Mobile Base Sinhala Book Reader for Visually Impaired Individuals

TMP-23-198

SLIIT
FACULTY OF COMPUTING

Our Team

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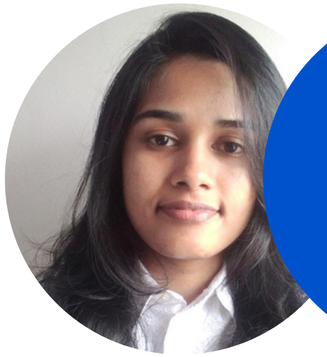

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Introduction

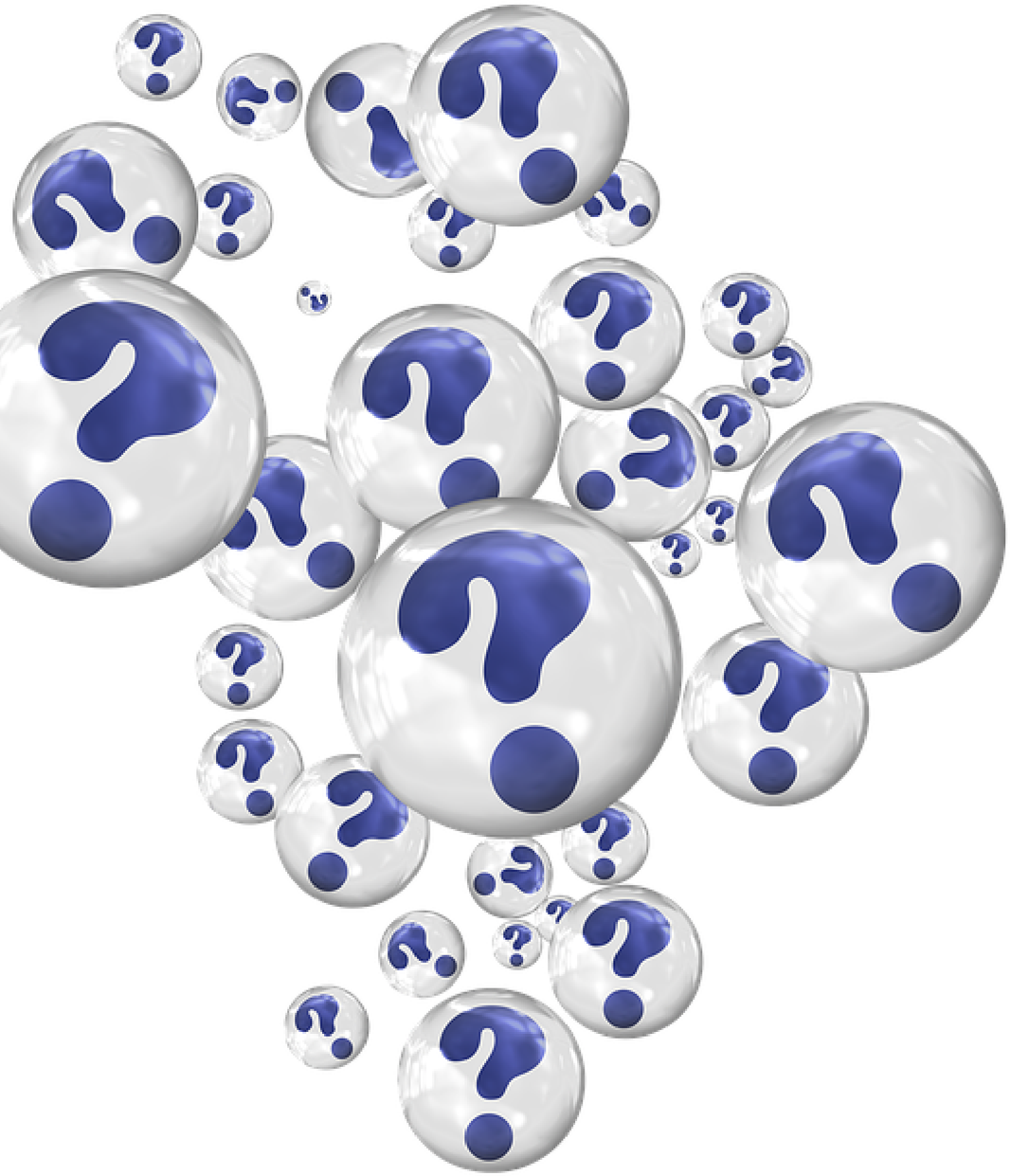
- According to the World Health Organization (WHO), there are 285 million physically impaired individuals worldwide, including 39 million blind people.
- Communicating with blind persons requires a different approach than communicating with sighted individuals.
- Verbal communication, tactile communication, and assistive technology are some of the ways to communicate with blind people.
- Assistive technologies such as text-to-speech software, screen readers, and speech recognition software can also help blind people to communicate with others.

Commercialization

- **Identifying the Target Audience: In this case, the target audience would be visually Impaired Individuals who could benefit from the features of the Mobile Application.**

- **Revenue Generation: Commercialization also involves generating revenue from the mobile application. This could involve charging for the application itself, offering premium features for a fee.**

- **Promotions: The target audience should be reached through targeted campaigns on social media and other channels. Collaboration with organizations that work with visually impaired individuals, such as libraries or schools, can also be an effective way to reach the target audience.**



Research Question

- What are the user requirements and preferences for a mobile base Sinhala book reader for visually impaired individuals?
- How can the accessibility of the book reader be enhanced for visually impaired individuals?
- What are the existing technologies and tools available for creating a mobile base Sinhala book reader for visually impaired individuals?
- How can the usability and user experience of the book reader be improved for visually impaired individuals?
- How to Enhance The Overall Visually Impaired Individual's Satistification?
- How to Address the Limited Availability of Sinhala-Language Resources for Visually Impaired Individuals?

OBJECTIVES

MAIN OBJECTIVE

- The primary purpose of creating a Sinhala book reader for visually impaired individuals is to enable them to access literature in their mother tongue.
- This initiative aims to improve their literacy and promote their integration into society.

SUB OBJECTIVE

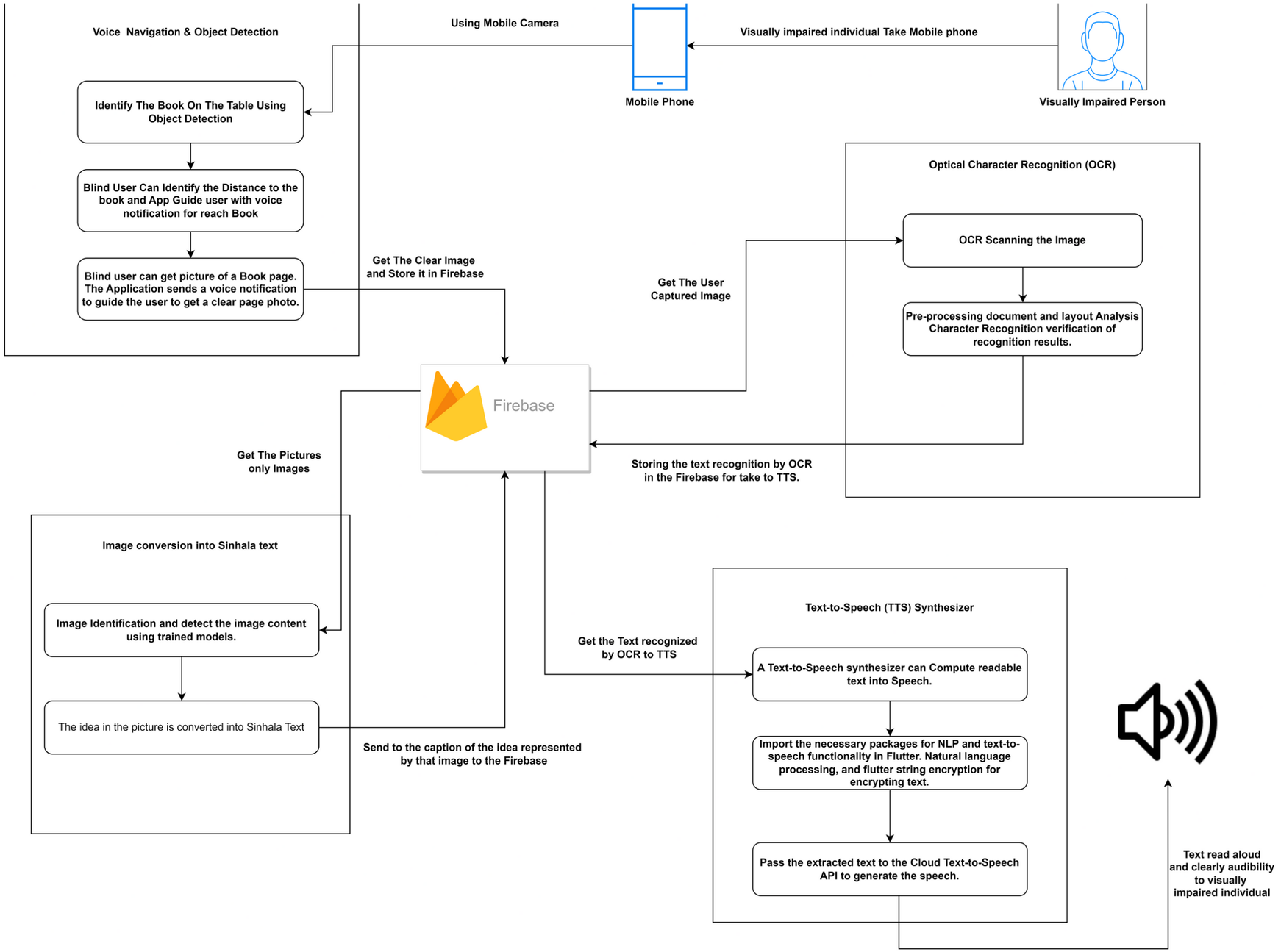
Voice Navigation & Object Identification

