

**POLITEKNIK BANTING SELANGOR**

**LINE MAINTENANCE SIMULATOR USING ROBLOX**

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**DEPARTMENT OF AIRCRAFT MAINTENANCE**

**SESSION 1 2025/2026**

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AIRCRAFT MAINTENANCE

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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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# ABSTRACT

This project aims to introduce aircraft maintenance to teenagers through an engaging and interactive Line Maintenance Simulator developed on the Roblox platform. As interest in technical aviation careers among younger generations remains limited, this simulator serves as an educational tool that exposes teenagers to the fundamentals of aircraft systems, inspection procedures, and the responsibilities of aircraft maintenance personnel. By presenting these concepts in a game-based environment, the project encourages early curiosity and awareness of opportunities within the aviation industry.

Beyond creating interest, the simulator also supports foundational learning by providing a virtual environment where users can perform basic line maintenance tasks such as walk-around inspections, identifying defects, and understanding aircraft components. Roblox was chosen due to its accessibility, user-friendly interface, and compatibility with standard computers, allowing a wider range of teenagers to experience the simulation without specialized hardware.

The project demonstrates that game-based learning can effectively introduce complex technical fields to younger audiences while complementing traditional education methods. Through interactive exploration and guided tasks, the Line Maintenance Simulator contributes to early exposure, deeper understanding, and increased interest in aviation maintenance among teenagers.

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# CHAPTER 1

## INTRODUCTION

### 1.1 BACKGROUND OF STUDY

Roblox is a platform that are widely used among kids and teenagers worldwide. Roblox can be a very good platform for educational purposes where it blends education with gameplay making it fun for the younger generation. Since Roblox is very popular among the younger generation and offers a seamless integration of gaming and learning, it will be a very suitable platform for us to provide aviation education. Furthermore, Roblox is also popular with its accessibility features where it can be accessed on various devices including computers, mobile phones, and gaming consoles. *“Roblox has eight key features of the Metaverse: identity, friends, immersive, anywhere, low friction, variety of content, economy, and safety, which attract young users.” (Jining Han, 2023)*



*Figure 1.1: Roblox*

Our surveys data highlights the effectiveness of Roblox in educational activities. Most of our respondents said they had good experiences and liked the hands-on way of learning. They also said Roblox is fun and makes learning easier because it is very popular with kids and teenagers. This popularity helps make a friendly and fun place for learning.

4. Do you think a simulator game can help students prepare for real-world line maintenance tasks?  
42 responses

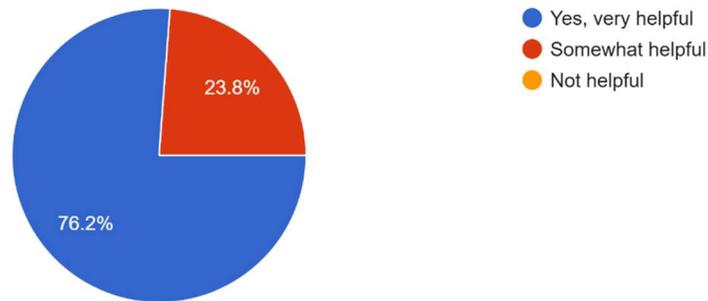


Figure 1.2: Survey Question

The “Line Maintenance Simulator Using Roblox” game is a good example. It lets students play and learn about aircrafts by looking at them in a virtual world. This makes learning fun and interesting.

This game teaches things that are part of STEM learning (science, technology, engineering, and math). It shows students the different parts of a plane, like the engine, wheels, wings, and other important parts. Knowing about these parts helps students understand how planes work. The game also lets students be creative and work together, which is what Roblox is all about. “Users can be greatly immersed in the virtual environment in terms of visualization and motion.” (Hyeonju Lee, 2022)

To conclude, this game uses Roblox's popularity to make learning about aircrafts exciting. Surveys show that younger generation enjoy learning this way because it's fun and interactive. The game teaches important STEM skills and lets students be creative while learning about aircraft maintenance. Roblox and games like this can change how we learn about aviation, making it more exciting and accessible.

## 1.2 PROBLEM STATEMENT

Aircraft line maintenance is a fundamental component of aviation operations, focusing on the inspection, servicing, and minor repairs of aircraft to ensure continued airworthiness and safety between flights. It is a time-sensitive and safety-critical task, typically carried out on the ramp or apron area. Where efficiency, accuracy, and compliance with aviation regulations are essential.

For students in aircraft maintenance programs, gaining hands-on experience in line maintenance is crucial for building the technical competencies and confidence needed in real-world settings. However, access to actual aircraft and maintenance facilities is often restricted due to a variety of challenges, including high operational costs, strict safety regulations, limited institutional resources, and the inherent risks involved in working near active aircraft. As a result, many students graduate with strong theoretical knowledge but insufficient exposure to practical, real-time maintenance procedures, which can affect their readiness for employment in the aviation industry.

Traditional methods of practical training, such as workshops and live demonstrations, are valuable but may not be sufficient or scalable for large groups of students. Meanwhile, existing aviation maintenance simulators, though effective, are frequently expensive, hardware-intensive, or not easily accessible to all learning institutions. Considering these issues, there is a pressing need for a more accessible, engaging, and cost-efficient method of delivering line maintenance training.

This project proposes the development of an Aircraft Line Maintenance Simulation using Roblox, a widely used game development and virtual world platform that supports interactive 3D simulations. Roblox offers a flexible, low-cost environment that allows developers to create immersive training scenarios tailored to educational needs. By simulating real-world line maintenance tasks—such as visual inspections, servicing tires, checking oil levels, and responding to minor technical faults, this project aims to enhance student learning through a safe, repeatable, and interactive platform. The simulation will also serve as a supplementary tool to traditional training methods, helping to bridge the gap between theory and practice while fostering a deeper understanding of aircraft maintenance operations in a modern and digital format.

## **1.3 PROJECT OBJECTIVES**

### **1.3.1 General Project Objectives**

This project's objectives are:

- To make a fun educational game for everyone:  
Create an online game that's enjoyable and easy to play for all ages, especially students interested in aircraft and engineering.
- To teach about aircraft in a fun way:  
Let players explore airplanes, hangars, and their parts while learning through gameplay and interaction.
- To show how airplane parts work:  
Use simple visuals and activities to explain how the basic parts of an aircraft function.
- To keep players motivated:  
Add goals, rewards, and unlockable content to encourage players to keep playing and learning.
- To connect students and lecturers:  
Include study tools and communication features that help students learn more easily and stay in touch with their teachers.

### **1.3.2 Specific Individual Project Objectives**

#### **1.3.2.1 Game Structure**

This project aims:

- To develop various fun and educational Roblox games about aviation that follow real learning standards.

- To create exciting and interactive gameplay that helps students stay interested and learn better.
- To find ways to use Roblox to bring aviation education to more people, no matter where they are.

### **1.3.2.2 Game Mechanism**

This project aims:

- To add interactive spots on aircraft so players can click and get detailed info, helping them learn on their own.
- To make the game fun by challenging players to find and learn about different aircraft parts.
- To include mini-games or quizzes about aircraft to let players test what they've learned in an enjoyable way.

### **1.3.2.3 Interface Layout**

This project aims:

- To make it easier for students to learn what each aircraft part does.
- To teach students through fun and interactive visual games.
- To let students explore and practice what they're learning in a game environment.
- To turn complex topics into enjoyable learning experiences.

## **1.4 PURPOSE OF THE PROJECT**

The goal of our project is to develop an educational mobile game on the Roblox platform that focuses on teaching students about aircraft line maintenance through a realistic simulation environment. This game is designed to help aviation students understand the essential concepts and procedures involved in line maintenance, allowing them to learn and perform maintenance tasks while playing.

By combining interactive learning methods, realistic simulations, and social features, the game offers an engaging and practical learning experience. Players will explore various aircraft systems, learn how to conduct inspections, perform basic troubleshooting, and understand the standard operating procedures used in real-world line maintenance operations.

We chose Roblox as our development platform due to its accessibility across multiple devices. It is available on Google, the Play Store, and the App Store making it easy for students and educators to access the game anytime and anywhere.

This simulation game takes aviation education to the next level by integrating hands-on practice with theoretical knowledge. It encourages active learning and helps students reinforce what they've learned in class by allowing them to apply it in a virtual, risk-free environment. With this approach, students can build confidence and skills that are directly relevant to their future careers in aviation maintenance.

## **1.5 SCOPE OF PROJECT**

### **1.5.1 General Project Scopes**

Our proposed project scope 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**

Line Maintenance Simulator Using Roblox 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 favourite game to use for learning about all the line maintenance tasks on aircraft. While playing the games, players can learn about aircraft. With the Blender app, we 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 we will use Blender because it is free and easy to use.

In this game, players can have customizable aircraft equipped with detail explanations about the maintenance or inspection task. With the 3D model of the aircraft, it will make explanations interactive and players will keep interested in the learning process as the game world changes over time with new challenges, updates, and events.

### **1.5.2.2 Game Mechanism**

The line maintenance simulator tasks within the game may face limitations in terms of complexity and variety, impacting the diverse learning opportunities available to players. “*Social connections in the metaverse are weaker than interactions in the real world.*” (Bokyung Kye, 2021) 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 inspections/maintenance instructions.

### **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, gamification has emerged as a transformative approach to reshaping traditional teaching and learning practices. *“The use of immersion-oriented affordances has been significantly less frequent in the education and learning domain.” (Jenni Majuri, 2018)* By incorporating game elements into educational settings, gamification seeks to create engaging and impactful learning experiences for students.

One of the key benefits of gamification is its ability to enhance student motivation. By adding game like features such as rewards, badges, levels and leaderboards, educators can tap into student’s intrinsic motivation, making the learning process more enjoyable and interactive. This increased motivation leads to greater participation and a stronger desire to learn. Additionally, gamification fosters critical thinking skills. In many games, players are required to analyze information, evaluate options and make decisions. By integrating these aspects into educational content, students are encouraged to think critically, consider different viewpoints and make well-informed judgements. This not only improves their cognitive abilities but also prepares them for real-world challenges.

Despite its significant potential, gamification presents challenges in creating and implementing effective learning experiences. Educators must carefully balance the integration of game elements with the academic integrity of the content. Moreover, the long-term effectiveness of gamification, particularly in terms of student retention, learning outcomes, and knowledge transfer requires further research and evaluation.

To ensure the success and sustainability of gamification in diverse educational settings, it's crucial to develop best practices and guidelines. Educators need to understand the principles of gamification and adapt them to meet the specific needs of their students. Sharing success stories, strategies, and lessons learned can help educators build a collective knowledge base for more effective implementation.

As the educational landscape continues to evolve, gamification holds great promise for revolutionizing traditional teaching methods. By harnessing the benefits of increased motivation, creativity, problem solving and critical thinking, gamification has the potential to create more dynamic and effective learning environments. The integration of emerging technologies and the development of proven strategies will further amplify its impact in education. With ongoing exploration and refinement, gamification could become a powerful tool in preparing students for the challenges of the 21st-century workforce.

### **2.1.2 Interactive Learning in Aviation**

In an industry as dynamic and safety critical as aviation, continuous learning and adaptability to evolving technologies and procedures are essential. In recent years, the aviation sector has increasingly embraced interactive learning as a powerful tool for training and education. Methods such as simulation based training and virtual reality (VR) offer immersive and realistic learning experiences that closely replicate real world scenarios. These hands-on approaches significantly enhance essential skills such as critical thinking, decision making, and problem solving, which are vital for pilot competence and safety. *“In this way, students get to experience what to say under certain situations by taking part in a real-life situation, which makes the process of learning more effective.” (Oksana Pershukova, 2023)*

While the advantages of interactive learning in aviation are clear, its adoption comes with notable challenges. One of the primary obstacles is the high cost of advanced technologies, such as full motion flight simulators and sophisticated VR systems. These tools can be financially out of reach for smaller training institutions. Additionally, successfully integrating interactive learning into existing aviation curricula requires careful instructional design to ensure that learning objectives are met without compromising educational standards. Instructor readiness is also crucial as trainers must be well equipped to manage interactive platforms and deliver effective, scenario-based feedback.

