POLITEKNIK BANTING SELANGOR

AIRCRAFT PARTS EXPLORER GAME

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DEPARTMENT OF AIRCRAFT MAINTENANCE

SESSION 1 2023/2024

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

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CERTIFICATION 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.

SIGNATURE: WRITER 1

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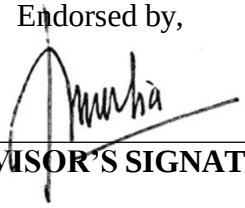

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DATE: 18 Dec 2023

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Finally, we express our sincere gratitude to everyone who helped to finish this thesis. It has been an honor to work with such remarkable people, and your advice, encouragement, and support have been priceless.

ABSTRACT

In our technology-infused culture, where learning is increasingly recognized as most effective when meaningful and engaging, the integration of technology in education holds paramount importance. This is exemplified by the APEX (Aircraft Parts Explorer) Game on Roblox, seamlessly blending education and gaming to provide an immersive experience focused on aviation mechanics. The broader educational benefits of gaming in various media, especially in aviation education, have not yet been systematically explored and understood despite the growing emphasis on technology-infused learning experiences. While some studies have explored the integration of technology in education, there is a research gap concerning the comprehensive examination of the transformative impact of gaming, such as the APEX Game, on traditional and online education in the field of aviation mechanics. It aims to evaluate the impact of gaming on traditional and online education in the field of aviation mechanics, using the APEX Game as an example of its educational benefits. A quantitative study was conducted to gauge the effectiveness of the APEX Game, involving a sample group of students, evaluating the game's usability, its effectiveness in improving knowledge of aircraft parts, and overall user satisfaction. Data analysis revealed a substantial 94.7% of total respondents expressing satisfaction. The APEX Game has the potential to significantly improve students' knowledge of aircraft parts, addressing gaps in understanding and offering a practical and engaging tool for self-directed learning in aviation mechanics. The transformative impact of the APEX Game on traditional and online education in aviation mechanics suggests broader implications for incorporating gaming into educational practices, enhancing learning experiences, and making education more accessible and enjoyable. Based on the study findings, it is recommended to further explore and integrate gaming elements into aviation education curricula, fostering collaboration between educators and game developers to design more immersive and educational gaming experiences that cater to diverse learning styles and preferences.

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LIST OF ABBREVIATIONS

APEX	Aircraft Parts Explorer
AEM	Aero Engineering Management
AEP	Aero Engineering Practical
RAT	Replace, Amplify and Transform
NPC	Non-Playable Characters
STEM	Science, Technology, Engineering and Mathematics
NASA	National Aeronautics and Space Administration
UI	User Interface
HUD	Heads-Up Display
RAF	Royal Air Force
LAE	Licensed Aircraft Engineers
GUI	Graphic User Interface
iOS	iPhone Operating System
RAM	Random-Access Memory
AMOLED	Active-Matrix Organic Light-Emitting Diode
IPS	In-Plane Switching
LCD	Liquid Crystal Display
OLED	Organic Light-Emitting Diode
LED	Light-Emitting Diode
TFT	Thin Film Transistor
VR	Virtual Reality
AR	Augmented Reality

LIST OF APPENDICES

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND OF STUDY

A platform that is widely used by kids and teenagers worldwide, Roblox provides a platform for educational inquiry. Roblox's aviation education utilizes the accessibility and popularity of the platform to create a seamless blend of education and gameplay. Roblox's integration of gaming and education offers an enjoyable and captivating learning experience for users to expand their aviation knowledge. The platform is accessible via a variety of platforms, including desktop computers, mobile devices, and gaming consoles.

Figure 1.1: Roblox (Calum Self, 2022)

The data of the survey strongly testify to the effectiveness of Roblox's educational activities. Respondents highlight positive interactions and hands-on learning, highlighting the immersive features of the platform. One important factor is that Roblox is quite popular among kids and teenagers because it offers a comfortable and entertaining environment. Although there have been some challenges, the survey's agreement highlights the benefits of educational content on the Roblox platform.

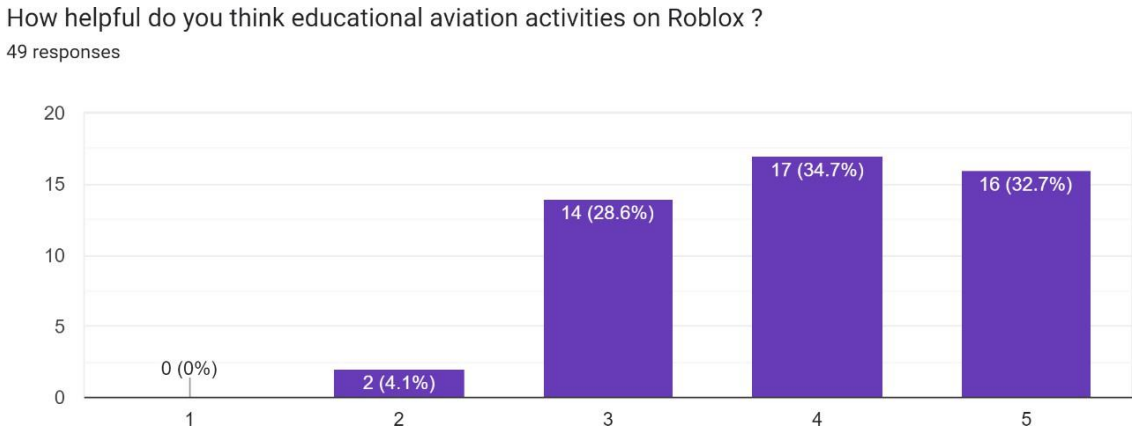


Figure 1.2: Survey Question

With the help of the Roblox platform, the APEX (Aircraft Parts Explorer) game can now provide an immersive learning environment where students can explore and interact with virtual aircraft to learn about the roles that various parts play in flight. In addition to being an interactive game, the game guarantees an organized educational experience by adding a curriculum that is in line with STEM education standards to the learning process.

The APEX game covers the many parts that comprise an aircraft, reflecting Roblox's own creative and cooperative spirit. It provides an interactive introduction to the main components of an aircraft, including the engine, landing gear, wings, pitot tube, and ram turbine engine. It is essential to comprehend the importance of each component, as they all contribute significantly to the smooth operation of an aircraft.

In conclusion, the APEX game on Roblox takes advantage of the platform's accessibility and popularity to offer an innovative and engaging approach to aviation education. In order to make Roblox an even more useful tool for teaching, the study emphasizes the necessity for a regulated setting and admits the potential difficulties. It also calls for the creation of an official education edition.

1.2 PROBLEM STATEMENTS

There is a common pattern in Malaysia nowadays where quite a few people show opposition or dislike for going to further school or continuing their education. Even with the obvious benefits of lifelong learning and postgraduate degrees in the quickly changing global context of today, a significant portion of Malaysians seem unwilling or uninterested in pursuing further education. Many factors, such as economic limitations, ignorance of the long-term advantages of advanced education, limited opportunities for educational opportunities, and cultural influences that might not prioritize lifelong learning, can be blamed for this rejection of continuing education. There is an issue among students nowadays, globally and in particular contexts like Malaysia, where many people seem to lack innate motivation or passion for pursuing higher education.

Declining enrolment rates, rising dropout rates, and a general lack of interest in higher education are all typical of this cyclical trend. This opposition has many kinds of negative effects that go beyond personal growth. Lack of qualified workers might hurt Malaysia's workforce and make the country less competitive in the global knowledge economy. Additionally, when people miss out on chances for professional and personal development, that pattern may contribute to a lifetime of socioeconomic inequality.

Examining the aviation industry in Malaysia reveals a common hesitancy among individuals to pursue higher education in aviation-related fields, despite the industry's substantial growth and importance. The current state of education and societal attitudes 24.1 16 indicates a lack of interest in aviation education and jobs among Malaysians,

posing a barrier to Malaysia's sustainable efforts to expand its aviation workforce. Current research highlights a dearth of information on factors influencing Malaysians' reluctance to pursue further aviation education, with a general lack of interest in or knowledge about aviation potentially playing a significant role. Another possible cause is limited awareness of the diverse job prospects within the aviation sector.

To promote the development of all students, educational games are crafted on the Roblox platform targeting diverse academic levels, particularly engineering learners, especially those specializing in aircraft engineering. The objective is to enhance students' comprehension of aircraft parts while making aviation enjoyable. The game aims to offer a fun and educational experience to players curious about aviation fields. The target audience comprises students, aviation enthusiasts, and anyone seeking a comprehensive yet entertaining introduction to aircraft components. The project's scope involves creating an interactive platform covering essential aircraft parts, recognizing limitations such as the complexity of certain systems and the necessity for a balance between education and entertainment.

1.3 PROJECT OBJECTIVES

1.3.1 General Project Objectives

This project's objectives are:

- To develop an online game for all ages of students and aircraft engineering students.
- To create an aviation game that educates users on aircraft, hangar and aircraft components in a fun and interactive way.
- To demonstrate how aircraft basic parts work.

- To design a game progression system that encourages players to proceed through the game by fulfilling objectives, obtaining awards, and getting access to new content.
- To ease students' access to online study resources and close the distance between them and their lecturers.

1.3.2 Specific Individual Project Objectives

1.3.2.1 Game Structure

This project aims:

- To develop a variety of Roblox games, simulations, and virtual worlds with an aviation theme that adhere to accepted aviation curriculum guidelines.
- To create challenging games and interactive gameplay for the Roblox aviation education materials to encourage students' active learning.
- To investigate the possibilities of using Roblox to scale aviation education in order to reach a wider audience and offer equal learning opportunities.

1.3.2.2 Game Mechanism

The project aims:

- To help players learn about aircraft components by placing interactive points in the game, allowing them to click on specific parts for detailed information and fostering a self-directed learning experience.
- To promote interactive exploration, which challenges players to explore different aircraft parts.
- To improve educational content by adding aircraft-related in-game components, giving players an entertaining chance to test their knowledge.

1.3.2.3 Interface Layout

This project aims to:

- To help students have a better understanding of aircraft parts.
- To give students a better learning process through visual games.
- To make sure students have exposure to their studies.
- To develop easier and more enjoyable learning.

1.4 PURPOSE OF PROJECT

The goal of our project is to develop an educational mobile game on the Roblox platform that will inform and interest students studying aviation. With a focus on aircraft components, flying principles, and aircraft exploration within the field of aviation, this application will provide a thorough learning experience. Our goal is to create an enjoyable aviation-loving learning community by combining realistic simulations, social elements, and interactive learning methods. However, these aircraft parts explorer games are available and can be downloaded on the Roblox platform.

To achieve our goal, we chose the Roblox platform in order to accomplish our objective. Roblox can be downloaded from Google, the Play Store, and the App Store. So, there is less limitations for specific or certain online platform. This educational game takes the learning process to another level of e-learning by making an online game consisting of a basic explanation of aircraft parts, how aircraft turn on, and how aircraft fly. By making educational games, students and educators can access our games anywhere, anytime, and whenever they want. The seamless implementation of learning into a learner's daily routine through mobile learning enhances learning and encourages effective learning completion.

1.5 SCOPE OF PROJECT

1.5.1 General Project Scopes

Our proposed concept will have the following limitations:

- Performance and graphics may be influenced by the player's device.
- Detailed and advanced aviation topics may require additional resources.
- Roblox's library of pre-built assets may not offer a wide range of accurate and detailed aircraft models.
- The server may be laggy or down.

1.5.2 Specific Individual Scopes

1.5.2.1 Game Structure

APEX Game will be focusing on education aviation suitable for teenagers and aviation students that can attract them with all interactive graphics and 3D models and make this game in Roblox their favorite game to use for learning about all the parts of aircraft. While playing the games, players can learn about aircraft. With the Blender app, APEX can create 3D models to make the game more realistic. We can also use other apps such as AutoCAD, Prisma 3D, Scuplt+, Qubism 3D Modeling, and many more. But APEX uses Blender because it is free and easy to use.

In APEX, players can have customizable aircraft equipped with advanced explanations about the system of aircraft, which is the 3D model of the aircraft Airbus 330-300, which has its own script to make interactive explanations. Players are kept interested in the exploration process as the game world changes over time with new challenges, updates, and events.

Ensuring that the player's choices and actions feel reflected in a lively and dynamic game world. This strategy promotes continuous exploration and involvement in the game's developing ecosystem, which helps sustain players' long-term interests.

1.5.2.2 Game Mechanism

The exploration of aircraft parts within the game may face limitations in terms of complexity and variety, impacting the diverse learning opportunities available to players. Balancing the need for an enjoyable gameplay experience may impose restrictions on the depth of educational content, potentially limiting the extent of detailed information provided about various aircraft parts.

1.5.2.3 Interface Layout

For the Roblox games themselves, Android and iOS users can download them. But the game itself may need a steady internet connection in order to use some features, such as collaborative learning or real-time updates. Certain functionality may be delayed or unavailable to users on devices with erratic or sluggish network connectivity. This app is also taking up a considerable amount of storage space, so a considerable amount of storage space may be needed by the software to hold used data, updates, and content. The quantity of content that may be downloaded or saved locally may be limited if users devices with limited storage must manage their storage space to fit the software.

CHAPTER 2

LITERATURE REVIEW

2.1 GENERAL LITERATURE REVIEW

2.1.1 Gamification in Education

In recent years, the concept of gamification has emerged as a revolutionary approach to reshaping traditional teaching and learning methods. By infusing elements of games into educational environments, gamification aims to create engaging and effective learning experiences for students.

A major advantage of gamification is its capacity to boost student motivation. By incorporating game-like features such as rewards, badges, levels, and leaderboards, educators can tap into students' intrinsic motivation, making the learning process more enjoyable and engaging. This intrinsic motivation leads to enhanced student participation and a greater willingness to learn. Furthermore, gamification promotes critical thinking skills. In numerous games, players must dissect information, evaluate alternatives, and make decisions. By integrating these aspects into educational games, students are encouraged to think critically, weigh different perspectives, and make reasoned judgments. This not only enhances their critical thinking abilities but also equips them with valuable skills for real-world scenarios.

Despite its immense potential, gamification poses challenges in crafting and implementing impactful learning experiences. Educators need to strike a balance between incorporating game elements and maintaining the academic integrity of the content. Additionally, the long-term effectiveness of gamification, and its effect on student learning, retention, and knowledge transfer necessitate further exploration.

To ensure the effectiveness and sustainability of gamification in different educational contexts, the development of best practices and guidelines is essential. Educators need to understand the principles of gamification and tailor them to suit the specific needs of their students. By sharing success stories, strategies, and lessons learned, educators can enhance their collective knowledge and effectively implement gamification.

As the educational landscape evolves, gamification represents a promising technique to revolutionize traditional teaching methods. By leveraging the benefits of increased motivation, creativity, problem-solving skills, and critical thinking, gamification has the potential to create more engaging and effective learning environments. The integration of emerging technologies and the development of best practices will further enhance the impact of gamification in education. With continued exploration and refinement, gamification can become a powerful tool in preparing students for the demands of the 21st-century workforce.

2.1.2 Interactive Learning in Aviation

An industry like aviation requires continuous learning and adaptation to changing technologies and procedures. A number of fields, including aviation, have recognized the effectiveness of interactive learning in the past few years. Interactive learning methods, such as simulation-based training and virtual reality, offer unique advantages in aviation education. Through these approaches, trainees can engage in situations that closely mimic real-world scenarios, resulting in a realistic and immersive learning environment. A hands-on experience like this enhances critical thinking, decision-making, and problem- solving skills, which are essential for pilots.

The benefits of interactive learning in aviation are undeniable, but its implementation presents several challenges. In the first place, interactive learning technologies can be quite expensive to acquire and maintain. Smaller aviation training institutions cannot afford advanced flight simulators and virtual reality systems due to their high cost. Moreover, interactive learning must be carefully planned and adapted into existing aviation curricula. There is a need to redesign training programs so that interactive elements can be incorporated effectively without compromising the overall training objectives. Additionally, instructors need adequate training to facilitate interactive learning experiences and provide learners with effective feedback.

