POLITEKNIK BANTING SELANGOR

ARCOCKPIT

NAME	MATRIX NO.
NUR BATRISYIA BINTI SHAIFUL AZHAR	24DAM21F2012
VANDY BRAN GERRON	24DAM21F2003
MUHAMMAD IKHWAN ZAFRI BIN AH SABRI	24DAM21F2008

DEPARTMENT OF AIRCRAFT MAINTENANCE

SESSION: II 2023/2024

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A REPORT SUBMITTED TO DEPARTMENT OF AIRCRAFT MAINTENANCE IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR A DIPLOMA ENGINEERING IN AIRCRAFT MAINTENANCE

SUPERVISOR:

EN AMALUDDIN SALIHIN BIN MUHAMAD

REPORT ENDORSEMENT

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Date : 27/05/2024

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CERTIFICATE OF PROJECT ORIGINALITY & OWNERSHIP

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"We hereby declare that this report is the result of our own work, except excerpts That we have outlined its sources and this project will be the ownership of polytechnic."

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Date: 27/05/2024

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ABSTRACT

The integration of Augmented Reality (AR) into aviation education brings about a transformative impact on how students engage with the complexities of the aviation industry. AR enhances the learning experience by providing immersive, interactive simulations for theoretical understanding and practical skills development. For maintenance training, AR overlays digital information on aircraft components, guiding students through procedures efficiently. In flight training, AR headsets offer real-time data, improving situational awareness for aspiring pilots. Remote collaboration becomes seamless, enabling students to receive guidance from instructors irrespective of location. AR also aids in safety training, allowing students to practice responses to emergency scenarios in a risk-free virtual environment. Overall, AR in aviation education fosters a more dynamic and effective learning process, preparing future professionals for the demands of the industry.

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CHAPTER 1

INTRODUCTION

1.1 BACKGROUND OF STUDY

Applications have become essential for various activities, including shopping, gaming, streaming movies, and online education. The growth in mobile usage has led to the development of mobile technologies, transforming the way people learn and teach. The classroom is now the only location for lectures, seminars, and classes. The education industry is evolving as students opt for digital courses, prefer online learning over traditional classroom settings, and shift away from paperback books in favour of digital ones.

As we also know, students have trouble understanding the complex learning process of aircraft. The students also lack understanding only by learning from the books and without practice. Aircraft cockpit component has distinct features and functions, catering to diverse needs and requirements. Furthermore, the missing parts of the flight instrument can also confuse the students and also the authorities on the plane.

"The integration of Augmented Reality (AR) in aviation has brought significant advancements across multiple domains within the industry. In the cockpit, AR-enhanced displays offer pilots real-time data overlays, enhancing situational awareness and aiding in decision-making processes. Maintenance crews benefit from AR applications that provide detailed, step-by-step instructions and diagnostics, improving accuracy and efficiency in aircraft upkeep. Furthermore, AR is transforming pilot training by creating immersive simulations that replicate real-world scenarios, thereby improving training outcomes and safety. These innovations underscore the potential of AR to enhance operational efficiency, safety, and overall performance in the aviation sector." (Smith, John. "The Impact of Augmented Reality on Aviation." Aviation Technology Journal, vol. 23, no. 4, 2023)

Figure 1.1 Example of Aircraft Boeing Cockpit (Google, n .d)

An education app platform provides a customized, end-to-end learning solution by combining technology and learning management systems. It promotes online learning, particularly self-study, and simplifies remote learning. Professionals, college and high school students, and professionals use instructional apps. There are millions of mobile learning applications available worldwide, including AR apps, which are one type of mobile learning app. Therefore, ARCOCKPIT app revolutionized aviation education by combining augmented reality technology with detailed simulations. We enable students to explore aircraft cockpit layout, interact with controls and learn about cockpit functions in realistic virtual settings. It enhances knowledge and practical. The app also features an intuitive UI with easy navigation and user-friendly controls.

1.2 **PROBLEM STATEMENT**

Globalization has made it crucial for graduates to have a background and skill set that allows them to immerse themselves in the global economy from graduation. Polytechnics in Malaysia offers courses that teach practical skills, and has designed a mobile learning app for engineering students, specifically for Aircraft Engineering students. The app aims to balance practical and theoretical knowledge to meet the current demands of Malaysian workers.

An innovative, user-friendly smartphone application is needed to provide realistic, hands-on learning opportunities for aviation students, overcoming challenges in finding controlled settings. The current generation of learning materials, including textbooks and online resources, often lack real-time feedback and interaction, hindering students' comprehensive understanding of learning strategies. Lack of educational resources or leaning aids in the aviation sector can lead to students losing interest and attention, hindering their ability to grasp basic aviation skills.

"The integration of Augmented Reality (AR) in aviation faces several significant challenges that hinder its full adoption and utilization. One major issue is the compatibility of AR systems with the existing technological infrastructure in aircraft and airports. Many current systems were not designed to support AR capabilities, necessitating substantial upgrades or replacements. Additionally, ensuring the accuracy and reliability of AR data is critical, as errors in visual overlays could lead to misinterpretations and potentially hazardous situations. Training aviation personnel to proficiently use AR technology also presents a challenge, as it requires a comprehensive overhaul of existing training programs. Regulatory frameworks governing AR applications in aviation are still developing, leading to inconsistencies in safety standards and operational protocols. Addressing these challenges is crucial for the successful implementation of AR, which holds the potential to greatly enhance situational awareness, efficiency, and safety in the aviation industry." (Brown, Lisa. "Navigating the Challenges of Augmented Reality in Aviation." Journal of Aviation Technology and Engineering, vol. 28, no. 2, 2023, pp. 112-130).

This can result in boredom in lectures, reducing their understanding level and affecting their motivation in studying and learning. However, existing apps are not suitable for the aviation industry due to lack of innovation, mobility, resources, and accessibility of aircraft cockpit. The existing product is not appealing enough to attract students.

1.3 PROJECT OBJECTIVES

1.3.1 General Project Objectives

- To design an application for aircraft engineering students and also for aviation institution.
- To develop ARCOCKPIT as learning apps and help students have better understanding about aircraft cockpit specifically for aircraft engineering students.
- To provide student with a heightened, more immersive experience that boost their intellectual curiosity.
- The aim is to facilitate students' easy access to online study materials and bridge the gap between students and lecturers.

1.3.2 SPECIFIC INDIVIDUAL PROJECT OBJECTIVES

1.3.2.1 Introduction Layout

- To make it simple, and easier for students to understand and recognize the aircraft cockpit.
- To make it easy for students to find all the aircraft cockpit component that they need for learning purposes.
- To attract more students to use it with a responsive design and suitable for learning purposes.

1.3.2.2 Interface Layout

- To let students have fun using it with the up-to-date design of layout and 3D model of aircraft cockpit.
- The goal is to ensure seamless, enjoyable, and effective interactions between students and the apps.
- The goal is to enhance student engagement and motivation.

1.3.2.3 Storyboard

- To help students keep track of their studies.
- To visually guide students throughout the learning process.
- To simplified every stage of learning for the students.

1.3.3 Software Designation

- To help the to achieve better grades for their test, assignments, examinations and handle other time-consuming processes.
- To give organize content and access to it.
- To help reduce the cost of education cost for the students.

1.4 PURPOSE OF PRODUCT

Augmented Reality (AR) is revolutionizing aviation education by providing immersive simulations for theoretical understanding and practical skills development. It aids in maintenance training by overlaying digital information on aircraft components, improving situational awareness in flight training, and facilitating remote collaboration. AR also aids in safety training by allowing students to practice responses to emergency scenarios in a risk-free virtual environment.

The project aims to enhance aviation students' analytical skills by analysing media using their studies' theories and concepts. By observing these concepts in action on their smartphones, students can develop new ideas and enhance their critical thinking skills for problem-solving. Overall, AR fosters a dynamic learning process for future aviation professionals.

1.5 SCOPE OF PROJECT

1.5.1 General Project Scopes

The project aims to design and develop a functional application, including aircraft cockpit parts, and ensure its perfect operation without any bugs. The project's primary objective is to equip students and aviation enthusiasts with the necessary information and skills to enhance efficiency and safety in the aviation sector.

Testing and validation will be employed to ensure the application runs flawlessly. The app enhances learning flexibility by providing instructional content in various formats, such as videos and multimedia, on smartphones or devices, allowing students to access content anytime and anywhere, promoting successful course completion and knowledge improvement.

1.5.2 Specific Individual Scopes

1.5.2.1 Introduction Layout

This ARCOCKPIT learning apps will be focusing on the interesting layout that can attract more student to use it and make this app as their favourite app to use for learning about all the aircraft cockpit component parts. The introduction layout is more focused on simple and eye catchy tone colour for the background and style.

1.5.2.2 Interface Layout

The scopes for interface layout are that all contents and all the details are specifically for aircraft engineering student an aviation institution. All details, the function, the notes that we provide in the app followed exactly like the one that lecturer use for teaching and it will be detail out as specified in the learning scopes for Aircraft's Engineering Course scopes so that the students can just take directly and learn from the app and use it without any worries or mis-used for further learning.

1.5.2.3 Storyboard

This app is mostly using 3D model aircraft diagram content and is applicable in portrait mode. Its simple storyboard approach encourages frequent use, simplifies learning stages, and makes understanding faster. It is straightforward about content and context, making it a valuable apps for students. Utilize storyboarding techniques to plan and visualize the educational content in the Augmented Reality world, mapping user interactions like selecting options and navigating through the virtual environment, and ensure alignment with the defined learning objectives and educational outcomes.

1.5.2.4 Software Designation

For software itself, it is available for current latest mobile phone technology. The app is designed for both learning and teaching purposes, aiming to improve students' grades for tests, quizzes, assignments, and exams. It is organized with easy access to learning the apps and is designed for 24/7 availability, ensuring students can access it anytime, anywhere.

CHAPTER 2

LITERATURE REVIEW

2.1 GENERAL LITERATURE REVIEW

2.1.1 Education Industry in Malaysia

Education is a discipline focused on teaching and learning methods in schools or school-like environments, rather than nonformal and informal means of socialization. Students and lectures are often related to education. In the 90s, students faced difficulties accessing information due to the lack of the internet and books. However, with the development of education, these difficulties have decreased. Today, we live in a modern era with the internet and various education methods available, making education more effective for students and easing their study. There are various methods to use to improve students' learning experience.

