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LEXI: An AI-Powered Dyslexia Assistive Learning Platform

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Declaration Page

We, the undersigned, declare that this project report, titled **"Lexi: An AI-Powered Dyslexia Assistive Learning Platform,"** is our own work and has not been submitted elsewhere in any form for another degree or qualification. This project was undertaken as part of the requirements for the module **5COSC021C.Y Software Development Group Project** of the **BSc(Hons) Computer Science** program in collaboration between the **Informatics Institute of Technology** and the **University of Westminster, UK**.

We have worked collaboratively on this project, each contributing to various aspects of the research, development, and documentation. Any external sources referenced within this report have been acknowledged accordingly in the References section.

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Abstract

This report delves into the design and implementation of Lexi - Dyslexia Assistive Learning Platform. Lexi is a mobile application designed to support individuals with dyslexia by providing various tools to enhance their reading, writing and learning experiences. It provides a combination of educational tools, gamified learning, and supportive accessibility features that make learning more adaptable and engaging.

The report begins by examining the background of the problem, emphasising the lack of accessible and inclusive learning tools for individuals with dyslexia and the subsequent impact on users and society. A detailed analysis of existing solutions and their limitations provides the foundation for the proposed solution. The proposed application, Lexi, aims to address these gaps through innovative design principles and advanced technologies. The report discusses the features that will be implemented to support these individuals as well as the features that are planned to be implemented in the following phases, such as advanced games, localisation into native languages and offline functionality. Additionally, this report elaborates on the methodologies used, covering development, design, and project management approaches that ensure effective implementation. The ultimate goal of Lexi is to provide a personalised, supportive, and inclusive learning platform that meets the unique needs of dyslexic learners.

Keywords

Lexi, Dyslexia, Accessibility, Learning disabilities, Inclusion, Text-to-speech, Speech-to-text, Gamified, Accessible Learning Platform, Inclusive Learning, AI for learning, Adaptive Learning.

Acknowledgement

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Abbreviations Table

Abbreviation	Full Form
AI	Artificial Intelligence
ML	Machine Learning
NLP	Natural Language Processing
API	Application Programming Interface
UI	User Interface
UX	User Experience
SDLC	Software Development Life Cycle
SWD	Students with Disabilities
IDE	Integrated Development Environment
AWS	Amazon Web Services
CDN	Content Delivery Network
CI/CD	Continuous Integration/Continuous Deployment
OOAD	Object-Oriented Analysis and Design
WBS	Work Breakdown Structure
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNICEF	United Nations International Children's Emergency Fund
DCS	Department of Census and Statistics
INCEDU	Inclusive Education Program
ER Diagram	Entity-Relationship Diagram
PDF	Portable Document Format
TTS	Text-to-Speech
STT	Speech-to-Text
eSpeak NG	eSpeak Next Generation
Flutter	Google's UI toolkit for crafting natively compiled applications
Firebase	Google's platform for mobile and web application development
FOSS	Free and Open Source Software
HTML	Hypertext Markup Language
CSS	Cascading Style Sheets
MoE	Ministry of Education
GEM	Global Education Monitoring
Pytest	Python Testing Framework

Chapter 1: Introduction

1.1 Chapter Overview

This chapter introduces the background of the challenges faced by individuals with dyslexia in accessing quality education. It highlights the problem of a lack of accessible and inclusive learning tools and presents the proposed solution—an interactive mobile application named Lexi. The chapter also outlines the project's aims, scope, and required resources, providing a clear foundation for the development of Lexi and its role in addressing these educational barriers.

1.2 Problem background

1.2.1 Introduction to the problem

In today's rapidly evolving educational landscape, access to quality education still remains a fundamental challenge for individuals with learning disabilities. The core problem lies in the significant barriers these individuals face when attempting to engage with traditional learning materials since these disabilities often lead to impairments in social, motor, language and cognitive functioning.

The lack of accessible tools that accommodate diverse learning needs leaves individuals with learning difficulties without effective alternatives to process complex material. While efforts have been made to provide inclusive education, accessibility remains an ongoing issue, obstructing the potential to reshape the learning environment into more accessible formats.