Aviation education could be revolutionized by interactive learning. Through advancements in technology, interactive learning tools can simulate a wide range of scenarios, including emergencies and adverse weather conditions. The simulations enable pilots to gain valuable experience and develop the necessary skills, increasing their readiness for real-life situations.

In order to prepare pilots for safer and more competent operations, the aviation industry should harness the full potential of interactive learning. For aviation education to be of the highest quality, it will be essential to continuously invest in interactive learning technologies, curriculum development, and instructor training.

2.1.3 Types of Aviation Games

a) **Flight Simulators:**

   A flight simulator offers a realistic and engaging simulation of flying an airplane. These games focus a strong emphasis on specific mechanics, realistic airplane models, and detailed environments. They offer a thorough simulation of flight controls, navigation, and procedures and let players fly a variety of aircraft, from military planes to commercial airliners.

Figure 2.1: Flight Simulator Game (Google, n.d)

b) **Maintenance and Repair games:**

Provide an immersive insight into the world of maintaining and repairing aircraft. These video games provide players the chance to put themselves in the position of aviation mechanics or technicians and take on the challenging task of inspecting, troubleshooting, and repairing various aircraft systems and components.

Figure 2.2: Plane Mechanics Airplane Game (Google, n.d)

c) Air Traffic Control games:

Air traffic control players take on the role of an air traffic controller who directs the movement of aircraft through airports. These games require players to control several airplanes, plan takeoffs and landings, and control airspace to prevent

crashes. To maintain the safe and effective running of the airport, players must act quickly, set priorities, and communicate clearly.

Figure 2.3: Air Traffic Controller (Wikipedia, n.d)

d) Airport Management games:

These video games simulate the duties involved in running and managing an airport. Assuming the role of an airport manager, players are responsible for duties including planning airport layouts, managing finances, scheduling flights, and ensuring customer satisfaction. These games challenge players to balance multiple airport management aspects while offering insights into the complexity of airport operations.

Figure 2.4: Airport Management 1 game (Google, n.d)

e) Combat Flight Games:

Aerial combat and dogfighting are the main themes of these games. Players fly fighter planes or other military aircraft in severe air-to-air combat. These games frequently have challenging missions, action-packed gameplay, and strategic elements such as weapon system management and target selection.

Figure 2.5: Combat Flight Simulator (Google, 2023)

2.2 SPECIFIC LITERATURE REVIEW

2.2.1 Game Structure

To achieve excellence in the APEX game, deliberate decisions must be made in its design and essence. In determining the success of a Roblox game, strategic choices in the game's structure and content play an equally important role in choosing the right elements for an immersive gaming experience.

2.2.1.1 Map design

An airport environment is a complex and strategically organized facility designed to facilitate air travel. Several key elements are involved, each serving a specific purpose to ensure smooth air traffic operations.

a) Hangars:

- Hangars are spacious, enclosed structures designed for storing, servicing, and maintaining aircraft.
- Offer protection for aircraft from unpredictable weather and serve as secure storage when they aren't in use.
- Hangars serve as hubs for maintenance activities, repairs, and inspections, ensuring the safety of aircraft and airworthiness.

Figure 2.6: Malaysia Airlines Hangar (Google n.d)

b) Runways:

- Runways are long, paved strips on which aircraft take off and land.
- Are meticulously designed and engineered to withstand the weight and speed of diverse aircraft.
- Runways are equipped with lighting systems and markings to assist pilots during takeoff and landing, especially in low-visibility conditions.

Figure 2.7: Airport Runway (Swayne Martin, 2023)

2.2.1.2 Aircraft Models

Three-dimensional (3D) representations of different kinds of aircraft are referred to as aircraft models. These models are designed to replicate the physical appearance of real aircraft, providing detailed and accurate representations of their structure, components, and overall design. Here's a more detailed explanation:

a) **Aircraft Types:**

- Aircraft models can portray a diverse array of aircraft types, including military jets, commercial airliners, propeller-driven planes, helicopters, and experimental aircraft.
- Every model is made to accurately represent the unique features and design details of its real-world version.

Figure 2.8: Airplane (Google, n.d)

b) Detailed Parts:

- Aircraft models include intricate details of various components, such as wings, fuselage, engines, landing gear, cockpit, and pitot tube.
- These detailed parts are essential for providing an accurate representation of the aircraft's structure and functionality.

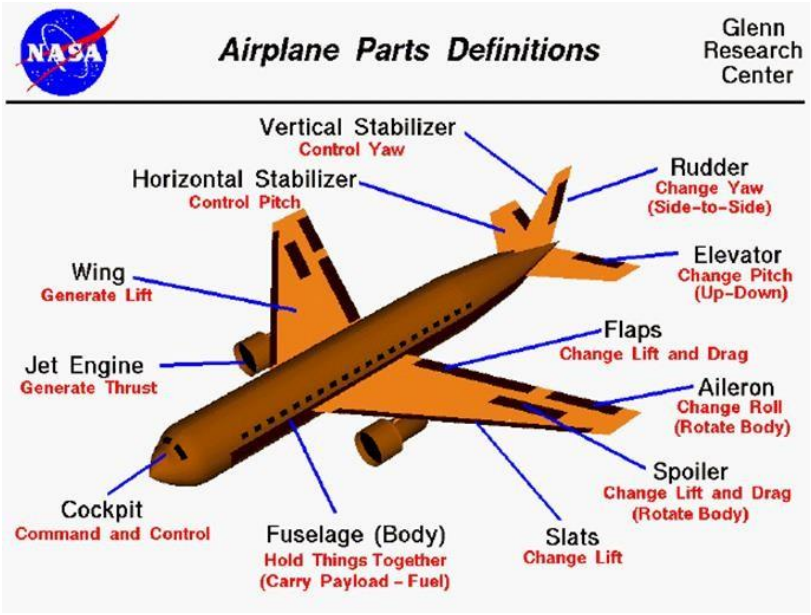


Figure 2.9: Parts of Airplane (NASA, n.d)

c) Educational and Professional Use:

- Aircraft models are valuable educational tools, aiding students and aviation enthusiasts in understanding the complexities of different aircraft designs.
- In a professional context, these models are used for engineering analysis, virtual prototyping, and training programs within the aerospace industry.

2.2.2 Game Mechanism

The systems and guidelines that guide a video game's gameplay are known as game mechanics. Game mechanics have interactive elements that affect how players progress through challenges, engage with the game's content, and navigate challenges. These

mechanisms establish the foundation for player interactions, forming the game's general framework and substantially impacting its popularity and success.

2.2.2.1 Player Control

In the context of games, player controls in a virtual environment refer to the devices and systems that let players engage with and move around the virtual world. This covers both camera manipulation which establishes the viewpoint and perspective and movement controls, which specify how the virtual character or thing moves.

a) Movement Control:

- Input techniques known as movement controls let players control how a character, item, or vehicle moves inside a virtual world.
- The responsiveness and intuitiveness of these controls are crucial for providing players with a sense of agency and control over their virtual entity.

b) Camera Manipulation:

- The player's perspective and point of view in the virtual environment are controlled by the camera manipulation controls.
- This involves allowing players to explore the surroundings from various perspectives and distances by panning, tilting, zooming, and rotating the camera.
- In order to give players a complete view of the simulated aircraft or location, camera controls are necessary. This facilitates navigation and observation.

c) Customization Options:

- Player controls are frequently customizable to accommodate a range of tastes and ability levels.
- To suit their preferred interaction style, players may be able to customize key bindings, invert controls, and modify sensitivity.

2.2.2.2 Interaction Scripts

A virtual environment's interactive and instructional features are greatly enhanced by interaction scripts. These scripts are sets of pre-programmed instructions meant to respond to inputs from the player and make it easier to interact with specific elements in the virtual environment.

a) **Click Detectors and Input Methods:**
   - Click detectors and other input techniques are frequently used by interaction scripts as triggers to start particular activities or responses.
   - Click detectors monitor player actions, like mouse clicks or taps, indicating that the player intends to play with a certain piece in the virtual world, like various aircraft elements.

b) **Interacting with Aircraft Parts:**
   - These scripts are designed primarily to allow players to interact with different parts of a model aircraft.
   - Players can interact with the virtual aircraft by clicking on or selecting particular elements, which will activate the linked interaction script and produce a response.

c) **Displaying Information:**
   - Interaction scripts are mostly used to show relevant information when a player interacts with or chooses particular aircraft parts.
   - This information may include details about the purpose, function, specifications, or historical significance of the selected part, offering users a deeper understanding of the aircraft's intricacies.

d) **Enhancing Educational Value:**
   - Interaction scripts significantly contribute to the educational value of virtual environments, especially in simulations or applications related to aviation or engineering.
   - By providing detailed information about aircraft components, these scripts facilitate a more immersive and educational experience, allowing users to explore and learn about the aircraft in a hands-on manner.

2.2.3 Interface Layout

The way features and elements are arranged to influence the player's experience is referred to as the interface layout. It includes the systematic organization of guidelines and processes that affect how players interact with the game's content, overcome challenges, and advance through it. The efficient arrangement of these components within the game's framework enhances the player experience and boosts the overall popularity and success of the game.

2.2.3.1 User Interface (UI)

User Interface (UI) is the visual and interactive part of a device or software. It includes elements such as buttons, icons, and menus that users see on the screen. The purpose of UI is to make it straightforward for users to navigate and control the system, providing a clear and user-friendly experience.

a) Heads-Up Display (HUD):

- Shows important details during the game.
- Displays key information like altitude, speed, and mission objectives.
- Focuses on clarity for quick understanding.
- Provides dynamic and immediate information for better gameplay awareness.

b) Menus:

- Helps users navigate game features and settings.
- Easy and clear layout for user-friendly experience.
- Covers in-game settings, customization, and tracking achievements.
- Well-structured menus for smooth access to different functionalities.
- Enhances overall user experience, making the game more interactive and enjoyable.

2.2.3.2 Testing

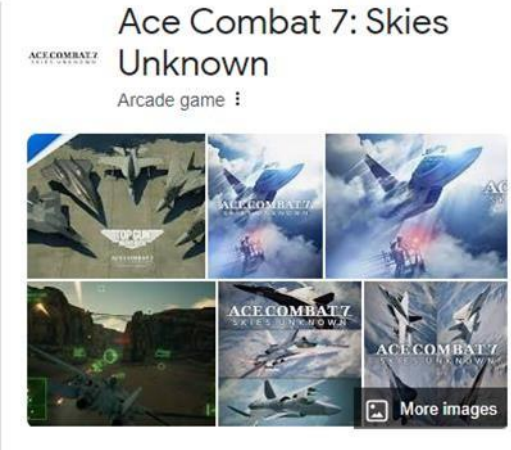
a) Play Testing

- Regular tests conducted to make sure the game works well and is enjoyable.

- Actively seeks feedback from players to identify areas for improvement and understand what players like.
- Actively seeks feedback from players to identify areas for improvement and understand what players like.

2.3 REVIEW OF RECENT RESEARCH / RELATED PRODUCTS

2.3.1 Recent Market Products

No.	Marketed Product	Patent Summary
1.	 Figure 2.10: Ace Combat 7: Skies Unknown (Google, n.d)	**Game name:** Ace Combat 7: Skies Unknown **Developer:** Bandai Namco Entertainment **Release:** PlayStation 4, Xbox One January 18, 2019 Windows February 1, 2019 **Description:** Ace Combat 7: Skies Unknown is an action flight simulation video game. The player can also choose novice or expert control settings; the latter enables the player to execute realistic aircraft maneuvers such as rolls, high-G turns, and even Cobra maneuvers. The game features 28 different aircraft, with an additional nine as

		downloadable content and the F-4E Phantom II offered as a pre-order bonus. As with previous entries in the series, most of the aircraft are licensed from real-world manufacturers, although a set of fictional superplanes is also included.
2.	 Figure 2.11: Infinite Flight Game (Google, n.d)	**Game name:** Infinite Flight **Developer:** Infinite Flight **Release:** April 25, 2011 **Description:** Infinite Flight Simulator offers a vast selection of aircraft, including commercial airliners, general aviation planes, military jets, and more. Each aircraft is meticulously designed with accurate cockpit instruments, systems, and physics simulation, giving players a realistic flying experience. The game also includes various liveries and aircraft customization options.
3.	 Figure 2.12: World of Airport Game (Google, n.d)	**Game name:** World of Airports **Developer:** Haug. Land **Release:** October 23, 2019 **Description:** World of Airports is a strategy game that focuses on airport management. You can take on the role of an air traffic controller while developing one of the many international airports that are

		accurately rendered in realistic 3D. Join a massive community of airport, airplane, and aviation enthusiasts in the World of Airports. It provides airplane games, airport simulators, and airline management features.
4.	 Figure 2.13: Plane Mechanic Simulator (Google, n.d)	**Game name:** Plane Mechanic Simulator **Developers:** Disaster Studio, Cobble Games **Release:** February 13, 2019 **Description:** In Plane Mechanic Simulator, players assume the role of a mechanic stationed at a British Royal Air Force (RAF) base during World War II. The game offers a realistic simulation of the maintenance and repair process for different types of aircraft, such as the Supermarine Spitfire and the North American P-51 Mustang. It also provides an experience, allowing players to interact with the aircraft's engines, fuel systems, landing gear, and more.

Table 2.1: Recent Market Products

2.4 COMPARISON BETWEEN RECENT RESEARCH AND CURRENT PROJECT

2.4.1 Product A vs Current Project

Table 2.2: Product A vs Current Project

Product	**Ace Combat 7: Skies Unknown**	**APEX Game**
Purpose	To provide an exhilarating combat experience, allowing players to engage in thrilling aerial battles.	To create an educational Roblox game where players explore aircraft parts, simulating real scenarios to build practical knowledge and skills in identifying and understanding these components.
Target	Teenagers	High School Students
Platform	PlayStation 4, Xbox One, Microsoft Windows	Roblox platform, accessible on multiple devices such as PCs, consoles, and mobile devices.
Features	Need to Purchase	Free to Play
Genre	Aerial Combat	Educational Simulation

2.4.2 Product B vs Current Project

Table 2.3: Product B vs Current Project

Product	**Infinite Flight**	**APEX Game**
Purpose	It aims to replicate real-world aviation procedures, aircraft physics, and navigation systems. The game offers a	To create an educational Roblox game where players explore aircraft parts, simulating real scenarios to build practical

	wide range of aircraft, detailed cockpits, and realistic flight environments.	knowledge and skills in identifying and understanding these components.
Target	Everyone	High School Students
Platform	Ipad and other mobile devices	Roblox platform, accessible on multiple devices such as PCs, consoles, and mobile devices.
Features	Free to Play	Free to Play
Genre	Flight Simulation	Educational Simulation

2.4.3 Product C vs Current Project

Table 2.4: Product C vs Current Project

Product	**World of Airports**	**APEX Game**
Purpose	Focuses on airport management and operations. Players are responsible for managing various aspects of airport operations, such as runway management, gate assignments, and aircraft handling.	To create an educational Roblox game where players explore aircraft parts, simulating real scenarios to build practical knowledge and skills in identifying and understanding these components.
Target	Primary school	High School Students
Platform	Android and IOS	Roblox platform, accessible on multiple devices such as PCs, consoles, and mobile devices.
Features	Free to Play	Free to Play
Genre	Airport Management	Educational Simulation

2.4.4 Product D vs Current Project

Table 2.5: Product D vs Current Project

Product	**Plane Mechanic Simulator**	**APEX Game**
Purpose	Focuses on simulating realistic maintenance procedures, including engine repairs, electrical system checks, hydraulic system maintenance, and more.	To create an educational Roblox game where players explore aircraft parts, simulating real scenarios to build practical knowledge and skills in identifying and understanding these components.
Target	Everyone	High School Students
Platform	Platforms: Nintendo Switch, PlayStation 4, Microsoft Windows, Xbox One	Roblox platform, accessible on multiple devices such as PCs, consoles, and mobile devices.
Features	Need to Purchase	Free to Play
Genre	Simulation	Educational Simulation

CHAPTER 3

RESEARCH METHODOLOGY

3.1 PROJECT BRIEFING & RISK ASSESSMENT

To accomplish the project objectives, we discussed with our supervisor getting a consultant from an individual company, TEAM D.R. NT 3D Game Development, to ensure the game was created successfully.