Optical Character Recognition (OCR)

Image conversion into Sinhala text

Text-to-Speech (TTS) Synthersizer

SYSTEM DIAGRAM



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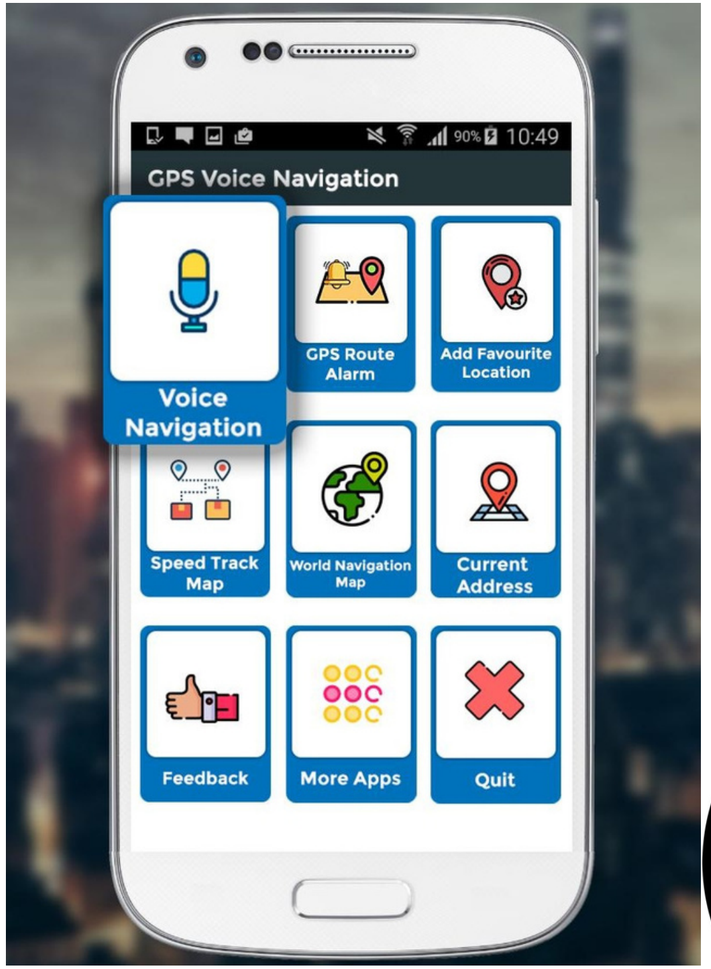
INFORMATION TECHNOLOGY



VOICE NAVIGATION AND OBJECT DETECTION

INTRODUCTION

- Sinhala voice navigation is a technology that enables users to navigate an application using voice commands spoken in the Sinhala language, which is the primary language spoken in Sri Lanka. This technology is particularly useful for individuals who may have difficulty seeing as visually impaired persons, as it allows them to interact with the application in a more natural and intuitive way.

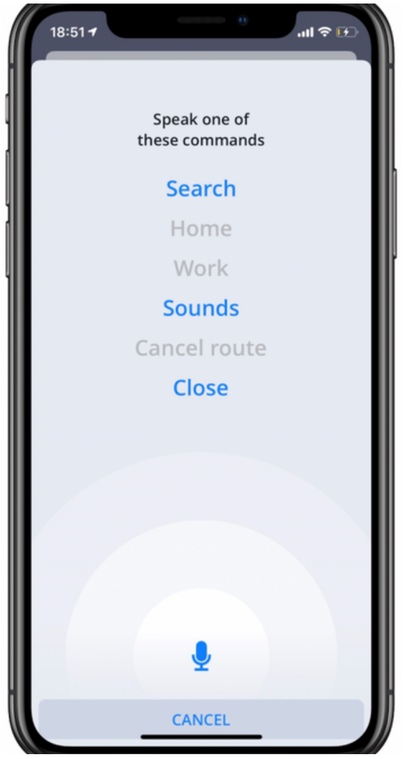
- Voice navigation technology has become increasingly popular in recent years, as more and more people rely on their smartphones and other devices for daily tasks. Sinhala voice navigation technology is especially important for users in Sri Lanka, where the majority of the population speaks Sinhala as their first language.

- Object detection is a computer vision technology that enables an app to identify and locate objects within an environment using the device's camera.

- Using this technology, the user's potential benefit is the capability of exploring a new environment safely. This feature allows users to identify the objects around them and notify in the Sinhala language about what the object is and how much distance that object is.

RESEARCH QUESTION

- How effective is Sinhala voice navigation technology in improving the accessibility and usability of mobile applications for Sinhala-speaking users?
- What are the key technical challenges in implementing Sinhala voice navigation in mobile applications, and how can these challenges be addressed?
- How does the accuracy of Sinhala voice recognition technology compare to other voice recognition technologies, such as English or Mandarin?
- What are the cultural and linguistic considerations that need to be taken into account when designing Sinhala voice navigation technology for mobile applications?
- How can Sinhala voice navigation be integrated with other accessibility features, such as screen readers or haptic feedback, to create a more inclusive user experience?
- What are the privacy and security implications of using voice commands to navigate mobile applications, and how can these concerns be addressed?
- How can Sinhala voice navigation technology be adapted to support users with different levels of language proficiency or dialects?



RESEARCH PROBLEM

- The primary problem that this research project aims to address is the lack of comprehensive technology that can aid visually impaired people in their daily lives.
- Visually impaired people face challenges in navigating an app, object detection, and avoidance, which limits their mobility and independence.

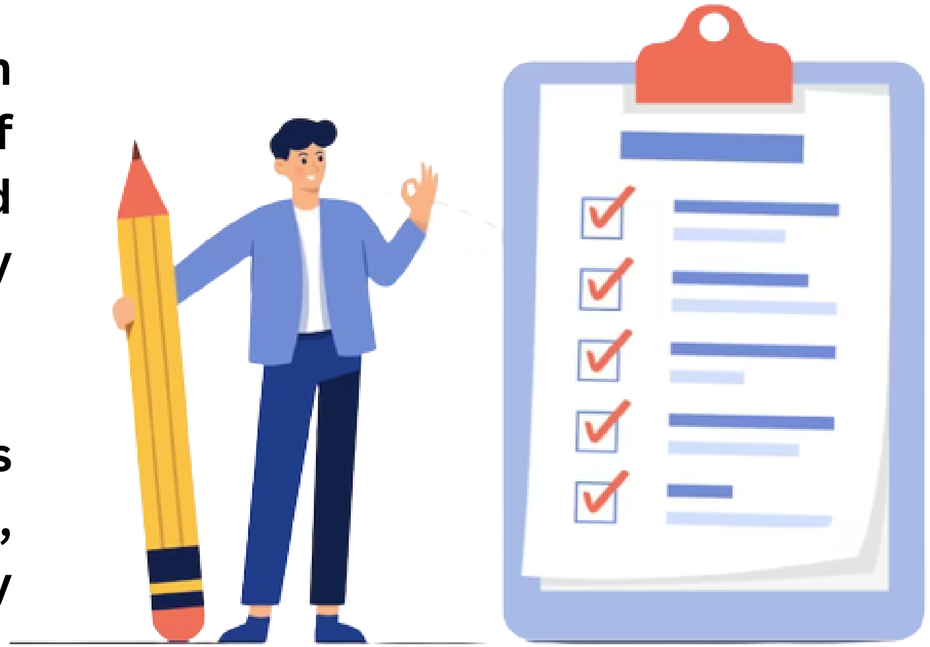
RESEARCH GAP

References	Opportunities for implementing voice navigation technology for Sinhala-speaking users	Identify the voice of the user and identify the command clearly	Clear Sinhala Voice commands and navigations	Real time object detection and distance calculation, with guidance to avoid dangerous objects.
Research A				
Research B				
Research C				
Proposed System				

