Destroy Covid-19: 3D E-book in Augmented Reality & Games Application

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***Abstract*—Coronavirus Disease 2019 (COVID-19) has become a major health problem causing severe acute respiratory illness in humans. The viruses are spreading quickly across the world. With the advancement of today's technology, learning about Covid-19 that affects the world can make the people understand how dangerous this virus can affect the whole world. In order to disseminate information on Covid-19 to the public, an interactive method of learning by using Augmented Reality (AR). To make people aware of the Covid-19 disease, an application named Destroy Covid-19 was developed. AR was chosen as a platform for Destroy Covid-19 since it is the most current and motivating technology that can attract many users. It can increase learning capabilities and deliver knowledge more effectively, straightforward and exciting. A physical activity mobile game was created using the Unity game engine and AR. The principles of E-book visualization have been used, and the application for games makes the information browsing process much more fun and accessible. The application was developed using the Instructional Design model ADDIE (Analysis, Design, Development, Implementation, and Evaluation). An evaluation on the application has been conducted and based on the result, positive feedbacks were obtained from the respondents where they most likely feel satisfied and prefer to use this application. The respondents feel like they will be much more aware of this disease. In the beta testing phase, 51 people used the app to put it through its paces. A post-action survey was sent out to users to measure their interest in the activity. According to the findings, users must also adjust to new improvements in their learning environment. The entire movement has a practical effect on users, shown by positive users' feedback.**

Keywords—Covid-19, Corona Virus, Augmented Reality, Games Application

I. INTRODUCTION

Coronavirus, also known as Covid-19, was detected in November 2019. Covid-19 has been spreading rapidly around the world, including Malaysia. There is a lack of awareness and knowledge about the impact of these Covid-19 viruses on communities. The majority of people took no preventative measures against infection. They clearly disregard for and underestimated the disease. Typically, when a person gets sick, they will visit a pharmacy and purchase over-the-counter medication. Those who were afflicted did not seek medical attention or undergo a proper medical examination. This is why the viruses have spread rapidly throughout the world [1].

Through Augmented Reality (AR), researcher introduces a new application for learning the disease, known as "Destroy Covid-19: 3D Augmented Reality E-Book and Games Application" or in short “Destroy Covid-19”. It is the first platform and application for Covid-19 disease to be developed in 3D and AR [2]. This application is usable on any device that supports the Android operating system.

AR is a technology that superimposes computer-generated virtual three-dimensional (3D) objects over the natural environment in real-time. It is the real-time incorporation of digital data with the user's world; that is, it works with what is already there and overlays new knowledge on top of it [3].

The AR technology can create a new method of learning and can be used to disseminate information which incorporates abundance of novel methods for imparting knowledge. For instance, AR can improve the educational environment, thus can draw people's attention to education. The development of Destroy Covid-19 is explained with visuals, and games included. This application will address the issue of insufficient information regarding virus disease awareness. When conducting any disease researches, AR is an effective method

of communicating the findings. Nowadays, people prefer interactive contents rather than static images or no content at all. This enables them to concentrate entirely on learning and comprehension. Using AR is the optimal strategy for generating interests.

The objective of this study is to evaluate the effectiveness of the new interactive learning method based on 3D AR, which consists of 3D and AR learning system game applications. With this application, it attracts and entices more users to interact as in the real world. This clearly shows that this application can inspire people's impact in the current technology environment. With a better understanding of AR, many users are impressed by the interactive features that were included in Destroy Covid-19 application. Next objective for this application is to develop learning systems and game applications using 3D Augmented Reality (AR). Using Augmented Reality (AR) in this application can have a good impact in the world with new technology. This augmented Reality User can also develop new knowledge, and also users will feel interested in Augmented Reality (AR) technology which is becoming increasingly popular nowadays.

II. Related Works

A. Augmented Reality

In education, augmented reality provides a visual representation of the learning material. It enables teachers to impart interactive learning through multimedia-rich lessons. At the same time, it allows learners to see visual information layered on top of their real-world surroundings, presented through digital devices such as projectors and interactive whiteboards. Augmented reality in education makes teaching surfaces more intelligent, enables digital devices to capture and generate a wealth of relevant insights used to improve students' learning experiences, and has a significant impact on the entire ecosystem [4].

