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Implementation of Augmented Reality in a Mobile Application for In-Flight Emergency Equipment and Evacuation Procedure

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ABSTRACT

Aircraft safety is the highest priority for every airplane. In relation to this, emergency procedures must be learned when onboarding the aircraft. In the current method, flight attendants will explain the proper procedures should any emergency happen by demonstrating it in front of the passengers or using the handout provided at each seat. However, this method is not promising because passengers might not be unaware of the safety procedures due to unclear explanations and distractions from the surroundings. Hence, taking this as an opportunity, this study aims to design an application that provides information about emergency equipment and evacuation procedures inflight, develop a mobile application that will include augmented reality, and to test the usability of the augmented reality using the System Usability Scale (SUS) Model to evaluate on the user enjoyment while using the application. This study also implements the TRES-D methodology due to its suitability and provides a complete guideline to develop the augmented reality-based application. The results show that the overall response to the questionnaire provided favourable feedback on the application and demonstrated how the aspects of the application work well together. Thus, it concludes that the users enjoyed the programme and interacted well. Future work on this study can be applied by making the application available on iPhone OS as well as providing more features to the users.

1. Introduction

In the modern world, there are many modes of transportation via land, water, and air. The most popular method travellers use to get where they are going fast is via plane. Over the past ten years, there has been a steady growth in the number of people who want to travel by air [17]. Although it is uncommon to hear about accidents caused by airlines, travellers should become more aware of the aircraft's safety features. The necessity of passengers escaping from aircraft in the case of an incident is becoming more and more crucial for aviation accident survival. Because of years of

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research on in-flight safety, people have begun understanding the importance of passengers' interest in the supply of in-flight safety information and distribution of information [6].

The aircraft's safety features cover every step of the safety evacuation methods, including where to find the life vest, how to use the oxygen mask, and how to open the emergency exit door. According to Wang *et al.,* [24], the use of dynamic emergency evacuation signs to improve passengers' perception of wayfinding aids, the use of safety demonstrations or safety videos to strengthen the education of passenger safety knowledge and to improve emergency response capabilities are all important aspects of the safety procedure.

Every airline must do a pre-flight safety demonstration before passengers begin boarding. The cabin crew will perform the safety demonstration or show it via a video. However, most passengers do not take emergency situations seriously and are unaware of how to evacuate, which could impact them when they arise [21]. A study by Shiwakoti *et al.,* [20] found that when the emergency alert went off, some passengers would wait for instructions from station staff or the public address (PA) system before leaving and they have proven to be illiterate in crisis situations. Besides that, presenting the aircraft's safety information was not attractive. The safety demonstration best addresses this issue when it is engaging, vibrant, imaginative, and creative [7].

The goal of this study is to develop an Augmented Reality (AR)-based safety information system for passengers that will improve their comprehension of flight safety information. As a result, this project will offer a realistic seat model and details on how to utilise the safety equipment and where it is placed. Besides that, a video about life vests will also be included to improve the application's usability. In addition, an animated plane with guidance about the emergency exit also will be one of the application features. The study's usability is measured to ensure it can increase passenger awareness. The following is the paper's structure:

i. an introduction
ii. references to other works that discuss aircraft procedure
iii. methodology, which describes the steps taken to complete the project
iv. result and discussion, which examines the usability testing and project results
v. the paper's conclusion

2. Related Works

2.1 Aircraft Emergency Simulation

An aircraft emergency is a situation where a flight might experience a problem and it may lead to a threat to the airplane and its passengers. Hence, every flight passenger must be equipped with knowledge and understanding of measures to be taken during such a situation. Despite depending on the instruction and explanation provided by the aircraft crew before boarding, aircraft emergency simulation is one of the cost-effective methods available for demonstrating the real situation during an aircraft emergency. It shows that the success of evacuation during an aircraft emergency could help to increase the survival rate [5].

Aircraft emergency simulation is a model used to imitate the real situation during a flight emergency. The challenge that exists in developing the aircraft simulation is the complex structure of the aircraft itself including the layout of the aircraft itself. In addition, the wayfinding information such as the exit door, evacuation map, emergency alarm, and location of the safety equipment is hard to comprehend by the passenger [24]. Hence, the development of aircraft emergency simulation is believed to increase passenger understanding and preparedness.