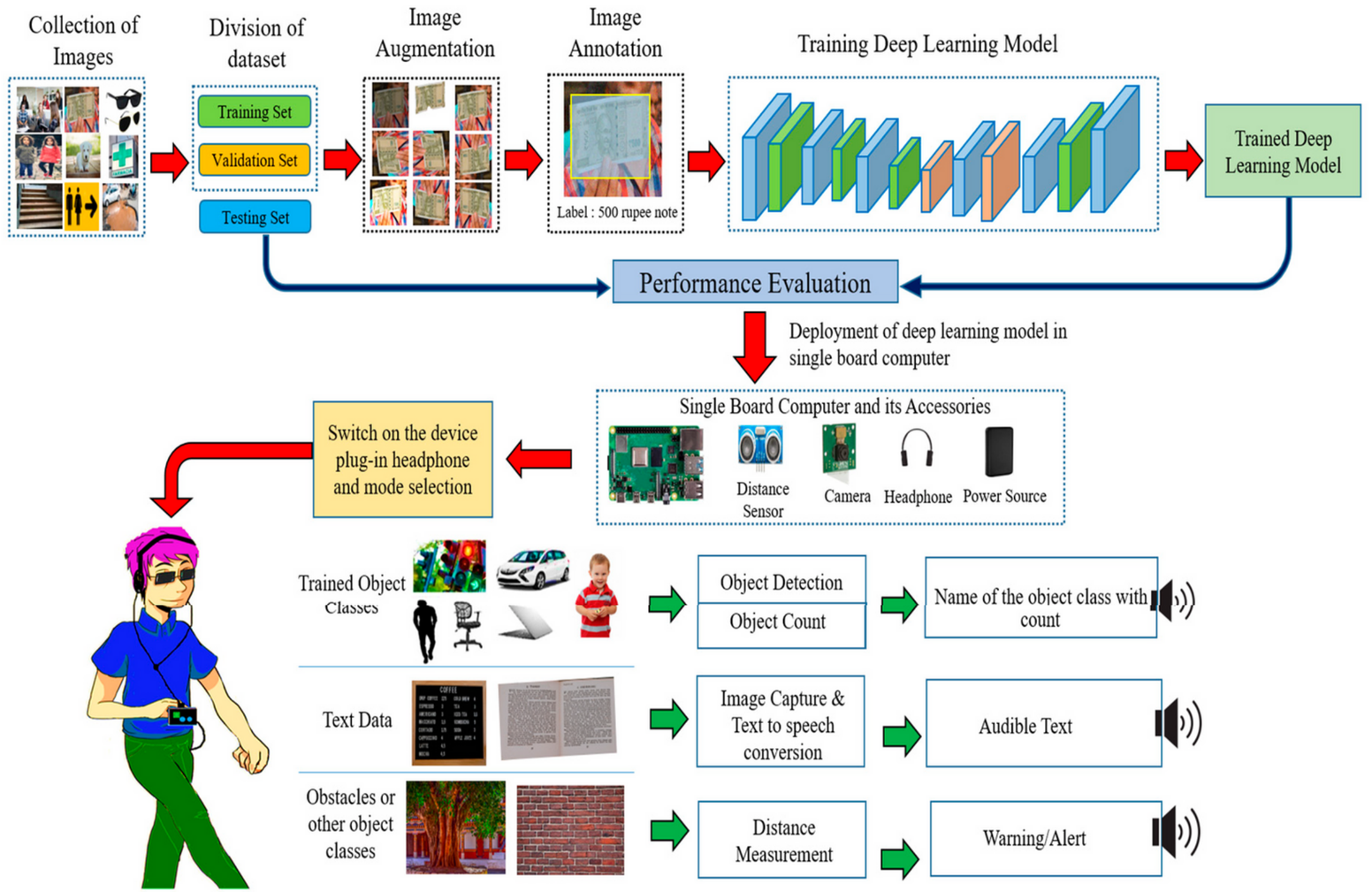
OBJECTIVES

- **The primary problem that this research project aims to address is the lack of comprehensive technology that can aid visually impaired people in their daily lives.**

- **Visually impaired people face challenges in navigating an app, object detection, and avoidance, which limits their mobility and independence.**



METHODOLOGY SYSTEM DIAGRAM



TECHNOLOGIES

- Android
- Flutter Framework
- Firebase Database
- Google's Natural Language API
- Google Speech Recognition
- Microsoft's Cognitive Services
- Amazon Polly
- TensorFlow
- Natural Language Processing






TECHNIQUES

1: System Design and Development

- The first step of the research project will be to design and develop the system. The system will consist of a mobile app that will enable visually impaired people to navigate using voice commands. The app will also have an object detection and avoidance system that will instruct the user to avoid objects through voice commands.

2: Machine Learning Integration

- The object detection and avoidance system will use machine learning to enhance its accuracy and efficiency. The system will be trained on a dataset of objects to detect and avoid. The machine learning algorithm will be integrated with the system to enable real-time object detection and avoidance.

3: System Testing and Validation

- The developed system will be tested and validated to ensure its accuracy, efficiency, and effectiveness in aiding visually impaired people. The testing will be done using a sample of visually impaired people who will use the system and provide feedback on its performance. The system will be refined based on the feedback received to improve its performance

FUNCTIONAL & NON-FUNCTIONAL REQUIREMENT

Functional

- Hardware: A computer with sufficient processing power, a smartphone or tablet, and a camera
- Software: Programming languages (Python, Java, etc.), machine learning libraries (TensorFlow, PyTorch, etc.), app development frameworks (React Native, etc.)
- Data: A dataset of images for object detection and distance calculation, as well as a dataset of voice commands and feedback responses

Non-Functional

- Performance: Responsive and seamless voice conversion and navigation.
- Accessibility: The application should be accessible to visually impaired individuals and conform to accessibility guidelines.
- Reliability: The application should be reliable and provide consistent voice conversion and feedback.
- Security: The application should be secure to protect user information and reading history.

SOFTWARE & PERSONAL REQUIREMENTS

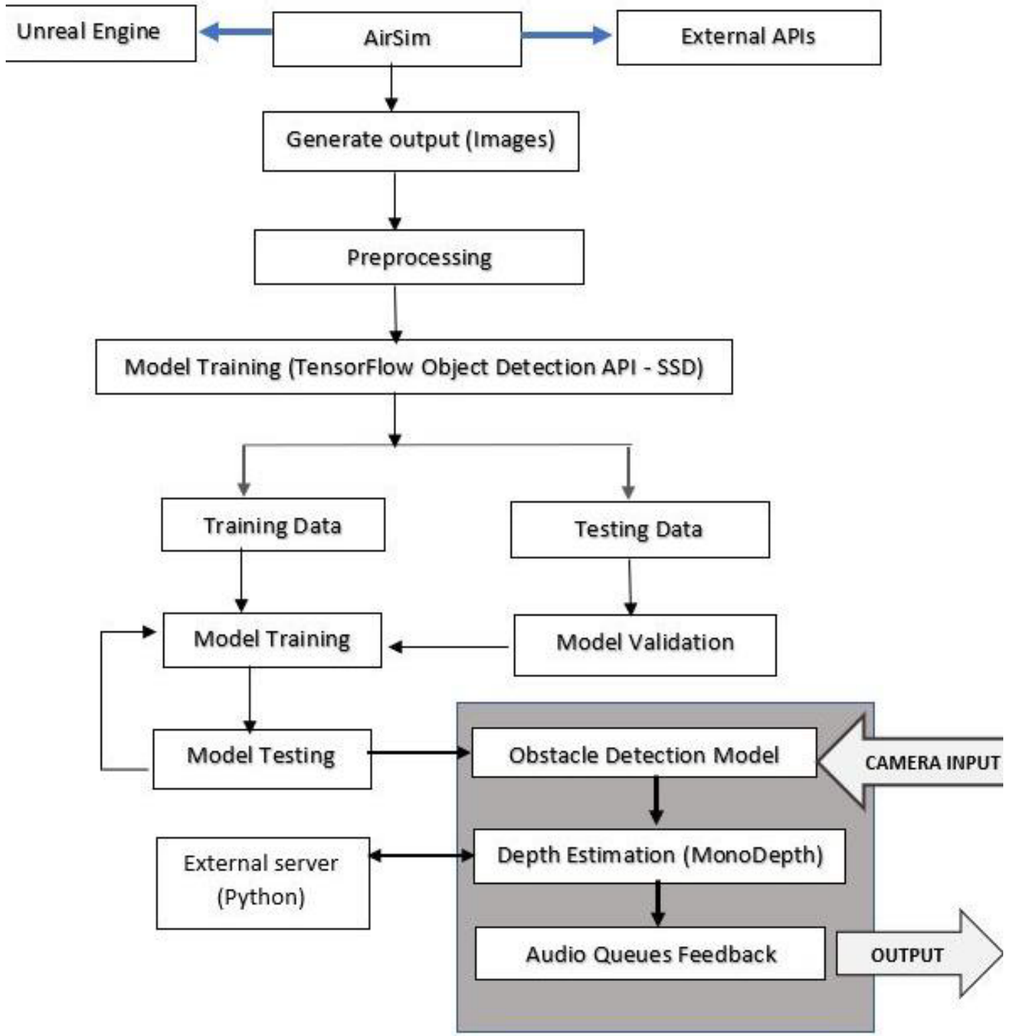
Software Requirement

- Mobile Operating System: The application should be compatible with Android operating systems.
- Google's Natural Language API
- Google Speech Recognition
- Microsoft's Cognitive Services