Many companies have already used Augmented Reality to deliver information or create an interesting application for users to feel something interesting. Augmented Reality can provide numerous benefits to both the user and the developer, such as in education. Augmented Reality (AR) in education includes elements that improve learning abilities such as problem-solving, collaboration, and creation to better prepare students for the future. It is also appropriate for traditional pedagogy, which emphasizes technical knowledge and skills [5]. Just using the Augmented Reality can make people give more intention to the information that the application delivers.

Technology can significantly impact and motivate users to learn actively and make contributions to an effective learning cycle. Innovative ways of teaching and learning can lead to lessons that use technology [6]. AR is formally identified as a direct or indirect real-time view of a real-world physical environment in which virtual computer-generated knowledge has been enhanced, according to the Handbook of Augmented Reality. Regarding the effectiveness of this technology, the number of studies on AR has already been growing at a high rate. AR could be visualized as a static 3 Dimension (3D) and animations [7] as shown in Fig. 1.

Fig. 1: Augmented Reality

B. 3D Animation

Animation is a complex process that involves modifying images or structures to make them appear as moving pictures. It is also a show that features a collection of objects, such as marionettes or designs that are subtly different from one another, computer graphics, or photographs that create the illusion of motion when viewed quickly and repeatedly. Unfortunately, since the mould has become more fractured, we are experiencing an emotional reaction to cinematic storytelling. We are starting to immerse ourselves in virtual worlds while misrepresenting our own [8].

3D animations in teaching can be used in almost any subject to improve students' focus and concentration. For example, in a history class, educational animation could clearly show students how their ancestors migrated around the world. Similarly, math teachers could use 3D animation to explain how the principles of geometry are applied in real life. In addition, the significance of 3D educational animation cannot be underestimated. Furthermore, the importance of 3D educational animation in the arts cannot be overstated [9] .

The 3D Augmented Reality contents were created so that users can experience learning and acquiring information through the application while seeing it in real life. This application will include a 3D model, as shown in Fig. 2, as well as crucial data about the Covid-19, such as symptoms, life

effects, sensitivity, and guidance on how to track the virus's development which is available in the E-book. Blender was used to design attractive graphic contents for this application and Unity was used to construct the site for the application [10].

Fig. 2: 3D Animation

C. Covid-19

Coronavirus disease 2019 (COVID-19) is defined as illness caused by a novel coronavirus known as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2; formerly known as 2019-nCoV), which was discovered during an epidemic of respiratory illness in Wuhan City, Hubei Province, China [11]. Coronavirus infection is associated with a high mortality rate in heart disease, diabetes, cancer, and the elderly. COVID-19 is spread in three ways. Breathing in the air while near an infected person exhaling small droplets and particles containing the virus. Having virus-containing droplets and particles land on the eyes, nose, or mouth, particularly through splashes and sprays such as a cough or sneeze, and touching the eyes, nose, or mouth with virus-infected hands.

The depiction of Covid-19 virus can be seen in Fig. 3. The coronavirus will infect both animals and humans. Coughing, fever, headaches, losing sense of taste or smell, frequent movement of the body with chills, trouble breathing, and muscle pain are all symptoms of this condition. Individuals may prevent the signs by taking caution and keeping a healthy distance between themselves. When going out in public, it is important to wear a mask and constantly wash your hands [12].

