POLITEKNIK BANTING SELANGOR

ALLI250 X – DIGITAL OPS

NAME	MATRIC NO.
TAN JENG	24DAM23F1017
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DEPARTMENT OF AIRCRAFT MAINTENANCE

SESSION I : 2025/2026

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

The Allison 250 is a turboshaft engine in service on a wide variety of light helicopters, with its reliable operation dependent upon stringent adherence to precise startup procedures. Traditional methods using static, page-bound manuals and classroom instruction do not offer the interactive engagement required to gain mastery of such complex sequences. It is this void in accessible, hands-on training media that comprises the core challenge of this Final Year Project. Current training methods are non-interactive, prone to human error, and lack realistic simulation. These findings were further validated through a pre-development survey of aviation students, where 53.5% identified paper-based checklists as "prone to human error," while 78.9% showed a strong preference for digital learning tools. In response, this project has designed and developed the ALLISON 250X Digital Learning Application using the Thunkable platform. The application is designed with a user-friendly interface that is segmented into Pre-Start, Start-Up, and Shutdown procedures. It also integrates instructional videos, interactive checklists, and visual guides into an immersive learning environment. A post-development evaluation returned outstanding results, where over 78% of respondents found the app easy to use, and 87% agreed that information and instructions are clear and easy to understand. This work, in other words, concludes that the ALLISON 250X application successfully modernizes aviation maintenance training by replacing error-prone paper-based methods with an engaging and effective digital platform. The positive user feedback confirms the usability and educational clarity of the app, hence confirming its role of enhancing procedural understanding and student confidence. This work contributes to the growth of digital aviation and wider objectives related to improving operational safety and standardizing training through technology-enhanced learning.

Keywords: ALLISON 250 Engine, Aviation Maintenance Training, Thunkable Development, Digital Learning Application, Mobile Learning

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LIST OF ABBREVIATIONS

NO	ABBREVIATION	MEANING
1	STEM	Science, Technology, Engineering, and Mathematics
2	FAA	Federal Aviation Administration
3	IATA	International Air Transport Association

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CHAPTER 1

INTRODUCTION

1.1 BACKGROUND OF STUDY

1.1.1 Allison 250 Engine

The Allison A250 engine is a small turboshaft engine that is widely used in light helicopters for both military and civilian applications. It is renowned for being reliable and small and is a very important component in the functionality of rotorcraft (Rolls-Royce, 2020). Nevertheless, the engine startup process is highly sensitive and has to be done in strict adherence. Every action—from checking the fuel level to engaging the starter—needs to occur in a precise order and under the appropriate conditions. Out-of-sequence execution of these actions can lead to damage to the engine, premature wear, or, at worst, safety risks (EASA, 2021). This makes training on the startup procedure not just necessary but critical to safe and effective operation. In spite of this significance, training on the Allison A250 engine today remains concentrated on static paper-based manuals and classroom-style learning with an instructor. Though a common practice followed for many years, this sort of learning methodology is largely unhelpful when it comes to novice trainees who cannot easily learn advanced technical details through static visuals and paper-based instructions by themselves. These formats are non-interactive and do not provide opportunities for repetition and reinforcement of practical steps in a hands-on manner. As a result, most trainees are unable to gain confidence or memorize the procedure, increasing the risk for operational errors, longer learning curves, and even field hazards.

Figure 1.1: Allison A250 Engine

Addressing these challenges, technology-enabled and interactive learning solutions are gaining prominence in aviation training. Mobile applications, simulations, and web tutorials have the potential to make training more accessible, engaging, and repeatable. A specialized training application for Allison A250 engine startup can offer step-by-step instruction with the help of visual aids, and instant feedback. This enables students to view all the steps of a process, correct errors in real-time, and practice exercises through proficient levels. It also gives flexibility to students to learn at any location and time, minimizing classroom time and costly physical equipment.

Lastly, the creation of an interactive learning app for the Allison A250 engine start procedure can greatly contribute to the improvement of the quality and consistency of the training. Not only is it a more secure and a more flexible environment for training, but it also helps to standardize the training experience across groups of users. Trainees will be better equipped, experienced technicians can more conveniently refer back over what they do know, and startup errors that cause maintenance to be done improperly can be drastically reduced. This strategy fits within the overall aviation performance and safety objectives, supplementing the industry's general shift towards digitalization and computerized training modules (FAA, 2023).

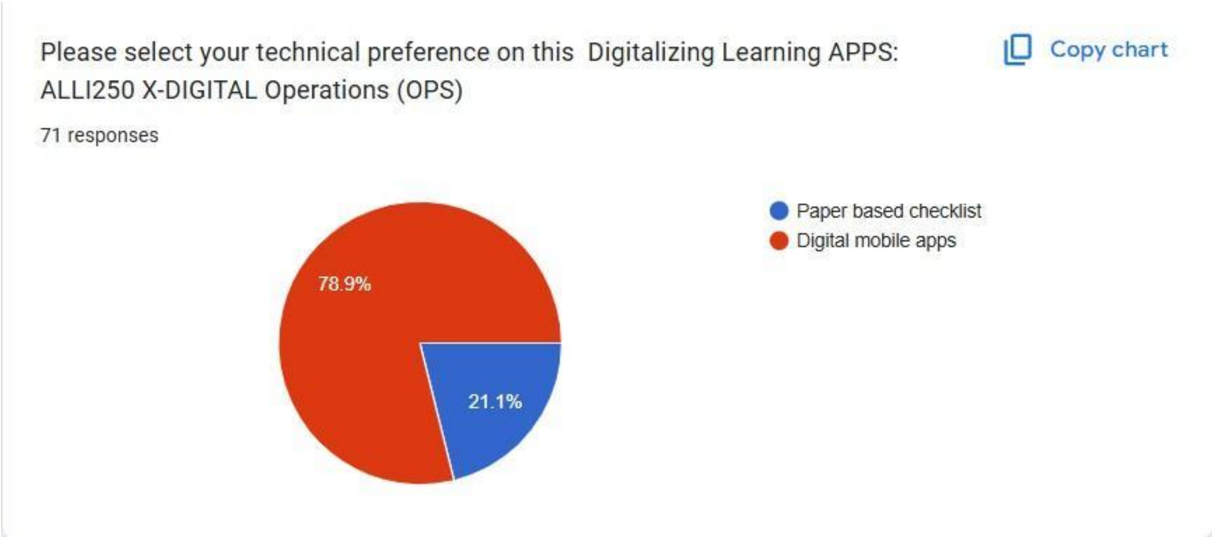


Figure 1.2: Survey Result – Preference For Digital Or Paper-Based Learning Method

To identify the students' preferred learning method in understanding the Allison 250 engine operation, a survey (FIGURE 1.1) among students was conducted. Results of the survey: 78.9% of students preferred digital mobile applications, while the remaining 21.1% still preferred paper checklists. This means that most students are more comfortable and interested in digital learning. In consideration of the above, this project aims at designing a digital learning app, ALLI250 X-DIGITAL Operations, which will further upgrade the existing traditional training and thus make learning more interactive, accessible, and effective for aviation students.

1.2 PROBLEM STATEMENT

The Allison A250 engine, a common powerplant for light helicopters, has a standardized and accurate startup procedure for ensuring flight safety and engine longevity. The procedure is a series of several technical steps that need to be executed in rigorous sequence and under certain conditions (Chen & Ohta, 2022). Any mistake in the process—whether in timing, switch action, or omission to monitor critical parameters—can result in engine failure, higher maintenance, and even flight safety risks.

Although this procedure is so critical, most trainees and even new technicians cannot comprehend and remember the proper startup process. Existing training processes depend mainly on paper-based manuals, PDF documents, or classroom sessions, which are too technical, boring, and detached from practical application. These techniques are not interactive, lack instant feedback and realistic simulation, which makes it difficult for students to comprehend the process fully or develop the confidence to carry it out safely (Gupta et al., 2021). Such a disconnect between theory and practice results in typical mistakes and retardation in acquiring skills.

Therefore, developing a digital learning application that simulates the Allison 250 engine operation will help bridge the gap between theory and practice, reduce human error, and enhance training effectiveness.

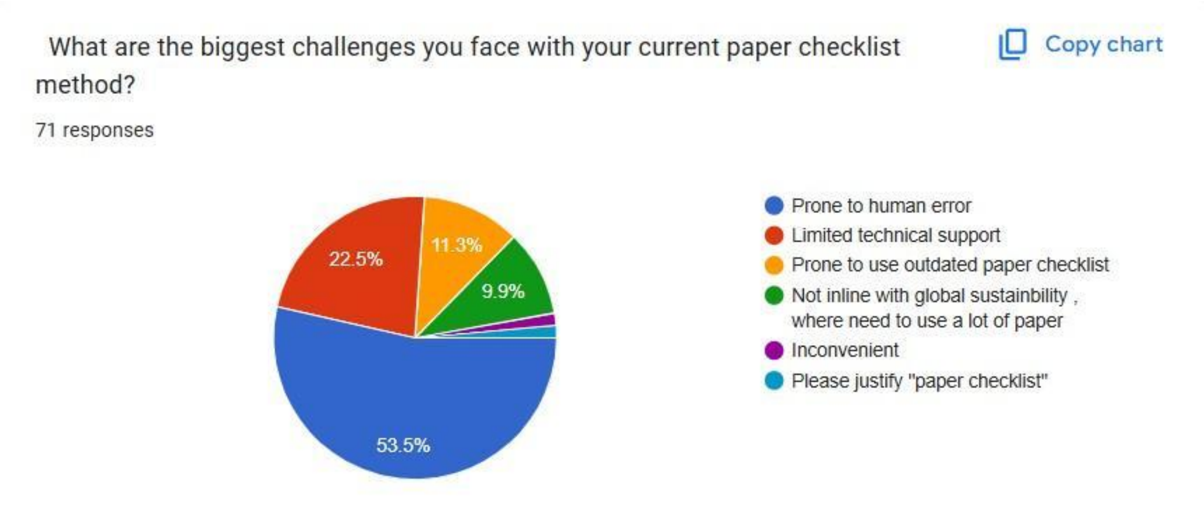


Figure 1.3: Survey On Challenges Faced With Current Paper Checklist Method

A survey was conducted (FIGURE 1.3) among students to find out the main problems in using paper-based checklists. Results indicated that 53.5% of the respondents stated “Prone to human error” as the most frequent problem, hence justifying developing an advanced digitalized learning app to reduce errors and improve learning effectiveness.

1.3 PROJECT OBJECTIVE

1.3.1 General Project Objective

The primary goal of this project is the creation of a digital learning application for the Allison 250 engine operation that will be subject to design, development, and evaluation. The whole idea behind this project is to develop an app that is not only interactive but also user-friendly, and to help aviation students and maintenance trainees in learning the proper step-by-step procedures of engine operation, which involve pre-start, start, and shutdown. During the design phase, the team concentrates on the development of a well-organized and interactive user interface that is conducive to learning. The application consisting of several major elements like step-wise instructional videos, interactive quizzes, and a section providing background information on the engine and its operation under the heading About. The design is based on simplicity, clarity, and engagement so that the users can easily go through the app and effectively absorb technical knowledge.

In the development phase, the entire team does its best to research different programming platforms and tools to find the most appropriate one for app creation. The members of the team work together with quite a close relationship in sharing tasks like software programming, content research, video editing, and the design of the user interface. This phase guarantees that the technical content, visual materials, and user experience are fused together perfectly to give birth to a functional and educational application. The app's functionalities get created with the most dependable software development tools that are ascertained through the research process, and the focus is on smooth performance and compatibility across devices. The evaluation phase will see the finished application being put through testing and collecting feedback from the intended users like students and teachers of aviation. The evaluation covers factors such as ease of use, functionality, visual attraction, and the learning process's improvement effectiveness. The app’s performance and learning impact would be enhanced by making the necessary improvements and refinements in light of the responses and test results.

1.3.2 SPECIFIC INDIVIDUAL PROJECT OBJECTIVES

1.3.2.1 Objective 1: Design Phase – Creating an Interactive Learning Interface

- User-Friendly Design: The app features a simple, intuitive interface with clear menus, color-coded buttons, and easy navigation to help all users learn effectively.
- Organized Learning Modules: Content is divided into dedicated sections (Pre-Start, Start-Up, Shutdown, Quiz, About), each focusing on a specific learning goal.
- Practical Video Support: Instructional videos for each engine stage connect theory with real-world practice, improving understanding and memory of procedures.
- Clear Visual Guides: The use of icons, color-coding, and a logical step-by-step flow makes the app accessible for both beginners and experienced trainees.

1.3.2.2 Objective 2: Development Phase – Building and Programming the Application

- Platform Selection: The team selected Thunkable for its drag-and-drop interface, Android compatibility, and multimedia features, which allowed for development without advanced programming skills.
- Core Feature Development: Key app functions were built, including video players, screen navigation, and an interactive quiz that provides instant feedback and tracks user scores.
- Testing and Troubleshooting: The development process involved fixing issues like score resets and layout alignment for different screen sizes to ensure consistent performance.
- Focus on Self-Learning: Features like the checklist and "About" sections were designed to support independent study and improve understanding of the Allison 250 engine system.

1.3.2.3 Objective 3: Evaluation Phase – Testing, Feedback, and Performance Improvement

- Comprehensive Testing: The app was evaluated through peer reviews, self-assessment, and supervisor testing to check its functionality, usability, and teaching effectiveness.
- Bug Identification & Fixes: Feedback helped identify and resolve technical issues such as unresponsive buttons, quiz errors, and slow video loading, which improved the app's stability and user experience.
- Effective Learning Tool: The evaluation confirmed the app successfully achieved its core learning objective: enhancing user understanding of the Allison 250 engine startup procedure.
- High User Engagement: Users reported that the app's interactive and visual components made the learning process more engaging and easier to understand compared to traditional PDFs and classroom notes.

1.4 SCOPE OF PROJECT

1.4.1 General Project Scopes

The project is especially designed for Aircraft Maintenance students and aviation enthusiasts who would want to learn the operations of the Allison 250 engine in a more modern and interactive way. Unlike any other manual or classroom lecture, this learning app offers an engaging medium that can be easily accessed via mobile devices. While it is targeted primarily for aviation learners, it's easy to navigate and can be used by anyone interested in learning about the operation of turbine engines.

Moreover, the Allison 250 Engine Learning App is designed to run on Android devices and can be used offline in places where access to the internet is limited, such as hangars or workshops. Key learning features of the app include step-by-step instructional videos, startup and shutdown simulations, a quiz section, and an "About" section for background knowledge. It gives learners the ability to see how real engines would work, test their knowledge, and gain confidence before actual practice.

Moreover, the app is designed to support asynchronous learning, where students can learn independently without requiring direct supervision or the need for a constant online connection. This flexibility makes it suitable for use under Part 145 MTOs as a supplementary learning tool that supports enhancements in both comprehension and procedural accuracy. Aviation students and enthusiasts alike will take away practical insights from this project into the Allison 250 engine operations in an efficient, safe, and accessible digital environment

1.4.2 SPECIFIC INDICVIDUAL SCOPE

1.4.2.1 Introduction Layout

The Allison 250 Engine Learning App creates a visually attractive introduction layout aimed at capturing the attention of its users right from the start. It incorporates a clean, modern design with uncluttered icons, soft background tones, and highly readable fonts to clearly present information in a professional manner. The introduction will have the title of the app, a short overview of what it is about, and clearly direct the user toward easy navigation to the main menu. This design tries to keep students and those interested in aviation motivated to continue using this app while maintaining professionalism, suitable for aviation learning environments.