1.2.2 Problem Definition

Across the spectrum of learning disabilities, global statistics demonstrate that dyslexia is the most prominent among people with learning disabilities. It's estimated that 5 - 10% of the worldwide population experience dyslexia, translating to roughly 700 million people. (World Population Review, 2022) Today, dyslexia is the most frequent childhood learning disorder, accounting for up to 80% of all identified learning disabilities.(Alqahtani, Alzahrani and Ramzan, 2023)

Dyslexia is a specific learning disability that is neurobiological in origin. It is characterised by difficulties with accurate and/or fluent word recognition and poor spelling and decoding abilities. These difficulties typically result from a deficit in the phonological component of language that is often unexpected about other cognitive abilities and the provision of effective classroom instruction. Secondary consequences may include problems in reading comprehension and reduced reading experience that can impede the growth of vocabulary and background knowledge. (International Dyslexia Association, 2002)

From a neuropsychological approach, these disorders result from one or more malfunctioning learning-related brain systems, where the functions of the left hemisphere are imbalanced, such as impairment in the area concerned with short-term memory, motor skills, visual perceptions, language processing, auditory, speed, and speaking.(Alqahtani, Alzahrani and Ramzan, 2023)

The following image shows that any disorder in the brain's left hemisphere would lead to difficulties in a person's ability to write and read and some other skills.

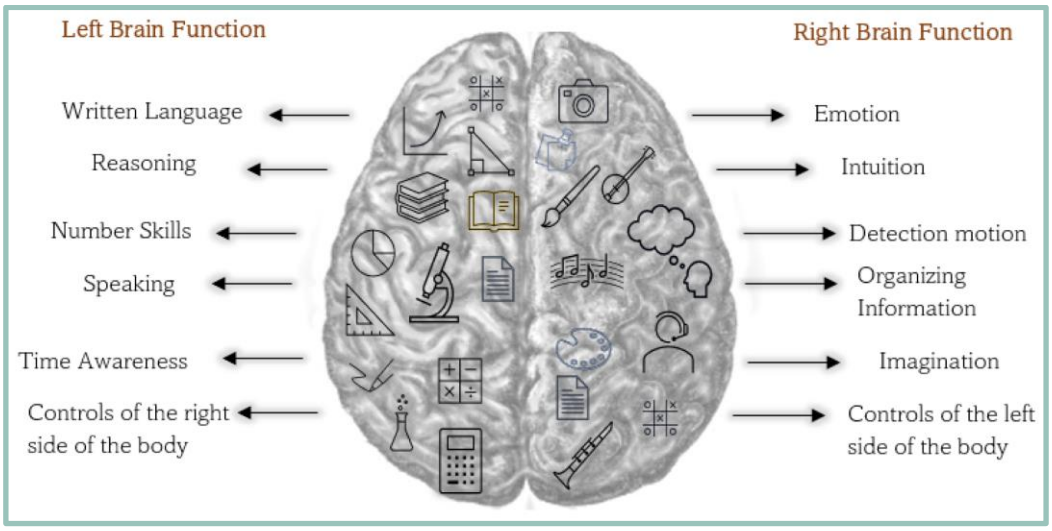

Figure 1: Functions of the Brain (Alqahtani, Alzahrani and Ramzan, 2023)

Individuals with dyslexia face significant challenges depending on the different types of dyslexia that they struggle with.

A. Phonological Dyslexia

Difficulties in matching sounds to symbols and breaking down the sounds of language, as well as struggling to decode or sound out words.

Symptoms and difficulties

- Difficulty learning sounds made by letters/letter combinations
- Difficulty sounding out unfamiliar words
- Difficulty spelling
- Spelling the same word in different ways on the same page
- Slow reading
- Difficulty recognising familiar words in new contexts

B. Rapid Naming Dyslexia

Struggle with the ability to rapidly name colours, numbers, and letters. Linked to both reading speed and the processing speed for reading.

Symptoms and difficulties

- Difficulty in retrieving words
- Frequently substituting words or leaving words out altogether
- Slow to respond orally
- Slower to complete reading or writing assignments
- Making up nonsense words in place of real words

C. Double Deficit Dyslexia

Struggles with two aspects of reading, such as naming speed and identifying sounds in words

Symptoms and difficulties

- Poor naming speed rate when recalling words
- Weak phonological awareness

D. Surface Dyslexia

Can sound new words with ease but has difficulties recognising familiar words. Failing to recognise what the word looks like in order to process the word quickly.

Symptoms and difficulties

● Difficulty with whole word recognition

● Difficulty reading words that don't sound the way they're spelt.

E. Visual Dyslexia

Affects visual processing; the brain doesn't get the complete picture of what the eyes see. Difficulties in learning how to spell or form letters because both require the brain to remember the correct letter sequence and shape.

Symptoms and difficulties

●Symptoms and Difficulties

● Text appearing blurred or going in and out of focus

● Difficulty tracking across lines of text

● Difficulty keeping the place in the text

These barriers or rather challenges faced by individuals with learning disabilities, mainly dyslexia, are amplified by the lack of specialised educational tools capable of accommodating their unique needs.

1.2.3 Problem Statistics

The following statistics clearly demonstrate that the current educational systems and technologies globally and in Sri Lanka lack inclusivity and accessibility, failing to provide necessary accommodations to ensure equitable learning experiences.

