process, which begins with the creation of 3D models of the house, encompassing both its exterior and interior. The application development process is carried out using Blender and Unity software.
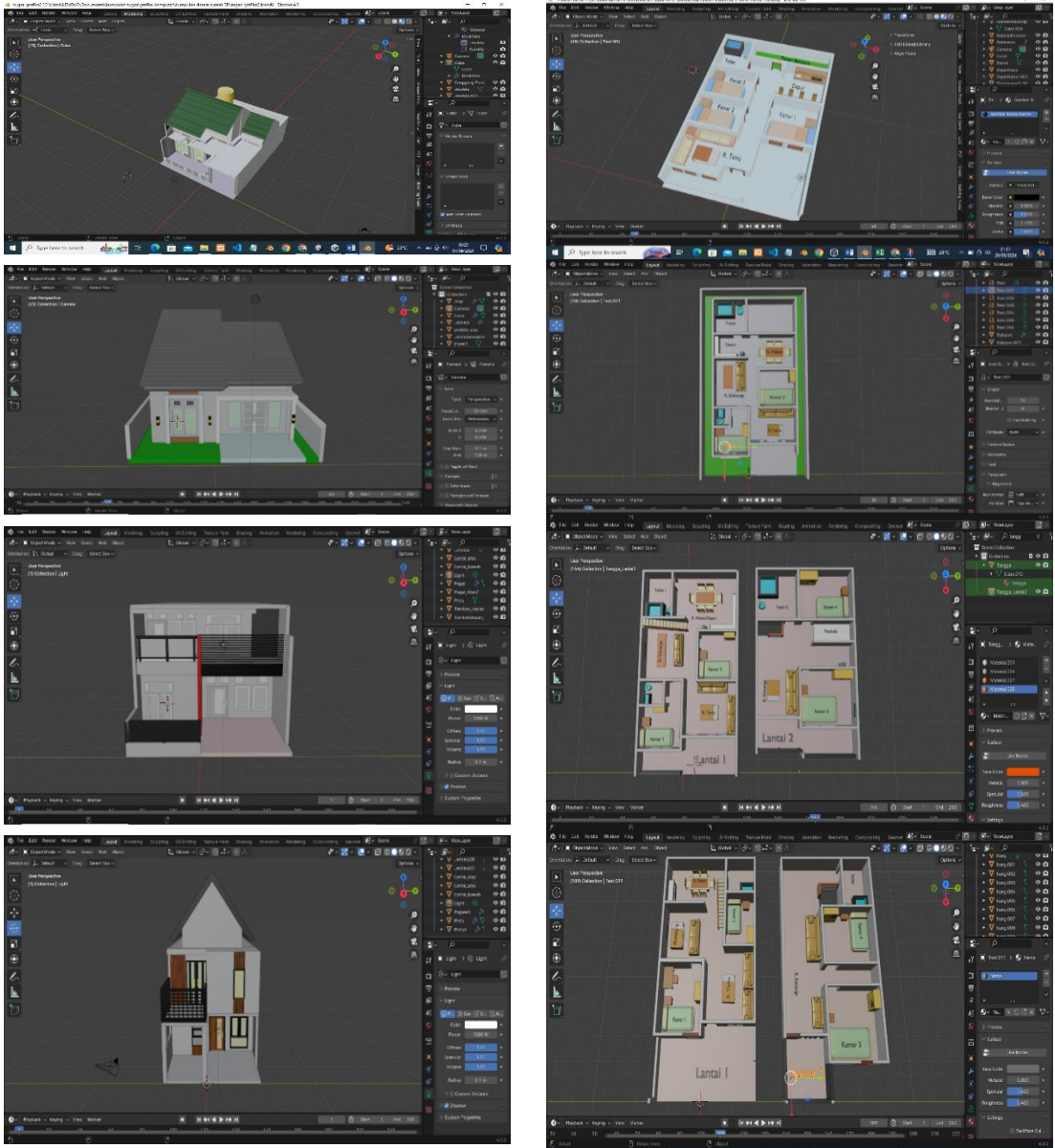

Fig. 5.   The development of objects

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.