Figure 3.1: Logo TEAM D.R. NT Company

To facilitate collaboration for APEX game development using Roblox Studio, Google Meet has been chosen as the platform to leverage. This virtual meeting space serves as a central hub for team discussions, enabling the exploration of various aspects of game design, the intricacies of game mechanics, and the formulation of a comprehensive storyboard. By utilizing Google Meet, a seamless and interactive environment is ensured

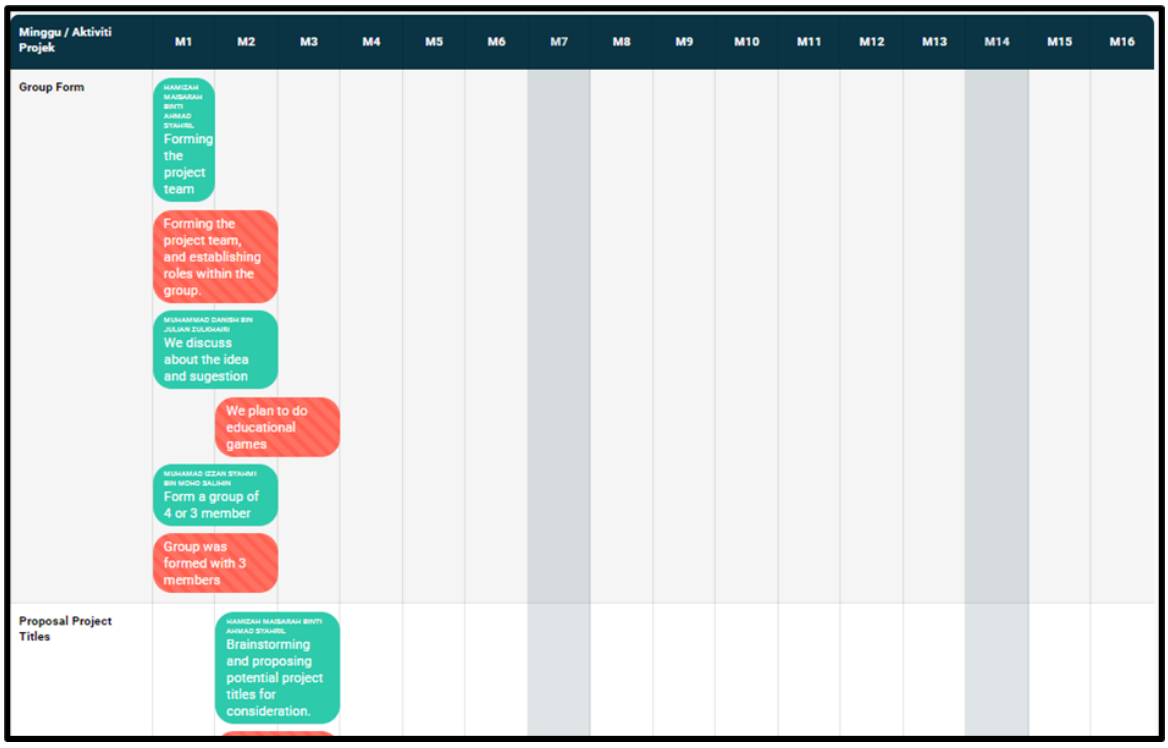
where team members can share ideas, provide feedback, and collectively shape the vision of the game.

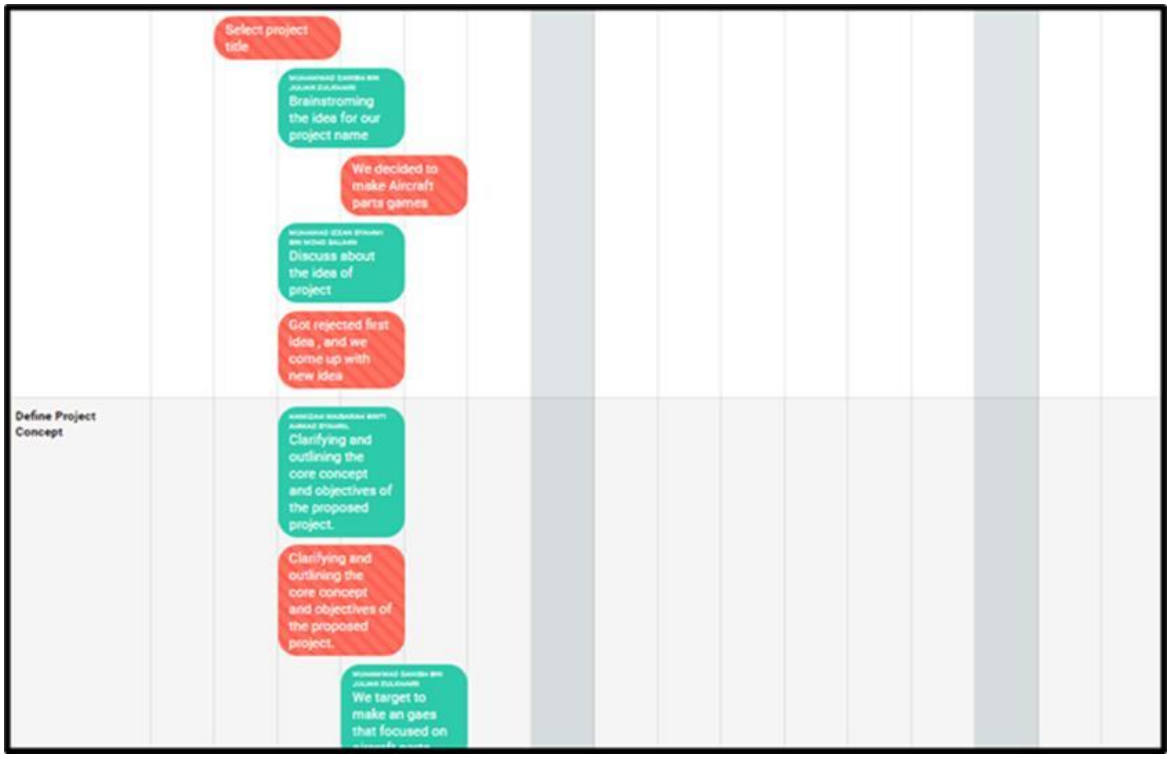
3.2 OVERALL PROJECT GANT CHART

3.2.1 Gant Chart for AEM

CARTA GANTT : PERANCANGAN DAN PELAKSANAAN PROJEK PELAJAR

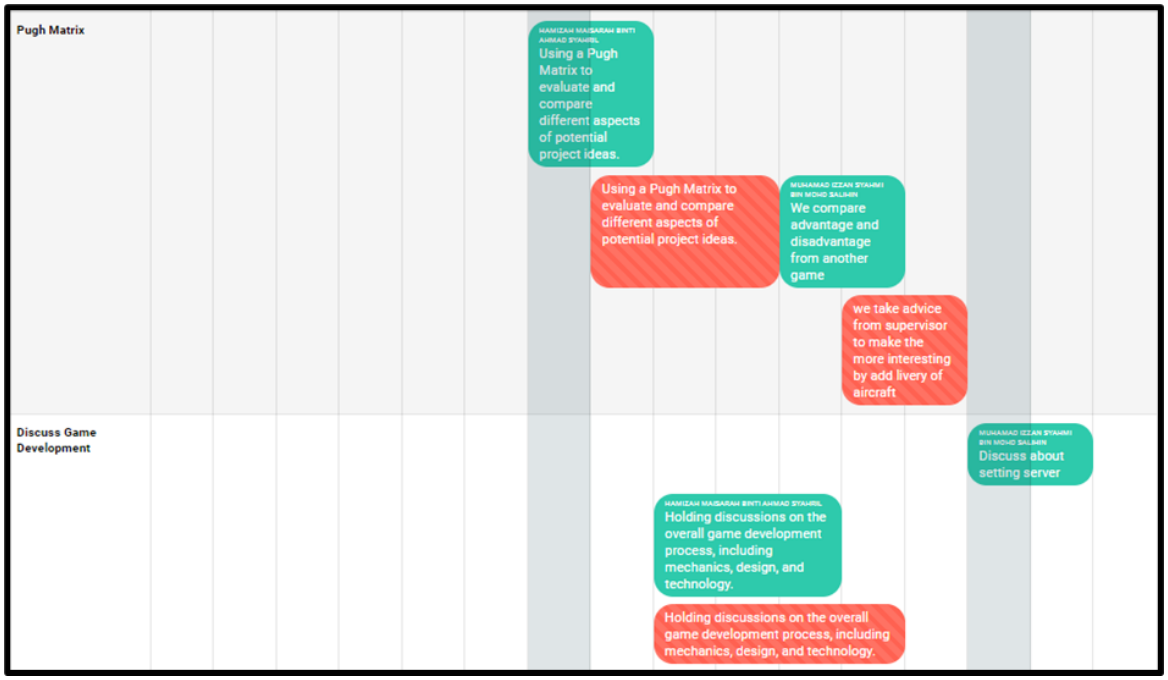
SESI : 2 : 2022/2023
JABATAN: JPP
KODKURSUS: DWM40312
TAJUK PROJEK : ROBLOX AVIATION EDUCATION




Select project title
Brainstroming the idea for our project name
We decided to make Aircraft parts games
Discuss about the idea of project
Got rejected first idea , and we come up with new idea
Define Project Concept
Clarifying and outlining the core concept and objectives of the proposed project.
Clarifying and outlining the core concept and objectives of the proposed project.
We target to make an gaes that focused on


We specific our project for aircraft parts and explorer aircraft
We do research about Roblox Player and Roblox Studio
We refer all our research to supervisor
Idea Selection by create pre game google form
Evaluating and selecting the most promising project idea from the proposed titles.
Selecting the most suitable idea from the proposed titles.
Discussing about google form content to collect data
survey question was rejected cause by not related the game
Re-do the survey question
Approve by supervis


Conduct Research
MUHAMAD IZZAN SYAHMI BIN MOHD SALIMIN
We do some research about game that already in Roblox
FInd some idea by play games in Roblox focusing in aviation
HAMIZAH MAISARAH BINTI AHMAD SYAHRIL
Carrying out research related to the chosen project concept to gather essential information.
Carrying out research related to the chosen project concept to gather essential information.
Survey Question
HAMIZAH MAISARAH BINTI AHMAD SYAHRIL
Creating a questionnaire to collect opinions relevant to the project.
Sharing a questionnaire to collect opinions relevant to the project.
MUHAMAD IZZAN SYAHMI BIN MOHD SALIMIN
collect data from google form for idea and improvement
Apply idea from google form to the game


Pugh Matrix
HAMIZAH MAISARAH BINTI AHMAD SYAHRIL
Using a Pugh Matrix to evaluate and compare different aspects of potential project ideas.
Using a Pugh Matrix to evaluate and compare different aspects of potential project ideas.
MUHAMAD IZZAN SYAHMI BIN MOHD SALIMIN
We compare advantage and disadvantage from another game
we take advice from supervisor to make the more interesting by add livery of aircraft
Discuss Game Development
MUHAMAD IZZAN SYAHMI BIN MOHD SALIMIN
Discuss about setting server
HAMIZAH MAISARAH BINTI AHMAD SYAHRIL
Holding discussions on the overall game development process, including mechanics, design, and technology.
Holding discussions on the overall game development process, including mechanics, design, and technology.

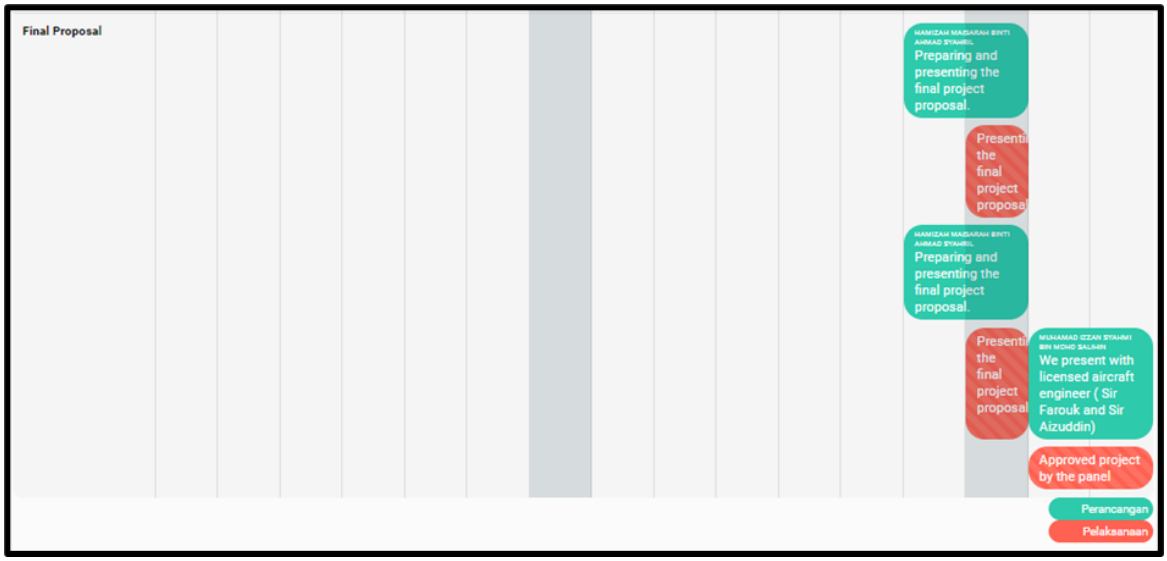
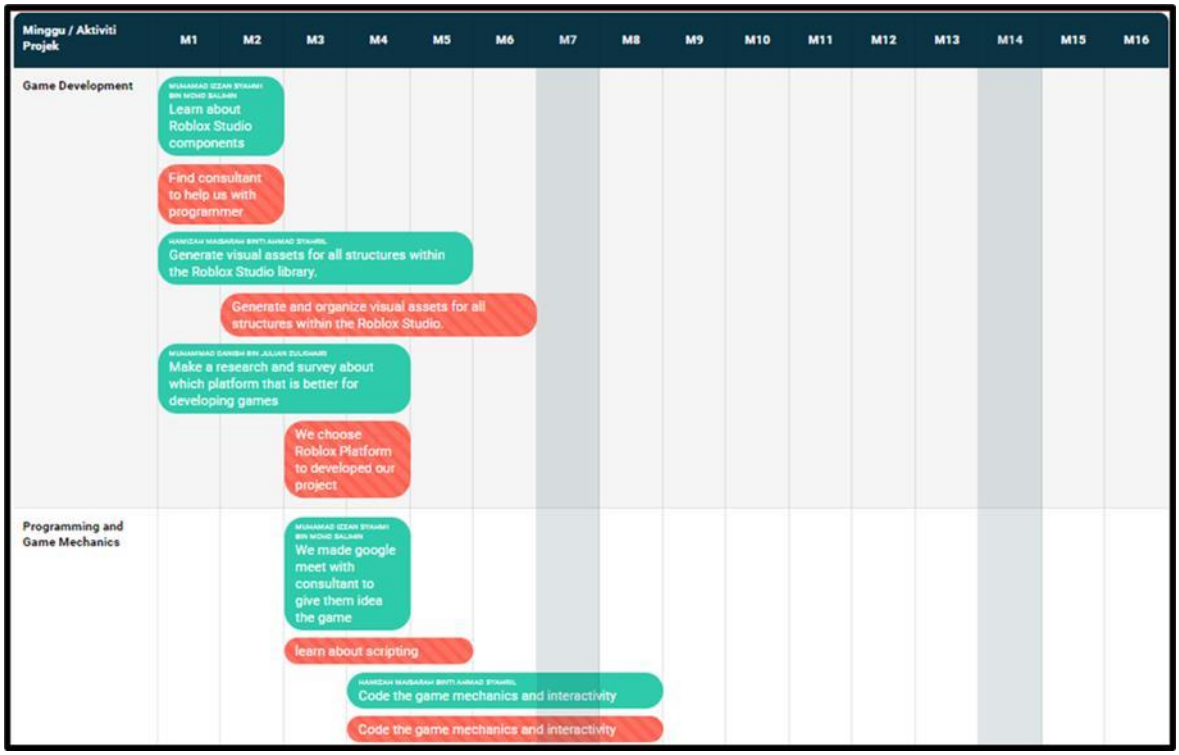
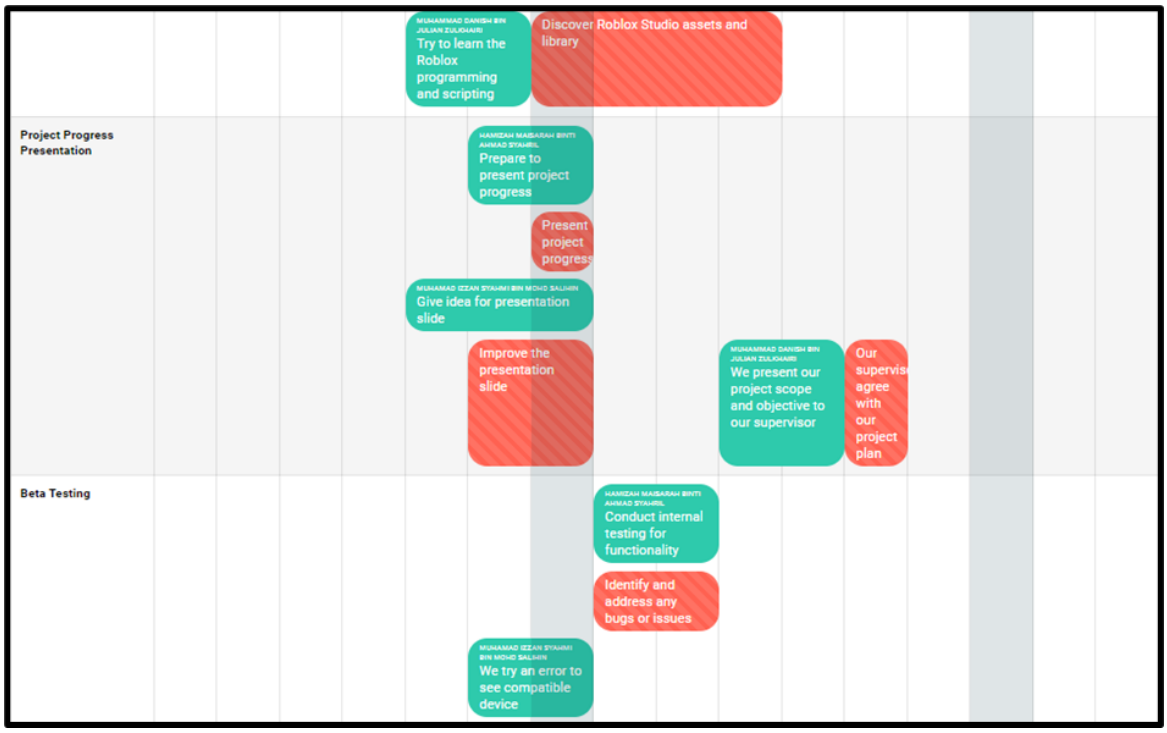