There are many available aircraft emergency simulations in the literature. Poudel *et al.,* [17] developed the Cellular Automata-based simulation model for the purpose to replicate the aircraft evacuation real-case scenario. Next, the three ongoing developed simulation tools for aircraft emergency simulation that are widely accepted are EXODUS from the University of Greenwich, PATHFINDER invented by Thunderhead Engineering [16] and STEPS by Mott MacDonald Simulation Group [8]. All the above-mentioned simulations are able to imitate the real scenario during an aircraft emergency [5].

2.2 Aircraft Emergency Equipment

Today's airplanes range from the smallest to the largest superjumbo jets. There are numerous airlines worldwide, ranging from low-cost airlines, which offer the cheapest tickets, to airlines that offer their clients comfort. All airline companies provide a wide range of variations to improve their services. But everything will remain the same when it comes to the safety equipment. The same emergency supplies, including an oxygen mask, a life jacket, an emergency floor light, and an emergency escape, are present on these aircraft. Every seat receives a life jacket, which is always tucked under the seat but varies depending on the class. When a life vest is required, it's crucial to avoid using it inside the aircraft or blowing it up instead of utilising it outdoors. In emergency scenarios, it is rumoured that a well-trained cabin crew helps all the passengers [4]. This ensures that all the passengers can survive during the safe evacuation. Life vests and other safety equipment must be replaced after a specific time has passed so that other passengers can use them. To significantly increase passenger safety, all of the aircraft's emergency equipment frequently needs to be rechecked [21]. Table 1 shows the standard safety equipment in the aircraft.

Table 1
Safety equipment

Oxygen Mask		The oxygen masks fall under the overhead compartment during an oxygen shortage inside the cabin.
Life Vest		The life vest for an airplane in case of a water emergency.

Safety Card		To avoid confusion between the passengers and emergency procedures, the safety card should depict the situation exactly as it is (Butcher *et al.,* [3]).
Life Raft		In a flight emergency, use the life raft that was kept near the emergency exit.

2.3 Pre-Flight Procedures

There are few safety procedures in the pre-flight protocol, such as during turbulence, where the cabin crew must ensure what they do to the passengers to avoid injury to the passengers [23]. To ensure that the passengers can survive an emergency, the cabin staff must explain all safety measures to the passengers. The passengers must be instructed on safety information as part of the pre-flight protocol since it is crucial. Even though the passengers are aware of the safety instructions, they must escape in an emergency [19]. Travelling by an airplane is the safest transportation in the world and this is supported by several factors, such as the quality being in the best condition and the flight procedures being thoroughly followed [12]. Pre-flight safety briefings are essential to provide to passengers before they board the aircraft; they not only inform them of the aircraft's safety emergency procedures but also alter their emotional state in the event of an emergency.

2.4 Augmented Reality and Flight

Azuma, as cited in Schaffernak *et al.,* [18] believes that 3D technology Augmented Reality (AR) helps enhance the real world with virtual objects but does not replace the real world, unlike virtual reality. In addition, AR is characterised by offering a real-time interaction with the user as both real-world and virtual objects can coexist in a common environment in real-time.

At first, AR was used in the aviation industry for the emergency training purpose. AR was used to help the Cabin Crew during Training especially to face the emergency. The AR mimic the real Boeing 787 Dreamliner of Virgin Atlantic to give real view during simulation when the emergency happens [4]. Now, AR was rapidly growth in aviation industry for Pilot training as it is more learner centred, immersive and help to visualize current situation for the pilots during training [9]. Interest of AR has been expressed in aviation industry to support during training and simulation [2]. From the Research, Abnormal and emergency procedures in planes was the highest benefited from the AR based learning compared to other aviation simulation [9]. Nowadays, people attracted to the AR as it is very interesting and improve the learning intention [25].