1.4.2.2 Interface Layout

The interface design of this app is targeted at aircraft maintenance students and learners in aviation, who require information that is clearly and structurally presented. Pre-Start, Start-Up, Shutdown, Quiz, and About are the five sections supported by step-by-step visuals and short instructions based on the AMM. The interface is kept simple, hence accessible to users switching between different parts of the application without hassle. Optimized for both portrait mode and Android devices, this would not result in any inconvenience during the study sessions or the performance of engine operation simulations. The interface provides an interactive learning experience that mimics real-world procedures while maintaining safety and accuracy.

1.4.2.3 Storyboard

The storyboard of this application shows a clear, instructive flow that enhances user engagement in viewing and understanding. The user lands from the Main Menu into each learning module: Pre-Start, Start-Up, and Shutdown. Each of these contains step-by-step instructional videos, with descriptive visuals and short explanations. In developing the storyboard, simplicity and logical progression of elements were emphasized so that learners will find it easy to follow the sequence of how an engine operates. A Quiz section has also been included for users to test their understanding, while an About page includes background information about the Allison 250 engine. This clear and linear storyboard helps learners absorb information quickly and effectively.

1.4.2.4 Software Designation

This application is meant primarily for Android devices, supports offline mode, and thus could be utilized anywhere, independent of an internet connection. The development of this app is based on integrating media such as video, sound, and text in order to interactively present learning. It is designed not only for learning but also as a supplementary teaching tool that instructors can use to enhance classroom lessons or practical workshops. Accessible 24/7, the app ensures continuous learning opportunities for both aviation enthusiasts and maintenance students. The structure of the software promotes flexibility, reliability, and convenience in accordance with modern digital education standards in aviation training.

1.5 PROJECT IMPACT

The education app has much to offer education, industry, and society. At the educational level, the app facilitates public and student awareness of aviation systems with particular emphasis on airplane materials and start-up procedures of the Allison A250 engine. Through the presentation of technical data with interactive features, it enhances STEM education activities (National Science Foundation, 2022) and is an effective supplemental textbook for students learning aviation maintenance.

In readiness for industry, the app delivers practical value by introducing new hires and junior technicians to normalized procedures and key safety protocols. This minimizes onboarding time and prepares users for actual maintenance work. The design of the app partially follows aviation industry standards like FAA Part 147 modules (Federal Aviation Administration, 2023), connecting academic and professional practice.

The project brings innovation to technical education too. By incorporating gamified features, simulation-based modules, and interactive interfaces, the app transforms traditionally static learning into an experience (Davis et al., 2022). The app enables users to learn complicated engineering concepts, like material properties or assembly sequences, in a visual and interactive way.

From a user engagement point of view, the app increases accessibility to aviation training for both professionals and non-professionals. It supports anywhere, anytime learning through mobile and tablet devices, with rewards, daily tasks, and progress tracking features to motivate regular usage. This framework inculcates the practice of continuous learning and skill reinforcement outside the traditional classroom or workshop setting.

Furthermore, the app facilitates professional development through providing properly formatted modules that can be utilized for upskilling or revision. It can incorporate digital certificates or badges, which can be added to a user's professional development portfolio (Gibson & Carter, 2023). In the long run, it might assist in lifelong learning in a detail-rich, high- demand career like aircraft operation and maintenance.

Long term, the project has excellent scalability. The application's modular design makes it simple to introduce new subjects beyond the Allison A250 engine, for example, additional engines, hydraulic systems, or avionics. It also opens up possibilities for collaboration with aviation schools, museums, and training centers. By making technical information more accessible and enjoyable, the app assists in encouraging broader knowledge of aerospace engineering and general interest in aviation.

1.6 PURPOSE OF PRODUCT

The ALLISON 250X Digital Learning Application is designed to provide an interactive, mobile-based training tool that significantly enhances the comprehension and retention of start-up, operational, and shutdown procedures specific to the Allison 250 turbine engine.

This product modernizes aviation maintenance training by moving away from static, error-prone paper manuals to a dynamic learning environment that contains step-by-step guided checklists, instructional videos, and interactive diagrams. It is designed to bridge the gap between theoretical knowledge and practical application, increasing student competency, reducing human error, and supporting the aviation industry in the move toward digitalized and standardized training solutions.

CHAPTER 2

LITERATURE REVIEW

2.1 GENERAL LITERATURE REVIEW

2.1.1 Learning App In Aviation

As to the incorporation of mobile applications into aviation education, a substantial deployment has occurred during these advancements in digital technology and the realization that training is more effective, efficient, and accessible. Nothing beats conventional printed manuals or classroom instruction, nor can they ever, but both methods lack engagement and adaptability even in cases where they do well (Johnson et al., 2021).

Learning application features such as video demonstrations, simulations, quizzes, and interactive models offer visual, auditory, and kinesthetic learning; their affordances improve knowledge retention and understanding

According to IATA, mobile learning is about improvement in competence and efficiency particularly regarding engine operations, aircraft systems, and maintenance procedures. Examples of apps feature Boeing's Maintenance Training App and Flight Ready: these have worked to show how timing with a digital platform prevents human errors through step-by-step guides, brief video walkthroughs, and their real-time troubleshooting (Garcia & Lee, 2022).

Learning apps also provide just-in-time education to students and technicians offering them opportunities for on-site or on-demand clarity on procedures involved. Such apps can be hugely beneficial when dealing with more advanced systems like Allison 250 engine, where visual and interactive training improve the understanding of the subject tremendously compared to static documents (Kearney & Maheshwari, 2023).

2.1.2 Engine Allison 250: Types, Functions And Working Principles

The Allison 250 engine, is one of the most commonly used engines in the industry as a turboshaft engine. It is generally used in light helicopters, like the Bell 206. This family of engines consists of different engine variants such as the C18, C20, C30, C40, and C47. Some of these types differ from one another in power output and fuel-efficient models (Federal Aviation Administration, 2021). These engines are modular, lightweight, and extremely reliable as far as performance is concerned by both civil and military applications.

The main usage of the Allison 250 is converting fuel energy to mechanical energy to become rotor propulsion or propeller to aircraft. It provides drives for all the accessories, generators, and hydraulic pumps that support various other aircraft systems (Kroes et al., 2021).

The Allison 250 works on a continuous Brayton cycle, which consists of intake, compression, combustion, and exhaust. In the first module of an engine, intake is done for air, and it gets compressed by either an axial or centrifugal compressor. The compressed air is now mixed with fuel and burnt in the combustion chamber, resulting in the generation of gases at high temperatures and pressure. The high-temperature gases will expand in the turbine section, where energy is extracted to power the compressor as well as the output shaft. The output shaft then powers the rotor or propeller of the helicopter. The Allison 250 makes aircraft propulsion systems superlative and cheap in operation with less maintenance effort because of its efficiency and compact design.

Figure 2 1: Engine Allison 250 Engine 1

2.1.3 Current methodologies used to teach about engine Allison 250

In the field of aviation, the concept of teaching methods on Allison 250 engine includes a variety of components. It starts from the traditional classroom activities, printed manuals, and static diagrams to PowerPoint presentations. These methods deal with the theoretical side of engine components, operations, and maintenance procedures (Kearney & Maheshwari, 2023). Practical training is essential, where students conduct inspections and disassemblies of particular components under the supervision of an instructor.

In the advanced settings, modules of computer-based training (CBT) and maintenance simulators can be utilized to introduce the interactive approach to education. In this aspect, students can practice startup procedures and fault diagnosis (IATA, 2021). However, many educational institutions still apply non-interactive methods of teaching, which may not engage students and simulate real-life situations. Therefore, there is an increasing tendency to begin integrating other digital tools such as video demonstrations, virtual reality (VR), and mobile learning apps that provide immersive, accessible, and efficient ways of engine training, especially with complex systems like the Allison 250.

2.2 SPECIFIC LITERATURE REVIEW

2.2.1 Software / Programming

The application ALLISON 250X was developed on Thunkable, a no-code, cross-platform development tool. The reason this platform was chosen is due to its visual interface for programming using a drag-and-drop and block-based methodology. This eliminates the need to create complex code in traditional languages, such as Java, and instead opens efficient development to creators of more varied backgrounds. Thunkable's environment allowed for the rapid assembly of the app's core architecture, including its multiple screens for procedures like Pre-Start, Start-Up, and Shutdown.

The development process involved the creation of functional blocks for key feature management. This included logical programming to ensure smooth navigation through learning modules, the integration of a native video player that allowed streaming of instructional content, and construction of an interactive quiz system. The quiz was specifically coded to give users instant feedback and to track scores locally on the device. Secondly, considerable troubleshooting and refinement of the user interface were done to make sure the performance remained consistent on different Android screen sizes and that interactive elements, such as buttons and checklists, responded appropriately to user input, leading to a stable and user-friendly final product.

2.3 REVIEW OF RECENT RESEARCH / RELATED PRODUCT

2.3.1 Previous Study

Figure 2.2: X-Plane Mobile 1

X-Plane Mobile by Laminar Research presents a cutting-edge flight simulation for mobile devices on platforms like iOS and Android. The app replicates the aerodynamics of real-world flight, allowing the user to fly a variety of aircraft, from small general aviation planes to commercial airliners to military fighters. Each aircraft is rendered with detailed 3D cockpits and working instruments to allow users to operate any of the aircraft's systems ranging from engines to avionics to autopilots.

The app includes interactive engine start-up and shut-down capability for full flight control, navigation systems, and real-time environmental conditions (weather and time of day). Features such as worldwide scenery coverage and multiplayer accommodate an immersive and dynamic simulation environment for users. Not only is this useful for entertainment, but it serves as a training aid for aviation students and prospective pilots wanting to get familiar with the dynamics of aircraft operations.

X-Plane Mobile has a free version with limited aircraft and features; unlocking more sophisticated airplanes, airports, and capabilities requires in-app purchases or a subscription on the monthly basis.

2.3.2 Table: Comparison Between Previous And Current Study

Table 2.1: Comparison Between Previous and Current Study

Criteria	X-Plane Mobile (Previous Study)	Learning App on Allison 250 Engine Operations (Current Study)
Purpose	Flight simulation with emphasis on realistic flying experience.	Educational tool focused on step-by-step engine start-up and shut-down procedures.
Platform	Mobile devices (iOS and Android); performance depends on device capabilities.	Mobile; optimized for ease of use in aviation training settings.
Interactivity	High – users control cockpit instruments, but learning is self-directed.	High – guided steps with interactive elements tailored for learning.
Cost Efficiency	Freemium model; advanced features require in-app purchases or subscriptions.	Cost-effective; designed for accessible training with minimal to no ongoing cost.

2.4 CYBER SAFETY CONSIDERATIONS

Learning App for Allison 250 engine operation has all measures for cyber safety. It ensures user security as well as integrity and privacy of data. The application is an offline application and does not use a cloud service; however, it is secured by secure programming practices to prevent vulnerabilities (OWASP, 2021). The device-level security features the app has ensure that learning progress, quiz results, and user activity are safely stored only inside the device of the user. Encryption protocols are being invoked in local data storage to protect against unauthorized access or modification.

The app is designed to collect minimal personal information; consequently, a limit is set to what operational data might be needed. It eliminates exposure to any potential cyber threats. Very little login detail is required, and there is no requirement to be online, thereby reducing the chances of phishing, hacking, or data breach altogether (Cloud Security Alliance, 2022). One of the app's lifecycle managements will also include appropriate internal updates and regular security checks to timely manage emergent vulnerabilities. It also encourages device owners to maintain device security by conducting software updates and using good antivirus programs. Public unsecured networks should also be avoided.

2.5 ENVIRONMENTAL IMPACT

The Learning App on Allison 250 Engine Operations promotes minimum environmental impact availing traditional learning methods thoroughly dependent on printed manuals and frequent physical engine operations to an entirely digital, offline platform. By offering step-by-step training of engine operations through a mobile application, it would drastically reduce paper resources from deforestation and waste. And because the application does not require a real engine startup for learning practice, it consumes less fuel and emissions, thus saving more in sustainable aviation education practices. Students can train efficiently on personal devices, avoiding further traveling to centralized training facilities, lowering even more the carbon footprint.

The application is developed to be weightless so that it is in such efficient comfort without stressing much the hardware available on devices or energy consumed. Since it runs without the cloud services, then everything is "local" to the device; thus, this saves energy by eliminating the continuous internet data movement and server-side resource usage. The project promotes sustainable learning in a reusable long-term training tool to decrease the environmental impact that aviation-styled training programs usually have on the environment. The careful designing and responsible building of the software ensure eco-friendly learning along with high quality in the levels of education delivered scholars.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 PROJECT BRIEFING & RISK ASSESSMENT

This chapter presents the methodology of research, project briefing, and risk assessment in developing the ALLI250 X-DIGITAL OPERATIONS learning application. The key aim of the project is to design and develop an interactive digital learning platform that focuses on the Allison 250 engine operation, including pre-start, start-up, and shutdown procedures. The research phase started with identifying the existing problem in the present paper-based training and analyzed user feedback through surveys. Based on the findings, we designed a structured plan of action that encompasses concept design, app layout, content development, and testing phases to ensure smooth performance and user engagement.

Risk assessment played an important role throughout the project for ensuring safety, efficiency, and quality. Every member in our team has been assigned particular responsibilities to avoid overlaps and ensure progress is steady. Any risk of losing any data, malfunction of the software, or any error in the design was minimized by proper backup and periodic review of progress with our supervisor. Though it is a software-based project, good teamwork and planning were maintained with concern for safety so that the app may be developed efficiently to achieve the objectives and work as a reliable tool for aviation learning and training purposes.

