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Visualization of Virtual House Model on Property Brochure Using Augmented Technology

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Abstract. Brochures are used to help companies promote products or services that they offer to customers. In the property business, brochures have a great effect on the level of customer interest in the housing that is offered. Well-made brochures are needed to build interaction with customers. Augmented Reality (AR) is an environment that incorporates 3-dimensional virtual objects into real environments in real-time. Development of this application using Augmented Reality in order to make the housing brochure becomes more real with the existence of 3-dimensional objects. It aims to show customers a house form that is offered in 3-dimensional. Furthermore, it can increase the interest of customers of the houses that are sold and reduce the cost of making miniature models. Moreover, it is run on the android mobile platform and to display augmented objects in 3-dimensional this application uses Vuforia SDK.

1. Introduction
Brochure is an advertisement media for customers to gain information about the product and services offered and published only for a certain period of time. As one of the marketing strategies, a company is needed to design their brochure as interactive and attractive as possible. Attractive brochures are well-designed, providing useful or interesting information and easy to understand by customers.

A new technology called Augmented Reality (AR) is technology that combines what is in reality and what is generated from the computer by enhancing what we see, hear, smell, and feel[7]. Augmented reality is implemented as the education media and the information media. Augmented reality is the technology which implements computer vision in its process[5]. The development of information technology evolves along with the times. Marketing media is no longer promoted manually but in real-time with Augmented Reality technology, the addition of a media, the media can be in the form of brochures or catalogues.

2. Problem Identification
Mostly the brochures offered by property developers are in the form of 2-dimensional objects or miniature models of the housing that are placed in the developers' marketing office. Apparently, it will take customers times to see and try to understand the miniature models. Moreover, it cost the developers to build the
3. Previous research
Research in augmented reality field has been done widely. Undoubtedly, it captivates the interest of academic researchers. Such as in 2010 Phan et al conducted research on utilizing Augmented Reality technology for interior design, along with studied of interior design work. At the same time, rapid development of virtual technology, it will be needed in the field of architecture [1]. Lim et al (2011) has completed research about implementation augmented reality on smart exhibition system. The purpose of this research is to encourage user to participate and allows user to get in-depth information not only through text, images, and video, but also through virtual 3D objects in real-time [2]. Thus, in 2012 Wahid, Arif R conducted research by utilizing Augmented Reality to create a spatial appearance system that can be changed. The purpose of this research is to provide virtualized space that is visualized, due to limited physical space, and can be utilized for space in design [3]. Furthermore, in 2013 Rifa'i et al conducts research by utilizing AR technology for replaced the mockups / miniatures house models with 3D house models that are displayed virtually using android mobile devices, it helps property developers to save on expenses because they no longer need to create a miniature house and replaced it with this AR housing catalog application [4]. And then Syahputra et al used augmented reality applications with image processing methodologies into 3D models through several toolkits[6].

4. Research methodology

4.1. System design

4.1.1. General architecture
Application visualization of the virtual house model is a Mobile Augmented Reality application to show customers a house form in real with the existence of 3-dimensional objects. The system will detect the image used as a target, next the camera will capture each frame, then will compare each frame with the current database in the system. After the process is completed, the system will do the process of positioning and orientation. This process is to analyze location and position from the image in real world, it purposes to determine the location and position of the virtual content which will be added to the real world through the smartphone screen. Once the image position and orientation has been determined, the system will perform the rendering process to display virtual content in accordance with predetermined positions and orientations by the system. All these processes are done by Vuforia SDK, library used in developing this application. The general architecture of the application is shown in Figure 1.

4.1.2. Modelling
Modelling is performed to facilitate system development. System modelling is made using Use case. Use case diagram of Visualization virtual house model applications is shown in figure 2. Main function of visualization virtual house model applications is to display augmented object. The explanation for Figure 6 is as follows:

- User is preparing a brochure that have registered markers.
- Camera identify (tracking) marker.
- If the marker valid run the next stage, otherwise the user is needed to re-identify the marker.
- A valid and identifiable marker can display the 3D house objects.
- User can interaction through the smartphone screen, the screen will display each corner of the room, technical specification and the ambience of the room in the form of video.
Figure 1. General architecture of visualization virtual house model applications.

Figure 2. Use case system visualization virtual house model applications.

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4.1.3. Interface design
Interface is service provided as interaction media between user and system. Interface is built to allow user to understand and run the application properly. Nevertheless, not set aside aspects of aesthetic so user will feel interested while using it. Interface design consists of main menu, house type design, guide, and about. User interface main menu is built as shown in figure 3.

![Figure 3. Main menu design of visualization virtual house model applications.](image)

5. Result
The results of the system design that has been built are as follows:

5.1. Main interface
Main interface is a page that shows buttons containing features in House's Model Visualization AR App that describes the housing, house type 168, 190, Guide, About Menu and Log Out. The Main interface in the application can be seen on figure 4.

![Figure 4. Main interface.](image)

5.2. Test result

5.2.1. Interface testing
After the interface design is implemented, then the next test is done using blackbox testing. The interface test results can be seen at Table 1.

| No. | Testing target | Expected result | Testing result | Status   |
|-----|----------------|-----------------|----------------|----------|
| 1.  | Main page      | Shows menu buttons | Shows menu buttons | Succeeded |
| 2.  | Selecting “AR Complex” menu | Redirects to AR Complex menu | Redirects to AR Complex menu | Succeeded |
| 3.  | Selecting “AR Type 168” menu | Redirects to AR Type 168 menu | Redirects to AR Type 168 menu | Succeeded |
5.2.2. Augmented reality system testing

The input data utilized in this application is the image edited and processed by Target Management System, developed by Qualcomm. The editing process is aimed to increase brightness and contrast value of the image, thus increasing the quality of the image. In this research, three images are utilized as testing data. The augmented reality result is described by Table 2.

**Table 2. Augmented Reality test result.**

| No. | Result target                        | Result | Status |
|-----|--------------------------------------|--------|--------|
| 1.  | Display Housing Model 3D Object in AR |        | Success|
| 2.  | Display House Model Type 168 3D Object |        | Success|
| 3.  | Display Type 168 House Plan 3D Object |        | Success|
| 4.  | Display House Type 168 Specification |        | Success|
| 5.  | Display House Model Type 190 3D Object |        | Success|
| 6.  | Display Type 190 House Plan 3D Object |        | Success|
| 7.  | Display House Type 190 Specification |        | Success|
5.2.3. Testing "Guide and About" menu on application

5.2.3.1. "Guide Apps" menu interface
The guide interface will be active when user click on Guide on Menu list. Guide menu interface can be seen on figure 5.

Figure 5. Guide menu interface.

5.2.3.2. "About Apps" menu interface
The About interface will be active when user click on About menu on Menu List. About Apps menu interface can be seen on figure 6.

Figure 6. About interface.

6. Conclusion
According to system analysis and testing result of augmented reality implementation for Android-based housing complex models visualization, it is shown that augmented reality can be used to visualize housing complex models object, thus giving detailed information of the housing project to users. The quality of augmented reality rendering process has correlation with the specifications of the mobile phone, in which the system is installed. For the future researches, 3-D vertex can be reduced during 3D object creation for minimize the size of generated 3D object. The system can be also modified to be accessible via internet in order to enhance the feature of augmented reality system.

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