UNESCO indicates that only 10% of the countries have comprehensive laws guaranteeing full educational inclusion. Also, it states that only 30% of countries have regulations ensuring the

accessibility of digital learning materials. (Global Education Monitoring Report,2023) There are an estimated 240 million children with disabilities worldwide. (Eburu et al., 2023) and the statistics clearly show that systems are not in place to accommodate these children's educational needs. It's further estimated that 10 - 15% of the global population experiences barriers to learning and educational access. (The World Bank's Disability Inclusion Report, 2023).

Out of the children with disabilities enrolled in the Sri Lankan education system, it is clear that the majority of the students have learning disabilities compared to other disabilities, as shown in the figure below.

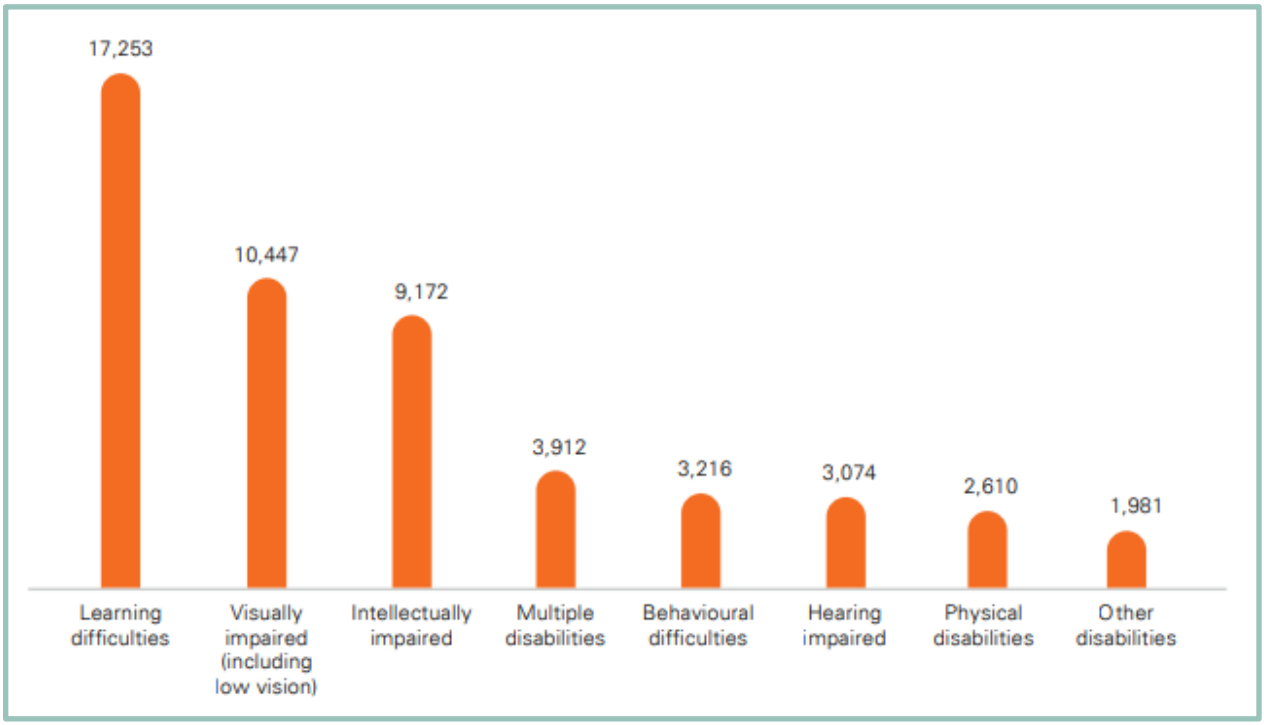

Figure 2: Students with disabilities in Sri Lanka (UNICEF, 2021)

However, in Sri Lanka there still aren't many systems in place to support these individuals with learning difficulties. A report by UNICEF Sri Lanka named "Learning Disabilities in Sri Lanka" highlights the severity of this issue, revealing that many disabled youth are excluded from educational opportunities. 23.5% of children aged 5 - 14 are excluded from mainstream education, and among those who attend mainstream schools, participation in educational activities decreases with age. Around 55.4% of the disabled population aged 15 - 19 and 86% of the disabled population aged 20 -24 are not engaged in any educational activity or vocational training. (DCS, 2012)

Age group	Total Disabled	Not Engaged in Educational Activity	% of the disabled population engaged in educational activity
5 -9	31,545	6,404	20.3
10 - 14	27,527	7,460	27.1
15- 19	29,668	16,444	55.4
20- 24	27,810	23,905	86.0
5-14	59,072	13,864	23.5

Table 1: Engaged in educational activity of 5-24 year-old group with disabilities DCS (2012)