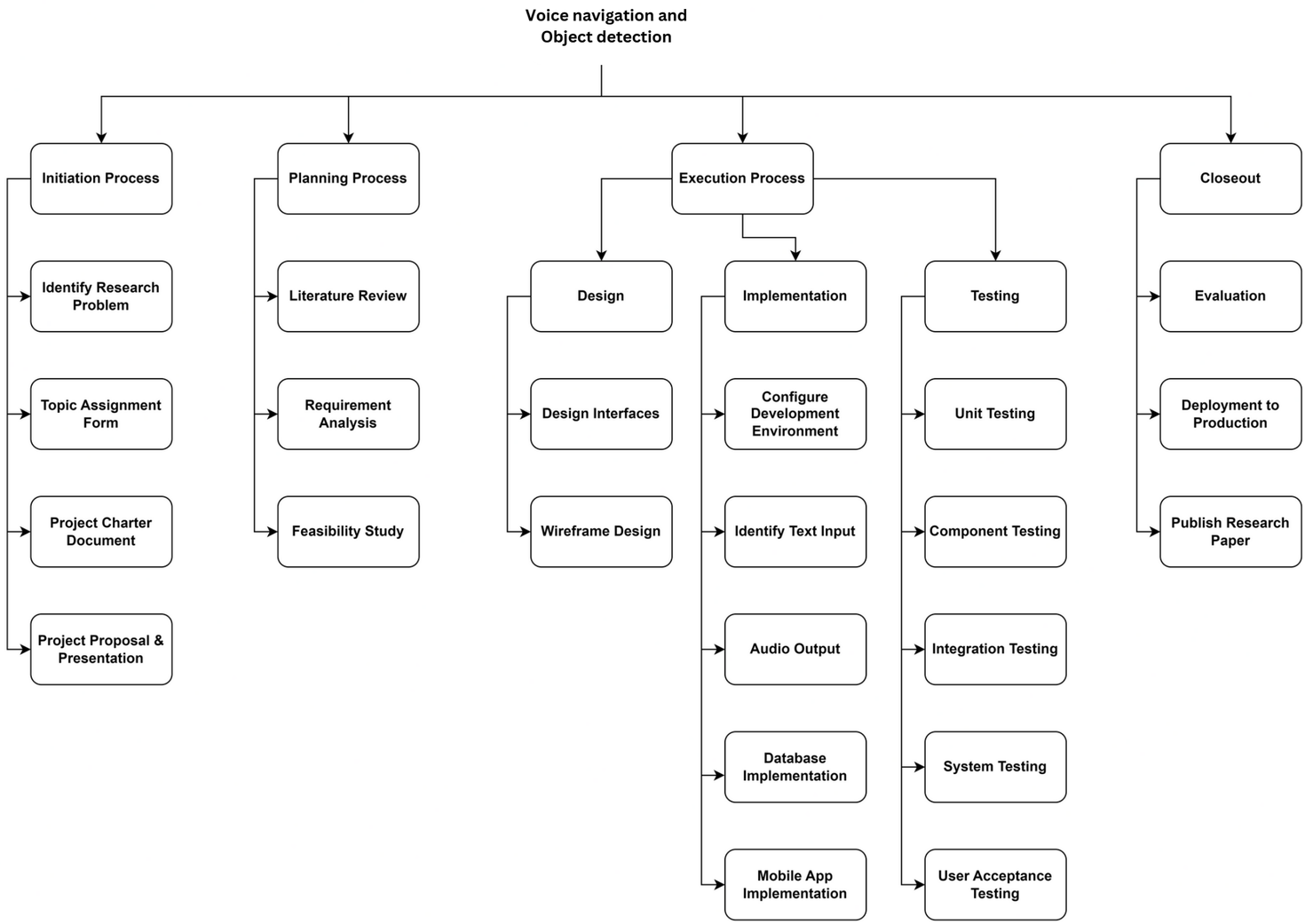
Personal Requirements

- Sinhala Language Support: The application should support the Sinhala language and have accurate voice commands and feedback.

OVERALL IMPLEMENTATION PROCESS



WORK BREAKDOWN STRUCTURE



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INFORMATION TECHNOLOGY

OPTICAL CHARACTER RECOGNITION (OCR)

INTRODUCTION

- Optical character recognition is the process of classification of optical patterns contained in a digital image. This turns images of typed, handwritten, or printed text into machine-encoded text that might be electronic or mechanical.

- This allows users to scan and recognize text from images or documents using the camera of their smartphone. With the help of OCR technology, the app can convert recognized text into spoken words, allowing visually impaired individuals to access and understand the content.

- We understand the importance of inclusive technology, and we are committed to providing visually impaired individuals with the tools they need to access information and enhance their quality of life. With the OCR part of our app, users can read books.

- Most existing OCR programs are designed for English and industrial use, so this application is mainly for the Sinhala language.

RESEARCH QUESTION

- **What are the key features and functionalities that blind users look for in an OCR mobile app, and how can these be optimized for a better user experience?**
- **What are the current challenges and limitations in OCR technology for mobile apps, and how can they be overcome to improve the accuracy and speed of text recognition?**
- **What are the best ways to train and educate blind people on how to use OCR mobile apps effectively, and what are some common barriers to adoption and usage?**
- **How can OCR technology be combined with other assistive technologies, such as voice assistants?**
- **The challenge of achieving high accuracy and reliability in text recognition, particularly when dealing with a wide range of fonts, styles, and languages**

RESEARCH PROBLEM

- **Most visually impaired people in Sri Lanka doesn't have a proper platform to capture the texts they need and read it.**
- **Identify the limitations of visually impaired people while using a smart phone and thier knowledge about the technology.**

RESEARCH GAP

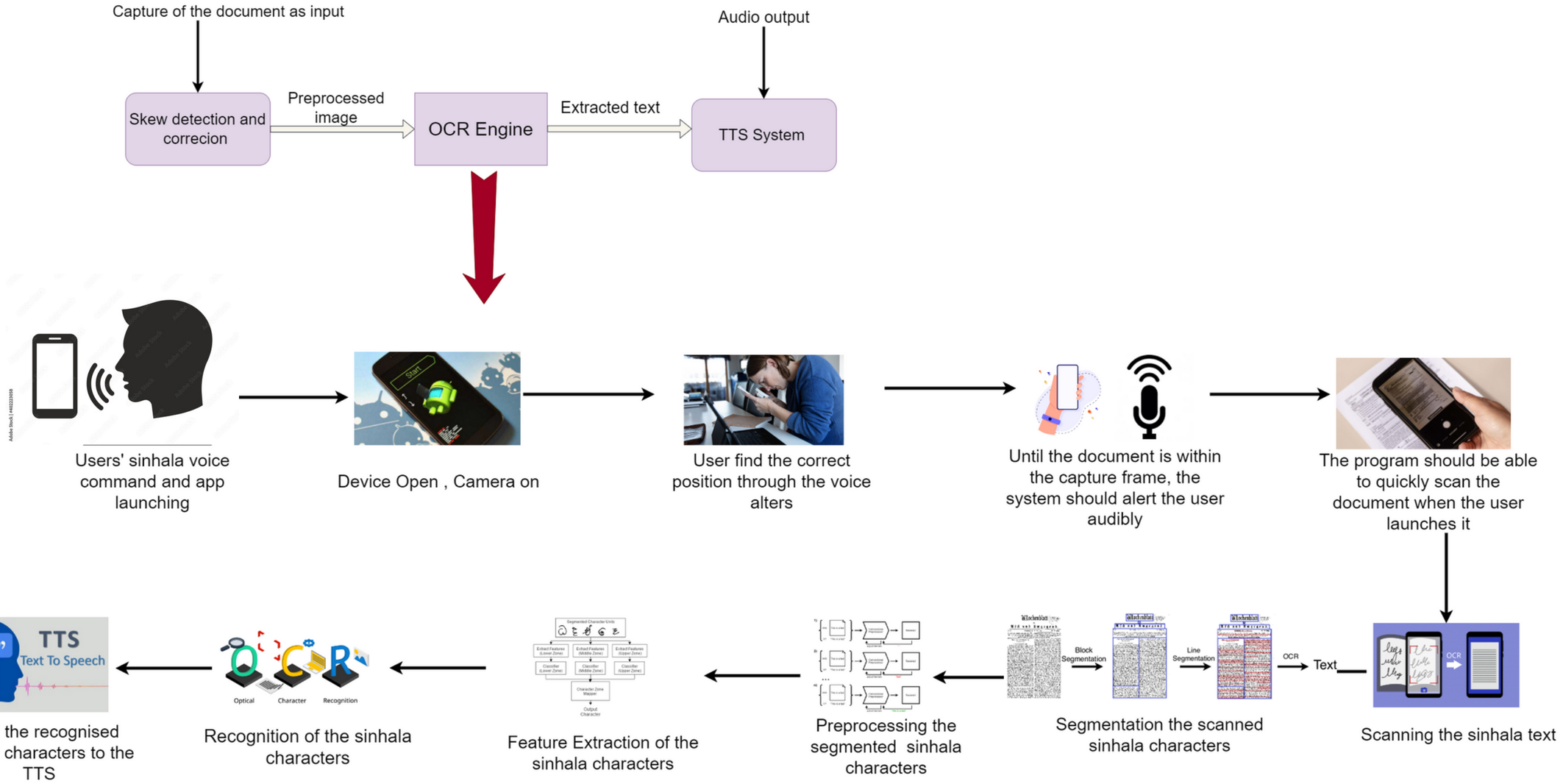
Application Reference	OCR system for identifying the included texts of a image which supports for visually impaired people	Support for Sinhala Language	Until the document is within the capture frame, the system should alert the user audibly.	Uses for multi-font and multi size fonts identification,supported by segmenting the characters	Mobile Application
Research A	✗	✗	✗	✓	✗
Research B	✗	✗	✗	✗	✗
Research C	✓	✗	✗	✓	✗
Research D	✓	✗	✗	✓	✓
Proposed System	✓	✓	✓	✓	✓

OBJECTIVES

To develop an OCR system which is basically suitable for sinhala language.

- Developing a reliable and accurate OCR system.Also Achieve high accuracy in recognizing text from images
- The OCR system should be able to recognize text in sinhala language, depending on the user's needs.
- Sinhala Character Identification and word formation through engine and translate to the speech then send it to the TTS
- Integrate and evaluate the sinhala OCR system for visually impaired individuals

METHODOLOGY SYSTEM DIAGRAM



TECHNOLOGIES

- Android
- Flutter Framework
- Firebase Database
- OCR Engine
- Tesseract OCR
- Google Cloud Vision OCR
- Google API
- Natural Language Processing

TECHNIQUES

- OCR engine: The OCR engine is the core component of the app, which is responsible for converting the scanned image into text. The OCR engine should be able to recognize different fonts and text sizes accurately

- Accessibility: The app should be designed to be accessible for users with different levels of visual impairment.

- Testing: Testing is a critical component of app development, and it is especially important when building an app for blind users. The app should be tested with blind users to ensure that it is accessible and easy to use.

- Techniques for continuous integration and deployment can make it possible to update the app more efficiently and frequently

- Localization techniques can ensure that the app is properly adapted to the Sinhala language and culture.

- The device's storage should be used to store the image that was captured.

