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Augmented reality to INSTIKI building recognition using marker based method

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ABSTRACT

The fourth industrial revolution has been initiated by advances in augmented and virtual technologies. AR technology can simulate the actual world in a virtual setting, allowing for more effective trials. In the context of educational institutions such as the Indonesian Institute of Business and Technology (INSTIKI), there are still many locations where information is disseminated through media such as brochures. The objective of this study is to use Augmented Reality (AR) to introduce facilities in the INSTIKI campus building via a marker-based method. The contribution of this study is the application of augmented reality (AR) technology to improve the community's access to information about campus building facilities and specifications. The results of this study are augmented reality (AR) applications for the introduction of INSTIKI campus buildings that have undergone compatibility testing, distance testing, and user response testing with a total average score of 88.9%, which is a very good rating. In order for this augmented reality (AR) application to function as a digital media to promote the INSTIKI campus, the average value of 88.9% must be derived from the percentage of respondents who rated the application as either very good or decent.

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1. INTRODUCTION

The world is currently in the midst of the fourth industrial revolution. The industrial revolution 4.0 is generally characterized by an increase in artificial intelligence and virtual intelligence. The fourth industrial revolution is also associated with technology that can create virtual representations of real-world installations, processes, and applications, which can then be tested to improve their efficacy(Boari, Megavitry, Pattiasina, Ramdani, & Munandar, 2023). In addition, current technological advancements can be utilized in the field of information dissemination, with brochures being one of the information media that is still widely used (Benckendorff, Xiang, & Sheldon, 2019; Fauzi et al., 2023; Rifani & Sadikin, 2020; Saragih & Harahap, 2020).

In the process of introducing the campus building facilities of the Institute of Business and Technology Indonesia(INSTIKI) containing pictures fromfloor plan of the rooms in the INSTICI campus building using brochure media. In the development of technology that continues to increase, the delivery of information about campus needs to be innovated to make it more attractive and add to the attractiveness of prospective students (Ramdhan, Saputri, & Susanto, 2022). One effort that can be done is to create information media for the Indonesian Institute of Business and Technology (INSTIKI) by utilizing Augmented Reality which is applied to Android devices.The information that is planned to be published in the INSTIKI Augmented Reality brochure includes activities on the INSTIKI campus. In the previous brochure, it was not emphasized what activities are on the INSTIKI campus, with the Augmented Reality brochure it is hoped that it can provide interesting information on campus activities and foster the interest of new students. Some of the activities that will be displayed in this Augmented Reality brochure include activities carried out in the front office room, library room, living room, INBIS INSTICI room, and activities in the classroom and lab.Based on the results of an interview with one of INSTICI Marketing that a touch of technology is needed in disseminating information related to INSTICI. In addition to conducting interviews, the researcher also conducted a survey by creating and distributing questionnaires to several SMA/SMK level schools as well as several INSTKI students.

From the results of the questionnaire, 120 respondents were obtained where 85.4% of the respondents came from SMA/SMK and 14.6% of the respondents were INSTICI students. Of the 120 respondents, 68.3% knew about INSTICI. 97.8% of respondents wanted the application of Augmented reality in the INSTICI campus introduction brochure because the information obtained from brochures and social media according to each respondent was incomplete.From the presentation above. Therefore, researchers want to innovate on the INSTICI campus brochure so that prospective students get an interesting impression and know 3D visualization and videos explaining INSTICI campus objects in more detail.