	Male	Female	Total	As a % of disabled
Pre-school	1,132	1,010	2,142	6.8
School	28,440	25,871	54,311	46.6
Undergraduate /Postgraduate	802	1,274	2,076	1. 8
Vocational/ Technical	1,606	839	2,445	2.1
Other educational activity	4,312	3,954	8,266	7.1
Not engaged in educational activity	25,833	21,477	47,310	40.6
Population with disabilities (5-24)	**62,125**	**54,425**	**116,550**	**100**

Table 2: Educational activity of the aged 5-24 disabled population (DCS (2012)

Students in Sri Lankan Universities also face these issues. 52% of the students with disabilities(SWDs) felt that their disability had a negative impact on their academic life and that the small number of SWDs enrolled in Sri Lankan Universities mainly stemmed from the lack of awareness and capacity on the part of educators, administrators and society in general to handle their needs and requirements, as well as due to organisational obstacles. (INCEDU, 2021).

As per the Annual Sri Lanka School Census Summary Report, 2022, Prepared by the Ministry of Education, the total number of schools in Sri Lanka is 10 126, but it is peculiar to note that the number of schools which have special education units are not considered as KPI or indicated in this report. However, it is learned from the Ministry of Education that as of 31.12.2023, 879 schools have been incorporated with special educational units in Sri Lanka. 2135 students in 27 special schools assisted by the Ministry of Education are segregated from mainstream education (MoE Statistics, 2023).

These global and Sri Lankan Statistics highlight the persistent challenges individuals with learning disabilities come across in accessing education. The significant gap in accessible educational materials, coupled with a lack of awareness and support, leaves millions of individuals at a disadvantage. To address these issues, there is a pressing need for more comprehensive tools and technologies designed to create an equitable and inclusive environment for all.

1.2.4 Real World Scenarios: Dyslexia Specific Challenges

A. School children facing reading challenges

A child with dyslexia is unable to keep up with their classmates in reading activities. While others read fluently, this child struggles to recognise words and decode sentences. Standard classroom materials and methods lack the support this child needs, such as multisensory learning tools, causing this student to feel frustrated, fall behind academically and experience social isolation.

B. High school students with Dyslexia in test preparation

High school students with dyslexia preparing for tests often come across unique barriers. Reading comprehension and time constraints pose significant challenges, as they will need more time to process information than what is allowed on typical exams.

C. College students with dyslexia handling dense academic texts.

They require more time to digest textbooks, research papers, and lecture notes. The slower processing speed can lead to missed deadlines and increased stress, as many colleges lack adequate tools and accommodations to support their unique learning needs.

D. Adults in the workforce managing written tasks.

A dyslexic professional in a corporate setting will struggle to read emails quickly, draft reports, or process written instructions accurately. This can affect job performance, reduce productivity, and even limit career growth opportunities if their needs are not met with supportive tools.

E. Parents advocating for their children with dyslexia.

Many parents of children with dyslexia face challenges in securing educational support for their children. They often have to become advocates, pushing for tailored educational plans, specialised tutors, or dyslexia-friendly tools.

1.2.5 Impact on users and society

A. Children and young adults with dyslexia

Dyslexia can deeply impact a student's educational experience and personal development. Difficulty in reading and writing can lead to frustrations, low self-esteem and diminished motivation to engage in learning and may also cause behavioural problems. This academic gap limits their opportunities and affects their confidence, impacting their potential achievements in school and beyond.

B. Educators and schools

Teachers, often lacking specialised training, may struggle to support dyslexic students effectively within a typical classroom setting. The absence of accessible educational tools creates challenges for educators who want to provide inclusive learning experiences. This

can hinder their teaching effectiveness and prevent students with dyslexia from achieving their best outcomes.

C. Families and Caregivers

Dyslexia not only affects the individual but also has a significant impact on families. Parents and caregivers may experience stress and emotional strain as they support their child's unique learning needs. Many families invest considerable time, energy, and resources into finding appropriate tools or interventions to aid their loved ones with dyslexia.

D. Employers and the workforce

Dyslexia's impact extends into the professional world, where adults with dyslexia may struggle with tasks involving written communication. This can reduce job satisfaction, lead to lower productivity and affect career advancement. Employers miss out on valuable perspectives and talents that dyslexic individuals bring when they don't create supportive, accessible work environments. This ultimately affects workplace diversity and inclusivity.

E. Society and Education System

The lack of accessible educational tools for individuals with dyslexia affects society as a whole. When dyslexic students don't receive the support they need, it limits their career paths, reduces workforce diversity, and can result in underutilised talent. By not fostering an inclusive educational system, society misses out on the potential contributions of individuals with dyslexia who, if properly supported, could make substantial societal and economic impacts.

Addressing the specific needs of dyslexic learners promotes inclusivity, ensures equitable educational experiences, and empowers individuals with dyslexia to achieve their full potential, benefiting both individuals and society as a whole.