Despite these challenges, interactive learning holds the potential to revolutionize aviation training. With technological advancements, simulators can now replicate a broad range of conditions, including emergency procedures, system failures and adverse weather that allowing pilots to develop confidence and expertise in a safe, controlled environment.

To fully harness the benefits of interactive learning, the aviation industry must invest in technological infrastructure, curriculum innovation and instructor development. Doing so will ensure that pilot training remains aligned with the evolving demands of modern aviation and supports the goal of safer, more proficient flight operations.

### 2.1.3 Types of Aviation Games

#### a) **Flight Simulators games:**

RFS- Real Flight Simulator is a mobile flight simulation game that offers a realistic flying experience on smartphones and tablets. In this game, players can choose from a wide range of aircraft, including commercial airliners, private jets, and military planes, and fly them across real-world locations using detailed global maps.

The game features real-time weather conditions, day and night cycles, and live air traffic, which makes the experience more immersive and closer to real-life flying. Players can view the flight from multiple camera angles, including a fully functional 3D cockpit, and interact with realistic flight instruments and controls.



*Figure 2.1: Real Flight Simulator Game*

**b) Maintenance and Repair games:**

Plane Mechanic Simulator is a realistic simulation game where you take on the role of an aircraft mechanic during World War II, working on iconic British planes such as the Spitfire, Hurricane, and Lancaster. Instead of flying the aircraft, your main responsibility is to ensure they are fully operational and safe for flight by performing detailed maintenance tasks.

In the game, you carry out over 80 different procedures, including engine repairs, fixing hydraulics, replacing damaged parts, adjusting instruments, and refuelling. Each component of the aircraft is highly detailed and interactive, requiring you to use the correct tools and follow step-by-step procedures just like in real-life aviation maintenance.

The game also includes a career mode, where you progress through missions, face time pressure, and deal with unexpected problems like battle damage or last-minute repairs before a flight. It challenges your problem-solving skills and teaches the basics of how aircraft systems function.



*Figure 2.2: Plane Mechanic Simulator Game*

**c) Airport Management games:**

Airport City is a mobile simulation game where you are tasked with building and managing both an airport and a surrounding city. The goal is to expand your airport, create a thriving city, and manage everything from building terminals and runways to sending flights to various global destinations.

In the game, you start with a small airport and gradually grow it by unlocking new planes, upgrading existing infrastructure, and establishing routes to earn rewards. You need to carefully manage resources, plan your expansions, and complete missions and challenges to earn money and items.



*Figure 2.3: Airport City Game*

**d) Air Combat Flight games:**

Ace Fighter: Modern Air Combat is a mobile action game that puts you in the cockpit of advanced military fighter jets, where you engage in intense aerial combat and high-stakes missions. You take on the role of a skilled pilot tasked with completing various objectives, such as intercepting enemy aircraft, attacking ground targets, and protecting allies.

In the game, you can fly a wide range of modern jets like the F-22 Raptor, F-16 Fighting Falcon, and SU-27 Flanker, each with unique capabilities. The game features fast-paced combat, where you'll engage in thrilling dogfights with enemy planes, use missiles and machine guns, and take out ground targets like military bases and armoured vehicles.

The missions become increasingly challenging, requiring you to navigate through dangerous airspace, avoid enemy fire, and outmanoeuvre opponents in dynamic weather conditions. You can also unlock and upgrade new planes and equipment, improving aspects like speed, firepower, armour, and manoeuvrability.



*Figure 2.4: Air Combat Flight Game*

## **2.2 SPECIFIC LITERATURE REVIEW**

### **2.2.1 Game Structure**

Achieving a standout Line Maintenance Simulator on Roblox involves intentional design and well-informed development decisions. The effectiveness of the game is driven equally by its foundational structure and the thoughtful integration of features that foster a deeply immersive and authentic user experience.

#### **2.2.1.1 Map design**

Airports are intricate and carefully coordinated infrastructures built to support air transportation. They consist of various critical elements, each designed to perform a specific function that contributes to the orderly and efficient management of air traffic. The main components include:

##### **a) Hangars:**

- Hangars are large, enclosed structures specifically designed for the storage, servicing, and maintenance of aircraft.
- Provide protection from harsh and unpredictable weather conditions, acting as secure storage when aircraft are not in operation.

- Hangars also function as central hubs for maintenance, inspections, and repairs, playing a critical role in ensuring aircraft safety and continued airworthiness.



*Figure 2.5: Malaysia Airlines Hangar (Google n.d)*

#### **b) Runways:**

- Runways are long, paved surfaces that serve as the primary zones for aircraft take-off and landing.
- carefully engineered to handle the high speeds, weight, and impact forces of various types of aircraft.
- Runways features standardized lighting systems and surface markings that guide pilots during take-off, landing and taxiing especially in low visibility or night conditions.



*Figure 2.6: Airport Runway (Google n.d)*

### 2.2.1.2 Aircraft Models

Three-dimensional (3D) aircraft models refer to digital representations of various types of aircraft. These models are crafted to closely mimic the actual appearance of real world aircraft, offering precise and detailed depictions of their structure, components and overall design.

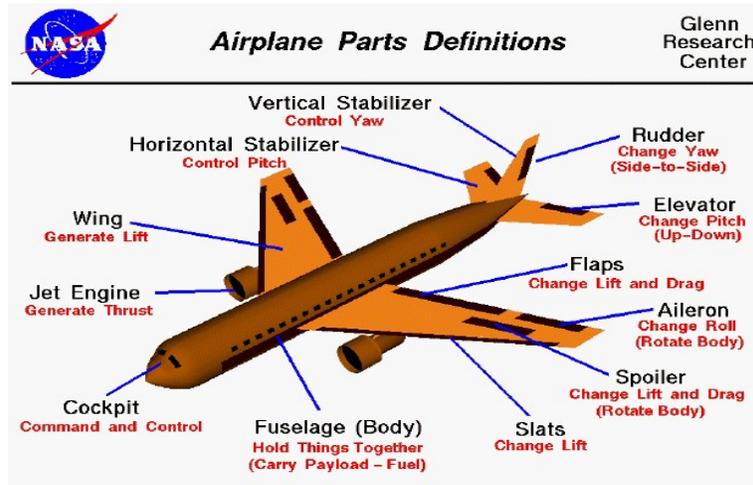


Figure 2.7: Parts of Airplane (NASA, n.d)

### 2.2.2 Game Mechanism

Game mechanics are the systems and rules that shape how a video game functions and how players interact with it. These interactive elements influence player progression, engagement with in-game content and the way challenges are approached. Game mechanics form the core structure of gameplay, playing a crucial role in defining the overall experience and significantly contributing to a game's success and appeal.

#### 2.2.2.1 Player Control

In gaming, player controls refer to the input systems and devices that allow users to interact with and navigate within a virtual environment. This includes both camera controls, which determine the player's viewpoint and perspective, and movement controls, which define how characters or objects move through the game world.

### **a) Movement Control:**

- Movement controls are input methods that allow players to direct the movement of a character object or vehicle within a virtual environment.
- The effectiveness of these controls, particularly their responsiveness and ease of use is essential for giving players a strong sense of control and immersion in the game world.

### **b) Camera Manipulation:**

- Camera manipulation controls determine the player's viewpoint and visual perspective within a virtual environment.
- These controls enable players to explore the game world by adjusting the camera through panning, tilting, zooming, and rotating.
- Effective camera controls are essential for providing a comprehensive view of simulated aircraft or environments, aiding in both navigation and situational awareness.

### **c) Customization Options:**

- Player controls are often customizable to cater to different preferences and skill levels.
- Players can typically adjust settings such as key bindings, control inversion, and sensitivity to match their personal playstyle and comfort.

## **2.2.2.2 Interaction Scripts**

Interaction scripts significantly enhance the interactive and educational aspects of a virtual environment. These scripts consist of pre-defined code that responds to player input, enabling meaningful interactions with specific objects or elements within the virtual space.

### **a) Click Detectors and Input Methods:**

- Interaction scripts often rely on input methods such as click detectors to trigger specific actions or responses within the virtual environment.
- Click detectors track player interactions like mouse clicks or screen taps which is signaling the intent to interact with particular elements, such as components of an aircraft or other in-game objects.

### **b) Interacting with Aircraft Parts:**

- Interaction scripts are primarily designed to enable players to engage with various parts of a model aircraft.
- By clicking on or selecting specific components, players trigger the corresponding interaction script, prompting a programmed response or action within the virtual environment.

### **c) Displaying Information:**

- Interaction scripts are primarily used to display relevant information when players interact with or select specific parts of an aircraft model.
- The displayed content may include details about the component's function, technical specifications, operational purpose, or historical background enhancing the player's understanding of the aircraft's complexity and design.

### **d) Enhancing Educational Value:**

- Interaction scripts play a vital role in enhancing the educational value of virtual environments, particularly in aviation and engineering simulations.
- By delivering in-depth information about aircraft components, these scripts create a more immersive and hands-on learning experience enabling users to explore, understand and engage with complex systems in an interactive way.

## **2.2.3 Interface Layout**

Interface layout refers to the structured arrangement of features and elements that shape how players experience and interact with a game. It involves the deliberate organization of instructions, processes and interactive components that guide players as they engage with content, tackle challenges and progress through the game. A well-designed interface layout improves usability, enhances player immersion and contributes significantly to the game's overall appeal and success.

### **2.2.3.1 User Interface (UI)**

User Interface (UI) refers to the visual and interactive components of a device or software. It encompasses elements like buttons, icons and menus that users interact with on the screen. The primary goal of UI design is to ensure ease of navigation and control, offering users a clear, intuitive and seamless experience.

**a) Heads-Up Display (HUD):**

- The User Interface (UI) presents essential information throughout the game.
- It displays key metrics such as altitude, speed, and mission objectives to keep players informed.
- Emphasis is placed on clarity to ensure quick comprehension of important data.
- The UI offers real-time, dynamic updates to enhance gameplay awareness and decision-making.

**b) Menus:**

- The User Interface (UI) assists users in navigating game features and settings.
- It provides a straightforward and organized layout for an intuitive, user-friendly experience.
- The UI includes options for in-game settings, customization and achievement tracking.
- Well-designed menus allow easy access to various game functionalities.
- Overall, it enhances the user experience, making the game more interactive and enjoyable.

**2.2.3.2 Testing**

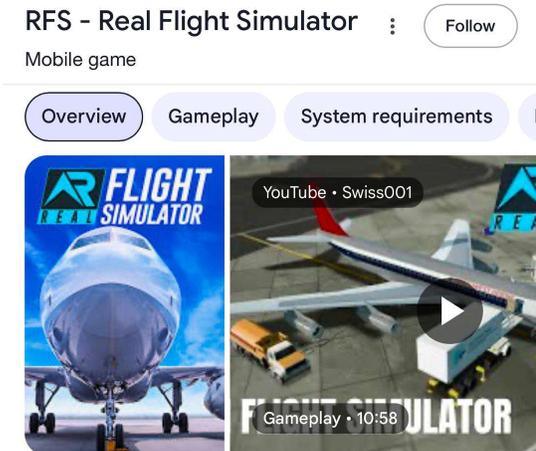
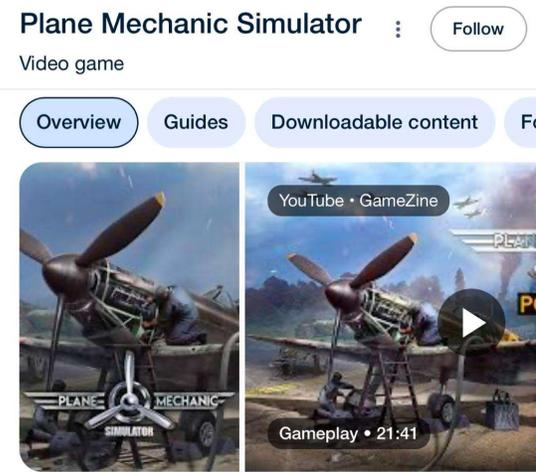
**a) Play Testing:**

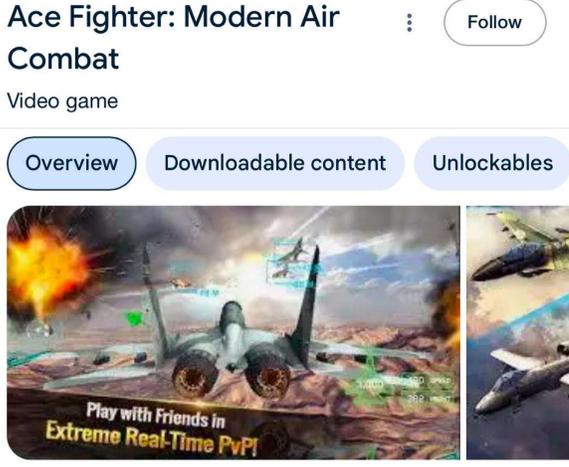
- Regular testing is performed to ensure the game functions properly and provides an enjoyable experience.
- Player feedback is actively collected to pinpoint areas for improvement and gain insights into what players enjoy.
- Continuous feedback helps refine gameplay elements and align the game with player preferences.

