POLITEKNIK BANTING SELANGOR

VOICE'EM MANUAL

NAME	MATRIC NO.
MUHAMMAD AFIF DANIAL BIN RAMLEE	24DAM21F2002
MIRZA MUHAMMAD AL-AMIN BIN MUSTAPA KAMAL	24DAM21F2011
ALFATTAH BIN FAUZI	24DAM21F2004
MUHAMMAD AZRIN NIZAM BIN ARBA'IN	24DAM21F2007

DEPARTMENT OF AIRCRAFT MAINTENANCE

SESSION 2 2023/2024

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A REPORT SUBMITTED TO THE DEPARTMENT OF AIRCRAFT MAINTENANCE IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR A DIPLOMA ENGINEERING IN AIRCRAFT MAINTENANCE
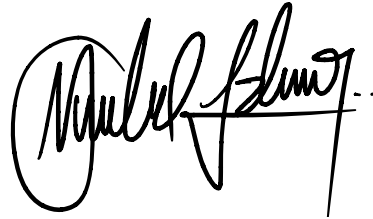
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Date : 25/5/2024

CERTIFICATE OF PROJECT ORIGINALITY & OWNERSHIP

VOICE'EM MANUAL

SESSION: II 2023/2024

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MUHAMMAD AFIF DANIAL BIN RAMLEE	**24DAM21F2002**
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MUHAMMAD AZRIN NIZAM BIN ARBA'IN	**24DAM21F2007**

"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."

Endorsed by

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25 Mei 2024

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ACKNOWLEDGEMENT

ABSTRACT

This abstract outline the design and development of Voice'Em Manual, a cutting-edge smartphone application that uses voice recognition technology to simplify the process of navigating Aircraft Maintenance Manuals (AMMs). The program meets the demand for a productive, easy-to-use, hands-free way for maintenance staff to retrieve and handle technical data instantly. Voice'Em Manual is a technology that utilizes sophisticated speech recognition algorithms to facilitate spoken instructions from users to search, retrieve, and display particular sections of the AMM. This feature improves workflow efficiency and lowers the possibility of human error. This thesis describes the planning, creation, and assessment of the Voice'Em Manual. The application architecture ensures accurate and timely responses to user questions by integrating a powerful voice recognition engine with an extensive library of AMMs. Maintaining personnel's ease of use in a variety of operating conditions is made possible by a thorough user interface design approach that guarantees intuitive interaction. In order to verify the application's dependability, accuracy, and performance, a lot of testing was required. The outcomes show that voice command recognition can be done with a high degree of accuracy and that manual navigation activities can be completed much more quickly. Professionals in the sector have provided input on the application, highlighting its potential to revolutionize maintenance operations through convenient, hands-free access to vital information. All things considered, Voice'Em Manual is a major development in the world of aircraft maintenance, providing a workable way to raise the efficiency and security of maintenance operations. This thesis describes the application's development process, technological difficulties, and potential future improvements and capabilities.

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LIST OF ABBREVIATIONS

AMM	Aircraft Maintenance Manual
API	Application Programming Interface
ATA	Air Transportation Association
BITE	Built In Test Equipment
EASA	European Aviation Safety Agency
FAA	Federal Aviation Administration
ICA	Instructions For Continous Airworthiness
ICAO	International Civil Aviation Organization
KLIA	Kuala Lumpur International Airport
MRO	Maintenance, Repair And Overhaul
NLP	Natural Language Processing
PC	Personal Computer
SRM	Structure Repair Manual
UI	User Interface

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CHAPTER 1

INTRODUCTION

1.1 BACKGROUND OF STUDY

During our aviation studies, delving into the Aircraft Maintenance Manual (AMM) became an essential part of comprehending the practical intricacies of aircraft maintenance and repair. Early coursework introduced the significance of this manual in upholding aircraft safety and airworthiness standards.

Understanding the AMM became intertwined with learning about intricate aircraft systems, ranging from engines to avionics. It provided comprehensive insights into maintenance practices, including routine inspections, servicing procedures, and troubleshooting methods.

Emphasis was placed on how adherence to the AMM ensures compliance with stringent aviation regulations, aligning theoretical knowledge with practical application. Practical training sessions involved supervised utilization of the AMM, allowing for hands-on experience in simulated maintenance scenarios. Through this, students honed problem-solving skills and learned the importance of safety protocols and meticulous documentation outlined within the manual.

Understanding that each aircraft model has a unique AMM tailored to its specifications, I learned to navigateand apply varied AMMs as per the aircraft being maintained. Overall, studying the AMM was foundational in bridging theoretical concepts with real-world practices, preparing me for the meticulous tasks integral to aircraft maintenance in ensuring optimal safety and performance.

BOEING
737-300/400/500
AIRCRAFT MAINTENANCE MANUAL

CHAPTER 33
LIGHTS

Subject/Page	Date	COC	Subject/Page	Date	COC	Subject/Page	Date	COC
EFFECTIVE PAGES			33-11-80 (cont)			33-15-00 (cont)		
1 thru 4	Mar 25/2009		202	May 25/2008		502	May 25/2008	
33-CONTENTS			203	May 25/2008		503	May 25/2008	
1	May 25/2008		204	BLANK		504	BLANK	
2	May 25/2008		33-11-81			33-20-00		
3	May 25/2008		201	May 25/2008		1	May 25/2008	
4	Sep 25/2008		202	May 25/2008		2	May 25/2008	
5	May 25/2008		203	May 25/2008		3	May 25/2008	
6	May 25/2008		204	BLANK		4	BLANK	
7	Sep 25/2008		33-11-82			33-21-03		
8	Sep 25/2008		201	May 25/2008		1	May 25/2008	
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10	Sep 25/2008		203	May 25/2008		33-21-03		
11	Sep 25/2008		204	May 25/2008		201	May 25/2008	
12	Sep 25/2008		205	May 25/2008		202	BLANK	
O 13	Mar 25/2009		206	May 25/2008		33-21-03		
14	BLANK		207	May 25/2008		501	May 25/2008	
33-00-00			208	BLANK		502	May 25/2008	
1	May 25/2008		33-11-90			33-21-12		
2	BLANK		401	May 25/2008		201	May 25/2008	
33-11-00			402	May 25/2008		202	May 25/2008	
1	May 25/2008		33-15-00			203	May 25/2008	
2	May 25/2008		1	May 25/2008		204	May 25/2008	
3	May 25/2008		2	May 25/2008		205	May 25/2008	
4	May 25/2008		3	May 25/2008		206	BLANK	
5	May 25/2008		4	May 25/2008		33-21-22		
6	BLANK		5	May 25/2008		201	May 25/2008	
33-11-00			6	BLANK		202	May 25/2008	
101	May 25/2008		33-15-00			33-21-32		
102	May 25/2008		101	May 25/2008		201	May 25/2008	
103	May 25/2008		102	May 25/2008		202	May 25/2008	
104	BLANK		103	May 25/2008		203	May 25/2008	
33-11-71			104	BLANK		204	May 25/2008	
401	May 25/2008		33-15-00			205	May 25/2008	
402	May 25/2008		201	May 25/2008		206	May 25/2008	
403	May 25/2008		202	May 25/2008		207	May 25/2008	
404	BLANK		203	May 25/2008		208	May 25/2008	
33-11-80			204	BLANK		33-23-00		
201	May 25/2008		33-15-00			1	May 25/2008	
			501	May 25/2008		2	May 25/2008	

A = Added, R = Revised, D = Deleted, O = Overflow, C = Customer Originated Change

33-EFFECTIVE PAGES

Page 1
Mar 25/2009

D6-37583

BOEING PROPRIETARY - Copyright © Unpublished Work - See title page for details

FIGURE 1.1: AMM for BOEING 737-300/400/500 (CHAPTER 33 – LIGHTS)

Figure 1.1 shows Chapter 33 of the Boeing 737 Aircraft Maintenance Manual, covers various aspects related to lights on the aircraft, including exterior and interior lighting systems. This chapter provides detailed information on the installation, operation, and maintenance procedures for the lights used on the Boeing 737-300, 737-400, and 737-500 series aircraft.

Exterior lighting systems typically include navigation lights, anti-collision lights, landing lights, taxi lights, wing lights, and logo lights. These lights are crucial for ensuring the aircraft's visibility to other air traffic and ground personnel during all phases of flight. Maintenance procedures outlined in this chapter may include checks for proper functioning, bulb replacement, cleaning of lenses, and electrical system inspections to ensure continuous and reliable operation.

Chapter 33 also covers interior lighting systems, such as illumination in the cabin and cockpit. These lights improve crew vision and passenger comfort on night flights and in low light. To maintain a well-lit and secure cabin atmosphere, maintenance procedures for interior lighting may include changing out lightbulbs, checking control switches, and troubleshooting electrical connections.

All things considered, Chapter 33 of the Boeing 737 Aircraft Maintenance Manual provides a thorough reference for servicing the aircraft's numerous lighting systems while guaranteeing adherence to legalrequirements and operational safety standards.

1.2 PROBLEM STATEMENT

Firstly, the manual itself has limited resources. The number of hardcopies is limited, and it would be a challenge to face when there are too many personnel that require it than the manual itself. Not just that, it's also prone to damage, it can easily damage if exposed to water and oil.

Moreover because of the size that is too thick, it comes with another problem which is hard to carry. carrying a thick book of manual will be a hindrance for us when performing maintenance.

Aviation industry works in fast pace, it takes time to flip through the manual for new personnel and those that are in training when the work is tense. This problem can cause mistakes when working in such a rush.

Updates and revision management. Managing updates, revisions, and incorporating service bulletins into the manual poses a challenge. Keeping the manual current and ensuring all personnel have access to the latest information can be a logistical issue.

Finally, complexity and accessibility. AMMs can be intricate and extensive, posing challenges for technicians in finding specific information swiftly. Accessing crucial data within the manual might require extensive navigation, leading to delays in maintenance procedures.

1.3 PROJECT OBJECTIVES

1.3.1 General Project Objectives

The project objectives are:

- To provide easy accessibility on mobile phone with a voice generator

- To demonstrate an easy learning for upcoming students

- To develop student interest with easy and effective learning

- To introduce students with e-learning methods according to current trends.

- To evaluate user's satisfaction towards security features, comfort of using aircraft maintenance manual(AMM).

1.3.2   Specific Individual Project Objectives

1.3.2.1 Product Structure

The specific project objectives are:

- To develop an easy access of aircraft maintenance manual (AMM) documentation through voice generator
- To retrieve data history based on what task have personnel/students completed.
- To design an app that essential sections of the AMM are available for access even without an internetconnection to support maintenance in remote or low-connectivity areas.

1.3.2.2 Mechanical Mechanism

The specific project objectives are:

- To develop the capability that allows functions to be executed offline, enhancing accessibility in low-connectivity environments.
- To design an intuitive user interface that enables smooth transition and minimal user effort.
- Implement stringent data security measures to ensure compliance with privacy regulations and industry standards.

1.3.2.3 Electrical/Electronic Mechanism

The specific project objectives are:

- To ensure the app is compatible with various devices.
- To optimize the app to utilize the device's microphone effectively.
- To design an app with efficient voice processing algorithms to handle voice commands in real-time.

1.3.2.4 Accessories & Finishing

The specific project objectives are:

- To ensure that essential AMM sections and functionalities are available offline, minimizing reliance onconstant internet connectivity.
- To design an app that offers interactive tutorials, tooltips, or guided assistance within the app.

1.4 PURPOSE OF PRODUCT

The development of an application using a speech generator for document search accomplishes multiple important goals.

First off, it improves accessibility by accommodating users—like people with disabilities or multitaskers— who want or need hands-free engagement.

Second, it improves user experience by providing a quick and easy method of accessing documentation without requiring manual query typing. This can save users a lot of time and effort when navigating large or complicated documentation collections.

Furthermore, adding speech technology might improve the app's usability and appeal to a wider user base, including non-native speakers who might find it simpler to ask questions aloud. The app's overall goal is to maximize accessibility and usability so that users can easily and quickly locate the information they need within the documentation.

1.5 SCOPE OF PROJECT

1.5.1 General Project Scopes

The project scope for creating an Aircraft Maintenance Manual (AMM) within an app utilizing a voice generator encompasses a comprehensive set of objectives, functionalities, and deliverables. It involves developing a user-centric, technologically advanced platform that integrates voice recognititon and synthesis technologies with AMM content.

The scope includes designing an intuitive user interface enabling efficient navigation through voice commands, incorporating extensive AMM sections and procedures, and ensuring compatibility across various devices and operating systems.

The scope extends to rigorous testing, quality assurance checks, and the creation of engaging user experiences, aiming to produce an innovative, accessible, and efficient tool tailored for aircraft maintenance personnel.

1.5.2 Specific Individual Scope

1.5.2.1 Product Structure

First, this app is intended for industrial use based on aircraft maintenance manual (AMM) that already exists in the aviation field. The product documentation is would still be the same.

Other than industry, this app could work as source of reference for students when they perform their hands-on task. This will help them to find the operation of aircraft systems which consists of removal/installation and inspection of aircraft sections faster without getting it wrong.

1.5.2.2 Mechanical Mechanism

This app can only be used by approved personnel/technician/engineer and student to avoid it falling into the wrong hands and will be misuse that deviated from our main goal of creating this app.

Furthermore, we put a subscription to this app to ensure it won't be downloaded unintentionally. Moreover, aircraft maintenance manual (AMM) documentation is official and approved, we cannot alter it intentionally without approval.

1.5.2.3 Electrical/Electronic Mechanism

This app also comes with a voice activation button, we design an intuitive UI featuring a voice activation button or trigger that seamlessly integrates with the app's functionalities, enabling users to initiate voice commands effortlessly.

Then, it also has microphone accessibility. It will optimize the app to utilize the device's microphone effectively, capturing and processing voice commands with high clarity and accuracy.

1.5.2.4 Accessories & Finishing

This app also offers implement features to notify users of updates, new features, or improvements,encouraging user engagement and ensuring they benefit from the latest enhancements in the app**.**

Finally, it conducts rigorous testing and quality assurance checks to ensure the app's functionality, voice recognition accuracy, and overall performance across different devices and scenarios.

CHAPTER 2

LITERATURE REVIEW

2.1 GENERAL LITERATURE REVIEW

2.1.1 Aviation Industry in Malaysia

Malaysia is home to several major airports, including Kuala Lumpur International Airport (KLIA), which serves as a crucial aviation hub in Southeast Asia. The country hosts various airline operators, including Malaysia Airlines, AirAsia, and Malindo Air, offering domestic and international connectivity (*AM Bardai, 2017*).

Moreover, Malaysia has been actively developing its aerospace manufacturing sector, focusing on aircraft components, maintenance, repair, and overhaul (MRO) services. The country is a hub for aerospace manufacturing, with facilities involved in aircraft parts production and assembly (*SR Kamat, 2021*).

Furthermore, the nation has MRO facilities catering to both domestic and international aircraft maintenance needs. These facilities provide services ranging from routine maintenance to complex repairs for various types of aircraft.

Then, Malaysia offers aviation-related education and training programs, including pilot training, aircraft engineering, and aviation management courses. Several institutions provide internationally recognized certifications and degrees in aviation-related fields.

Ultimately, Malaysia has shown interest in adopting advanced aviation technologies, such as drones and digital solutions, to enhance operations, safety, and efficiency within the industry.

2.1.2 Demand in Aviation

Aviation authorities mandate strict adherence to maintenance procedures outlined in AMMs to ensure compliance with safety regulations (*S Dalkilic, 2017*). As regulations evolve, so do the manuals, necessitating updates and revisions.

With advancements in aviation technology, aircraft systems have become more complex. AMMs need to continually update and adapt to incorporate new technologies, systems, and best practices.

Aviation technicians and engineers rely on AMMs for training and reference purposes. As new professionals enter the field, the demand for these manuals persists to facilitate education and skill development.