1.3 Problem Statement

"The lack of accessible and inclusive learning tools to support diverse learning needs of people with learning disabilities, mainly people with dyslexia"

1.4 Proposed Solution

The proposed solution for the project is an inclusive and interactive mobile application named **Lexi** that aims to support individuals with dyslexia in their learning journey. The app is designed to address the significant barriers faced by people with dyslexia by providing a combination of educational tools, gamified learning, and supportive accessibility features that make learning more adaptable and engaging.

1.4.1 Core Components of Lexi

Studies show that dyslexia presents at different levels, including Phonetic or Full Alphabetic, Transitional or Consolidated Alphabetic, and Conventional (Mather and Wendling, 2011, p76–81). Different individuals with dyslexia require varying levels of attention and therapy to address their unique challenges. Lexi incorporates an ML Model that fine-tunes the app's features and games by asking users personalised questions during the onboarding process and throughout their learning journey. An evaluation of reading fluency includes measures of accuracy, rate, and prosody. (Mather and Wendling, 2011, p99) The gathered information helps the system adapt content, games, and overall interactions to each user's specific learning style and needs, ensuring a continuously personalised experience. This adaptive learning approach allows Lexi to address individual challenges faced by dyslexic learners more effectively, providing a customised and supportive educational experience.

To enhance accessibility for individuals with dyslexia, The app uses specially selected colours and fonts that are proven to be effective for dyslexic learners. Research has shown that using fonts like OpenDyslexic or sans-serif fonts (Laddusaw and Brett, 2019), as well as high-contrast colour schemes, can significantly improve readability for those with dyslexia (Rello & Baeza-Yates, 2016; Bradford, 2021). These features help reduce visual stress and make reading more comfortable, thereby improving learning outcomes.

The app Lexi is built around three core components:

1.4.2 LearnZone (Features Section)

This section offers productivity tools and assistive technologies aimed at making reading and comprehension smoother for individuals with dyslexia.

The **SmartRead** tool allows users to upload documents, extract key content, receive simplified summaries, and read the content aloud. This feature addresses the challenge of reading

comprehension by breaking down complex information into more digestible pieces, making it easier for dyslexic learners to understand and retain information (UNESCO, 2023).

Additionally, the **VoiceFlow** feature includes a speech-to-text feature that converts spoken words into written text, highlighting each word as it appears on the screen. This feature helps users visualise their or others spoken language, reinforcing spelling and word recognition (Smith & Johnson, 2022).

VoxBuddy: An AI-powered voice-driven assistant, fine-tuned to function like a supportive therapist. Users can interact entirely by voice, asking questions and receiving responses through natural conversation. VoxBuddy is trained to provide personalised guidance, helping users with dyslexia build language skills, address specific difficulties, and improve their confidence (Garcia & Patel, 2021)

Read With Me is an interactive feature that helps users read a document in an engaging way. Users can scan a book page or document, and the app will highlight words one by one, prompting them to read aloud. Using voice recognition technology, the feature determines if the word was pronounced correctly; if so, the user can proceed to the next word. If the user struggles, they can listen to the correct pronunciation before trying again. This process builds the reader's confidence and promotes independent learning. Although individuals with dyslexia can often recall the spelling of a word immediately after learning it, they often soon forget how to spell the word. (Mather and Wendling, 2011, p81). Research indicates that consistent practice significantly improves reading skills, making 'Read With Me' a valuable tool for building fluency and self-reliance in reading (Bradford, 2021).

This combination of tools helps address the primary challenges of reading comprehension and language acquisition, which are often significant barriers for people with dyslexia. By simplifying content and providing supportive, interactive practice, Lexi ensures that individuals with dyslexia can engage with learning materials more effectively, reducing frustration and enhancing confidence.

1.4.3 PlaySpace

A gamified learning section that incorporates various games aimed at enhancing users' reading fluency and memory. The games are personalised using machine learning algorithms that adjust difficulty levels based on the user’s progress. These games are grounded in theories like **Phonological Deficit Theory**, which suggests that phonological awareness is a key difficulty for

people with dyslexia, and **Multisensory Learning Theory**, which emphasises using multiple senses to aid learning (Snowling, 2019).

By engaging users through visual, auditory, and interactive gameplay, PlaySpace not only enhances motivation but also ensures effective learning by reinforcing phonological skills and improving memory retention, which are critical areas for dyslexic individuals (Fernández-López et al., 2013).

The **adaptive learning** aspect is particularly innovative as it allows the system to automatically adjust the level of difficulty, ensuring that users are constantly challenged but not overwhelmed. This personalised approach makes PlaySpace a powerful tool for addressing the unique needs of each learner, helping them achieve steady progress.

1.4.4 Explore+

This section provides detailed progress reports and insights to caregivers, as well as a marketplace for connecting with professional therapists.

