

AI base Alzheimer care and Cognitive Support Mobile App.

Project ID: 24-25J 304

Project Proposal Report

Sandaruwan W.M.I.M.

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B.Sc. (Hons) Degree in Information Technology

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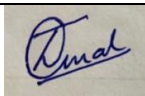
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DECLARATION

We declare that this is our own work, and this proposal does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any other university or Institute of higher learning and to the best of our knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

Candidate Name	Student ID	Signature
Sandaruwan W.M.I.M.	IT21231100	

The above candidates are carrying out research for the undergraduate Dissertation under my supervision.



.....
Signature of the supervisor

(Mrs. Uthpala Samarakoon)
23/08/2024



.....
Signature of the co-Supervisor

(Ms. Poorna Panduwawala)
23/08/2024

Abstract

The goal of this research is to create an AI-powered smartphone application that improves Alzheimer's care and cognitive support for patients, carers, and clinicians. Alzheimer's disease, which is characterized by cognitive deterioration, presents substantial obstacles in patient treatment, particularly in early detection and continued monitoring. Current systems frequently lack real-time analysis, tailored care recommendations, and user-friendly tools for non-expert carers. This research aims to fill these gaps by utilizing AI technologies including real-time voice analysis, cognitive evaluation tools, and personalized learning paths.

The study will involve designing and implementing a mobile application with features such as real-time speech analysis to detect early signs of cognitive decline, AI-powered cognitive assessment tools, and an AI assistant that provides social interaction prompts and personalized Alzheimer's care recommendations. The software will also prioritize data protection and security, ensuring that patient information is safe. To increase user engagement, the app will deliver real-time feedback and allow users to customize their cognitive workouts based on their performance. The study will follow a development lifecycle that includes requirements gathering, design, programming, testing, and deployment, as well as ongoing user feedback loops to improve features and functionality.

This novel technique stands out from previous research by providing a comprehensive, real-time, and personalized Alzheimer's care tool that incorporates numerous AI-powered features. This software, which focusses on ease of use and accessibility, will enable carers and physicians to better manage and monitor the progression of Alzheimer's disease, resulting in more prompt interventions and better patient outcomes. The projected conclusion is a scalable, user-friendly program that dramatically improves the quality of care delivered to Alzheimer's patients, thereby setting a new bar for AI integration in healthcare.

Keywords: Alzheimer's care, AI-powered mobile phone application, cognitive assistance, real-time speech analysis, cognitive assessment tools, personalized learning paths, healthcare technology, patient monitoring, data privacy and security, early diagnosis, carer support, and machine learning in healthcare.

Acknowledgement

This is to express my sincere gratitude to you for all of your help and advice when I put together my research proposal. I could not have submitted this proposal without your experience and willingness to share your knowledge.

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LIST OF FIGURES

Figure 1 Research Gap Table.....	11
Figure 2 System overview.....	15
Figure 3 Mobile App.....	15
Figure 4 Connectivity Of the Project Component.....	16
Figure 5 Ghant Chart.....	18
Figure 6 Work Breakdown chart.....	19

Table of Contents

Table of Contents

DECLARATION	3
Abstract	4
Acknowledgement	5
LIST OF FIGURES	6
LIST OF ABBREVIATION	8
01. Introduction	9
1.1 Background and Literature Survey.....	10
1.2 Research Gap.....	11
1.3 Research Problem	11
02. Objectives	12
2.2 Main Objectives.....	12
2.2 Specific Objectives	12
2.2.1 User Requirements.....	12
2.2.2 Functional Requirements	13
2.2.3 Non-Functional Requirements	14
03. Methodology	15
3.1. Overall System Overview	15
3.1.1 Hardware Component	17
04. Description of Personal and Facilities	18
4.1. Functionality Of the Project Component.....	18
4.1.1. Connectivity Of the Project Component	18
4.1.2. Functionality Of the Hardware Component.....	18
4.2. System Technology.....	19
05. Gantt Chart	20
06. Work Breakdown Structure	21
07. Commercialization	22
08. Reference List.....	23