**2.3 REVIEW OF RECENT RESEARCH / RELATED PRODUCTS**

**2.3.1 Recent Market Products**

No.	Market Product	Patent Summary
1.		<b>Game Name:</b> Real Flight Simulator <b>Developer:</b> RORTOS <b>Release:</b> Mobile (July 25, 2019) <b>Description:</b> Real Flight Simulator (RFS) is a premium simulation video game for mobile

	 <p><b>RFS - Real Flight Simulator</b> : Follow Mobile game</p> <p>Overview Gameplay System requirements</p> <p>YouTube • Swiss001 Gameplay • 10:58</p>	<p>devices by the developer, RORTOS. It's a flight simulator that provides players with a unique and realistic flying experience as they take control and be a pilot of an aircraft used for airline transport services around the world.</p>
2.	 <p><b>Plane Mechanic Simulator</b> : Follow Video game</p> <p>Overview Guides Downloadable content For</p> <p>YouTube • GameZine Gameplay • 21:41</p>	<p><b>Game Name:</b> Plane Mechanic Simulator <b>Developer:</b> Disaster Studio, Cobble Games <b>Release:</b> Nintendo Switch, Xbox One, PlayStation 4, Windows (July 13, 2019) <b>Description:</b> Plane Mechanic Simulator puts you in a role of an RAF ground crew technician at the start of the Battle of Britain. You will face various tasks ranging from simple refuelling to engine repairs and gun harmonization.</p>
3.	 <p><b>Airport City</b> : Follow Mobile game</p> <p>Overview Gameplay Downloadable content</p>	<p><b>Game Name:</b> Airport City <b>Developer:</b> Game Insight <b>Release:</b> Mobile (February 11, 2012) &amp; Microsoft (April 3, 2014) <b>Description:</b> Airport City tasks the player with expanding a small airport into a major one, while developing a nearby town to support the airport operations with passengers from residential buildings and taxes from commercial properties.</p>

4.	 <p style="text-align: center;"><i>Figure 2.11: Ace Fighter: Modern Air Combat</i></p>	<p><b>Game Name:</b> Ace Fighter: Modern Air Combat  <b>Developer:</b> Action Games Az  <b>Release:</b> Mobile (November 2, 2018)  <b>Description:</b> Ace Fighter: Modern Air Combat transfers you to the world of modern war planes and supersonic jet fighters. Join players from around the globe in the ultimate multiplayer PvP combat for air force domination. Military aeronautics at its finest brings you a huge variety of aircraft and airplanes.</p>
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*Table 2.1: Recent Market Product*

## 2.4 COMPARISON BETWEEN RECENT RESEARCH AND CURRENT PROJECT

### 2.4.1 Product A vs Current Project

Product	RFS: Real Flight Simulator	LMS Game
<b>Purpose</b>	Provides pilot iconic aircraft, access global flights in real time, and explore ultra-realistic airports with live weather and advanced flight systems	Develop an interactive aircraft line maintenance open world simulation using Roblox that serves as an accessible and cost-effective educational tool for aviation maintenance students
<b>Target</b>	Kids and Teenagers	High School/Aviation Students
<b>Platform</b>	Microsoft, Mobile Phone, Tablet	Roblox Platform, Microsoft Windows, console and mobile devices
<b>Features</b>	Need to Purchase	Free to Play
<b>Genres</b>	Flight Simulation	Education Simulation

*Table 2.2: Product A vs Current Project*

### 2.4.2 Product B vs Current Project

<b>Product</b>	<b>Plane Mechanic Simulator</b>	<b>LMS Game</b>
<b>Purpose</b>	Provides a role of an RAF ground crew technician at the start of the Battle of Britain. Players will face various tasks ranging from simple refuelling to engine repairs and gun harmonization.	Develop an interactive aircraft line maintenance open world simulation using Roblox that serves as an accessible and cost-effective educational tool for aviation maintenance students
<b>Target</b>	Everyone	High School/Aviation Students
<b>Platform</b>	Nintendo Switch, Xbox One, PlayStation 4, Microsoft Windows	Roblox Platform, Microsoft Windows, consoles and mobile devices
<b>Features</b>	Need to Purchase	Free to Play
<b>Genres</b>	Simulation	Education Simulation

*Table 2.3: Product B vs Current Project*

### 2.4.3 Product C vs Current Project

<b>Product</b>	<b>Airport City</b>	<b>LMS Game</b>
<b>Purpose</b>	Immerse players in building and managing a bustling airport and a supporting city, ultimately creating a thriving international transport hub. Players develop their own airport, assemble a fleet of aircraft, send flights worldwide, and manage a city to support airport operations	Develop an interactive aircraft line maintenance open world simulation using Roblox that serves as an accessible and cost-effective educational tool for aviation maintenance students
<b>Target</b>	Kids and Teenagers	High School/Aviation Students
<b>Platform</b>	Microsoft Windows, iOS, Android	Roblox Platform, Microsoft Windows, consoles and mobile devices
<b>Features</b>	Free to Play	Free to Play
<b>Genres</b>	Management Simulation	Education Simulation

*Table 2.4: Product C vs Current Project*

#### 2.4.4 Product D vs Current Project

<b>Product</b>	<b>Ace Fighter: Modern Air Combat</b>	<b>LMS Game</b>
<b>Purpose</b>	Provides players to the world of modern war planes and supersonic jet fighters. Players from around the globe in an ultimate multiplayer PvP combat for air force domination.	Develop an interactive aircraft line maintenance open world simulation using Roblox that serves as an accessible and cost-effective educational tool for aviation maintenance students
<b>Target</b>	Everyone	High School/Aviation Students
<b>Platform</b>	Android and iOS	Roblox Platform, Microsoft Windows, consoles and mobile devices
<b>Features</b>	Free to Play	Free to Play
<b>Genres</b>	Combat Flight Simulation	Education Simulation

*Table 2.5: Product D vs Current Project*

# CHAPTER 3

## METHODOLOGY

### 3.1 PROJECT BRIEFING & RISK ASSESSMENT

The title of this final year project is "*Simulation of Aircraft Line Maintenance Operations Using Roblox Studio.*" The main objective of this project is to develop an interactive simulator using Roblox Studio that replicates basic aircraft line maintenance procedures in a virtual environment. This simulation is designed to serve as an educational tool for students and early-stage aviation trainees.

The scope of this project includes designing a virtual airport ramp within Roblox, along with simulating common line maintenance activities. These activities include pre-flight inspections, refuelling, and changing tyre. All interactions within the simulator will be scripted using the Lua programming language.

This project aims to provide users with an immersive and realistic experience of maintenance activities while ensuring safety and procedural accuracy based on industry guidelines. References such as the Aircraft Maintenance Manual (AMM), Minimum Equipment List (MEL), and aviation safety standards will be used as guidelines.

The project will be carried out using Roblox Studio and Lua scripting. No consultants will be hired, so all technical aspects will be handled in-house by the project team, with feedback from academic supervisors.

One of the key risks in this project is the possibility of using inaccurate or outdated aircraft maintenance procedures in the simulation. This could lead to the delivery of misleading information to users and reduce the educational value of the simulator. To mitigate this risk, the team will refer to official technical documents such as the Aircraft Maintenance Manual (AMM) and Minimum Equipment List (MEL) and seek regular feedback from academic supervisors to ensure that all simulated procedures follow current industry standards.

