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Home's Décor - Home Decoration Implementing Augmented Reality

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Abstract: Home's Décor is a combination of Augmented Reality (AR) technology and interior design integrated into a smartphone application. The aim of this project is to present the implementation of an interior design mobile application using AR technology, a new alternative technology to projecting a virtual object into the real world with the device as an interface. The interior design application has the capability to project a three dimension (3D) object that can then be scaled, rotated and displaced by the user from multiple perspectives on a flat ground plane. This project was conducted by following the ADDIE Model while the project was designed and developed using Unity 3D and Vuforia. The Home Décor application prototype will widen the perspective of technology advancement where users can visualize the virtual world within the real world.

Keywords: Augmented Reality (AR), Mobile Application, 3D Object

1. Introduction

With the rapid development of AR technology in our daily lives, visualizing a virtual object into the real world has never been easier. AR is the integration of virtual elements with the real world in real time. Unlike Virtual Reality (VR), AR uses the existing environment as a platform of display rather than create an artificial environment. The technology is versatile for many dedicated uses such as mapping, training workers and even education. By implementing the innovative concept in interior design, the workflow between the designer and client can be simplified [1]. Interior designers always

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have problems explaining their ideas to the client. The level of understanding of the client relies on the communication skill of the designer.

Therefore, a mobile application using AR-themed interior design concept is developed as the platform of materialization of the designer's ideas. The application visualizes a 3D object of a product onto a desired plane as well as texture on the wall. The application can estimate virtual objects stored on the cloud storage and view multiple models at once. The user can then take a picture of the scenery as reference to the designer.

There are several types of AR to choose when planning to develop an AR-based application like projection based AR, recognition based AR, location based AR and superimposition based AR, while the methods are marker based AR or marker-less AR. AR technology also has been used in many fields such as medical [2], military [3], manufacturing [4], business [5][6], education [7], tourism [8] and entertainment.

2. Methods

To develop the Home AR application, the methodology used is the ADDIE model as it covers most of the development processes. The phases in the ADDIE model which are Analyse, Design, Development, Implementation and Evaluation phases, are generally used as the base phases to many other methodology models. The ADDIE model was developed by Florida State University (FSU) where a five-phase process detailed the development process in a much more intricate design [9]. The ADDIE model serves as a foundation to many other instructional systems development models with a more specific purpose. The current ADDIE model is simpler and more systematic.

2.1 Analyse

In this phase, developers will thoroughly analyse the project's requirement in terms of measuring the space and size needed in order to visualize a 3D image onto a flat plane. The application should be able to calculate the distance between the device and the plane to determine the scale of image from the original size of object. This is to make sure that when the application is used, users will get an accurate measure of the space when designing the house interior.

2.2 Design Phase

The environment where the projection of 3D model will be initialized as to be the starting point of the application. Then, the user will choose which model they want to initialize and the model will be fetched from a cloud storage, which is the Google Drive online storage. The model will then be projected onto the environment based on the given coordinate. This process will be repeated depending on how many models the user wants to initialize in the environment. After deciding on the environment, the user can then save the viewed environment as an image, as a reference when arranging the real furniture. The image will be saved on the device's database. Finally, the user can either choose to do the initialization again or to end the application.

The interface of Home's Décor is designed to be simple yet easily understandable by users. **Figure 1** shows the design for the application start menu where users are provided with three options which are Start, Manual and Exit.

Figure 1: Application Start Menu interface

Choosing the Start option in the start menu will bring the user into the Augmented Reality Scene as shown in **Figure 2**, where the application shows the current view of the device's camera and control buttons.

Figure 2: Augmented Reality Scene interface

When the user selects an object by touching it on the screen and clicking the edit button, the application will load the selected object into the Edit Scene as shown in **Figure 3**, where the user is allowed to modify the colour of each object's part by using the colour slider to create a variety of colour combinations.
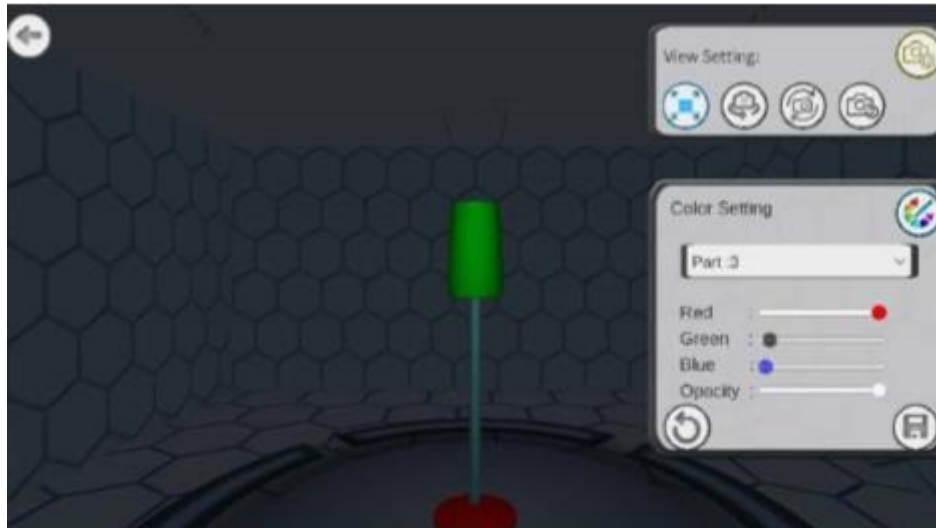
Figure 3: Edit Scene Interface

2.3 Implementation

The Implementation phase is meant to experiment the finished prototype by designated users, which are the general public. The application prototype will be tested by interior designers in real life situations to test the functionality and fluidity in practical use. Developers have chosen Kolej Kediaman Pagoh, Universiti Tun Hussein Onn Malaysia, KM 1, Jalan Panchor, Muar, 84000 Johor, Malaysia as the testing environment. A total of 16 randomly selected members of the public will test the application. They are also required to fill in a feedback form as evidence of application assessment.