AR has a long history in the aviation industry. Caudell and Mizell (1994), cited in Schaffernak *et al.,* [18], found that AR has been mentioned in supporting aircraft manufacturing at Boeing. According to De Crescenzio *et al.,* as cited in Schaffernak *et al.,* [18] it has been shown that there was an improvement in task efficiency when AR was used for aircraft maintenance training. Brown (2017), as cited in Schaffernak *et al.,* [18] talked about AR in aviation training transformation. She mentioned the new techniques can be useful in bridging the gaps among classroom, simulation, and practical operations. She added to understand the internal processes better, users are allowed to examine and interact with an engine. Moreover, other possible use cases including Procedure training, aircraft systems training, aircraft familiarization, maintenance training operations, cabin familiarization and training, virtual manuals, and hands-free remote assistance have been proposed by her.

Fadden *et al.,* as cited in Adam Biggs *et al.,* [1], mentioned the AR benefits of reducing the need to visually scan between the outside-the-window scene and the cockpit instruments because relevant flight information can be superimposed on the outside world. According to Weinstein and Ercoline, as cited in Adam Biggs *et al.,* [1], pilots will be able to spend more time looking at the outside world because visual transitions are kept to a minimum. To maximize these benefits, Fadden *et al.,* as cited in Adam Biggs *et al.,* [1], believe that AR flight displays are most often collimated to optical infinity, reducing the burden of re-accommodation between instruments and the outside world while also smoothing the transition between the two types of information. Moreover, AR displays can link information to the real world. For example, an artificial horizon overlaid on the real horizon helps to integrate different sources of information and better link the display with the world. Moreover, a few existing applications are related to the research, such as optimARes, Euro Seating AR, and Zodiac Aerospace Seating AR. Table 2 compares the application mentioned with our EEPAR application.

Table 2
Comparisons among existing applications

Application	optimARes	Euro Seating AR	Zodiac Aerospace Seating AR
Operating System	Apple	Android	Apple and Android
Content	- Allows the user to interact with the seat models created in the application in the physical AR. - By pointing the camera lens to the marker, users can easily use the application and simulate the chair with their features. - resizes the chair by pinching the screen and rotate the chair based on the user's preference. - Provides the seat feature that the user can interact with, such as the chair's reclining angle and other seat components.	- can be used by using the brochure provided, which acts as the marker for the user to scan before starting to use the application. - By scanning a side of the brochure containing the AR logo using the smartphone's camera, the AR model will automatically display on the screen. - User can view the model with an actual scale and resize the chair.	- 3D model of this application provides interaction to the user by giving the usability to the user for freely rotating and scaling the flight seat. - provides a detailed texture for the user to get highly experienced with the actual seat. - Users can easily change to AR mode by tapping the button on the screen. During the AR mode, the user must find the application marker so that the application can scan and pop up the model on top of the marker. - moves around the model 360 degrees and move towards the model. - can use the animation of the screen to change the set position into a flatbed and seat position from upright to inclined.

	- more to the seat design and appearance		
Type of AR	Marker-based	Marker-based	Marker-based
Technology Approach	Web	AR	AR
Model	3D	3D	3D
Function	Seat viewer with real interaction	Seat viewer	Seat viewer with real interaction
Advantage	- Using realistic model - Users can have the experience like the real seats	Using realistic model	- Easy and enjoyable to use - Many types of interaction with the user.
Disadvantage	No emergency equipment	Lack of functionalities	No emergency equipment

For the project, EEPAR will use both types of models, which is 2D and 3D. The main function of this project is to provide interactivity between the user and the emergency equipment of the aircraft. This ensures that the user will have the real situation based on the position of the equipment at the seat. There are several advantages of this project. First, the user will be provided with an exciting delivery type of information. The safety equipment and how to use it has been delivered in an uninteresting way on this day, and this causes troubles for the passengers to understand the procedures. Therefore, this project provides an interactive experience in a form that the user can quickly learn and find interesting. Besides, this project also provides a real experience inside the aircraft. The aircraft's seats and features are the same as the real model. All of the emergency equipment is also located in real places in order to enhance the usability of this application.

Besides that, EEPAR uses the QR code as a marker and is placed it in front of the user at the back of the front seats. This is a lot easier as it is accessible to every user. Although there are a few advantages of this project, there is also a disadvantage: this AR application can only be used by certain airlines as the model has to be created first before it can be used.