2.1.2 Demand of E-Learning

The demand for e-learning has grown due to technological advancements, changing learning preferences, and the need for flexible, accessible education. However, challenges like the digital divide, quality assurance, and learner engagement need to be addressed. Mobile applications have emerged as a tool to meet this demand, offering interactive platforms for education and increasing popularity in remote and online education due to their accessibility and flexibility.

2.1.3 Various Type of Aviation Educational Application

1. Flight Training Apps - Flight training apps are comprehensive tools for learning to fly, covering topics like flight manoeuvres, navigation, radio communication, and emergency procedures. They cater to aspiring pilots and existing skill-seekers.

2. Aircraft Systems Apps - Aircraft systems apps offer comprehensive understanding of aircraft systems, including avionics, engines, hydraulics, and fuel systems, providing valuable insights for aviation enthusiasts, students, and professionals.

3. Aircraft Interior Showcase Apps - Apps like aircraft interior showcase offer detailed cabin tours, 3D models, and information about seating arrangements, amenities, and in-flight services, catering to aviation enthusiasts and travellers.

2.2 SPECIFIC LITERATURE REVIEW

2.2.1 Storyboard

The app can be downloaded from the phone or shared via a shared link. Once downloaded, users can access the app's home page, which displays information about the AR camera and their figures, including a note with the figure of the components.

Upon opening the AR camera, it allows student to scan for a flat surface and find the 3D model for aircraft cockpit component that they want to learn about. The cockpit component section displays detailed cockpit component with a back button for returning to the selection option and selecting the note to learn. Users can also access the menu by clicking on the back button. The menu also includes a note for each component function. Use icons and imagery to enhance visual appeal and convey information effectively. If they don’t want to watch the 3D model aircraft, they can press the back button and return to the menu.

Final feature is about the developer information. Clicking this button will show information about the developer information for users to read. It also provides with back button to go back to the menu if they finish reading about the developer’s information.

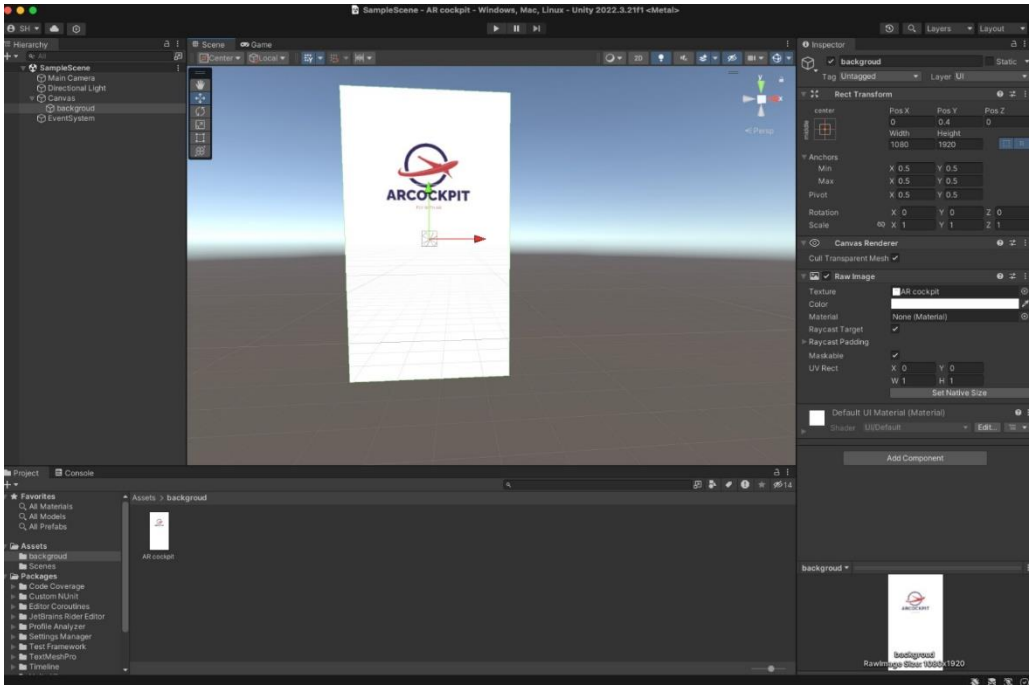


Figure 2.1 User Interface Designing for ARCOCKPIT Apps

2.2.2 USER TESTING AND FEECBACK

The design process will involve user feedback from aviation industry students and educators through Google form surveys. The data will be analysed to identify strengths, weaknesses, and areas for improvement. The app will be iteratively refined, focusing on enhancing usability, addressing issues, and improving the overall user experience.

2.3 REVIEW OF RECENT RESEARCH / RELATED PRODUCTS

No	Marketed Product	Patent Summary
1.		**Description:** Unity is a widely used game development engine that supports the creation of both 2D and 3D applications, including AR experiences. It provides a robust environment for creating interactive simulations, virtual environments, and educational content.
2.		**Description:** Unreal Engine, like Unity, is a powerful game development engine that supports AR development. It offers high-quality graphics and is suitable for creating immersive AR simulations, including aviation-related educational content.
3.		**Description:** ARKit and ARCore are software development kits (SDKs) provided by Apple and Google, respectively. They enable developers to integrate AR features directly into iOS and Android apps. These SDKs are suitable for creating AR experiences on mobile devices.

2.4 COMPARISON BETWEEN RECENT RESEARCH AND CURRENT PROJECT

2.4.1 Product A vs Our Product

Product	**X – Plane Flight Simulator**	**ARCOCKPIT**
Design		ARCOCKPIT FLY WITH AR
Purpose	The platform offers a realistic flying experience with a diverse range of aircraft and global multiplayer capabilities.	We enable students to explore aircraft cockpit layout, interact with controls and learn about cockpit functions in realistic virtual settings.
Features	Some of the features need to be purchased	Free to play
Target	Teenager	Everyone
Platform	Smartphone	Smartphone and Tablet

2.4.2 Product B vs Our Product

Product	**Infinite Flight**	**ARCOCKPIT**
Design		ARCOCKPIT FLY WITH AR
Purpose	The game offers a realistic flying experience with a diverse range of aircraft and global multiplayer functionality.	We enable students to explore aircraft cockpit layout, interact with controls and learn about cockpit functions in realistic virtual settings.
Features	Free to play	Free to play
Target	Everyone	Everyone
Platform	iPad and another mobile platform	Smartphone and Tablet

2.4.3 Product C vs Our Product

Product	**ForeFlight**	**ARCOCKPIT**
		ARCOCKPIT FLY WITH AR
Purpose	Sophisticated flight planning and navigation app developed by ForeFlight. It is tailored for pilots and aviation professionals,	We enable students to explore aircraft cockpit layout, interact with controls and learn about cockpit functions in realistic virtual settings.
Features	Free to play	Free to play
Target	Pilot and aviation professional	Everyone
Platform	Smartphone	Smartphone and Tablet

CHAPTER 3

RESEARCH METHODOLOGY

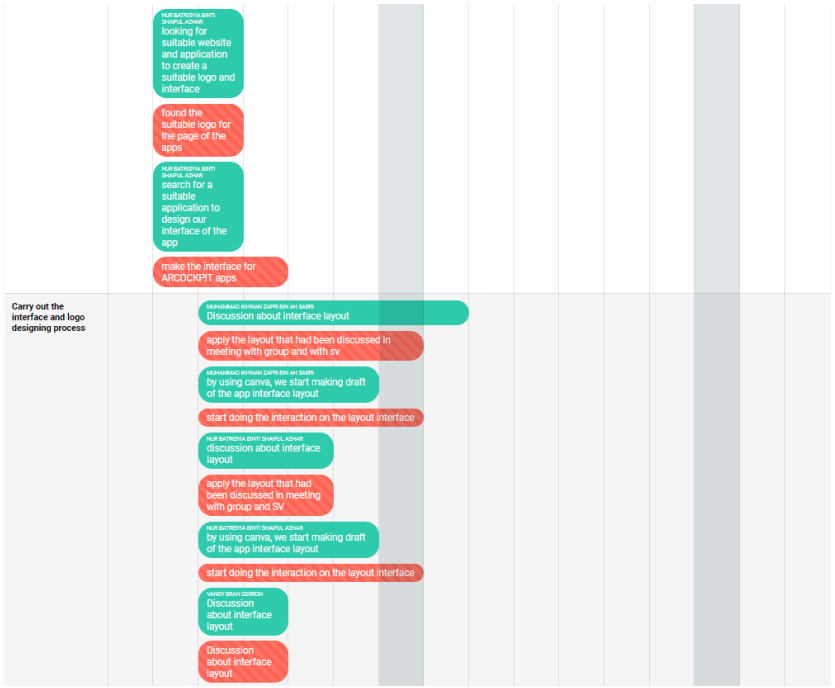
3.1 PROJECT BRIEFING & RISK ASSESSMENT

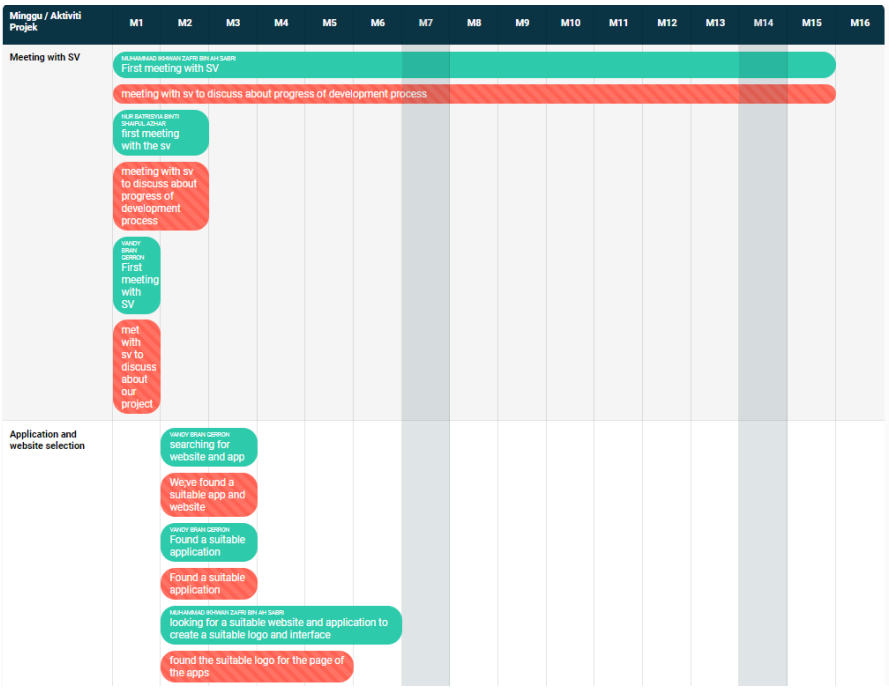
This chapter details the production of our app, including designing, editing, developing, and testing stages, and emphasizes the importance of safety precautions to ensure its successful operation and user-friendliness, achieving our objectives.