The **progress reports** include metrics like reading fluency improvements and memory retention scores, which help caregivers understand the user's development over time.

The **Therapist Marketplace** enables users to find specialists for virtual or in-person sessions, addressing the need for professional support, which is crucial for individuals with severe dyslexia symptoms who benefit from tailored therapeutic interventions (Shaywitz, 2020). By bridging the gap between users and specialised professionals, Explore+ ensures comprehensive and continuous learning support, which has been identified as a key factor in successful dyslexia interventions (Torgesen, 2004).

The inclusion of professional support and real-time progress tracking gives Lexi a competitive advantage by offering a more holistic approach compared to standalone educational apps that lack integrated therapeutic support.

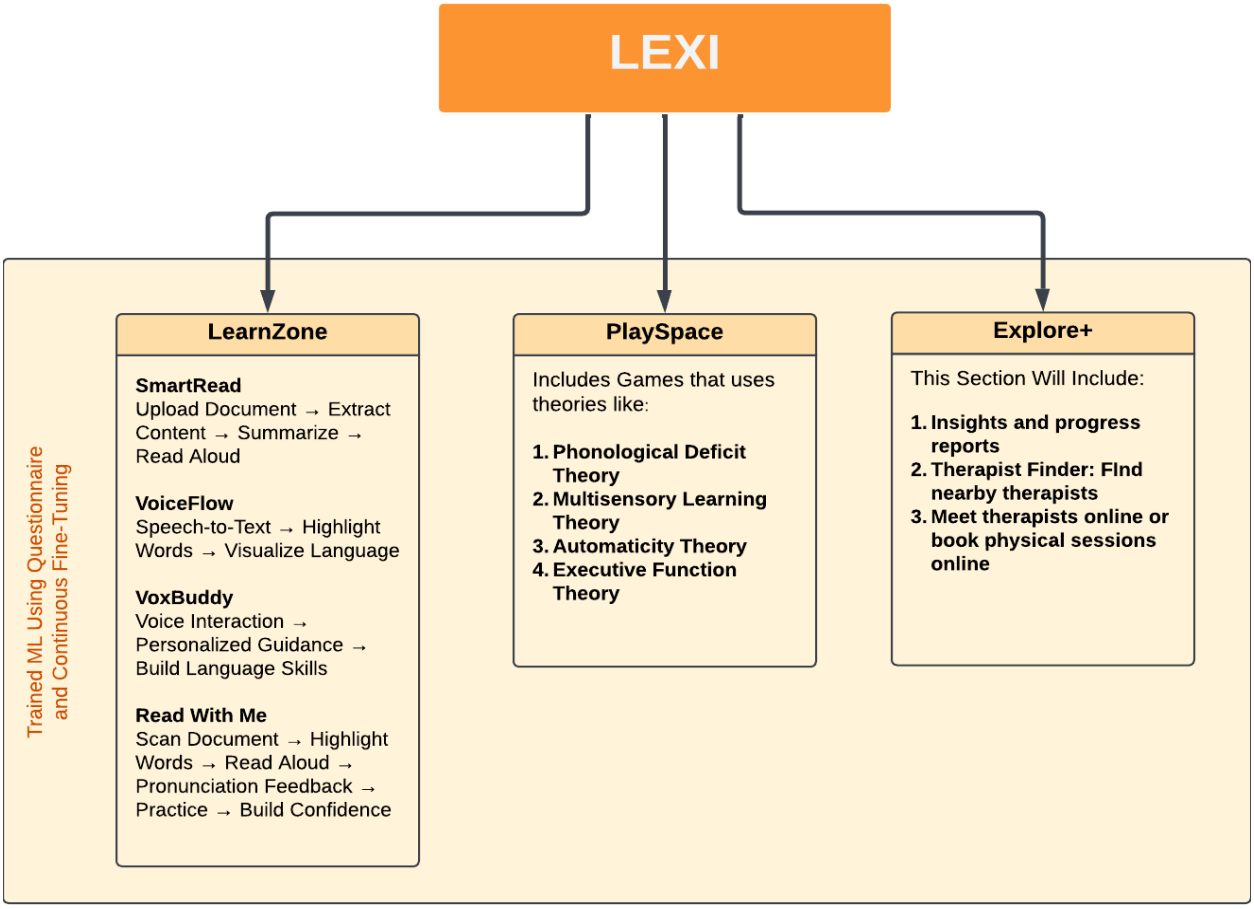

Figure 3: Feature Breakdown of Lexi App

1.4.5 Addressing the Identified Problem

Our app addresses the identified problems by offering a multifaceted approach to learning support. Many individuals with dyslexia struggle with reading comprehension, phonological awareness, and retaining information due to the nature of their condition (Shaywitz, 2020; Snowling, 2019). By integrating tools like **SmartRead**, **VoxBuddy**, **VoiceFlow** and **ReadWithME,** Lexi simplifies complex content into more accessible forms and provides immediate, personalised feedback on language skills.