3.1.1 Pareto Diagram

Table 3.1: Pareto Data Extracted from Survey Response

Pareto Diagram: ALLI250 X-DIGITAL Operations			
Features	**Frequency**	**Cummulative Percentage**	**Pareto Baseline**
Prone to human	38	54%	80%
Limited technical	16	76%	80%
Prone to use out	8	87%	80%
Not inline with global sustainbility , where need to use a lot of paper	7	97%	80%
Inconvenient	1	99%	80%
Please justify "pa	1	100%	80%
GRAND TOTAL	71		

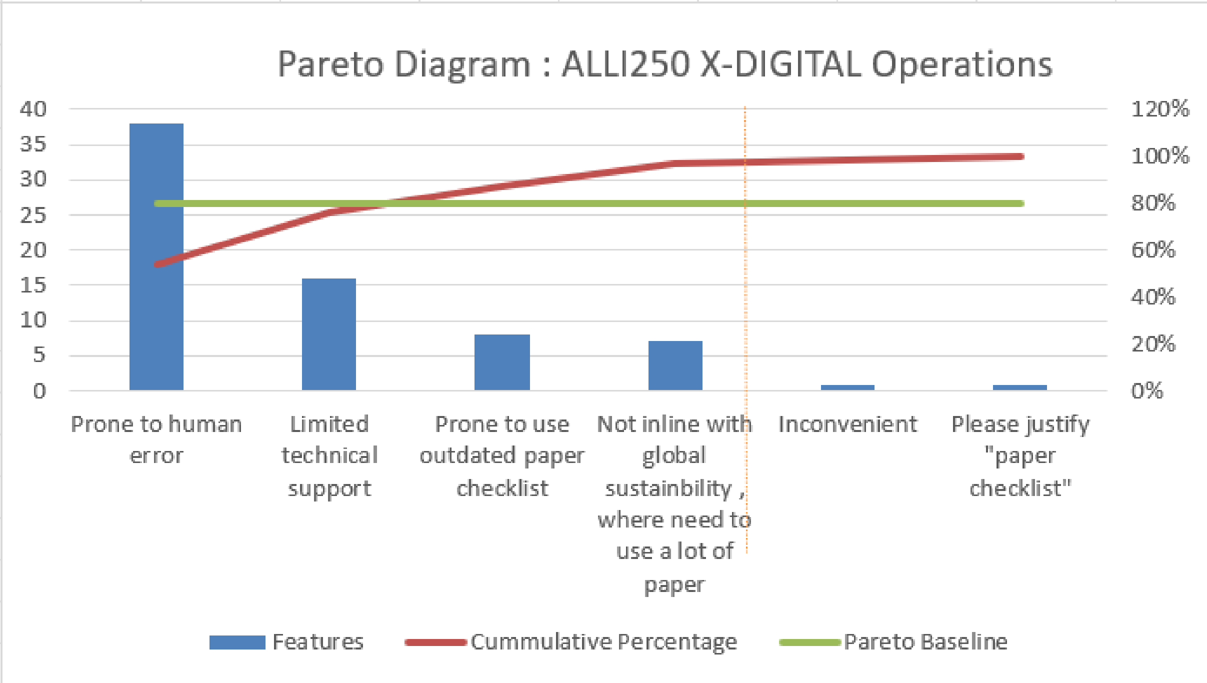


Figure 3.1: Pareto Diagram of ALLI250 X-DIGITAL Operations

3.2 DESIGN ENGINEERING TOOL

3.2.1 Design Concept Generation

3.2.1.1 Function Tree

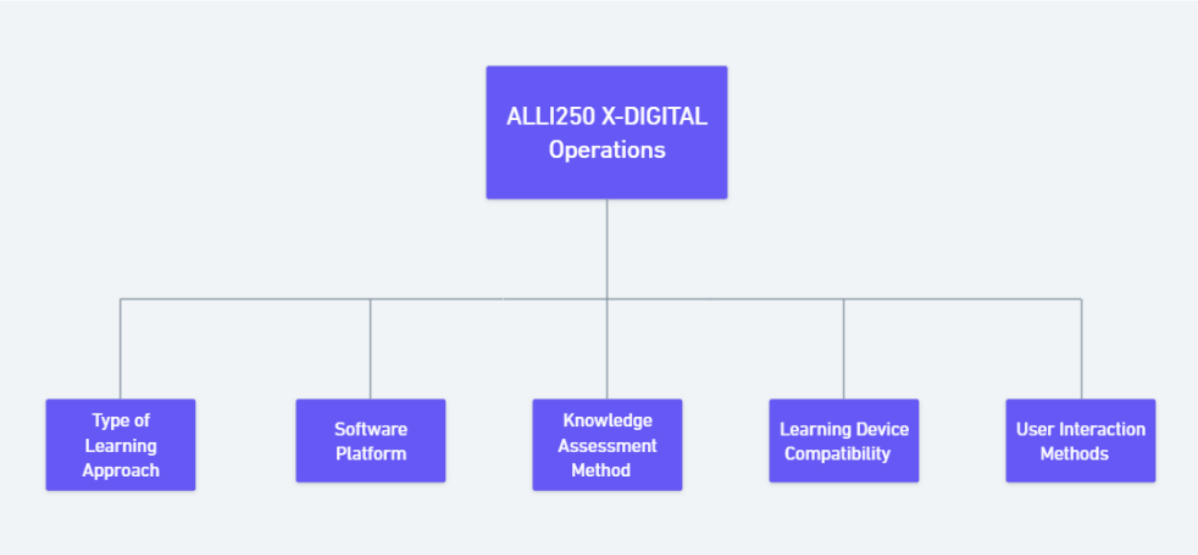
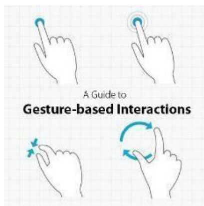


Figure 3.2: Design Concept Idea

3.2.1.2 Morphological Matrix

Table 3.2 : Morphological Matrix

FUNCTION	IDEA 1	IDEA 2	IDEA 3
Type of Learning Approach	Interactive 3D model 	Video demonstrations 	Simulation based Training 
Software Platform	Zoho Creator	Thunkable	OutSystems
Learning Device Compatibility	PC/ Laptop 	Tablet 	Smartphone 
User Interaction Methods	Touchscreen  	Keyboard input 	Gesture Control 
Knowledge Assessment Method	Written Exams	In-App Quiz with Feedback	Procedural Checklist Scoring

3.2.1.3 Proposed Design Concept 1

Table 3.3: Proposed Design Concept 1

Function	Idea 1	Justification
Type of Learning Approach	Interactive 3D model	By an interactive 3D model, learning becomes experiential and immersive, with users able to explore, rehearse procedures, and debug the operations of the Allison 250 engine in a real-life situation-free environment. The model aids in spatial understanding, enables AR and VR integration, and provides better retention and accuracy in performing the said operations.
Software Platform	Zoho Creator	Zoho Creator is a low-code platform that is able to be developed rapidly with the help of the training application, moreover, one does not need extensive programming skills. This feature makes it efficient and economical. It has built-in tools for database management that allow easy storage and retrieval of learning materials, user progress tracking, and cloud-based access for remote learning.
Learning Device Compatibility	PC / Laptop	The computers or laptops can be put to rather productive use by giving an enhanced performance and precision as well as

		multitasking and providing very intricate 3D interaction for checklist navigation and formal training sessions for aviation students.
User Interaction Methods	Touchscreen	The Allison 250 Checklist by touch screen is increased in interactivity and intuitiveness: users can tap, swipe, and drag for the stepwise operations, the three-dimensional exploration, and instant feedback, which contributes to improved learning effectiveness and realism.
Knowledge Assessment Method	Written Exams	This traditional method provides a formal, standardized way to assess theoretical knowledge across all students. It ensures a comprehensive evaluation of a student's understanding of the Allison 250 engine's technical specifications and procedures as outlined in official documentation like the AMM.

3.2.1.4 Proposed Design Concept 2

Table 3.4 : Proposed Design Concept 2

Function	Idea 2	Justification
Type of Learning Approach	Video demonstrations	Step-by-step visual instructions of video lessons are simplified procedures that are usually difficult, for example, Allison 250 engine operation. As a consequence of the observation of real-world examples, students are able to keep and remember the notions they are dealing with better.

Software Platform	Thunkable	Thunkable offers you an entirely no-code, cross-platform platform to quickly develop an elegant and user-friendly checklist application for the Allison 250. You have to drag, drop, move your finger while supporting media and real-time updates; the entire process is very smooth for you to learn. You create applications very quickly and deploy them on Android so that many people can use them.
earning Device Compatibility	Tablet	The tablets are light in weight and easily portable, thereby enabling learners to access their learning materials anywhere, at any time, and without any bulky setup. In contrast, tablets are more intuitive devices and therefore cheaper than PCs or laptops. They are the best learning option as they turn trainees from a not-very-efficient state into a brilliant working machine, at the same time.
User Interaction Methods	Keyboard input	Keyboard input supports the fast and accurate entry of data whereby users can quickly input commands, notes, and responses, without relying on touch or voice prompt. It can be used with home or office PCs, laptops, or tablets, with detachable keyboards, thereby representing versatile input mechanisms across a variety of leaning contexts.
Knowledge Assessment Method	In-App Quiz with Feedback	This method offers immediate, interactive evaluation. It enhances learning by allowing users to instantly identify knowledge gaps, reinforcing correct information and correcting misunderstandings on the spot, which is crucial

		for building a solid foundational knowledge of engine operations in a self-paced environment.

3.2.1.5 Proposed Design Concept 3

Table 3.5: Proposed Design Concept 3

Function	Idea 3	Justification
Type of Learning Approach	Simulation based Training	Learning process while playing the game
Software Platform	OutSystems	fast development, works perfectly on tablets and smartphones, and comes with maintenance tools integrated to monitor in real time. Robust security, a simple user interface, and offline support ensure it is reliable in any environment and enhance aircraft maintenance efficiency and effectiveness.
Learning Device Compatibility	Smartphone	Smartphones are an ideal learning app device as they are convenient, accessible, and user-friendly. Smartphones can support interactive learning approaches like augmented reality (AR), 3D models, video lectures, and live quizzes. Smartphones possess robust processors, high-definition screens, and touch-sensitive screens, allowing for a smooth and interactive learning experience. Smartphones support various learning apps, cloud storage, and web-based resources, allowing learning

		anywhere at any time. They also come with gesture-controlled interaction, voice command, and integration of AI, making them very versatile for use in aircraft maintenance training and technical education.
User Interaction Methods	Gesture Control	Gesture control offers an intuitive, natural, and immersive experience for aircraft maintenance training, with more interaction with 3D models, simulations, and AR environments. Users can zoom, rotate, and manipulate engine components without using their hands, allowing for more hands-on learning. This is especially useful in maintenance hangars, where touchscreens are impractical.
Knowledge Assessment Method	Procedural Checklist Scoring	This approach directly assesses practical competency by evaluating the user's ability to execute the correct steps of a procedure in the proper sequence. It simulates real-world maintenance tasks, training users to follow protocols accurately and minimizing the risk of human error in practice.

3.2.1.6 Proposed Final Concept

Table 3.6 : Proposed Final Concept

Function	FINAL CONCEPT	Justification
Type of Learning Approach	Video demonstrations	Step-by-step visual instructions of video lessons are simplified procedures that are usually difficult, for example, Allison 250 engine operation. As a consequence of the observation of real-world examples, students are able to keep and remember the notions they are dealing with better.
Software Platform	Thunkable	Thunkable offers you an entirely no-code, cross-platform platform to quickly develop an elegant and user-friendly checklist application for the Allison 250. You have to drag, drop, move your finger while supporting media and real-time updates; the entire process is very smooth for you to learn. You create applications very quickly and deploy them on Android so that many people can use them.
Learning Device Compatibility	Smartphone	Smartphones are an ideal learning app device as they are convenient, accessible, and user-friendly. Smartphones can support interactive learning approaches like augmented reality (AR), 3D models, video lectures, and live quizzes. Smartphones possess robust processors, high-definition screens, and touch-sensitive screens, allowing for a smooth and interactive learning experience. Smartphones support various learning apps, cloud storage,

		and web-based resources, allowing learning anywhere at any time.
User Interaction Methods	Touchscreen	The Allison 250 Checklist by touch screen is increased in interactivity and intuitiveness: users can tap, swipe, and drag for the stepwise operations, the three-dimensional exploration, and instant feedback, which contributes to improved learning effectiveness and realism.
Knowledge Assessment Method	In-App Quiz with Feedback	This method offers immediate, interactive evaluation. It enhances learning by allowing users to instantly identify knowledge gaps, reinforcing correct information and correcting misunderstandings on the spot, which is crucial for building a solid foundational knowledge of engine operations in a self-paced environment.

3.2.2 Evaluation & Selection Of Conceptual Design

3.2.2.1 Pugh Matrix

3.2.2.1.1 Pugh Matrix : Concept 1 As A DATUM

Table 3.7 : Pugh Matrix : Concept 1 As A Datum

Criteria	Idea 1	Idea 2	Idea 3
Type of Learning Approach	D	2	3
Software Platform	A	2	3
Learning Device Compatibility	T	2	3
User Interaction Methods	U	1	3

Knowledge Assessment Method	M	3	1
Total		10	13

3.2.2.1.2 Pugh Matrix : Concept 2 As A DATUM

Table 3.8 : Pugh Matrix : Concept 2 As A Datum

Criteria	Idea 1	Idea 2	Idea 3
Type of Learning Approach	3	D	3
Software Platform	1	A	1
Learning Device Compatibility	2	T	3
User Interaction Methods	3	U	3
Knowledge Assessment Method	1	M	1
Total	10		11

3.2.2.1.3 Pugh Matrix : Concept 3 As A DATUM

Table 3.9 : Pugh Matrix : Concept 3 As A Datum

Criteria	Idea 1	Idea 2	Idea 3
Type of Learning Approach	1	1	D
Software Platform	1	3	A
Learning Device Compatibility	1	1	T
User Interaction Methods	3	1	U
Knowledge Assessment Method	3	2	M
Total	9	8	

3.2.2.1.4 Pugh Matrix : Learning App As DATUM

Table 3.10 : Pugh Matrix : Concept 4 As A Datum

Criteria	Idea 1	Idea 2	Idea 3	LEARNING APP
Type of Learning Approach	1	3	2	D
Software Platform	2	3	1	A
Learning Device Compatibility	2	1	3	T
User Interaction Methods	3	1	2	U
Knowledge Assessment Method	1	3	2	M
Total	9	11	10	

3.2.3 General Product Sketching

3.2.3.1 Allison 250 Engine App Coding page :

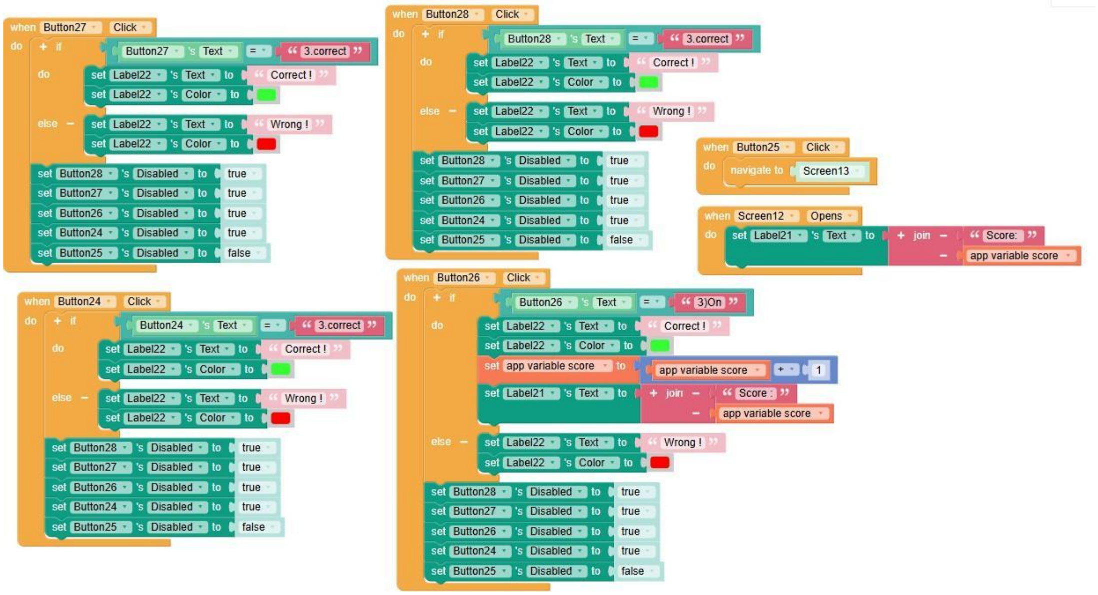


Figure 3.3: Coding Page 1

This block of code manages the logic for an interactive quiz within the Thunkable platform. The yellow "When Button Clicked" blocks serve as the triggers that activate when a user selects an answer. Inside these blocks, conditional "if-then" statements check whether the selected answer is correct or incorrect. Based on this check, the code provides immediate feedback to the user (e.g., displaying "Correct" or "Wrong!") and controls the navigation by disabling the current set of answer buttons and enabling the next set for the following question. This structure creates a sequenced, interactive flow that guides users through the assessment step-by-step.