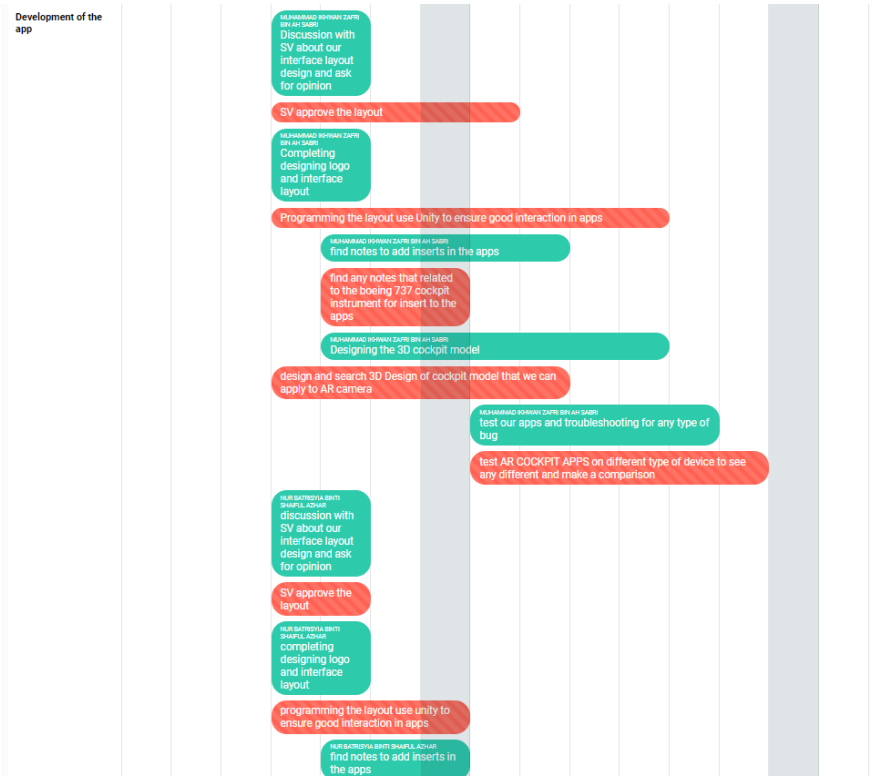
3.2 OVERALL PROJECT GANTT CHART

CARTA GANTT : PERANCANGAN DAN PELAKSANAAN PROJEK PELAJAR

SESI : 2 : 2023/2024
JABATAN: JPP
KODKURSUS: DWM50313
TAJUK PROJEK : ARCOCKPIT






Development of the app
MUHAMMAD IKHWAN ZAFRI BIN AH SABRI
Discussion with SV about our interface layout design and ask for opinion
SV approve the layout
MUHAMMAD IKHWAN ZAFRI BIN AH SABRI
Completing designing logo and interface layout
Programming the layout use Unity to ensure good interaction in apps
MUHAMMAD IKHWAN ZAFRI BIN AH SABRI
find notes to add inserts in the apps
find any notes that related to the boeing 737 cockpit instrument for insert to the apps
MUHAMMAD IKHWAN ZAFRI BIN AH SABRI
Designing the 3D cockpit model
design and search 3D Design of cockpit model that we can apply to AR camera
MUHAMMAD IKHWAN ZAFRI BIN AH SABRI
test our apps and troubleshooting for any type of bug
test AR COCKPIT APPS on different type of device to see any different and make a comparison
NUR SATRIDYA BINTI SHAIFUL AZHAR
discussion with SV about our interface layout design and ask for opinion
SV approve the layout
NUR SATRIDYA BINTI SHAIFUL AZHAR
completing designing logo and interface layout
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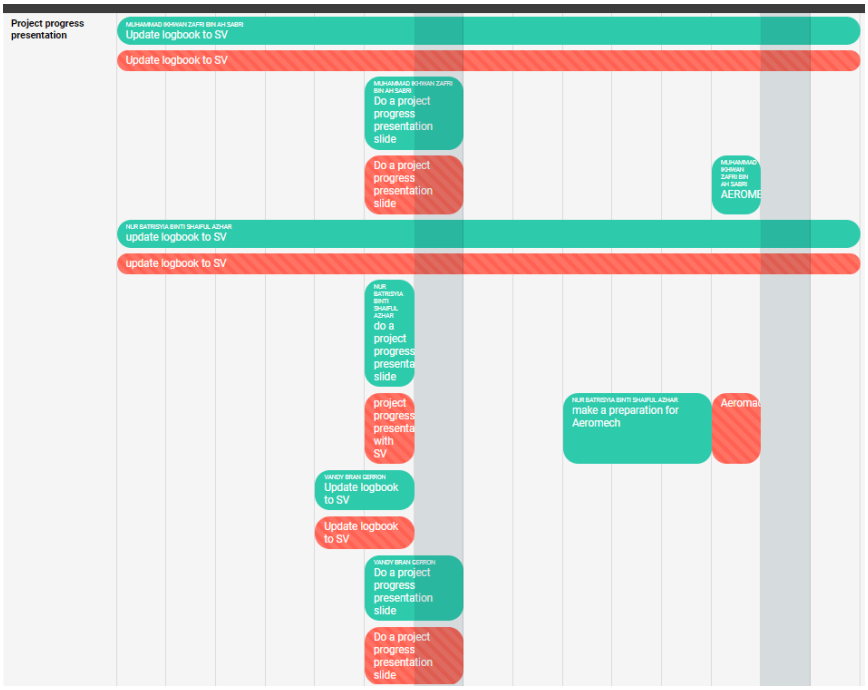

Table 3.7 Project Gantt chart

3.3 PROJECT FLOW CHART

3.3.1 Overall Project Flow Chart

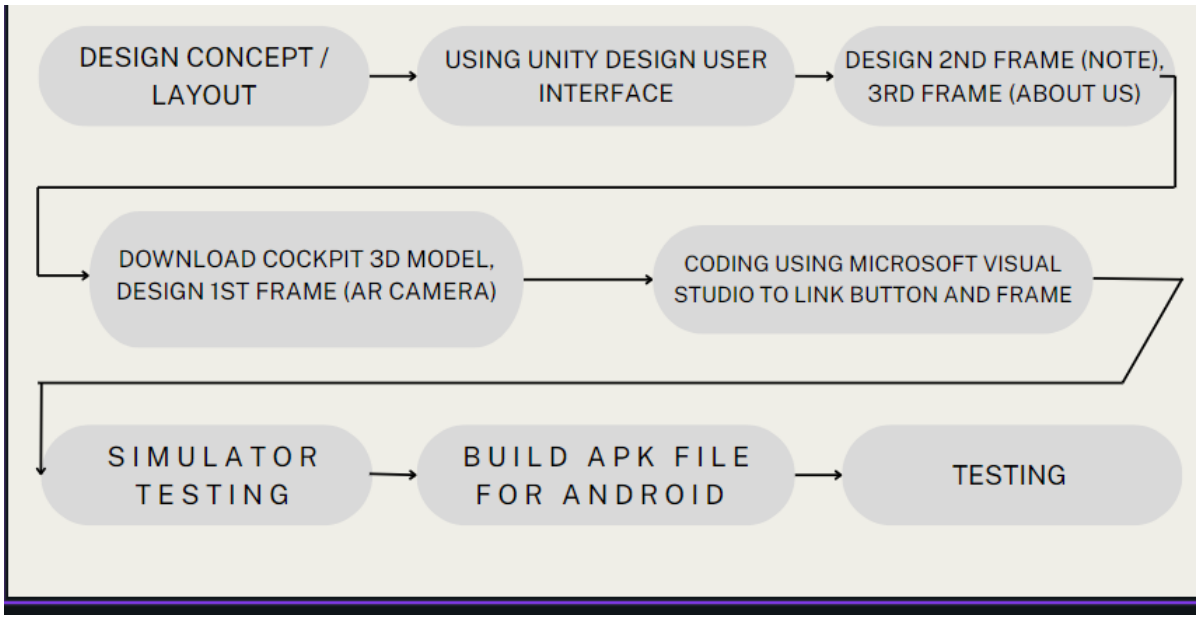

Figure 3.4 Overall Project Flow Chart

3.4 LIST OF MATERIALS & EXPENDITURES

CONTENT	UNIT	PRICE PER UNIT(RM)	TOTAL PRICE (RM)
Canva	1	0.00	0.00
Unity editor	1	0.00	0.00
Blender	1	0.00	0.00
3D cockpit model	1	100.00	100.00
TOTAL	4	100.00	100.00

Table 3.1 List and Material & Expenditures

3.5 Interface Layout

3.5.1 General Product Interface Layout

Figure 3.1 General Product Interface Layout

When login into our app, this interface will show and you can choose the option as where you want to go. There is AR camera, notes and lastly about us.

Figure 3.2 Aircraft cockpit layout

After you pressed the AR camera, you will get to see the inside of aircraft cockpit instrument and move it around to see each component on the cockpit.