2.1.3 Type of Manuals

Examples:
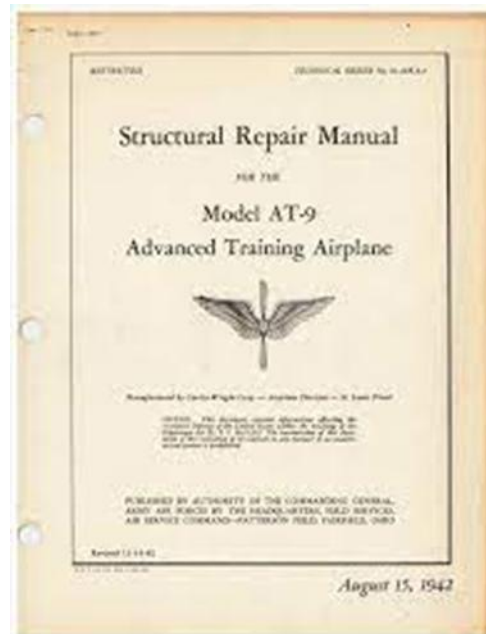
Figure 2.1: Structural Repair Manual for the AT-9 Advanced Training Airplane
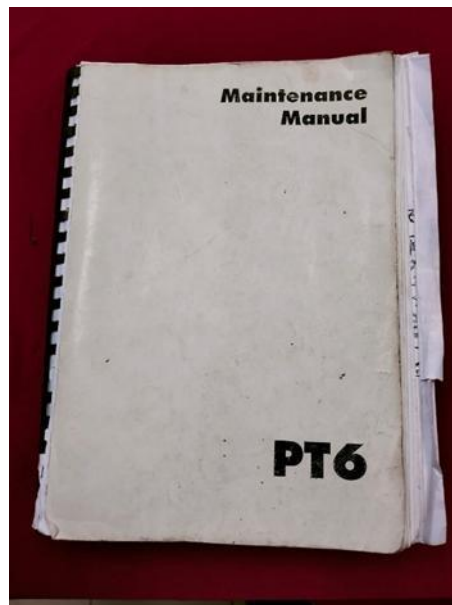
Figure 2.2: Aircraft maintenance manual (AMM) specialized for PT6 engine.

Figure 2.3: Airbus A320 Aircraft Operation Manual

2.1.4 Evolution of Aircraft Maintenance Manual (AMM)

Initially, aircraft maintenance guidelines were relatively basic and often relied on individual mechanics' experience (*BR Aubin, 2004*). As aviation grew, simple manuals were created, outlining basic maintenance procedures and practices.

With the growth of commercial aviation, regulatory bodies like the FAA (Federal Aviation Administration) introduced stringent safety standards. These regulations necessitated more comprehensive and standardized manuals to ensure compliance.

As aircraft became more complex with the introduction of jet engines, advanced avionics, and computerized systems, AMMs evolved to incorporate detailed instructions for these sophisticated systems. Manuals expanded to cover a broader range of systems and components.

2.1.5 Aircraft Maintenance Manual Specification

Introduction. Overview of the manual, including its purpose, scope, and how to use it. This section often includes a table of contents for easy navigation.

General Information. Details about the aircraft, its systems, configurations, and specifications. This section might include aircraft description, limitations, and performance data.

Maintenance Procedures. This is one of the most extensive sections, providing step-by-step instructions for performing maintenance tasks. It covers various systems and components, outlining procedures for inspection, repair, replacement, adjustment, and testing.

Safety Information. Essential safety precautions and guidelines to ensure that maintenance activities are conducted safely.

2.2 SPECIFIFC LITERATURE REVIEW

2.2.1 Product Structure

The Aircraft Maintenance Manual (AMM) is a manual developed by the manufacturer that provides detailed technical maintenance instructions for a specific type of aircraft and engines (*BR Aubin, 2004*). The AMM contains the instructions for the on-aircraft maintenance necessary to ensure the continued airworthiness of the aircraft.

The content of the Aircraft Maintenance Manual (AMM) is part of the Instructions for Continued Airworthiness (ICA) that the Type Certificate Holder is required to provide and maintain (*P Samaranayake, 2012*). The AMM contains information required to replace, adjust, inspect and check equipment and systems on the aircraft.

The AMM also contains information about inspections and maintenance of aircraft structures. However, repair of structure is contained in the Structural Repair Manual (SRM).

2.2.1.1 Adaptation of Aircraft Maintenance Manuals

During the early aviation era, aircraft were relatively simple, and maintenance procedures were often informal and based on the experience of mechanics. As aviation technology advances, there's a need for more structured maintenance guidelines to ensure the safety and airworthiness of aircraft (*MW Suckow, 2005*). With the end of World War II, post war standardization of the aviation industry experienced rapid growth in both civil and military sectors.

The standardization efforts led to the establishment of structured maintenance manuals that adhered to industry-wide guidelines and regulations. International organizations and aviation authorities help played a major role in shaping the format and content of these manuals (*M Tsakalerou, 2022*).

As aviation became increasingly globalized, the need for standardized procedures across international borders became apparent. Organizations like the International Civil Aviation Organization (ICAO) and the European Aviation Safety Agency (EASA) have played a key role in harmonizing maintenance documentation standards (D Mackenzie, 2010).

Figure 2.4: International Civil Aviation Organization Logo

Figure 2.5: European Aviation Safety Agency Logo

2.2.1.2 AMM Evolution in Technological Advancements

In 1969, Boeing not only introduced the first 747 airplane but also provided new methods for maintenance. They started applying the "bottom up" approach in place of trial and error (*DR Vieira, 2016*). This provided technicians with an efficient way to assess their systems and identify the broken parts. But unlike modern digital systems of today, technicians worked with mechanical and analog systems during the 1980s (*R Szczepanik, 2006*).

Beginning in the 1960s, aircraft were beginning to be equipped with BITE (built-in test equipment).Unfortunately, BITE could only use the system's specified indicators, which did not account for every potential problem (*JR Perkins, 1977*).

This meant that there was still a chance that technicians might swap out the correct equipment while the malfunctioning pieces were still there. Airlines were able to save money by implementing regular maintenance and Power-by-the-Hour, that replaces just essential parts and left functioning components alone (*H Saranga, 2006*). Improved safety standards were also aided by scheduled maintenance.

With all the advances in technology there has also been an advancement in safety, not only for passengers and crew but also those on the ground. Everything in the aviation industry is highly regulated, with standards and policies set by the government.

The biggest change, however, is now technicians are taking preventative measures. They are no longer trying to fix problems as they arise, they are trying to prevent them from happening in the first place. Although this scheduled maintenance began almost 60 years ago, it has been fine-tuned since with government regulations leading the way (*S Weerasekera, 2020*).

Today, maintenance checks occur after:

- A certain number of hours flown.

- Days since last check

- A certain number of trips flown.

- Or a combination of all three of these factors

After these maintenance checks are carried out, a licensed technician must record and sign off on all repairs made.

2.2.1.3 AMM Key Breakthrough and Standardization

The standardization of Aircraft Maintenance Manuals (AMMs) within the aviation industry has been a crucial process to ensure uniformity, safety, and efficiency in aircraft maintenance practices.

The International Civil Aviation Organization (ICAO) established Annex 6 (Part I) - Operation of Aircraft, which outlines international standards and recommended practices for the operation of aircraft. This document sets the foundation for the standardization of maintenance practices, including the creation of maintenance manuals.

The Air Transport Association (ATA) introduced the ATA 100 Specification, which provided a common numbering system for aircraft documentation, including AMMs. This standardized approach facilitated the organization and retrieval of information across different aircraft types.

ICAO Doc 9379 - Manual of Procedures for Operations Inspection, Certification and Continued Surveillance provided guidelines for the preparation and content of maintenance manuals, contributing to the standardization of documentation across international aviation operations (*E Agustini, 2021*).

The European Aviation Safety Agency (EASA) introduced Part-M, outlining requirements for the continuingairworthiness of aircraft. This regulation standardized maintenance processes, including the documentation provided in AMMs, within the European Union.

These key milestones represent a progression toward standardized, international practices in the development and use of Aircraft Maintenance Manuals, contributing to the safety, reliability, and efficiency of aircraft maintenance operations worldwide.

Chap.	Subject	Chap.	Subject
00	Air Vehicle General	51	Standard Practices – Structures
04	Airworthiness Limitations	52	Doors
05	Time Limits/Maintenance Checks	53	Fuselage
06	Dimensions and Areas	54	Nacelles and Pylons
07	Lifting, Shoring, Recovering and Transporting	55	Stabilizers
08	Levelling and Weighing	56	Windows and Canopies
09	Handling and Taxiing	57	Wings
10	Parking and Mooring	60	Standard Practices – Propeller or Rotor
11	Placards and Markings	61	Propellers and Propulsors
12	Servicing	62	Main Rotors
14	Air Vehicle Loading and Offloading	63	Main Rotor Drives
15	Aircrew Information	64	Tail Rotor
16	Change of Role	65	Tail Rotor Drive
18	Vibration and Noise Analysis and Attenuation	66	Folding Blades and Pylon
20	Standard Practices – Airframe Systems	67	Rotors Flight Control
21	Environmental Control	70	Standard Practices – Engine
22	Auto Flight	71	Power Plant
23	Communications	72	Engine
24	Electrical Power	72	Engine turbine/turboprop – Ducted fan/Unducted fan
25	Equipment and Furnishings	72	Engine Reciprocating
26	Fire Protection	73	Engine Fuel and Control
27	Flight Controls	74	Ignition
28	Fuel	75	Air
29	Hydraulic Power	76	Engine Controls
30	Ice and Rain Protection	77	Engine Indicating
31	Indicating and Recording Systems	78	Exhaust
32	Landing Gear	79	Oil
33	Lights	80	Starting
34	Navigation	81	Turbines
35	Oxygen	82	Water Injection
36	Pneumatic	83	Accessory Gearboxes
37	Vacuum	84	Propulsion Augmentation
38	Water and Waste	91	Charts and Diagrams
41	Water Ballast	93	Surveillance
43	Tactical Communications	94	Weapons Systems
45	Central Maintenance System (CMS)	95	Crew Escape and Safety
46	Systems Integration and Display	96	Missiles, Drones and Telemetry
47	Liquid Nitrogen	97	Image Recording
48	In-Flight Refuelling Tanker	98	Meteorological and Atmospheric Research
49	Airborne Auxiliary Power		

Figure 2.6: ATA 100 Specification

2.2.1.4 The Role of AMM in Aviation Safety

While direct case studies specifically highlighting the role of Aircraft Maintenance Manuals (AMMs) in preventing accidents may be limited, incidents and accidents in aviation history often underscore the importance of comprehensive maintenance documentation and adherence to prescribed procedures.

The investigation into the crash of American Airlines Flight 191 revealed that maintenance errors, specifically related to engine maintenance procedures, played a significant role (*ME Vatz, 2004*). The incident emphasized the importance of thorough and accurate documentation in AMMs to prevent human errors during maintenance tasks.

American Airlines Flight 191 was a regularly scheduled domestic passenger flight in the United States from O'Hare International Airport in Chicago, Illinois, to Los Angeles International Airport in California.

On the afternoon of May 25, 1979, the McDonnell Douglas DC-10 operating this flight was taking off from runway 32R at O'Hare when its left engine detached from the wing, causing a loss of control, and the aircraftcrashed less than one mile (1.6 km) from the end of the runway (*DJ Porter, 2020*). All 258 passengers and 13 crew on board were killed, along with two people on the ground. With 273 fatalities, it is the deadliest aviation accident to have occurred in the United States.

The National Transportation Safety Board determines that the probable cause of this accident was the asymmetrical stall and the ensuing roll of the aircraft because of the uncommand retraction of the leftwing outboard leading-edge slats and the loss of stall warning and slat disagreement indication systems resulting from maintenance-induced damage leading to the separation of the No. 1 engine and pylon assembly at a critical point during take-off (*DJ Porter, 2020*). The separation resulted from damage caused by impropermaintenance procedures, which led to the failure of the pylon structure.

Figure 2.7: American Airlines Flight 191

In this case, the role of AMMs indirectly influenced aviation safety by emphasizing the importance of accurate, up-to-date, and easily understandable documentation. While AMMs themselves may not be the direct cause or solution in accidents, their influence on maintenance practices, procedures, and human factors contributes to overall aviation safety.

2.2.1.5 AMM Structural Organization

The structure and organization of an Aircraft Maintenance Manual (AMM) are crucial for ensuring that maintenance personnel can efficiently access and utilize the information necessary for the safe and effective maintenance of an aircraft.

The AMM is typically designed to be user-friendly, with clear headings, subheadings, and cross-references to facilitate easy navigation. The goal is to provide maintenance personnel with a comprehensive guide that supports efficient and accurate aircraft maintenance. Standardization of AMM structure is often influenced by industry guidelines and regulations to ensure consistency and compliance.

2.2.1.6 Clear and Concise Documentation

Clear and concise documentation in Aircraft Maintenance Manuals (AMMs) is of the highest importance for several reasons, ultimately contributing to the safe and efficient maintenance of aircraft. The comprehension simplicity of documentation directly impacts the effectiveness of maintenance personnel.

Clear and concise language also helps prevent misinterpretation of instructions. Unclear statements can lead to errors in maintenance procedures, potentially compromising the safety and airworthiness of the aircraft. Clear documentation ensures that individuals with different levels of expertise can understand and follow procedures accurately.

In troubleshooting scenarios, concise documentation allows maintenance personnel to quickly identify and address issues. Efficient problem-solving is crucial to minimizing aircraft downtime and ensuring timely operational readiness.

New technicians and personnel undergoing training rely on clear documentation to grasp procedures and bestpractices. Well-documented procedures facilitate effective onboarding and training programs, ensuring that new team members can contribute quickly and confidently.

Aircraft are also required to undergo maintenance at different locations. Clear documentation promotes consistency in procedures, preventing discrepancies between different maintenance teams and locations.

In critical situations, such as emergency procedures, clear and concise instructions are vital. Maintenance personnel must be able to quickly and accurately implement emergency protocols to ensure the safety of the aircraft and its occupants.

In summary, the importance of clear and concise documentation in AMMs cannot be overstated. It is a fundamental element that supports safety, operational efficiency, and the overall effectiveness of maintenance practices in the aviation industry. Clarity in documentation is an investment in the well-being ofaircraft and passengers.

2.2.1.7 Maintenance Procedures and Inspections

An in-depth analysis of the maintenance procedures outlined in Aircraft Maintenance Manuals (AMMs) reveals a comprehensive and meticulously structured framework that serves as the backbone of aircraft maintenance operations.

The analysis encompasses a detailed examination of each maintenance procedure, delving into the specificity of tasks, step-by-step instructions, and the incorporation of safety measures. Each procedure is meticulously crafted to address various aspects of the aircraft's systems, components, and structures, ranging from routine checks and preventive maintenance to intricate troubleshooting scenarios.

Maintenance procedures within the AMM are characterized by a structured approach, often beginning with comprehensive pre-task preparations, including safety precautions, equipment requirements, and any prerequisites necessary for the successful execution of the task.

Clear identification and categorization of maintenance tasks according to their complexity, criticality, and frequency are evident, allowing maintenance personnel to prioritize and execute tasks with a strategic understanding of their impact on overall aircraft performance (*N Papakostas, 2010*).