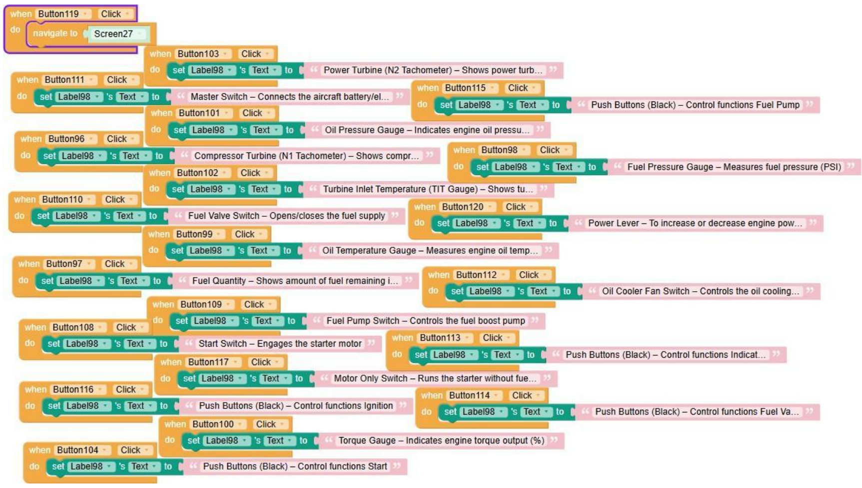


Figure 3.4: Coding Page 2

This block of code creates an interactive component identification system for the Allison 250 engine. Each block, triggered by a "When Button Clicked" event, corresponds to a specific button on a diagram of the control panel. When a user taps a button, the code updates a central information label (Label98) to display the name and function of the selected component, such as the "Power Turbine (N2 Tachometer)" or "Master Switch." This allows users to explore and learn about different engine parts freely, with the display resetting for each new selection to ensure clear and focused information presentation. This feature provides an engaging, self- directed way for students to familiarize themselves with the engine's instrumentation.

3.2.3.2 Allison 250 Engine App Loading Page :

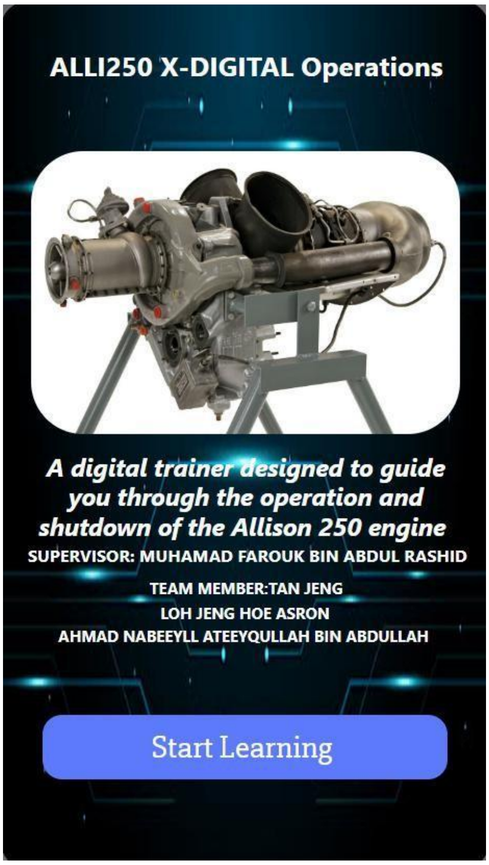


Figure 3.5: Alli250 Loading Page 1

3.3 INTERFACE LAYOUT

3.3.1 General Product Interface Layout

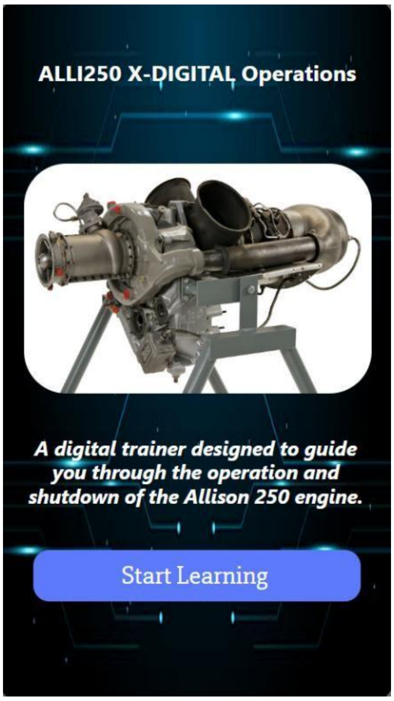


Figure 3.6: First Page Layout Of Alli250 X-Digital Operations App

The first page displays the app title with a single Start button at the center of the screen. It serves as a simple and welcoming entry point for users to begin navigating the app.

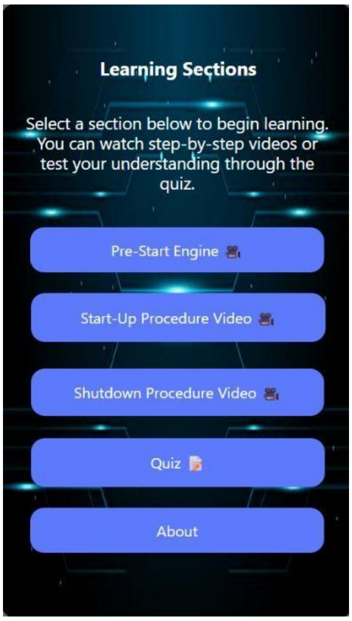


Figure 3.7: Main Menu Interface Layout

After pressing the Start button, the user is directed to the Menu Page, which contains five main buttons — Pre-Start Check, Start-Up, Shutdown, Quiz, and About. This page acts as the main navigation hub

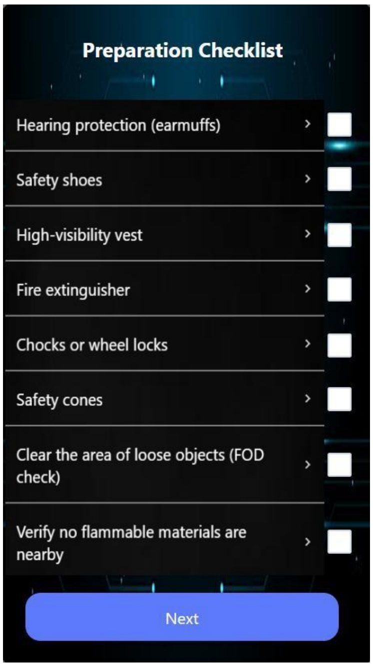


Figure 3.8: Pre-Start Checklist Page Layout

When the Pre-Start Check button is selected, a checklist page appears showing all necessary items and procedures to inspect before starting the engine. This page helps users understand and follow proper pre-start safety procedures.

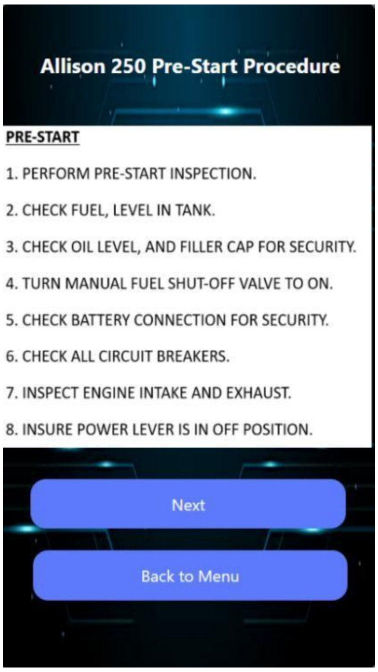


Figure 3.9: Amm Instruction Page Layout

After completing the checklist, the Next button brings the user to the AMM Instruction Page. Here, detailed step-by-step procedures from the Aircraft Maintenance Manual (AMM) are displayed for clear guidance — this same AMM instruction layout is also used in both the Start-Up and Shutdown sections to ensure procedural consistency.

Figure 3.10: Video Instruction Page Layout

Once the AMM instructions are reviewed, the user proceeds to the Video Page showing demonstrations of the engine operation process. Similar video pages are included in the Start-Up and Shutdown sections, allowing learners to visually understand each procedure before performing it in real-life situations

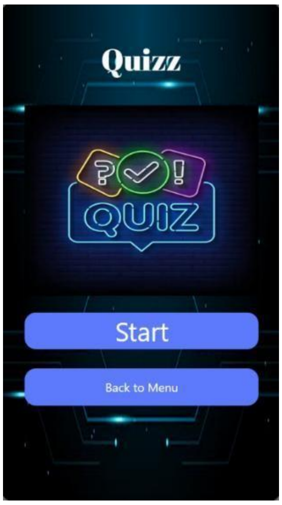


Figure 3.11: Quiz Page Layout

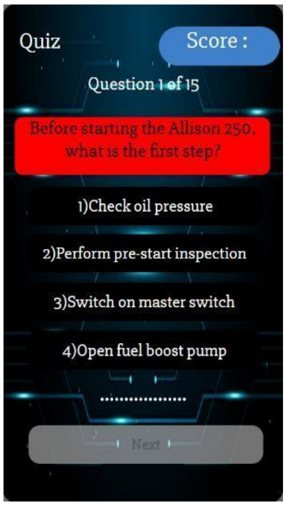


Figure 3.12: Quiz Page Layout

Quiz Page lets users test their knowledge after completing the learning modules. It features multiple-choice questions with instant feedback to evaluate understanding and retention.

Figure 3.13: About Page

Figure 3.14: About Page With Engine Diagram View

The About Page provides background information about the app, its purpose, and development. It also includes an engine diagram view to help users explore and identify key components of the Allison 250 engine.

3.4: DEVELOPMENT OF PRODUCT

3.4.1 : Material Acquisition

THUNKABLE

Figure 3.15: Example Of Software/Programming

Thunkable was the primary software used for the development of this project. This is a block-based, drag-and-drop app development platform for developing an application on Android without expertise in programming languages. It supports an intuitive approach to design layouts, integrate multimedia elements, and embed interactive features such as quizzes and instruction videos associated with the Allison 250 engine operation.

Thunkable allowed the programming of functions like button navigation, color changes, video playback, and data storage in the app by building visual logic blocks. That kept the process of coding really simple and freed the team to focus on the user experience and how content would be presented. Real-time testing allowed for changes to be tested and fixed as necessary on this platform. Thunkable supported the team in designing a professional, easy-to-use, and efficient educational app for the aviation learning environment on Android users.

3.4.2 Devices

3.4.2.1 Personal Computer / Laptop

Development of the learning application primarily starts on a personal computer or laptop, acting as the focal point of designing, programming, and integrating multimedia components into the app. A laptop is used to efficiently develop the application using Thunkable, an online application maker that makes it easier to develop an Android-compatible learning application through drag-and-drop programming.

The laptop offers a greater screen size with varied editing tools and better options to work on the design layout of the interface, link different pages, and arrange the positioning of multimedia content such as tutorial videos, AMM instruction slides, and quiz modules. One can easily position each separate object-button, sequence of navigation, or background image-to assure that the design is user-friendly and educationally effective. The testing of this design for bugs and debugging processes is also supported on the computer before actual testing. Besides these general designing steps, research and content development, such as collecting reference materials from the Aircraft Maintenance Manual-AMM and preparing educational videos, will be done on the laptop for greater accuracy.

3.4.2.2 Smartphone / Tablet

Following the initial design and testing on the laptop, the application is transferred to smartphones for further assessment and performance tests. This will ensure that the app's interface, navigation, and interactive elements such as videos, quizzes, and checklist pages work properly and smoothly on touch-screen devices. Since the development target for this application is for Android users, smartphones and tablets are ideal for testing offline accessibility features that assure the users can access learning materials without an internet connection.

Testing on these devices allows the team to assess visual clarity, responsiveness, and layout adaptability across different screen dimensions. It also verifies that aviation enthusiasts and aircraft maintenance students can operate the app conveniently during training sessions, even in workshops or hangar environments where connectivity may be limited. Overall, this dual-platform development approach ensures the final product is stable, accessible, and optimized for practical aviation learning experiences.