LIST OF ABBREVIATION

AD	Alzheimer's disease
AI	Artificial Intelligence
ML	Machine Learning
GDPR	General Data Protection Regulation
HIPPA	Health Insurance Portability and Accountability Act

01.Introduction

Millions of people worldwide suffer from the complicated and crippling neurological condition known as Alzheimer's disease. It is characterised by a persistent cognitive decline that progressively erodes the capacity to carry out daily tasks by impairing thinking, memory, and behaviour. Alzheimer's disease is becoming more common as the world's population ages, posing a serious threat to public health. Conventional techniques for identifying and treating Alzheimer's, like cognitive evaluations, neuroimaging, and clinical exams, frequently identify the illness only after significant cognitive impairment has already occurred. The effectiveness of therapies is hampered by this delay in diagnosis, which highlights the need for creative solutions that allow for earlier detection and more individualised care.

Recent developments in machine learning and artificial intelligence (AI) have created new opportunities for tackling the problems related to Alzheimer's disease. Speech analysis is one of these new developments that shows promise as a non-invasive early detection method. Research has demonstrated that minute modifications in speech patterns, like longer pauses, simpler speech, and different word choice, can act as early warning signs of cognitive deterioration linked to Alzheimer's disease. Through the use of artificial intelligence (AI) to examine these patterns, scientists have created machine learning models that can identify the disease's early indicators, perhaps leading to earlier interventions.

Despite these developments, existing methods frequently fall short of offering a complete answer that takes care of all aspects of Alzheimer's care. Even though speech analysis models' accuracy has significantly improved, systems that incorporate social and emotional assistance in addition to cognitive assessments are still required. While emotional health is vital to an Alzheimer's patient's overall quality of life, it is frequently disregarded in conventional care methods. Additionally, loneliness and social isolation are frequent problems for people with Alzheimer's, which exacerbates their illness.

My initiative intends to close these gaps by creating an AI-driven platform that emphasises the emotional and social aspects of Alzheimer's care in addition to cognitive assessment. Personalised guided meditation, relaxation techniques, and real-time mood tracking will all be incorporated into the system based on the individual needs and preferences of each patient. In order to fight isolation and encourage social participation, the platform will also make it easier for people to communicate with one another through safe video calls, messaging, and AI-suggested conversation topics.

This platform is designed to continuously learn and adapt in order to provide increasingly personalised and responsive treatment. This is achieved through the integration of clinical trial data, patient contact logs, and machine learning datasets. In addition to tracking mood trends and analysing ambient data, the AI-powered system will provide emotional support and interventions in real time. By addressing the cognitive, emotional, and social requirements of Alzheimer's patients in a cohesive manner, this holistic approach seeks to improve the quality of life for these individuals.

In addition, this project places a high priority on data security and privacy, guaranteeing adherence to laws governing healthcare like HIPAA and GDPR. The platform will protect sensitive patient data with strong encryption and data security procedures, making it a dependable and trustworthy resource for patients and carers alike.

1.1 Background and Literature Survey

AD is a neurological condition that worsens with time and causes substantial difficulties for sufferers and their family in terms of memory loss and cognitive function. The incidence of Alzheimer's disease is expected to increase as the world's population ages, highlighting the critical need for efficient interventions that can improve the lives of people who are impacted. The traditional focus of Alzheimer's care has been on improving daily functioning through a variety of therapeutic techniques and pharmacological therapies for cognitive impairment. Nonetheless, an increasing amount of studies emphasises how crucial it is to treat emotional well-being as a crucial part of all-encompassing Alzheimer's care.

It is becoming more widely acknowledged that an important aspect affecting an Alzheimer's patient's overall quality of life is their emotional well-being. Many people with Alzheimer's suffer from a variety of emotional problems, such as social isolation, anxiety, and sadness, which can worsen cognitive symptoms and have a detrimental effect on day-to-day functioning. As a result of this realisation, treatment regimens are now more likely to include emotional support in an effort to lessen the emotional suffering that patients frequently experience. Therefore, it is crucial to discover creative strategies to deal with these emotional issues.