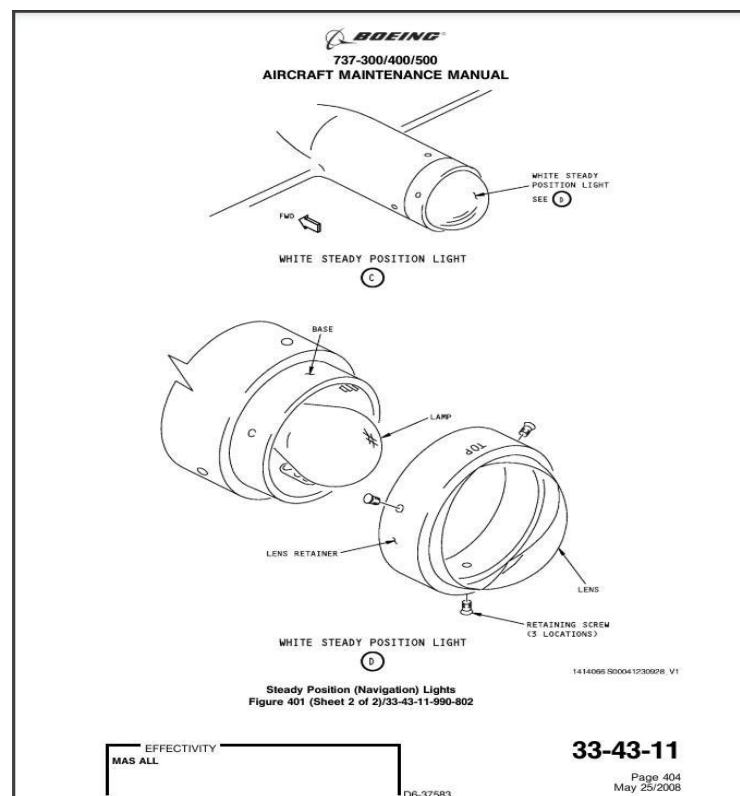Below is an example of Boeing 737 White Steady Position Light Removal / Installation:

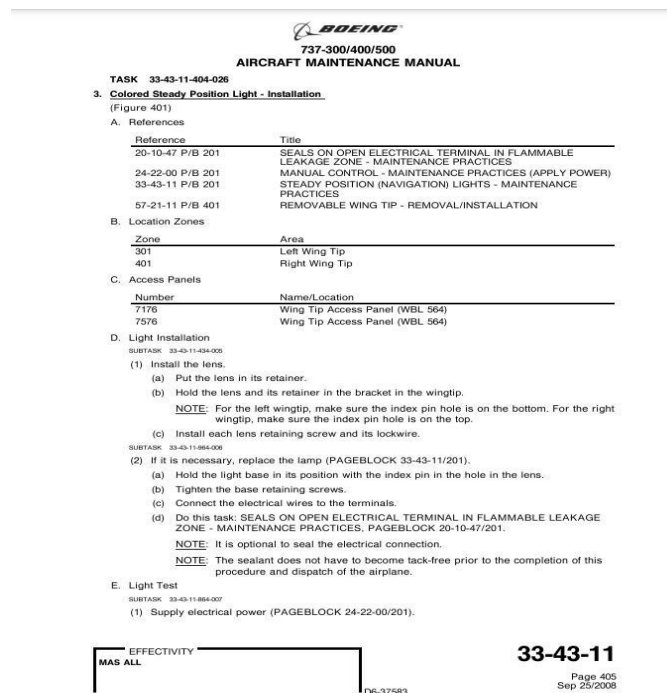Figure 2.8: Boeing 737 White Steady Position Light Assemblies

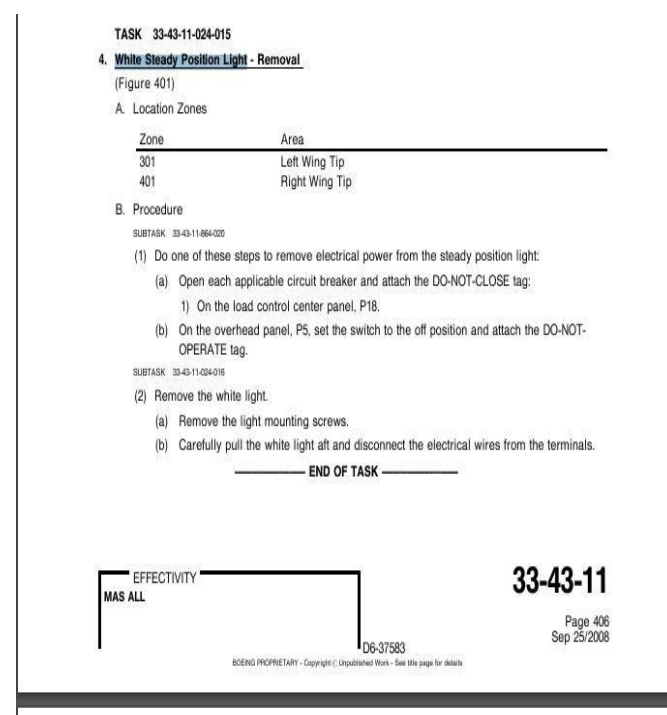Figure 2.9: Boeing 737 Colored Steady Position Light Installation

Figure 2.10: Boeing 737 White Steady Position Light Removal

TASK   33-43-11-424-017

5. **White Steady Position Light - Installation**

   (Figure 401)

   A. References

Reference	Title
24-22-00 P/B 201	MANUAL CONTROL - MAINTENANCE PRACTICES (APPLY POWER)
33-43-11 P/B 201	STEADY POSITION (NAVIGATION) LIGHTS - MAINTENANCE PRACTICES

   B. Consumable Materials

Reference	Description	Specification
A00247	Sealant - Pressure And Environmental - Chromate Type	BMS 5-95

   C. Location Zones

Zone	Area
301	Left Wing Tip
401	Right Wing Tip

   D. Light Installation

   SUBTASK   33-43-11-864-022

   (1) If it is necessary, replace the lamp (PAGEBLOCK 33-43-11/201).

   SUBTASK   33-43-11-424-018

   (2) Install the white light.

   (a) Connect the electrical wires to the terminals.

   WARNING: MAKE SURE YOU USE THE COMPOUND TO SEAL EACH BARE ELECTRICAL CONNECTION NEAR THE LIGHT. THIS WILL PREVENT AN EXPLOSION OF THE FUEL FUMES. AN EXPLOSION CAN CAUSE INJURY TO PERSONS AND DAMAGE TO EQUIPMENT.

   (b) Apply a layer of sealant, A00247 on the electrical terminals.

   (c) Push the light into the tube.

   NOTE: Make sure the TOP mark on the lens retainer is up.

   (d) Install the mounting screws.

   E. Light Test

   SUBTASK   33-43-11-864-013

   (1) Supply electrical power (PAGEBLOCK 24-22-00/201).

   SUBTASK   33-43-11-864-012

   (2) Remove each DO-NOT-CLOSE or DO-NOT-OPERATE tag.

   (a) Close each circuit breaker that was opened when the light was removed.

   SUBTASK   33-43-11-864-014

   (3) Set the switch to the on position.

   (a) Make sure the new lamp comes on correctly.

EFFECTIVITY
MAS ALL

33-43-11

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Figure 2.11: Boeing 737 White Steady Position Light Installation

2.2.2 Product Mechanism

Our product (Voice Em Manual) improvises the latest version of Aircraft Maintenance Manual (AMM) by integrating it into an application. This application can be navigated through voice and speech search to find information from the currently certified AMM. The product flow will be explained below accompanied by a series of pictures.
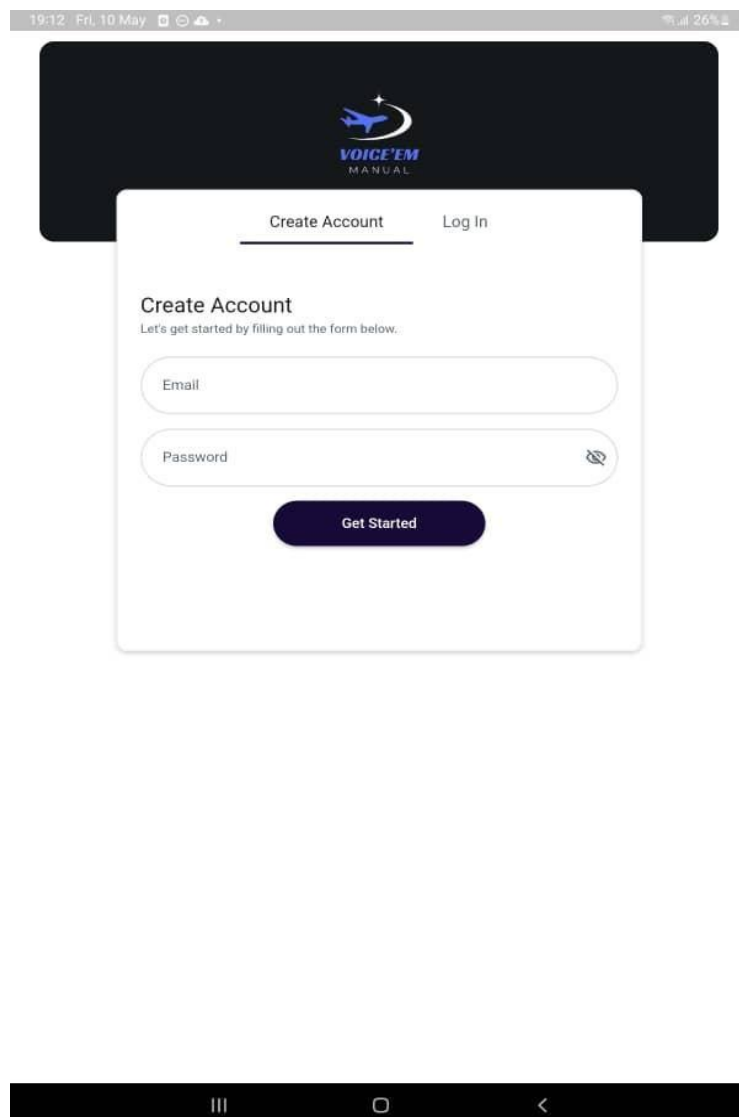

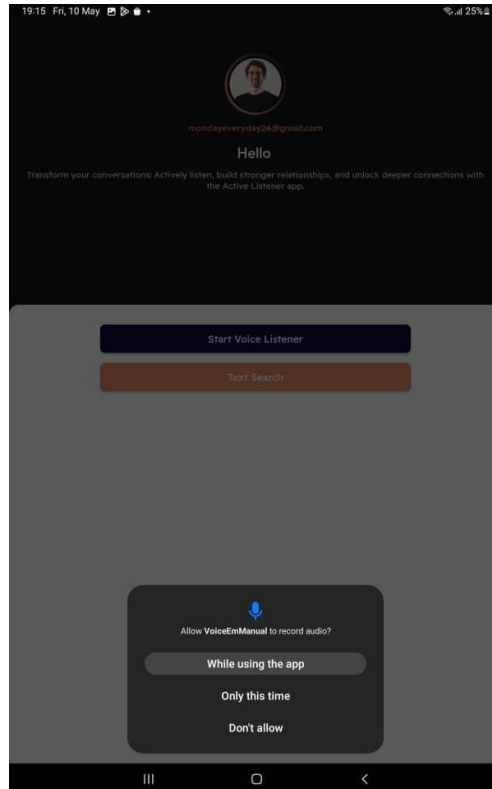Figure 2.12: Users can create their own account or log in to an existing one.

Figure 2.13: Users must allow access to the app for the voice navigation
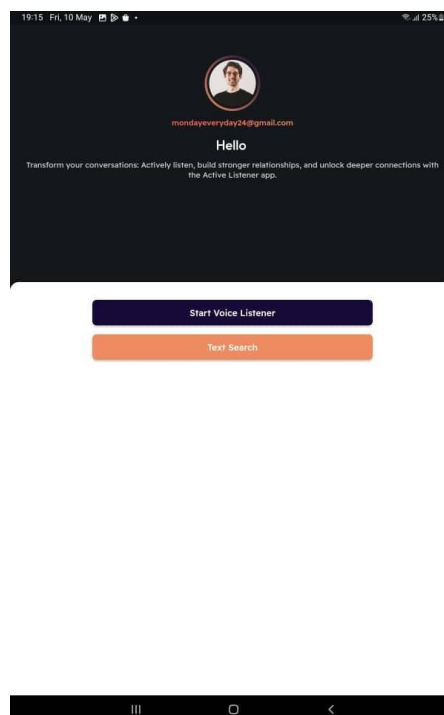to function.

Figure 2.14: Users will be given choices to use Voice navigation through the

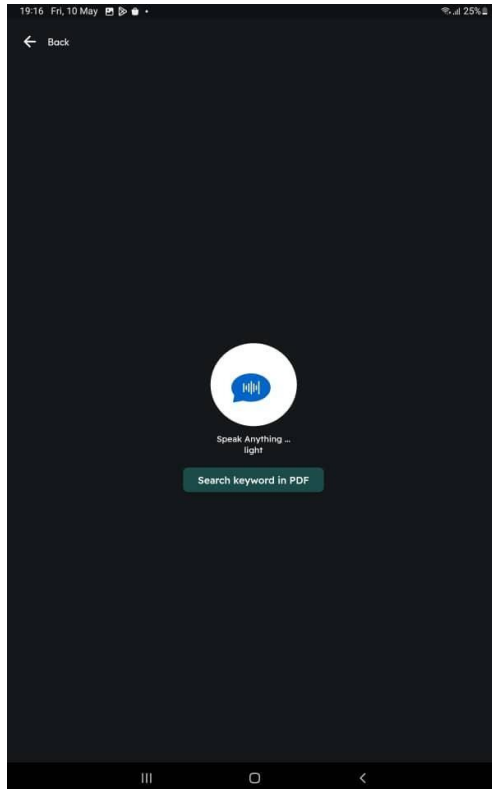manual or a simple text search.

Figure 2.15: Voice navigation search
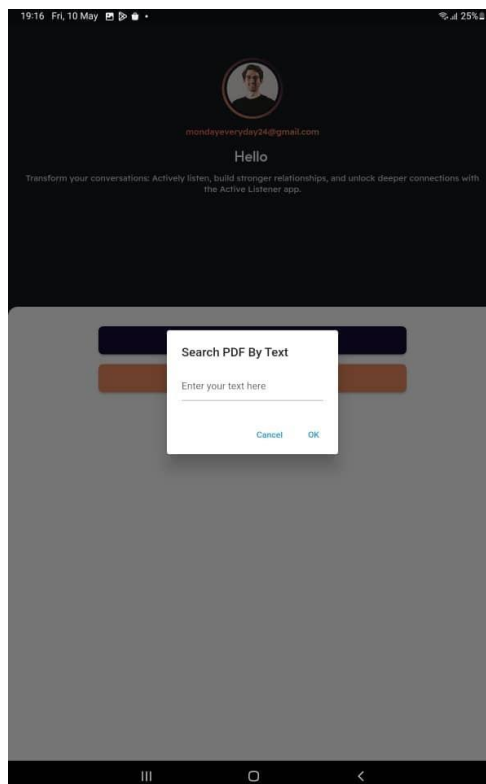
Figure 2.16: Text search.

2.2.3 Software/Programming

2.2.3.1 Type of software used for the app.

We explored the integration of Visual Studio Code (VSCode) into our app as a primary software tool within the context of application development. With the rapid evolution of technology and the increasing complexity of software projects, we seek efficient solutions to streamline our workflows. VSCode, known for its lightweight yet powerful features and easier for our team members to use compared to others, emergesas a compelling choice for modern software development.

By customizing VSCode according to project requirements, we can optimize their development experience and enhance productivity across various application development scenarios. Our attention was caught when VSCode provides mobile app development which aligned with our goal to develop a mobile app.

For mobile app development, developers can utilize frameworks like React Native, Flutter, or Xamarin. VSCode offers extensions specifically designed for these frameworks, providing syntax highlighting, code completion, debugging, and project scaffolding capabilities. VSCode extensions often come with built-in support for emulators or simulators, allowing developers to run and debug mobile applications directly from the IDE.