3.5 PROJECT FLOW CHART

3.5.1 Overall Project Flow Chart

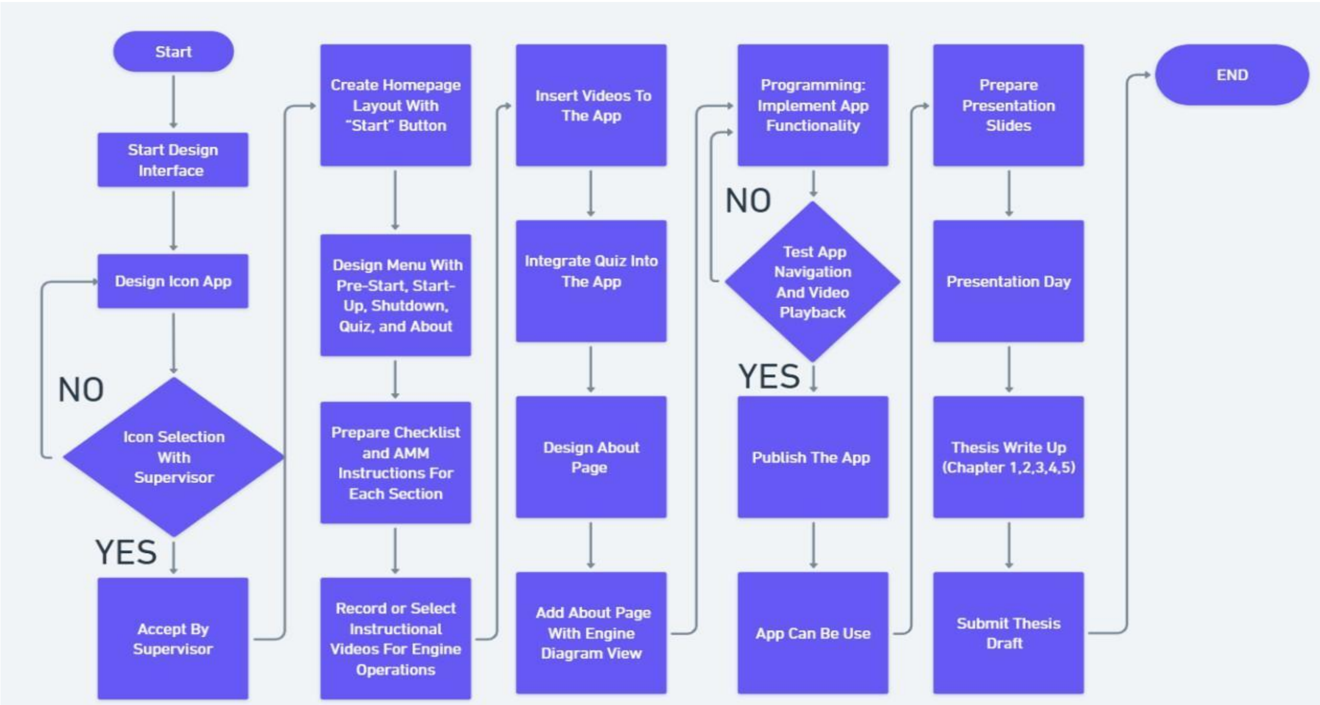


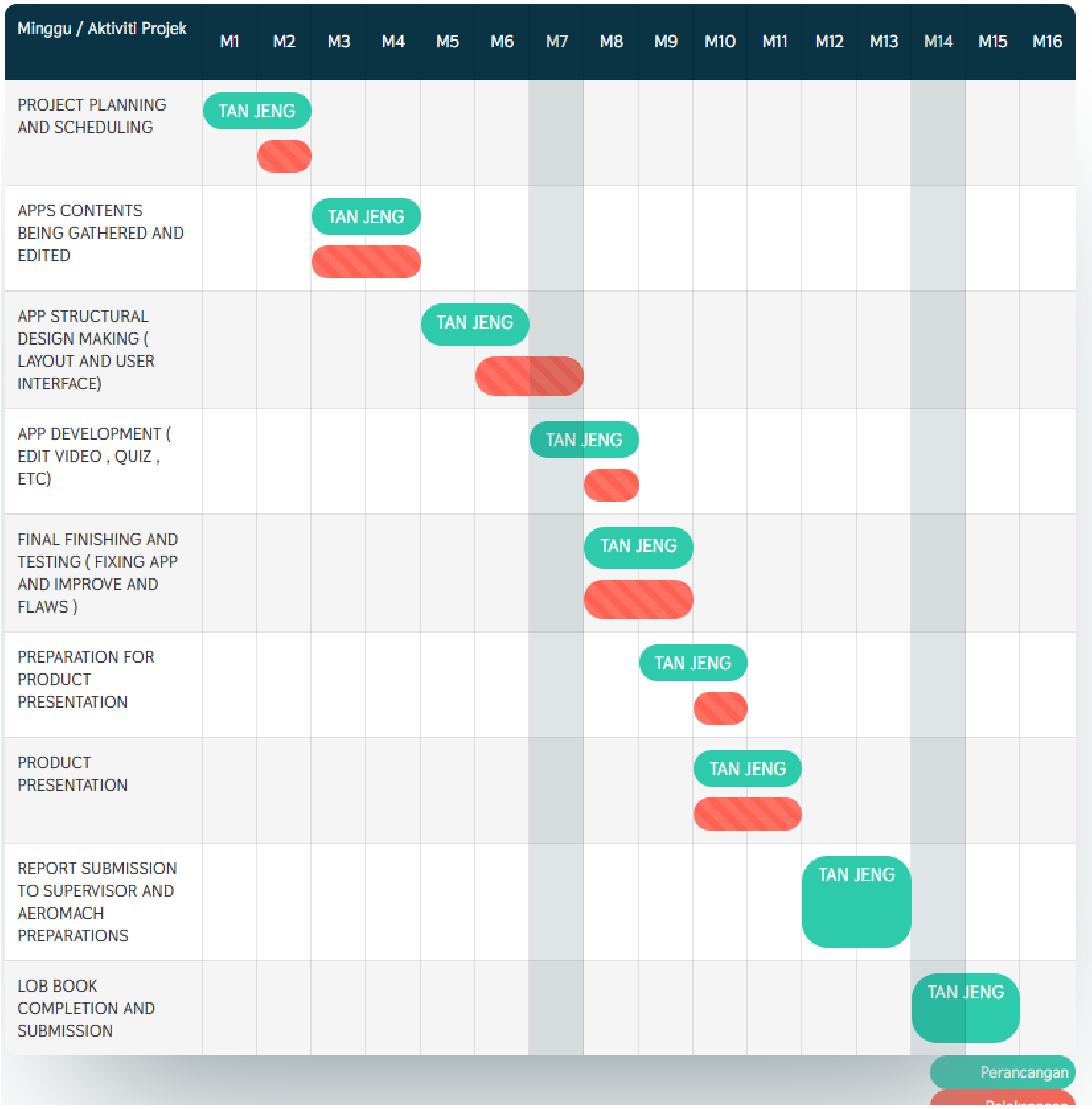
Figure 3.16 : Project Flow Char

3.6 LIST OF MATERIALS & EXPENDITURES

The estimated cost for this FYP reached up to a total of RM250, needed just for a subscription to Thunkable. This subscription was required to fully enable the creation and testing of the ALLI250 X-DIGITAL Operations App. Other aspects of creating this project were completely free. Data collection was done from the information and content compiled from school sources like the Aircraft Maintenance Manuals (AMM), laboratory manuals, and academic references found at the institution. Filming and documentation were also done within the school using its equipment and facilities; thus, no extra costs had to be incurred outside it. The proper use of institutional resources and free online tools allowed the group to come up with an efficient app at low costs. Consequently, this is an act of proper planning, resource utilization, and dedication toward attaining the project objectives without incurring unnecessary costs.

3.7 OVERALL PROJECT GANTT CHART

Table 3.11 : Overall Project Gantt Chart



3.8 PRODUCT TESTING / FUNCTIONALITY TESTS

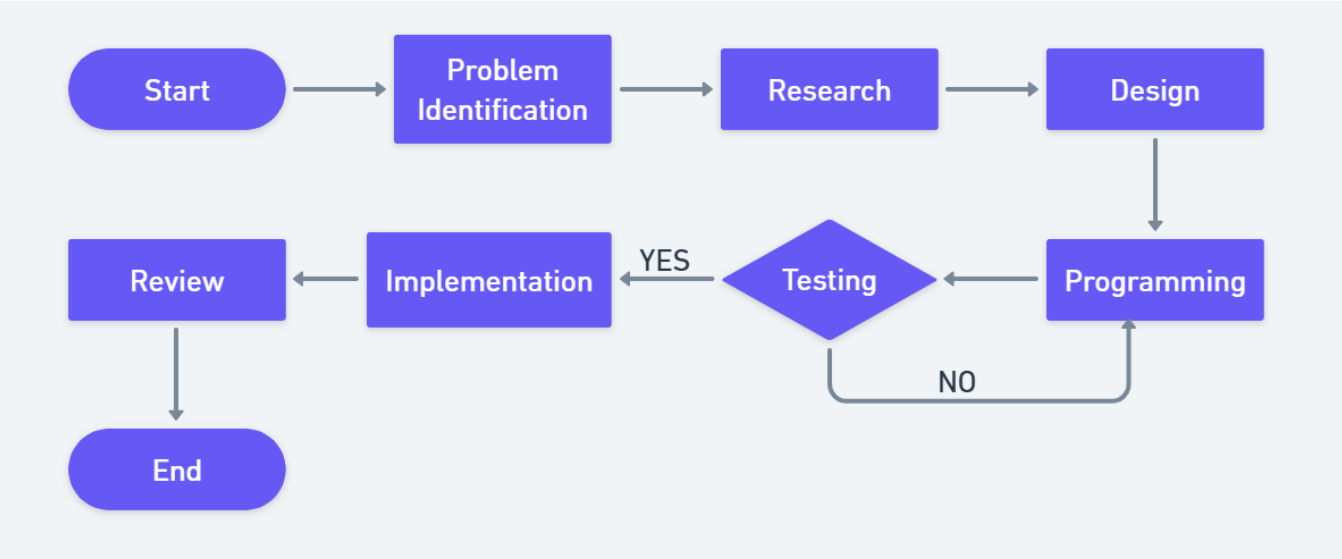


Figure 3.18: PRODUCT TESTING / FUNCTIONALITY TESTS

CHAPTER 4

RESULT AND DISCUSSION

4.1 PRODUCT DESCRIPTIONS

4.1.1 General Products & Functionalities

The Allison 250 Engine Learning App is designed as an interactive educational platform to help aviation students and enthusiasts understand the correct startup, operation, and shutdown procedures of the Allison 250 engine. The app provides a simple, structured, and user-friendly interface suitable for self-learning or classroom use.

Key features of the app include step-by-step instructional videos for pre-start, start-up, and shutdown procedures, based on real Aircraft Maintenance Manual (AMM) guidelines. These videos allow users to observe actual operating sequences and safety steps. A quiz section is also included to test the user's knowledge and reinforce understanding through instant feedback. The About section provides background information on the engine and its system, giving learners additional context.

The app also includes a checklist function, where users can interactively tick off necessary tools, items, and safety equipment before performing procedures—simulating real-world maintenance preparation. Designed with offline functionality, users can access learning materials anytime and anywhere without needing an internet connection. Overall, this app promotes hands-on learning, reduces training errors, and enhances procedural understanding in aviation education.

4.1.2 Specific Part Features

4.1.2.1 Specific Part Features

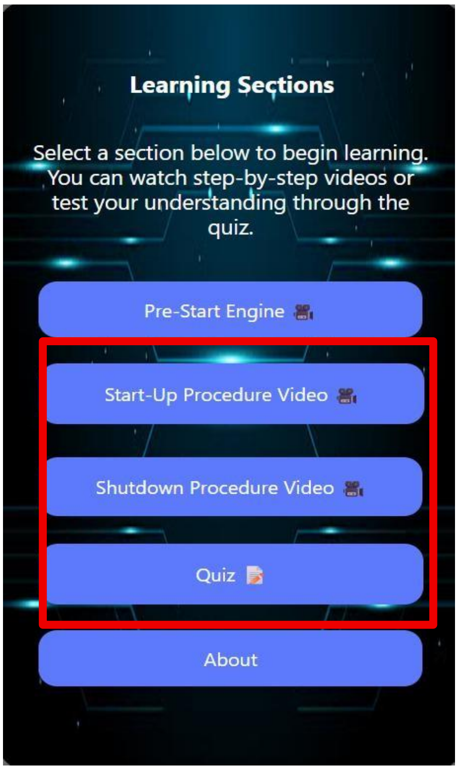


Figure 4.1: Menu Page

The ALLI250 X-DIGITAL OPERATIONS app focuses on three major functional sections: Pre-Start, Start-Up, and Shutdown, simulating real procedures of the Allison 250 engine operation. Each section is developed to guide users through accurate and interactive steps in correspondence with the Aircraft Maintenance Manual (AMM).

The Pre-Start Section provides the user with a comprehensive checklist for complete prerequisites before engine start, including visual references and detailed explanations of system readiness checks. This helps users build familiarity with standard safety and inspection routines required before engine operation.

The Cold Start-Up Section enables the user to follow a systematic procedure of engine ignition through both written instructions in the AMM and step-by-step video demonstrations. This part trains users to conduct precise actions in the right sequence, keeping the engine safe and operationally efficient.

Finally, the Shutdown Section shows how to turn off the engine properly after use. It describes the timing, switch control, and system monitoring that must be accomplished to avoid component over-stress for long engine life.

4.1.2.2 Product Structure

Engine Operation Modules:

The Allison 250 engine AMM was utilized to design the application's three primary modules: Pre-Start, Start-Up, and Shutdown. These modules are detailed in steps, allowing users to recognize the correct sequence and safety checks required at each operation stage. Each module is visually guided with simple explanations for easier learning and engagement.

AMM Instruction Display:

Procedures in each operation are integrated with written AMM procedures that explain every step clearly. Given the digital format, users can easily work their way through standard maintenance practices from their devices without having to refer to bulky printed manuals. This helps trainees and aviation enthusiasts build accurate procedural knowledge aligned with real-world aviation maintenance standards.

Video Demonstration

This app comprises instructional videos on how to perform Pre-Start, Start-Up, and Shutdown procedures. They graphically demonstrate actual steps in realistic scenario visual format, supported by switch operations a user will encounter. Videos are short, direct, and easy to follow in order to reinforce what has been learned from the AMM instructions.

Interactive Quiz (15 Questions):

A built-in quiz contains 15 multiple-choice questions, all drawn directly from the AMM procedures for the Allison 250. The quiz tests users' knowledge of critical steps and safety checks, offers immediate feedback to correct wrong choices, and scores results to track areas where learners may need to review the subject.

Safety Emphasis:

Important safety reminders are featured in every module before, during, and after the operation of an engine. The pre-checks and shutdown monitoring ensure that the user learns how to avoid damage or hazard during turbine operations.

Offline Accessibility:
The app is fully functional without internet connectivity, allowing users to view instructions and videos anytime and anywhere. This feature supports continuous learning in workshops, classrooms, or hangars where internet access may be limited.

User-Friendly Design:

Self-directed learners and students alike will find this interface simple to use and interactive, with large buttons and clear icons that structure the layout, allowing easy navigation through modules in a practical and pleasant manner.

4.1.2.3 Product Mechanism

User Interface:
The application is designed with a clean, easy-to-use interface that will enable users to work their way through various sections like Pre-Start, Start-Up, and Shutdown. The layout has large buttons, clearly labeled, and simple icons to make operation smooth and intuitive for both aviation students and self-learners. The overall visual design ensures a professional look while maintaining user-friendliness and accessibility during training activities.

Backend Infrastructure:
The application would be developed on Thunkable, a no-code development tool that offers rich backend support for user input management, media content storage, and flawless page transitions. All data, such as instructional texts and videos, are stored locally to enable offline access. This ensures small load times, making sure the app will work well in maintenance workshops or classrooms with no internet access.

Engine Operation Database:

This application maintains a structured database containing procedural data, based on the AMM of the Allison 250 engine. Every operation module (Pre-Start, Start-Up, and Shutdown) is joined with its corresponding instruction in the AMM, providing accuracy and coherence to real aviation standards. Through this mechanism, the user receives a reliable guide, as in actual maintenance documentation.

Video Integration Mechanism:

The app integrates high-quality instructional videos demonstrating each stage of the engine operation. These videos are embedded directly into the interface to synchronize with the written instructions. These allow the user to study each step in detail by playing, pausing, and replaying the videos, which reinforces procedural memory and improves comprehension by means of visual learning.

4.1.2.4 Accessories & Finishing

Accessories:

The application incorporates a number of supportive features that work toward its usability and performance. These include navigation icons and progress indicators in every video module. A home button and restart option are also provided, so users can go back to the main menu or replay chosen parts with ease. These accessories shall help users interact with the app smoothly and maintain an efficient flow of learning.

Finishing:

The final version of the application had interface optimizations for smooth operation, professional visual appeal, and standard color themes. Refined fonts, shapes of buttons, and spacing in the layout were made to enhance readability and precision of touches. Finishing puts an emphasis on simplicity, clarity, and accessibility. The clean and user-friendly design ensures a seamless and interactive experience.