Figure 3.2: Gantt Chart for AEM

3.2.2 Gantt Chart for AEP


Minggu / Aktiviti Projek
M1
M2
M3
M4
M5
M6
M7
M8
M9
M10
M11
M12
M13
M14
M15
M16
Game Development
Learn about Roblox Studio components
Find consultant to help us with programmer
Generate visual assets for all structures within the Roblox Studio library.
Generate and organize visual assets for all structures within the Roblox Studio.
Make a research and survey about which platform that is better for developing games
We choose Roblox Platform to developed our project
Programming and Game Mechanics
We made google meet with consultant to give them idea the game
learn about scripting
Code the game mechanics and interactivity
Code the game mechanics and interactivity


Try to learn the Roblox programming and scripting
Discover Roblox Studio assets and library
Project Progress Presentation
Prepare to present project progress
Present project progress
Give idea for presentation slide
Improve the presentation slide
We present our project scope and objective to our supervisor
Our supervis agree with our project plan
Beta Testing
Conduct internal testing for functionality
Identify and address any bugs or issues
We try an error to see compatible device

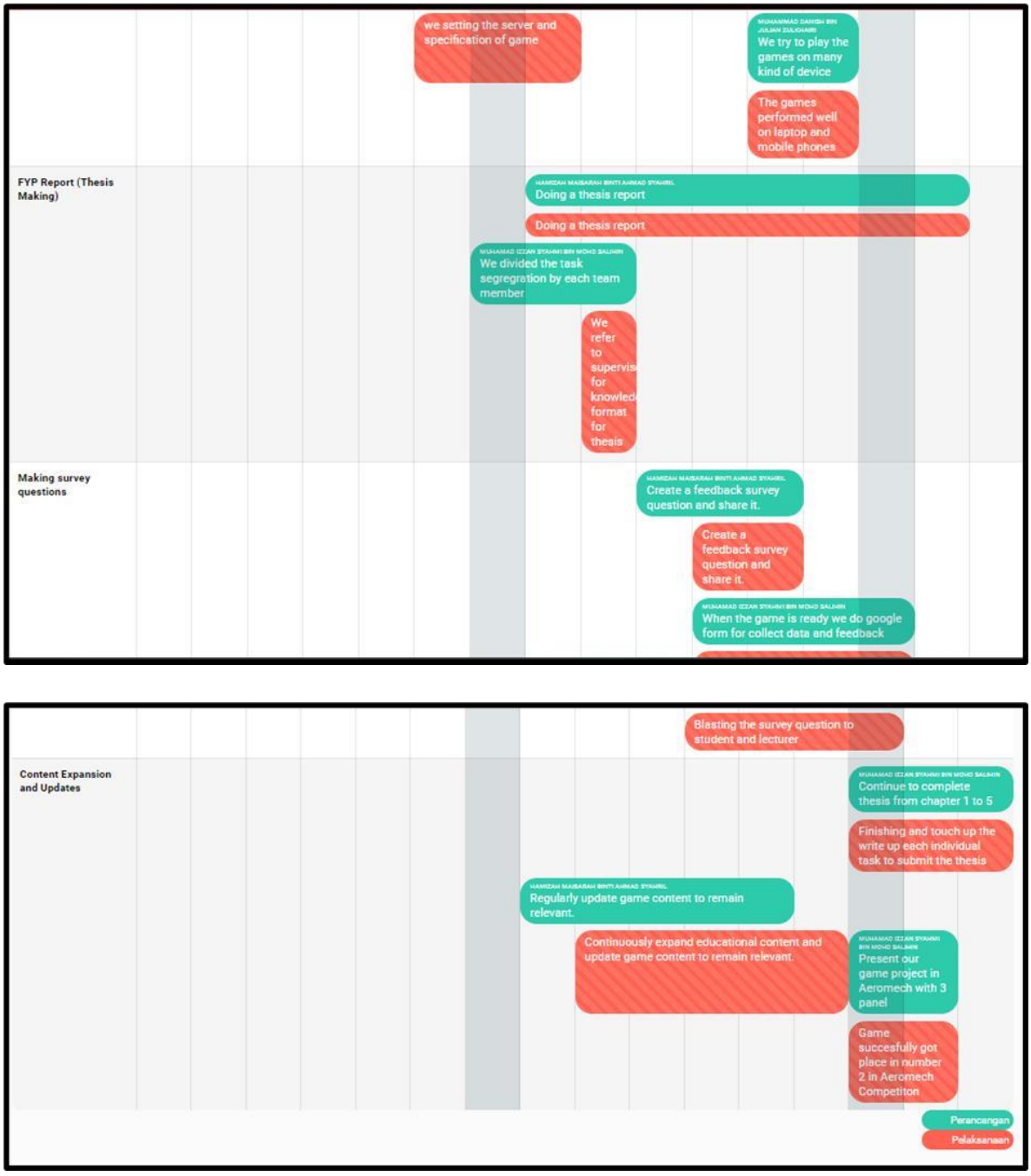


Figure 3.3: Gantt Chart for AEP

3.3 PROJECT FLOW CHART

3.3.1 Project Flowchart for AEM

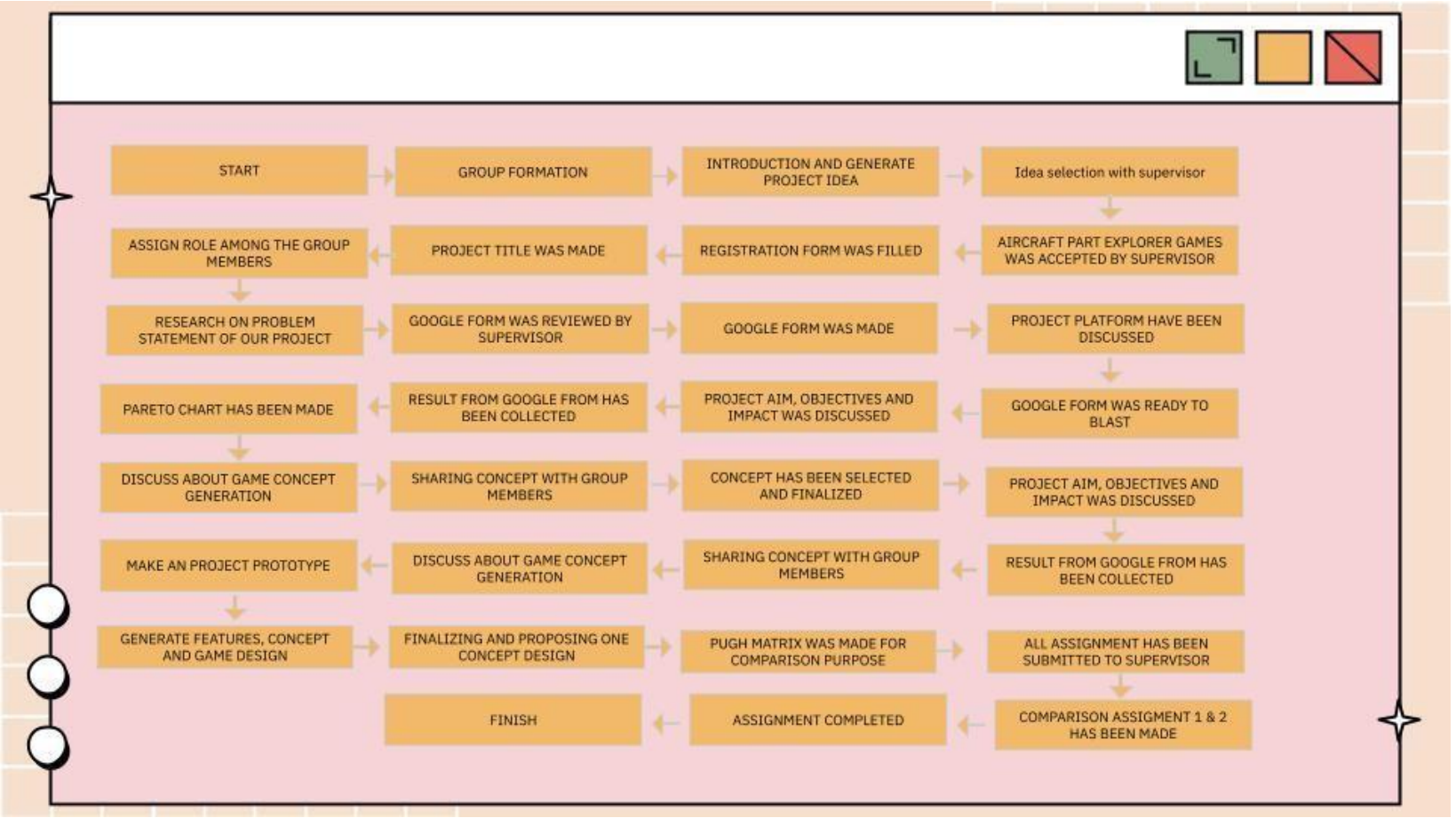


Figure 3.4: AEM Project Flowchart

3.3.2 Project Flowchart for AEP

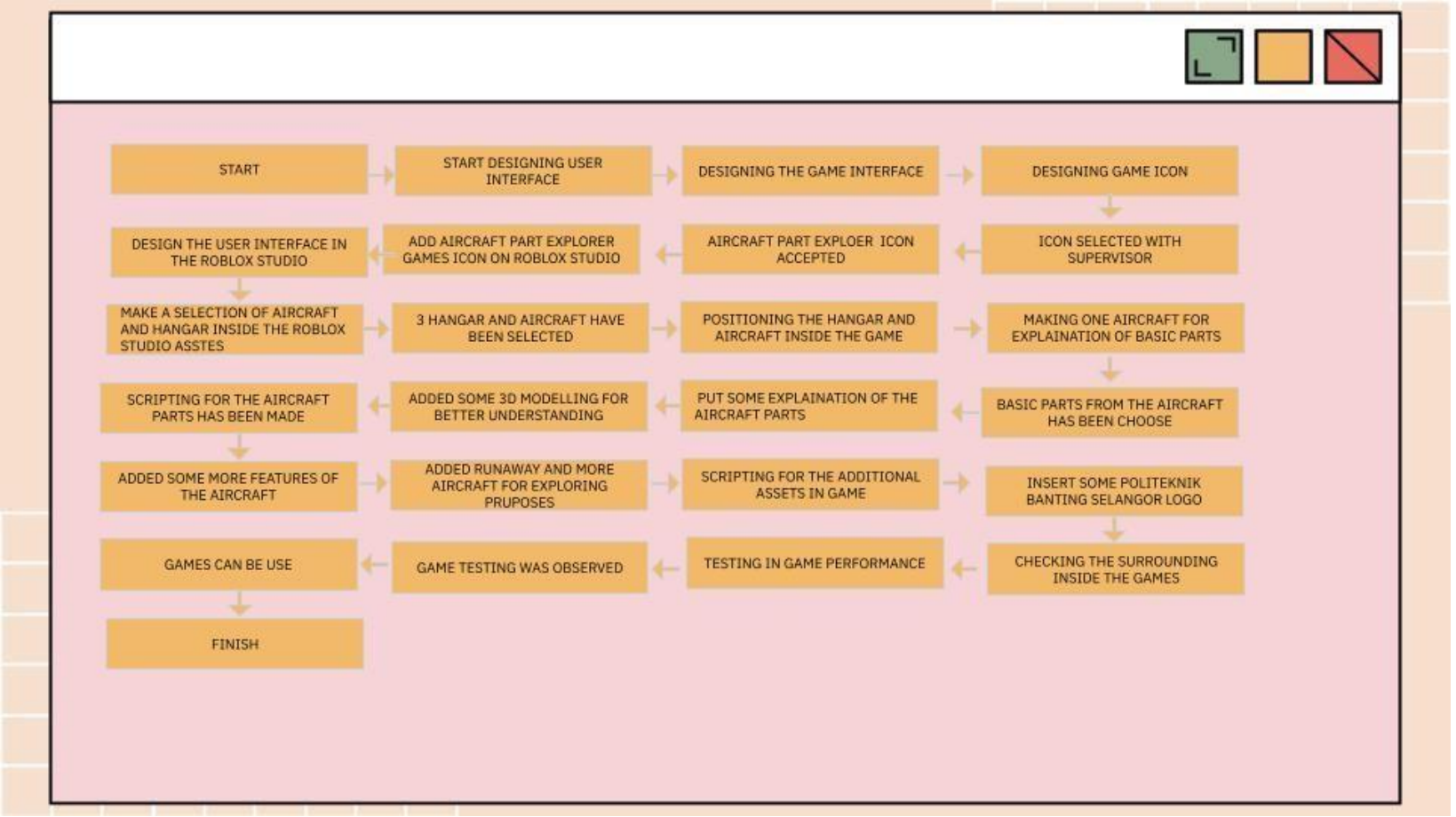
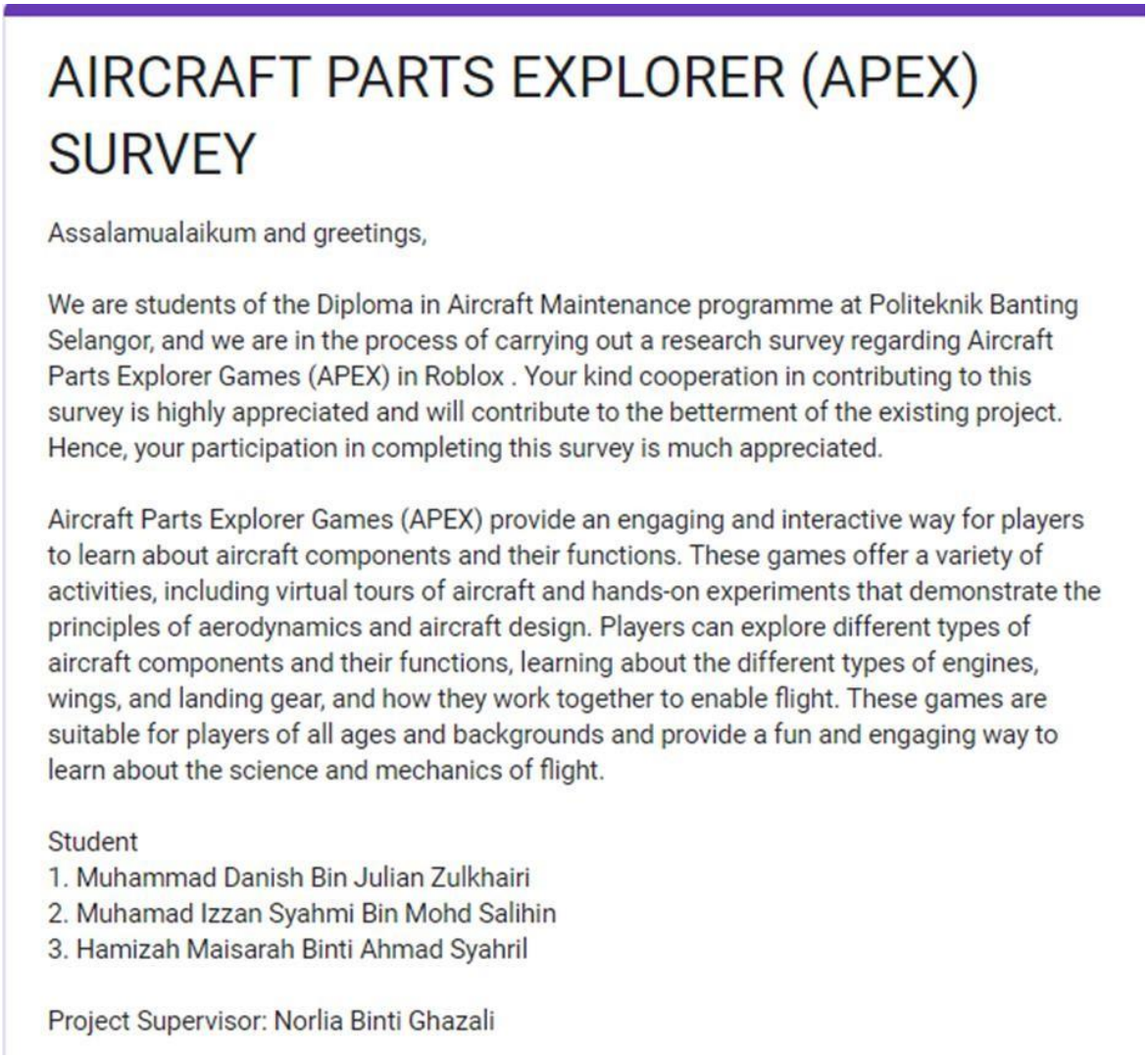


Figure 3.5: AEP Project Flowchart

3.4 DESIGN ENGINEERING TOOLS

3.4.1 Gaming Requirement Analysis

3.4.1.1 Questionnaire Survey



AIRCRAFT PARTS EXPLORER (APEX) SURVEY

Assalamualaikum and greetings,

We are students of the Diploma in Aircraft Maintenance programme at Politeknik Banting Selangor, and we are in the process of carrying out a research survey regarding Aircraft Parts Explorer Games (APEX) in Roblox . Your kind cooperation in contributing to this survey is highly appreciated and will contribute to the betterment of the existing project. Hence, your participation in completing this survey is much appreciated.

Aircraft Parts Explorer Games (APEX) provide an engaging and interactive way for players to learn about aircraft components and their functions. These games offer a variety of activities, including virtual tours of aircraft and hands-on experiments that demonstrate the principles of aerodynamics and aircraft design. Players can explore different types of aircraft components and their functions, learning about the different types of engines, wings, and landing gear, and how they work together to enable flight. These games are suitable for players of all ages and backgrounds and provide a fun and engaging way to learn about the science and mechanics of flight.

Student
1. Muhammad Danish Bin Julian Zulkhairi
2. Muhamad Izzan Syahmi Bin Mohd Salihin
3. Hamizah Maisarah Binti Ahmad Syahril

Project Supervisor: Norlia Binti Ghazali

Figure 3.6: Questionnaire Survey through Google Form

The survey was conducted through a Google Form. The question was about collecting data from students at Politeknik Banting and several teenagers regarding their knowledge of the Roblox platform. Sample questions included in the survey were:

- How often do you play games on Roblox?
- How would you rate the quality of educational aviation activities on Roblox compared to other educational resources (e.g., textbooks, online courses, simulations)?
- Have you ever participated in a Roblox aviation game?

The survey was distributed to students in Politeknik Banting, lecturers, and Licensed Aircraft Engineers (LAE).

3.4.1.2 Pareto Diagram

Once the survey was completed, the results of all respondents were analyzed in a Pareto chart based on the survey responses.

Features	Frequency	Cummulative	Cummulative Percentage	Pareto Baseline
Participated	28	49	33%	80%
Often Plays	25	74	63%	80%
Helpful	17	91	83%	80%
Satisfied	14	105	100%	80%
GRAND TOTAL	84			

Figure 3.7: Pareto Data Extracted from The Survey Response

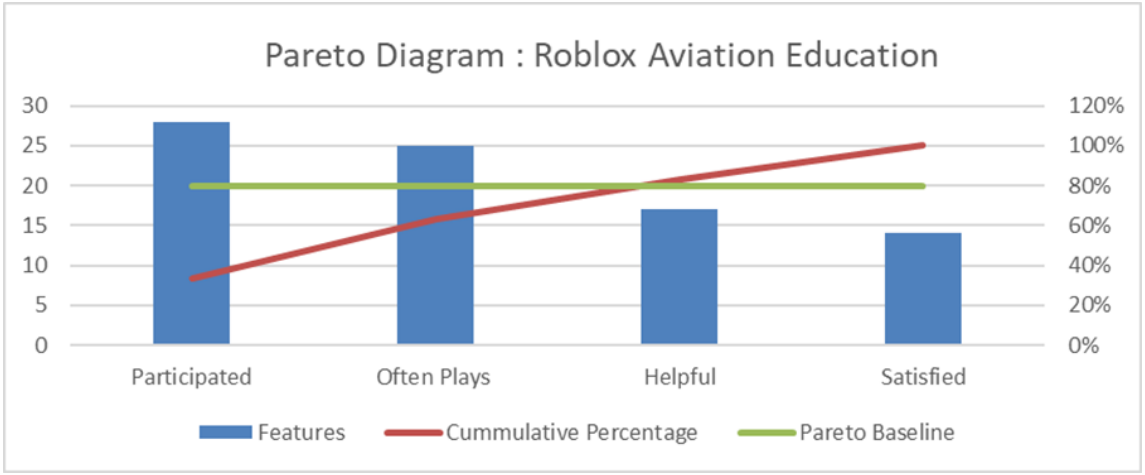
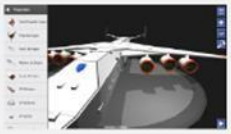


Figure 3.8: Pareto Diagram of APEX Game

3.4.2 Design Concept Generation

3.4.2.1 Morphological Matrix

Table 3.1: Morphological Matrix of APEX Game

FUNCTION	IDEA 1	IDEA 2	IDEA 3	IDEA 4
GAME MODES	AIRCRAFT DESIGN 	MAINTENANCE AND REPAIR 	FLIGHT SIMULATION 	AIR TRAFFIC CONTROL 
PLACE	AIRPORT TERMINAL 	HANGAR 	RUNAWAY 	MOUNTAIN 
THEMES	COLORFUL	DARK	BRIGHT	PASTEL
EXPLANATION	PARAGRAPH	MINDMAP	POINT	INFOGRAPHIC
ENVIRONMENT	SC-IFI 	FANTASY 	ADVENTURE 	SPACE EXPLORATION 

After the data collection phase was completed, ideas were generated for each function and sub-function. These concepts were developed based on creative insights and research drawn from existing games within the Roblox platform.

3.4.2.2 Proposed Design Concept 1

Table 3.2: Proposed Design Concept 1

FEATURES	CONCEPT 1	JUSTIFICATION