Some research(Aditama & Setiawan, 2020; Aditama, Sudipa, & Yanti, 2022; Cabanillas-Carbonell, Cusi-Ruiz, Prudencio-Galvez, & Herrera Salazar, 2022; Verhulst, Woods, Whittaker, Bennett, & Dalton, 2021)explained that Augmented Reality is a technology that combinesobjecttwo-dimensional and three-dimensional into a real environment and then project these virtual objects in real time. This technology does not completely replace reality, but adds one or several virtual objects in 3D so that the visual appearance is more attractive. (Prasetia, Hidayat, & Shofa, 2018; Sudipa, Aditama, & Yanti, 2022). Research that applies AR in building recognition is by(Gotama, Fernando, & Pasha, 2021; Prasetia et al., 2018; Siwalette & Tuhuteru, 2022)which explains the advantages of AR technology in 3D visualization of buildings so that it makes it easier for users to see the details of each object as a whole. Other research by(Pangestu, Fitri, & Fauziah, 2020; Setiawan & Hijriana, 2019)explained the application of AR can be used as a medium in mapping buildings that are on a campus, as well as research by(Badri, Ikhwan, & Putri, 2022; Muliadi et al., 2022; Turnip, Manurung, Tampubolon, & Sitanggang, 2021)which explains the advantages of the marked based method which is suitable for the needs of making AR applications.

The implementation of Augmented Reality that is applied in this study is to display 3D building objects that can be displayed on the cellphone screen in real time as if the information was real and alsodisplays video information on each room plan, such as information on the facilities in each room and what activities can be carried out in that room(Santoso, Sari, & Jalal, 2021; Warmanto, Lahinta, & Tuloli, 2021). So as to provide information to prospective students in a more varied modern visualization. Based on the above, by packaging interesting information for prospective students in obtaining information about the Campus of the Indonesian Institute of Business and Technology (INSTIKI), one of them is by using new information media. With the addition of this new

information medium, it is hoped that Augmented Reality can be used as an additional visualization medium in the introduction of digital buildings with 3D objects.

2. RESEARCH METHOD

In this study using the Marker Based Tracking method, which is one of the methods used in Augmented Reality. This method requires a special marker which is a black and white square illustration with a thick black border and a white background(Arifitama, Syahputra, Permana, & Bintoro, 2019; Yanti & Murpratiwi, 2021). By using a camera that can be accessed on a 12ystem12r device or smartphone. The position and orientation of the marker object can be recognized so that it can create a 3D virtual world, namely the point (0,0,0) and the axis consisting of X, Y and Z (Karundeng et al., 2018). In this study, applying Single Marker as a marker detector to identify only one object. The object designed on the marker is read by the camera and will then appear as a 3D object according to the selected menu. The single marker method is a camera method for tracking objects that are captured with only one meaning, when the smartphone camera scans, one marker will issue a 3-dimensional object (Sembiring, Sapriadi and Brahmin, 2016).(Aditama, Adnyana, & Ariningsih, 2019; Aditama & Setiawan, 2020; Pratama et al., 2021). The software specifications used are Unity 2019.4 for image, graphics, sound and other input processing. SoftwareAndroid SDK that can be integrated with Unity to create Augmented Reality applications for the Android and iOS platforms. Blender software for creating 3D objects and animations and Vuforia softwarecreate Augmented Reality (AR) applications on mobile phones. The phases of planning, modeling, implementation (construction), testing, application, and maintenance are carried out using the Waterfall design methodology. The cascade method is utilized to structure each system development phase.

3. RESULTS AND DISCUSSIONS

3.1. AR Application Design

In designing AR applications, namely displaying the process of making applications from creating UI, creating 3D objects, making videos of the INSTKI Building facilities and the process of making applications in Unity.

The modeling process begins by entering a reference image or photo from the INSTIKI building, the modeling process follows the scale or size of the reference image that has been entered, which can be seen in Figure 1 below.

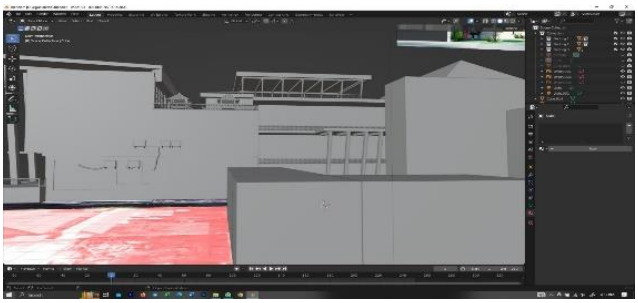

Figure 1. The modeling process

Texture making is done with the Photoshop application according to the reference photo of the INSTICI building, importing the texture in the blender application and then applying it to objects according to the texture made, can be seen in Figure 2 below.

