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The Development of Personal Hygiene 3D Augmented Reality

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Abstract: This study aims to develop 3D augmented reality on Personal Hygiene Care. The development of this 3D augmented reality will provide understanding and awareness to the community. This 3D augmented reality design and development process generally uses the Waterfall development model. The model consists of six phases, namely planning, analysis, design, development, implementation and testing, and maintenance. In this study, there are six (6) experts consisting of three (3) lecturers, namely two (2) lecturers from the field of Creative Multimedia from the Faculty of Technical and Vocational Education, UTHM, and one (1) lecturer who is an experienced Multimedia Expert and IoT from the Faculty of Electronic Engineering Technology UniMAP. Meanwhile, three (3) other officers and nurses with educational backgrounds under the Ministry of Health Malaysia from Kuala Lumpur Hospital. The data analyzed found that experts agreed with the content and interface of the development of 3D augmented reality on personal hygiene. The development of 3D augmented reality can attract the interest of users because of the realistic shape of 3D animation. The development of 3D augmented reality can also provide awareness of good Personal Hygiene to the community, schools, and hospitals. Finally, the development of 3D augmented reality will have a positive impact on presenting information more effectively and easily understood by users.

Keywords: 3D Augmented Reality, Personal Care Hygiene, Provide Understanding and Awareness

1. Introduction

Hygiene refers to ways and activities that help maintain health and prevent the spread of disease (Water Aid, 2012). Personal hygiene is important for the mental and physical well-being of everyone, especially children. According to the United Nations Children's Fund (UNICEF, 2016). Personal Hygiene includes the cleanliness of all parts of the body. Among them are the face, hair, body, legs,and hands. Furthermore, cleanliness is an important aspect of living a healthy lifestyle, according to Bashir and Masih (2018). As a result, good hygiene can help people avoid contracting unwanted diseases.

The primary care tasks of personal hygiene, dressing, nutrition, and removal are all included in managing personal hygiene. The word hygiene originates from the Greek word "hygiene" which carries the term health and fitness of the body. Good hygiene is shown through cleanliness. According to D'Fonseca, humans need a clean environment and good personal hygiene to be healthy, odorless, and to prevent the spread of dirt or germs to themselves and others. Bathing, brushing teeth, washing hands, and wearing clean clothes are all examples of personal hygiene (Selo & Hantono, 2015). According to Shapley et al., (2011), washing is a method of hygiene that involves the use of water and soap or detergent. Washing hands with soap or using hand hygiene products is the best way to prevent the spread of "Influenza" and colds Society is less exposed to good self-care. Most have health problems and are exposed to pathogens that may weaken their bodies. In addition, they have a lower immune system than other students. According to Kusters (2009), aspects of personal hygiene play an important role in protecting children from being easily infected with any epidemic or virus that could endanger their lives. Children who practice good personal hygiene will be able to strengthen their immune systems and avoid infections, epidemics, or viruses. As a result, personal hygiene practices need to be adhered to by personal health (Bush, 2014).

Personal hygiene, also known as self-care, includes cleaning feet, nails, genitals, hair, bathing, and dental care, and washing clothes. According to Ahmadu et.al (2019), Grooming includes taking care of hair and nails, such as clipping nails and combing hair. Home and personal hygiene can also act as a shield strategy against an upcoming epidemic. Therefore, hygiene is a key safety to reduce the spread of pathogens in the daily environment. According to Aunger et.al (2016), washing hands with soap may be one of the main keys to preventing the transmission of infectious diseases. Personal hygiene is an important thing and helps to fight germs in the body that can lead to bad smells and diseases. Finally, in health, *augmented reality* (AR) systems have been successfully used to provide medical, nursing, and allied health professionals and students with a variety of procedural skills (Botden, 2009). For example, in the health curriculum, procedural skills competence begins with basic learning theory in the classroom and understanding the context for its application. Students then practice in a safe and controlled environment such as a simulation lab. Students use these new skills under supervision while conducting clinical practice. Performing a new procedure can be very stressful for physicians and students who may feel nervous or overwhelmed by the experience and are often afraid of making mistakes that could cause harm to the patient (Pulido-Martos, 2016). Ongoing guidance and support are necessary, and AR applications have the potential to support students remotely in the workplace (Lee, 2012).