In the healthcare industry, AI has become a game-changer, opening up new avenues for improving Alzheimer's patient care. AI is being used to develop sophisticated systems that promote mental health in addition to helping with cognitive decline diagnosis and tracking. For example, machine learning algorithms examine vast amounts of patient data to forecast the course of a disease and adjust treatment plans accordingly. With the help of data from several sources, including speech patterns, facial expressions, and physiological signs, these AI-driven systems can now provide emotional support to patients. They can detect and react to their emotional states in real-time.

The use of AI in mood monitoring has drawn interest as a potential strategy for improving mental health. AI-based mood monitoring solutions have shown promise in providing real-time insights into patients' emotional states through data analysis from a variety of sources, such as speech analysis, facial recognition, and physiological monitoring. By using these techniques to recognise emotional fluctuations' patterns and triggers, tailored interventions that cater to the individual needs of each patient can be created. Managing mood and emotional distress successfully requires this kind of personalisation, especially when it comes to Alzheimer's care.

Concurrently, the therapeutic effects of guided meditation and relaxation techniques have been thoroughly investigated. Research indicates that these techniques can considerably lower stress and elevate mood, serving as a beneficial non-pharmacological addition to conventional therapies. These exercises are more effective when customised based on input from individual patients and mood data, which guarantees that therapies are in line with each patient's particular emotional needs. A unique strategy to treating emotional well-being in Alzheimer's patients involves personalising guided meditation routines and relaxation exercises based on real-time feedback from AI-driven technologies.

Another essential component of emotional support that technology may help with is social engagement. Social isolation is a prevalent problem among those with Alzheimer's disease, and preserving significant relationships with loved ones and friends is crucial for mental well-being. Cognitive and social deficits can be addressed by integrating secure video call platforms, messaging systems, and AI-suggested conversation topics into care models. These platforms support emotional comfort and cognitive stimulation in addition to offering chances for social interaction.

The suggested concept presents a cutting-edge artificial intelligence (AI) emotional support system that can modify in-the-moment interventions according to ambient and mood data. This approach attempts to anticipate emotional states and deliver timely, individualised care based on each patient's changing needs by

utilising past feedback and present emotional assessments. This novel strategy, which combines AI-driven personalisation with real-time responsiveness to improve the emotional well-being of Alzheimer's patients, constitutes a substantial advancement in the field. By addressing the many issues that people with Alzheimer's experience, the combination of various technologies promises to provide a more comprehensive and successful solution, thereby enhancing the quality of life for those affected.

1.1 Research Gap

The proposed system addresses gaps in current research by integrating real-time mood tracking with dynamic emotion-cognition interactions, predicting emotional levels based on past feedback and current emotions, and offering personalized support. Existing solutions often lack these integrated, predictive, and personalized approaches, making this system a novel advancement in Alzheimer's care.

Below shows a summary table about the research gap.

Feature	Research 01	Research 02	Research 03	Proposed System
AI-Personalized Mood Tracking	✓	✗	✗	✓
Use of Personalized Meditations and Exercises	✗	✗	✗	✓
monitors emotional levels through facial expressions	✗	✗	✗	✓
Real-Time Emotional Analysis	✓	✓	✗	✓
Feedback-Driven Content Customization	✗	✗	✗	✓
Mood Data Analysis	✓	✗	✗	✓

Figure 1 Research Gap Table

1.2 Research Problem

The absence of individualised emotional support for Alzheimer's patients—who frequently struggle with social isolation, anxiety, and depression—is the main area of research concern. Conventional care approaches fall short of providing these emotional difficulties in a flexible and dynamic way. The goal of this research is to create an AI-powered platform that offers individualised, real-time emotional therapies, such as guided relaxation techniques, mood monitoring, and improved social interactions. The system aims to enhance Alzheimer's patients' overall quality of life and emotional well-being by combining clinical data and machine learning.

0.2 Objectives

2.2 Main Objectives

The main objective of this research is to develop an AI-driven emotional support system that enhances the emotional well-being of Alzheimer's patients. The system will provide personalized, real-time interventions that address the emotional and social challenges faced by these patients, ultimately improving their quality of life.