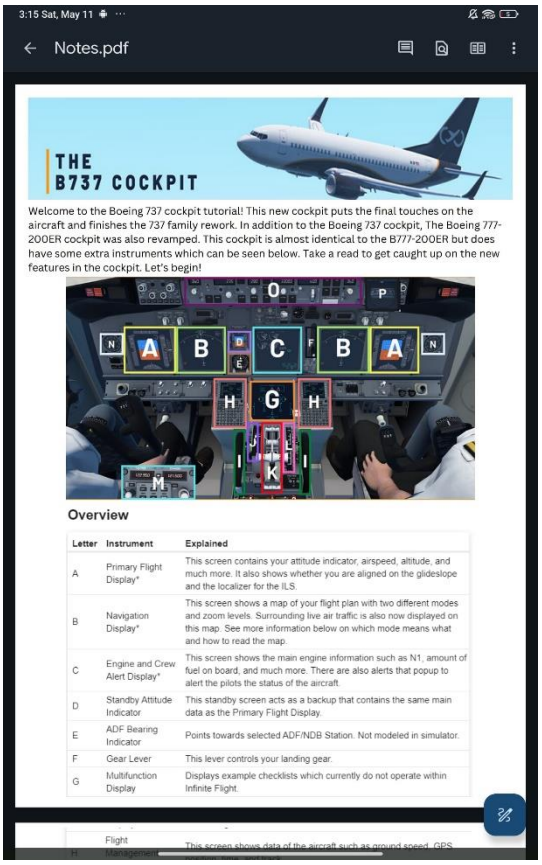

Figure 3.3 Notes

There is also a note for student to deeply understand the each of the cockpit instrument function.

Figure 3.4 About Us

Finally, about Us section show that this is our apps and also, we want to attach our credit so people cannot steal our product.

3.6: DEVELOPMENT OF PRODUCT

3.6.1: Material Acquisition

DESCRIPTION	MATERIAL
As a platform for us to make the notes for the apps	
As a platform to edit and design an app.	
As a platform to design our user interface in the beginning.	

Table 3.6 Material Acquisition

CHAPTER 4

RESULT&DISCUSSION

4.1 PRODUCTDESCRIPTION

4.1.1 General Product Features & Functionalities

AR Cockpit is an app that combined with augmented reality to produce a model of Boeing 737 cockpit. The realistic augmented reality feature enables to produce a highly realistic model of Boeing 737 cockpit through a mobile device such as mobile phone or tablet. The ARCockpit also conclude with notes about all the instrument and avionics of the Boeing 737 cockpit so that there will be a extra information for the user of the ARCockpit application user

The AR Cockpit educational app aims to revolutionize aviation learning by offering a hands-on and immersive experience through augmented reality technology. Its primary purpose is to provide users with a realistic virtual cockpit environment. With this augmented reality features student were able to see the realistic cockpit just through their mobile phone and no need to go to the actual cockpit. The user also can see the whole components of the cockpit instrument since some of the actual cockpit instruments of the Boeing 737 is missing and the label is no longer visible. So it will ease the user to understand and acknowledge the instrument of the cockpit.

Overall, the purpose of the AR Cockpit educational app is to provide a versatile and effective platform for aviation education and training, empowering users to learn, practice, and master aviation skills in an immersive and interactive way.

4.1.2 Specific Part Features

4.1.2.1 Product Structure

The core of the app is its augmented reality (AR) interface, which overlays virtual cockpit elements onto the user's real-world environment. The augmented reality (AR) interface of the AR Cockpit educational app revolutionizes aviation education by seamlessly integrating virtual cockpit elements into the user's real-world environment. Through the app's AR interface, users can transform their smartphones or tablets into immersive training platforms, where aircraft instruments, controls, and displays are digitally overlaid onto their surroundings in real-time. Through the app's AR technology, users can view highly detailed and realistic representations of cockpit instruments, controls, and displays overlaid onto their real-world surroundings.

These virtual cockpit elements are seamlessly integrated into the user's environment, appearing as if they are physically present in the space around them. Users can explore and observe these virtual components from different angles and perspectives, gaining a deeper understanding of aircraft instrumentation and layout. The AR interface offers users a unique opportunity to visually immerse themselves in the intricacies of cockpit design and operation, without the need for physical interaction.

This passive viewing experience allows users to appreciate the complexity and functionality of cockpit systems in a visually compelling and educational manner, making it an invaluable tool for aviation enthusiasts, students, and professionals alike.

Overall, the augmented reality interface of the AR Cockpit educational app transforms the user's device into a virtual cockpit, enabling them to explore the whole cockpit just by using mobile device this will ease a lot for the purpose of learning aircraft cockpit instrument.

4.1.2.2 Product Mechanisms

The AR Cockpit educational app works by using augmented reality (AR) to overlay virtual cockpit elements onto the real world. It uses a smart technology that positions these virtual objects accurately within your surroundings, making it seem like they're actually there. Inside the app, you'll find detailed simulations of different cockpit setups, including all the instruments and controls you'd see in a real aircraft.

The augmented reality of the cockpit also provides simple interaction by simply tapping, swiping, and moving them around on your device's screen. By moving the device towards the augmented reality model, you can see the interior of the cockpit and zoom in and zoom out to see the detailed instrument of the cockpit.

4.1.2.3 Electronic / Programming

Firstly, to design the draft for interface layout we use Canva software for better design because it is more user-friendly and simpler than the other software. And then, moving to designing the logo of our application also using Canva.

In the programming process for designing the app interface using Unity software, several steps are involved, with a primary focus on creating an intuitive and visually appealing user interface (UI) for the AR Cockpit app. Firstly, we begin by outlining the UI requirements based on user needs and feedback. This involves creating wireframes or sketches to visualize the layout and structure of the app interface.

Next, we move on to designing the actual UI components within Unity. This includes creating buttons for the application. Unity provides a range of tools and features for designing UI elements, allowing for customization and flexibility in the design process.

Once the UI elements are designed, we integrate them into the app's overall interface layout. This involves arranging and positioning the UI components to create a cohesive and user-friendly interface. We also ensure that the UI design is responsive and adapts well to different screen sizes and resolutions.

Simultaneously, we work on designing the 3D model of the Boeing 737 cockpit. Using modelling software such as Blender or Maya, we create a detailed and accurate representation of the cockpit layout, including instruments, controls, displays, and other components. This 3D model serves as the foundation for the virtual cockpit environment within the app.

Throughout the programming process, we regularly test and iterate on the app interface and 3D cockpit model to ensure usability, functionality, and visual fidelity. User feedback and testing play a crucial role in refining the design and improving the overall user experience of the AR Cockpit app.

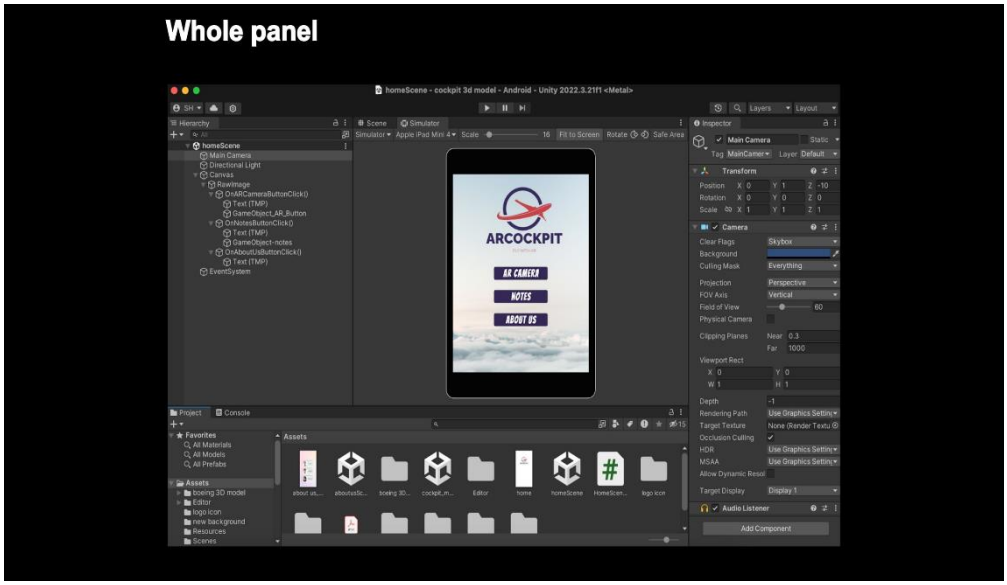

Figure 4.1 Designing interface using Unity Software

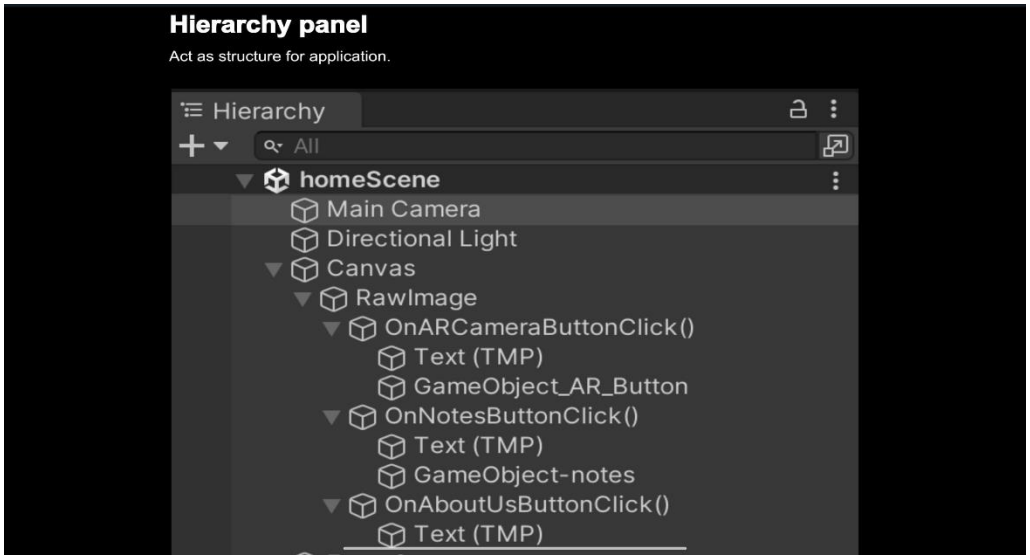

Figure 4.2 Act as structure of the application

4.1.2.4 Accessories & Finishing

In addition to the AR Cockpit app's main features, there are several accessories that enhance the user experience and provide additional resources:

Notes Section

The app includes a notes section where users can jot down important information, observations, or reminders while exploring the virtual cockpit. This feature allows users to keep track of their progress, record insights, and review key concepts at their convenience.