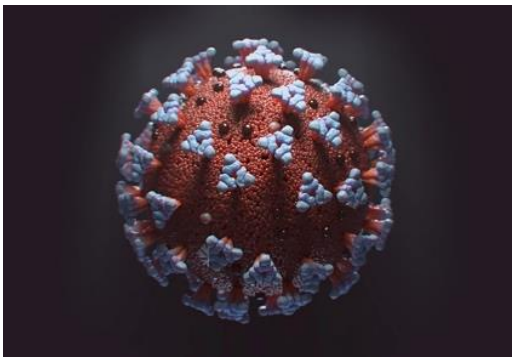

Fig. 3: Covid-19

D. Case Study

1) Pokémon Go

Pokémon Go (short for pocket monster) application. Pokémon Go, as shown in Fig. 4, is a Nintendo franchise that started in the mid-1990s as a game for the Game Boy. The game revolves around imaginary characters known as Pokémon, where humans (Pokémon Trainers) capture and train to fight one another. The Japanese franchise became well-known for its distinctive visuals and endearing characters. The famous game spawned from a successful franchise that included television, trading cards, comics, and toys. Pokémon Go has made a major comeback in the form of a location-based mobile game 20 years later [13].

Fig. 4: Pokémon Go Application

2) AR Liver Viewer for Anatomy study

AR Liver Viewer for Anatomy study of an Augmented Reality Liver app as shown in Fig. 5. These apps clearly show the tool's ability for real-time 3D medical education and are delivered in real-time using highly detailed anatomical models. It is one of many applications produced by a team of anatomists, medical illustrators, designers, and researchers using real-world CT imaging data and the most detailed 3D modeling technology available for iPad 2 and current iPad. This AR Liver is suitable for high school students, diplomas, bachelor's degrees, and health professionals [14].

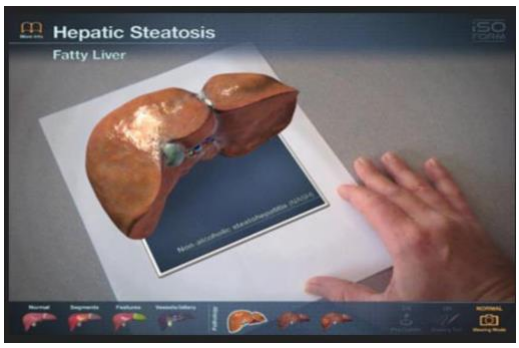

Fig. 5: AR Liver Viewer

3) Firefighter 360 Games

This firefighter 360 game implements Augmented Reality to make the game more like the real world. This video game needs a first-person shooter as shown in Fig. 6 to uses water to put out the fire. The player must use the joystick to look around and search for the fire before extinguishing it. The goal is simple: the player must extinguish the fires that appear on whatever street they are standing on (as viewed through their phone screen [15].

Fig. 6: Firefighter 360 Games

TABLE I: TABLE OF COMPARISON

Approach	Strengths	Weakness
Pokémon Go	The game involves going from place to place, players will explore places that have never been before.	Players will have to deal with the Pokémon online. Every time they play, the game expects players to be linked to the internet.
AR Liver Viewer Anatomy Study	The view of Augmented Reality is more realistic after scanning, and the 3D is more detailed.	The application did not provide any narration for explanation after scanning.
Firefighter 360 Games	Make player interested in searching the fire by a move around to 360º.	Player need to move 360º to extinguish the fire. It may be dangerous if they focus on the hand phone searching the fire without seeing what is in front of them.

III. METHODOLOGY

ADDIE Model is represented in Fig. 7 has been used as the guideline for the development of this. To put the idea into action, ADDIE (Analysis, Design, Growth, Implementation, and Evaluation) method has been used. This method is used due to its systematic approach to the instructional development of an application [16].

The systematic instructional ADDIE model was used at each point of the 3D Augmented Reality E-book development, including the study phase, design phase, construction phase, implementation phase, and evaluation phase. The model offers continuous or formative input while designing instructional materials. Each phase in the model has an impact on the one before it. Today, the influence of the ADDIE method can be seen in most instructional design (ID) models being used [17].