3. Methodology

This study implements ThREe-dimensional uSer interface Development (TRED-D) methodology to complete the project. It aims to recognise the roles, tools to perform the activities, and the guiding principle. There are six stages of TRES-D method that need to be followed to build this AR mobile application for inflight emergency equipment and evacuation methods. The phases in TRES-D are:

i. initial requirements
ii. understanding requirements
iii. concept design
iv. iterative design
v. building and implementation
vi. deployment and maintenance [11,13].

Figure 1 shows the phases in the TRES-D.

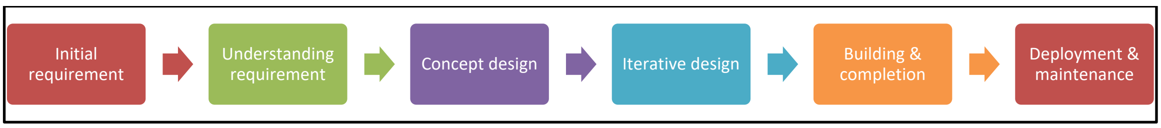

Fig. 1. Phases in TRES-D

3.1 Initial Requirements

The research was conducted by making references to a number of theses, publications, journals, and relevant websites during the initial requirement stage to learn more about the project and develop goals and problem statements about AR for this study.

Passengers boarding an airplane are taking less serious about cabin safety and the evacuation procedure. As soon the passengers aboard the plane the cabin crew have to demonstrate cabin safety as it is the responsibility of the airlines and will affect the passengers' mood [22]. Passengers who are boarding the aircraft are not aware of the safety of the aircraft. There are two ways the safety briefing should be done. First by watching the safety briefing and the other one is by reading the safety card. Based on the survey 69% watched the safety briefing but only 14% thought it would help for the evacuation 39% read the safety card and 16% thought it would help for the evacuation. Furthermore, passengers who board the plane do not pay attention to the safety flight briefing by the flight attendant. Moreover, the passengers assume that they know all of the things about safety information and do not need to know more.

Next, the way the safety information was delivered was not clear enough. A large number of passengers lost their lives when the aircraft accident occurred. The investigation shows that the safety information briefing is not clear and not in a specific manner to the passengers. Passengers have to be brief about the safety information so that the passengers especially children will easily understand the safety of the aircraft [7]. In addition, the Civil Aviation Safety Authority of Australia (CASA) informs that the well-delivered information to the passengers will help them to survive during emergency evacuations.

Last but not least, the method of presenting the safety information about the aircraft was not interesting. Airlines have provided many types of safety information but many passengers ignored it because of distraction, lack of time and uninteresting methods of presentation. Besides, the children who board the planes along with their parents need to know about the safety information procedure but in an attractive way such as in cartoons or something that they can easily learn. By using the interesting way, it can attract the passengers along with their kids to know about the safety procedure. In addition, the safety demonstration was found effective when it is interesting, lively, dynamic and innovative. Thus, this will attract the passengers to know more about the safety of the aircraft.

3.2 Understanding Requirements

During this step, the study’s needs were identified and comprehended. The project would be able to provide the user with interactive, simple-to-understand information about aeroplane safety. Function-related criteria and non-function-related requirements were both applied to this study. The project's functional requirement was when the application became useful and achieved its goals. In the meantime, this product's non-functional requirements included the seat model's similarity to a real aeroplane, the absence of safety information, and the unattractiveness of the safety information's presentation.

3.3 Concept Design

A flowchart and a storyboard were created based on the project's inspiration from the study. The application's design was made based on opinions from experts and airline policies. The low-fidelity storyboard and the flowchart were the results of this stage. An example of a low-fidelity storyboard used by the designer to build the environment of the AR application is shown in Figure 2.