About Us Page

The About Us page provides users with information about the app's creators, their background, and their mission. Users can learn more about the team behind the app, their passion for aviation education, and their commitment to delivering a high-quality learning experience. This page helps users feel connected to the app's developers and fosters trust in the app's content and expertise.

Overall, these accessories enhance the AR Cockpit app's functionality and user engagement, providing users with valuable tools and information to support their aviation learning journey.

4.1.3 General Operation of the ARCOCKPIT

The operation of the AR Cockpit app is straightforward. To begin, users launch the app on their device. Once the app is launch than click on the AR camera, the app activates the device's camera, overlaying a virtual cockpit onto the real-world environment visible through the screen.

Users can then swipe their finger across the screen to look around and explore the details of the virtual cockpit. They can examine various instruments, controls, and displays without interacting with them directly. This passive exploration allows users to familiarize themselves with the layout and components of the cockpit.

Throughout the exploration process, users can take in the details of the cockpit environment, such as instrument panels, seating arrangements, and cockpit windows. This visual exploration provides users with a better understanding of the aircraft's interior layout and helps them become more comfortable with the cockpit environment.

Overall, the AR Cockpit app offers users a visually immersive experience of exploring a virtual cockpit through swiping gestures, allowing them to gain insight into the intricacies of aircraft interiors and enhance their aviation knowledge.

4.1.4 Operation of the Specific Part of the Product

4.1.4.1 Product Structure

The operation of the Product Structure in the AR Cockpit app is pretty straightforward. It's all about how different parts of the app work together to give users a great experience. Firstly, there's the AR interface, which puts virtual cockpit stuff on your screen. Then, you've got cockpit simulations, where you can check out different aircraft and learn about their controls. Secondly there will be a note about the cockpit instrument this will give the user better

understanding about the instrument that have been seen. Altogether, these parts make sure the AR Cockpit app is easy to use and helps you learn all about aviation in a fun way.

4.1.4.2 Product Mechanisms

When you open the app on your device, it uses the camera to show your surroundings. Then, it adds virtual cockpit elements, like controls and instruments, on top of what your camera sees. This creates the illusion that you're inside a real cockpit, even though you're just looking at your device's screen. You can look around and see how everything works, getting a feel for what it's like to be a pilot. Using simple swiping gestures, you can explore the virtual cockpit and learn about its various components. While you can't physically interact with the controls, you can still familiarize yourself with them and understand their functions. The app also provides additional resources like notes for every part of the instruments.

4.1.4.3 Electronic/ Programming

Programming for the AR Cockpit app involves the meticulous crafting of instructions, known as code, to govern its functionality. This intricate process encompasses various essential components. Firstly, programmers focus on designing the app's user interface, where they decide on the layout and appearance of elements like buttons and menus to ensure ease of navigation. Additionally, programmers integrate augmented reality (AR) technology into the app, enabling the overlay of virtual cockpit elements onto the device's camera feed. This integration requires writing code to accurately position these virtual objects within the real-world environment, creating an immersive experience for users.

Furthermore, programmers meticulously develop detailed 3D models of aircraft cockpits, ensuring authenticity and functionality. Through coding, they simulate the behaviour of cockpit controls and instruments, enabling users to interact with them virtually. User interaction features, such as swiping gestures and tapping on controls, are implemented through code, allowing the app to detect user input and respond accordingly.

Figure 4.3 Coding for the home screen interface

Coding for 3d cockpit model

```
using UnityEngine;
using UnityEngine.SceneManagement;

public class dmodel : MonoBehaviour
{
    public void OpenAR()
    {
        SceneManager.LoadScene("cockpit_model"); // Replace "ARSceneName"
with the name of your AR scene
    }

    public void ExitApp()
    {
        Application.Quit();
        Debug.Log("exit dah");
    }
}
```

Figure 4.4 Coding for3D Cockpit model

Coding for notes

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;

public class notes : MonoBehaviour

{
    public string url =
"https://drive.google.com/file/d/1XKtQb1PNpnlx_qDQTTg-xPPv9luqb2n6/view"; //
URL to open