GAME MODES	MAINTENANCE AND REPAIR	TROUBLESHOOTING VARIOUS SYSTEMS AND DOING MAINTENANCE ON THE AIRCRAFT.
PLACE	AIRPORT TERMINAL	CENTRAL HUB FOR AVIATION-RELATED ACTIVITIES.
ENVIRONMENT	FANTASY	A WORLD OF MAGIC AND MYTHICAL CREATURES, WITH ENCHANTED FORESTS, CASTLES, AND EPIC QUESTS.
THEMES	BRIGHT	VIBRANT AND LIVELY COLORS, CREATING AN ENERGETIC AND CHEERFUL ATMOSPHERE.
EXPLANATION	POINT	PRESENTED USING CONCISE AND BRIEF STATEMENTS, TYPICALLY IN A BULLETED OR NUMBERED LIST FORMAT.

3.4.2.3 Proposed Design Concept 2

Table 3.3: Proposed Design Concept 2

FEATURES	CONCEPT 2	JUSTIFICATION
GAME MODES	AIRCRAFT DESIGN	CAN TEACH PLAYERS ABOUT THE PRINCIPLES OF ENGINEERING AND DESIGN.
PLACE	HANGAR	USED TO PERFORM MAINTENANCE AND UPGRADES ON THE PLAYER'S AIRCRAFT.
ENVIRONMENT	SCI-FI	FUTURISTIC ENVIRONMENTS, ADVANCED TECHNOLOGY, AND SPACE EXPLORATION.
THEMES	COLORFUL	A VIVID AND DIVERSE RANGE OF COLORS, CREATING A VIBRANT AND DYNAMIC ATMOSPHERE.
EXPLANATION	INFOGRAPHIC	PRESENTED IN A VISUALLY APPEALING AND CONCISE MANNER USING A COMBINATION OF TEXT, ILLUSTRATIONS, CHARTS, AND GRAPHS.

3.4.2.4 Proposed Design Concept 3

Table 3.4: Proposed Design Concept 3

FEATURES	CONCEPT 3	JUSTIFICATION
GAME MODES	FLIGHT SIMULATION	WHERE PLAYERS CAN FLY PLANES, TAKE OFF AND LAND AT AIRPORTS, AND COMPLETE MISSIONS.
PLACE	MOUNTAIN	LEARN ABOUT THE UNIQUE CHALLENGES THAT COME WITH FLYING IN HIGH-ALTITUDE AREAS.
ENVIRONMENT	ADVENTURE	DIVERSE LANDSCAPES, ANCIENT RUINS, AND THRILLING QUESTS AND CHALLENGES.
THEMES	NATURAL	EARTHY AND ORGANIC COLORS FOUND IN NATURE, PROVIDING A SERENE AND PEACEFUL AMBIANCE.
EXPLANATION	MINDMAP	PRESENTED IN A VISUAL FORMAT, UTILIZING NODES OR BRANCHES CONNECTED TO A CENTRAL IDEA.

3.4.2.5 Proposed Design Concept 4

Table 3.5: Proposed Design Concept 4

FEATURES	CONCEPT 4	JUSTIFICATION
GAME MODES	AIR TRAFFIC CONTROL	MANAGING THE FLOW OF AIR TRAFFIC AND COORDINATING ARRIVALS AND DEPARTURES.
PLACE	RUNAWAY	USED TO CREATE REALISTIC TAKEOFF AND LANDING EXPERIENCES FOR PLAYERS.
ENVIRONMENT	SPACE EXPLORATION	EXPLORE OUTER SPACE, VISIT PLANETS AND GALAXIES, AND ENGAGE IN INTERSTELLAR ADVENTURES.
THEMES	PASTEL	SOFT AND DELICATE COLORS, OFFERING A GENTLE AND SOOTHING ENVIRONMENT.
EXPLANATION	PARAGRAPH	PRESENTED IN A WRITTEN FORMAT, UTILIZING COMPLETE SENTENCES AND PARAGRAPHS.

3.4.2.6 Accepted Vs Discarded Solution

Table 3.6: Accepted Vs Discarded Solution

CRITERION	CONCEPT 1	CONCEPT 2	CONCEPT 3	COONCEPT 4
GAME MODE	Low (Maintenance & Repair for minor maintenance)	High (Aircraft Design explaining about aerodynamic and structure system)	High (Flight Simulation design to mimic of the real aircraft).	Low (Air Traffic Control design to ensure the safe and efficient flow air traffic)
PLACES	Low (Terminal KLIA International Airport central hub for various activity related to air travel.)	High (Hangar is large enclosed structure used for storing and maintenance aircraft)	Low (Mountain is about to learning the challenges flying at high altitude)	High (Runway to create realistic takeoff and landing)
ENVIRONMENT	Low (Fantasy is immerse themselves in magical)	High (Sci-Fi futuristic environments)	Low (Adventure is diverse landscape and ancient ruins)	High (Space Exploration is interstellar adventures build and customize their own spaceships)
EXPLAINATION	Low (Point is denoted by the symbol)	High (Infographic is visual of information)	High (Mindmap is graphical representation of idea)	Low (Paragraph is self-contained unit)
THEMES	Low (Bright is vibrant and lively colours)	High (Colourful is vivid and diverse range of colours)	Low (Natural is earthy and organic colours)	High (Pastel is soft and delicate colours)

3.4.3 Evaluation and Selection of Conceptual Design

3.4.3.1 Pugh Matrix

Table 3.7: Concept Design Evaluation Using Pugh Matrix (Concept 2 as Datum)

CRITERION	FACTOR	CONCEPT 1	CONCEPT 2	CONCEPT 3	CONCEPT 4
GAME MODE	0.2	1	D	2	2
PLACES	0.2	2	A	2	2
THEME	0.1	1	T	1	1
EXPLAINATION	0.3	1	U	1	1
ENVIROMENT	0.2	3	M	1	3
TOTAL SCORE	1.0	1.6		1.4	1.8
RANKING		2		3	1

Using the Pugh matrix, the selected solution (Concept 2) is proven to be the best selection with Concept 4. All concepts are rated according to five criteria: game mode, places, theme, explanation, and environment.

Table 3.8: Concept Design Evaluation Using Pugh Matrix (Project Flight Enclosure as Datum)

CRITERION	CONCEPT 1	PROJECT FLIGHT	CONCEPT 3	CONCEPT 4
GAME MODE	3	DATUM	3	1
PLACE	2		2	2
THEME	1		2	3
EXPLAINATION	3		3	1
ENVIRONMENT	3		3	1
TOTAL SCORE	12		13	8
RANKING	2		1	3

By using Pugh Matrix, the selected solution (Concept 4) is proven to be the best solution, with Project Flight as the datum. All concepts are rated according to five criteria: game mode, places, theme, explanation, and environment.

3.5 Interface Layout

3.5.1 General Project Interface Layout

Figure 3.9: Entry point interface upon launching the game

Upon entering APEX in Roblox, a loading screen appears before the server stabilizes. On the initial GUI screen, players input their name to record data and commence the game by clicking "enter."