This directly addresses the core difficulties in reading and language acquisition, which are often highlighted as primary obstacles for dyslexic learners (Fernández-López et al., 2013; Rello & Baeza-Yates, 2016).

Additionally, **PlaySpace** uses gamified learning to reinforce phonological skills and memory retention, which are critical areas identified as lacking in traditional educational systems for dyslexic individuals (UNESCO, 2023). The adaptive nature of these games ensures that learners receive content tailored to their current level, promoting effective and sustained progress.

1.4.6 Mascot for Engagement

To further enhance engagement, Lexi features a friendly mascot that interacts with users throughout their learning journey. The mascot provides encouragement, guidance, and motivation, making the learning experience more enjoyable and interactive. This approach helps create a positive emotional connection, which has been shown to improve user engagement and retention, particularly in younger learners (Plass et al., 2015).

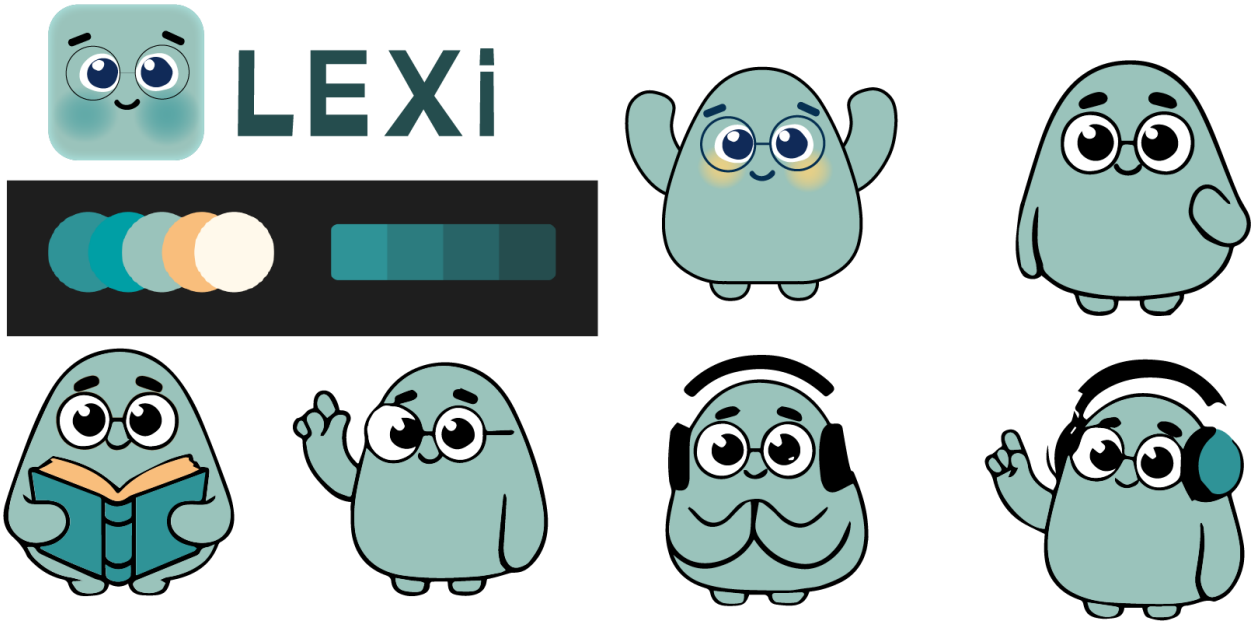

Figure 4: "Lexi", the Mascot used in the Application

1.4.7 Innovative Aspects and Competitive Advantages

Lexi stands out for its **innovative combination of AI and gamified learning**, creating a highly personalised and engaging learning experience. By utilising tools like **voice-driven AI, adaptive learning games, and therapist connections**, Lexi not only makes learning accessible but also enjoyable and supportive for people with dyslexia. Unlike other solutions that focus solely on one aspect of learning, Lexi integrates multiple approaches, ensuring a holistic experience that addresses the unique needs of individuals with dyslexia and ultimately empowers them to achieve

their full potential. The integration of **machine learning for personalisation**, **real-time voice interaction**, and **a comprehensive therapist network** gives Lexi a unique edge, making it a one-stop solution for both educational and therapeutic needs. Additionally, Lexi can be used as an accessible tool to help with day-to-day activities, overcoming challenges that dyslexic individuals face beyond the educational context. This ensures that Lexi is not only a learning companion but also a practical support system for everyday life.