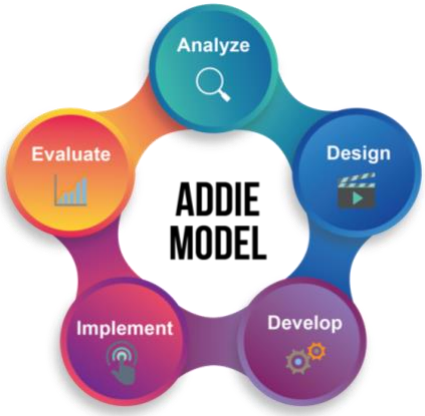

Fig. 7: ADDIE Model

A. *Analysis Phase*

The analysis phase is an important stage in the process of running a project. To save the course, effort, and time, instructional designers must first go through an analytical phase before moving on to the planning, production, or execution phases. The learning difficulties, goals and expectations, audience needs, existing knowledge, and other related characteristics will all be established during the review stage. This phase is used to establishing instructional objectives, learning objectives and developing instructional analyses that include required steps, current learning opportunities, and the application of new information in instruction.

An initial analysis was conducted on the project title, information of the disease, software required for the 3D, Augmented Reality (AR), and games. In order to cover the report's area of expertise, context analysis for the thesis must be completed. Finally, the pre-questionnaire needs to be ready to be given to the intended respondents.

B. *Design Phase*

The design method is a practical teaching or learning approach that focuses on the development of action-oriented learning for direct instructions. The following components are examined throughout the design process: learning objectives, assessment methods, drills, materials, subject matter analysis, and lesson planning. At this stage, the preparatory phase's ideas will be documented in a storyboard, including all rough sketches used to visualise the previous phase's ideas and refined

to meet the applications design requirements. This project has several sections, such as a guide, Covid AR, and a game. The main menu of the application is shown in Fig. 8. In this phase, it is imperative to define multimedia elements used in the subsequent development project.

Fig. 8: Main menu of Destroy Covid-19

In Fig. 9 is showing the flowchart that the researcher has already developed to explain how the application will work for the user. It focuses on the prototype's knowledge and development. After the researcher has integrated all content into the mobile application, researcher will focus on the design and details of the user interfaces. Then, five Augmented Reality 3D models of the virus will be included in the Augmented Reality scene, along with their details. The user can zoom in and out, and rotate to see the entire Animation that appears after scanning the book. After clicking the Games button, the user is taken to the Intro game scene, which contains an introduction of the game. Users will see some story that researcher already includes to make user can understand about this game before clicking the skip or play button. This scene will show user how to use the joystick or will provide information about the games. If a user requires additional information, user may do so by pressing the button that already appear in the game scene. The game can be stopped and restarted if a player dies while playing. At the conclusion of the game, a game over will appear. After that, user will user how many points they already receive. This mobile application can help users accumulate disease-related information, increase their awareness of the disease, and experience a more detailed 3D Augmented Reality (AR) representation of the condition.

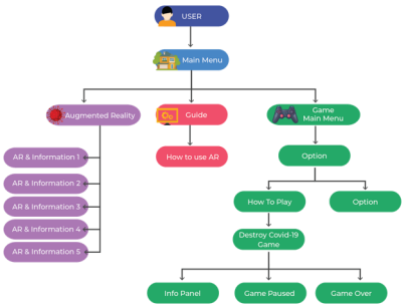

Fig. 9: Flowchart of Destroy Covid-19

C. Development Phase

The development stage is where instructional designers build and incorporate content resources for the powder-coated plan period, as well as produce and prepare the actual learning material used during guidance. The innovation is integrated with the instructional situation, strategy, and, if the chosen technology does not perform, an alternative course of action is considered by the instructional planners [18]. Any improvements offered will be performed with a survey and make any required project changes. Researcher uses the Unity software framework and the C# programming language to complete a portion of the project. Blender software is used to create the 3D model, object, and model used to generate Augmented Reality in Unity software. Finally, the smartphone was selected as the best platform for my hardware design application. Project Scene is depicted in Fig. 10.

Fig. 10: Destroy Covid-19 interface

D. Implementation Phase

During the assessment process, which took place near the end of the execution period, raw data as well as data collected through semi-organized interviews, questionnaires, and observations were saved and prepared for the survey [19]. Prior to beta testing and assessment, a supervisor managed compilation and alpha testing with the team. The analysis is required to ensure that the quality is clearly understood. The technique should be used to ensure there are no errors when

introducing the element. This level should cover the learning outcomes, goal, cause, methodology, strategy conveyance, and testing. Last but not least, and depending on the requirements, the researcher should put in a lot of effort. Consider and double-check the mission's organisation, planning, essential issues, and material.