Figure 3.10: Outfit selection to the player

Players have unrestricted freedom within the game. After entering their name, they can select from outfit options like co-pilot, pilot, airport worker, ground crew, or security.

Figure 3.11: Teleportation to different locations

The platform facilitates seamless teleportation, eliminating the need for players to manually traverse to different locations.

Figure 3.12: An aircraft inside the hangar

A 3D model of the A330-300 adorned with Malaysia Airlines livery was incorporated to capture players' interest and create a realistic gaming environment for enhanced education.

Figure 3.13: Yellow plate facilitates player teleportation and awards points

The yellow plate applied to the aircraft serves as a clue, allowing players to accrue points and teleport to educational destinations.

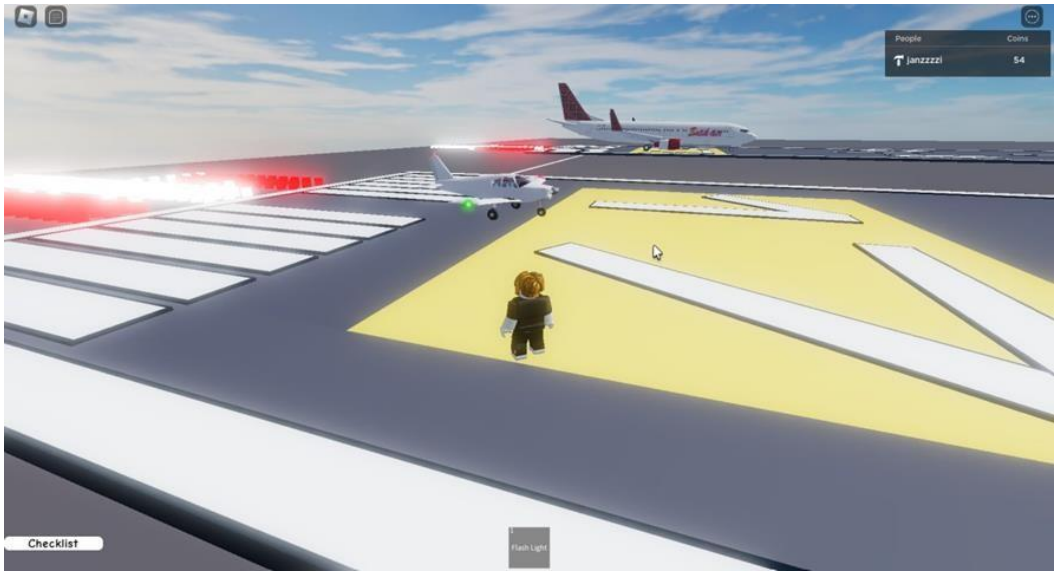


Figure 3.14: Runway inside the APEX Game

The inclusion of an aircraft and runway not only marks the game's conclusion but also enables players to pilot the aircraft post-game, encouraging further exploration and fostering a heightened interest in aviation.

3.6 DEVELOPMENT OF GAME

3.6.1 : Material Acquisition

Description	Material
Roblox Studio: To create APEX Game and import 3D model	

Roblox: To set the game preference, information game, and server settings.	
Google Meet: To have discussions with consultants and supervisors.	
Blender 3D Model: To create model that did not have in Roblox Studio	

Table 3.9: Material Acquisition

3.6.2 DEVICES

3.6.2.1 Personal Computer / Laptop

Figure 3.15: Laptop (Google, n.d)

To do this APEX, there are two major parts that need to be done, which are designing and developing. For the designing part, there are some specs for the PC to have. It is because the PC that has been used is Roblox Studio. When the hardware platform does not support the version, it will affect the hardware or the software itself. There are some effects because the software does not follow the specs, i.e., randomly crashes while doing the work, unable to run Roblox Studio. Product crashes when communicating with the licensing server, corrupt files, fatal errors while opening the software, and 3D models in a drawing can crash when using Blender. To avoid all of these, there are some specs for PCs or laptops that need to be followed, which are that the operating system needs to be Microsoft Windows 10 (64-bit only), Windows 8.1 (64-bit only), and Windows 7 SP1 (64-bit only). Not only that, the 72-bit processor and memory of the hardware are also important. Basically, the default processor and memory of a PC are 2.5 GHz and 8 GB of memory. While using the default, there are some issues that you will face, which are lagging and slow refresh. To avoid it, the processor needs to be upgraded to 3 GHz, and the memory needs to be added to 16GB. The disk space of the hardware is enough to use the default (6.0 GB). The resolution of the screen is also important to create amazing graphics. So, the specs that needed to be there were 1920 x 1080p with true color.

3.6.2.2 Smartphone / Tablet

Figure 3.16: Smartphone / Tablet (Google, n.d)

We do the testing of the APEX on Android devices, iOS devices, and also laptop devices. The testing can be done on the iOS system only by using a link from the app to open the website. Low-spec phones can also use this application. There are some specs for a suitable smartphone. The phone that needs to be used must not be older than 3–4 years from the current year. It is because there are some hardware issues that cannot be resolved by software solutions. When the phones are not too old, the default version of the phone is enough to access the game. 4GB of RAM is plenty for a phone to run smoothly. The display of the phone is also important. There are some types of phone displays, which are AMOLED, Super AMOLED, IPS, LCD, OLED, Retina, LED, and TFT.

3.7 FUNCTIONALITY TEST

3.7.1 Game Operating Procedure

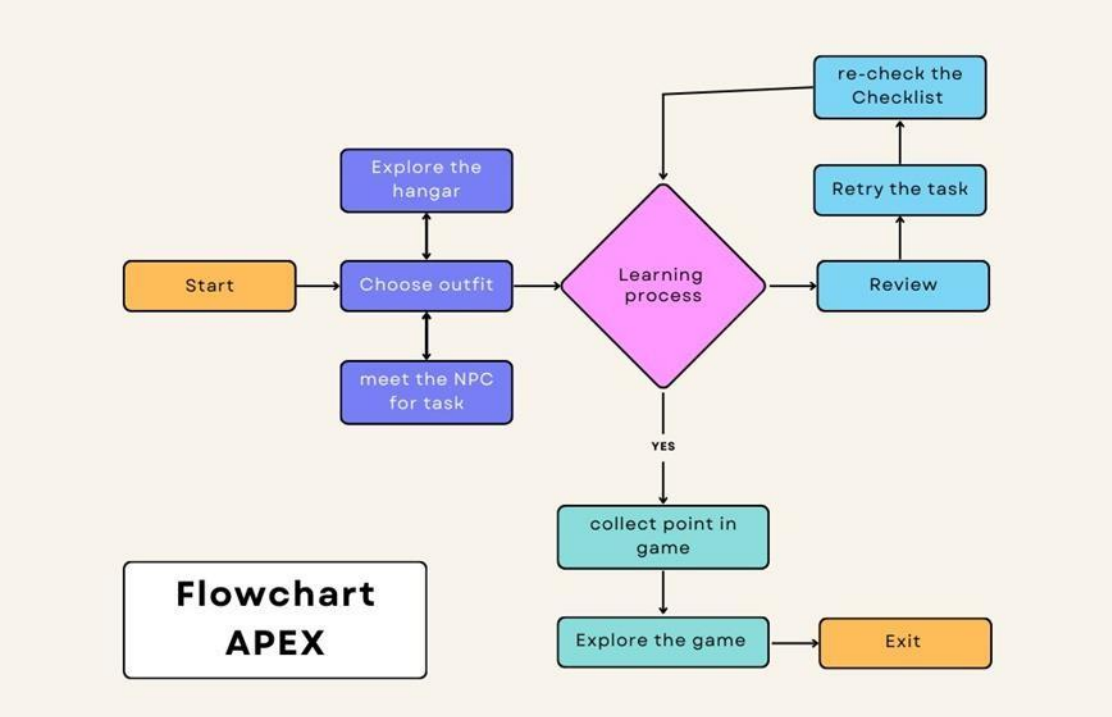


Figure 3.17: APEX Game Flow Chart

Players have the freedom to pursue their desired actions within APEX without any limitations, be it completing tasks or teleporting to different locations. Points and achievements are earned as players skillfully navigate and engage in various minigames, reflecting their exploration and gaming proficiency.

3.8 LIST OF MATERIALS & EXPENDITURE

Table 3.10: List of Materials & Expenditure

3.8.1 Product Structure				
No.	**Item Details**	**Unit**	**Price/Unit**	**Total (RM)**
1.	**(FULL TUTORIAL) Udemy, Complete Roblox Lua Start Making Game with Roblox**	**1**	**4**	**4**

CHAPTER 4

RESULT & DISCUSSION

4.1 PRODUCT DESCRIPTION

4.1.1 General Product Features & Functionalities

The Aircraft Parts Explorer game on Roblox is designed to cater to students worldwide, offering an accessible and easy-to-play educational experience. Players worldwide can identify and understand aircraft components like landing gear, engine, wing, pitot tube, and ram air turbine with ease within the Roblox community. Features like a flashlight for inspections, a scoreboard for coin rewards, a chat box for communication, and a customizable uniform enhance the game's user-friendly interface. This ensures that learners globally can seamlessly engage with aviation mechanics, making Aircraft Parts Explorer a universally accessible and enjoyable educational tool within the diverse landscape of Roblox.

Figure 4.1: Roblox Character

4.1.2 Specific Part Features

4.1.2.1 Game Structures

The game is about the education of components and parts in aircraft that promote effective learning, realistic experience, and knowledge acquisition in the hangar environment. A hangar is a large building for storage, maintenance, or housing aircraft. It's suitable to do the inspection on it. This type of environment will increase interest among students at the school level.

a) **Hangar:**

The game has hangars that look like hangars in Subang, Selangor. It is for Malaysian players to have a realistic experience. APEX Game has 3 hangars for the game storyboard to make the player browse the hangar environment with some asset models in the hangar. Each hangar has its own design to make it more interesting.

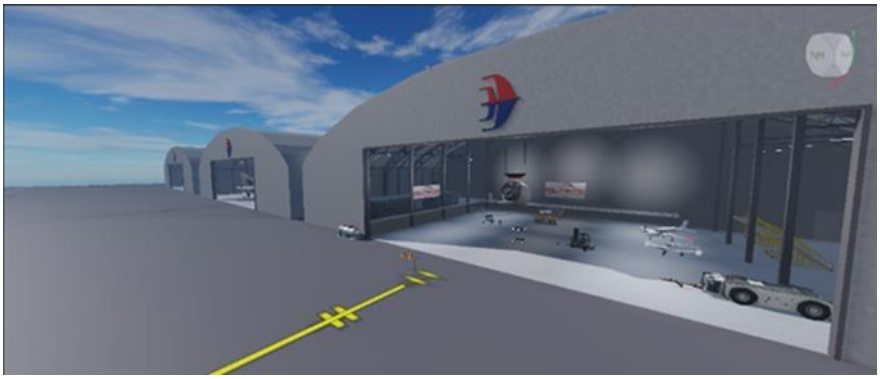


Figure 4.2: Hangar in APEX game

Figure 4.3: Hangar Malaysia Airline at Subang

b) Asset Aircraft, The Airbus 330-300 Series:

This game used this aircraft because it's large enough to fit in the hangar. Also, the aircraft is more suitable for characters in Roblox to make the player do the task. Furthermore, large aircraft made it easier to inspect each component of the aircraft for teleportation to the education place at another hangar.

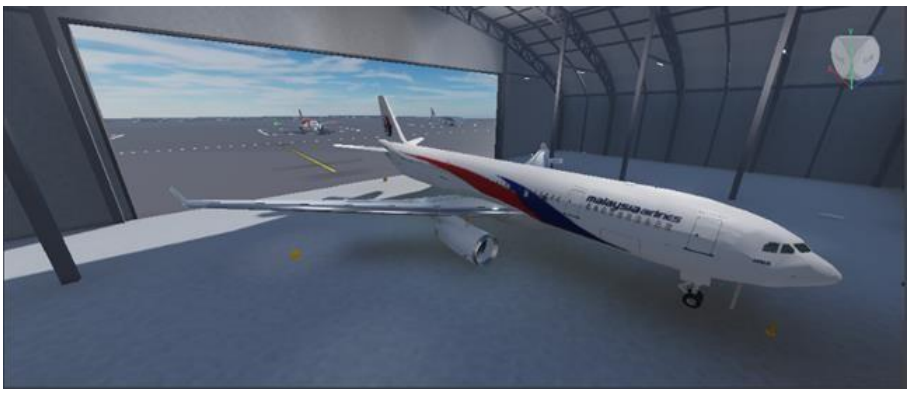


Figure 4.4: Asset Model in Roblox Studio A330-300

c) 3D model by Blender Apps:

3D models are created using Blender apps and placed in the hangar. The engine is made to resemble the A330-300, which is hanging in the hangar for educational purposes. Players can examine the engine closely and learn about its parts and components.

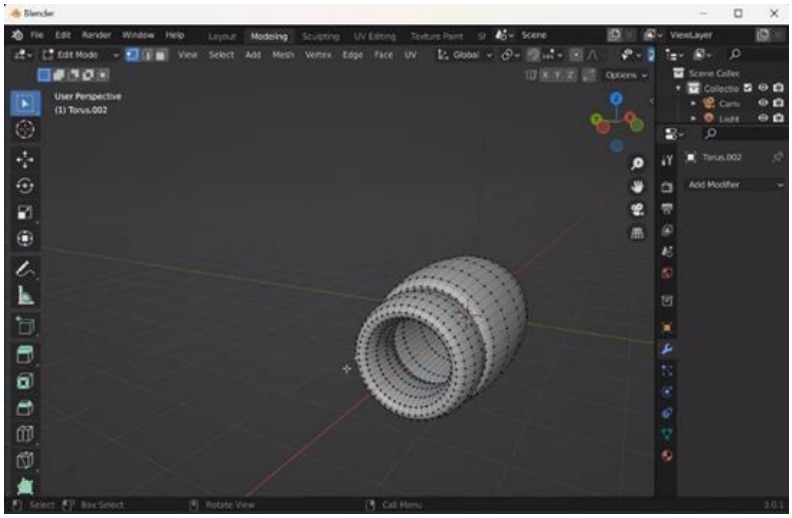


Figure 4.5: 3D Model Engine Aircraft using Blender

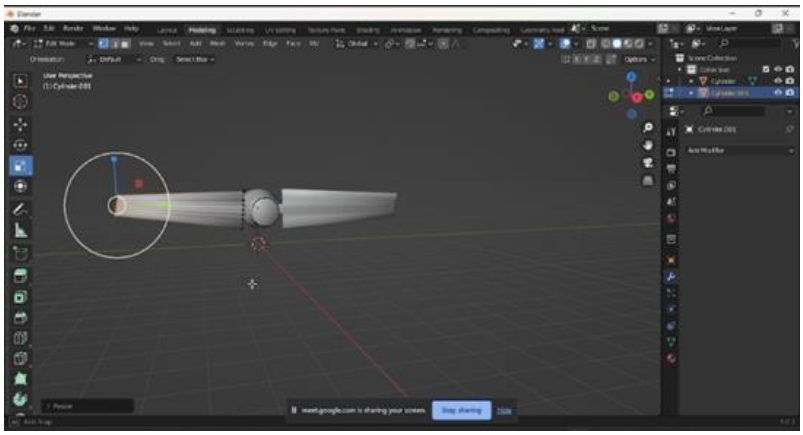


Figure 4.6: 3D model RAT created by Blender

d) Education Cubicle:

Five cubicles have been created in the hangar, each dedicated to one of the five components of the aircraft: the engine, wing, pitot tube, Ram air turbine (RAT), and landing gear. Each cubicle features its own explanatory wall detailing the respective parts of the aircraft. Additionally, a hidden wall surrounds the cubicles,

ensuring that players must locate each part one by one, following the checklist provided in the interface.