### 3.2 OVERALL PROJECT GANTT CHART

#### 3.2.1 Gantt Chart for AEM

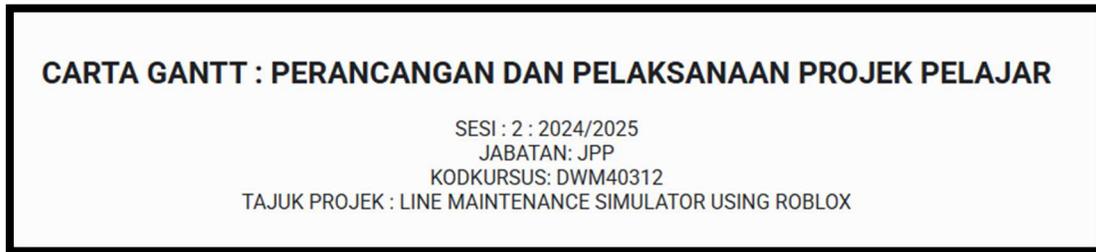


Figure 3.1: Project GANTT Chart

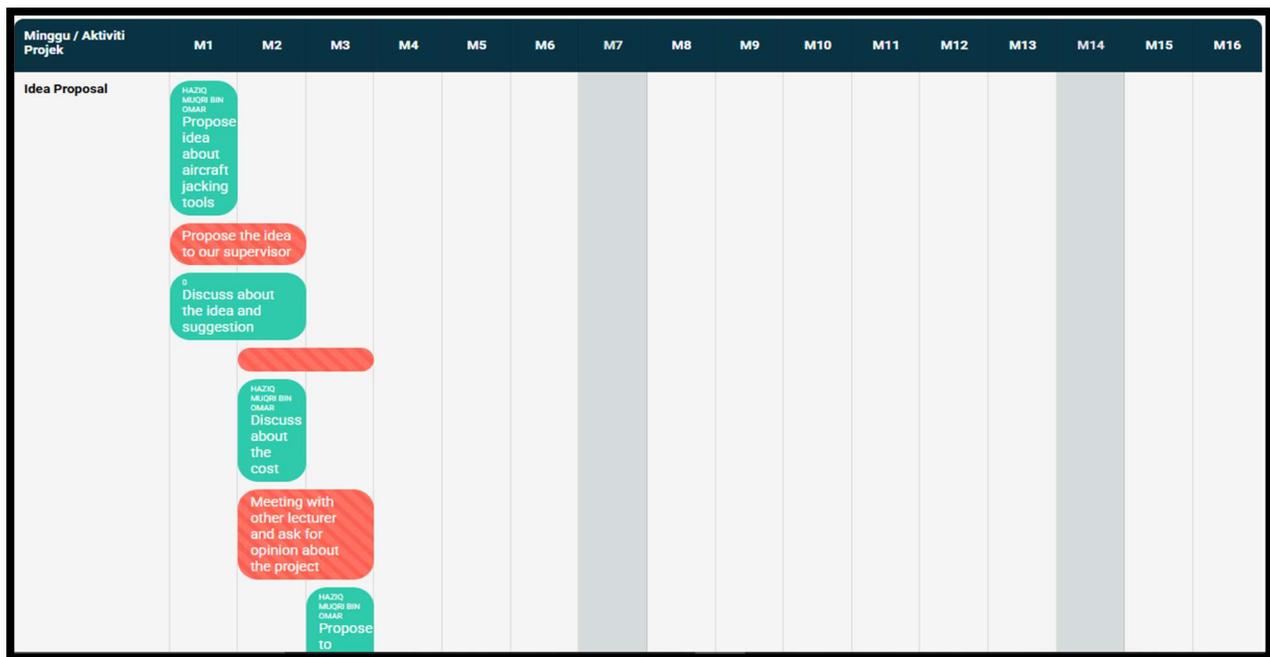


Figure 3.2: Project GANTT Chart Week 1-Week 3



Figure 3.3: Project GANTT Chart Week 3-Week 5

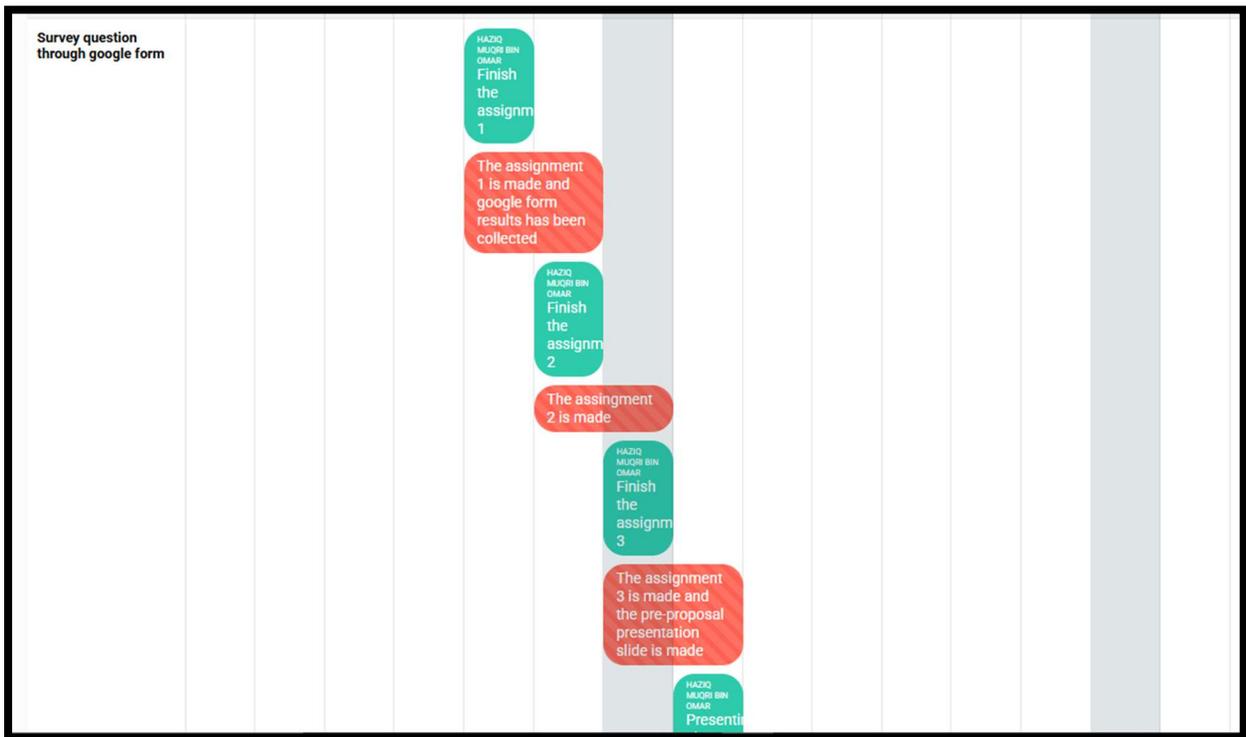


Figure 3.4: Project GANTT Chart Week 5-Week 8



Figure 3.5: Project GANTT Chart Week 9-Week 15

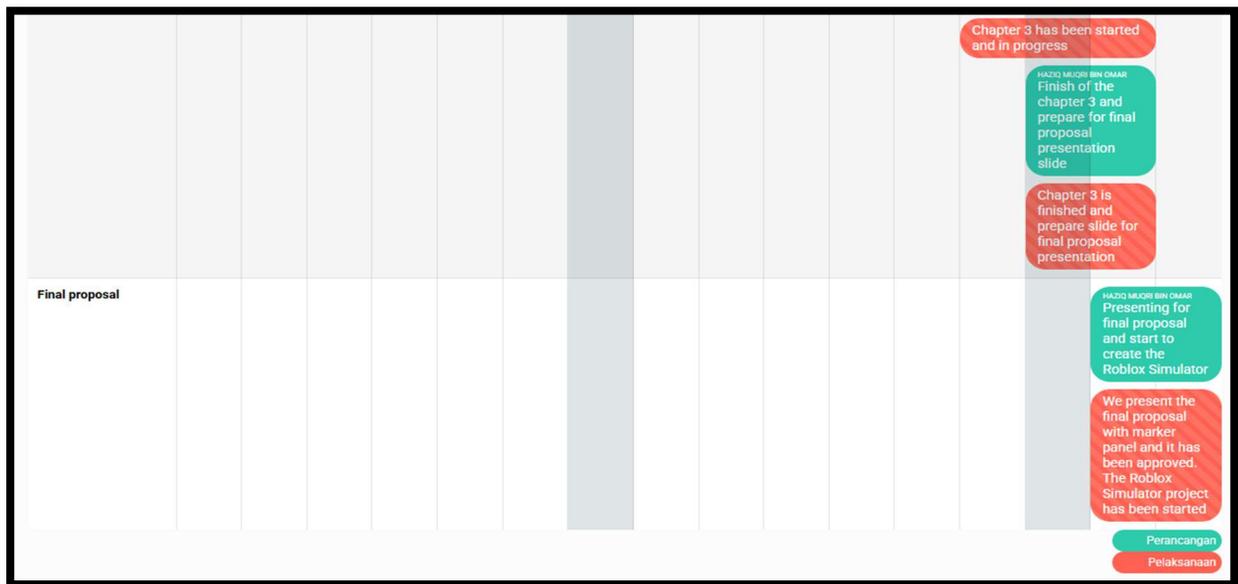


Figure 3.6: Project GANTT Chart Week 13-Week 16

### 3.3 PROJECT FLOW CHART

#### 3.3.1 Project Flowchart for AEM

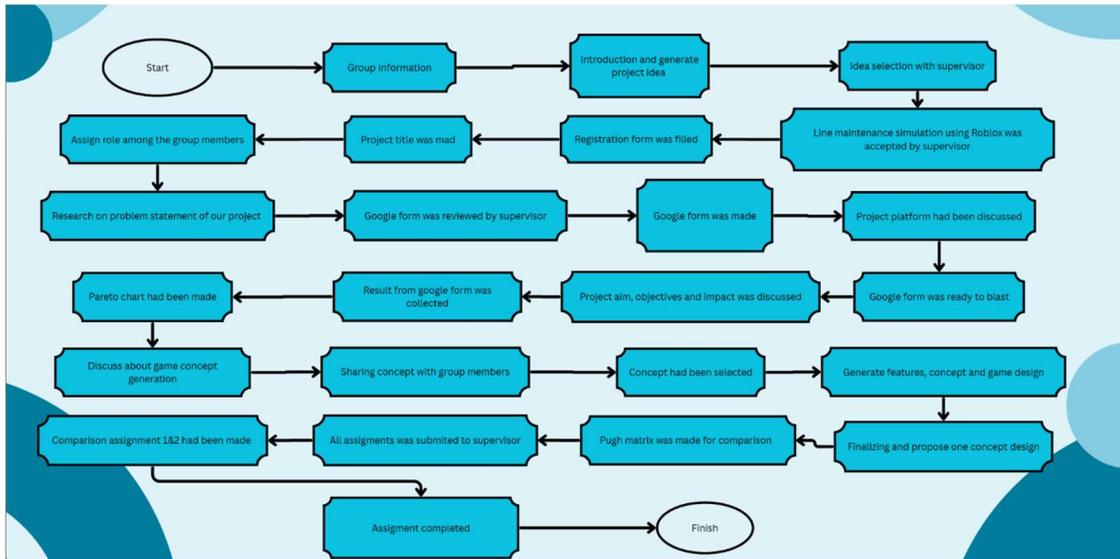


Figure 3.7: AEM Project Flowchart

### 3.4 DESIGN ENGINEERING TOOLS

#### 3.4.1 Gaming Requirement Analysis

##### 3.4.1.1 Questionnaire Survey

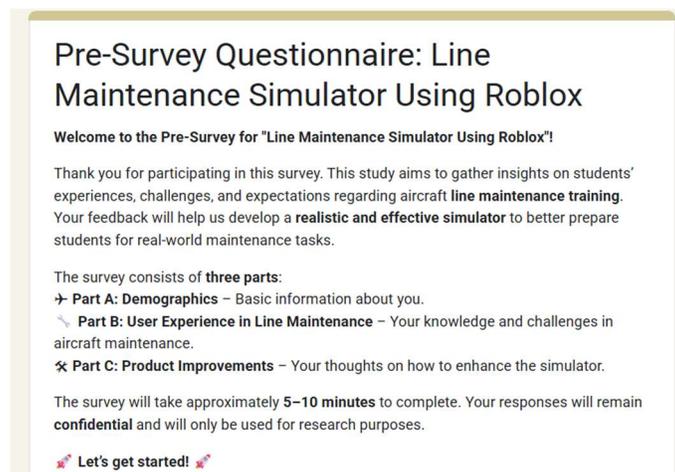


Figure 3.8: Questionnaire Survey through Google Form

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:

- Have you been involved in aircraft line maintenance before?
- Do you think a simulator game can help students prepare for real-world line maintenance tasks?
- What is the most important factor for making the simulator engaging?

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 analysed in a Pareto chart based on the survey responses.

Features	Frequency	Cummulative	Cummulative Percentage	Pareto Baseline
Identifying: Challenge	15	15	40.54%	80%
Operation: Determination	12	27	72.97%	95%
Understanding: Confusion	10	37	100%	100%

*Figure 3.9: Pareto Data (Conventional Method) Extracted from The Survey Response*

From Figure 3.9, we can conclude that “Operation: Determination” and “Identifying: Challenge” have the higher priority. We should focus on this feature to satisfy the user. This table then was shown in Pareto Diagram.

Features	Frequency	Cummulative	Cummulative Percentage	Pareto Baseline
Helping In Learning	18	18	30%	75%
Effectiveness	16	34	57%	90%
Potential	14	48	80%	98%
Interest	12	60	100%	100%

Figure 3.10: Pareto Data (Roblox Features) Extracted from The Survey Response

From Figure 3.10, we can conclude that effectiveness and helping in learning have the higher priority. We should focus on this feature to satisfy the user. This table then was shown in Pareto Diagram.