REQUIREMENTS

Functional Requirements:-

- Accurate character recognition: The OCR software must be able to accurately recognize characters from scanned images, even if they are of poor quality or resolution.
- Language support: The OCR software must be able to recognize characters in Sinhala languages .
- User customization: The OCR software must allow users to customize the font size and background of the text for each of reading.
- Accessibility features: The OCR software must comply with accessibility guidelines and have features such as when app is not running the program should also be able to start with a voice command

Non -Functional Requirements:-

- Reliability
- Performance
- Availability
- Security
- System should respond in real-time

SOFTWARE & PERSONAL REQUIREMENTS

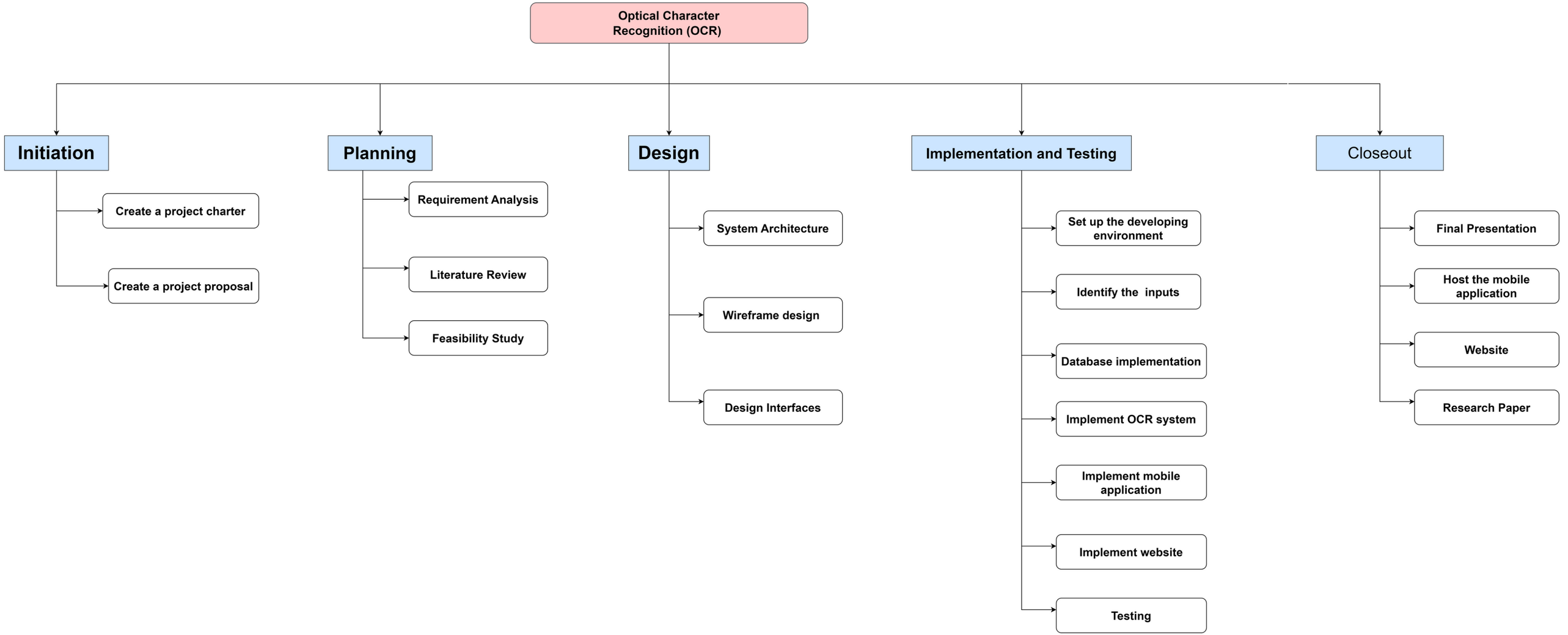
Software Requirement

- **Mobile Operating System: The application should be compatible with Android operating systems.**
- **OCR Engine: The application should use a reliable and high-quality OCR engine like Tesseract OCR**

Personal Requirements

- **Sinhala Language Support: The application should support the Sinhala language and OCR should identify the sinhala characters.**

WORK BREAKDOWN CHART



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INFORMATION TECHNOLOGY

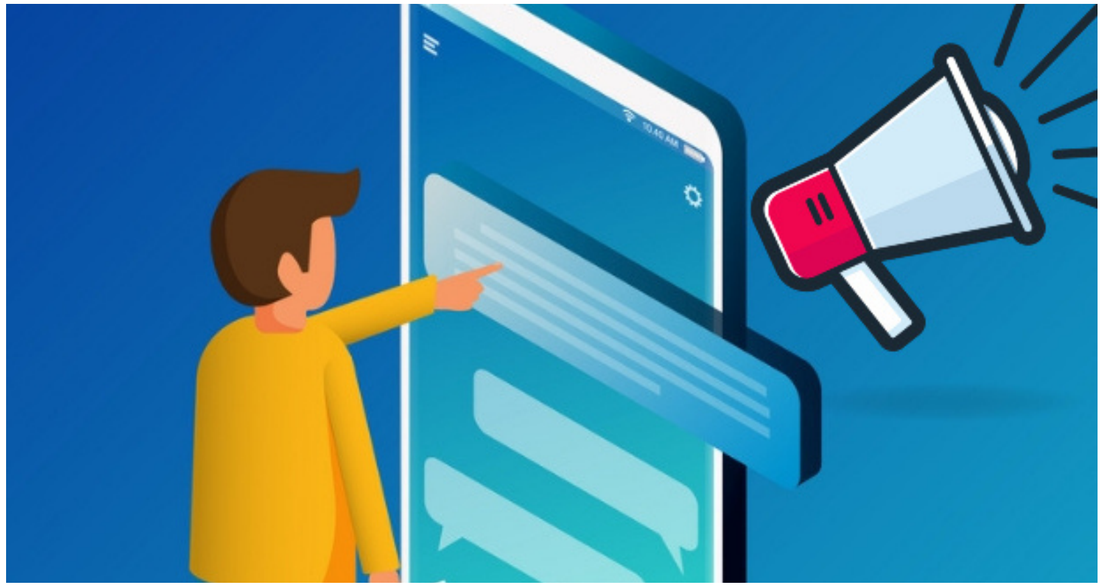


Image conversion into Sinhala text

IT20254520 | Bhagya H.D.M. | TMP-23-198

INTRODUCTION

- **Image detection and conversion to speech for blind users is an area of research in computer vision and assistive technology.**

- **The goal is to enable visually impaired individuals to have greater access to visual information in their environment.**

- **Traditional methods of using Braille or tactile cues can be limited in scope and time-consuming to learn. With the advent of mobile technology and machine learning, image detection apps offer an innovative and accessible solution to this problem.**

RESEARCH QUESTION

- **How effective is a mobile-based Sinhala book reader with an image detection function in improving reading accessibility for visually impaired individuals in Sri Lanka, and what factors contribute to its effectiveness?**

- **What are the challenges and opportunities in designing and developing a mobile-based Sinhala book reader with an image detection function that meets the needs of visually impaired individuals in Sri Lanka?**

- **How does the use of a mobile-based Sinhala book reader with an function affect the image experience and satisfaction of visually impaired individuals in Sri Lanka, and how does it compare to other image detection aids and tools currently available?**

RESEARCH PROBLEM

- **What types of visual information are most important for blind or visually impaired children to access in images, and how can we present this information in a way that is meaningful and engaging for them?**

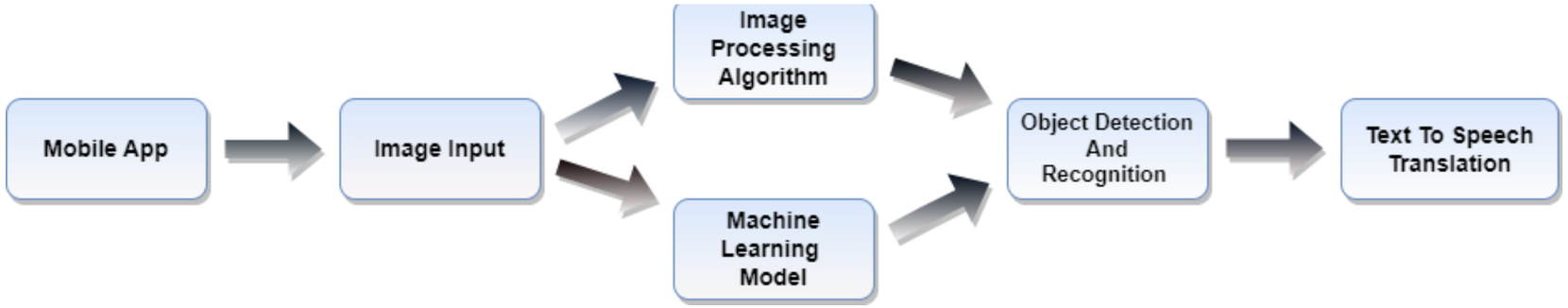
RESEARCH GAP

Application Reference	Highly accurate image to text conversion system	Real time image detection app for blind users	Mobile Application	Support for Sinhala Language	User friendly interfaces for blind users
Research A					
Research B					
Research C					
Proposed System					

OBJECTIVES

- Enhancing accessibility
- Improving quality of life
- Increased independence
- Enhanced entertainment
- Enhanced education

METHODOLOGY SYSTEM DIAGRAM



TECHNOLOGIES & TECHNIQUES

Technologies

- Android Studio
- Flutter
- Firebase
- TensorFlow
- Amazon Rekognition
- Flutter Vision

Techniques

- Agile software development techniques can allow for more flexible and iterative development of the app.
- User-centered design techniques can help to ensure that the app is designed with the needs of visually impaired users in mind.
- The app should be designed to be accessible for users with different levels of visual impairment