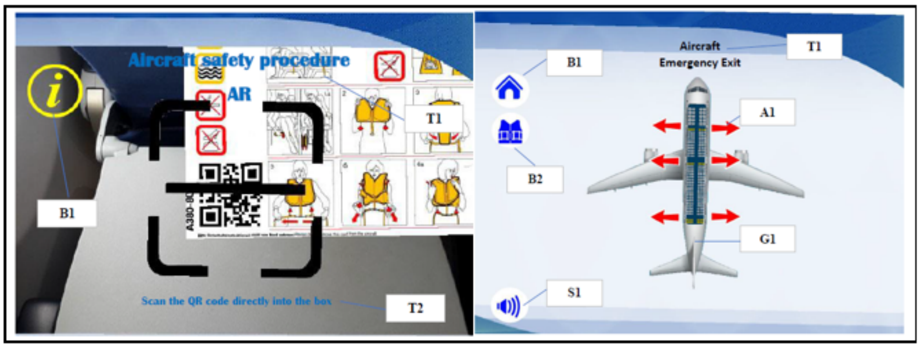

Fig. 2. Example of a low-fidelity storyboard

In the meantime, Figure 3 depicts the application's system structure and the steps that a user must take to use the EEPAR. In the following phase of the development process, these two processes are crucial. The system's flow and the required design must be thoroughly understood by the developer. Because the design is based on actual end-user requirements, it is important to follow. If the developer does not comprehend the layout and style of the virtual reality application environment, it will have a significant negative effect.

The essential steps a user will need to take to use the application are highlighted in green in Figure 3. The user will be able to determine what to do during an emergency during boarding time by carefully following all the primary operations. The user must comprehend every step of the process because it serves as a guide and prevents anxiety in case of an emergency.

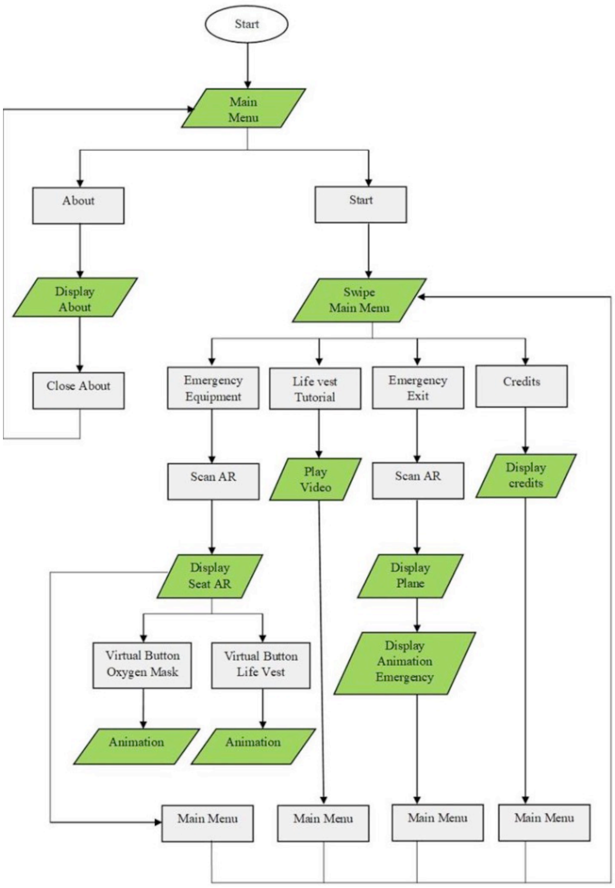

Fig. 3. EEPAR system architecture flowchart

3.4 Iterative Design

Presently, there are two distinct designs: presentation design and abstract design. Up until the completion of the final design, these two designs were used. The iterative design using the abstract and presentation design is shown in Table 3.

Table 3
Iterative design using the abstract and presentation design

Abstract design	Presentation design
Do not rely on the project software and hardware requirements.	Rely on the project software and hardware.
This project will create a storyboard and give it to the possible user, who usually boards an aircraft.	This study will have an application prototype for potential users who frequently board an aircraft.
The usability of the application to the user will be noted and fixed in the application.	The application will note and fix the prototype's usability to the user.

3.5 Building and Implementation

Every plane that flies need to have a piece of working emergency equipment in case an emergency happens. This emergency equipment needs to be in a specific place that is easy to take out by the passengers. The model in the project also needs to follow the aircraft emergency layout to make sure the model is good. The plane seats will be different from other airlines. This is due to the different seat layouts offered by the airlines themselves. Most airlines will locate the life vest underneath the seat and the oxygen mask under the compartment above the head. This has been used in most airlines as it is easier to take during an emergency.