    public void OpenNotesURL()
    {
        Application.OpenURL(url);
    }
}
```

Figure 4.5 Coding for the notes feature

4.1.4.4 Accessories & Finishing

The AR Cockpit app comes with several accessories that enhance the user experience and provide additional resources for learning about aviation. One of the main accessories is the notes section, where users can jot down important information, observations, or reminders while exploring the virtual cockpit. This feature allows users to keep track of their progress, record insights, and review key concepts at their convenience.

Additionally, the app includes an "About Us" page, providing users with information about the developers behind the app, their background, and their mission. This page helps users feel connected to the app's creators and fosters trust in the app's content and expertise. Overall, these accessories complement the AR Cockpit app's main features and contribute to a richer and more engaging aviation learning experience.

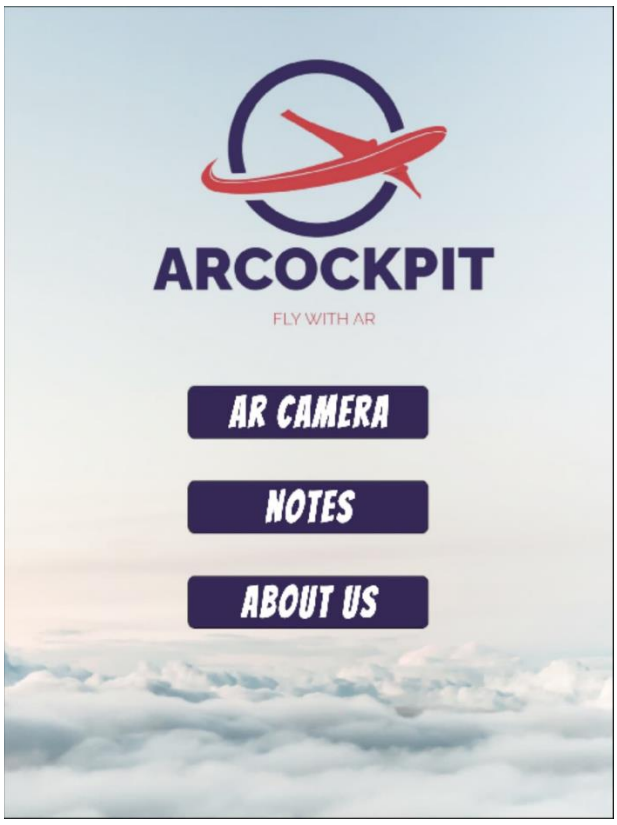

Figure 4.6 Accessories of the app including AR Camera, Notes and About us

4.3 ANALYSIS OF PROBLEM ENCOUNTERED & SOLUTIONS

4.3.1 Product Structure

In analysing the problems encountered with the app structure, several key issues were identified. Firstly, there were challenges with the integration of augmented reality (AR) technology, leading to inconsistencies in the rendering of virtual cockpit elements onto the device's camera feed. This resulted in a less immersive user experience and detracted from the app's overall functionality. Additionally, there were issues with the responsiveness of user interaction features, such as swiping gestures and tapping on controls, which affected the app's usability and user satisfaction.

To address these challenges, several solutions were proposed and implemented. Firstly, improvements were made to the AR integration process, optimizing the rendering of virtual cockpit elements and enhancing their alignment with the real-world environment. This involved refining the algorithms used to detect surfaces and accurately position virtual objects within the camera feed. Additionally, enhancements were made to the user interaction features, ensuring smoother responsiveness and more intuitive functionality. This was achieved through code optimizations and rigorous testing to identify and resolve any underlying performance issues.

Overall, by addressing the problems encountered with the app structure and implementing effective solutions, significant improvements were made to the app's functionality, usability, and overall user experience. These efforts have resulted in a more polished and refined app that better meets the needs and expectations of its users.

4.3.2 Product Mechanisms

The app mechanisms could involve compatibility issues with different devices and operating systems. Due to the diverse range of devices and OS versions available to users, the app may encounter challenges in consistently delivering a seamless experience across all platforms. This could result in functionality discrepancies, performance issues, or even app crashes on certain devices or OS versions.

To address this problem, we can implement rigorous compatibility testing procedures during the app development process. This involves testing the app on a wide range of devices, including various smartphones, tablets, and operating system versions, to identify any compatibility issues. By utilizing device emulators and real-device testing environments, developers can simulate different device configurations and accurately assess the app's performance and functionality across various platforms.

4.3.3 Electronic/Programming

Upon analysis, several problems were encountered in the app programming. One significant issue was related to the efficiency and performance of the code, leading to slow loading times and occasional crashes. This impacted the app's usability and user satisfaction, detracting from the overall user experience. Additionally, there were challenges with the stability of the app, with occasional bugs and glitches affecting its functionality and reliability.

To address these issues, several solutions were proposed and implemented. Firstly, optimizations were made to the app's codebase to improve efficiency and performance. This involved identifying and eliminating redundant code, optimizing algorithms, and reducing resource consumption to minimize loading times and enhance responsiveness.

4.3.4 Accessories & Finishing

In analyzing the problems encountered with the app accessories, several issues came to light. One significant problem was related to the functionality of the notes section, where users encountered difficulties in saving and accessing their notes reliably. This affected the usability of the feature and hindered users' ability to track their progress and record important information effectively. Additionally, there were challenges with the About Us section, such as incomplete or outdated information, which undermined users' trust in the app and its developers.

To address these issues, several solutions were proposed and implemented. Firstly, improvements were made to the notes section, enhancing its functionality and reliability. This involved optimizing the note-saving process, implementing automatic saving features, and introducing cloud synchronization capabilities to ensure users could access their notes across different devices securely. Additionally, efforts were made to update and maintain the About Us section regularly, ensuring that it provided accurate and up-to-date information about the app's developers and their mission.

CHAPTER 5

CONCLUSION & RECOMMENDATIONS

5.1 ACHIEVEMENT OF AIM & OBJECTIVES OF THE RESEARCH

5.1.1 General Achievements of the Project

Upon the completion of final project testing, ARCOCKPIT apps is able to show the Augmented reality and the content in the apps as expected. The AR was able to scan the flat surface that show on the camera to show a ARCockpit in front the camera. And we can move around the AR.

Other than that, a post survey is conducted to gather user satisfaction. Based on the data that we have been collected , majority of the respondents agreed that it is efficient to use ARCOCKPIT apps for learning apps.

5.1.2 SPECIFIC ARCHIVEMENT OF PROJECT OBJECTIVES

5.1.2.1 Product structure

The goal behind the developing of ARCOCKPITS APP structure has been met. To archive this goal , the suitable design of Boeing 737 cockpits had been selected by designed we got at Sketchfab web. The ARCOCKPIT APPS structure was created and develop using UNITY, a

user-friendly apps design easy for beginners. Once the ideal shape and dimensions of the 3D design were determined.

5.1.2.2 Product Mechanisms