REQUIREMENTS

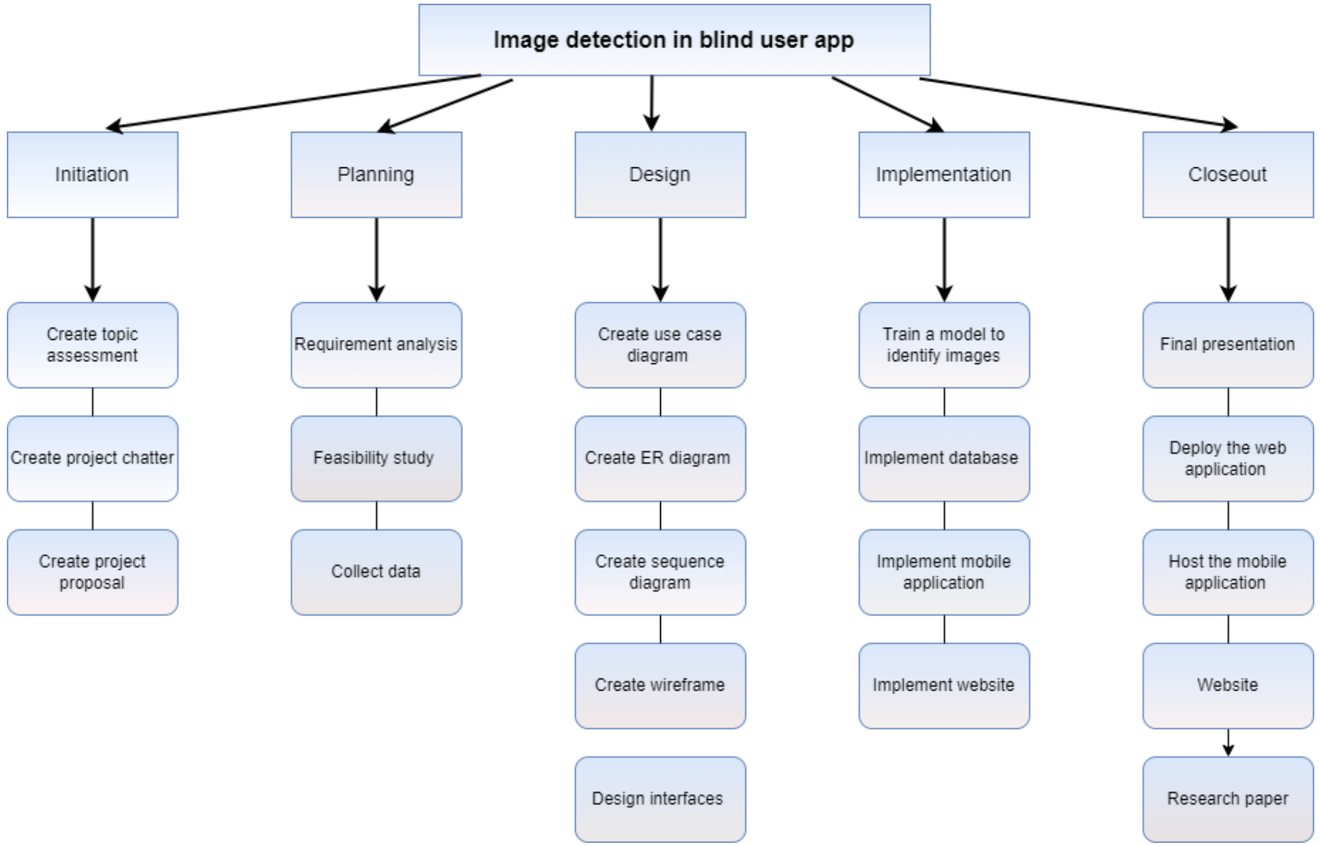
Software Requirement

- **Mobile Operating System: The application should be compatible with Android operating systems.**
- **Image detection Engine: The application should use a reliable and high-quality image detection engines**

Personal Requirement

- **Sinhala Language Support: The application should support the Sinhala language and images should cover to the Sinhala characters.**

WORK BREAKDOWN CHART



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- https://www.levelaccess.com/blog/understanding-assistive-technology-how-does-a-blind-person-use-the-internet/#:~:text=A%20braille%20display%20is%20a,read%20text%20using%20their%20fingers.
- https://nanonets.com/image-recognition

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INFORMATION TECHNOLOGY

INTRODUCTION

Text-to-Speech (TTS) Synthersizer

BACKGROUND

- TTS stands for Text-To-Speech, which is a technology that converts written text into spoken words. It's a useful tool for visually impaired people as well as others who prefer to listen to content instead of reading it.

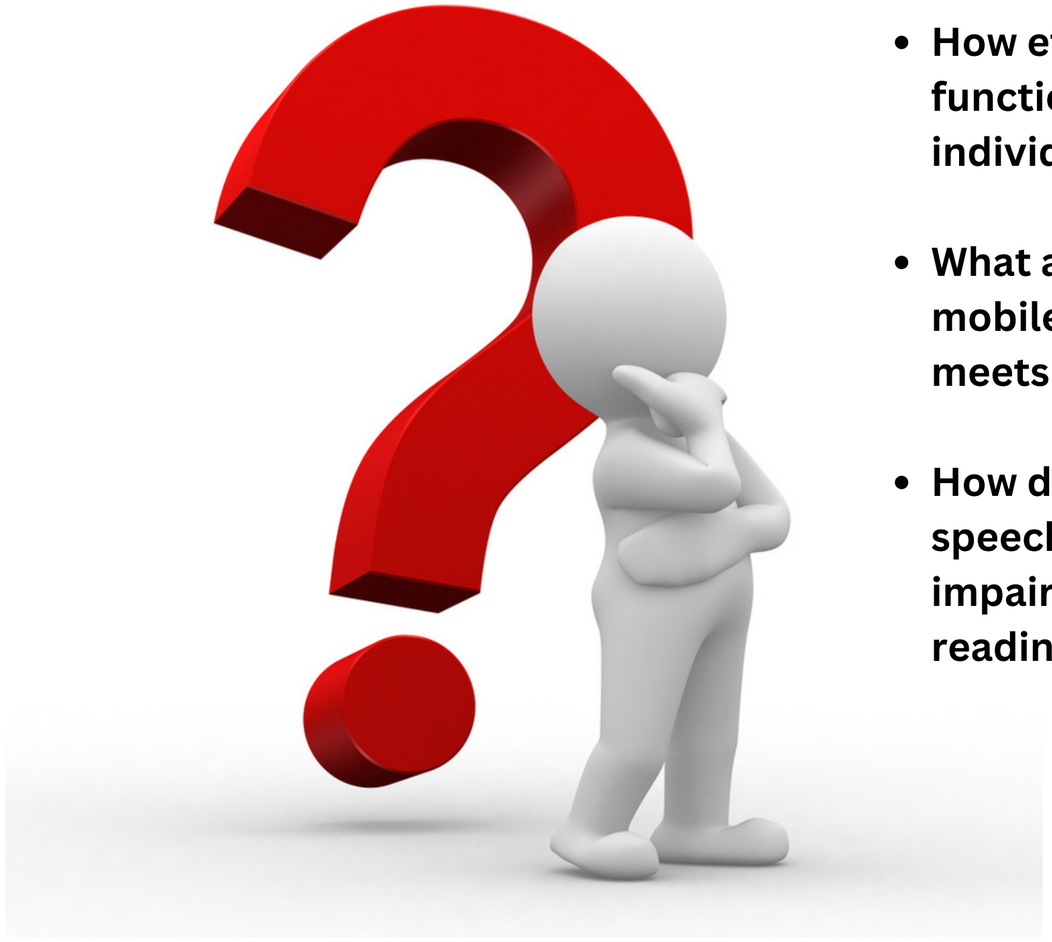
- The main purpose of using Text to speech (TTS) technology is to give a blind person the ability to access the written text of a Sinhala book. This allows them to easily listen to the valuable content of Sinhala books.

- TTS technology allows the written text in a Sinhala book to be read out loud in a natural-sounding voice, which makes it easier for visually impaired people to understand the content.

RESEARCH GAP

Application Reference	Highly accurate Sinhala TTS conversion system	Real time OCR text send to TTS synthesizer	Adjust the book reading Speed	Support for Sinhala Language	Mobile Application
Research A	✗	✗	✓	✓	✗
Research B	✗	✓	✗	✓	✗
Research C	✓	✓	✗	✗	✗
Research D	✓	✗	✗	✓	✗
Proposed System	✓	✓	✓	✓	✓

RESEARCH QUESTION

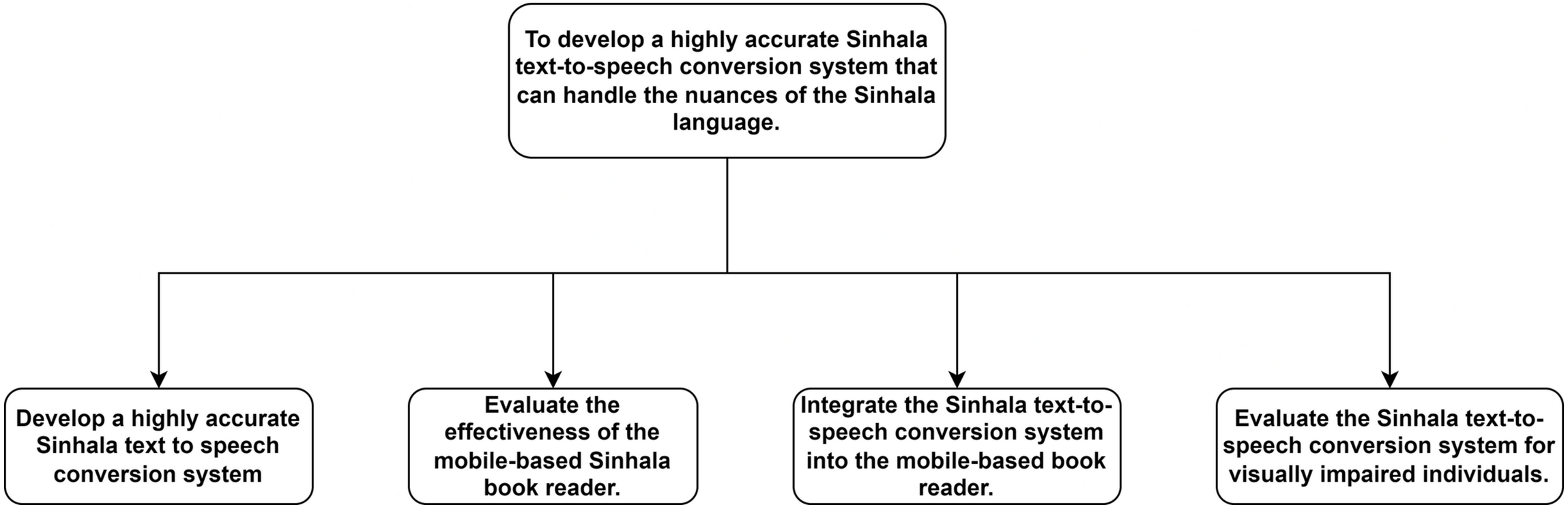


- How effective is a mobile-based Sinhala book reader with a text-to-speech function in improving reading accessibility for visually impaired individuals in Sri Lanka, and what factors contribute to its effectiveness?
- What are the challenges and opportunities in designing and developing a mobile-based Sinhala book reader with a text-to-speech function that meets the needs of visually impaired individuals in Sri Lanka?
- How does the use of a mobile-based Sinhala book reader with a text-to-speech function affect the reading experience and satisfaction of visually impaired individuals in Sri Lanka, and how does it compare to other reading aids and tools currently available?