For native mobile development (e.g., Android with Java/Kotlin or iOS with Swift/Objective-C), VSCode can be configured with relevant language support extensions and integrated with native development tools such as Android Studio or Xcode for building and debugging. These are the conclusions of our research findings of the software.
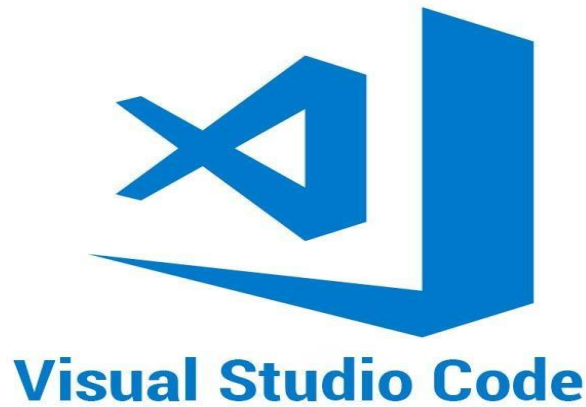
Figure 2.17: VSCode Logo

2.2.3.2 Types of programming language and plugin

The programming language that has been used is Flutter and Dart mainly because of the voice navigation search plugin that has been prepared by Flutter. Flutter is also an appealing option for developers since it allows them to create code once and distribute it across platforms, such as iOS, Android, web, and desktop, decreasing development time (*ML Napoli, 2019*). Its feature enables fast development by instantly reflecting code changes in the running program without losing state, allowing rapid UI tweaks, bug repairs, and feature experimentation.

Furthermore, Flutter's extensive library of pre-built UI components, known as widgets, enables the development of visually appealing and highly engaging user interfaces that are consistent with an app's branding and user experience needs. Its architecture is built for excellent performance (*ML Napoli, 2019*). It contains a rendering engine that directly draws UI elements on the screen, resulting in smooth animations and consistent performance across different devices and platforms.

Flutter also easily connects with platform-specific APIs and native capabilities via its plugin system, giving us easy access to device hardware, sensors, location services, and more. Furthermore, its fast-increasing ecosystem of libraries, packages, and plugins, such as the voice navigation system, together with a dynamic community of developers, designers, and fans, assures continual support and resources for building complex and feature-rich applications (*A Biessek, 2019*).

Dart however contains advantages such as its single language for frontend and backend, efficient performance, strong typing, most importantly seamless integration with Flutter, developer-friendly productivity features, and backing by Google, making it an ideal choice for building modern applications.
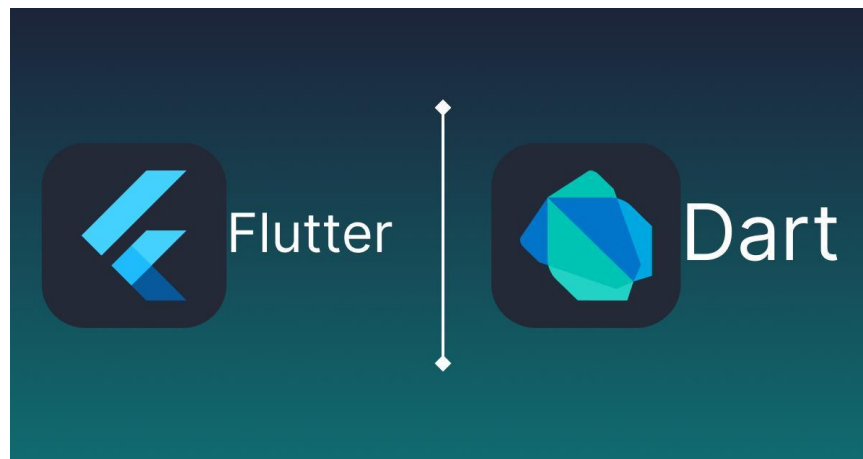
Figure 2.18: Flutter and Dart Logo
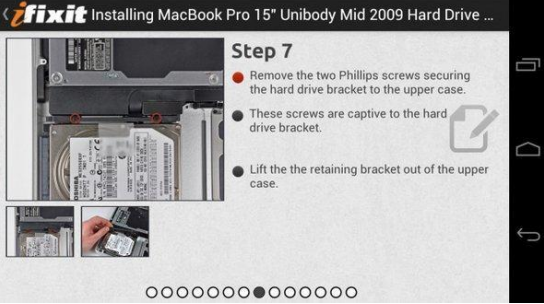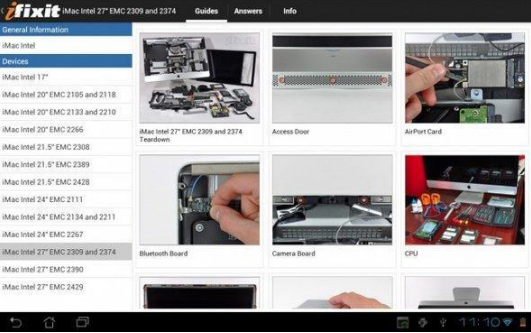
2.3 REVIEW OF RECENT RESEARCH /RELATED PRODUCTS
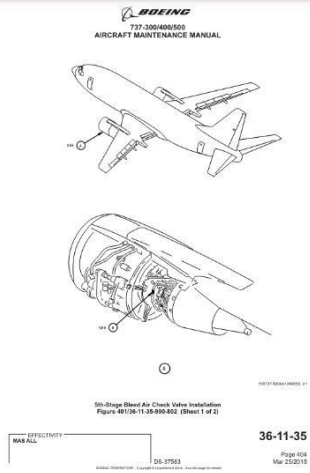
2.3.1 Related Patented Products

No.	Patented Products	Patent Summary
1.		**Patent Title:** Voice interface to a social networking service. **Patent No.:** US10078489B2 **Published Date:** 2018-09-18. **Patent Office Country:** United States **Inventors:** Ashvin Kannan **Abstract:** A machine can create a voice-user interface for a social networking service, allowing users to access member profile information for other users. This allows users to request specific information about a second member by speaking a natural language command or requesting an aural response. Additionally, users can record audio notes to be assigned to their own or the second member's profile, which can then be played back using the voice-user interface. This allows users to access and manage their profile information effectively.

Table 2.1: Related Patented Products

2.3.2 Recent Market Products

No.	Marketed Product	Product Summary
1.		**Product Name: iFixit:** RepairManual **Published Date:** 2003 **Inventors:** Kyle Wiens andLuke Soules **Description:** iFixit is a community-driven platform that offers free repair guides fora vast array of electronic devices. The Repair Manual includes step-by-step instructions, photos, and community-contributed contentto help users troubleshoot and repair various gadgets. The platform encourages a do-it- yourself (DIY) approach to fixing devices, promoting sustainability and reducing electronic waste.

| 2. | | **Product Name:** MaintenanceManual Boeing 737-400 **Published Date:** 1967 **Inventors:** Boeing **Description:** The maintenance handbook for the Boeing 737-400 provides comprehensive instructions for examining, maintaining, and troubleshooting every aspect of the aircraft, ensuring safety and airworthiness. It covers complex systems like hydraulics, electricals, and structural elements. This handbook is crucial for maintenance staff, providing step-by-step instructions, troubleshooting advice, and reference resources to ensure the aircraft runs effectively and reliably throughout its service life. |

3.	shutterstock.com · 1594326778	**Product Name:** Fixya **Published Date:** 2005 **Inventors:** Yaniv Bensadon **Description:** Fixya operates as a community-driven question and answer platform where users can ask for advice and solutions to problems they encounter with various products. The platform covers awide range of categories, including electronics, appliances, cars, computers, and more. Users can post questions, and the Fixya community, which includes experts and experienced users, provides answers and solutions.

<div align="center">Table 2.2: Recent Market Product</div>

2.4 COMPARISON BETWEEN RECENT RESEARCH AND CURRENT PROJECT
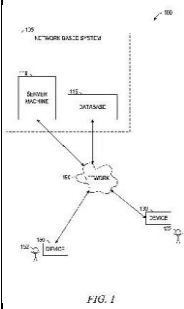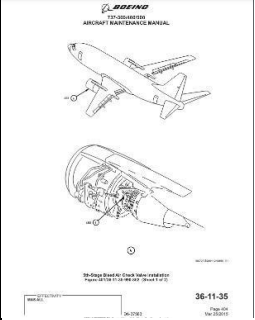
Product	Voice interface for social networking service	Voice`em Manual	Maintenance Manual PT 6
Appearance			
Purpose	To access member profileinformation for other members by voice command	To provide the users with hands free operation and avoid time consuming	To guide and instruct technicians on how to properly maintain, inspect, and repair an aircraft for safety and optimal performance.
Portability	Can be physically carriedbut not as portable as digital alternatives	Highly portable on tablets or smartphones	Potentially highly portable
Accessibility	Limited search capabilities	Easily accessible on mobile devices	May unfamiliar for new user
Dependency	No dependency on poweror electronic devices	Dependency on battery life and device functionality	Dependency on device functionality
Updates	Updates are time-consuming and may not be in real-time	Real-time updates	Not real-time updates

Table 2.3: Comparison between recent research and current research project

CHAPTER 3

RESEARCH METHODOLOGY

3.1 PROJECT BRIEFING & RISK ASSESSMENT

This chapter will go over the many actions that were taken to successfully complete the experiment's tasks and objectives. These included completing the necessary paperwork and getting approval from the supervisor. The Voice'Em Manual mobile application project uses voice recognition technology to improve the accuracy and efficiency of navigating Aircraft Maintenance Manuals (AMMs). The project's objectives are to construct a reliable voice recognition system, incorporate an extensive AMM database, and design an easy-to-use user interface. Multi-language support, fast information retrieval, and hands-free navigation are important characteristics. Targeted mitigation strategies, such as advanced noise-cancellation algorithms, user-centered design, rigorous testing, strong security measures, regulatory engagement, and continuous innovation, address potential risks such as accuracy of voice recognition, data integration challenges, user interface complexity, technical failures, user acceptance, security concerns, and market competition. By addressing these issues, the project hopes to give maintenance staff a dependable and easy-to-use tool, which will ultimately improve operational effectiveness and safety.

3.2 OVERALL PROJECT GANTT CHART
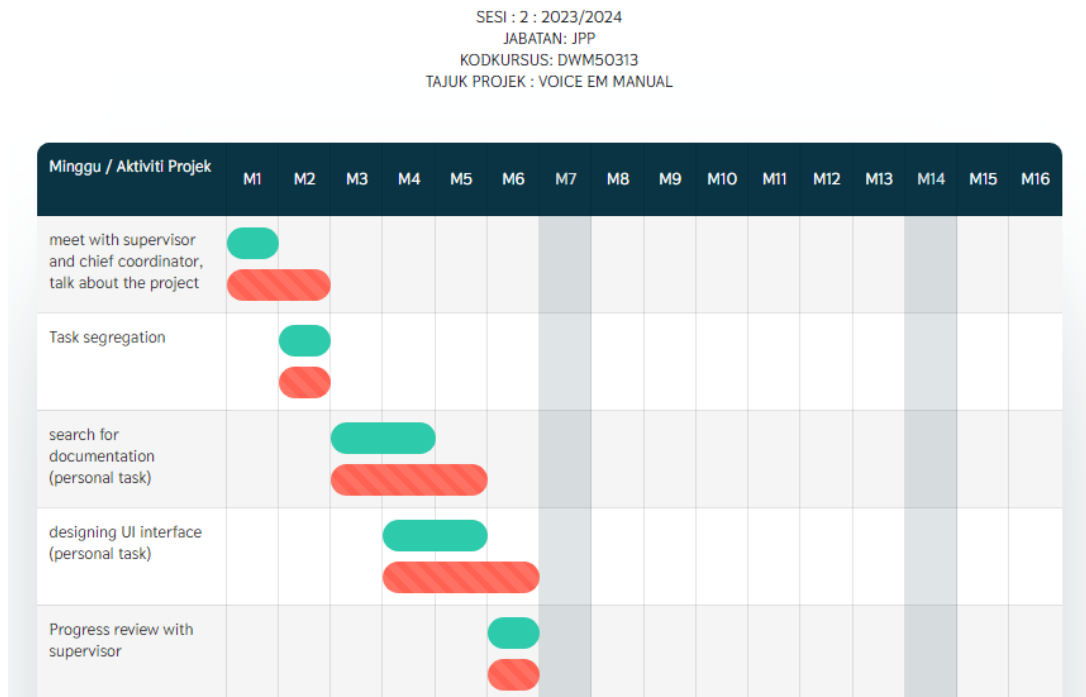
Figure 3.1: A Gantt Chart for Voice'Em Manual
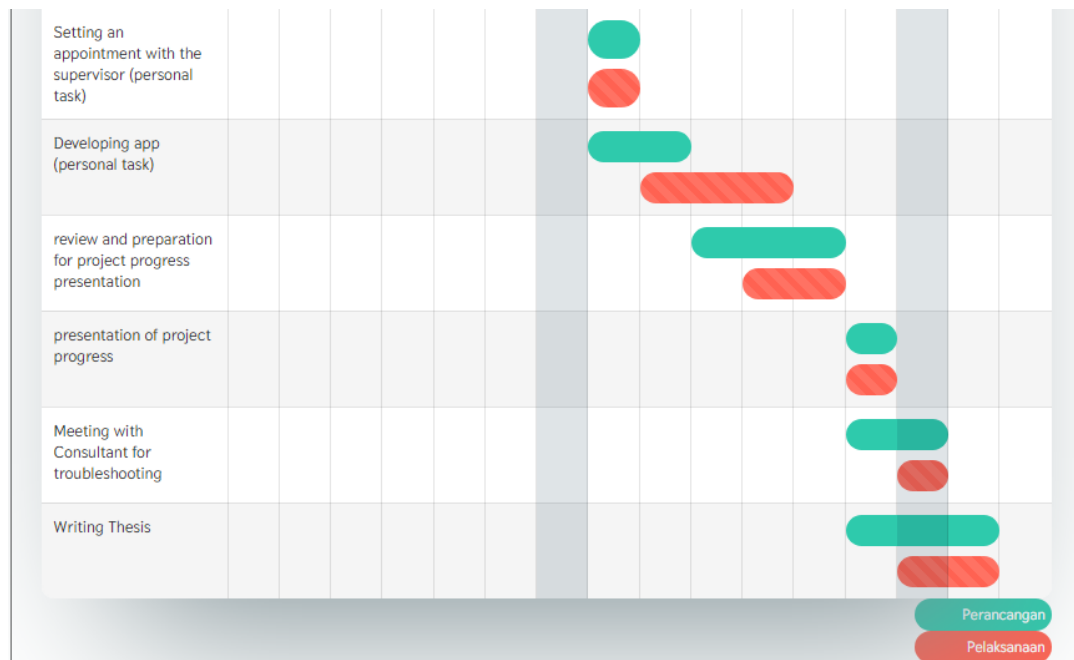
Figure 3.2: A Gantt Chart for Voice'Em Manual