Based on the context of the problem, as can be seen that there are various issues related to personal hygiene in society. Various diseases spread due to the uncleanness of society. Water-borne diseases are the most common where water is a basic need for human beings. Cholera, meningitis, and polio are diseases carried through water. Even skin diseases also occur due to a lack of personal hygiene. The use of 3D augmented reality is one of the approaches that can help in the process of conveying information. It is a more effective application and attracts the interest of the community in conveying important and useful everyday information. In this era of information explosion, all the information obtained by an individual is through the telephone and it has become a part of human life. An approach that uses Augmented Reality will have a positive and effective impact on society. It is also an easy-to-get app, and it can be used for teaching and learning sessions. Through augmented reality, we can provide information through media that combines the senses of hearing, sight, and touch. It will provide an opportunity for the community to better maintain personal hygiene in daily activities. Thoroughly, in

This study, augmented reality will be developed to give awareness to the community about personal hygiene and its care in a way that is more accessible and can be used anytime.

2. Methodology

The Waterfall model (Figure 1) was chosen by the developer as a design model in the development of *3D augmented reality* of personal hygiene care. The Waterfall design model is one of the modelsused as the basis for the design model. The Waterfall model contains 5 phases namely Analysis, Design, Development, Testing, and Implementation (Pfleeger & Atlee, 2006).
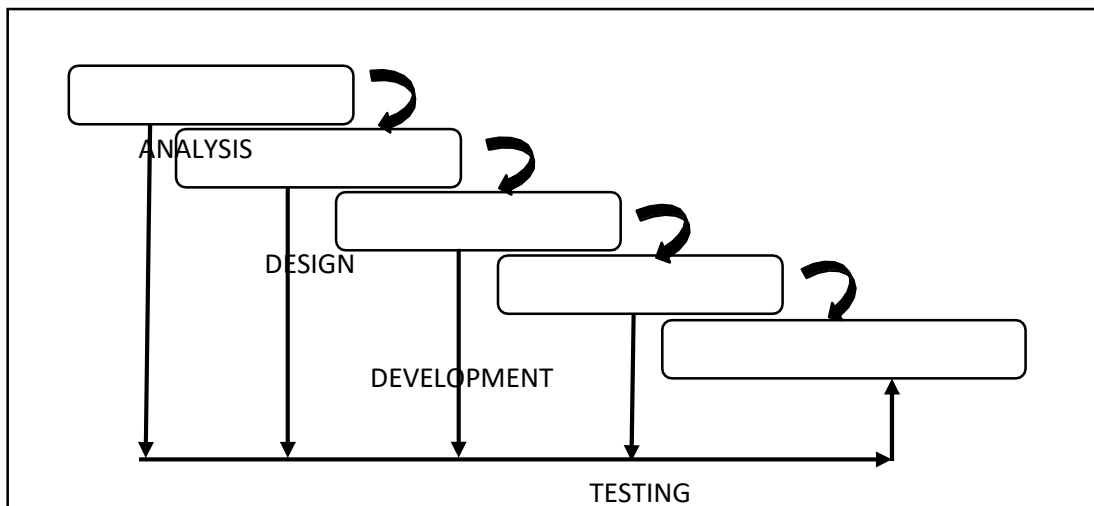
Figure 1: Waterfall Model (Source: Pfleeger and Atlee, 2006)

The Waterfall model in the development of *3D augmented reality* about personal hygiene care also assists the developer in achieving the set objectives, ensuring the development process goes smoothly and the product may be finished within the predetermined timeframe.

2.0 Analysis Phase

The Waterfall model's analysis phase is the first phase. This analysis phase includes severaltasks, such as analyzing the problems and the methods used to solve the problems uncounted, determining the objectives of the study, and identifying the constructions needed for this *3D augmented reality* about personal hygiene care. To gain the most correct data and information, the analytical method can be applied by reading publications and journals.

2.1 Design Phase

The second stage of the Waterfall model is the design phase. The knowledge gathered during the analysis phase is converted into a physical sketch during the design phase for usage during the development process.In this stage, the development team will create a storyboard for the product, a 3D *augmented reality* that focuses on personal hygiene. Multimedia components should be included in the storyboard if necessary.