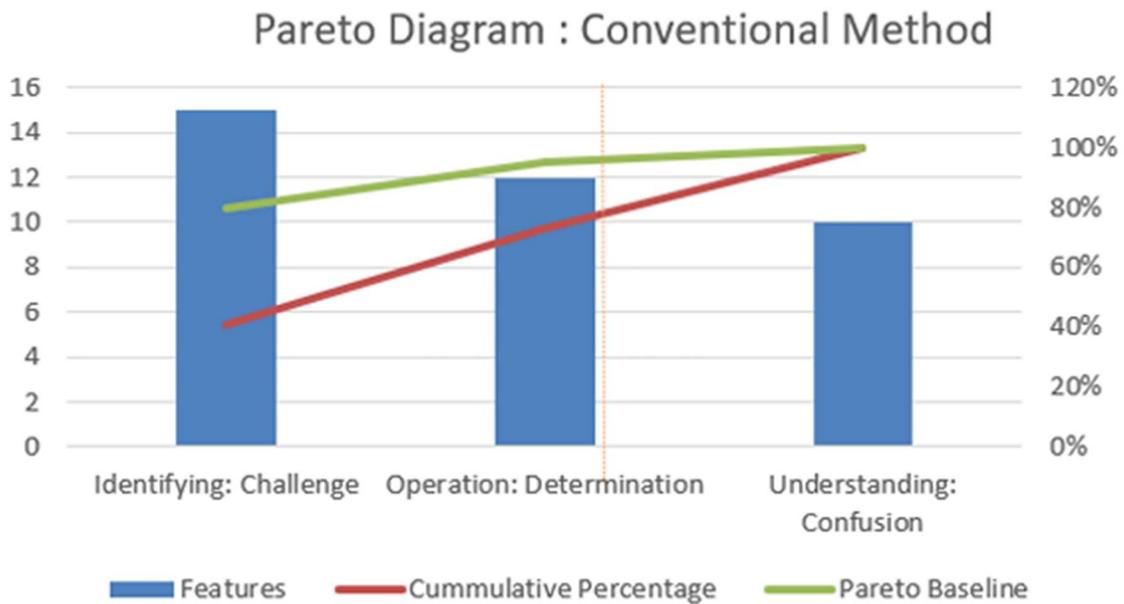


Figure 3.11: Pareto Diagram (Conventional Method)

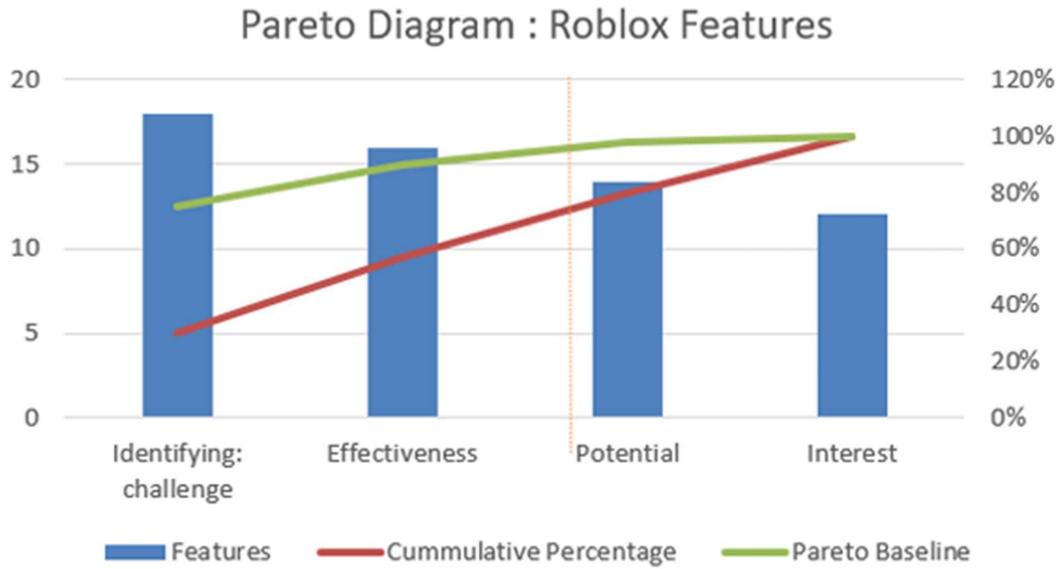


Figure 3.12: Pareto Diagram (Roblox Features)

### 3.4.2 Design Concept Generation

#### 3.4.2.1 Morphology Matrix

FUNCTION (SUB-FUNCTION)	CONCEPT 1	CONCEPT 2	CONCEPT 3	CONCEPT 4
Type	Game 	Game 	Game 	Game 
Software	Roblox Studio 	Roblox Studio 	Roblox Studio 	Roblox Studio 
Hardware	Mouse & Keyboard 	Dualshock Controller & Monitor 	Mobile Phone 	Mouse & Keyboard 
Programming Language	Lua 	Lua 	C++ 	Lua 
Interaction	Point & Click 	Point, Drag & Click 	Finger Movement 	Player-To-Object 

Table 3.1: Morphological Matrix of LMS Game

### 3.4.2.2 Proposed Concept Generation 1

<b>FUNCTION</b>	<b>CONCEPT 1</b>	<b>JUSTIFICATION</b>
<b>TYPE</b>	Game	Learning process while playing the game.
<b>SOFTWARE</b>	Roblox Studio	Roblox development software to create simulation in Roblox.
<b>HARDWARE</b>	Computer	Some Roblox games are too demanding for mobile devices, especially those with large maps, many players, or advanced effects.
<b>PROGRAMMING LANGUAGE</b>	Lua	Simple programming language used in Roblox games development.
<b>INTERACTION</b>	Keyboard & Mouse	Users perform task or inspection by selecting object in the virtual environment.

*Table 3.2: Proposed Concept Generation 1*

### 3.4.2.3 Proposed Concept Generation 2

FUNCTION	CONCEPT 2	JUSTIFICATION
TYPE	Open World Game	<ul style="list-style-type: none"> <li>- The simulation reduces the cost of real-life training in the aviation industry.</li> <li>- It provides a realistic yet safe learning experience.</li> </ul>
SOFTWARE	Roblox Studio	<ul style="list-style-type: none"> <li>- It provides a user-friendly platform for building and testing the simulation.</li> <li>- It supports scripting using Lua, enabling interactive elements such as troubleshooting and aircraft inspections.</li> </ul>
HARDWARE	Game Consoles	<ul style="list-style-type: none"> <li>- Parents often prefer consoles for younger kids because of built-in parental controls.</li> </ul>
PROGRAMMING LANGUAGE	Lua	<ul style="list-style-type: none"> <li>- Lightweight and easy-to-learn language, making it ideal for development in Roblox Studio.</li> </ul>
INTERACTION	Controller	<ul style="list-style-type: none"> <li>- Controller for better control over maintenance tools and equipment</li> <li>- Monitor provides a larger and clearer display.</li> </ul>

*Table 3.3: Proposed Concept Generation 2*

### 3.4.2.4 Proposed Concept Generation 3

<b>FUNCTION</b>	<b>CONCEPT 3</b>	<b>JUSTIFICATION</b>
<b>TYPE</b>	Game	Learning process while playing the game.
<b>SOFTWARE</b>	Roblox Studio	Roblox Studio is a powerful game development platform that is well-suited for creating the game due to its flexibility, accessibility, and multiplayer capabilities.
<b>HARDWARE</b>	Mobile Phone	As a platform for an Aircraft Line Maintenance Simulator offers accessibility, convenience, and cost-effectiveness, making it an excellent choice for aviation training.
<b>PROGRAMMING LANGUAGE</b>	C++	Fast, efficient, and capable of handling complex physics and simulations.
<b>INTERACTION</b>	Finger Movement	It enhances engagement, accuracy, and skill development. Preparing trainees for real world aircraft maintenance tasks.

*Table 3.4: Proposed Concept Generation 3*

### 3.4.2.5 Proposed Concept Generation 4

<b>FUNCTION</b>	<b>CONCEPT 4</b>	<b>JUSTIFICATION</b>
<b>TYPE</b>	Game	Give fun while learning
<b>SOFTWARE</b>	Roblox Studio	designed to be beginner-friendly, making it easy to get started with game development
<b>HARDWARE</b>	Computer	Higher graphics quality and smoother performance enhance immersion in games.
<b>PROGRAMME LANGUAGE</b>	LUA	Lua has a simple and readable syntax, making it beginner-friendly
<b>INTERACTION</b>	Keyboard & Mouse	The mouse allows precise actions, and keyboard helps players move around

*Table 3.5: Proposed Concept Generation 4*

### 3.4.2.6 Accepted Solution

FUNCTION	CONCEPT 5	JUSTIFICATION
TYPE	Game	Learning process while playing the game.
SOFTWARE	Roblox Studio	Roblox Studio is a powerful game development platform that is well-suited for creating the game due to its flexibility, accessibility, and multiplayer capabilities.
HARDWARE	Computer	Some Roblox games are too demanding for mobile devices, especially those with large maps, many players, or advanced effects.
PROGRAMMING LANGUAGE	Lua	Simple programming language used in Roblox games development.
INTERACTION	Keyboard & Mouse	The mouse allows precise actions, and keyboard helps players move around

*Table 3.6: Accepted Solution*

### 3.4.3 Evaluation and Selection of Conceptual Design

#### 3.4.3.1 Pugh Matrix

CRITERIA	CONCEPT 1	CONCEPT 2	CONCEPT 3	CONCEPT 4
TYPE	D	3	2	2
SOFTWARE	A	2	2	2
HARDWARE	T	1	3	2
PROGRAMMING LANGUAGE	U	2	1	2
INTERACTION	M	3	3	2
TOTAL SCORE	-	11	10	10
RANKING	-	1	2	2

Legend = 3(+), 2(=), 1(-)

*Table 3.7: Concept Generation Evaluation Using Pugh Matrix (Concept 1 as Datum)*

CRITERIA	CONCEPT 1	CONCEPT 2	CONCEPT 3	CONCEPT 4
TYPE	1	D	2	2
SOFTWARE	2	A	2	2
HARDWARE	3	T	2	2
PROGRAMMING LANGUAGE	2	U	1	2
INTERACTION	1	M	3	1
TOTAL SCORE	9	-	10	9
RANKING	2	-	1	2

Legend = 3(+), 2(=), 1(-)

*Table 3.8: Concept Generation Evaluation Using Pugh Matrix (Concept 2 as Datum)*

CRITERIA	CONCEPT 1	CONCEPT 2	CONCEPT 3	CONCEPT 4
TYPE	2	3	D	2
SOFTWARE	2	2	A	2
HARDWARE	1	1	T	2
PROGRAMMING LANGUAGE	3	3	U	3
INTERACTION	1	1	M	1
TOTAL SCORE	9	10	-	10
RANKING	3	1	-	1

Legend = 3(+), 2(=), 1(-)

*Table 3.9: Concept Generation Evaluation Using Pugh Matrix (Concept 3 as Datum)*

CRITERIA	CONCEPT 1	CONCEPT 2	CONCEPT 3	CONCEPT 4
TYPE	2	2	2	D
SOFTWARE	2	2	2	A
HARDWARE	2	2	3	T
PROGRAMMING LANGUAGE	2	2	3	U
INTERACTION	2	1	1	M
TOTAL SCORE	10	9	11	-
RANKING	2	3	1	-

Legend = 3(+), 2(=), 1(-)

*Table 3.10: Concept Generation Evaluation Using Pugh Matrix (Concept 4 as Datum)*

With creating a PUGH Matrix, which is a chart that helps us pick the best option. We list different choices and rate them based on things that matter to us. Then, we compare all the scores and choose the one with the highest points. This method helps us make a smart decision by considering all important factors. All concepts are rated according to five criteria: Type, Software, Hardware, Programming Language and Interaction.

## 3.5 INTERFACE LAYOUT

### 3.5.1 General Project Interface Layout

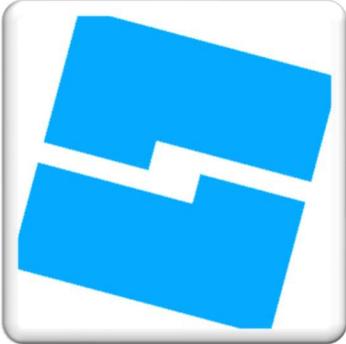
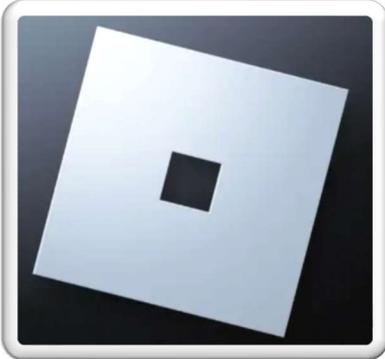


*Figure 3.13: Entry point interface upon launching the game*

Upon entering this game, a loading screen appears before the server stabilizes. On the initial GUI screen, players commence the game by clicking "play."

### 3.6 DEVELOPMENT OF GAME

#### 3.6.1 Material Acquisition

Description	Material
<p><b>Roblox Studio:</b> To create Line Maintenance Simulator Using Roblox and import 3D model.</p>	 The icon for Roblox Studio, featuring a blue stylized 'R' with a white notch, set against a white background with a subtle reflection below it.
<p><b>Roblox:</b> To set the game preference, information game and server settings.</p>	 The icon for the Roblox application, showing a white square with a black square in the center, tilted at an angle, on a dark background with a reflection below it.
<p><b>Google Meet:</b> To have discussions with team members.</p>	 The icon for Google Meet, consisting of a colorful square (red, yellow, blue, green) with a white square in the center, and a green video camera lens to the right, all on a white background with a reflection below it.