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3.3 PROJECT FLOW CHART

3.3.1 Overall Project Flow Chart
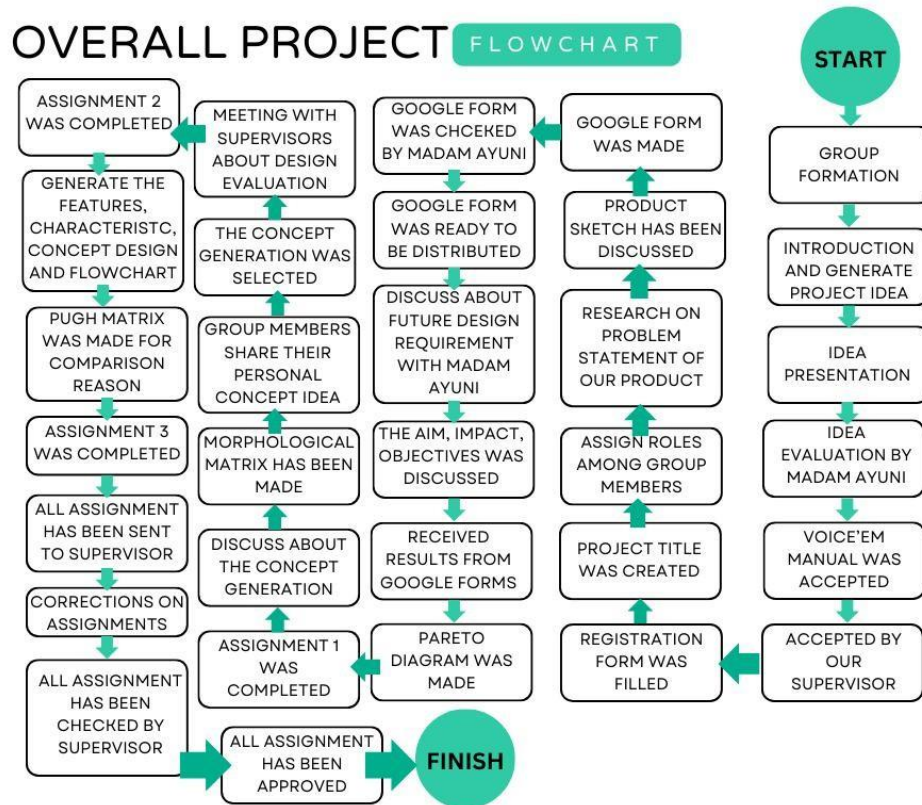
Figure 3.3: Overall Project Flow Chart

3.3.2 Specific Project Design Flow

3.3.2.1 Product Mechanisms
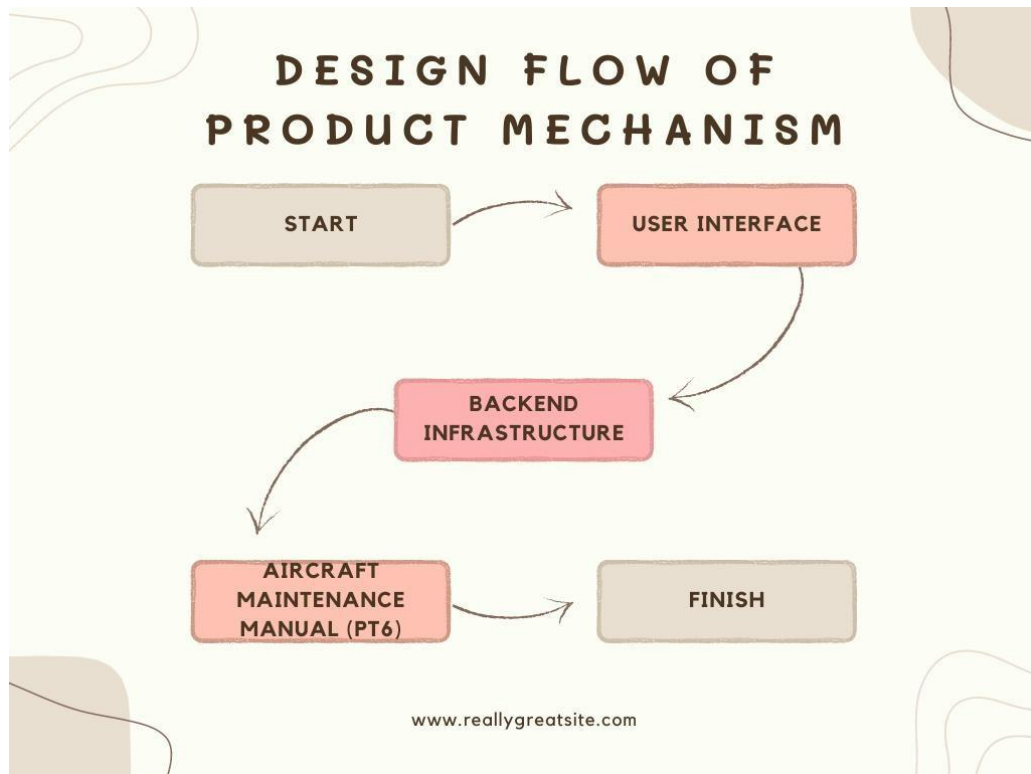
Figure 3.4: Design Flow of Product Mechanism

3.3.2.2 Software/Programming
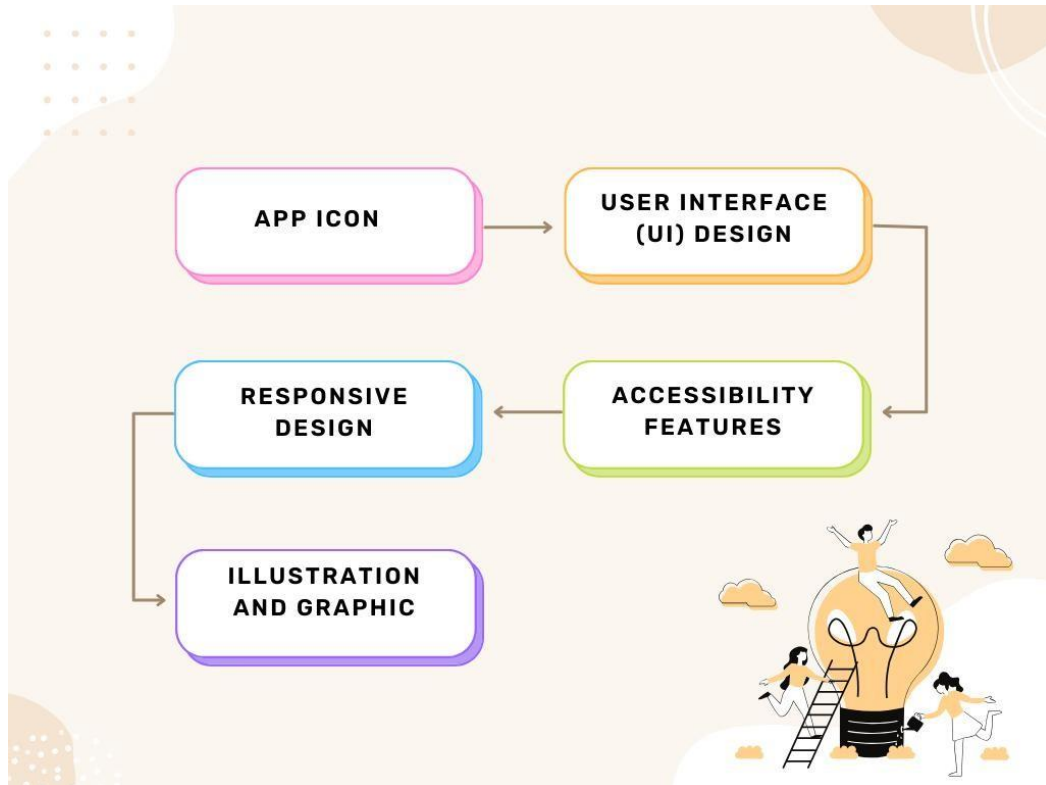
Figure 3.5: Design Flow of Software/Programming

3.4 DESIGN ENGINEERING TOOLS

3.4.1 Design Requirement Analysis

3.4.1.1 Questionary Survey

As a form of collecting data, a questionnaire is handed out. A questionnaire is a research tool that consists of a series of questions designed to elicit information from respondents via survey or statistical analysis. A research questionnaire is often composed of both closed-ended and open-ended items.
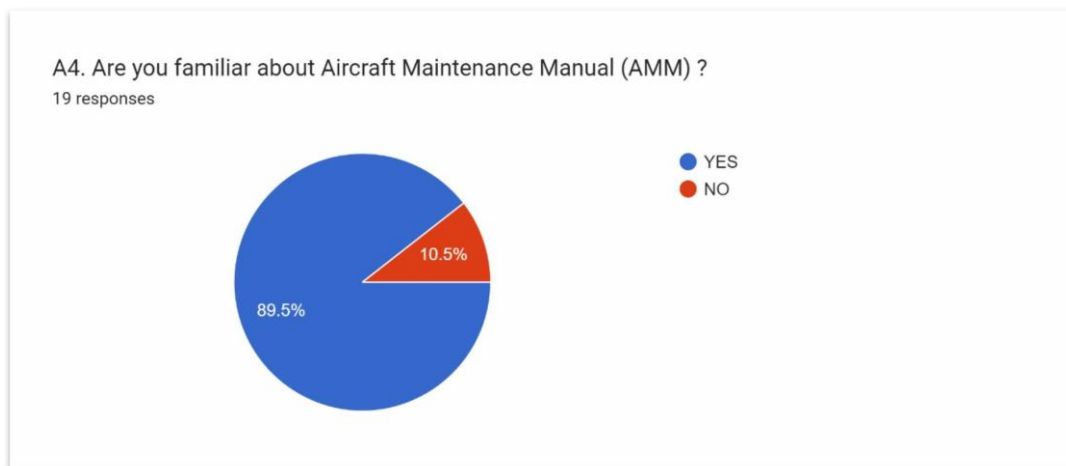
Figure 3.6: Pie chart results from survey

Figure 3.4.1.1.1 above is an example data from our questionnaire by using google form. A majority of our respondents are familiar with the Aircraft Maintenance Manual (AMM). This result is crucial asit shows how important AMM is to the industry and those who are involved in it.
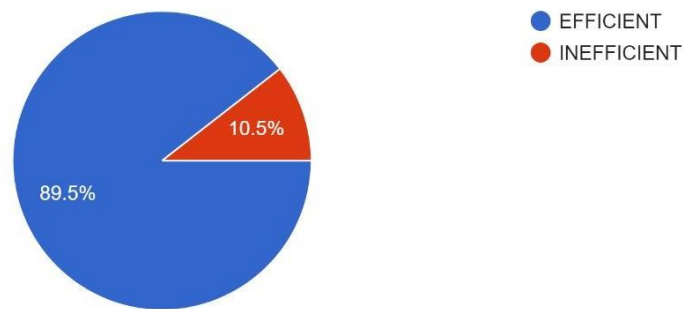
Figure 3.7: Pie chart results from survey.

Figure 3.4.1.1.2 above is an example data from the user's experience. Most of our respondents agree that AMM would be effective if it came into mobile apps. This result indicates the need for an efficient AMM to be used in industry.

C2. If yes, what type of difficulties have you experience ?
19 responses
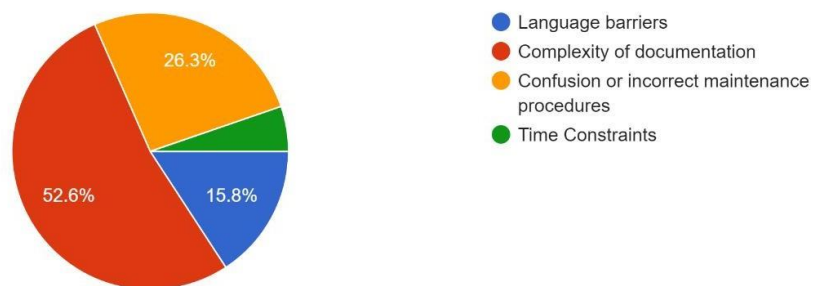
Figure 3.8: Pie chart results from survey.

Based on our survey, as shown in Figure 3.1.1.3, half of our respondents are frustrated with the complexity of documentation of the AMM while a few others were facing confusion or stumbling upon incorrect maintenance procedure. Both of these are major problems that our product seeks to overcome and improve.

3.4.1.2 PARETO DIAGRAM

Features	Frequency	Cummulative Percentage	Pareto Baseline
Clarity and readability	8	44%	80%
Accessibility	8	89%	80%
Up to date	2	100%	80%
GRAND TOTAL	18		

Figure 3.9: Pareto Table for Features to Improve
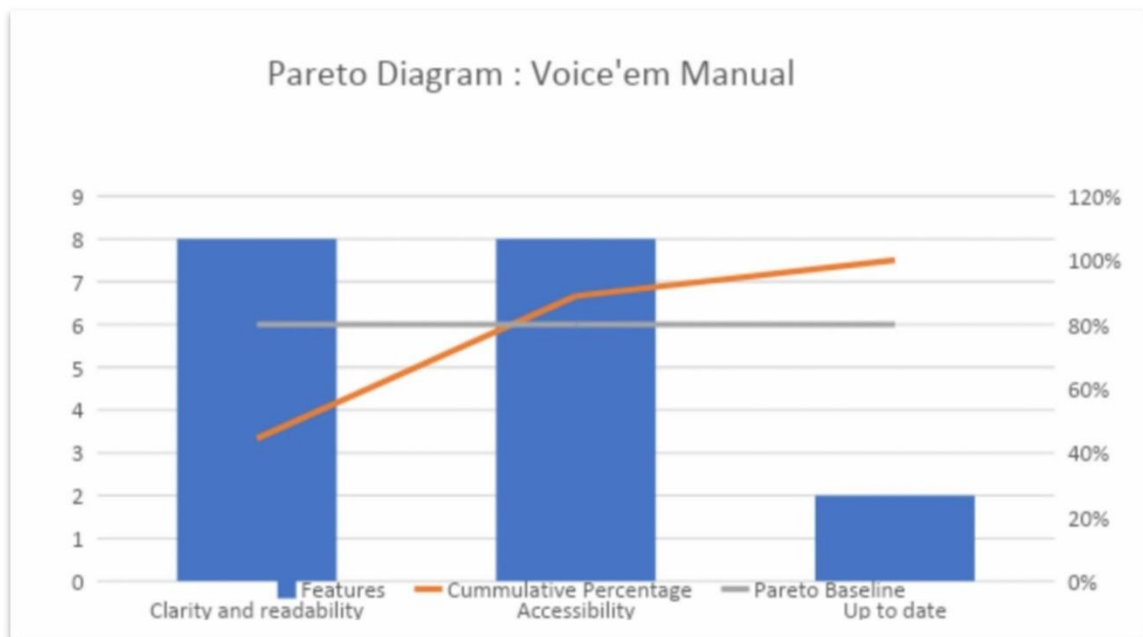
Figure 3.10: Pareto Diagram for Features to Improve

From this diagram on Figure 3.4.2.2, we can conclude that clarity and readability and also accessibility is theutmost priority according to our respondent. We should focus on this feature for our user's satisfaction.

3.4.2 Design Concept Generation

3.4.2.1 Function Tree
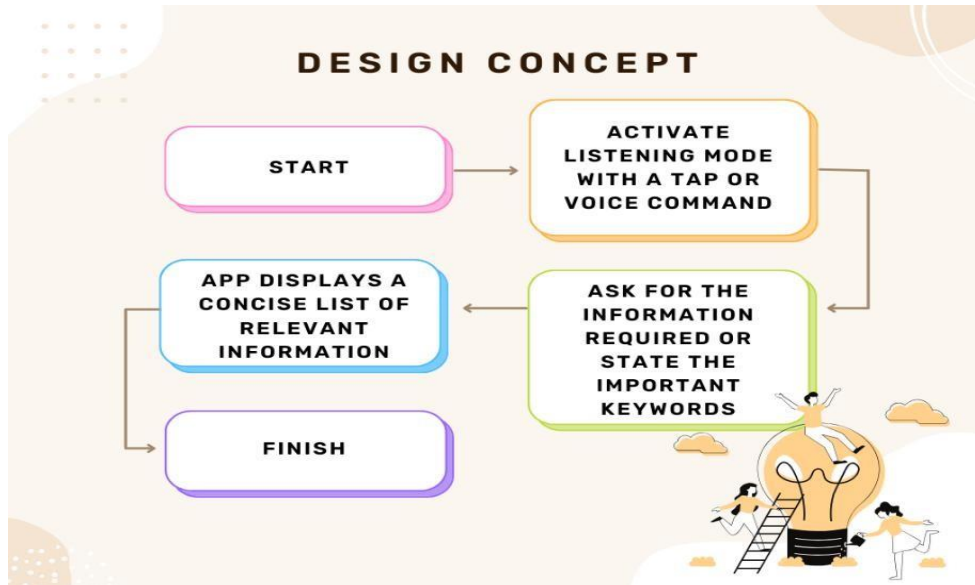
Figure 3.11: Design Concept Flowchart of
VOICE'EM MANUAL

Based on our design concept, we decided that this is our design concept for VOICE'EM MANUAL.