2.2 Development Phase

The third stage of the Waterfall paradigm is the developer phase. With the aid of the data obtained

during the analysis phase and the design phase, this step involves creating a *3D augmented reality* concerningpersonal hygiene care that was initially envisioned. With the aid of technologies like Adobe Illustrator CS6,Unity 3D, Android SDK, Autodesk 3D Max 2022, and Wondershare Filmora, 3D *augmented reality* regarding personal hygiene care was created. Before creating the final product, storyboards representing product prototypes will be created.

2.3 Testing Phase

The fourth stage of the Waterfall paradigm is the testing phase. The testing and evaluation of this product is evaluated by experts in two different aspects namely through content and interface design. The content evaluation was evaluated by three (3) expert officers serving at Kuala Lumpur Hospital while the *3D augmented reality* interface design evaluator developed will be evaluated by three (3) creative multimedia lecturers from the Faculty of Technical and Vocational Education (UTHM) and an expert is a Multimedia and IoT lecturer from the Faculty of Electronic Engineering Technology UniMAP. Next, the developer makes the process of improving or improving the quality of the *3D augmented reality* that is developed to meet the needs of users and objectives that have been developed to meet the needs of users and objectives that have been developed.
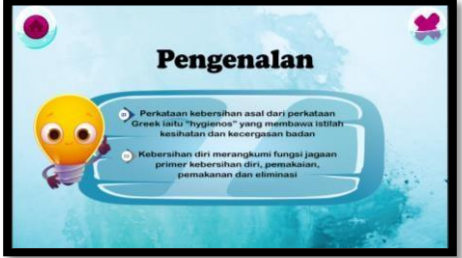
2.4 Implementation Phase

The fifth stage of the Waterfall paradigm is the implementation phase. The implementation phase is thefinal phase used in this study. In this phase, the finished product developed by the developer will be presented informally to the evaluator. The goal is to test functionality and identify any issues that may not be encountered during the design and development phases. Any shortcomings and weaknesses found will be corrected and tested until they are successful. Developers can make changes to developed items based on user feedback.
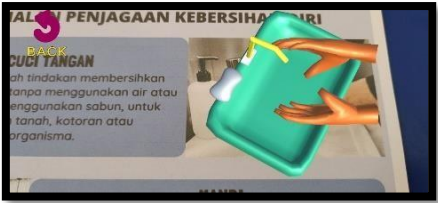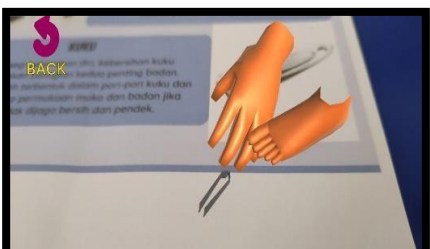
2.5 Develops *3D augmented reality* about personal care hygiene.
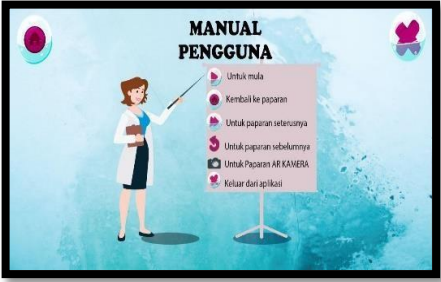
Interface design combines a broad range of materials, multimedia components, and numerous interactive components. The developed interfaces are displayed in Table 1.

Table 1: *3D Augmented Reality* Interface

Application Interface	Descriptions
Main Display Screen 	The home screen shows the use of text graphics andaudio. Text – Title. Graphic – Design of the background screen andinteraction buttons. Audio – Background music 'happy background music'.