<p><b>Blender 3D Model:</b> To create model that did not have in Roblox Studio.</p>	
---	---

*Table 3.11: Material Acquisition*

### 3.6.2 DEVICES

#### 3.6.2.1 Smartphone



*Figure 3.14: Computer*

Computers provide superior processing power, larger displays, and precise input controls, making them highly suitable for running simulation-based projects that require smooth performance and detailed visual interaction.

To ensure stable operation of the Roblox-based Line Maintenance Simulator, the recommended minimum specifications include a dual-core processor (Intel i3 or equivalent), 4–8 GB RAM, integrated graphics such as Intel HD/UHD, and a stable internet connection for asset loading and multiplayer features.

### 3.7 FUNCTIONALITY TEST

#### 3.7.1 Game Operating Procedure

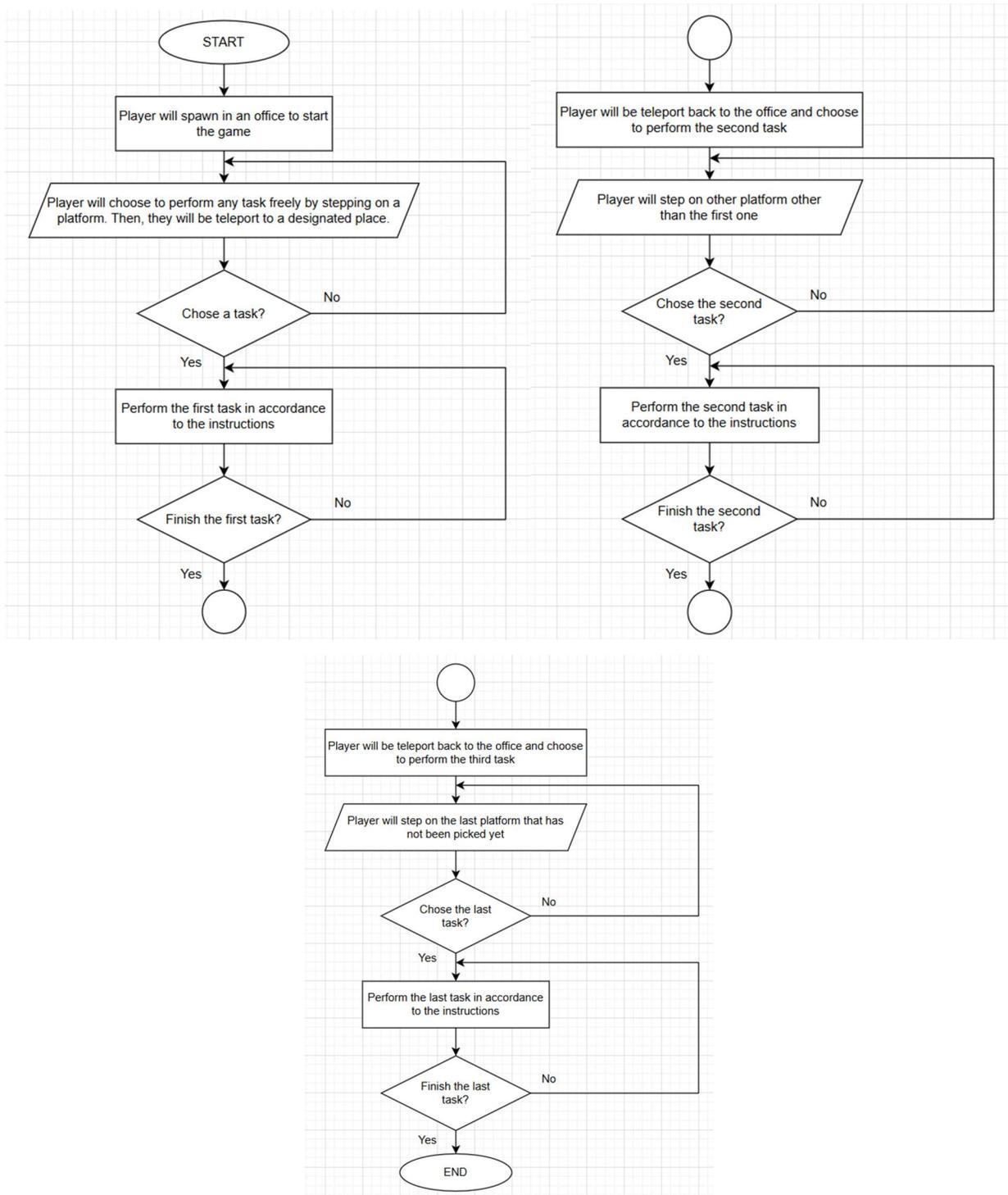


Figure 3.15: Game Operating Procedure

Players have the freedom to pursue their desired actions within the simulator 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

EXPENDITURE				
No.	Item Details	Unit	Price	Total
1.	Internet purchase	4	RM30.00	RM120.00
2.	LUA programming online course	1	RM80.00	RM80.00

*Table 3.12: List Of Materials & Expenditure*

# CHAPTER 4

## RESULT & DISCUSSION

### 4.1 PRODUCT DESCRIPTION

#### 4.1.1 General Product Features & Functionalities

The Line Maintenance Simulator Using Roblox is designed to attract teenagers to the aviation industry especially aircraft maintenance and provide aircraft maintenance students with a realistic and interactive virtual training environment. The simulator focuses on daily line maintenance activities performed by aircraft maintenance technicians, including preflight/walkaround inspection, wheel assembly installation, aircraft refueling, and aircraft systems functional test.

The simulator allows players to experience real-world line maintenance operations through virtual tools and get to see how an actual aircraft maintenance manual looks like. Users can perform walk-around inspections, perform wheel assembly installation, experience aircraft refueling and also perform aircraft systems functional tests.

Features such as an inspection checklist, interactive equipment, safety procedure, and guided instructions enhance the learning process by combining education with gamification. The simulator aims to introduce the younger generation to the aircraft maintenance industry and prepare students for real maintenance environments while improving their understanding of maintenance procedures and safety awareness.

## 4.1.2 Specific Part Features

### 4.1.2.1 Game Structures

#### a. Main Lobby

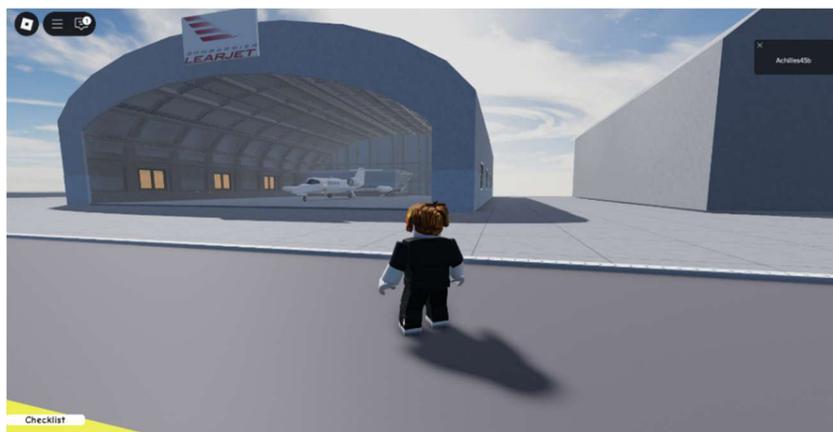
This is where the player will spawn first once they have entered the game. They are able to choose any maintenance task listed by stepping on the platform. Then, they will be teleported to a designated task area.



*Figure 4.1: Main lobby*

#### b. Hangar Area

The simulator is set in a detailed virtual hangar environment. The area includes taxiway markings, maintenance zones, and parked aircraft. The environment mimics real airport conditions, allowing players to perform tasks like daily checks and servicing under realistic lighting and weather conditions.



*Figure 4.2: Hangar area*

### c. Aircraft Model

A highly detailed 3D model of an aircraft is used as the main training aircraft. Players can perform inspections on key components such as the landing gear, flight control surfaces, and engine cowlings. Interactive zones allow users to identify defects and complete the maintenance checklist according to standard procedures.



*Figure 4.3: Aircraft model*

### d. Aircraft Refueling Truck

The player will drive the truck and park under the aircraft refueling point (under wing), then perform the refueling task as per instructions.



*Figure 4.4: Aircraft refueling truck*

### e. Sample of Instructions

Players will perform the task in accordance to the instructions given



Figure 4.5: Sample of instructions

### 4.1.2.2 Game Mechanism

The Line Maintenance Simulator operates through a series of interactive tasks and objectives:

#### a. Pre-flight/Walkaround Inspection

Players follow a step-by-step inspection route around the aircraft, they will do visual inspection for the aircraft structure and system. Pop-up checklist boxes will appear and players can tick the box indicating they have done visual inspection on that part.



Figure 4.6: Pre-flight/walkaround inspection

### b. Wheel Assembly Installation

The player will bring a wheel assembly near the aircraft and simply attach it to the landing gear strut. There will be instructions for wheel installation from an actual AMM to give exposure to the player.



Figure 4.7: Wheel assembly installation

### c. Aircraft Refueling

The player will drive a refueling truck and park it under the aircraft refueling point (under wing). Then, they will pull the refueling hose and attach it to the fuel point attachment. There are also instructions at the spawn point and notes for safety precautions at the spawn point before they begin the task.



Figure 4.8: Aircraft refueling

#### d. Aircraft Systems Functional Test

The player will perform functional tests to various aircraft systems such as engines, doors, lights, and flight controls.



Figure 4.9: Aircraft systems functional test

#### 4.1.2.3 Interface Layout

##### a. Main Menu

Allow players to change to settings of the game.

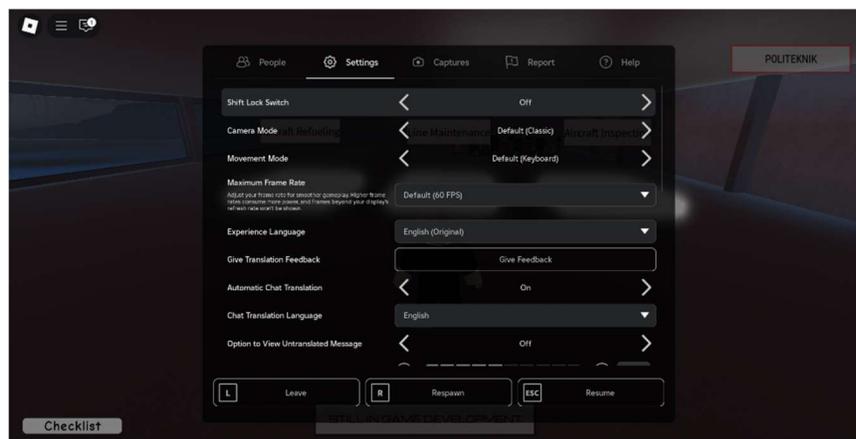


Figure 4.10: Main menu

## b. Task Interface

Players can see what to do in the task, e.g. walkaround inspection checklist

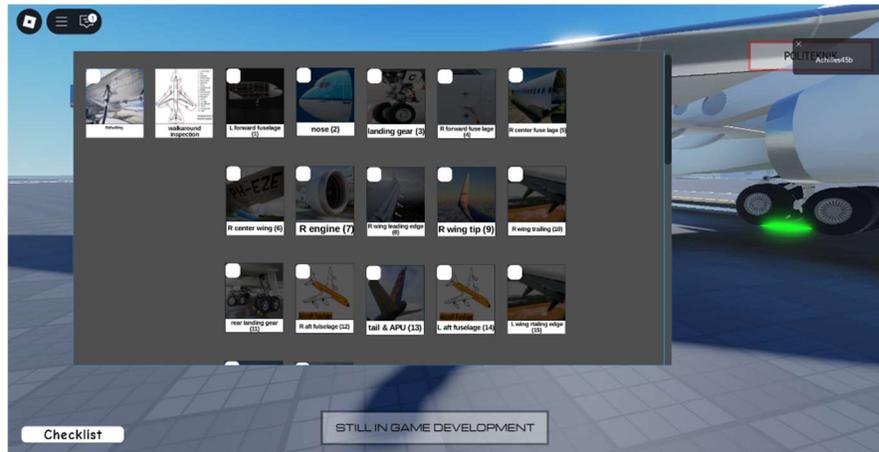


Figure 4.11: Walkaround inspection checklist

## c. Pop-up Guides

Appear near components, offering quick references to standard practices and part information.