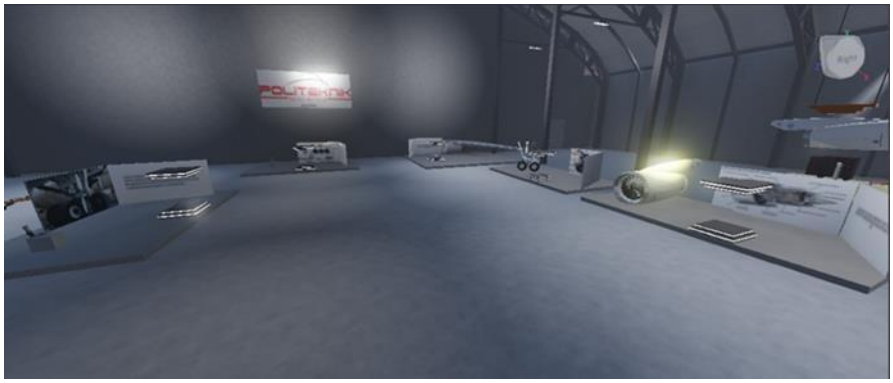


Figure 4.7: Education Cubicle Each Part of Aircraft

e) Classic Baseplate:

To enhance the texture and overall feel of the asset model, a classic baseplate is employed. In the context of Roblox, a "baseplate" serves as the foundational element that establishes the groundwork for a game or experience. Developers utilize baseplates as a starting point for crafting games on the user-generated online game platform Roblox.

4.1.2.1 Game Mechanism

The product mechanism of the Aircraft Parts Explorer Roblox game revolves around providing an immersive and educational experience focused on aviation mechanics. The game employs several key mechanisms to achieve this:

a) Detailed Aircraft Components:

Players navigate through visually rich environments where they can actively inspect and interact with detailed representations of specific aircraft parts, which are the engine, landing gear, pitot tube, wing, and ram air turbine. This not only involves visual observation but also interactive elements like clicking or interacting with controls to delve deeper into each aircraft part.

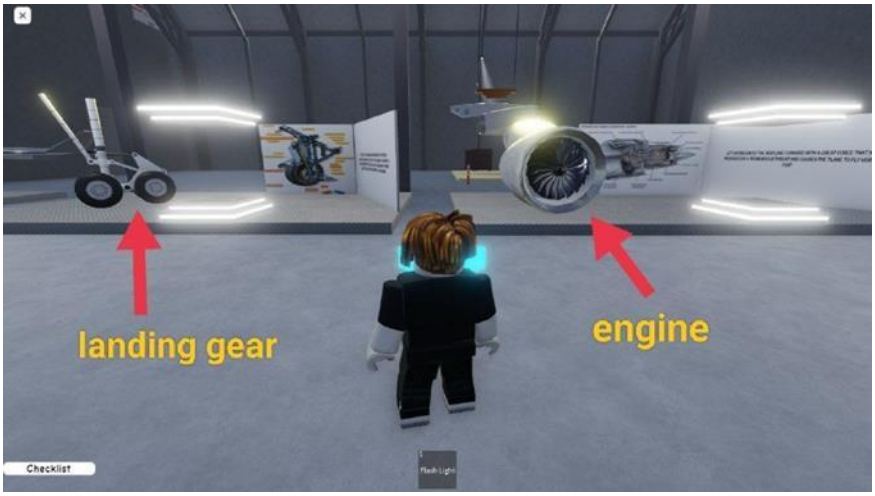


Figure 4.8: Detailed Aircraft Compenents

b) Interactive Learning:

Interactive learning is facilitated through tasks that emphasize the identification of aircraft parts. Players engage in challenges where they need to identify specific components. For each part of the aircraft, an explanation is also provided. The hands-on approach ensures that players actively engage with the educational content in the specific context of identifying aircraft parts.

Figure 4.9: Explanation for RAT

c) Cockpit Controls:

Players are empowered to fully operate the aircraft's cockpit, engaging in immersive mini-games that include initiating a simulated engine start-up sequence, calibrating flight controls such as ailerons and flaps for optimal performance, and interacting with additional features like lights and doors. Players can learn and get practical insights into the many facets of aircraft operation through this hands-on experience, which enhances the realism and enjoyment of the operation.

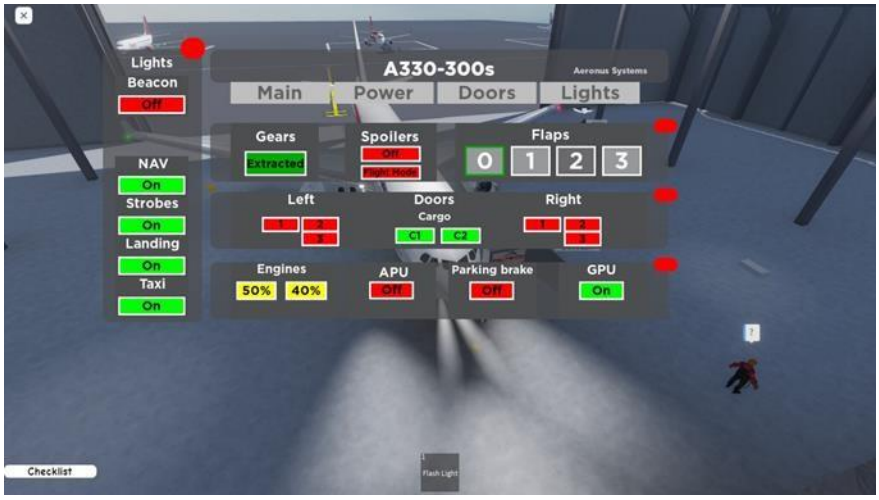


Figure 4.10: Cockpit Controls

d) User-Friendly Interface:

The user-friendly interface enhances the gaming experience. The flashlight feature, for instance, might be utilized for close inspection of components in darker or hard-to-reach areas. In addition, the game provides a checklist of aircraft parts, which simplifies the identification procedure. The scoreboard clearly shows players' progress and achievements. The chat box, meanwhile, facilitates communication and collaboration among players.

Figure 4.11: Features in the APEX Game

e) Transportation

This added feature introduces a handy garage in the game for storing vehicles, including the provided transport. In addition to simplifying exploration and enhancing overall gameplay ease, it offers players a convenient central location to access and manage the vehicles.

Figure 4.12: Garage

4.1.2.3 Interface Layout

For the success and efficiency of the "Aircraft Parts Explorer Games" project on Roblox, a robust software infrastructure must be established. This infrastructure encompasses the tools, frameworks, and architecture necessary for the seamless creation, implementation, and maintenance of the game.

a) Button Visibility and Placement:

In the menu interface, the settings button is strategically placed to ensure it stands out, offering players a noticeable and easily accessible spot. To enhance visibility and convenience, clear iconography or labeling was utilized, distinctly representing the purpose of the settings button. This approach aimed to facilitate quick and efficient identification for players.

b) Dropdown Menu:

As a result, users seamlessly found and interacted with the settings button, enabling them to customize preferences and access additional features within the menu. Players can conveniently adjust settings such as visuals, sound, language, and accessibility choices, all conveniently grouped together for a more user- friendly experience.

Figure 4.13: Menu Display

4.1.3 General Operation of Product

Fundamentally, the APEX Game application seeks to empower players by furnishing them with the knowledge and guidance necessary to navigate the realm of aircraft components confidently. The game's goal is to deliver an engaging and educational gaming experience focused on enhancing players understanding of aircraft parts. The operation of the application, involves various processes and interactions designed to enable effective player utilization.

This game aspires to offer an enjoyable and instructive gaming experience. To personalize this experience, players are prompted to input their name in the designated box and create a profile within the game. Subsequently, they can perform a checklist, monitor their progress, and attain achievements. Upon logging in, players gain access to diverse game features, including the ability to start an aircraft, FL, and explore different aircraft parts, all through a user-friendly main menu.

Within the exploration mode, players undertake a detailed inspection of a specific aircraft. They can activate the aircraft engines, lights, and door access, as well as delve into information about various aircraft parts. The game environment facilitates roaming exploration, allowing players to interact with and closely examine individual aircraft and their components. These interactive elements within the game are designed to be realistic; approaching a checkpoint triggers informative pop-ups and explanations about the aircraft parts.

Enriching the instructional aspect, descriptive language, historical context, and multimedia components such as photos and videos provide users with a comprehensive understanding of each aircraft component. Gamification features, including badges, points, and unlocking content, foster user engagement by offering incentives and achievements throughout their exploration journey.

4.1.4 Operation of Product Feature

The Roblox game Aircraft Parts Explorer functions as a whole because of the way its main components work together. Here's a breakdown of how each feature functions.

a) Personalization with Uniform Change:

The ability for users to change the outfits of their avatars gives their virtual experiences an extra personal touch. With the use of this function, players can dress as co-pilots, pilots, airport employees, ground staff, or security personnel, among other clothes, which helps them feel unique and in control of the virtual world. To fully immerse players and give them a sense of authenticity within the APEX world, outfit choices have been carefully considered.

Figure 4.14: Uniform Customization

b) Teleportation Style

Teleportation is used to make it easier for a player's avatar to move around the game world. The teleportation platform is built with a vibrant and distinctive color palette. This deliberate design decision seeks to draw players to the teleportation platform, fulfilling a dual function by drawing the player's attention and acting as a practical means of facilitating quick teleportation. The unique and colorful

design makes the game more enjoyable overall and encourages players to explore the game's various areas.

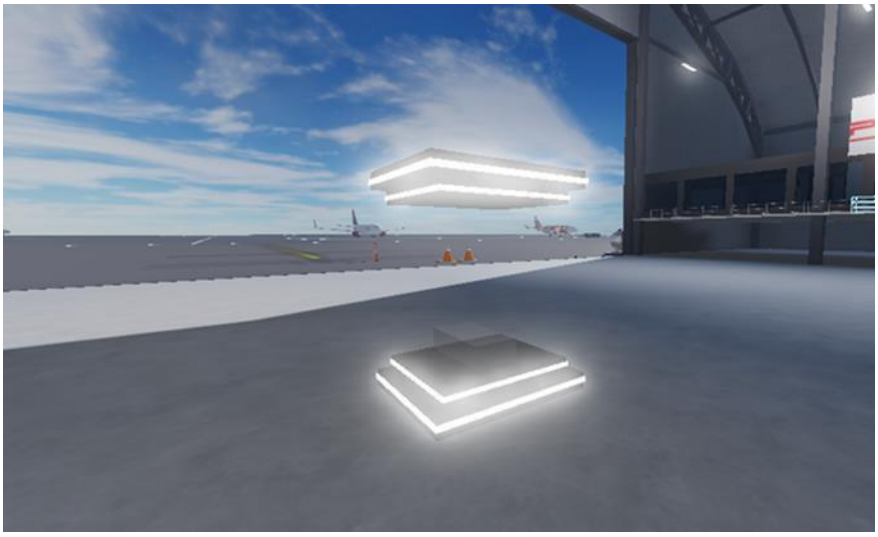


Figure 4.15: Teleportation

c) **NPCs (non-playable characters):**

NPCs (non-playable characters) are used to precisely integrate key mechanics in APEX. These non-player characters function as interactive characters that direct players through essential tasks and offer important game checks. These NPCs' scripts are all uploaded straight into Roblox Studio. The option for players to offer input to the NPCs helps them better comprehend the game's storyline.

Figure 4.16: NPC Guides

d) **Scoreboard and Rewards:**

The scoreboard tracks players' progress and achievements, rewarding them with in-game coins. This feature operates by continuously monitoring user activities and accomplishments, providing a visual representation of their success and motivating further engagement through tangible rewards.

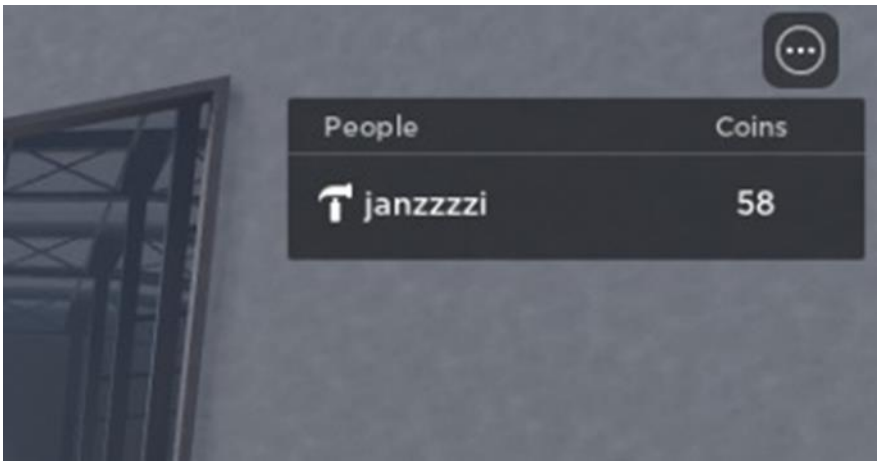


Figure 4.17: Scoreboard

e) Chat box:

The chat box facilitates communication among players within the virtual learning environment. This feature operates by enabling real-time text-based communication, allowing users to collaborate, share insights, and build a sense of community as they collectively navigate the educational challenges presented in the game.

Figure 4.18: Chatbox

4.2 PROJECT IMPACTS/ PURPOSE OF PRODUCT

APEX is an education game that delivers aviation education with new teaching strategies to provide early exposure to the aviation field.

a) **Educational Purpose:**

By giving users knowledge about various aircraft parts, their purposes, and how they affect an aircraft's overall performance, the project can be used as an instructional tool. Anybody interested in learning more about the parts of an aircraft, including students and aviation enthusiasts, can use it as a resource. Also, APEX can change the method of teaching using the new technology of 3D models with more detail and realisticity.

b) **Engaging Interactive Education:**

Players can close-up view components, view information, and possibly even see animations or demonstrations of how these parts work thanks to the interactive nature. 3D models and interactive graphics can also intensify interest in studying parts of aircraft. The goal of creating an interactive learning environment that

actively involves users in the educational process is to go beyond traditional teaching methods.

c) Responsive Design:

Ensure APEX is accessible across various devices, utilizing a responsive design that can adjust to various formats and screen sizes, especially for Android, iOS, and Windows. To give the user experience on smaller screens priority, implement mobile-first design concepts. This is scaling up for larger screens after first optimizing interactions and content for mobile devices. Create user-friendly and intuitive navigation for desktop and mobile interfaces. The use of collapsible tabs, phones, or other cross-device navigation patterns should be considered.

d) **The student can understand the fundamental concepts on their own without overly relying on lectures:**

The benefit of playing APEX is that it allows students, kids, or teenagers to self-learn the fundamental concepts and lessens their reliance on teachers or lectures in the education system. They can independently comprehend the fundamental concepts of the theory through a gaming experience, an interactive 3D model, and accessible tools in detail. Players can study at their own pace, review the material as needed, and get early exposure to the world of aviation. This enables students and users to assume responsibility for their own education and have a sense of independence and ease of access to learn about aircraft, and their mindset is that they can learn anything without needing to learn at the school level.

To sum up, the APEX project is effectively blending learning and entertainment, offering users an engaging and educational encounter. The game's accomplishment of its goals has a variety of effects on users, ranging from community building within the Roblox platform to career exploration and educational enrichment.

4.3 ANALYSIS OF PROBLEM ENCOUNTERED & SOLUTIONS

4.3.1 Product Structures

One of the problems encountered in the scripting process of the asset 3D model and Graphic User Interface (GUI) is that the coding and scripting are not the same when opening the games on another device, such as a window or phone. Other than that, it was hard to set the GUI to be the same size on all devices. For example, setting a preference size on the phone screen is not the same as on the window screen. It's affected by the GUI error and cannot function.

For the asset, it has some issues when the asset in Roblox Studio has its own script that makes the APEX game lag and not function. Furthermore, the game's aircraft elements may have an overly complicated structure, which could make navigating confusing or challenging. So APEX come up with ONE (1) solution that analyze the complexity of the current structure and determines whether it is appropriate for the target audience's comprehension and learning style.