In this project, we used the AirAsia Airbus A320-200 safety information and seat layout as our benchmark to make sure the model built is not falsely invented. In the project, we located all the emergency equipment such as a life raft, life vest, oxygen mask, and seat same where it is located in the AirAsia plane. This was done to ensure that all models in the project achieved the specifications that had been used in the Aviation industry. In the project, only seat shape and colour were different as we wanted to create our layout to suit the project's theme colour.

Fig. 4. AirAsia’s safety information and seat configuration

The developer developed the prototype using specific hardware and software before the testing phase, named EEPAR. The software used in this study is as in Table 4, meanwhile, Table 5 shows the hardware requirement for users.

Table 4
Software requirements for the developer

No	Features	Requirements
1.	Operating system	Windows 10
2.	Programming Language	C#
3.	Modelling Designing Tool	Autodesk 3ds Max, Blender
4.	Editing Designing Tool	Adobe Photoshop
5.	Video Editing Tool	Wondershare Filmora
6.	Scripting Tool	Qualcomm Vuforia
7.	AR Engine	Unity

Table 5
Hardware requirements for the user

No	Features	Requirements
1.	Device	Smartphone
2.	RAM	2GB
3.	Storage	32GB Internal storage
4.	Processor	Qualcomm Snapdragon 865
5.	Camera	12MP Camera

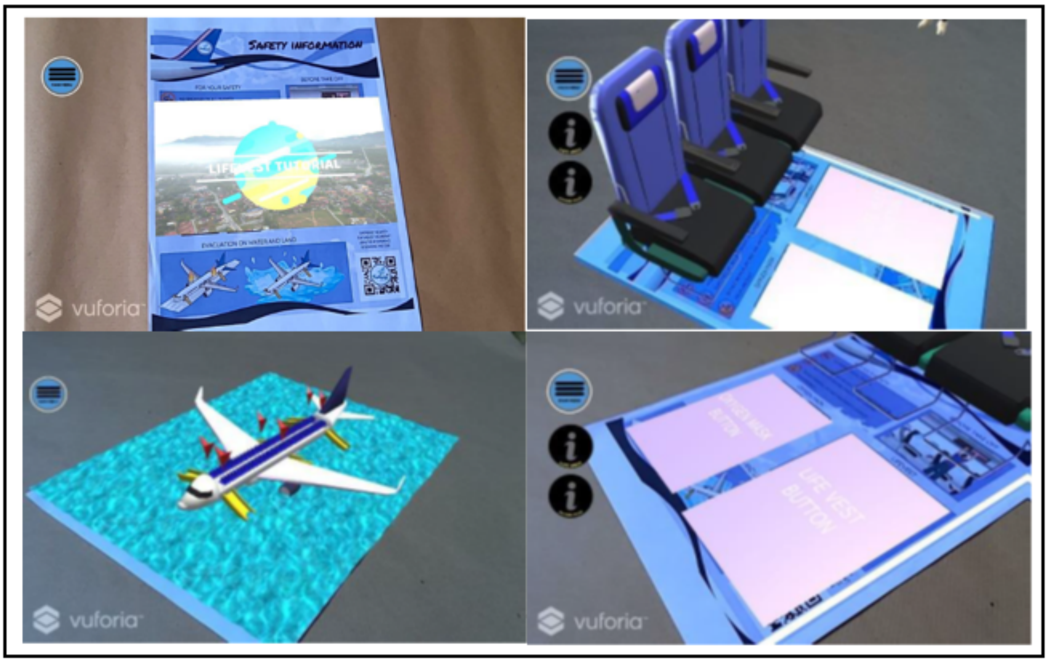

Fig. 5. Examples of EEPAR interfaces

This application also includes a video scenario. A video has been recorded, edited, and uploaded to the programme. To give the viewer additional information about the life vest, this film was made. When the scene begins, the video will automatically begin playing; it will stop when it is over. In addition, the video was shown in augmented reality to increase user involvement. A straightforward C# script has been built for the video player script so that the video can be played once the scene begins. Because the script wants the user to focus entirely on watching the video, it does not allow the user to stop, pause, or speed up the video. Since playing the video is all that is necessary, the script will be shorter. Figure 6 displays the AR-enabled video utilised in EEPAR.