2.4 Evaluation Phase

In the Evaluation Phase, developers will determine whether the project's aim and objectives are accomplished at the end. There are two parts in this Evaluation phase; the Formative and Summative. The Formative parts are when the developers begin the project until the final alteration of the application. Meanwhile, the Summative parts are when collecting and evaluating the feedbacks as well as the final conclusion of the whole project at end. After determining the verifiability of the end product, the application will be officially launched for the use of interior designers.

3. Results and Discussion

By implementing the ADDIE development model as a guideline the Home's Décor application has been successfully developed using multiple development software that includes Unity Engine, Visual Studio 2017 and by integrating Vuforia Grounplane and smart terrain function into the application.

3.1 Results

The demographic profile of the respondents is classified into faculty and occupation as shown in **Table 1**. The faculty consists of Centre for Diploma Studies (CeDS), Faculty of Engineering Technology (FTK) and Faculty of Applied Sciences and Technology (FAST) while the occupation consists of student, lecturer and general public.

Table 1: The demography of respondents

Demography	Frequency (N=16)	Percentage(%)
Centre for Diploma Studies (CeDS),	13	81.3
Faculty of Engineering Technology (FTK)	1	6.3
Faculty of Applied Sciences and Technology (FAST)	0	0
Other	2	12.5
Student	13	81.3
Lecturer	1	6.3
Staff	0	0
General Public	2	12.5

In terms of convenience as result in **Table 2**, respondents acknowledged the application rather easy to be used, with 10 'Good' responses and 5 'Very Good' responses. They also recognized the interface to be rather suitable for the purpose of the application.

Table 2: The response regarding user convenience

Question	Frequency (N=16)				
	Very Bad	Bad	Unsure	Good	Very Good
Was the application easy to use?	0	0	1	10	5
Does the interface suit the purpose of the application?	0	0	0	10	6

Most respondents identified the 3D models available to suit their interest as it clearly displays the size and shape of the product. They also noticed the manuals was interesting and easy to understand.

3.2 Discussions

The strengths represent what edge this product have in relation to other AR interior design applications. The strengths of this product are free movement of model, editable models and the use of cloud storage.

However, even after a thorough development of the application, there are some weaknesses, given the short time to develop the application. The weaknesses identified include a narrow range of compatible devices, performance strongly dependent on device's specification and the requirement of an internet connection.

3.3 Improvement Suggestion

The application will be improved to optimize its potential in the near future. Some of the improvements that have been planned are as follow:

i. Increase number of product model

As users' interest and need in furniture diversify depending on occasions and individuals, a wide range of sample models is needed for selection. Therefore, to make the choices of models suit the users, the number of sample models will be increased from time to time.

ii. Add function to enable user to use their own models

Aside from only using our sample models, we wish to allow users to utilize models from an external source. This will give users the freedom of choosing their own models for a more versatile design.

4. Conclusion

As an overall conclusion, the application was built as a new initiative for users to visualize the arrangement of furniture at any given state and coordination without having to buy the furniture beforehand. This is also to implement the rapidly developing AR technology in our daily lives. This application will not only broaden the general public perspective on AR technology but also introduces new possibilities on the development of virtual-based smart home.

Acknowledgement

References

[1]	Baruah, M. (2019). Deskkart- Furniture Mall with Augmented Reality. International Journal for Research in Applied Science and Engineering Technology, 7(5), 653-660. doi:10.22214/ijraset.2019.5113

[2]	Munzer, B. W., Khan, M. M., Shipman, B., & Mahajan, P. (2018). Augmented Reality in Emergency Medicine: A Scoping Review (Preprint). doi:10.2196/preprints.12368

[3]	Wilson, K. L., Doswell, J. T., Fashola, O. S., Debeatham, W., Darko, N., Walker, T. M., . . . Weaver, W. L. (2013). Using Augmented Reality as a Clinical Support Tool to Assist Combat Medics in the Treatment of Tension Pneumothoraces. Military Medicine, 178(9), 981-985. doi:10.7205/milmed-d-13-00074.

[4]	T. K. Wang, X. Y. Gu, Z. W. Yang et al., "Application of augmented reality (AR) Technology in equipment maintenance", Engineering Research-Engineering in an lnterdisciplinary Perspective, no. 2, 2017.

[5]	H. Van Kerrebroeck, M. Brengman, K. Willems When brands come to life: Experimental research on the vividness effect of Virtual Reality in transformational marketing communications Virtual Reality, 21 (4) (2017), pp. 177-191

[6]	M.Y.C. Yim, S.C. Chu, P.L. SauerIs augmented reality technology an effective tool for E-commerce? An interactivity and vividness perspective Journal of Interactive Marketing, 39 (2017), pp. 89-103

[7]	Chou, R. (2017) Going out into the field: an experience of the landscape architecture studio incorporating service-learning and participatory design in Taiwan, Landscape Research, Vol. 43, No. 6, pp. 784– 97.

[8]	Yung and Khoo-Lattimore, 2017 R. Yung, C. Khoo-Lattimore New realities: A systematic literature review on virtual reality and augmented reality in tourism research Current Issues in Tourism (2017), pp. 1-26

[9]	Chang, S. L. (2006). The Systematic Design of Instruction. Educational Technology Research and Development, 54(4), 417-420. doi:10.1007/s11423-006-9606-