4.1.3 General Operations Of The Product

This learning application is designed to give students in aviation an interactive and realistic feeling in learning aircraft engine procedures, such as Pre-Start, Start, and Shutdown. Once the application has opened, the user will be taken to a main menu showing several options: Start Learning, Pre-Start Procedure, Start Procedure, Shutdown Procedure, and Exit. The interface is designed for easy navigation, and users can select any module that they would like to explore.

It includes step-by-step visual guides and video demonstrations of actual processes based on procedures in the Aircraft Maintenance Manual for each section of the application. The Pre-Start section deals with system checks for safety and readiness before it is actually started. The Start section details the correct way to ignite the engine, covering parameters such as fuel flow, N1, N2, and ITT readings. The Shutdown section addresses proper shutdown techniques: how to cool down the systems and perform post-operation inspections.

In the app, voice explanations and interactive buttons for stopping, replaying, and skipping to other stages are integrated. This allows the student to learn at their own pace and revisit specific steps again if they have trouble. There is also a quiz on the app containing 15 multiple-choice questions that can be used to test one's understanding of the AMM procedures outlined in the modules.

All functionality within the app works offline once downloaded, making it accessible in areas without internet connectivity. The system is designed to be lightweight, allowing for seamless usability whether on mobile, tablet, or desktop devices. The user interface is also designed to be intuitive and limit mistakes when using it. Generally, this application enhances learning efficiency and accuracy regarding aircraft engine procedures in a modern, interactive digital format.

4.1.4 Operations of the specific part of the product

4.1.4.1 Pre-start, start-up, and shutdown

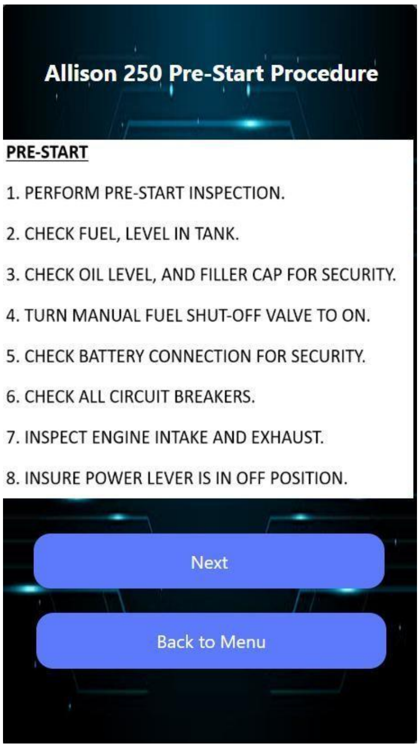


Figure 4.2: Pre-Start Instruction Page

Figure4.3: Pre-Start Video Demonstration Page

The core features of this learning application will be the Pre-Start, Start-Up, and Shutdown sections. Based on the Allison 250 engine following AMM standards, each section was designed to simulate real engine operation procedures.

This section, Pre-Start, walks the user through a detailed pre-start checklist to make sure all safety and system checks are accomplished before ignition. It includes step-by-step instructions and video demonstrations, allowing users to understand proper procedures before engine start. The visual content helps reinforce correct sequencing and awareness of potential safety hazards.

The Start-Up section gives a step-by-step tutorial on how the engine should be ignited. It shows the steps in order to make sure that the learner comprehends the right way to turn on the engine system without causing any damage. The Shutdown section is similarly formatted to include instructions and videos that show the proper way to cool the engine, cut off fuel, and power down the system.

4.1.4.2 Quiz

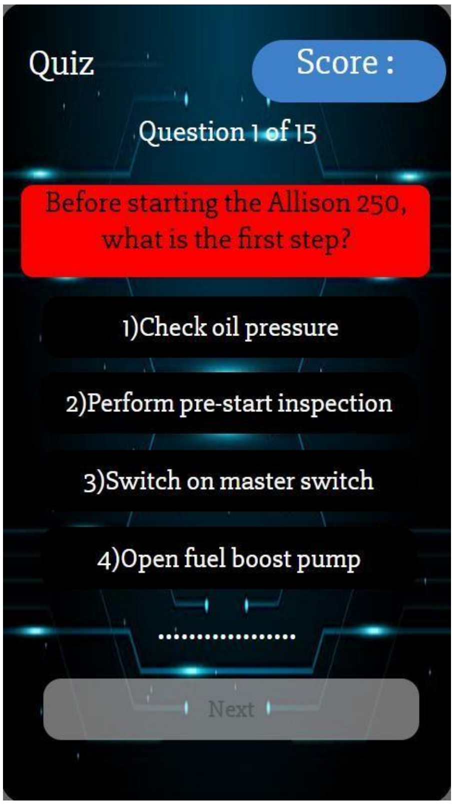


Figure 4.4: Quiz Question Interface Page

The Quiz section is designed to test users' knowledge regarding aircraft engine procedures learned through the app. It includes 15 multiple-choice questions, each strictly developed from procedures in the Aircraft Maintenance Manual (AMM) related to the Allison 250 engine. Each question provides four possible options for which users can test their comprehension of the Pre-Start, Start-Up, and Shutdown processes.

Upon completion of the quiz, immediate scoring and feedback enable users to perceive areas they need to work on. This quiz will further reinforce knowledge retention through interaction. It encourages learners to recall correct procedural sequences, safety steps, and parameters related to the operation of engines. It ensures that users are not just reading and watching but thinking critically about concepts. The quiz feature reinforces active learning, enabling users to review theoretical knowledge about aircraft engine handling in a digital, easily accessible manner.

4.1.4.3 About

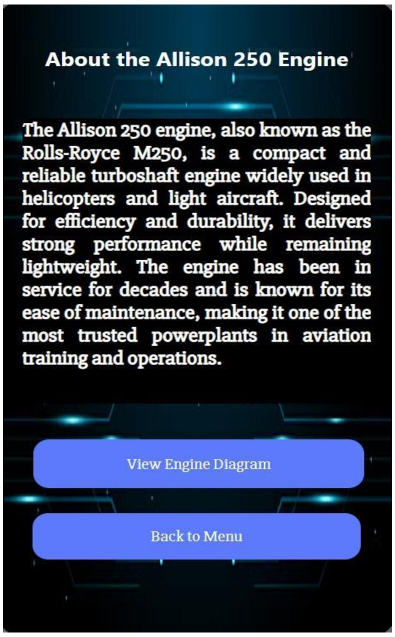


Figure 4.5: About Page

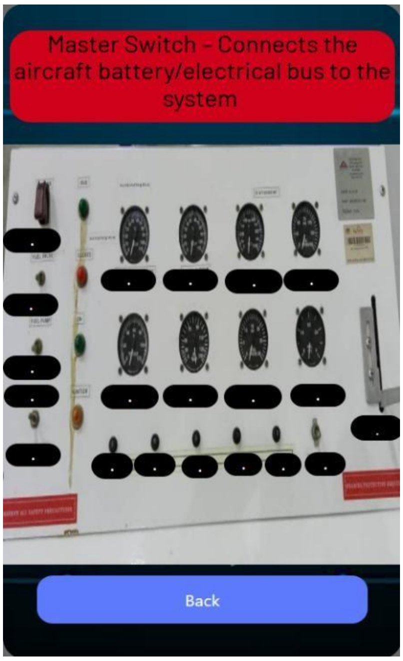


Figure 4.6: Engine Diagram Interactive

The About section is the informative part of the app, explaining in detail what Allison 250 is, its kind, and the thought process behind its creation. The Allison 250 is a gas turbine engine that is commonly used in light helicopters, like the Bell 206B3, for carrying and delivering goods over short ranges, as it has a reputation for reliability and efficiency. It outlines its components and operating principle, among other advantages accruable from its use in modern aviation. Furthermore, the About page includes a detailed engine diagram in which each instrument or indicator has an interactive button. Once users press a button, the description that appears in the upper section of the page explains what that particular instrument does, such as an oil pressure, N1, N2, fuel flow, or torque indicator. This interactive design greatly enhances user engagement in learning and helps visualize the engine system far better. Overall, this transforms complex engine data into a clear, educational, and interactive experience.

4.2 PROJECT IMPACTS/ PURPOSE OF PRODUCT

The ALLI250 X-DIGITAL Operations (OPS) is an online learning application designed to modernize and improve the learning effectiveness for students in aircraft maintenance, focusing on the Allison 250 engine. This project provides the opportunity to transform traditional, paper-based learning materials into a more engaging, interactive, and effective digital platform. Using digital checklists, videos demonstrating the operation, and instructional guides illustrating the steps of procedures according to the AMM, students will obtain a more practical and visual insight into real-life operations. Such an approach not only increases their comprehension but also provides an opportunity for independent and flexible learning, since these lessons can easily be reviewed at any time and place, without requiring access to the internet.

The project also tries to minimize the problems that exist in paper-based systems, such as human errors, loss of data, and inconvenience in updating contents. Since the app digitalizes the learning process, it ensures that the maintenance steps are properly followed to enhance accuracy and procedural discipline of the user. The application also facilitates a built-in quiz system to help in assessing users' understanding, technical knowledge reinforcement, and identification of weaknesses and strengths of the learners.

In essence, this project bridges the gap from traditional teaching to modern aviation technology education. This work fosters digital literacy for aircraft maintenance students in conjunction with standard procedures. Easily accessible and user-friendly, this application forms a very great learning companion for learners, both beginners and enthusiasts in aviation. Over the years, the ALLI250 X-DIGITAL Operations (OPS) application will contribute toward generating more competent, safety-conscious, and technologically proficient aircraft technicians who can support the advancement of the aviation maintenance industry.

4.3 ANALYSIS OF PROBLEM ENCOUNTERED & SOLUTIONS

4.3.1 Product Structure

The biggest challenge in structuring the product was to design an intuitive information architecture that could accurately reflect the strict, sequential procedures of the Allison 250 engine. At first, users were confused by the navigation, as the Pre-Start, Start-Up, and Shutdown phases were not distinct enough, thus yielding a fractured learning experience. We made the interface modular and menu-driven, compartmentalizing each major phase of operation within its own section. This technique set a clear and linear learning path, bringing the user through the procedures in the proper order without overwhelming them. In addition, technical data from the official Aircraft Maintenance Manual were carefully simplified and adapted for this digital format to be both accurate and educationally clear.

4.3.2 Software/Programming

During development in the Thunkable environment, we experienced issues related to the implementation of complex logic; for instance, the quiz scoring mechanism was unable to track and show the results correctly on a different screen. Other major problems included inconsistent renditions of the user interface across different Android devices, where components were appearing out of alignment. To surmount these issues, we used global variables to keep track of the state of our application, enabling the quiz score to be reliably stored, updated, and retrieved for the final results screen. For layout consistency, we avoided fixed sizing in favor of a responsive design using percentage-based widths and conducted rigorous testing on multiple screen emulators. That way, a consistent and professional user experience would be achieved regardless of the device used.

4.3.3 Accessories & Finishing

The lack of visual cohesion impeded the development of promotional and exhibition materials, as the initial app interface, poster, and brochure all presented different branding elements that detracted from the professionalism of the project. The poster was very wordy and wasn't catching viewer interest very well. To that end, a style guide has been provided for a single color palette, typography, and logo usage across physical and digital pieces. The poster was entirely redesigned from the bottom up, visually first, using big, high-resolution screenshots of the app, intuitive icons, and concise bullet points to make features instantly recognizable. Likewise, the demo video was created from a detailed storyboard to be comprehensive yet concise in showing the value of the app in less than two minutes to exhibition audiences.

CHAPTER 5

CONCLUSION & RECOMMENDATIONS

5.1 ACHIEVEMENT OF PRODUCT OBJECTIVE

5.1.1 General Achievement Of Project Objective

Allison 250 Engine Training Application software being developed for a digital device has created a new-age training platform that is portable and interactive for aeronautical students and maintenance personnel. Whereas the conventional methods emphasize printed manuals, classroom lectures, and limited hours of hands-on practice, this method offers a newer approach. Since it runs on a commercial off-the-shelf device, this application removed the need for special hardware. Therefore, any student or institute could use it almost without setup. They can employ it in practically every possible environment of instruction-one that uses a classroom setting or one that is strictly self-taught.

A complete engine operation cycle can be simulated in this application, comprising pre-start inspection, engine start, shut down, and post-inspection stages. These stages are introduced by step-by-step interactive features that closely replicate the actual procedures carried out in the field. This kind of learning environment offers users a much more real-world-like training experience as compared to theoretical training.

5.1.2 SPECIFIC ACHIEVEMENT OF OBJECTIVES

5.1.2.1 Product Structure

The main objective of the product structure was to develop an organized and interactive learning platform for users to gain better understanding about the operation of the Allison 250 engine. There are three sections in the app: Pre-start, Start-up, and Shutdown, comprising a checklist, AMM-based instruction, and video demonstration. A quiz section with 15 questions pertaining to the AMM procedures was integrated to check the users' comprehension and increase retention. The structure is built to ensure smooth navigation, logical flow in learning, and clear visual presentation, making it suitable for both aviation enthusiasts and aircraft maintenance students to enhance their learning experience efficiently.

5.1.2.2 Accessories & Finishing

Accessories & Finishing For accessories and finishing, the app was designed with a simple but modern interface for better usability and look. The colors, buttons, and layout used aimed at consistency and clarity throughout the app. Icons, buttons for navigation, and loading animations were added to enhance its usability. In finishing, there was refining page transitions, optimizing video playback, and also making it accessible offline. The inclusion of all these factors ensured that when the final product came out, it was not just functional but also polished, yielding a professional digital learning environment which would meet aviation training standards.

5.2 CONTRIBUTION OR IMPACT OF THE PROJECT

The ALLI250 X-Digital Operations project has contributed significantly to the aviation education sector with the introduction of a modern, digital-based learning platform to understand the operation of the Allison 250 engine. Traditionally, students relied on a paper-based checklist and manual, which were vulnerable to human-induced errors due to the lack of interaction. This app converts that into an engaging and accessible experience through digital simulation, step-by-step videos, and guided AMM-based instructions.

This project encourages self-directed learning for both aviation enthusiasts and maintenance students, whereby they are able to study and review procedures at any time, from any location, and without depending on an internet connection. It fills the gap between theory and practical application, thus supporting students in preparing to face real-life maintenance scenarios with greater confidence. In addition, it helps knowledge retention by embedding quizzes to enable continuous assessment.

Overall, it helps the field of aviation improve its training efficiency and technical competency, in addition to enhancing safety awareness. It further helps in integrating digital tools into technical education, according to global smart learning and airline industry expectations regarding digital transformation for aviation maintenance training.

5.3 IMPROVEMENT & SUGGESTIONS FOR FUTURE RESEARCH

5.3.1 Product Design

For future development, the product design can be enhanced by incorporating a 3D interactive model of the Allison 250 engine. Users would be able to rotate, zoom in and out, and view in depth each component of the engine for better clarity. The interface could also be enhanced further with better color schemes, smooth transitions, and animations that engage a learner's experience. Additionally, the addition of multi- language support would open the app to international users and increase its usability beyond local aviation students.