4.3.2 Product Mechanism

During the development phase of the Aircraft Parts Explorer game on Roblox, technical issues arose in the interactive exploration feature, causing disruptions to the user experience. Thorough testing and debugging were conducted to identify and rectify the technical issues. We employed continuous integration and deployment strategies which enabled us to detect and fix glitches earlier in the development cycle. This proactive approach not only facilitated the early identification and resolution of technical challenges but also contributed to the overall efficiency and reliability of the game's development. The lessons learned from this experience underscored the significance of rigorous testing and continuous improvement in ensuring a technically sound and user- friendly educational platform on the Roblox platform.

4.3.3 Interface Layout

In the pursuit of successful and efficient execution for the "Aircraft Parts Explorer Games" project on Roblox, various challenges emerged concerning tools, frameworks, and architecture. Identified problems encompassed clutter and complexity in the interface layout, prompting recommendations to simplify by prioritizing vital components, organizing similar functions, and using clear labels and icons for an improved user interaction. The absence of user instructions poses a significant obstacle, suggesting the inclusion of onboarding tutorials, tooltips, or a guided walkthrough to familiarize users with the UI. Explicit instructions and visual cues aim to enhance the user's understanding, contributing to a more immersive experience. The diligent addressal of these challenges and the implementation of suggested solutions aim to elevate the overall quality and user experience of the "Aircraft Parts Explorer Games" project on the Roblox platform.

CHAPTER 5

CONCLUSION & RECOMMENDATIONS

5.1 ACHIEVEMENT OF AIM & OBJECTIVES OF THE RESEARCH

5.1.1 General Achievement of the Product

The APEX Game has not only achieved its objectives, but it has also done an excellent job of giving players a thorough educational experience. It effectively helps players, especially high school students, gain an understanding and comprehension of various aircraft parts through a well-thought-out game concept. A smooth and simple navigation method is ensured by the user-friendly interface, which improves both the gaming and educational experience overall. Moreover, APEX's adaptability also includes platform compatibility, ensuring that players can participate in the educational exploration of aircraft parts on the popular Roblox platform. This collective's accomplishment highlights APEX as a useful and welcoming game that effectively blends player enjoyment and educational value.

5.1.2 Specific Achievements of Project Objectives

5.1.2.1 Game Structure

APEX objective is to design a game app using the Roblox platform for teenagers or students to have an interest in the aviation world by knowing the parts of aircraft and the functionalities of each part or aircraft. Also, APEX makes it more realistic by adding a 3D model with scripting. The functionality and interactivity of Roblox's 3D models can be improved by developers by utilizing these scripting features, resulting in dynamic and captivating gaming experiences.

5.1.2.2 Game Mechanism

The project has demonstrated noteworthy successes by effectively meeting particular objectives in the gaming mechanism. The game's design prioritizes intuitive user engagement, making it easy for players to interact with and learn about various aircraft parts, enhancing the overall educational experience. Furthermore, the gaming system ensures cross-platform compatibility, allowing easy access to educational content on the Roblox platform from various devices. Additionally, it helps high school students gain progressive skills, which is in line with the project's main objective of efficiently providing educational information. All of these accomplishments add up to the project's success, providing a user-friendly and entertaining way to learn about parts for aircraft inside the Roblox APEX game.

5.1.2.3 Interface Layout

Crafting the interface for the APEX Game involved achieving key goals. The interface was designed to be user-friendly, minimizing the learning curve and prioritizing easy navigation. A clear visual hierarchy was established, ensuring the prominence of essential elements like game controls and mission objectives. The inclusion of a progress tracker and user feedback mechanisms, along with visually appealing design elements, aimed to engage players effectively. Cross-platform consistency, load time optimization, and a comprehensive player testing process with iterative improvements solidified the success of the project objectives. The resulting interface is visually appealing, responsive, and user-centric, elevating the overall gameplay experience in the APEX Game.

5.2 CONTRIBUTION OR IMPACT OF THE PROJECT

The Roblox project "Aircraft Parts Explorer Games" holds significant promise in terms of entertainment, education, and community development. As an interactive educational tool, the project offers users a captivating insight into the aviation realm, allowing them to learn about the functionality, history, and importance of various aircraft components in a gamified environment. Beyond educational benefits, users stand to enhance critical thinking, problem-solving, and attention to detail as they delve into different aircraft parts. This initiative may also kindle a desire for further education and research in aviation and aerospace-related disciplines. Through gamification, the project aims to boost user engagement, transforming the study of airplane parts into an enjoyable experience that encourages extended participation and retention. Additionally, the game has the potential to motivate a new generation of aviation enthusiasts and aspiring pilots, inspiring them to consider careers in aerospace engineering, piloting, or related fields.

5.3 IMPROVEMENT AND SUGGESTIONS FOR FUTURE RESEARCH

5.3.1 Game Structure

The improvement that APEX wants to contribute to this game is that it wants to make the game more realistic, such as building a big airport with full utilities by adding a safety department, an engineering department, a design department, and a simulator for the aircraft itself. It can be done if the developer has an expert programmer and designer to create the game and improvise the game to another level of education.

5.3.2 Game Mechanism

Improvements and suggestions for future research in the context of the game mechanism can significantly enhance the APEX game. Research avenues include exploring ways to

enhance interactivity and potentially implementing more features, such as simulations or hands-on activities related to aircraft parts, to deepen the learning experience and increase player engagement. Additionally, investigating the integration of assessment tools, such as quizzes and challenges, within the game mechanism can offer valuable feedback to both players and educators, assessing comprehension and knowledge retention. A focus on continuously expanding and updating educational content, incorporating additional information, real-world examples, and emerging trends in aviation, is crucial for ensuring that the game remains a relevant and comprehensive educational resource over time.

5.3.3 Interface Layout

Several enhancement recommendations might be taken into consideration in order to strengthen the "Aircraft Parts Explorer Games" project's digital and software infrastructure and lay the groundwork for future studies. The integration of virtual reality (VR) or augmented reality (AR) technologies could provide users with a more immersive experience when exploring aircraft parts. Subsequent studies may examine the effects of immersive technology on user participation, retention of learning, and the educational process in general. Collaborative learning capabilities might improve the game's social aspects by enabling users to study aircraft parts with one another, exchange views, and participate in cooperative learning activities. The effects of collaborative learning on player engagement, knowledge acquisition, and community development inside the game might be the subject of future research projects. Through the integration of these enhancements and recommendations into the digital/software framework, the APEX Game initiative may progress to provide users with an increasingly captivating, customised, and influential learning experience. Future studies might also concentrate on evaluating the efficacy of these improvements and investigating fresh directions for innovation in digital learning and aviation instruction.

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APPENDIX A: LIST OF TASK SEGREGATIONS

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	List of Abbreviations
	List of Appendices
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1.3.2.3	Specific Individual Project Objectives (Interface Layout)
1.4	Purpose of Project
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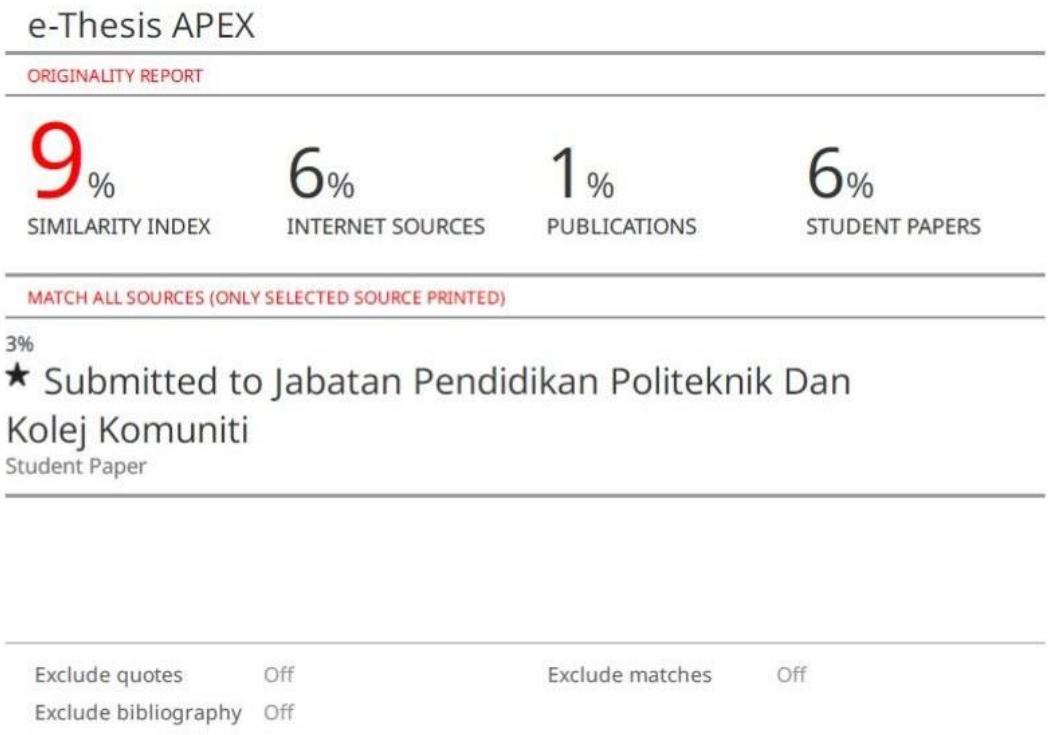
APPENDIX B: SUMMARY OF SIMILARITY REPORT



e-Thesis APEX

ORIGINALITY REPORT

9%	6%	1%	6%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

MATCH ALL SOURCES (ONLY SELECTED SOURCE PRINTED)

3%

★ Submitted to Jabatan Pendidikan Politeknik Dan Kolej Komuniti

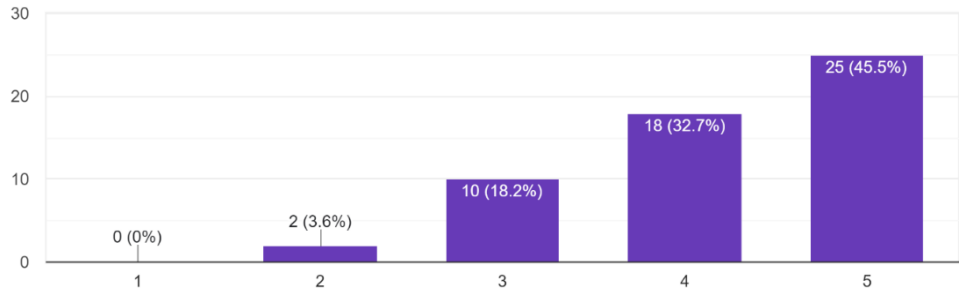
Student Paper

Exclude quotes	Off	Exclude matches	Off
Exclude bibliography	Off		

APPENDIX C: POST SURVEY

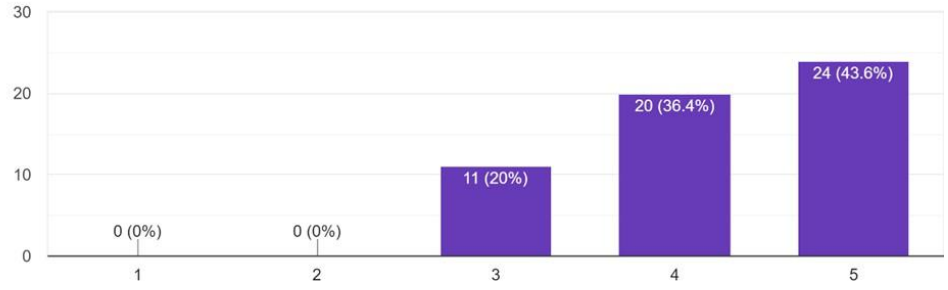
How easy is it to play the games on your personal devices?

55 responses



Did you find the aircraft identification checklist helpful in guiding your exploration of aircraft parts?

55 responses

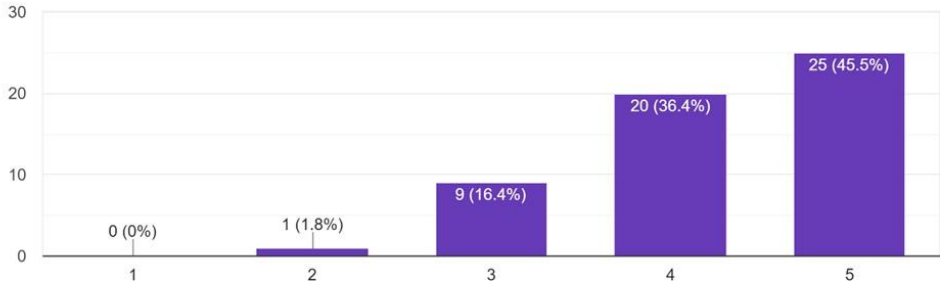


Is the information presented in the games easy to understand?

55 responses

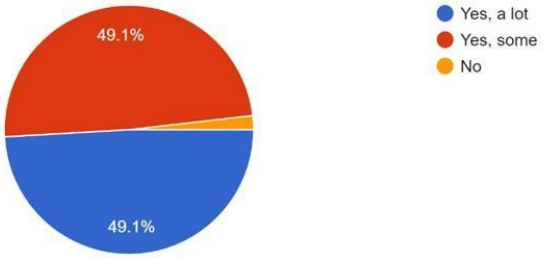
How satisfied were you with the interactive learning experience for exploring aircraft parts?

55 responses



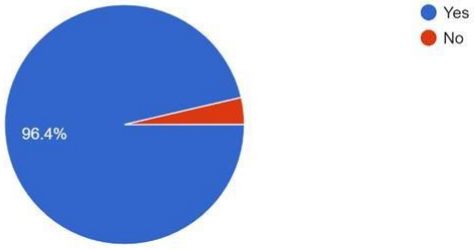
Did you learn new information about aircraft parts while playing the game?

55 responses



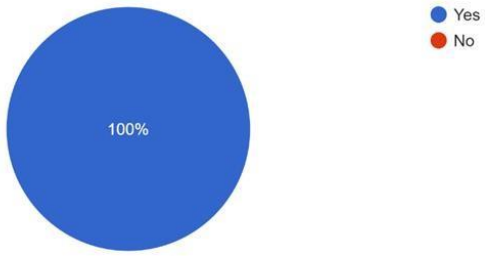
Do the games appear realistic, interesting and fun to play?

55 responses



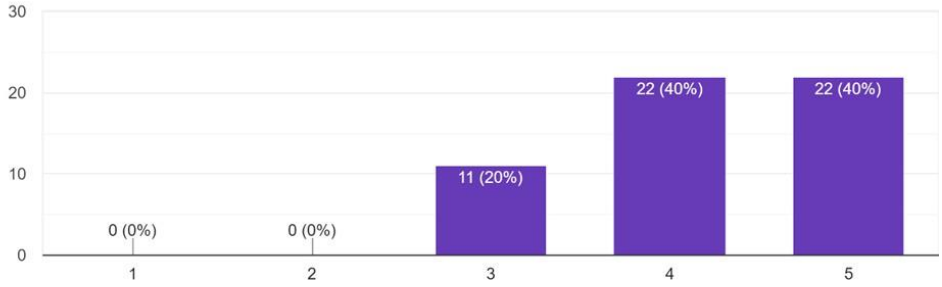
Do you having fun playing the games

37 responses



How likely are you to recommend the "Aircraft Part Explorer" game to others interested in aviation or educational games?

55 responses



What additional features or improvements would you like to see in the "Aircraft Part Explorer" game to enhance its educational value or overall experience?

55 responses

sound or text

The quality of the game

probably movable vehicles

N/A

To enhance the "Aircraft Part Explorer" game's educational value and overall experience, consider adding interactive tutorials, challenges, and quizzes for hands-on learning. Incorporate real-world scenarios and multiplayer modes to encourage collaboration and problem-solving. Introduce advanced aircraft systems, virtual tours, and augmented reality for a more immersive experience. Implement progress tracking, customization options, and a comprehensive information database. Ensure alignment with educational curricula and provide feedback mechanisms. These additions aim to create a more engaging and educational environment for users.

i like the idea but i think that “aircraft part explorer” need to improve in graphics and some of the part in aircraft.