E. Evaluation Phase

The analysis or assessment process is the final step. The product is presented, and the prototype is tested during the project's evaluation phase. The Post Questionnaire will be distributed to the final step is the analysis or assessment process. During the project's evaluation phase, the process is facilitated, and the prototype is tested. The Post Questionnaire will be distributed in order to assess the potential of the application. Finally, development proposals must be submitted. Following the viewing of the project's presentation video, randomly chosen users are given a 20-question questionnaire. This includes questions about the user's lack of augmented reality experience. The questionnaire was distributed at random to 51 people. The assessment could not meet with the content specialist and target customers to complete the evaluation process due to the pandemic.

IV. RESULT & DISCUSSION

The application was tested among the project's developers during the initial assessment; no users or clients were involved. This test is performed to ensure that the application is free of errors and bugs and that it has been improved as needed. Finally, at this stage, an actual evaluation has been performed. The research was conducted using an online Google Form with 20 questions distributed to 51 target respondents who tested and evaluated the application individually in a controlled environment. Users can select whether they want to download the application to try it or watch the application's demonstration video in Google form. Finally, as this application was used, most users strongly agreed that Destroy Covid-19 had improved, and the study's findings are shown in Table II.

The next question is about if that user is aware or knows about Augmented Reality. Regarding respondent's agreement that they are aware of Augmented Reality, the data show that some respondents were not aware of the technology. As shown in Table II, seventy-five (75%) of respondents say yes, and twenty-five (25%) percent say no if they are aware of Augmented Reality. The majority of those who were familiar with Augmented Reality were aged 13–18. Therefore, the researcher must determine why some users are still unaware of augmented reality or have never used it. This is because users have never heard of it or seen it in any application. There is a total of 13 people who have responded to these questions. These questions may help researchers determine how to promote Augmented Reality more effectively.

The next question is about interface colour, and the design is user-friendly. These terms of respondents agree that the interface's color and design are user-friendly. As shown in Table II, most respondents agree or strongly agree that the interface's color and design are user-friendly. After researching this subject, most researchers concluded that additional guidelines should be added to make the application more user-friendly. According to the questionnaire results, most of those say it is the only age range between 26 and 40 years old. The researcher posed this question to ascertain what needs to be improved.

The following questions are respondents' level of agreement that all buttons were functioning correctly. As can be seen in Table II, most respondents strongly agree that the button works that way. The main objective of this question is to help the researcher achieve a successful application result.

In terms of respondents' level of agreement that 3D Augmented Reality (AR) of the Destroy Covid-19 is attractive. As shown in Table II, almost forty-five percent (45%) agree this application is attractive. While thirty-nine percent (39%) strongly agreed. Meanwhile, the remaining sixteen percent (16%) of respondents agreed or disagreed that the 3D Augmented Reality (AR) of the Destroy Covid-19 is attractive. This question was created because the researcher needs to know if this application is successful in making it attractive. Therefore, the researcher needs to make some improvements to make the application more appealing and interact with the user. Thus, this question can help the researcher improving more.

The last question is whether 3D Augmented Reality and Games are very useful for education and informing people. As shown in Table II, half of all respondents, forty-eight percent (48%), strongly agreed on how the application's information was delivered, while forty-five percent (45%) agreed. Meanwhile, the remaining ten percent, seven percent (7%) of respondents, agreed or disagreed that whether 3D Augmented Reality and Games are truly useful for educating and providing information. Therefore, most respondents strongly agree that 3D Augmented Reality and Games help educate and inform people. This result was created to assist researchers in providing correct information details and to assist respondents in understanding the information provided within the application. Furthermore, for the researcher to fully comprehend the information provided about the disease, researcher must

continue to improve. Based on the answers to this question, it is possible to make additional improvements.