Fig. 6.   Workflow Diagram

(a)   (b)

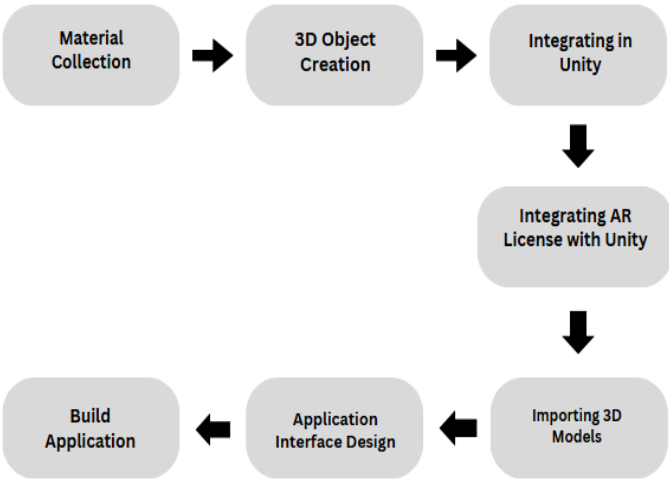(c)   (d)

Fig. 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. Table II is the testing results.

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TABLE II.   TESTING TABLE

No	Langka Pengujian	Testing Steps	Actual Results	Status
1	Start Button	Click the Start button on the main page.	The button works smoothly.	Passed
2	Tutorial Button	Click the Tutorial button on the main page.	The button works smoothly.	Passed
3	Guide Button	Click the Guide button on the main page.	The button works smoothly.	Passed
4	Exit Button	Click the Exit button on the main page.	The button works smoothly.	Passed
5	Back Button	Click the back button on the main page.	The button works smoothly.	Passed
6	Open Button	Click the open button	The button works smoothly.	Passed
7	View Object Button	Click the view Object button	The button works smoothly.	Passed
8	View Exterior Button	Click the view Exterior button	The button works smoothly.	Passed
9	View Interior Button	Click the view Interior button	The button works smoothly.	Passed
10	Start Camera Button	Click the Start Camera button	The button works smoothly.	Passed
11	Stop Camera Button	Click the Stop Camera button	The button works smoothly.	Passed
12	Exit Button	Click the Exit button	The button works smoothly.	Passed

Table II presents the results of testing 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 III.   APPLICATION TESTING RESULTS

No	Device	OS Version	CPU (Cores & Clock Speed)	RAM (GB)	Description
1	Device A	11	8 cores, 2.0 GHz	8	Application Running
2	Device B	8.1.0	4 cores, 1.8 GHz	2	Application Running
3	Device C	12	6 cores, 2.2 GHz	3	Application Running

The results of the application testing on various device versions are displayed in Table III. The first test was conducted on Device A, with OS Version 11, a CPU featuring 8 cores at 2.0 GHz, and 8GB of RAM. The application ran smoothly without any issues. The second test was performed on Device B, which had an OS Version 8.1.0, a CPU with 4 cores at 1.8 GHz, and 2 GB of RAM. The application also ran smoothly without any problems. The third test was conducted on Device C, with OS Version 12, a CPU with 6 cores at 2.2 GHz, and 3 GB of RAM. The application continued to run well.

This house sales promotion application, utilizing Augmented Reality (AR) technology, will be published and used as an interactive promotional medium for housing projects. The application will be tested by **50** prospective homebuyers and those managing the housing sales promotion, as the target audience includes both potential homebuyers and marketers involved in housing promotion. Feasibility testing will be conducted based on predefined evaluation categories. Table 3 presents the scoring category, where score 1 represents the "very poor" category (the lowest rating), and score 5 represents the "very good" category (the highest rating).