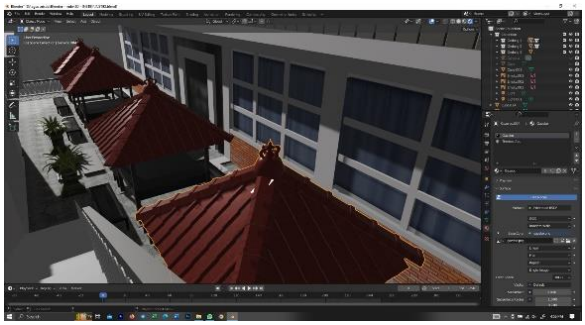

Figure 2. Texture Making

The last one is done with the export process in FBX format so that later it can be imported according to the format in Unity. Can be seen in Figure 3 below.

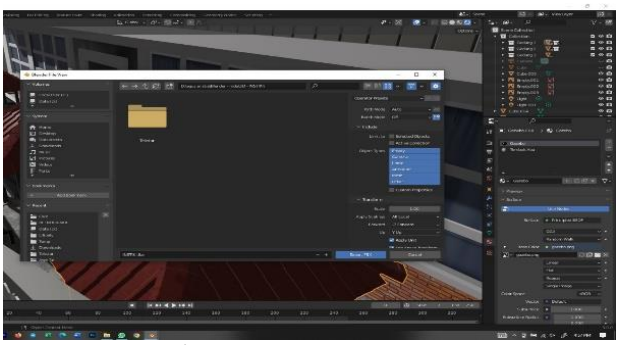

Figure 3. Export Process

3.2. AR Application Implementation

Based on the process of designing the Augmented Reality application interface for the introduction of the INSTIKI Campus building, it will then be implemented using the features found in Unity 3D. The implementation of the Augmented Reality application interface for the Introduction of the INSTIKI Campus Building is as follows.

a. Main Menu Interface Implementation

The main menu will appear after the Splash Screen display. On the main menu display there are 5 buttons namely Start AR button, Guide button, Quiz button, About button, Exit button. Making the icons on the main menu is made using Adobe Illustrator, can be seen in Figure 4.

Figure 4. The main menu of the AR application

b. AR Start Menu Interface Implementation

The AR Start menu is displayed when the user presses the AR start button to display the Running camera, and displays the entire Instiki campus building. On the Start AR menu display there are 2 buttons, namely in the top left corner the back button if clicked will return to the main menu and on the right side there is a home button to go to the floor plan menu, can be seen in figure 5.

Figure 5. AR Start Menu

c. Building Facility Interface Implementation

Building I facilities are displayed when the user presses the building I button on the floor plan menu. There are 5 buttons on the floor plan menu, namely in the upper left corner the back button when pressing the button will return to the floor plan menu and the buttons on each facility in building I if pressed will go to the video menu facilities in each building I, can be seen in figure 6.

Figure 6. The INSTKI Building Facility Menu

d. Implementation of Laboratory Facility Video Interface

The video for Lab A facilities is displayed when the user presses the Lab A button on the building I facilities menu. There are 4 buttons on the Lab A facility video, namely in the upper left corner the return button when pressing the button returns to the Building I facilities menu, the play button for playing video, the pause button to pause the video, the stop button to stop the video, and the slider to speed up the video. Can be seen in figure 7.

Figure 7. Video of Laboratory Facilities

e. Implementation of Studio Talk Show Facility Video Interface

The Studio Talk Show video facility is displayed when the user presses the Studio Talk Show button on the facilities menu in building III. There are 4 buttons on the Studio Talk Show video facility, namely in the upper left corner the return button when pressing the button will return to the Facilities menu building III, the play button to play the video, the pause button to pause the video, the stop button to stop the video, and the slider to speed up the video . Can be seen in figure 8.