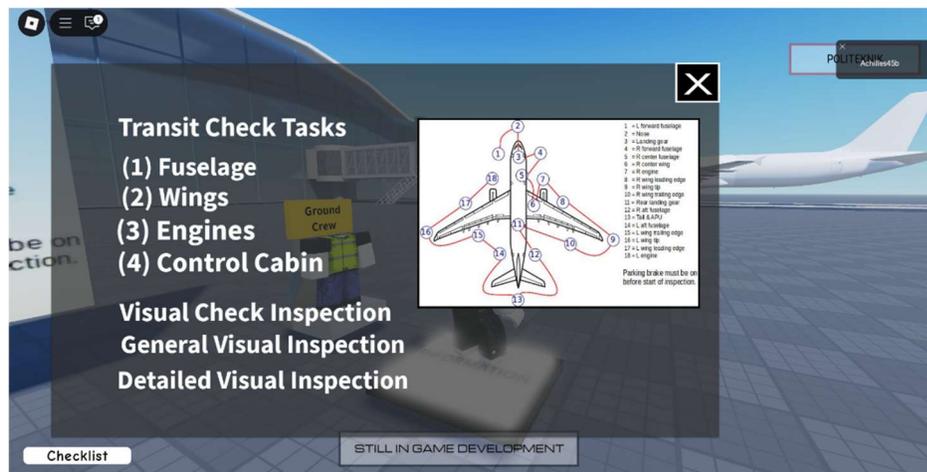
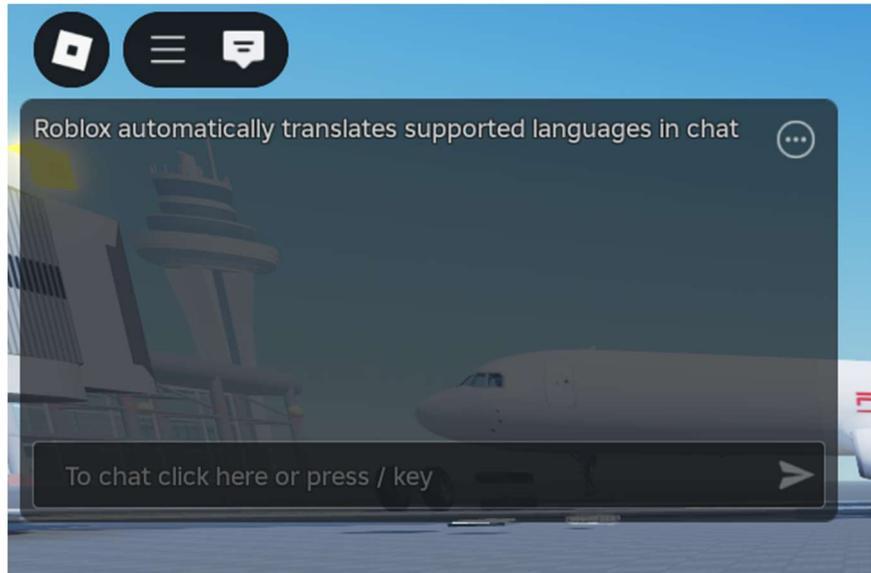


Figure 4.12: Pop-up guide

#### d. Chat Box

Allows players to chat or request assistance from other players, simulating teamwork in real maintenance environments.



*Figure 4.13: Chat box*

#### 4.1.3 General Operation of Product

Fundamentally, the Line Maintenance Simulator seeks to empower players by furnishing them with the knowledge and guidance necessary to navigate the realm of aircraft maintenance confidently. The game's goal is to deliver an engaging and educational gaming experience focused on enhancing player's understanding of aircraft line maintenance tasks. The operation of the simulator involves various processes and interactions designed to enable effective player utilization. This game aspires to offer an enjoyable and instructive gaming experience. Upon logging in, players gain access to diverse game features, including the ability to perform aircraft walkaround inspection, installing wheel assembly, perform aircraft refueling, and perform functional tests on the aircraft systems, all through a user-friendly main menu.

Within the walkaround inspection task, players undertake a detailed inspection of a specific aircraft. They can activate the aircraft engines, lights, and door access. 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 about the parts.

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

#### 4.2 PRODUCT OUTPUT ANALYSIS

No.	Parameters	Results	Remarks	Analysis
1.0	User Interaction Performance			
1.1	Task Completion Time	2-3 minutes per task	Average time taken by users to complete the basic aircraft walk-around inspection task inside the simulator.	Users completed the task within a short duration, indicating that the task instructions were clear and the interface was manageable for beginners.
1.2	Task Completion Accuracy	80%	Task completion accuracy percentage by users.	Users completed the task in accordance of the instructions, indicating that the task instructions were clear and easy to understand.
1.3	User Navigation Efficiency	90% of users navigated the simulator without assistance	Measurement of how many users could move around, interact with aircraft objects, and execute tasks without asking for help.	High navigation success demonstrates that the environment layout is user-friendly and suitable even for beginners with no aviation background.
2.0	Educational Output			
2.1	Knowledge Improvement	4.39 / 5 average rating	Measured via pre-survey and post-survey questions evaluating understanding of basic aircraft line maintenance tasks.	There is a noticeable improvement in users' understanding, showing that the simulator is effective for introductory aircraft maintenance learning.
2.2	User Engagement Level	75% users agreed	Measured via post-survey questions evaluating understanding of basic aircraft line maintenance tasks.	Indicating this simulator could attract younger generations and introduce them to aircraft maintenance industry.

3.0	System Usability			
3.1	System Stability	Reported by 32% of users	Minor issues such as delayed object pick-up, delay teleportation and occasional lag.	Most sessions ran smoothly, but improvements can be made in object collision, scripting, and optimization for lower-end devices.
3.2	Instruction Clarity	4.5 / 5 average rating	User feedback on whether the simulator tasks were clearly explained.	Instructions are generally clear, contributing to high task completion rates. Additional visual indicators or tutorials may help beginners even more.

## **4.3 ANALYSIS OF PROBLEM ENCOUNTERED & SOLUTIONS**

### **4.3.1 Product Structures**

During the early development of the Line Maintenance Simulator, one of the major problems encountered was the lack of scripting knowledge among the team members. Initially, the group had limited understanding of how to use Roblox Studio scripting, which made it difficult to create game functions such as teleportation, task interaction, and system animations.

To overcome this challenge, the team decided to enroll in an online Roblox Lua scripting course and follow various YouTube tutorials. The online course took around one to two months to complete, allowing the team to gradually understand scripting basics, such as functions, variables, and event connections. Through continuous learning and practice, the team successfully applied the scripting knowledge to build the structure of the simulator and improve its functionality.

### **4.3.2 Product Mechanism**

During the development process, the aircraft model faced a technical issue related to the “Anchor” setting. The aircraft was not properly anchored, which caused it to float or move uncontrollably during gameplay. This problem affected the realism of the simulator. The team solved this issue by referring to online tutorials and learning how to correctly use the “Anchor” and “Primary Part” settings in Roblox Studio.

Another issue was identified in the refuelling area. When players stepped on the “Refuelling” platform to teleport from the office area to the refuelling zone, the server took some time to load, causing a noticeable delay before teleportation occurred. This issue was not fixed but recorded as a limitation due to server performance and network response time.

Lastly, the tire changing zone initially contained too many animation sequences, which caused lag and long loading times. To improve performance, the team simplified the tire changing design by reducing unnecessary animations. However, to ensure players still understand the task clearly, the team added information notes that appear when players step on a platform labelled “Information.” These notes provide guidance on how to perform the tire change. Similar informational platforms were also added to other

maintenance areas, helping players learn and follow the correct maintenance procedures throughout the simulator.

### **4.3.3 Interface Layout**

For the interface and environment layout, the team designed everything from scratch using Roblox Studio. The aim was to create a realistic airport environment that could attract and engage players, especially teenagers who are the main target users. The team carefully added details such as airport buildings, hangars, ground equipment, and vehicles to make the simulator visually appealing and immersive.

During the design process, several issues occurred such as button alignment, unclear menu arrangement, and delayed response on certain devices. These problems made it difficult for players to navigate the simulator smoothly. The team solved these issues by adjusting the placement of GUI elements and simplifying the layout design.

After multiple testing sessions on both PC and mobile platforms, the final layout became more user-friendly, with organized menus, clear icons, and detailed visual surroundings. The combination of educational tasks and realistic airport scenery successfully increased player engagement and motivation to explore aviation maintenance activities.

### 4.3.4 Survey Findings

a) Which semester are they from?

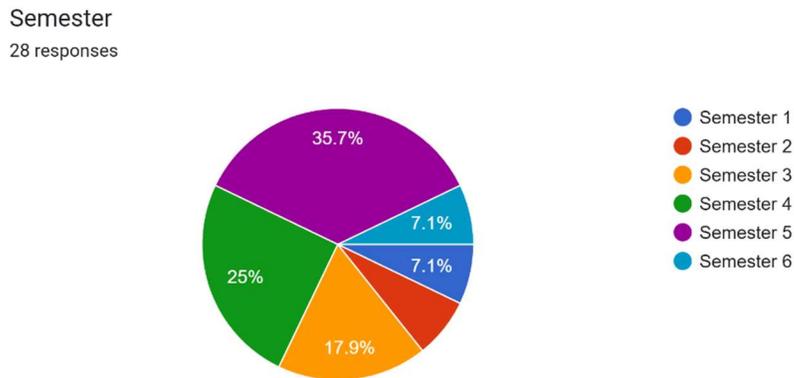


Figure 4.14: Post-Survey Question Number 1

b) What is their educational background?

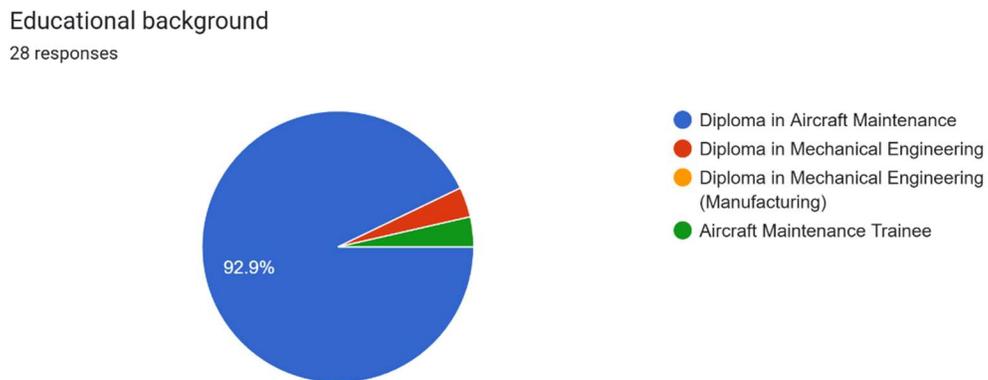


Figure 4.15: Post-Survey Question Number 2

c) How would you rate your overall experience using the Line Maintenance Simulator?