Main Menu Screen	The main menu screen shows the use of text graphicand audio. Text – Title and button name. Graphic – Design of the background screen andinteraction buttons. Audio – Background music 'happy background music'.
Introduction Screen	The introduction screen shows the use of text, and audio. Text – Title and button name. Graphic – Design of the background screen andinteraction buttons. Audio – Background music 'happy background music'.
Objective Screen	The objective screen shows the use of text graphics, andaudio. Text – Title and button name. Graphic – Design of the background screen andinteraction buttons. Audio – Background music 'happy background music'.
Personal Hygiene Care Screen	The objective screen shows the use of text graphics, andaudio. Text – Title and button name. Graphic – Design of the background screen andinteraction buttons. Audio – Background music 'happy background music'.
Hand Washing Graphics Screen	The hand washing graphics screen shows the use of textgraphics and audio. Text – Title and button AR Camera Graphic – Design of the background screen andinteraction buttons. Audio – Background music 'happy background music'.

3D augmented reality Hand Wash Object Display Screen	*3D augmented reality* Hand Wash Object DisplayButton – Back button. AR – Object 3D Model Pop-up Audio – Background music 'happy background music'.
Bath Graphics Screen	The bath graphics screen shows the use of text graphics, and audio. Text – Title and button AR Camera Graphic – Design of the background screen andinteraction buttons. Audio – Background music 'happy background music'.
3D augmented reality Bath Object Display Screen	*3D augmented reality* Bath Object Display Button –Back button. AR – Object 3D Model Pop-up Audio – Background music 'happy background music'.
Nail Cuts Graphics Screen	The nail cuts graphics screen shows the use of textgraphics, and audio. Text – Title and button AR Camera Graphic – Design of the background screen andinteraction buttons. Audio – Background music 'happy background music'.
3D augmented reality Nail Cuts Object Display Screen	*3D augmented reality* Nail Cuts Object Display Button – Back button AR – Object 3D Model Pop-up Audio – Background music 'happy background music'.

Manual Screen	The manual screen shows the use of buttons.Text – Title Graphic - Sign of the buttons Audio – Background music 'happy background music'.
Exit Screen	The exit screen shows the use of text, graphic and audioText – Title and button name. Graphic – Design of the background screen andinteraction buttons. Audio – Background music 'happy background music'.

3. Result and Discussion

Product testing and evaluation are very important to a developer because they can help measure product quality. Developers have used an expect checklist form to obtain confirmation of the reasons for the process of testing and evaluating *3D augmented reality* about personal hygiene care. The measured aspects of the developed product are in terms of content evaluation of *3D augmented reality* about personalhygiene care. The selected expert consists of experienced lecturers in the field of creative multimedia. A total of 3 lecturers were selected to obtain validation on the application interface design. Meanwhile, 3 staff from Hospital Kuala Lumpur were selected to obtain application content design evaluation. Table 2 showsthe demographic for these six experts.

Table 2: Demographic for Six Experts

Details	Expert 1	Expert 2	Expert 3	Expert 4	Expert 5	Expert 6
Gender	Female	Male	Male	Male	Female	Female
Educational Level	PhD	Degree	PhD	Degree	Diploma	Diploma
Field of Specialization	Information Technology and Multimedia	Information Technology and Multimedia	Multimedia and the Internet of Things (IoT)	General Medicine UD44	Nephology	Nephology
Working Period	>15	>15	5-10	>15	5-10	5-10
Position	Lecturer	Teaching Engineer	Lecturer	Doctor	Nurse	Nurse

3.1 Interface Expert Assessment Analysis

An expert's evaluation of the interface's layout to the multimedia components present in the created *3D augmented reality* for personal hygiene care is known as an interface expert evaluation. For the expert, 27 question items had been prepared. The frequency analysis and percentage of the expert acceptance of the product interface design are shown in Table 3.

Table 3: Frequency Analysis and Percentage of Expert Acceptance of Product Interface Design

Item	Frequency		Percentage
	Yes	No	Acceptance (%)
Text			
1. The type of text used is appropriate	3	0	100%
2. The type of text used is easy to read	3	0	100%
3. The type of text used is readable	3	0	100%
4. The text size used is readable	3	0	100%
5. The text size used is appropriate	3	0	100%
6. The text font used is consistent	2	1	67%
7. The type of text used is consistent	2	1	67%
8. The position of the text is consistent	2	1	67%
Graphic			
9. The 3D graphics used are interesting	1	2	33.3%
10. The 3D graphics used are clear	2	1	67%
11. Easy-to-understand the use of 3D graphics	3	0	100%
12. The graphic colors used are appropriate	3	0	100%
13. The arrangement of the graphics used is appropriate	3	0	100%
14. The 3D graphics used are easy to understand	2	1	67%
15. The use of graphic colors is appropriate	3	0	100%
16. Use Graphics that have a clear resolution	3	0	100%
Music			
17. Use of audio appropriate to the content	3	0	100%
18. Audio can be heard clearly	3	0	100%