TABLE IV.   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.
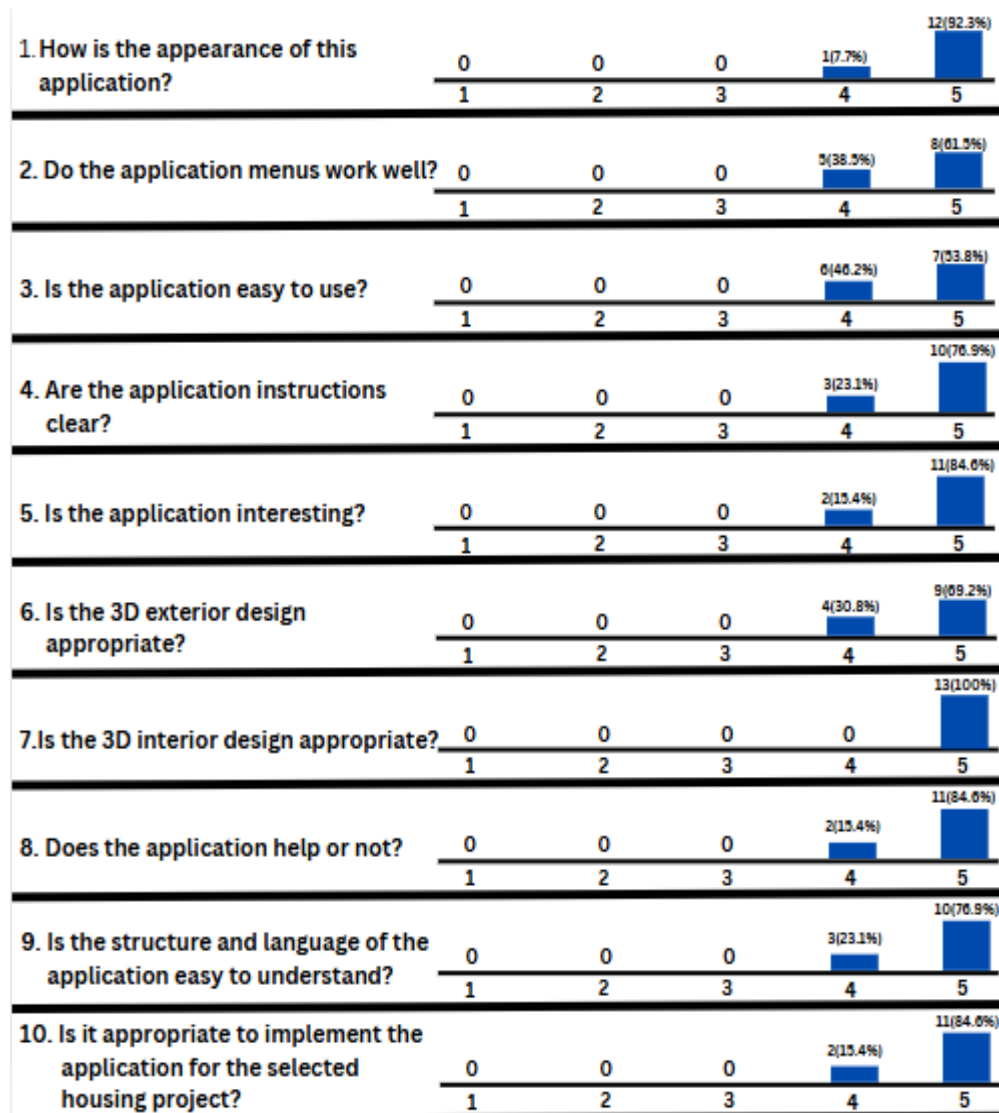

Fig. 8.   User Response Questionnaire

The results of the user response questionnaire, as a feasibility test, are shown in Table IV. 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 $X = 5 \times 10 = 50$. The expected score, symbolized by Y, is calculated by multiplying the user and developer ratings, which is determined as $Y = 50x$. 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
Likert : Likert score

P : Feasibility percentage
Y : Expected score
Therefore, the result of calculating the user satisfaction level is:

$$F = T \times \text{Likert}$$

$$P = fY \times 100\% = P\%$$

(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[15].

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 stage involves application distribution testing with housing marketers/developers and prospective buyers.
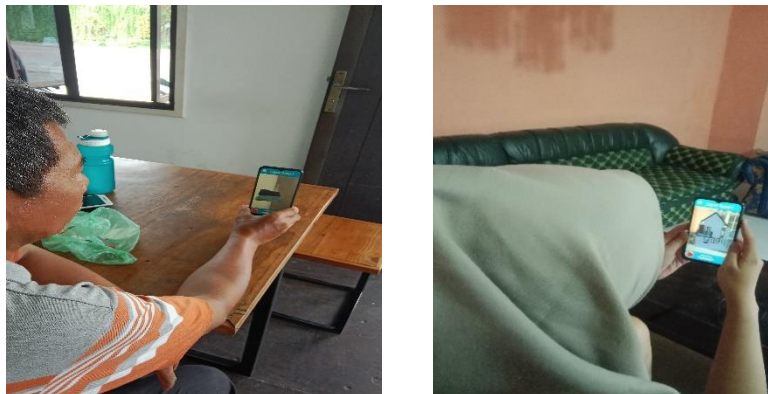
Fig. 9.   Application Testing

IV.   Conclusion

Based on the research outlined above, this study successfully designed and developed a home sales promotion application using Augmented Reality technology, tailored explicitly 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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