3.4.2.2 Morphological Matrix

FUNCTION (SUB-FUNCTION)	IDEA 1	IDEA 2	IDEA 3	IDEA 4
COMPATIBLE DEVICE	MOBILE PHONE	MOBILE PHONE	MOBILE PHONE	A RANGE OF ELECTRONIC DEVICES(MOBILE PHONE, TABLET, LAPTOP, PC)
ACCESSIBILITY	OFFLINE	ONLINE	ONLINE	AVAILABLE BOTH ONLINE & OFFLINE
MONETIZATION	PAID MONTHLY	SUBSCRIPTIONFOR EVERY CHAPTER	ADS	MONTHLY SUBSCRIPTION WITHACCESS LIMITED TO PERSONNEL FROM AMO
UPDATES	REGULARLY	UPDATE 12 HOURS AFTER OFFICIAL SRM RELEASED	EVERY 72 HOURS	UPDATE WITHIN 24 HOURS AFTER A NEWLY UPDATED SRM IS RELEASED
LANGUAGE	ENGLISH	ENGLISH	MULTIPLE	ENGLISH

Table 3.1: VOICE'EM MANUAL Morphological Matrix

Based on our discussion about Morphological Matrix, we got 4 options to put as an idea for our system. The criteria include compatible device, accessibility, monetization, updates and language. These criteria are used in order to improve our product's user experience.

3.4.2.3 Proposed Design Concept 1

FUNCTION	CONCEPT 1	JUSTIFICATION
COMPATIBLE DEVICE	MOBILE PHONE	• EASY TO CARRY ANYWHERE • LIGHTWEIGHT
ACCESSIBILTY	OFFLINE	MAKES WORK EASIER BECAUSE OF ERRATIC BROADCASTS
MONETIZATION	PAID MONTHLY	THIS APP IS MADE FOR MAINTENANCE PURPOSE. NOT SUGGESTED TO BE INSTALL AT WILL
UPDATES	REGULARLY	TO MAKE SURE THE APPS KEEP ON TRACK WITH REAL-TIME UPDATE
LANGUAGE	ENGLISH	THE AVIATION INDUSTRY USES ENGLISH AS THE MAIN LANGUAGE

Table 3.2: Proposed Design Concept 1

From proposed design concept 1, the device the app will operate is only on mobile phone. This is because mobile phones are easier to carry anywhere, and they are also lightweight. The app is also made available offline as it makes work easier because of erratic broadcasts. In this concept, we decided to monetize our app where users are subscribed monthly to use the app.

This is because we aim the target consumer are among maintenance personnel and people from the aviation industry only. We also decided the app to undergo regular update to make sure the content is always up to date. For this concept, we choose English as the language as it's the main language in the aviation industry.

3.4.2.4 Proposed Desing Concept 2

FUNCTION	CONCEPT 2	JUSTIFICATION
COMPATIBLE DEVICE	MOBILE PHONE	EASY TO ACCESS BECAUSE EVERYONE HAS MOBILE PHONE
ACCESSIBILTY	ONLINE	PRECISE INFORMATION DUE TO AUTO UPDATE FEATURES
MONETIZATION	SUBSCRIPTION FOR EVERY CHAPTER	CANNOT BE EASILY ACCESS BY ANYBODY. SOME PERSONNEL ONLY SPECIALIZED FOR SPECIFIC CHAPTER
UPDATES	UPDATE 12 HOURS AFTER OFFICIAL AMM RELEASED	TO AVOID ANY INCORRECT INFORMATION OCCURANCE
LANGUAGE	ENGLISH	ENGLISH IS MANDATORY LANGUAGE FOR WORKERS IN THE AVIATION INDUSTRY

Table 3.3: Proposed Design Concept 2

From proposed design concept 2, the device the app will operate is only on mobile phone. This is because mobile phones are easier to carry anywhere, and they are also lightweight. The app is also made available online to ensure precise information due to auto-update features. In this concept, we decided to monetize our app where users are subscribed for every chapter to use the app.

This is because we want to ensure the product cannot be easily accessed by anybody. some personnel only specialized for specific chapters. We also decided the app to undergo update 12 hours after official AMM is released to avoid any incorrect information occurrence. For this concept, we choose Englishas the language as it's mandatory for workers in the aviation industry.

3.4.2.5 Proposed Design Concept 3

FUNCTION	CONCEPT 3	JUSTIFICATION
COMPATIBLE DEVICE	MOBILE PHONE	EASY TO CARRY ANYWHERE AND LIGHTWEIGHT
ACCESSIBILTY	ONLINE	EASIER UPDATES DUE TO ORGANIZED FOLDER ANDINFORMATION
MONETIZATION	ADS	WE CAN ATTRACT ATTENTION FROM OTHER AVIONICS SALES OR PROMOTION AND PROVIDE ADSFOR THEM
UPDATES	EVERY 72 HOURS	TO AVOID ANY SUDDEN CHANGE OF INCORRECT INFORMATION AND MAKE SURE THE INFORMATION IS CERTIFIED
LANGUAGE	MULTIPLE	FOR PERSONNEL COMFORT AND CLEAR INSTRUCTION /INFORMATION

Table 3.4: Proposed Design Concept 3

From proposed design concept 3, the app will operate only on mobile phones. This is because mobile phones are easier to carry anywhere, and they are also lightweight. The app is also made available online as it makes easier updates due to organized folder and information. In this concept, we decide to monetize our app by having ads. This is to attract attention from other companies and promote our product in the market.

We also decided the app to undergo update every 72 hours to avoid any sudden change of incorrect information and make sure the information is certified. For this concept, we choose to add multiple language mainly the most common world language such as English, Mandarin, Arabic and Spanish.

3.4.2.6 Proposed Design Concept 4

FUNCTION	CONCEPT 4	JUSTIFICATION
COMPATIBLE DEVICE	A RANGE OF DEVICES (MOBILEPHONE, TABLET, LAPTOP, PC)	FLEXIBLE TO USE ANYWHERE
ACCESSIBILTY	AVAILABLE BOTH ONLINE AND OFFLINE	MAKES WORK EASIER IN CASE OF NETWORK DISRUPTION
MONETIZATION	MONTHLY SUBSCRIPTIONWITH LIMITED ACCESS TO PERSONNEL FROM AMO	THIS APP IS MADE FOR MAINTENANCE AND EDUCATIONALPURPOSE. NOT SUGGESTED TO BE INSTALLED AT WILL
UPDATES	WITHIN 24 HOURS AFTER A NEWLY UPDATED AMM IS RELEASED	TO MAKE SURE THE APPS KEEP ONTRACK WITH REAL-TIME UPDATE
LANGUAGE	ENGLISH	THE AVIATION INDUSTRY USES ENGLISH AS THE MAIN LANGUAGE

Table 3.5: Proposed Design Concept 4

From proposed design concept 4, the device the app will operate on a range of devices for flexibilityto use the app anywhere. This includes mobile phone, tablet, laptop and PC. The app is also made available both offline and online which makes work easier in case of network disruption. In this concept, we decided to monetize our app where users are subscribed monthly to use the app.

This app is made for maintenance and educational purposes. It is not to be used freely without authorization. We also decided the app to undergo update within 24 hours after official AMM is released to avoid any incorrect information occurrence. For this concept, we choose English as the language as it's the main language in the aviation industry.

3.4.3 Evaluation & Selection of Conceptual Design

3.4.3.1 Pugh Matrix

CRITERION	FACTOR	CONCEPT 1	CONCEPT 2	CONCEPT 3	CONCEPT 4
COMPATIBLE DEVICE	0.2	2	2	1	D
ACCESSIBILITY	0.2	2	2	2	A
MONETIZATION	0.2	3	1	1	T
UPDATES	0.2	2	3	2	U
LANGUAGE	0.2	3	3	1	M
TOTAL SCORE	1.0	12	11	7	
RANKING	-	2	3	4	-

Table 3.6: Pugh Matrix: Concept 4 as DATUM

CRITERION	FACTOR	CONCEPT 1	CONCEPT 2	CONCEPT 3	VOICE'EM MANUAL	CONCEPT 4
INTERFACE	0.2	2	2	1	D	3
ACCESSIBILITY	0.2	2	2	2	A	3
MONETIZATION	0.2	3	1	1	T	3
UPDATES	0.2	2	3	2	U	3
LANGUAGE	0.2	3	3	1	M	3
TOTAL SCORE	1.0	12	11	7		15
RANKING		2	3	4	-	1

Table 3.7: Pugh Matrix: VOICE'EM MANUAL as DATUM

As for the Pugh Matrix, we make concept 4 as the DATUM because it has the best concept among others. Its device compatibility, accessibility, monetization, updates and language are the best among others

3.4.3.2 Conceptual Design of The Proposed Product

FUNCTION	CONCEPT 4	JUSTIFICATION
COMPATIBLE DEVICE	A RANGE OF DEVICES (MOBILEPHONE, TABLET, LAPTOP, PC)	FLEXIBLE TO USE ANYWHERE
ACCESSIBILTY	AVAILABLE BOTH ONLINE AND OFFLINE	MAKES WORK EASIER IN CASE OF NETWORK DISRUPTION
MONETIZATION	MONTHLY SUBSCRIPTION WITH LIMITED ACCESS TO PERSONNEL FROM AMO	THIS APP IS MADE FOR MAINTENANCE AND EDUCATIONALPURPOSE. NOT SUGGESTED TO BE INSTALLED AT WILL
UPDATES	WITHIN 24 HOURS AFTER A NEWLY UPDATED AMM IS RELEASED	TO MAKE SURE THE APP KEEP ONTRACK WITH REAL-TIME UPDATE
LANGUAGE	ENGLISH	THE AVIATION INDUSTRY USES ENGLISH AS THE MAIN LANGUAGE

Table 3.8: Table of Proposed Concept 4

From the conceptual design of the proposed product, concept 4 has been chosen because it has the most suitable features. The app will be able to operate on a range of devices which allows for flexibility to use the app anywhere. This includes mobile phone, tablet, laptop and PC. The proposed concept also chooses the app to be made available both offline and online which makes work easier in case of network disruption during operation. In this concept, we decided to monetize our app where users are subscribed monthly to use the app.

This app is made for maintenance and educational purposes. It is not to be used freely without authorization. The app will undergo update within 24 hours after the official AMM is released to avoid any incorrect information occurrence. For this concept, English is the most convenient as it's the main language in the aviation industry hence chosen as the language used on the app.

3.5 PRODUCT DRAWING/SCHEMATIC DIAGRAM

3.5.1 GENERAL PRODUCT SKETCHING

3.5.1.1 Sketch for Concept 1
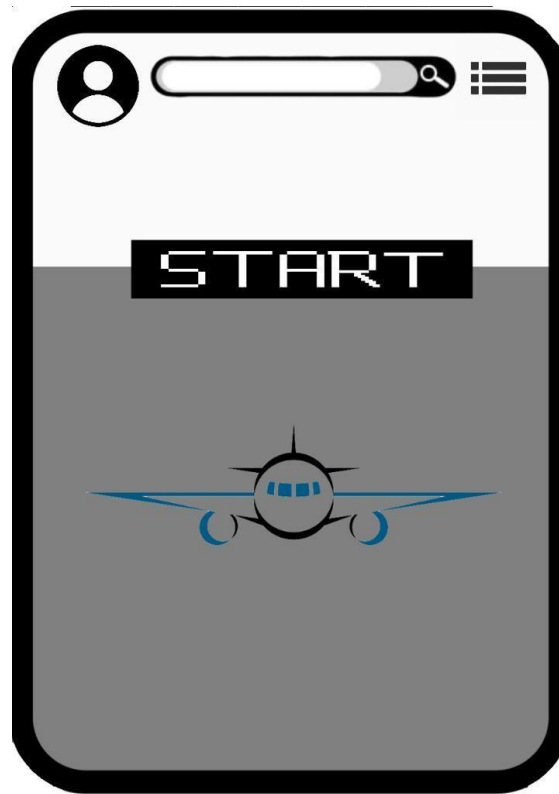
Figure 3.12: Sketch for Concept 1

Based on the product sketch of concept 1, those are the interface for the homepage of the VOICE'EM MANUAL app. This homepage interface design consists of an activation button, a user profile, a search bar and also a button to view other options such as settings and recent searches.

3.5.1.2 Sketch for Concept 2
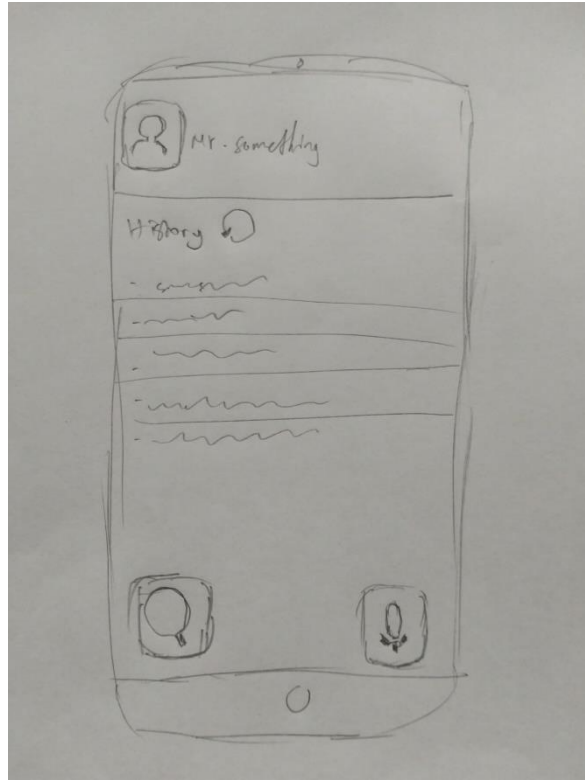
Figure 3.13: Sketch for Concept 2

Concept 2 features the display of the user profile at the top of the screen. A history feature to monitor past searches is also added to the homepage. There is also a search button at the bottom left ofthe screen and activation mode button at the bottom right of the screen.

3.5.1.3 Sketch for Concept 3
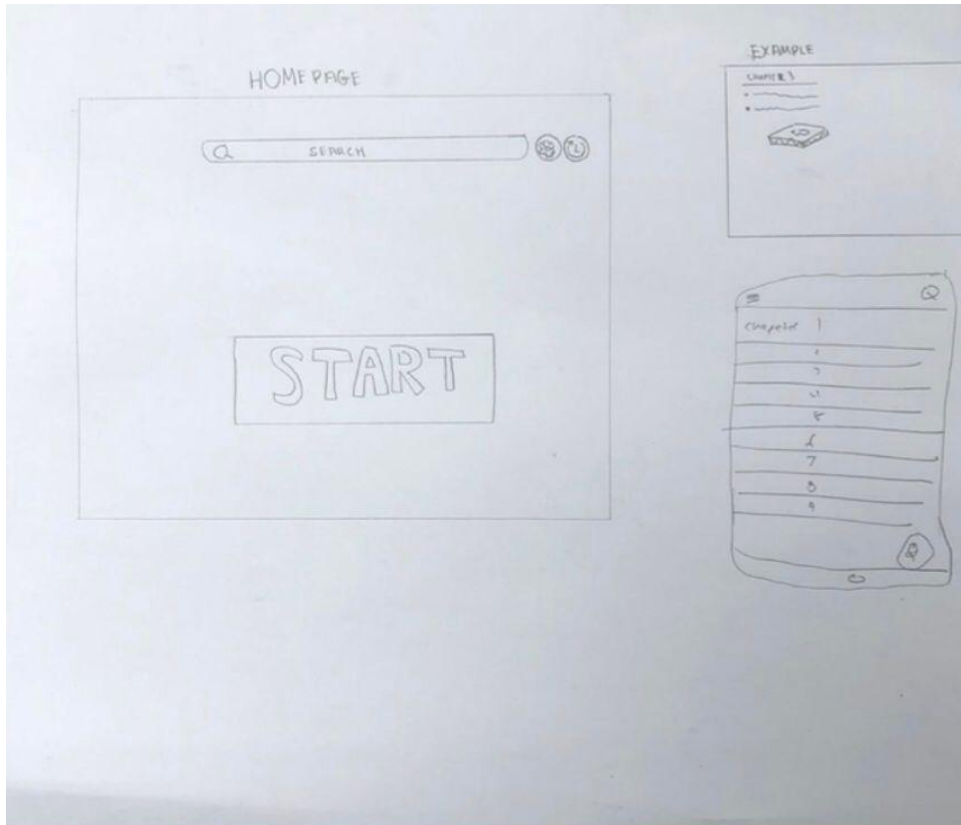
Figure 3.14: Sketch for Concept 3

Based on the sketch for concept 3, it features a minimalist style with the activation mode button at thecenter of the homepage. There is also a search bar at the top of the screen with a settings button and recent searches button adjacent to it.