TABLE II: RESULT QUESTION

Result/ Question	Strongly disagree (%)	Disagree (%)	Neutral (%)	Agree (%)	Strongly Agree (%)
The colour and design interface are user friendly.	0	0	25	45	35
All the buttons functioning properly.	0	0	10	32	58
3D Augmented Reality (AR) of the Destroy Covid-19 is attractive.	0	0	16	45	39
The 3D Augmented Reality and Game are really helpful to educate and give an information.	0	0	7	45	48

This segment is for users who have never used 3D Augmented Reality before.

The results of question 20 are depicted in Figure 18. Fifty-five percent (55%) of respondents said they wanted to use the Augmented Reality application, while forty-five percent (45%) of the remaining respondents said they did not. Thus, the researcher can determine whether or not the respondents want to know about the Augmented Reality application based on the results of this question.

Fig. 11: Question 18 result

As a result of the Fig. 12 question about respondents' willingness to try using an Augmented Reality application, seven of them indicated that they were unwilling to learn about it due to its difficulty of use. This result is visible to the researcher. According to some, this AR is difficult to use. Perhaps in the future, researchers should make it easier to understand and user-friendly to use.

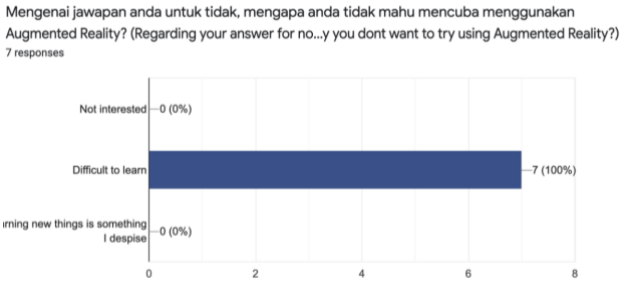

Fig. 12: Question 18 for no result

As displayed in Fig. 13, 100% percent of respondents agree that they will recommend this application to their friends. This shows that the application is suitable for use and that it is critical to have an attractive design and detailed information in order to capture the respondent's attention. This questionnaire's outcome was consistent with the researcher's expectations.

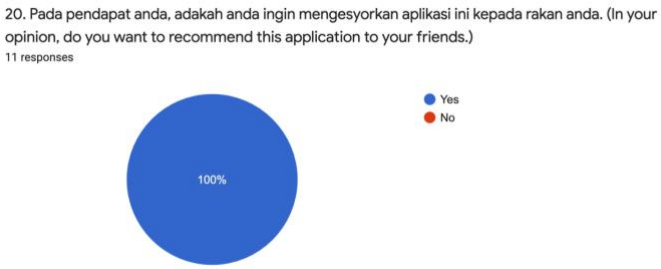

Fig. 13: Question 20 result

V. RECOMMENDATION AND CONCLUSION

A few aspects of the Destroy Covid-19 application could be improved. A few suggestions for the future have been made:

- Future researchers working on this project can enhance the framework by adding new technologies, features, and content. Maybe more features will be added to help provide more details that can be used in any company that needs other diseases in a single application. The researcher can use this to add or modify this application.

- On the game side, researchers could work on other projects like creating Augmented Reality games. In addition, to help people learn more about Covid-19 disease, researchers need to provide a basic understanding of the disease.
- Researchers can now improve the Destroy Covid-18 application using Virtual Reality (VR) software. Because VR allows users to interact in a 3D environment, researchers found that virtual reality could be a motivating platform for children to safely practice social skills, including those with autism spectrum disorders. A technology company has created scenarios that allow children to learn pointing, eye contact, and social connections. Parents can also interact with a tablet.
- With this Destroy Covid-19 application, researcher highly hopes that more people will gain knowledge and awareness of Covid-19 disease. With more exciting and attractive applications, people will learn more about Covid-19 disease and react if the disease affects them by learning the information given in E-book to avoid the disease. Finally, it is a lot to gain from the application for viewers. This application also a lot to improve to discover what works best or improves what works and what doesn't work for the viewers.

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