19.	Audio matches the content	3	0	100%
20.	The audio used does not disturb the user	3	0	100%
21.	The background music used is appropriate	3	0	100%
22.	The background sound used is appropriate	2	1	67%
Interaction Design				
23.	The interaction buttons used work well	3	0	100%
24.	The position of the interaction buttons used is consistent	3	0	100%
25.	Interaction buttons use icons	3	0	100%
26.	The interaction buttons on each display can be identified by them. function	3	0	100%
27.	The design of the interaction buttons used is user-friendly	3	0	100%

Table 3 shows the results of an analysis of the frequency of expert acceptance rules on interface design. On the text item, eight questions were answered by all three panels. Expert 1 and Expert 2 have agreed on all items that the type of text used is appropriate, easy, and readable. Further, he also agreed that the text size and font of the text used were also appropriate as well as the font, type, and position of the text used were consistent. While expert 3 has agreed that all items that are the type of text used are appropriate, easy, and readable. Next, he also agreed on the size of the text. However, three items were not agreed upon by expert 3 namely text font, text type, and text position were consistent.

Next, there are 8 items in the graphics that have been included in the interface design expert questionnaire. Expert 1 has agreed that the use of simple 3D graphics, color graphics, and graphic arrangementis appropriate and easy to understand. But he also disagreed on one item that the 3D graphics used were interesting. Expert 2 has agreed that the color of the graphics, and the arrangement of the graphics used areappropriate and easy to understand. The item that Expert 2 disagreed with was that the 3D graphics used were attractive and the 3D graphics used were easy to understand. While expert 3 has agreed with all the items contained in the graphics that the 3D graphics used are attractive, color graphics, and 3D graphics, the arrangement of graphics used is appropriate and easy to understand. Expert 1 has agreed on the use of audiothat is appropriate to the content, audio can be heard, audio is appropriate to the content, audio useddoes not disturb the user, and lastly, the background sound used is appropriate. Expert 2 has agreed with the use of audio that is appropriate to the content, audio can be heard, audio is appropriate to the content, and audio used does not disturb the user he disagreed with one of the items that the background sound used is appropriate. In addition, expert 3 has agreed with all items. The last is that the background voice used is appropriate. The last item in the questionnaire, this interface design containsan interaction design and there are 5 related questions. Experts 1, 2, and 3 have agreed that the interaction buttons used can work well, using appropriate icons, the interaction buttons on each display can be identifiedits function, and lastly the design of the interaction buttons used by the user.

Finally, the three experts also provided comments and suggestions focusing on graphics, 3d objects, and multimedia elements in interface design. On expert text, item 3 shows the font, type, and position

of the textused consistently has gained an acceptance percentage of 67%. While on the graphic items experts 1 and 2showed that the 3D graphics used are interesting and the 3D graphics used are easy to understand has received an acceptance of 67%. Overall, experts 1, 2, and 3 have chosen yes that is agreed on most items in thedesign questionnaire interface.

3.2 Content Expert Evaluation Analysis

Content expert evaluation is an evaluation conducted on the content contained in the development of *3D augmented reality* on Personal Hygiene Care. This evaluation is implemented on Augmented Reality (AR) 3D applications that are to be developed to ensure that the information to be conveyed to users can bewell understood. 15 question items have been prepared by the developer for experts to answerand 15 items are divided into 3 sub-items namely hospital, community, and school. The findings from the expert review were analyzed and described in terms of frequency and percentage. Table 4 shows the results of the evaluation study of content experts.