The objective to archive in the product mechanism section is to ensure that all the option in the apps was all functioning as it had to be, especially for the camera sensor for scan the surface that show the Augmented Reality. When all the UI is functioning, the apps will be done, the AR can be move around for show the cockpit and the instruments inside after being scan at the flat surface.

5.1.2.3 Electronic / Programming

As the Aviation friendly Application system , ARCOCKPIT Apps the programming were being build assembled , the objective was to make the Augmented Reality was really working to help the learning process in virtual world simulation. It also to make learning process easier. The using of UNITY software to programme the UI system take a long time and difficult process because needed to troubleshooting the programmed that done because it could be any bug in the Apps.

Finally , the use of design of 3D Boeing 737 cockpit was render by the 3d design software that make the 3d design that is 3D blender, to apply it on the apps its so difficult because of need to insert the correct measurement and size for being use on mobile phone and tablet. Other than that , the notes we are taken into the apps we take it by multi resource for example , on the website.

5.1.2.4 Accessories & Finishing

The goal of ARCOCKPITS is to make the UI suitable for all the range of ages and aviation industry. The AR cockpits design was very detail thanks for the UNITY software because can make the rendering process smoothly, by making the cockpit in detailed that will make the apps attractive for users. Then is the layout of the option we make more simple for all range of ages. Overall, the functionality and the operational effectiveness have been greatly improved by the successful of the operational of the apps and all the interactions on all button in the apps.

5.2 CONTRIBUTION OR IMPACT OF THE PROJECT

The impact of such AR cockpit simulations on aviation learning is multifaceted and profound. Firstly, they offer a level of immersion and engagement that traditional methods cannot match. By placing users directly within the cockpit environment, AR simulations provide a sense of presence and tangibility, fostering a deeper connection with the subject matter. This heightened engagement translates into increased motivation and enthusiasm for learning, driving students to explore and understand the intricacies of aircraft instrumentation with greater zeal.

Furthermore, AR cockpit simulations enhance accessibility and flexibility in aviation education. Unlike traditional flight simulators, which are often expensive and confined to specialized training facilities, AR apps can be deployed on common consumer devices such as smartphones and tablets. This democratization of access means that aspiring pilots and aviation enthusiasts can immerse themselves in cockpit training anytime, anywhere, without being bound by geographical or financial constraints. Whether studying at home, commuting on a train, or waiting at an airport, users can dive into the world of aviation learning with a simple tap of their device.

5.3 IMPROVEMENT & SUGGESTION

5.3.1 Product Structure

In the future, there is a lot of improvement that can be made to the structure of product. One of them include the using of VR (virtual reality) and Mixed reality like a new device of Apple that is Apple Vision Pro that combined Augmented Reality and Virtual Reality. The other improvement that can be made is to make version where all type of Aircraft and all the compartment In the Apps by collab with the Aircrafts company itself. Next structure improvement that can be made is to make all the compartment in detailed and can be interaction with all the button inside to make interesting experience like on the real Aircraft.

5.3.2 Product Mechanism

For the next idea in upgrading this project which is to improve the efficiency of the Augmented Reality scanner to measure the right size of each compartment. The is to minimise the battery consumption of the apps for the long used. The next idea is to make the multi-player option that will be more user in onetime like a online game that can make all of the users interact with other user to gain the actual knowledge and sharing the knowledge to the other user for learning process.

5.3.3 Software / Programming

The improvement that will be doing in the future is that the motion sensor will be added into the apps to detect and respond the hand and body gesture for example when user touch the button on the AR camera will be detect the gesture that user make and the instrument can show us any option and will be controlling the system in the AR camera by doing gesture itself.

Furthermore, the using of powerful spec of PC will be used for the smoothed of rendering process of any programming and codding process to make time that take to create the apps decrease. And in order to make an Artificial Intelligence needed of powerful spec PC is going to be a solution to it.

5.3.4 Accessories & Finishing

For the AR Camera Option we want to Enhanced Realism that Work on improving the realism of the cockpit AR overlay. This could involve refining the 3D models of cockpit instruments, adding realistic textures, and implementing dynamic lighting effects to simulate different lighting conditions. Then is adding an interactive element that introduce interactive elements within the AR environment, such as clickable buttons or tooltips that provide additional information about specific instruments when tapped. Then is adding a suitable animation that incorporate animations to simulate the movement and functionality of cockpit controls. For example, when a user interacts with a throttle lever or control panel, animate the corresponding movement or action within the AR scene.

Next for the notes option we comprehensive information that will expand the content of the notes section to provide comprehensive information about each instrument inside the cockpit. Include detailed descriptions, operational procedures, and real-world examples to enhance the educational value of the app. Then added the visual aids that Supplement the textual information with visual aids such as diagrams, schematics, or instructional videos to aid

comprehension and reinforce key concepts. And to make the learning process doing great the interactive quizzes will be make for Integrate interactive quizzes or learning exercises related to cockpit instruments. This can help users reinforce their understanding and test their knowledge in a fun and engaging way. the development of augmented reality cockpit simulations represents a significant advancement in aviation education and training. By leveraging AR technology to create immersive, interactive, and accessible learning experiences, we can empower the next generation of pilots and aviation professionals with the knowledge and skills necessary for safe and efficient flight operations. As we continue to embrace innovation in education, AR stands poised to revolutionize the way we learn, explore, and navigate the skies.