3.5.1.4 Sketch for Concept 4
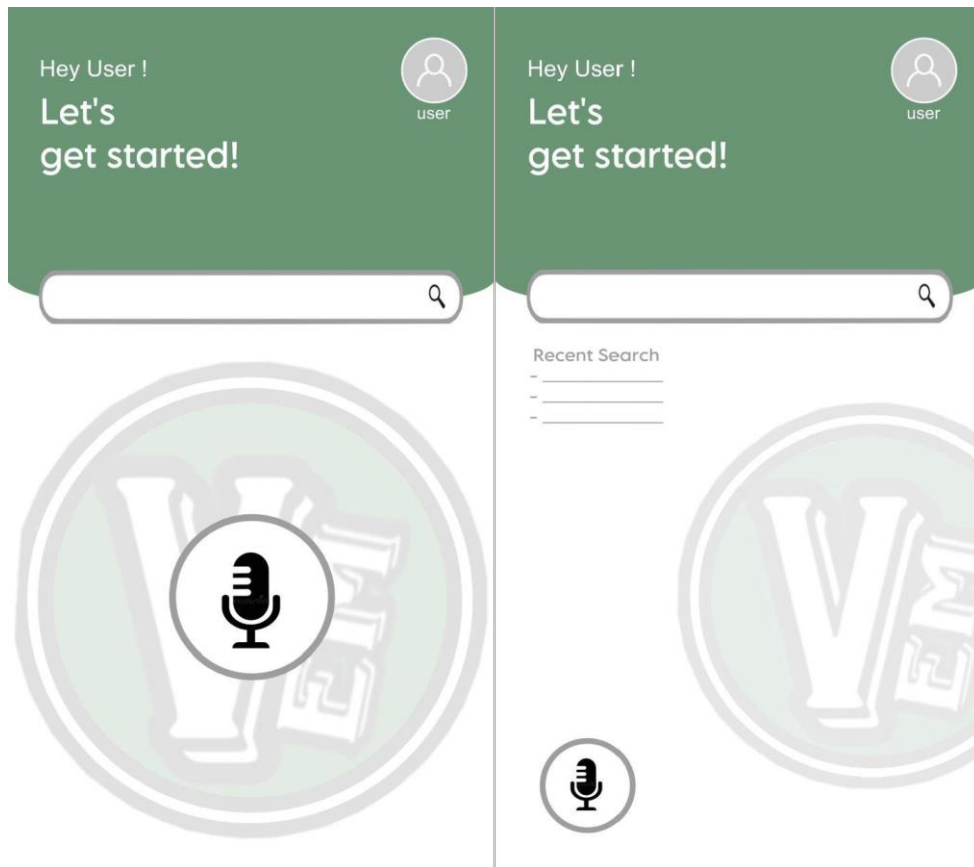
Figure 3.15: Sketch for Concept 4

For concept 4, it features a simple design with a tap activation button at the middle of the homepage. There is also user profile and greeting text at the top of the screen. Below the greeting text, there is a search bar.

CHAPTER 4

RESULT & DISCUSSION

4.1 PRODUCT DESCRIPTION

4.1.1 General Product Features & Functionalities

With its many advanced capabilities, our product aims to make your browsing experience even more enjoyable. Its cutting-edge voice-enabled search feature is at the forefront. Voice recognition technology allows you to speak your search queries aloud, and it quickly converts them into search commands that can be used without the need for human input. It replies quickly and accurately, providing customized results at your request, whether you're looking for information on a particular topic, the most recent news, or answers to urgent queries.

4.1.2 Specific Part Features
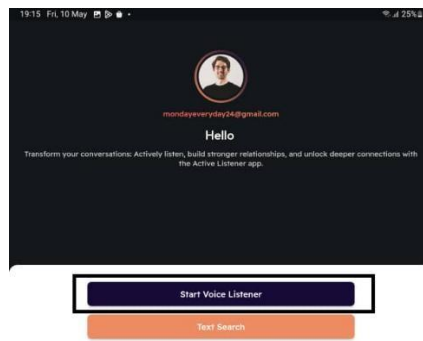
Figure 4.2: Start voice listener button.
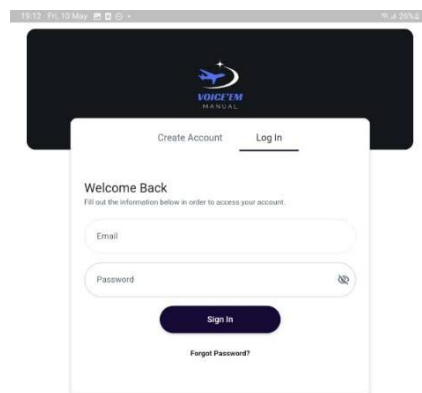
Figure 4.3: User App Log-in

4.1.2.1 Product structure

Voice'Em Manual offers a smooth voice-activated information engagement. Fundamentally, it has a voice- activated interface that lets users utilize natural language commands to easily browse through its features. Users can speak their inquiries aloud to retrieve a variety of information thanks to advanced natural languageprocessing. With the app's text-to-speech synthesis feature, written content may be consumed hands-free by turning it into realistic speech.

The user experience and accessibility are enhanced with customizable speech preferences, language support, and integration with external services. Acting as a navigational aid and virtual companion, it provides offline functionality and accessibility features to guarantee inclusivity and continuous information access for all users.

a) Start voice listener button

The application contains a start voice listener button. Users can browse the documentation using voice once the button is activated and get detailed information from the manual. The manual that is contained in this app has complete details, including maintenance instructions. Users can use this information to complete the procedure of their maintenance work.

b) Text search button

The application includes a text search button. This is provided in case any users device that have microphone issues, they still can use this apps by searching the information by using text.

c) Safety precaution

The application serves a secure workspace by offering precautions in the manuals itself. Users will be provided with the specific procedure of maintenance task to reduce the risk of accidents and injuries while doing the practical application.

d) Account verification

The application maintains secured by managing users that access through the app. Only approved and authorized people can access our app such as technicians, engineers, industry personnel and students. This method is to ensure the safety of manual documentation.

e) Offline access

The application runs with offline access to ensure students or personnel still can access it even if they are a at no- signal area or system shutdown so there is no internet required to use the app.

4.1.2.2 Product mechanism

The Voice'Em Manual has combination procedure and safety precaution to deliver its functionality. Common product mechanism for apps include:

a) Procedure

This will help students and personnel to make sure they are completing their task with a detailed procedure. Itwill ensure the safeness result of the student/personnel maintenance task.

b) User interface

The application is user-friendly layout makes it simple for users to access a wide range of features and move between different parts. The goal when designing the user interface was to make it easy to use, visually beautiful, and interactive.

c) Manuals (AMM Boeing 737-300/400/500)

The application serves you the content of aircraft maintenance manual (AMM) specialized for Boeing 737- 300/400/500. The manual itself has a lot of procedures, description and safety precaution that are required in every task.

4.1.2.3 Software/ Programming

The specifics on the development of the project includes:

a) Layout design: Flutter and dart

Flutter's cross-platform development features, developers can create applications for many platforms—iOS, Android, web, and desktop—using a single codebase, which streamlines the process.

b) Voice navigation: Flutter plugin (speech to text)

Give users the ability to interact with the app hands-free by allowing them to use voice commands for navigation and interactivity.

c) Database: Firebase

Its real-time database capability makes sure that all clients' data is instantly synchronized, facilitating easy communication and cooperation.

d) Software code editor: vscode

Support makes sure developers can maintain consistency in their development environments while working seamlessly across various operating systems.

4.1.2.4 Accessories & Finishing

Accessories and finishing products for the Voice'Em Manual app refer to complementary elements that enhance the user experience, aesthetics, and functionality of the app. This includes:

a) App icon:

An attractive and superior icon that shows the user how Voice'Em Manual will be used on their device.Icons for applications make it easier for users to find and access their programs.

b) User Interface (UI) Design:

A well created interface that puts the needs of usability, simple navigation, and beauty first. This covers the patterns, typefaces, buttons, and other visual components that are utilized across the board in the application.

c) Brand Elements:

Logotypes, colour schemes, and typefaces that complement the application's identity and improve awarenessare examples of consistent brand aspects. The brand elements support brand consistency and help toestablish a powerful visual presence.

d) Responsive design:

A kind of responsive design that guarantees your program can change to fit different screen sizes and orientations. Because of this, users may go between devices such smartphones, tablets, and desktop PCs and still use the apps without any problems**.**

4.1.3 General Operation of The Product

When the app is opened on a computer, tablet, or smartphone, the user's trip through it officially starts. The user could be asked to log in to their account upon opening to customize their experience and retrieve documents or remembered settings. The user is greeted with a simple and easy-to-use interface after logging in, enabling them to interact with voice commands.

The user only needs to press the voice start button or use a wake phrase to for the program to start listening for commands. The app's advanced speech recognition engine quickly converts the user's speech input into text, considering dialects and nuances to guarantee correctness.

After processing the user's command, the application uses cutting-edge natural language processing algorithms to determine the input's intended meaning. When a user requests, "White steady position light," the software recognizes the request and searches for the necessary files.

The program quickly fetches the needed documentation—the aircraft maintenance manual—in digital formatby utilizing integrated databases or linked systems. This handbook could include extensive details about checklists, scheduling, safety precautions, and maintenance methods.

Upon obtaining the documentation, the application smoothly advances to the text-to-speech synthesis phase. The program turns the textual material of the maintenance manual into speech that sounds natural by using cutting-edge algorithms. To ensure understanding and clarity, the speech synthesis reflects the naturalintonation and tempo of speech.

The application speaks the contents of the aircraft maintenance manual, giving users auditory access to vital information and increasing productivity and ease of use, particularly in settings where visual engagement is restricted or not feasible. While conducting inspections or hands-on work, users can pay close attention to safety recommendations, maintenance protocols, and troubleshooting instructions.

The software keeps users responsive and engaged throughout this process, letting them rewind, pause, or askfollow-up questions as needed. Users and the app engage in a dynamic and fruitful exchange thanks to this iterative engagement, which also provides users with easily accessible and useful information to help their maintenance operations.

4.1.4 Operation of the Specific Part of the Product

4.1.4.1 Operate of Product Features

a) Start voice listener button
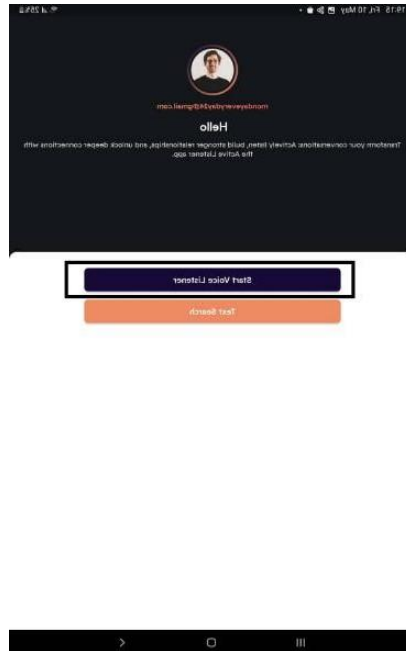
Figure 4.4: Step 1 to use Voice'Em Manual
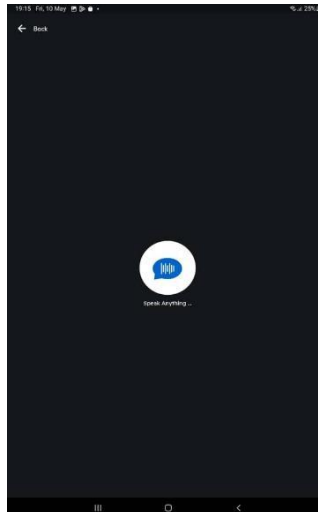
Figure 4.5: Step 2 to use Voice'Em Manual

The start voice listener button function activates the app to receive voice command (input) from user andprocessed it to give an (output) which is the manual documentation that shown at your screen device.

Key function:

As the start voice listener button activated, user start to give voice command "White steady position light" asan input.

Based on figure 4.5, it shown that it is processing the input that it gets and loading for the exactdocumentation to be shown as output

b) Text search

Incase device that user used got issue with the microphone, here is where the search text comes to itfunctionality. It lets the user to search for the information they needed by text.

4.1.4.2 Log-in Featured

Ensuring that only authorized users may access the app is crucial to preserving its integrity, user data, and general security. The software can reduce the possibility of unwanted access or misuse of private data by limiting access. By limiting access to the app's features and functions to those who have been granted authorization, this helps to guard against security lapses, data breaches, and malicious activity.

Furthermore, adhering to industry rules and guidelines protecting data security and privacy is facilitated by implementing permission protocols. This preserves the app's reputation and builds user trust by giving consumers peace of mind that their data is being handled appropriately. In today's digital landscape, limiting access to authorized staff is ultimately a crucial component of preserving the app's integrity, safeguarding user privacy, and enforcing security standards.
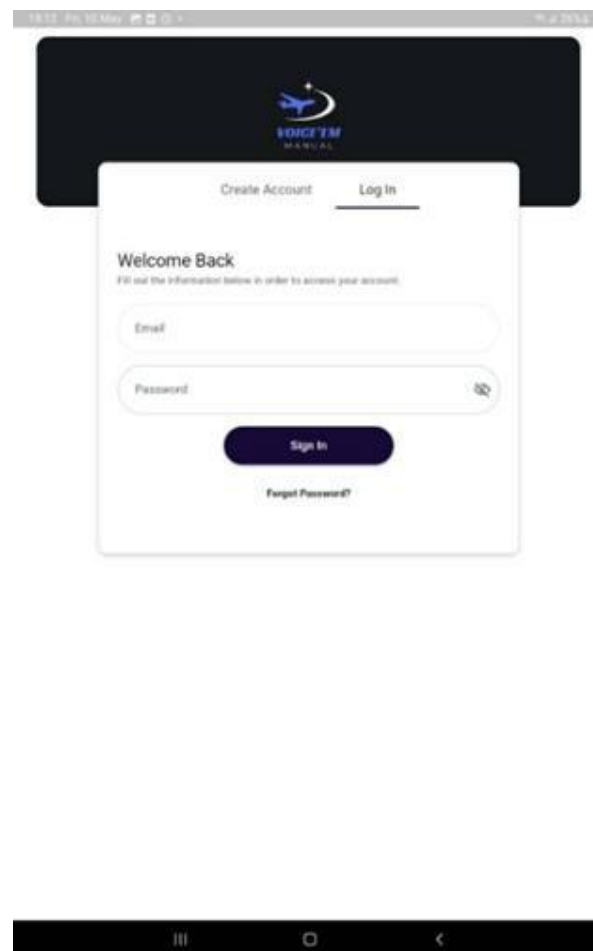
Figure 4.6: Log in Feature

4.1.4.3 Software/Programing

Figure 4.7: Different Files That Can Be Accessed

Allowing multiple file access through applications fulfills a number of essential functions. First off, by combining various content kinds into one platform, it promotes efficiency and ease. By centralizing access within a single app, users can save time and optimize their workflow by eliminating the need to switch between numerous programs or navigate different interfaces to access files that are dispersed across multiplelocations.