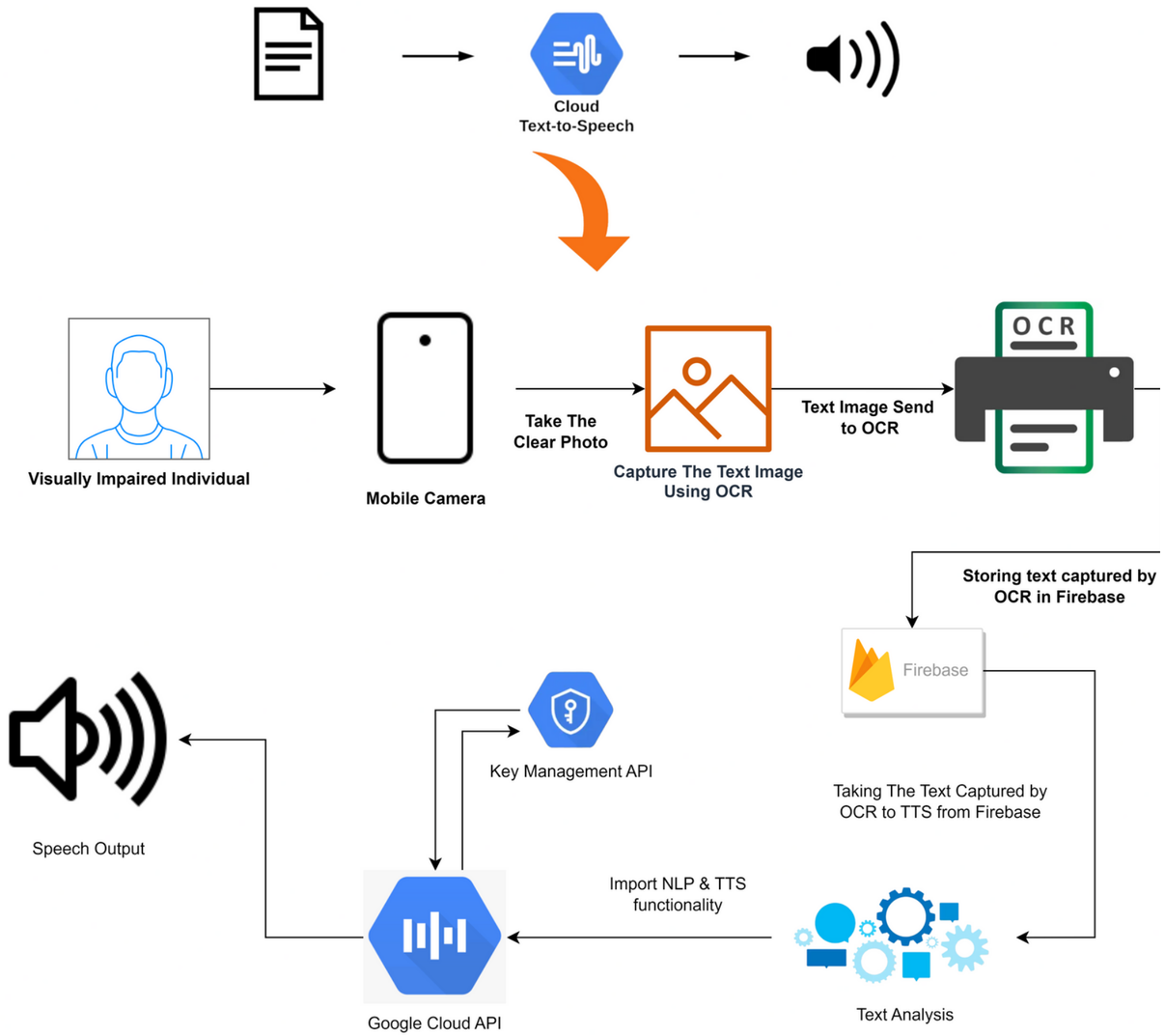
RESEARCH PROBLEM

- **How to develop an accurate Sinhala text-to-speech conversion system that can handle the nuances of the Sinhala language?**
- **How to design a user-friendly interface for visually impaired individuals to access and interact with the mobile-based book reader?**
- **How to evaluate the effectiveness of the mobile-based Sinhala book reader in enhancing the reading experience of visually impaired individuals?**

Objectives


To develop a highly accurate Sinhala text-to-speech conversion system that can handle the nuances of the Sinhala language.
Develop a highly accurate Sinhala text to speech conversion system
Evaluate the effectiveness of the mobile-based Sinhala book reader.
Integrate the Sinhala text-to-speech conversion system into the mobile-based book reader.
Evaluate the Sinhala text-to-speech conversion system for visually impaired individuals.

METHODOLOGY SYSTEM DIAGRAM



TOOLS & TECHNOLOGIES

- Android Studio
- Flutter
- Firebase
- Google API
- Flutter_tts
- TTS Engine
- Amazon Polly
- TensorFlow
- Natural Language Processing

TECHNIQUES

- User-centered design techniques can help to ensure that the app is designed with the needs of visually impaired users in mind.
- Agile software development techniques can allow for more flexible and iterative development of the app.
- Usability testing techniques like user testing can help to identify and address usability issues in the app.
- Continuous integration and deployment techniques can allow for more efficient and frequent updates to the app.
- Localization techniques can ensure that the app is properly adapted to the Sinhala language and culture.

FUNCTIONAL & NON-FUNCTIONAL REQUIREMENT

Functional

- The mobile book reader must have a high-quality text-to-speech (TTS) engine capable of accurately reading Sinhala text out loud.
- The TTS function must have adjustable speed settings so that visually impaired individual can adjust the reading speed according to their preferences.
- The TTS function should have a pause and resume feature so that the user can stop and start the reading at any time.

Non-Functional

- Performance: Responsive and seamless TTS conversion and navigation.
- Accessibility: The application should be accessible to visually impaired individuals and conform to accessibility guidelines.
- Reliability: The application should be reliable and provide consistent TTS conversion
- Security: The application should be secure to protect user information and reading history.