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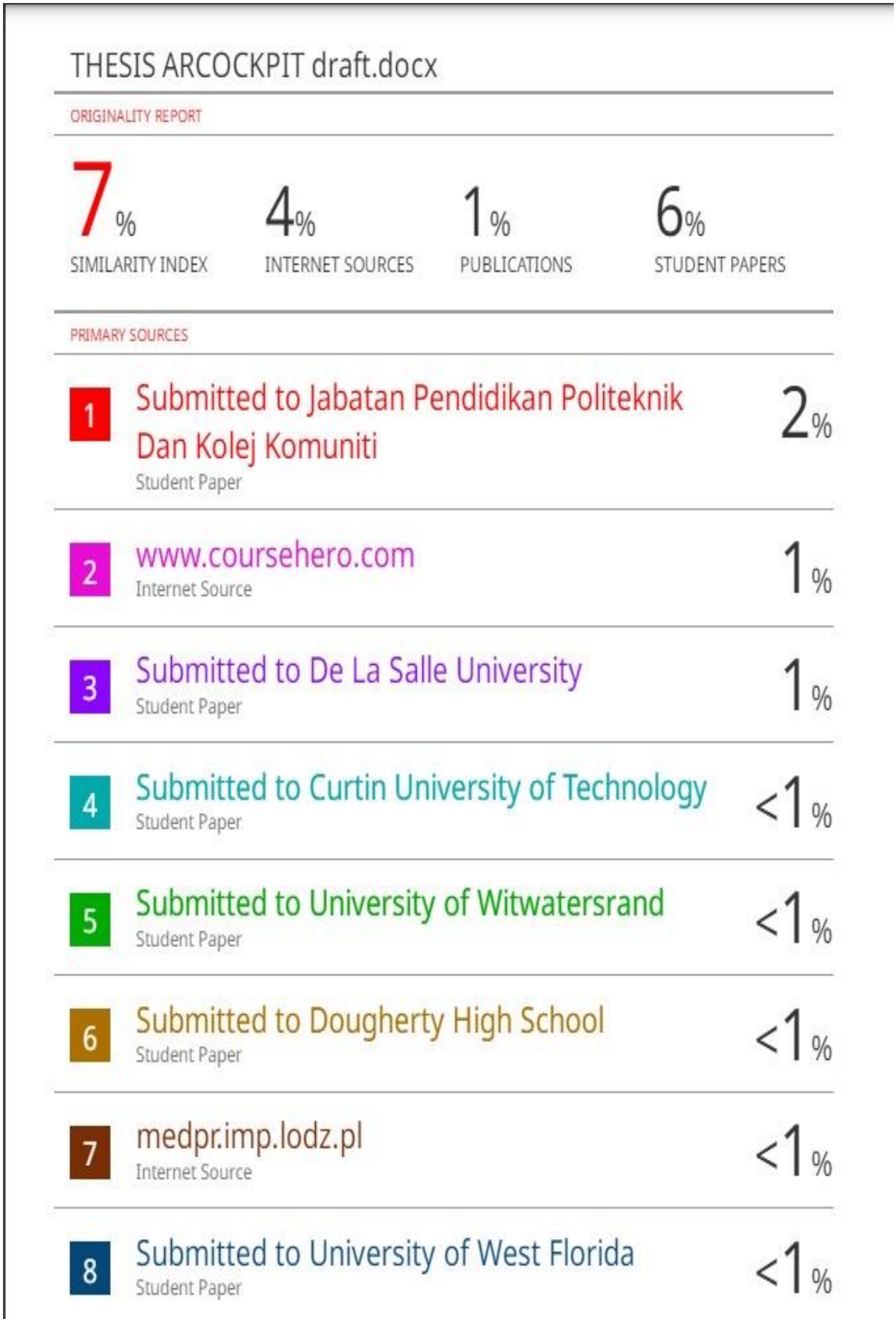
APPENDIX A: LIST OF SEGGERATION TASK

SUB CHAPTER	DESCRIPTION
NUR BATRISYIA BINTI SHAIFUL AZHAR	
1.3.2.1	Specific Individual Project Objective: Product Structure
1.3.2.2	Specific Individual Project Objective: Mechanical Mechanism
1.5.2.1	Specific Individual Scope: Product Structure
2.2.1	Specific Literature Review: Product Structure
2.3.1.1	Related Patented Products: Patent A
2.3.1.2	Related Patented Products: Patent B
2.3.2.1	Recent Market Products: Patent A
2.3.2.2	Recent Market Products: Patent B
2.4.1	Comparison between recent research and current project
3.3.2.1	Specific Project Design Flow / Framework: Product Structure
3.3.2.2	Specific Project Design Flow / Framework: Product Mechanisms
3.4.2.3	Proposed Design Concept 1
3.5.2.1	Specific Part Drawing / Diagram: Product Structure
3.5.2.2	Specific Part Drawing / Diagram: Product Mechanisms
3.7.3.1	Specific Project Fabrication: Specific Project Fabrication
3.9.1	LIST OF MATERIALS & EXPENDITURES: Product Structure
4.1.2.1	Specific Part Features: Product Structure
4.1.2.2	Specific Part Features: Product Mechanisms
4.1.4.1	Operation of the Specific Part of the Product: Product Structure
4.3.1	Analysis of problem encountered & solutions: Product Structure
5.1.2.1	Specific Achievement of Project Objectives: Product Structure
5.3.1	Improvement & suggestions for future research: Product Structure
VANDY BRAN GERRON	
1.3.2.3	Specific Individual Project Objectives: Software / Programming
1.5.2.2	Specific Individual Project Scopes: Product Mechanisms
1.5.2.3	Specific Individual Scopes: Software / Programming
2.2.2	Specific literature review: Product Mechanisms
2.3.1.3	Review of recent research / related products: Patent C
2.3.2.3	Recent Market Products: Product C
2.4.2	Comparison between recent research and current project: Patent B vs. Product B vs. Your Product
3.3.2.3	Specific Project Design Flow / Framework: Software / Programming
3.4.2.4	Design Concept Generation: Proposed Design Concept 2
3.5.2.3	Specific Part Drawing / Diagram: Software / Programming
3.7.3.2	Specific Project Fabrication: Phase 2 (Accessories & Mechanisms)
3.7.3.3	Specific Project Fabrication: Phase 2 (Accessories & Mechanisms)
3.9.3	List of materials & expenditures: Software / Programming
4.1.2.3	Specific Part Features: Software / Programming
4.1.4.2	Operation of the Specific Part of the Product: Product Mechanisms

4.1.4.3	Operation of the Specific Part of the Product: Software / Programming
4.3.2	Analysis of problem encountered & solutions: Product Mechanisms
5.1.2.2	Specific Achievement of Project Objectives: Product Mechanisms
5.1.2.3	Specific Achievement of Project Objectives: Software / Programming
5.3.2	Improvement & suggestions for future research: Product Mechanisms
5.3.3	Improvement & suggestions for future research: Software / Programming
MUHAMMAD IKHWAN ZAFRI BIN AH SABRI	
1.3.2.4	Specific Individual Project Objectives: Accessories & Finishing
1.5.2.4	Specific Individual Scopes: Accessories & Finishing
2.2.3	Specific literature review: Software / Programming
2.2.4	Specific literature review: Accessories & Finishing
2.3.1.4	Related Patented Products: Patent D
2.3.2.4	Recent Market Products: Product D
2.4.3	Comparison between recent research and current project: Patent C vs. Product C vs. Your Product
2.4.4	Comparison between recent research and current project: Patent D vs. Product D vs. Your Product
3.3.2.4	Specific Project Design Flow / Framework: Accessories & Finishing
3.4.2.5	Design Concept Generation: Proposed Design Concept 3
3.4.2.6	Design Concept Generation: Proposed Design Concept 4
3.5.2.4	Specific Part Drawing / Diagram: Accessories & Finishing
3.7.3.4	Specific Project Fabrication: Phase 4 (Finishing):
3.9.3	List of materials & expenditures: Software / Programming
3.9.4	List of materials & expenditures: Accessories & Finishing
4.1.2.4	Specific Part Features: Accessories & Finishing
4.1.4.4	Operation of the Specific Part of the Product: Accessories & Finishing
4.3.3	Analysis of problem encountered & solutions: Software / Programming
4.3.4	Analysis of problem encountered & solutions: Accessories & Finishing
5.1.2.4	Specific Achievement of Project Objectives: Accessories & Finishing
5.3.4	Improvement & suggestions for future research: Accessories & Finishing

APPENDIX B: SUMMARY OF SIMILARITY REPORT (TURNITIN)



THESIS ARCOCKPIT draft.docx

ORIGINALITY REPORT

7%	4%	1%	6%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

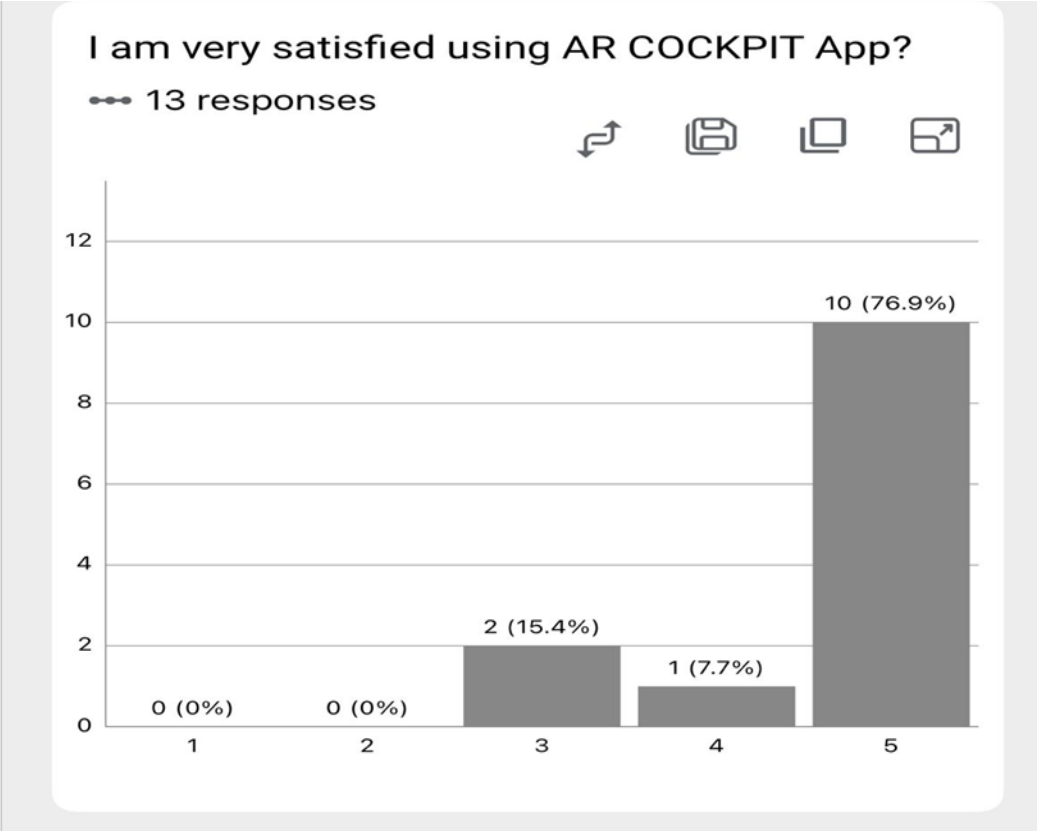
1	Submitted to Jabatan Pendidikan Politeknik Dan Kolej Komuniti Student Paper	2%
2	www.coursehero.com Internet Source	1%
3	Submitted to De La Salle University Student Paper	1%
4	Submitted to Curtin University of Technology Student Paper	<1%
5	Submitted to University of Witwatersrand Student Paper	<1%
6	Submitted to Dougherty High School Student Paper	<1%
7	medpr.imp.lodz.pl Internet Source	<1%
8	Submitted to University of West Florida Student Paper	<1%

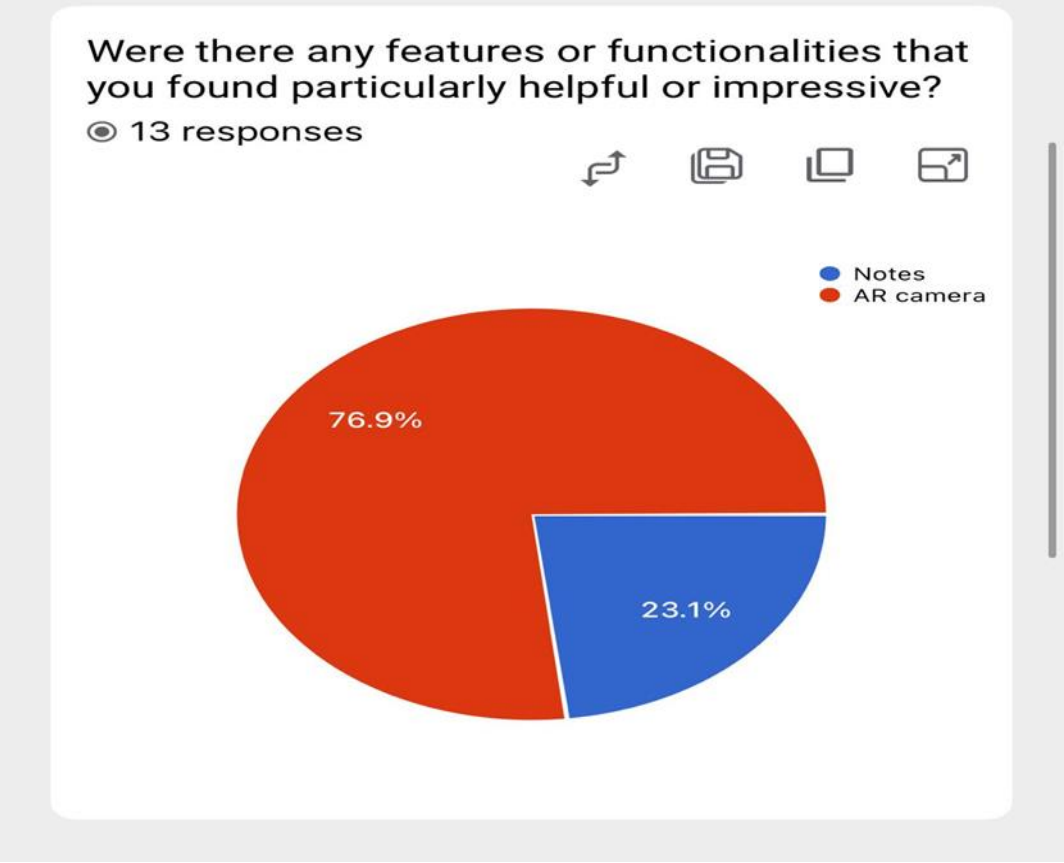
9	Submitted to University of New South Wales Student Paper	<1%
10	Submitted to Institute of Graduate Studies, UiTM Student Paper	<1%
11	Submitted to Bogazici University Student Paper	<1%
12	Submitted to RMIT University Student Paper	<1%
13	Reza Shahkaram, Hamid Reza Shoraka, Maryam Chegeni, Ali Soleimani. "Neutrophil to Lymphocyte Ratio as a Marker in the Diagnosis and Prediction of Acute Appendicitis", SN Comprehensive Clinical Medicine, 2024 Publication	<1%
14	Submitted to University of Gloucestershire Student Paper	<1%
15	Submitted to University of Surrey Student Paper	<1%

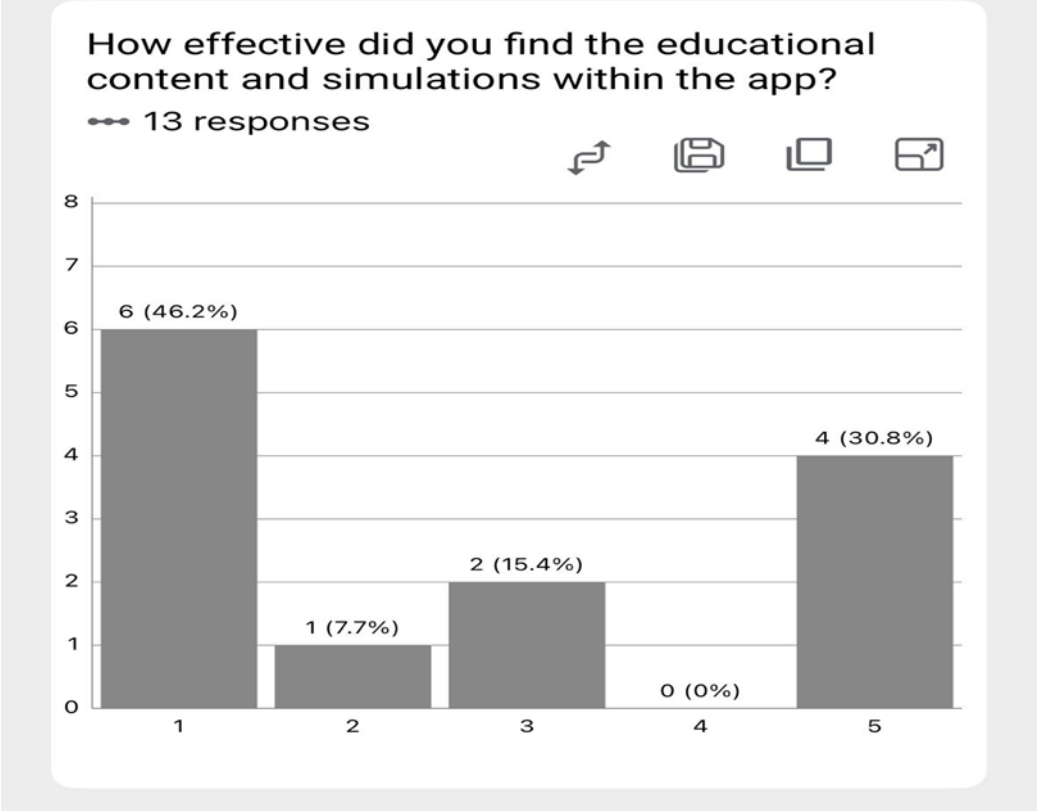
16	Submitted to University of Hull Student Paper	<1%
17	promobilemarketing.com Internet Source	<1%
18	www.ncbi.nlm.nih.gov Internet Source	<1%
19	www.openworldlearning.org Internet Source	<1%
20	etd.aau.edu.et Internet Source	<1%
21	flatworldsolutions.com Internet Source	<1%

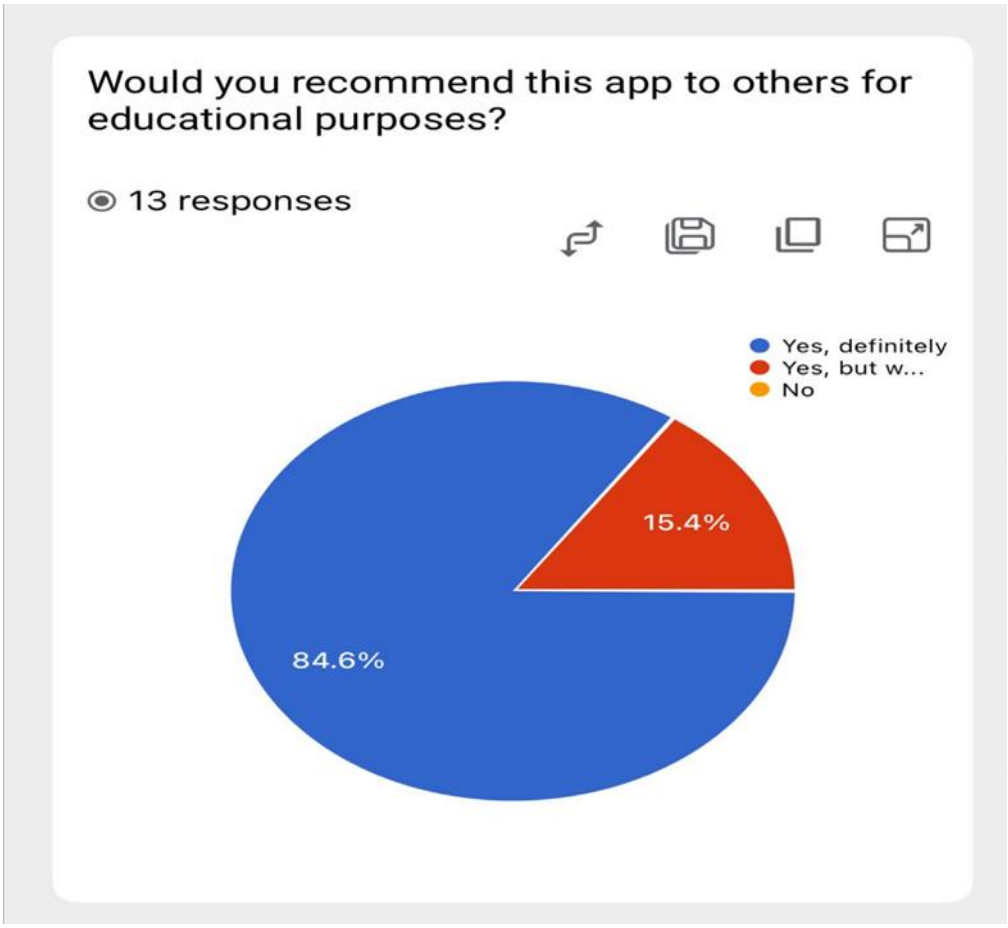
Exclude quotes	Off	Exclude matches	Off
Exclude bibliography	Off		

APPENDIX C : POST SURVEY



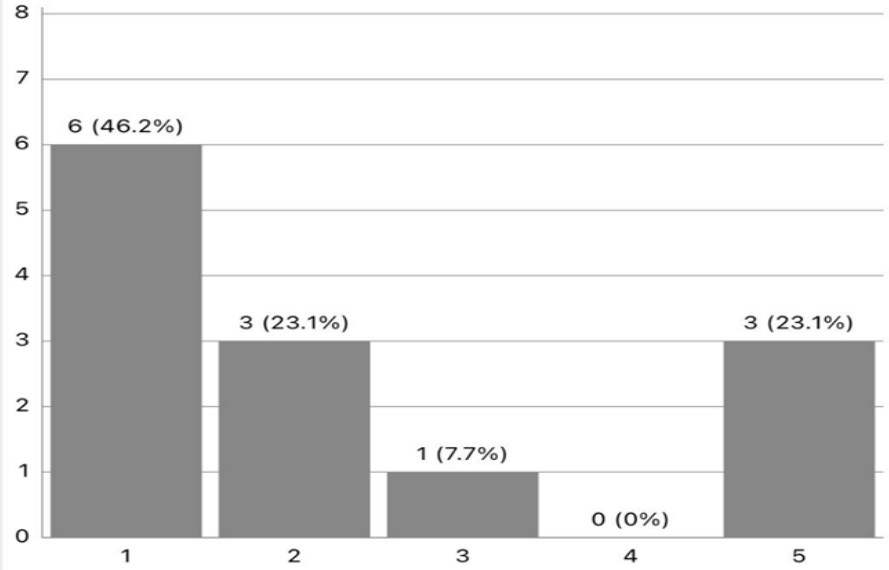



How effective did you find the educational content and simulations within the app?
13 responses
8
7
6
5
4
3
2
1
0
6 (46.2%)
1 (7.7%)
2 (15.4%)
0 (0%)
4 (30.8%)
1
2
3
4
5


Would you recommend this app to others for educational purposes?
13 responses
Yes, definitely
Yes, but w...
No
15.4%
84.6%

How likely are you to use this app for learning or teaching aviation-related topics in the future?

13 responses



This App is very interactive and engaging app for students

13 responses