Table 4 shows the results of the frequency of expert acceptance of the content design section. The findings through the analysis of the questionnaire form (google form) submitted to the experts showed that the experts agreed that item one is the content of 3D augmented reality on personal hygiene by the title of the study of hand washing, bathing, and nail cutting. Next, experts agreed with item two which is the 3D augmented reality content on personal hygiene care is easily understood by consumers. Experts also agree that the 3D augmented reality content on personal hygiene is clear according to each topic. Next, experts chose to agree on the fourth item which is the 3D augmented reality interface for Personal Hygiene Care is easily accessible by users. On the fifth item, experts choose to agree that the information presented through 3D augmented reality about personal hygiene care is realistic. Six experts agreed that the method of information delivery through the development of 3D augmented reality on personal hygiene care is accurate. The seventh item, experts agree that "Bahasa Malaysia" used in the development of 3D augmented reality on personal hygiene is easily understood by consumers. On the eighth and ninth items, the experts agreed that the 3D model developed corresponds to the topic of Personal Hygiene Care and the 3D augmented reality on personal care hygiene gives a clear picture.

Table 4: Frequency Analysis and Percentage of Expert Acceptance of Content

No	Item	Frequency		Percentage
		Yes	No	Acceptance (%)
1.	The content of 3D augmented reality on Personal Hygiene is in line with the title of the study of hand washing, bathing, and nail cutting.	3	0	100%
2.	The content of 3D augmented reality on Personal Hygiene is in line with the title of the study of hand washing, bathing, and nail cutting.	3	0	100%
3.	3D augmented reality content on personal hygiene care is easy forusers to understand.	3	0	100%
4.	The 3D Augmented Reality Content on personal hygiene care is clear according to each topic.	3	0	100%
5.	The 3D augmented reality interface on personal	3	0	100%

hygiene is easily accessible by users.

6.	The information presented through 3D augmented reality on personal hygiene care is realistic. The method of information delivery through the development of 3D augmented reality on personal hygiene care is accurate.	3	0	100%
7.	Bahasa Malaysia used in the development of 3D augmented reality on personal hygiene care is easily understood by users.	3	0	100%
8.	The 3D model developed corresponds to the title of personal hygiene care	3	0	100%
9.	3D augmented reality on personal care hygiene gives a clear picture	3	0	100%
10.	3D augmented reality on personal care hygiene provides a clear picture of hospitals, communities, and schools	3	0	100%
11.	3D augmented reality content on personal hygiene suitable for use in hospitals, communities, and schools	3	0	100%
12.	3D augmented reality on personal hygiene is easy to understand in hospitals, communities, and schools	3	0	100%
13.	3D augmented reality content on personal hygiene accurately describes hospital, community, and school information	3	0	100%
14.	3D augmented reality content on personal hygiene can be well understood by hospital, community, and school users	3	0	100%
15.	3D augmented reality on personal hygiene is timely and appropriate for hospitals, communities, and schools	3	0	100%

Then, experts agreed on item ten that 3D augmented reality on Personal Care Hygiene provides a clear picture of hospitals, communities, and schools. In addition, experts agree that 3D augmented reality content on personal hygiene is suitable for use in hospitals, communities, and schools. Next, experts agree that 3D augmented reality on personal hygiene is easily understood in hospitals, communities, and schools. Furthermore, experts agree that 3D augmented reality content on personal hygiene accurately describes hospital, community, and school information. Furthermore, experts also agree that the content of 3D augmented reality on personal hygiene can be well understood by hospital, community, and school users. Lastly, experts still agree with the last question item which is whether 3D augmented reality about care personal hygiene is appropriate and appropriate for the hospital, community, and school. Overall, all three experts answered yes i.e. agreed to all items regarding the content design of the developed 3D augmented reality application development. Experts also provide comments and suggestions for improvement in content design.

4. Conclusion

In conclusion, this 3D augmented reality on personal hygiene care has been successfully designed and produced considering the chosen learning approach, the Waterfall Model. The steps included in this

waterfall model have aided developers in delivering high-quality products on schedule. The study's goals, its scope, and its research questions are three aspects that need to be highlighted in product development. To attain the above goals, the design of its product considers these three factors. Therefore, it is hoped that educators can use this 3D augmented reality about personal hygiene careas a medium to impart knowledge about hygiene care.

Acknowledgment

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