Fig. 6. Video player in the application

3.6 Deployment and Maintenance

Testing and analysis were done at this point. Utilizing the System Usability Scale (SUS), this project carried out usability testing. Since it examined user performance, system potential, and the application's reusability, the SUS questionnaire was chosen to test the application's usability for this project. To test the application, participants were chosen among those who were familiar with flying to their destination to obtain a high-reliability result. Random airport travellers, family members, and children were chosen to test the application. Each participant examined the application and responded to certain predefined questionnaires. This test had twelve participants.

3.7 Experimental Design
3.7.1 Participants

Participants have been identified to test out the application. In order to get high reliability results, testers need to be from the person who has experience in taking flight to their destination. Random passengers at the airport, relatives and kids have picked to test the application. The application was tested by all of the participants and answered questionnaires that had been prepared. 12 participants have been tested on the application, to get the most reliable result for the System Usability Scale (SUS) the number of testers need to be between 8 to 12 testers.

3.7.2 Procedures

Testing sessions have been done at the airport as to approach the community with experience taking flight to destination was easier to be found. Firstly, the testing start off with the introduction about the application. All of the procedures on how to use the application have been stated in the application and just need to be followed by the tester. After the testing phase has been completed, the tester will answer the questionnaire provided.

3.7.3 Instruments

Questionnaire was separated into two parts which is the tester's demographic that includes gender, age and experience in taking the flight. Second parts for the question will be the usability of the application. Table 6 shows the table for the tester's demographic.

Table 6
Demographic of the participants

Item	Options	Frequency (n)	Percentage %
Gender	Male	6	50
	Female	6	50
Age	Under 19 years old	3	16.8
	20-29 years old	3	33.3
	30-39 years old	3	33.3
	40-49 years old	2	8.3
	Above 50 years old	1	8.3
Experience in taking airplanes	Yes	12	100
	No	0	0
Able to use the mobile device	Yes	12	100
	No	0	0

According to Table 6, a balanced number of participants between male and female has been produced to get the well-balanced result. From the age under 19 years old to above 50 has been tested using the application which the target users are suitable for all ages. All of the participants of the testing phases have experience in taking flight to their destination and are aware of the procedures involved during the flight. All of the participants also knew very well how to use the mobile devices. Second part of the questionnaire will focus on the usability of the user when using the application in order to satisfy the third objective for the project which is to test the usability of the Augmented Reality Emergency Equipment and Evacuation Procedure inflight Mobile Application. Each of the questions have five different scales to be selected. 10 questions as shown in Table 7 from the System Usability Scale (SUS) have been used to provide the questionnaire to the user.

4. Results and Discussion

The SUS has its formula to calculate all of the answers by the tester. Several steps must be followed to get the most accurate result. Firstly, all of the answers were converted into numbers. For example, the strongly agree scale was converted into 5, agree to 4, moderate to 3, disagree to 2 and strongly disagree to 1. For this study, the questionnaire was separated into user demographic, including gender, age and experience in taking the flight. The second part of the questionnaire was the usability of the application. Both male and female participants involved in this testing should understand the English language and familiar with mobile devices and applications as they had to answer the usability of the application. Hence, with their existing experience using mobile applications, they could differentiate the positive and negative sides of the usability of the EEPAR application. The participants also should be 19 years old and above and have the experience in travelling by airplanes. This is important is because they would be able to differentiate between the real situations and AR environments of the airplane. A total of 12 participants were involved in this testing. According to Nielsen [14], a total of 5 participants is enough to run the usability testing as well as to find problems in the interface of the application. Table 6 shows the demographics of the participants.