5.3.2 Product Structure

The current structure of the app can be refined by organizing its modules in a more systematic and expandable format. Future versions could include additional sections like troubleshooting guides, system fault simulations, or advanced maintenance tutorials. A feature for progress tracking would be included so that users could track their learning achievements and areas for improvement.

5.3.3 The Accessories & Finishing Touches

With further upgrades, the array and quality of learning accessories inside the app could be expanded. Quizzes could be adaptive tests whose question difficulty varies according to user excellence, such that advanced users feel challenged while beginners are building confidence.

Gamified elements may include achievement badges, leaderboards for tracking progress, and certificates of completion to encourage students to complete all modules. A teacher dashboard could let instructors keep track of student progress, assign activities to them, and provide direct feedback.

For that finishing touch, a digital logbook or note section would let students jot down key takeaways, an important tip, or a reference to regulations while studying. Also, a built-in reference library with links to official maintenance manuals and airworthiness directives would further add to the app's value as a training aid for industry professionals.

5.3.4 Electronics And Programming

In further research, the electronic and programming part of the project should be refined to perfect the code structure of the application and possibly introduce other advanced programming frameworks. AI-based adaptive learning can be implemented that may pace the content based on performance, give feedback, and make recommendations to the user. The integration of a data analytics system will also enable instructors to track trainee performance and find learning trends.

From the developer's perspective, migrating from Thunkable to more flexible platforms like Flutter or React Native would increase performance, responsiveness of the app, and compatibility with a wide range of devices. Besides that, AR features could be implemented using API to provide realistic visualizations of Allison 250 engine components. Finally, enhancing offline data management and error handling will ensure smooth performance and stability even in low-connectivity environments common in aviation workshops.

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APPENDIX A: DECLARATION OF TASK SEGREGATION

SUB-CHAPTERS	DESCRIPTION
TAN JENG	
1.1.1	ALLISON A250 ENGINE
1.4.1	GENERAL PROJECT SCOPE
1.5	PROJECT IMPACT
2.1.2	ENGINE ALLISON 250: TYPES, FUNCTION AND WORKING PRINCIPLES
2.3.1	CURRENT METHODOLOGIES USED TO TEACH ABOUT ENGINE ALLISON 250
2.4	CYBER SAFETY CONSIDERATIONS
3.2.1	DESIGN CONCEPT GENERATION
3.2.3	GENERAL PRODUCT SKETCING
3.4	DEVELOPMENT OF PRODUCT
5.3.4	ELECTRONIC AND PROGRAMMING
3.5.1	OVERALL AEP PROJECT FLOW CHART
3.7	OVERALL PROJECT GANTT CHART
4.1.2	SPECIFIC PART FEATURES
4.2	PROJECT IMPACT/PURPOSE OF PRODUCT
5.1.2	SPECIFIC ACHIEVEMENT OF OBJECTIVES
5.3.1	PRODUCT DESIGN
2.2	SPECIFIC LITERATURE REVIEW
LOH JENG HOE ASRON	
1.2.1	PROBLEM STATEMENT
1.3.1	GENERAL PROJECT OBJECTIVE
1.4.2	SPECIFIC INDIVIDUAL SCOPE

2.1.1	LEARNING APP IN AVIATION
2.1.3	CURRENT METHODOLOGIES USED TO TEACH ABOUT ENGINE ALLISON 250
2.3.2	TABLE: COMPARISON BETWEEN PREVIOUS AND CURRENT STUDY
2.5	ENVIRONMENTAL IMPACT
3.2.2	EVALUATION & SELECTION OF CONCEPTUAL DESIGN
3.3.1	GENERAL PRODUCT INTERFACE LAYOUT
3.4.1	MATERIAL ACQUISITION: THINKABLE
3.4.2	DEVICES
4.1.3	GENERAL OPERATIONS OF THE PRODUCT
5.1.1	GENERAL ACHIEVEMENT OF PRODUCT OBJECTIVE
5.2	CONTRIBUTION OR IMPACT OF THE PROJECT
3.8	PRODUCT TESTING / FUNCTIONALITY TESTS
AHMAD NABEEYLL ATEEYQULLAH BIN ABDULLAH	
1.2	PROBLEM STATEMENT
1.3.2	SPECIFIC INDIVIDUAL PROJECT OBJECTIVES
2.2	SELECTION OF IDEA/CONCEPT THEORY
3.1	PROJECT BRIEFING & RISK ASSESSMENT
3.6	LIST OF MATERIAL & EXPENDITURES
4.1.1	GENERAL PRODUCT & FUNCTIONALITIES
4.1.4	OPERATIONS OF THE SPECIFIC PART OF THE PRODUCT
5.3.2	PRODUCT STRUCTURE
5.3.3	THE ACCESSORIES & FINISHING TOUCHES
5.3.4	ELECTRONICS AND PROGRAMMING
4.3	ANALYSIS OF PROBLEM ENCOUNTERED & SOLUTIONS

APPENDIX B: TURNITIN SIMILARITY REPORT

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ORIGINALITY REPORT

5%	3%	1%	3%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

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2	www.pref.yamaguchi.lg.jp Internet Source	1%
3	Submitted to Jabatan Pendidikan Politeknik Dan Kolej Komuniti Student Paper	<1%
4	digitalcollection.utem.edu.my Internet Source	<1%
5	Submitted to Flinders University Student Paper	<1%
6	Submitted to University of Strathclyde Student Paper	<1%
7	etd.aau.edu.et Internet Source	<1%
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Silica Aerogel", University of Malaya (Malaysia), 2025
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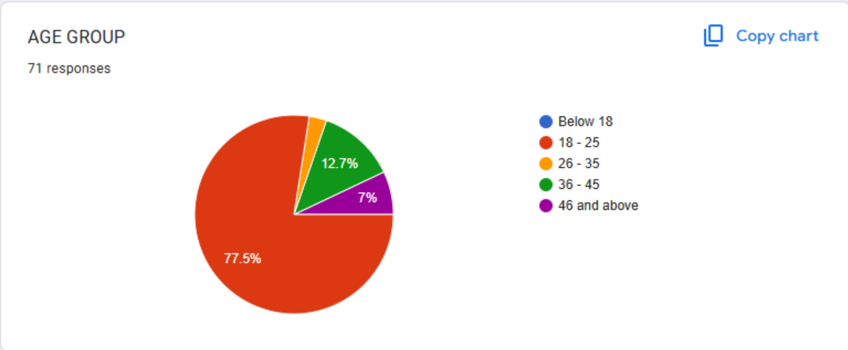
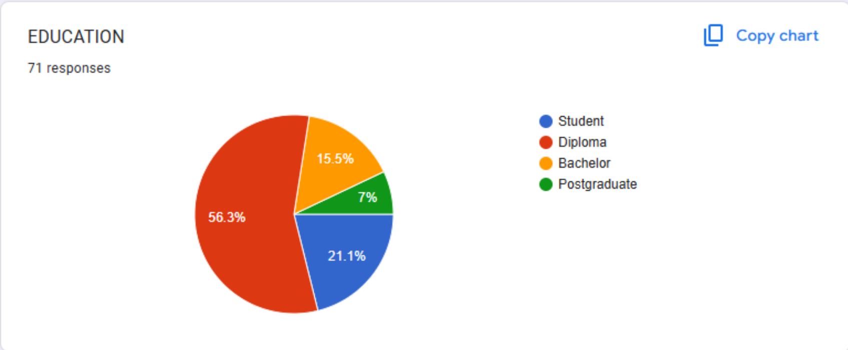
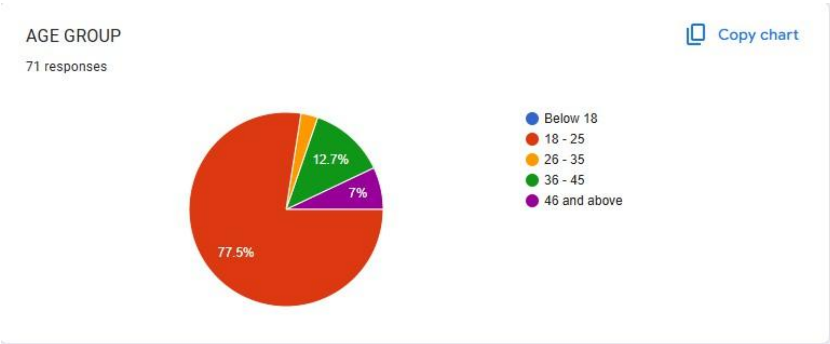
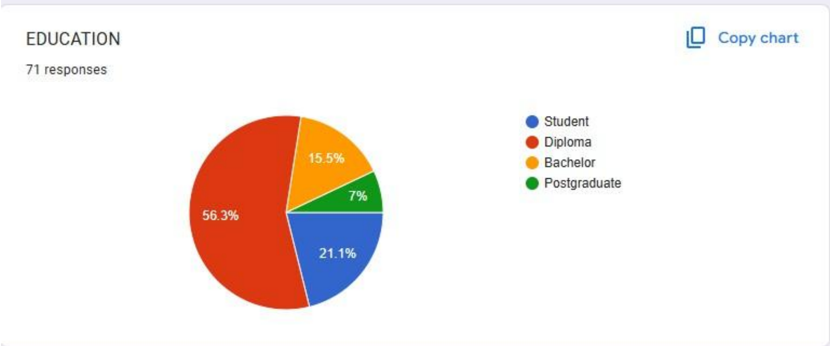
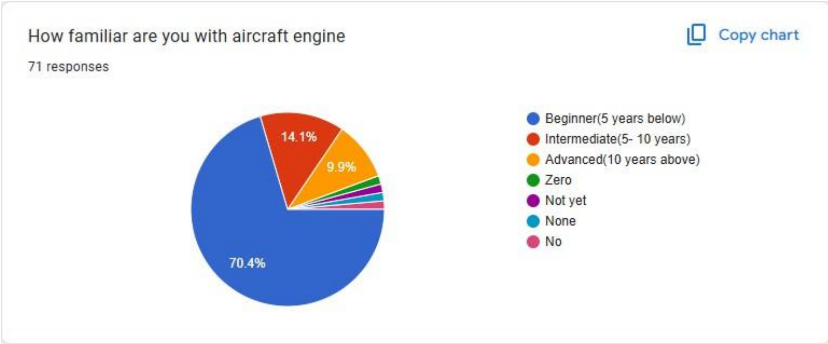
APPENDIX C: PRE-SURVEY FORM

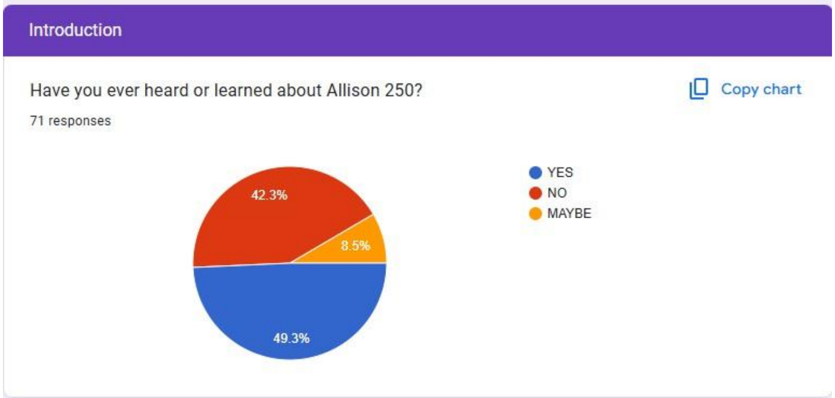









How familiar are you with aircraft engine
Copy chart
71 responses
14.1%
9.9%
70.4%
Beginner(5 years below)
Intermediate(5- 10 years)
Advanced(10 years above)
Zero
Not yet
None
No


Introduction
Have you ever heard or learned about Allison 250?
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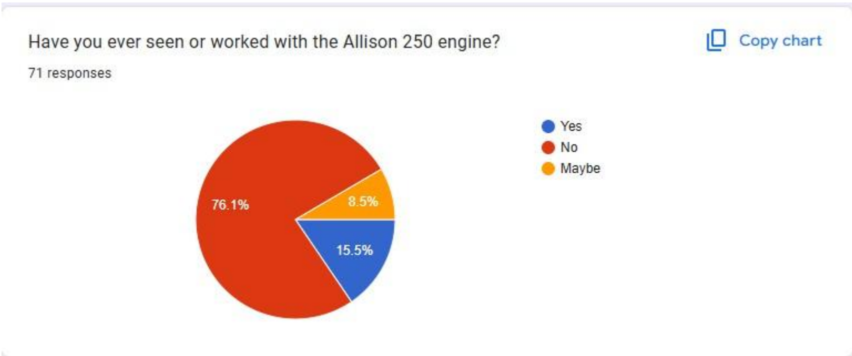
71 responses
42.3%
8.5%
49.3%
YES
NO
MAYBE


Have you ever seen or worked with the Allison 250 engine?
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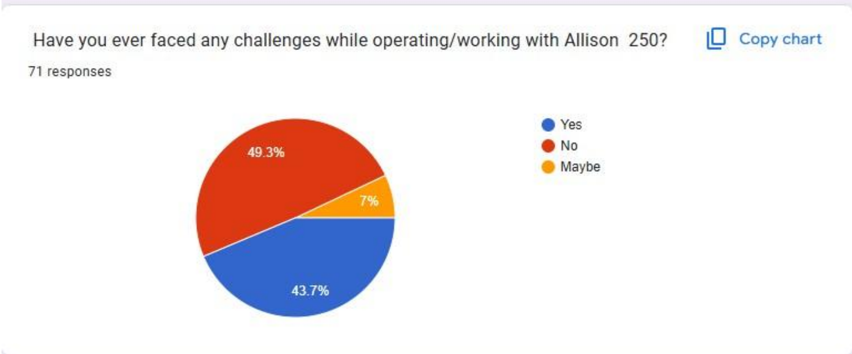
71 responses
76.1%
8.5%
15.5%
Yes
No
Maybe


Have you ever faced any challenges while operating/working with Allison 250?
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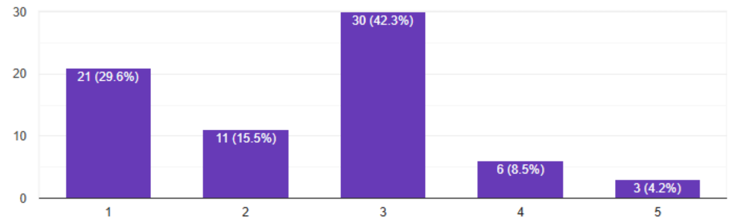
71 responses
49.3%
7%
43.7%
Yes
No
Maybe

How much did you know about the Allison 250 engine?