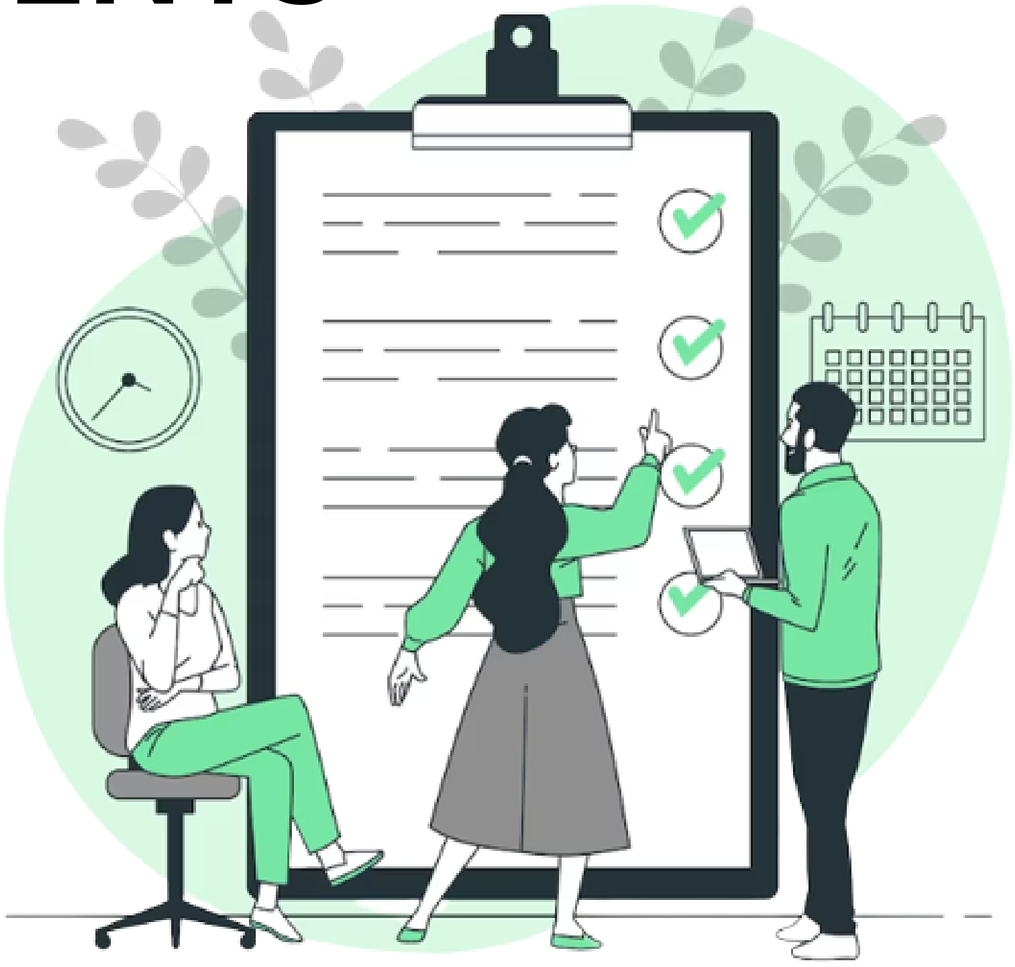
SOFTWARE & PERSONAL REQUIREMENTS

Software Requirement

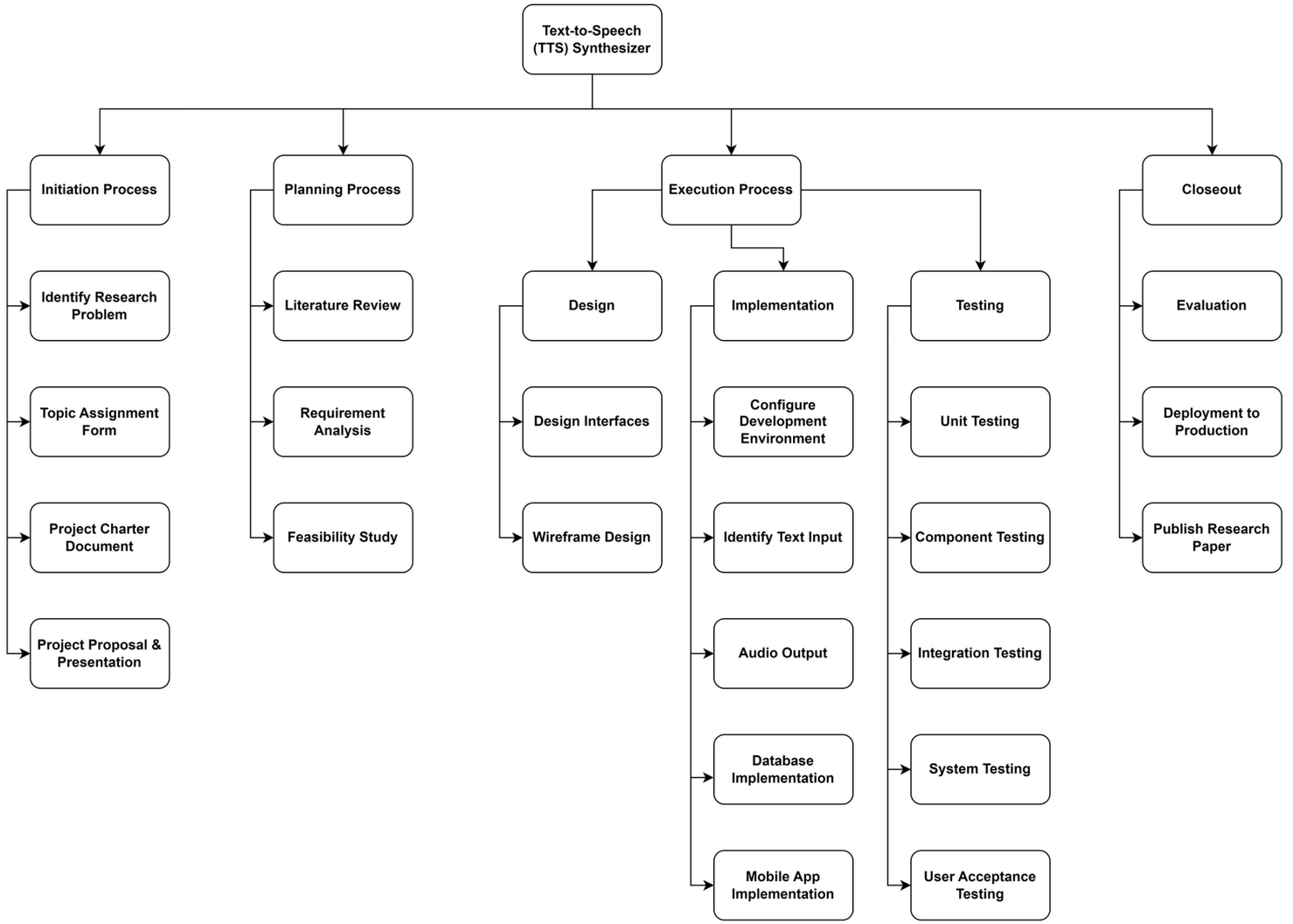
- **Mobile Operating System: The application should be compatible with Android operating systems.**
- **TTS Engine: The application should use a reliable and high-quality TTS engine like Google Text-to-Speech.**

Personal Requirements

- **Sinhala Language Support: The application should support the Sinhala language and have accurate TTS conversion for Sinhala text.**



WORK BREAKDOWN STRUCTURE



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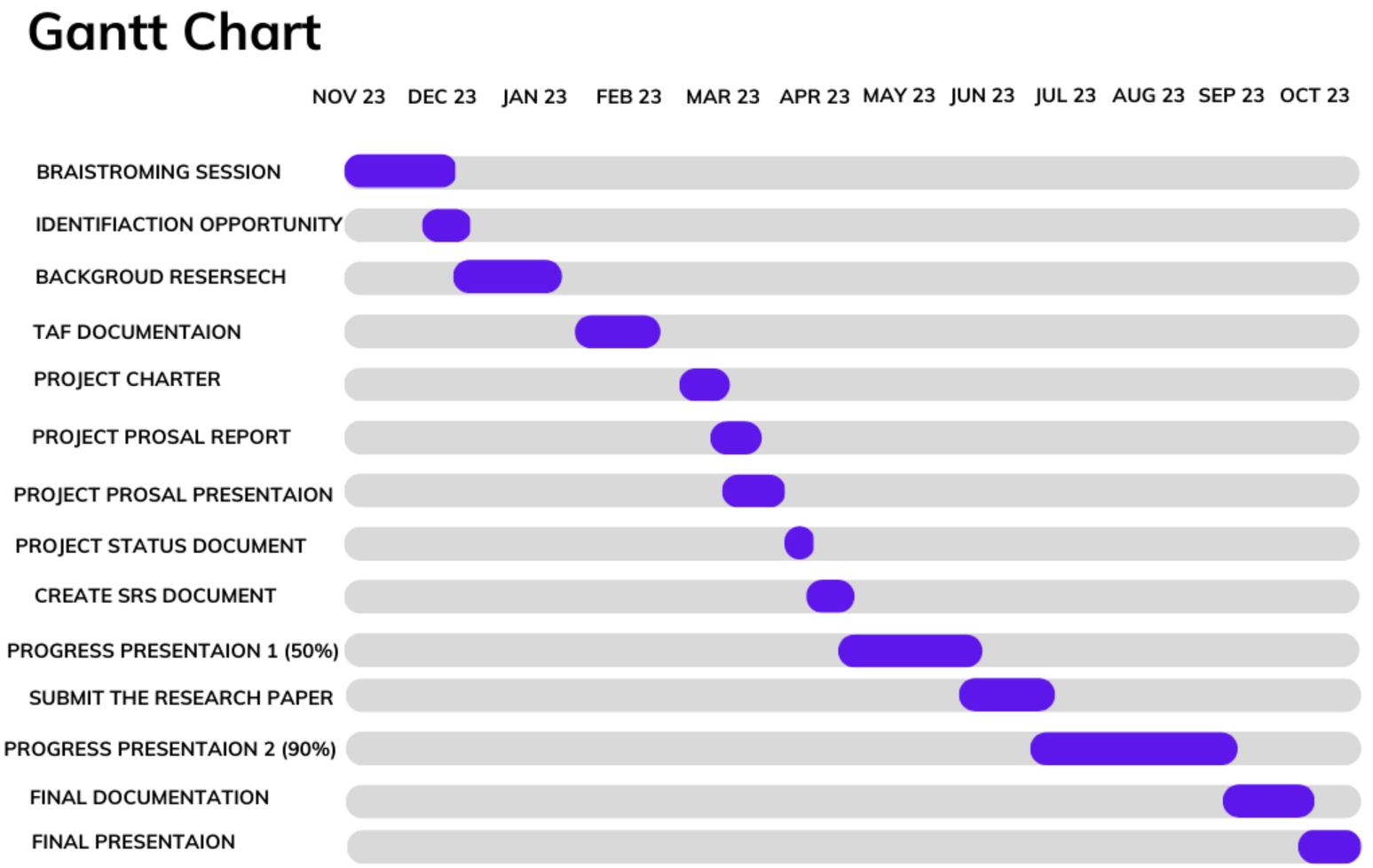
SUPPORTIVE INFORMATION BUDGET

- Development Cost
- Server & Hosting Cost
- Marketing Budget
- Purchasing necessary Softwares
- Maintenance Budget
- Legal & Administrative Expenses

GANTT CHART


Gantt Chart
NOV 23
DEC 23
JAN 23
FEB 23
MAR 23
APR 23
MAY 23
JUN 23
JUL 23
AUG 23
SEP 23
OCT 23
BRAISTROMING SESSION
IDENTIFIACTION OPPORTUNITY
BACKGROUD RESERSECH
TAF DOCUMENTAION
PROJECT CHARTER
PROJECT PROSAL REPORT
PROJECT PROSAL PRESENTAION
PROJECT STATUS DOCUMENT
CREATE SRS DOCUMENT
PROGRESS PRESENTAION 1 (50%)
SUBMIT THE RESEARCH PAPER
PROGRESS PRESENTAION 2 (90%)
FINAL DOCUMENTATION
FINAL PRESENTAION

Thank You