The data gathered in response to each questionnaire item are shown in Table 7. It was discovered that if a user is generally satisfied with the first inquiry, he/she will use the application regularly. According to the statement, a lot of users concurred with it because the application offered them a novel experience. In addition, every user disputed the idea that the application was overly complicated. Additionally, the user acknowledged the application's usability while being evaluated. A total of 12 participants who took part in the application's testing disagreed with the notion that a developer's help was necessary due to the application's complexity. The statement shows the usage of the application. The application features were then found to be flawlessly integrated.

By demonstrating how well the capabilities of each application function, these can be made more transparent. As all of the tutorials on how to use the programme were clearly described in the application, the testers of this application also discovered that the application could be rapidly taught and used. In addition, the tester disputed the idea that the application was complicated. Last but not least, the testers concurred that they felt confident while utilising the application. As a result, the overall response to the questionnaire provided favourable feedback on the application and demonstrated how the aspects of the application worked well together.

Table 7
Summary of the questionnaire items collected from the testers

No.	Question	Scale				
		1	2	3	4	5
1	I think I would like to use this application frequently.			2	5	5
2	I found this application unnecessarily complex.	1	11			
3	I though this application was easy to use.				7	5
4	I think I would need assistance to be able to use this application.	3	8	1		
5	I found the various functions in this application were well integrated.				2	10
6	I thought there was too much inconsistency in this application.	6	5	1		
7	I would imagine that most people would learn to use this application very quickly.				2	10
8	I found this application very cumbersome/awkward to use.	3	9			
9	I felt very confident using this application.			1	7	4
10	I needed to learn a lot of things before I could get going with this application.	3	8	1		

After all of the items were converted into numbers, they were then calculated according to the number of questions. X and Y are the terms for each calculation. X was used to calculate the expression for all numbers from an odd question. Meanwhile, Y was used to calculate the expression for all the numbers from the even questions. All of the answers for X were subtracted with five. Besides, 25 subtracted the total of Y. To calculate the SUS score, X and Y were added together, and the total was multiplied by 2.5. Hence, the SUS result was successfully calculated. Figure 7 shows the formula for calculating the SUS result.

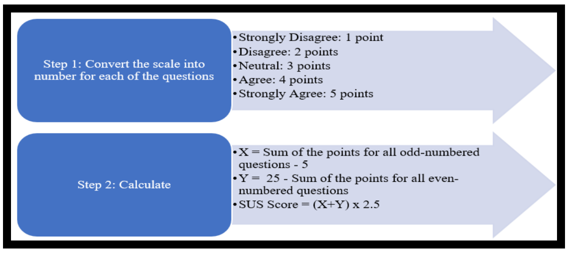

Fig. 7. Formula to calculate the SUS results

Meanwhile, Table 8 indicates the results of the usability testing carried out by the testers.

Table 8
SUS score for each of the testers

Tester	1	2	3	4	5	6	7	8	9	10	11	12
SUS Score	95.0	72.5	85.0	87.5	80.0	75.0	85.0	85.0	85.0	87.5	87.5	85.0

EEPAR SUS score = 95.0+72.5+85.0+87.5+80.0+75.0+85.0+85.0+85.0+87.5+87.5+85.0
= 1010 ÷ 1200
= 0.84 x 100
= 84

The final score is 84, which indicates that this application received an exceptional grade based on the indicator in Table 9. As conclusion, the users enjoyed the programme and interacted well.

Table 9
SUS score indicators

SUS Score	Grade	Adjective Rating
>80.3	A	Excellent
68 – 80.3	B	Good
68	C	Okay
51 - 68	D	Poor
< 51	F	Awful

5. Conclusion

To conclude, the application is beneficial and promising for all passengers travelling by airplane. This new advancement of technology, AR, helps to engage with the user to interactively gain more information about the safety equipment and procedures of the aircraft. Besides, as an added value, this application is also suitable for all ages. As for the limitations of this application, the application can only cater for Android, and there is no information about the flight details, such as flight destinations and duration. Future works may consider IOS as a platform for iPhone users as well as adding features such as flight destinations and duration. Besides that, to test and implement the idea, some collaborations with other parties such as aviation experts, manufacturers of emergency equipment, and OSH experts can be done to ensure that the app provides accurate and fast assistance to the passengers. Above all, this application has achieved its aim and objectives to assist passengers in understanding the safety in an airplane.

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