How would you rate your overall experience using the Line Maintenance Simulator? 1 = Very Poor, 5 = Excellent  
28 responses

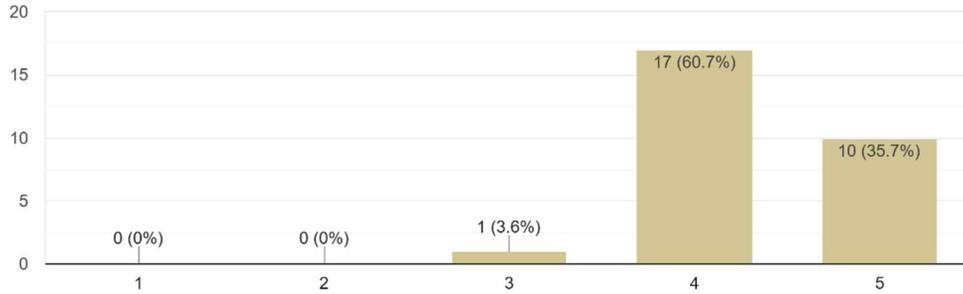


Figure 4.16: Post-Survey Question Number 3

d) Was the simulator easy to understand and navigate?

Was the simulator easy to understand and navigate? 1 = Very Difficult, 5 = Very Easy  
28 responses

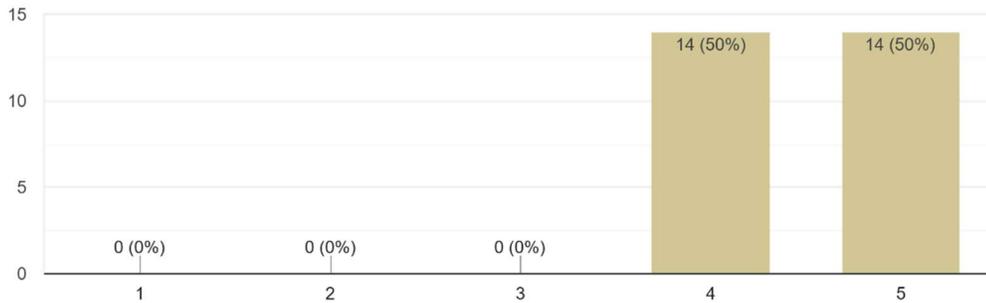


Figure 4.17: Post-Survey Question Number 4

e) Did the simulator help you understand basic aircraft line maintenance tasks?

Did the simulator help you understand basic aircraft line maintenance tasks? 1 = Strongly Disagree, 5 = Strongly Agree  
28 responses

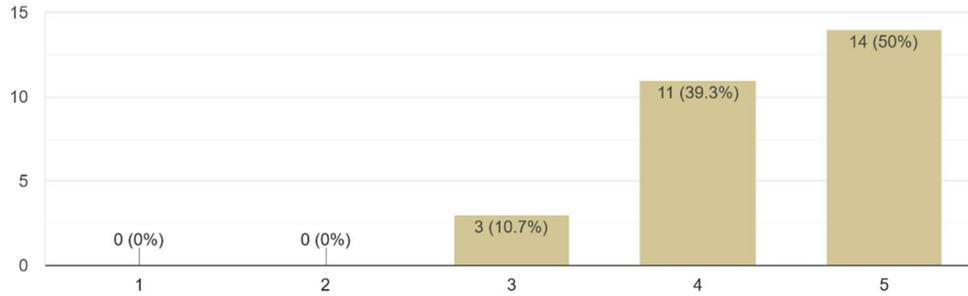


Figure 4.18: Post-Survey Question Number 5

f) Do you think this game can attract younger generations especially teenagers to be interested in aircraft maintenance industry?

Do you think this game can attract younger generations especially teenagers to be interested in aircraft maintenance industry?  
28 responses

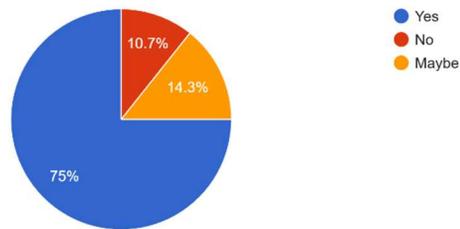


Figure 4.19: Post-Survey Question Number 6

g) Do you think this simulator can help students prepare better for actual aircraft maintenance training?

Do you think this simulator can help students prepare better for actual aircraft maintenance training?  
25 responses

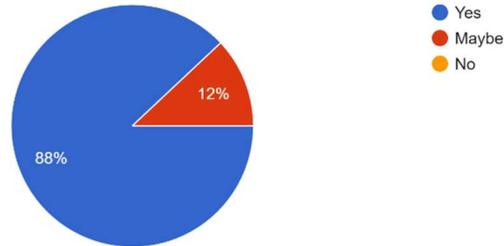


Figure 4.20: Post-Survey Question Number 7

h) Any additional comments or suggestions about the simulator?

Any additional comments or suggestions about the simulator?  
9 responses

Copy chart

Response Summary ✕

- **Gameplay/Content:** Suggestions were made to add more maintenance tasks and increase the level of detail or complexity in the simulation.
- **Visuals:** Feedback included a request for more detailed graphics.
- **Positive Feedback:** Respondents expressed appreciation for the game, describing it as "good," "nice," and stated they "Love the game," and specifically complimented the walkaround inspection.
- **No Comment:** Some respondents provided no additional comments.

Gemini for Workspace can make mistakes, including about people, so double-check it. [Learn more](#)

Retry Copy

Figure 4.21: Post-Survey Question Number 8

# CHAPTER 5

## CONCLUSION AND RECOMMENDATION

### 5.1 ACHIEVEMENT OF AIM & OBJECTIVES OF THE RESEARCH

#### 5.1.1 General Achievement of the Product

The Line Maintenance Simulator Using Roblox has successfully achieved its main objective of creating an interactive and educational platform that enhances students' understanding of aircraft line maintenance procedures. Through the integration of four key maintenance tasks which are tyre removal and installation, functional testing, refueling, and walk-around inspection. The simulator effectively combines theoretical knowledge with practical application in a safe and engaging virtual environment.

The use of Roblox as a development platform has proven to be effective, providing accessibility, interactive learning, and opportunities for teamwork among players. The project has shown that game-based learning can be a powerful tool for aviation education by encouraging self-paced exploration, problem-solving, and hands-on learning without the need for costly or risky real-world practice. Overall, this simulator successfully bridges the gap between classroom theory and practical experience, offering an innovative, affordable, and enjoyable approach to learning aircraft line maintenance.

#### 5.1.2 Specific Achievements of Project Objectives

##### 5.1.2.1 Game Structure

The Line Maintenance Simulator Using Roblox has been successfully structured to provide an organized and realistic learning environment that reflects actual aircraft line maintenance operations. The game features essential areas such as hangars, ramps, and service zones where players perform tasks like tyre removal and installation, functional testing, refueling, and walk-around inspection. Each task is arranged in a logical sequence to simulate real maintenance workflows, allowing students to understand proper

procedures and safety practices. The structured layout encourages exploration, interaction, and task completion, creating an effective framework that enhances both individual and group learning experiences in a virtual aviation setting.

#### **5.1.2.2 Game Mechanism**

The Line Maintenance Simulator Using Roblox applies interactive game mechanisms that make learning engaging and realistic. Each maintenance task which are tyre removal and installation, functional testing, refueling, and walk-around inspection is supported by clickable components and simple scripts that simulate real maintenance actions. Players receive instant visual feedback and guidance, helping them understand proper procedures and safety steps. These interactive elements, combined with animations and sound effects, create an immersive experience that encourages active participation and improves students' understanding of aircraft line maintenance.

#### **5.1.2.3 Interface Layout**

The Line Maintenance Simulator Using Roblox features a simple and user-friendly interface layout that allows players to easily navigate and perform maintenance tasks. At the beginning of the game, the player spawns inside an office where they can choose from three different platforms to carry out the line maintenance tasks. This starting area serves as the main hub, providing clear options and instructions before entering each task environment. The interface includes organized menus, icons, and guidance that help players perform activities such as tyre removal, functional testing, refueling, and walk-around inspection with ease. Interactive buttons and labeled tools make it simple to access the required components, while clear visuals and a clean layout ensure smooth gameplay on various devices. Overall, the interface layout is designed to be intuitive, informative, and efficient, enhancing the overall learning experience by allowing players to focus on completing maintenance tasks in a structured and engaging way.

## **5.2 CONTRIBUTION OR IMPACT OF THE PROJECT**

The Roblox project “Line Maintenance Simulator Using Roblox” shows strong potential in entertainment, education, and community building. As an interactive learning platform, it gives users an engaging introduction to the world of aviation. Players can explore different types of line maintenance tasks done on an aircraft. It can also spark interest in further studies or careers in aviation and aerospace fields. By using gamification, the project turns studying aircraft components into an enjoyable and memorable experience, increasing motivation and learning retention. Ultimately, this game has the power to inspire a new generation of aviation enthusiasts, future pilots, and young aircraft engineers.

## **5.3 IMPROVEMENT AND SUGGESTIONS FOR FUTURE RESEARCH**

### **5.3.1 Game Structure**

For future improvement, the game structure of the Line Maintenance Simulator Using Roblox can be enhanced by expanding the map to include additional areas such as hangars, parking bays, and tool storage rooms to create a more realistic environment. More maintenance tasks, like brake inspections or light replacements, could be added to increase variety and learning depth. A level-based or progression system could also motivate players to complete tasks step-by-step while unlocking new challenges. Adding realistic weather effects and time cycles would further improve immersion, making the simulator more engaging and reflective of real aircraft line maintenance operations.

### **5.3.2 Game Mechanism**

The game mechanism of the Line Maintenance Simulator Using Roblox can be improved by introducing more interactive and dynamic features to enhance player engagement and learning outcomes. Future versions could include a scoring or performance evaluation system to assess how accurately and efficiently players complete each maintenance task. Adding more detailed animations and tool interactions would also make the simulation feel more realistic and immersive. To improve the learning aspect, a built-in tutorial or guidance system could be developed to assist new players in understanding the correct maintenance procedures. Additionally, incorporating multiplayer functionality or cooperative tasks would

allow players to work together, reflecting the teamwork commonly practiced in real aviation maintenance operations. These improvements would strengthen the educational value of the simulator and create a more engaging and authentic gameplay experience.

### **5.3.3 Interface Layout**

The interface layout of the Line Maintenance Simulator Using Roblox can be improved by enhancing clarity, usability, and visual presentation to create a smoother learning experience. Future updates could include a more detailed main menu with clearer navigation buttons and task selection options to help players easily access each maintenance activity. Adding visual indicators or pop-up instructions during gameplay would guide players more effectively through each procedure. The interface design could also be optimized for better compatibility across different devices, ensuring that users on mobile and PC have the same smooth experience. Furthermore, integrating progress tracking or achievement displays on the interface would motivate players to complete tasks and monitor their learning progress. These improvements would make the overall interface more intuitive, engaging, and supportive of effective learning within the simulator.

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## APPENDIX A: LIST OF TASKS SEGREGATION

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## APPENDIX B: SUMMARY OF SIMILARITY REPORT (TURNITIN)

# e-Thesis Line Maintenance Simulator.pdf

by Muhammad Syazani Bin Mohd Khabibullah

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**Submission date:** 28-Nov-2025 03:18PM (UTC+0800)  
**Submission ID:** 2829362115  
**File name:** e-Thesis\_Line\_Maintenance\_Simulator.pdf (3.47M)  
**Word count:** 11432  
**Character count:** 64124

## e-Thesis Line Maintenance Simulator.pdf

### ORIGINALITY REPORT

<b>12</b> %	<b>8</b> %	<b>4</b> %	<b>8</b> %
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

### PRIMARY SOURCES

<b>1</b>	<b>Submitted to Jabatan Pendidikan Politeknik Dan Kolej Komuniti</b> Student Paper	<b>4</b> %
<b>2</b>	<b>keygensetup.com</b> Internet Source	<b>1</b> %
<b>3</b>	<b>rfs-real-flight-simulator.en.softonic.com</b> Internet Source	<b>&lt;1</b> %
<b>4</b>	<b>Marianne Kjørstad, Gerrit Muller, Kristin Falk. "Co-Creative Problem Solving to Support Rapid Learning of Systems Knowledge Towards High-Tech Innovations: A Longitudinal Case Study", Systems, 2021</b> Publication	<b>&lt;1</b> %
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