2.2 Specific Objectives

- 1) Develop personalized guided meditation and relaxation exercises
- 2) Create AI-driven mood tracking tools
- 3) Enable social interaction platforms
- 4) Integrate clinical trial data, patient interaction logs, and machine learning datasets
- 5) Validate the effectiveness

2.2.1 User Requirements

- The system should be easy to use for both Alzheimer's patients and their caregivers, with a user-friendly interface that accommodates varying levels of cognitive ability.
- The system should provide timely and accurate emotional support, with interventions that are relevant to the patient's current emotional state.
- The system should ensure patient privacy and security, particularly in handling sensitive emotional and health data.
- Caregivers should be able to monitor the patient's emotional well-being and receive notifications or alerts when necessary.

2.2.2 Functional Requirements

Real-Time Emotional Analysis:

- The system must analyze facial expressions and emotional cues in real time to assess emotional levels.
- This analysis should include data such as facial expression changes, voice tone, and physiological signals.

Personalized Emotional Interventions:

- The system must suggest guided meditation and relaxation exercises based on the patient's current emotional state.
- These interventions should be customized and adaptive, updating in real-time as the patient's mood changes.

Social Interaction Enhancements:

- The system must provide AI-generated conversation topics to stimulate social interactions.
- Social prompts should be tailored to the patient's preferences and current emotional needs.

Mood Tracking and Trigger Identification:

- The system must track mood patterns over time using AI analysis and identify triggers for negative emotions.
- Based on this analysis, it should recommend actions to improve the patient's mood.

Caregiver and Clinician Feedback:

- The system must provide real-time feedback to caregivers and clinicians regarding the patient's emotional well-being.
- The feedback should include alerts on emotional distress and suggestions for immediate intervention.

2.2.2 Non-Functional Requirements

1. Performance
2. Usability
3. Scalability
4. Reliability
5. Security
6. Maintainability
7. Compliance

0.3 Methodology

1.1. Overall System Overview

The proposed system for Alzheimer's care and cognitive support leverages AI to provide personalized emotional well-being interventions and social connection enhancements. By integrating real-time emotional analysis with personalized care techniques, the system aims to improve the emotional and social dimensions of Alzheimer's care.

The platform is divided into interconnected modules, each designed to deliver a specific function while maintaining a user-friendly interface. The front-end is accessible to caregivers, clinicians, and patients, providing real-time updates, insights, and personalized recommendations. The user interface is optimized for mobile devices, ensuring easy access to emotional tracking, guided meditation exercises, and social interaction prompts.

At the core of the system is the AI-driven emotional recognition engine. This engine analyzes facial expressions, voice tones, and physiological signals to assess the patient's emotional state in real-time. Machine learning models, trained on a large dataset of emotional and behavioral patterns, continuously refine the system's accuracy and effectiveness.

The data management and security layer ensures the secure storage of all patient data, including emotional logs, interaction histories, and personal information. Prioritizing data privacy, the system employs encryption mechanisms that protect data at rest and in transit, complying with standards such as GDPR and HIPAA. Anonymization features further safeguard patient identities when data is used for research or AI training.

The emotional tracking and intervention module offers personalized suggestions, such as guided meditation and relaxation exercises, tailored to the patient's current mood. These interventions are continuously updated based on real-time emotional data, ensuring a responsive and adaptive care approach.

The AI assistant enhances patient engagement by providing AI-suggested conversation topics and prompts for social interaction. This feature helps reduce isolation and encourages meaningful social engagement, especially for patients who struggle with maintaining social connections.

Additionally, the system includes a real-time feedback mechanism for caregivers and clinicians. This feature provides immediate insights into the patient's emotional well-being, highlighting potential areas of concern and suggesting appropriate interventions.