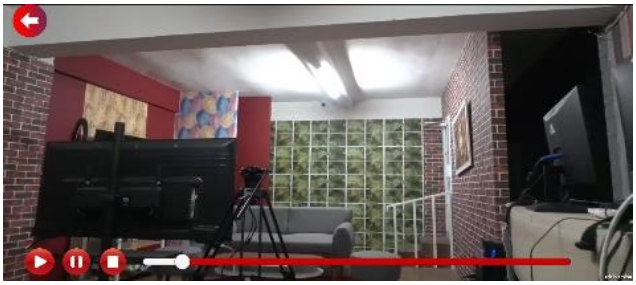

Figure 8. Video of Studio Talk Show Facilities

f. Guide Menu Interface Implementation

The application guide interface is an interface that displays an explanation of how to use the application. Can be seen in Figure 9 below.

Figure 9. Guide Menu Interface

g. quis Menu Interface Implementation

The quiz menu interface is an interface that displays general knowledge questions about the INSTICI campus. Can be seen in Figure 10 below.

Figure 10. Quiz Menu Interface

3.3. AR Application Testing

Compatibility testing is done by installing and running the application on several different Android devices with the aim of knowing the success rate of the application when running on each of these devices.

Table 1. Compatibility Test Results

No	Device Brand	Specification	Information
1	Infinix note 7	Android 10 version Screen : 6.95 inches Camera48 MP	The application runs smoothly, the application display is full
2	Xiomi Redmi Note 10 Pro Max	Android version 13 Screen : 5.67 inches Camera 108MP	The application runs smoothly, the application display is full
3	Oppo A83	Android version 7.1 Screen : 5.7 inches Camera 13MP	The application runs smoothly, the application display is full

The test results show that the application can run smoothly on all Android devices with operating system versions starting from 7.1 (Nougat) to version 13. Then a distance test is also carried out so that the distance at which 3D objects will be detected and visible on the smartphone is known which is shown in table 3.2.

Furthermore, there is a distance test using several mobile phones from various brands to determine the distance and time limit of the devices to display 3D AR objects.

Table 2. Distance Test Results

No	Device Brand	Distance Limit	Time
1.	Oppo A83	± 60cm	± 10.42 seconds
2.	Xiomi Redmi Note 10 Pro Max	±60cm	± 4.34 seconds
3.	Infinix note 7	±60cm	± 3.85 seconds

There is a test of the response of AR application users conducted in research. dFrom the results of the field test analysis it is known that the overall average percentage of 50 respondents with seven assessment items is 88.9%. The application is included in the Very Good criteria. Knowing the level of achievement of the application based on the rating scale, the number and percentage of user answers are calculated for each rating scale. Based on the calculation results of user responses, it can be seen that of the five assessment criteria for each item, 48 users stated that the Augmented Reality application for the Introduction of the INSTICI Campus Building was in very good criteria, and two users stated that the Augmented Reality application for the Introduction of the INSTICI Campus Building was in good criteria.

4. CONCLUSION

Based on the findings of the development analysis of the INSTIKI Campus Building Introduction The Augmented Reality application has been operating in accordance with the requirements for the visualization of facilities in the campus building in order to provide the community with a 3D visualization of the facilities in the INSTIKI campus building. Application of the Augmented Reality technology Respondents' responses to the INSTIKI Campus Building introduction were overwhelmingly positive. The aggregate average of the results from the questionnaire given to 50 respondents is 88.9%, which meets the excellent criteria. The average value of 88.9% is derived from the percentage of each respondent who rated the application's quality as either very good or good. The implication of this study is that this AR application can serve as a digital medium to introduce the INSTIKI campus with 3D visualization in each part of the building, thereby contributing to the production of application products for Augmented Reality-based

INSTIKI brochures that can be used as information media or promotional media. Suggestions for future research include focusing on the size of the application when developing Augmented Reality applications for the next version of Android, so that these applications can be used on devices with limited memory.

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