Additionally, granting users access to several files via apps improves data management and organizing features. Through the provision of comprehensive search, sorting, and classification functionalities, applications enable users to effectively identify and access files according to multiple parameters, such file type, date, size, or keywords. This increases user happiness and usefulness by encouraging neatness, reducing clutter, and optimizing information retrieval procedures.
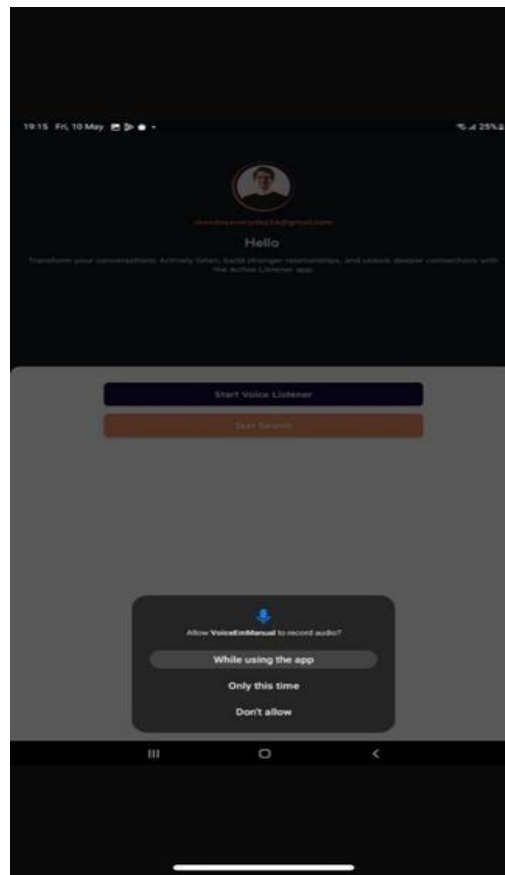
Figure 4.8: Enabling Microphone Access

Enabling microphone access is essential for seamless engagement with voice technology apps. Users enable accurate speech recognition in the app by granting access. The software uses the microphone as its main input source to accept commands and requests, which are subsequently processed by sophisticated speech recognition algorithms. These systems translate spoken words into text by analyzing the audio data in real- time.

The application then uses natural language processing (NLP) methods to decipher and derive meaning from the text that has been transcribed, allowing it to carry out orders or deliver pertinent responses. The app's operation would be hampered and the user's ability to engage with it through speech-to-text capabilities or voice commands would be restricted if the microphone was not accessible. Thus, to provide a smooth and simple user experience, the app must be able to access the microphone.

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4.1.4.4 Accessories & Finishing

Figure 4.9: Voice'Em Manual Logo

Choosing an aircraft for a project's logo might capture a variety of metaphorical meanings that align with the goals and ethos of the project. Aircraft represent progress, creativity, and technological improvement and are symbols of human ingenuity.

Voice'Em Manual refers to voice generator that we put in our app as an input and manual is for the manual itself, so people know that our product based on manual as it already stated on our logo.

Additionally, based on Figure 4.4, we designed a simple layout for our apps menu because we want to makeit user friendly, so users can easily use it without trouble. The display of the menu is direct to what they want examples if they want to use voice then activate the "start voice listener" button, if they want to use text search then press "text search".

CHAPTER 5

CONCLUSION & RECOMMENDATIONS

5.1 ACHIEVEMENT OF AIM & OBJECTIVES OF THE RESEARCH

5.1.1 Product Structure

The structure of the mobile application is designed to be user-friendly and intuitive, with a clear navigation system that allows easy access to different sections of the aircraft maintenance manual. The layout is optimized for mobile devices, ensuring compatibility across various screen sizes and resolutions. Additionally, the application's structure incorporates feedback from usability tests and pilot studies, ensuring that it meets the needs and preferences of its target users.

5.1.2 Product Mechanism

The mechanism of the application revolves around voice-controlled interactions, leveraging natural language processing (NLP) and machine learning algorithms to accurately interpret and respond to user commands. This mechanism enables users to access specific information within the maintenance manual through spokenqueries, eliminating the need for manual text input and enhancing accessibility in environments where hands-free operation is essential.

5.1.3 Software/Programming

The software and programming behind the application are developed using cutting-edge technologies in NLP and machine learning. Advanced algorithms are implemented to process and understand spoken language, enabling the application to extract information from the maintenance manual database accurately. The programming is optimized for efficiency and performance.

5.1.4 Accessories & Finishing

While the primary focus is on the mobile application itself, accessories such as compatible headsets or microphones may be recommended to users to optimize the accuracy of voice recognition in noisy environments. Additionally, integration with wearable devices or smart glasses could further enhance the accessibility and usability of the application in hands-on maintenance tasks. The finishing touches applied to the product involve user interface design elements aimed at enhancing the overall user experience. This includes visually appealing graphics, clear and concise labeling of interface elements, and customizable settings to accommodate individual user preferences. Additionally, thorough testing and debugging are conducted to ensure the stability and reliability of the application before deployment.

5.2 CONTRIBUTION OR IMPACT OF THE PROJECT

The development of this voice-controlled mobile application represents a significant contribution to the field of aircraft maintenance. By enabling technicians to access maintenance manuals through intuitive voice commands, the application has the potential to revolutionize traditional maintenance procedures. This innovation is expected to streamline workflow processes, reduce reliance on printed manuals, and mitigate the risk of errors associated with manual data entry. Ultimately, the project aims to enhance operational efficiency, promote safety, and contribute to cost savings within the aviation industry. Additionally, the insights gained from this research can inform future developments in voice-controlled applications across various industries, extending the impact of the project beyond the realm of aircraft maintenance.

5.3 IMPROVEMENT & SUGGESTIONS FOR FUTURE RESEARCH

5.3.1 Product Structure

a) Simplification: Consider streamlining the navigation structure further to minimize the number of steps required to access specific sections of the maintenance manual, thereby enhancing user efficiency.

b) Customization: Introduce options for users to customize the layout and organization of the interface based on their individual preferences and workflow requirements.

5.3.2 Product Mechanism

a) Accuracy Enhancement: Continuously refine the voice recognition algorithms to improve accuracy, particularly in recognizing technical terms and aviation-specific terminology.

b) Context Sensitivity: Implement context-awareness features to provide more relevant responses based on the user's current task or the aircraft's maintenance status.

5.3.3 Software/Programming

a) Performance Optimization: Optimize the application's codebase to minimize resource consumption and improve responsiveness, particularly on lower-end mobile devices.

b) Integration with Existing Systems: Explore opportunities to integrate the application with existing aircraft maintenance management systems for seamless data exchange and workflow integration.

5.3.4 Accessories & Finishing

a) Compatibility Expansion: Expand compatibility with a broader range of accessories, such as Bluetooth headsets and microphones, to accommodate users' diverse preferences and hardware configurations.

b) Wearable Device Integration: Investigate the feasibility of integrating the application with wearable devices, such as smartwatches or augmented reality glasses, to provide hands-free access to maintenance information in real-time.

c) Accessibility Features: Implement accessibility features, such as voice feedback and screen reader compatibility, to cater to users with disabilities or special needs.

d) Aesthetic Refinement: Refine the visual design and aesthetics of the user interface to enhance user engagement and satisfaction, aligning with modern design trends and best practices.

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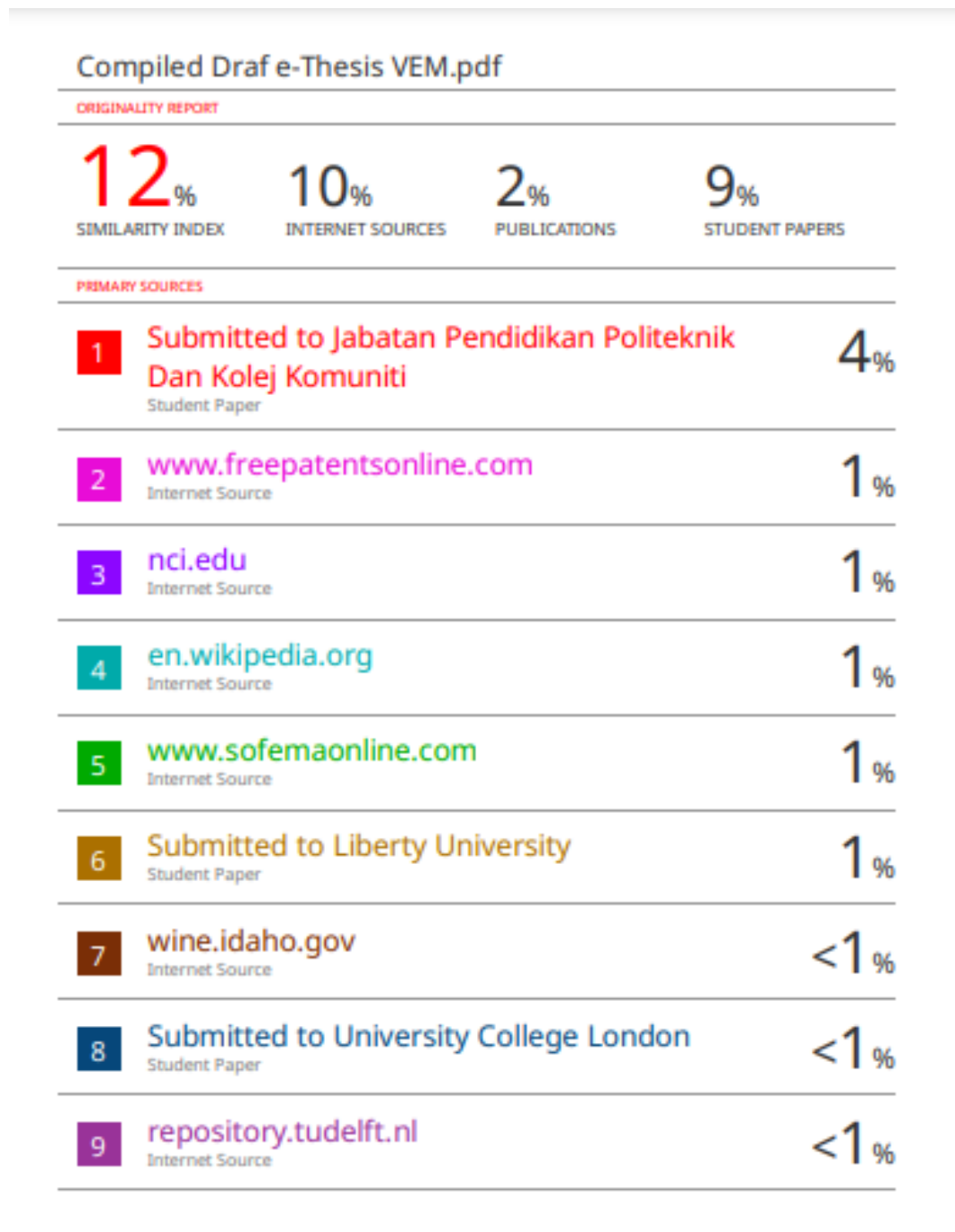
APPENDIX A: LIST OF TASK SEGREGATION

SUB CHAPTER	DESCRIPTION
MIRZA MUHAMMAD AL-AMIN BIN MUSTAPA KAMAL	
1.1	Background of Study
1.2	Problem Statement
1.3.1.	General Project Objectives
1.3.2.1	Product Structure
1.3.2.2	Mechanical Mechanism
1.3.2.3	Electrical/Electronic Mechanism
1.3.2.4	Purpose of Product
1.4	General Project Scope
1.5.1	General Project Scopes
1.5.2.1	Product Structure
1.5.2.2	Mechanical Mechanism
1.5.2.4	Accessories & Finishing
3.4.2.3	Proposed Design Concept 1
3.5.1.1	Sketch for Concept 1
4.1.1	General Product Features & Functionalities
4.1.2.1	Product Structure
4.1.2.2	Product Mechanism
4.1.2.3	Software/Programming
4.1.2.4	Accessories & Furnishing
MUHAMMAD AZRIN NIZAM BIN ARBA'IN	
2.3.1	Related Patent Product
2.3.2	Recent Market Products
2.3.2.1	Product A (iFixIt)
2.3.2.2	Product B (AMM 737)
2.3.2.3	Product C (Fixya)

2.4	Comparison Between Recent Research and Current Project
3.4.2.4	Proposed Design Concept 2
3.5.1.4	Sketch for Concept 4
4.1.3	General Operation of the Product
4.1.4.1	Operate of Product Features
4.1.4.2	Login Featured
4.1.4.3	Software/Programming
4.1.4.4	Accessories & Finishing
4.2	Product Output Analysis-Post Survey Results
MUHAMMAD AFIF DANIAL BIN RAMLEE	
3.1	Project Briefing & Risk Assessment
3.2	Overall Project Gantt Chart
3.3.1	Overall Project Flow Chart
3.3.2.1	Product Mechanism
3.3.2.2	Software/Programming
3.4.1.1	Questionary Survey
3.4.1.2	Pareto Diagram
3.4.2.1	Function Tree
3.4.2.2	Morphological Matrix
3.4.2.5	Proposed Design Concept 3
3.4.3.1	Pugh Matrix
3.4.3.2	Conceptual Design of The Proposal Product
3.5.1.3	Sketch for Concept 3
5.1.1	Product Structure
5.1.2	Product Mechanism
5.1.3	Software/Programming
5.1.4	Accessories & Finishing
ALFATTAH BIN FAUZI	
2.1.1	Aviation Industry in Malaysia
2.1.2	Demand in Aviation
2.1.3	Type of Manuals
2.1.4	Evolution of Aircraft Maintenance Manual (AMM)

APPENDIX B: TURNITIN SIMILARITY REPORT

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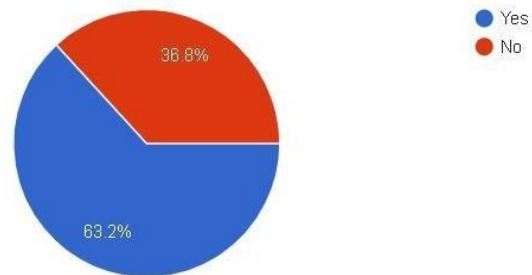
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APPENDIX C: POST SURVEY RESULTS

Do you often use Aircraft Maintenance Manual (AMM)?
19 responses

- Yes
- No

36.8%

63.2%

Are you familiar about Aircraft Maintenance Manual (AMM)?
19 responses

- Yes
- No

15.8%

84.2%
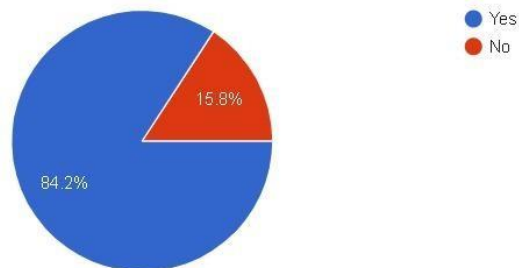
What are your suggestion/recommendation that can be done to improve this product?
6 responses

no
make it easier to use
Voice commands
make it 100% voice command
Make it easily accessible
Add a voice command

Choose one

Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree

Do you think it would be easier if Aircraft Maintena…

Do you face difficulties using the Aircraft Maintenance Manual…

Do you think it would be useful in a practical class?

Do you think it would be useful…