3.1. Overall System Overview Diagram

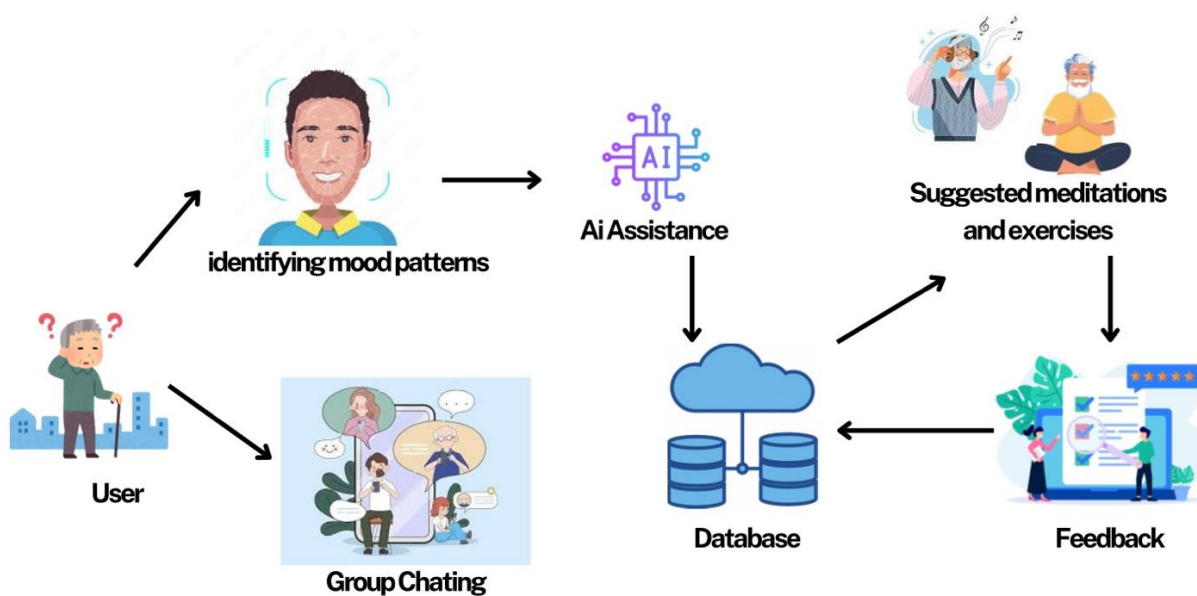


Figure 2 System overview

3.1.1 Hardware Component

Smartphones and tablets offer access to the platform's front-end interface, allowing carers, professionals, and patients to interact with the system. They enable features like as cognitive tests, real-time speech analysis, and care recommendat

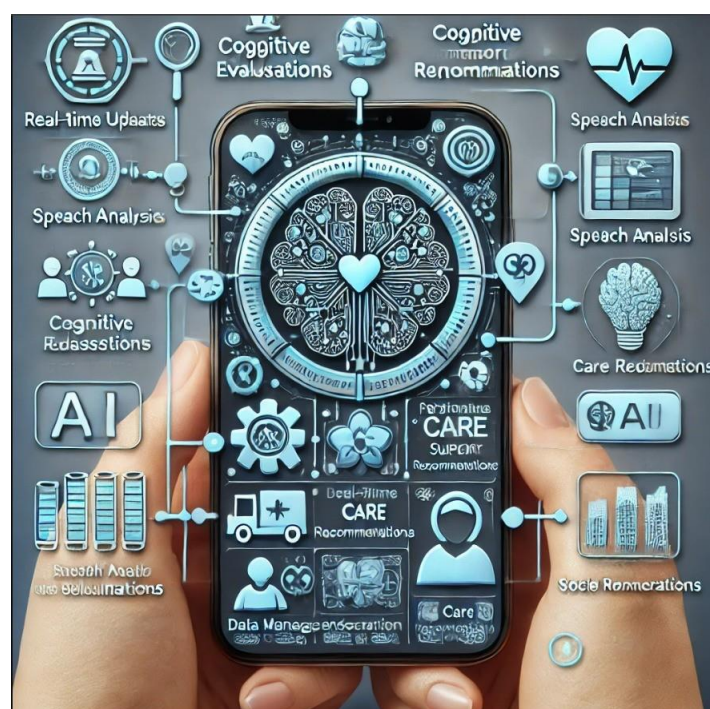


Figure 3 Mobile App

04. Description of Personal and Facilities

4.1. Functionality Of Project Component

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Task: Emotional Well-being for Alzheimer's Patients through AI-Driven Personalization and Social Connections