Copy chart

71 responses



Technical- Development of resilient TVET systems in regards operating Allison 250 engine

Please select your technical preference on this Digitalizing Learning APPS: ALLI250 X-DIGITAL Operations (OPS)

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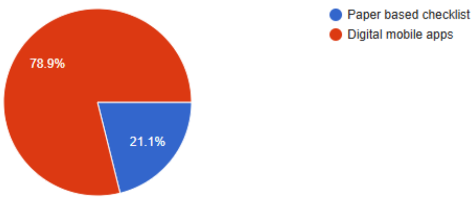
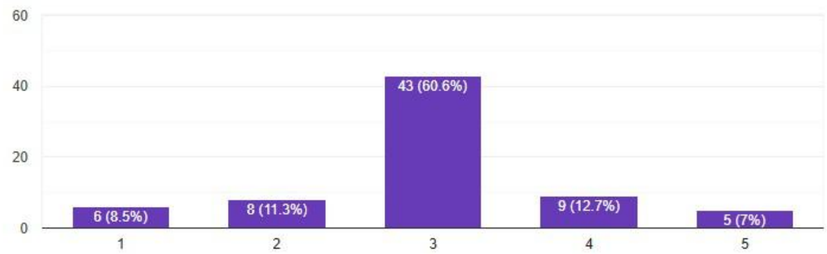
71 responses



How effective do you find your current method in ensuring engine operation using a paper based checklist?

Copy chart

71 responses



What are the biggest challenges you face with your current paper checklist method?

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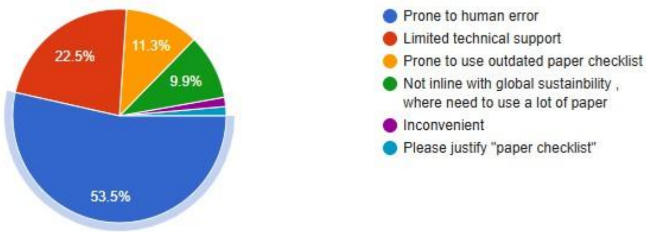
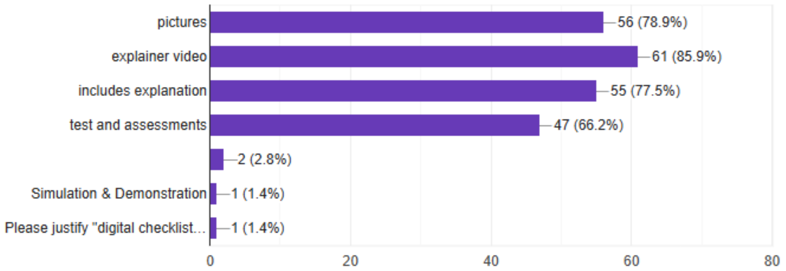
71 responses



What features would you like to see in a digital checklist app? (Select all that apply)

Copy chart

71 responses



What device would you prefer to use for a digital checklist?

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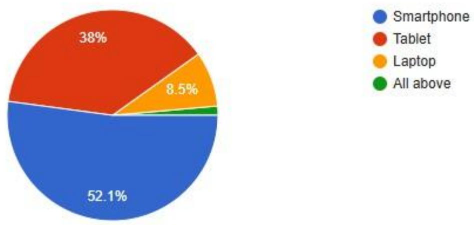
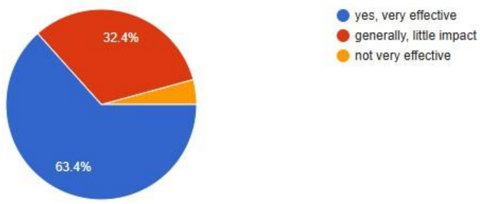
71 responses



Do you think that reducing the running time of actual engines through simulation training is an effective environmental protection measure through the mobile apps?

Copy chart

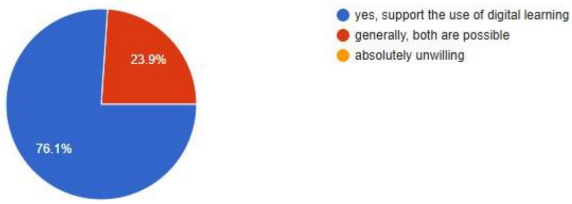
71 responses



Are you willing to use digital teaching materials and e-learning resources to reduce the use of paper materials?

Copy chart

71 responses



Do you think that reducing the running time of actual engines through simulation training is an effective environmental protection measure through the mobile apps?

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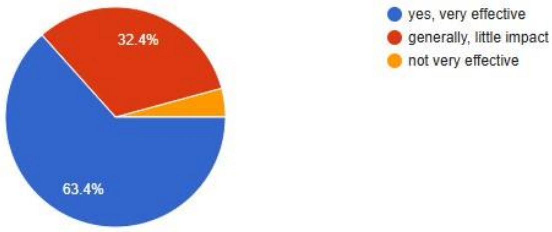

Are you willing to use digital teaching materials and e-learning resources to reduce the use of paper materials?

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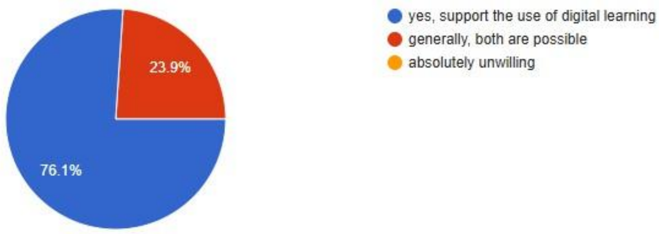
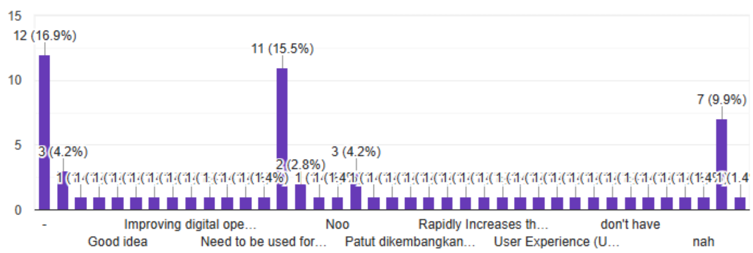


Final thought

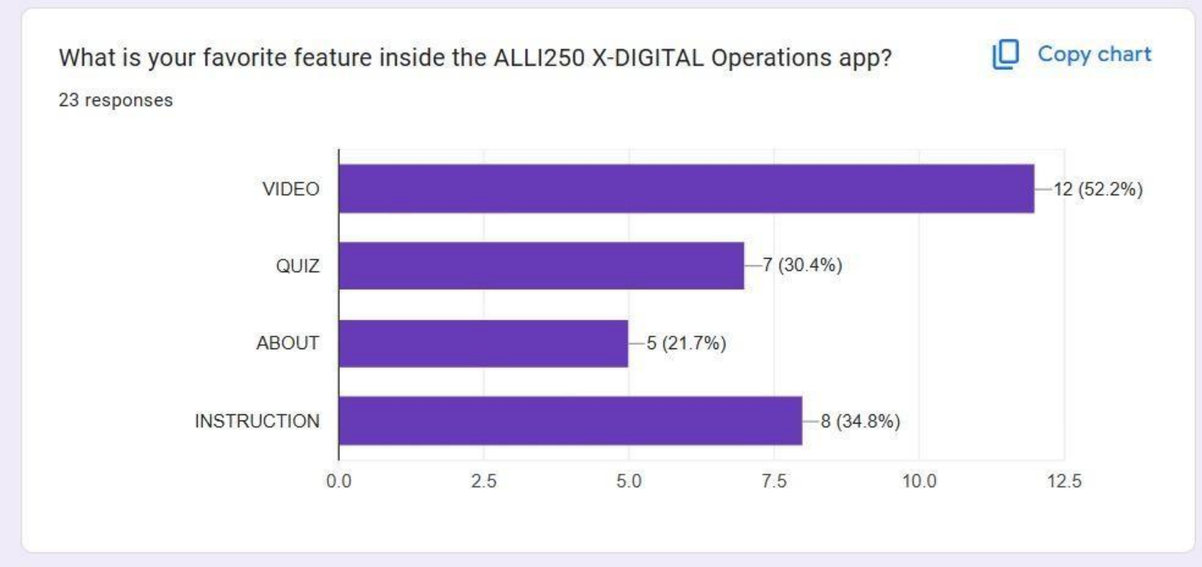
Do you have any additional comments or suggestions regarding digital operation for the Digitalizing Learning APPS? ALLI250 X-DIGITAL Operations (OPS)?

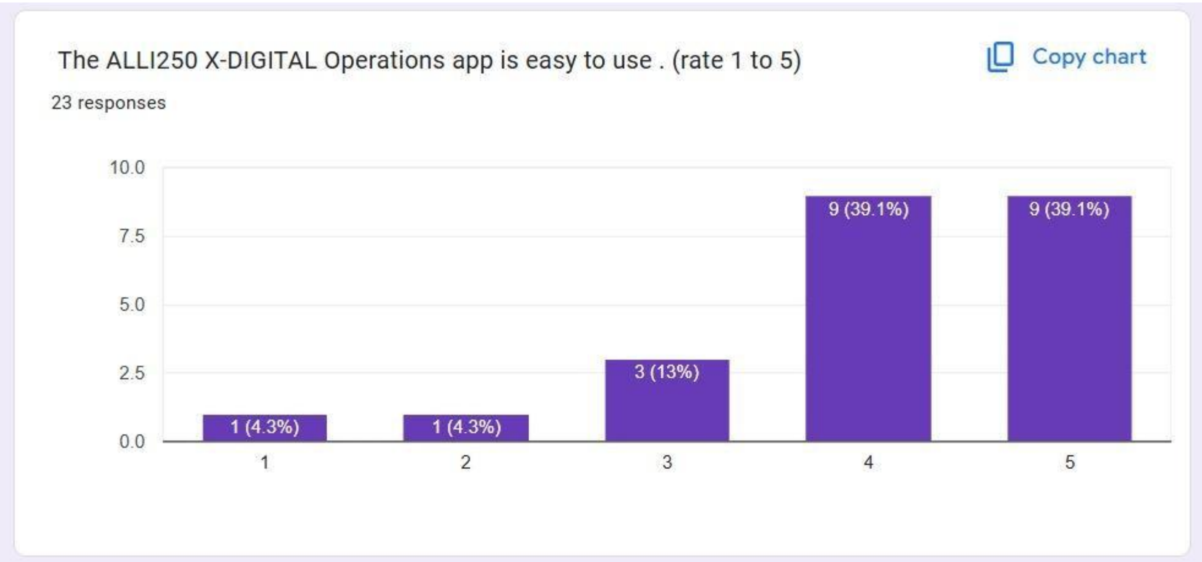
Copy chart

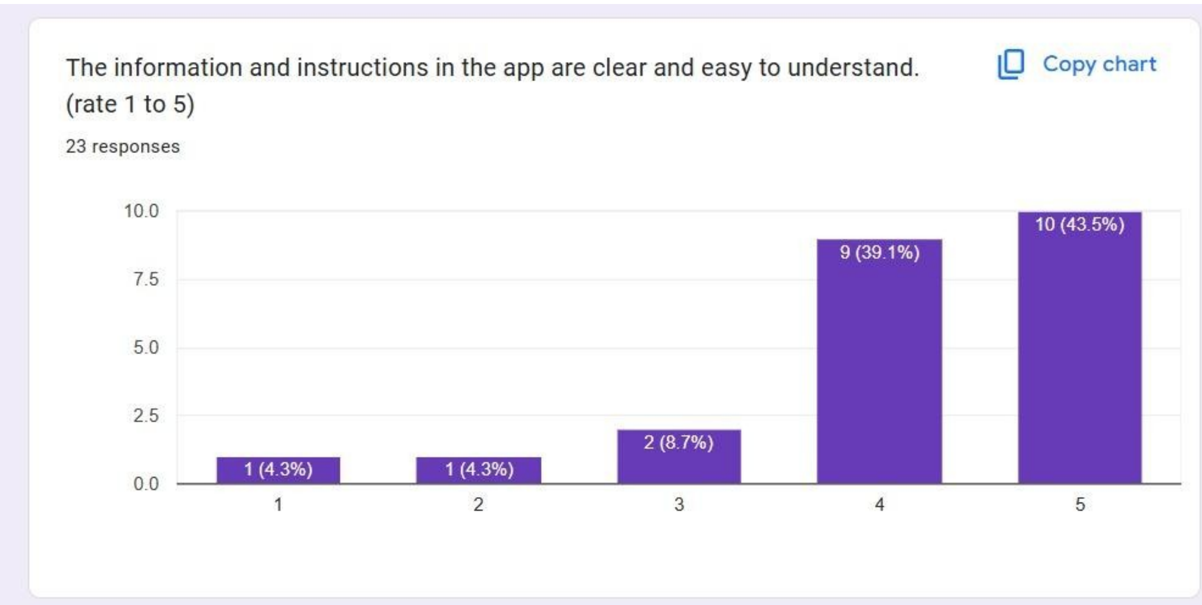
71 responses



APPENDIX D: POST-SURVEY FORM



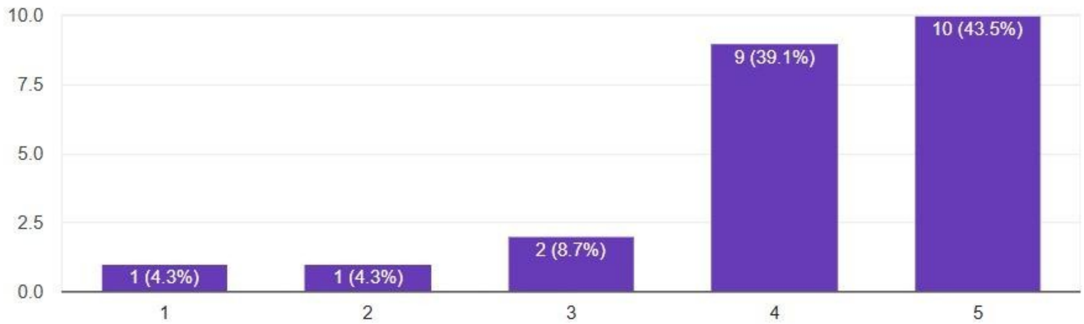




Using the ALLI250 X-DIGITAL Operations app has increased my understanding of the Allison 250 engine starting procedure.(rate 1 to 5)

Copy chart

23 responses



I am satisfied with the ALLI250 X-DIGITAL Operations app. (rate 1 to 5)

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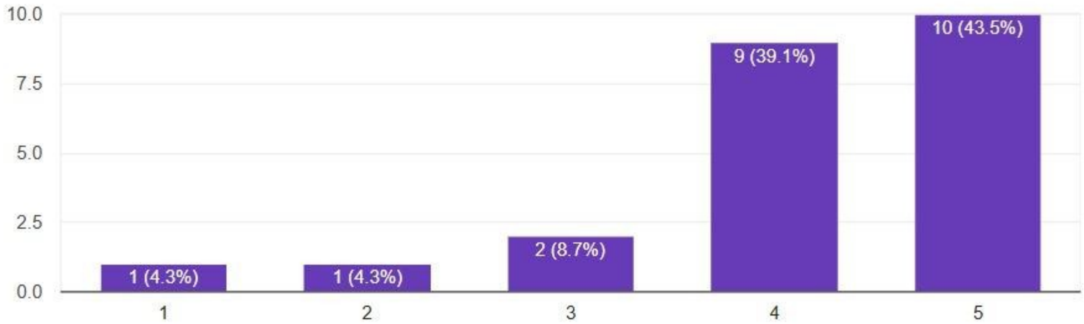
23 responses



I would recommend this app to other students studying aircraft. (rate 1 to 5)

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23 responses