4.1.1. Connectivity Of the Project Component

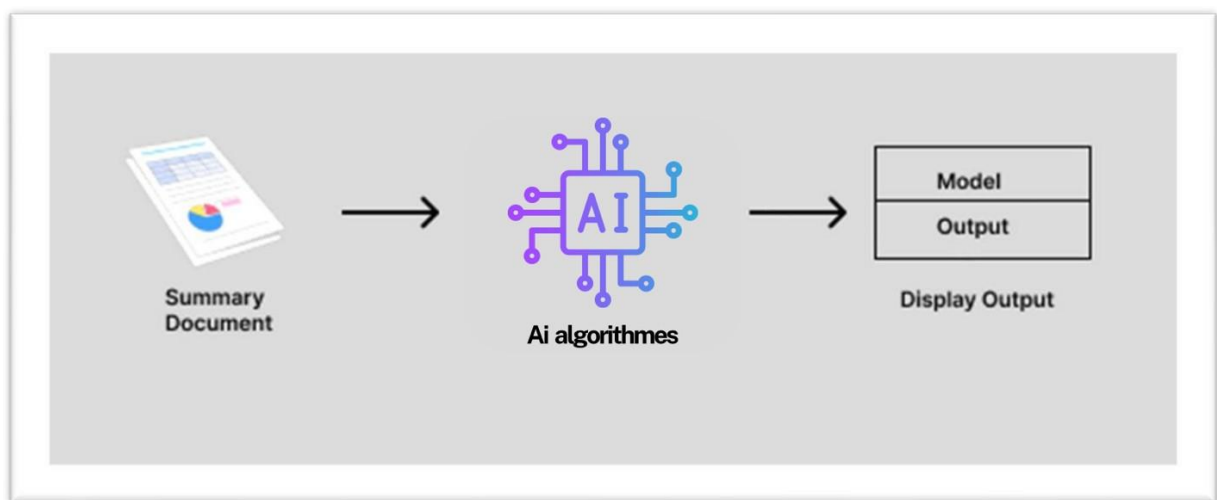


Figure 4 Connectivity Of the Project Component

4.1.2. Functionality Of the Hardware Component

- **Smartphone and Tablet**

Provide access to the platform's user interface, enabling caregivers, clinicians, and patients to interact with the system. Support real-time updates, alerts, and insights.

4.2. System Technology

1. Machine Learning - to analyze car features and classify them into different models.
2. Notification and Alert - The system will use real-time notification techniques to inform users.
3. Data Management and Security - to gather data from various sources to improve the accuracy of the classification system.

Programming Languages

- Python
- React Native
- JavaScript
- HTML/CSS

Tools

1. TensorFlow - an open-source software library for dataflow and differentiable programming across a range of tasks.
2. Visual Studio Code - A lightweight and adaptable code editor that supports a variety of programming languages and frameworks. It's great for building using React Native or Flutter.
3. Android Studio - The official IDE for Android development, which also works with Flutter. It includes comprehensive tools for designing, testing, and debugging Android applications.
4. Figma - A cloud-based design tool for UI/UX design that facilitates cooperation between designers and developers. It's perfect for developing prototypes and wireframes for mobile apps.
5. Firebase - Firebase offers a full suite of mobile app development capabilities, including authentication, real-time databases, cloud storage, and hosting.
6. Firebase Test Lab - Firebase provides a cloud-based application testing environment. It allows you to test your app across a variety of devices and setups.
7. GitHub - Platforms for hosting Git repositories that include tools for continuous integration (CI), problem tracking, and collaboration.
8. Firebase Cloud Message - FCM is a cross-platform messaging solution that lets you deliver notifications and messages to users on Android, iOS, and web apps.

Hardware parts

- Smartphones and Tablets

A variety of smartphones and tablets with varied operating systems (iOS and Android), screen sizes, and hardware specifications are necessary to evaluate the app's compatibility, performance, and user experience.

Examples:

Android: Google Pixel, Samsung Galaxy, and OnePlus devices.

iOS: iPhone models (latest versions like iPhone 12, 13, or after) and iPads.

05. Gantt Chart

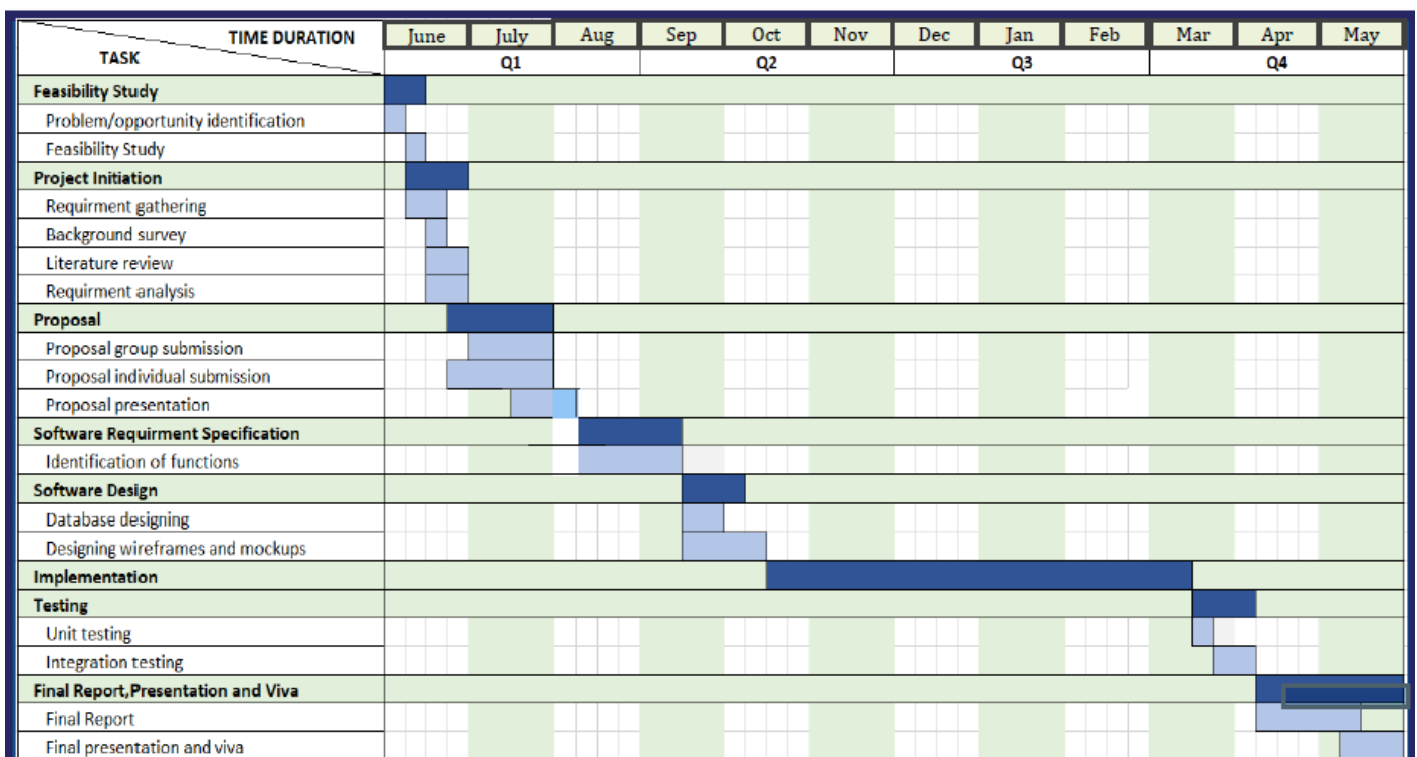


Figure 5 Ghant Chart

06. Work Breakdown Structure

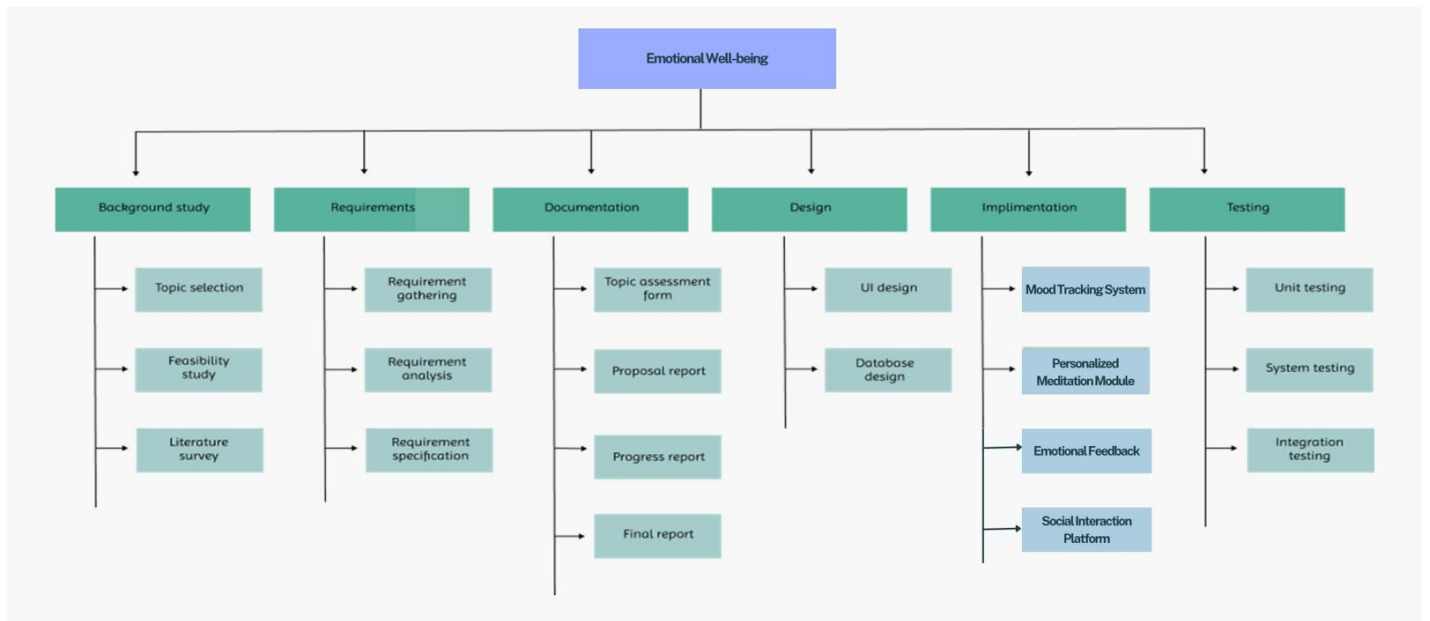


Figure 6 Work Breakdown chart

07. Commercialization

Commercializing an AI-powered Alzheimer's care and cognitive support mobile app requires a multifaceted approach that includes market entrance tactics, pricing models, collaborations, and scaling initiatives. This is a breakdown of the commercialization strategy.

1. Target Market: Alzheimer's patients, caregivers, and clinicians.
2. Pricing Model: In Basic Plan It has innovative features such as personalized learning routes, AI-powered emotional support, and real-time feedback. Targeted for major healthcare organizations and institutes.
3. Distribution Channel: Launch the app on key platforms such as Google Play and the Apple App Store.
4. Marketing and Promotion: Raising awareness can be accomplished through internet commercials, social media campaigns, and content marketing.

08. Budget

Description of Tasks	Estimated
1. Cloud Infranstructure	Rs. 8000
2. Internet Charges	Rs. 5000
3. Travelling Cost for Information Collection	Rs. 10000
4. Data gathering	Rs. 10000
Total	33000

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