1.4.8 Features of Lexi - Dyslexia Assistive Learning Platform

1. **Personalise the System using ML**: The ML model in Lexi is trained using responses gathered through a personalised questionnaire. This questionnaire is given to users during onboarding and throughout their learning journey, allowing Lexi to collect valuable insights about each user's preferences, learning pace, and areas of difficulty. This data is then used to fine-tune Lexi's features, such as content difficulty, types of games, and learning strategies, ensuring each user receives an experience tailored specifically to their needs.
2. **SmartRead**: A content extraction and summarisation tool that simplifies complex documents into more digestible formats, with audio output and real-time highlighting to facilitate comprehension.
3. **VoxBuddy**: An AI-powered voice-driven assistant that allows users to practise language skills, offering real-time feedback to improve pronunciation and spelling.
4. **Adaptive Learning Games**: A collection of gamified learning activities in the **PlaySpace** feature designed to enhance reading fluency and memory by adapting to the user's skill level using machine learning algorithms.
5. **Progress Reports**: Detailed reports generated through **Explore+**, which provide metrics on reading fluency, memory retention, and overall progress, helping caregivers track the user's development.
6. **Therapist Marketplace**: A platform for connecting users with professional therapists, offering both virtual and in-person sessions, ensuring personalised support for individuals with severe dyslexia symptoms.
7. **Visual and Sensory Support Tools**: Accessibility features such as adjustable fonts, colour overlays, and high-contrast modes to alleviate visual stress and improve focus during reading and learning.
8. **Read With Me**: An interactive reading companion that highlights words one by one, prompting users to read aloud. It uses voice recognition technology to provide real-time pronunciation feedback, helping improve reading fluency and confidence.

9. **VoiceFlow**: This feature provides an interactive way for users to assist with day-to-day reading activities. Users can speak to convert spoken words into text while highlighting each word as it appears on the screen. This reinforcement helps dyslexic individuals by building their spelling and word recognition skills, thus making reading accessible beyond educational purposes.

1.5 Aim

The aim of this project is to create an AI-powered assistive learning platform that empowers individuals with dyslexia to enhance their reading, comprehension, and language skills.

The goal of this project is to address the significant barriers faced by dyslexic learners by providing a personalised and accessible learning experience. The platform, named Lexi, will integrate a variety of tools, including adaptive games, AI-powered voice assistants, and personalised content summarisation features, to make learning more engaging and effective. These tools are designed to adapt to each user's unique learning needs, ensuring that the experience is tailored and supportive. By leveraging these technologies, the project aims to create a supportive environment where individuals with dyslexia can overcome challenges, progressively improve their skills, and build confidence in their literacy abilities. This holistic approach not only enhances educational outcomes but also supports everyday activities, such as reading documents or following instructions, ensuring a comprehensive support system for users. Furthermore, Lexi is intended to foster a sense of independence among users, allowing them to practise and develop their skills at their own pace, which ultimately contributes to long-term personal growth and success.

1.6 Project Scope

1.6.1 In-Scope:

The following elements will be included in the final product:

- **SmartRead**

  Content extraction and summarisation with real-time word-by-word highlighting and audio output to help with the pronunciation.

- **VoiceFlow**

Speech-to-text feature for reinforcing spelling and word recognition through real-time visualisation of spoken word.

- **VoxBuddy**

  AI-powered voice-driven assistant for personalised guidance and language support.

- **Read With Me**

  Interactive reading companion using voice recognition to improve pronunciation and reading fluency.

- **Progress Report**

  Progress Report to help caregivers monitor reading fluency, memory retention and skill improvement.

- **Detection System for Dyslexia**

  A system to diagnose and categorise the level of dyslexia, guiding users through tailored experiences based on their specific needs.

  AI/ML model that assesses user skill level, offering a personalised experience based on progress

- **PlaySpace (Games Section)**

  Initial focus on **Phonological Deficit Theory**: A gamified activity that enhances phonological awareness, tailored through machine learning to adjust to each user's abilities.

  Future plans to introduce additional games based on Multisensory Learning theory, Automatically Theory and Executive Theory

- **Therapist Marketplace**

  For connecting with professionals for virtual or in-person sessions.

- **Accessibility Features**
  Visual and sensory support tools such as adjustable fonts, colour overlays and high-contrast modes.

1.6.2 Out-Scope

Excluded tasks and features for the project are :

- Advanced game treatments beyond Phonological Deficit theory

  In the first phase of development, the plan is to implement a single game, which is under the Phonological Deficit Theory.

- Localisation into Native Languages

  Localising this product needs more research in other native languages, such as Sinhala and Tamil; due to limited time, the plan is to implement it in English, and the rest is out of scope.

- Offline Functionality for All Features

  Features such as Text-to-speech, content summarization, and report generation need network connections in order to function; making these available offline is not included in the project phase.

1.7 Rich Picture Diagram

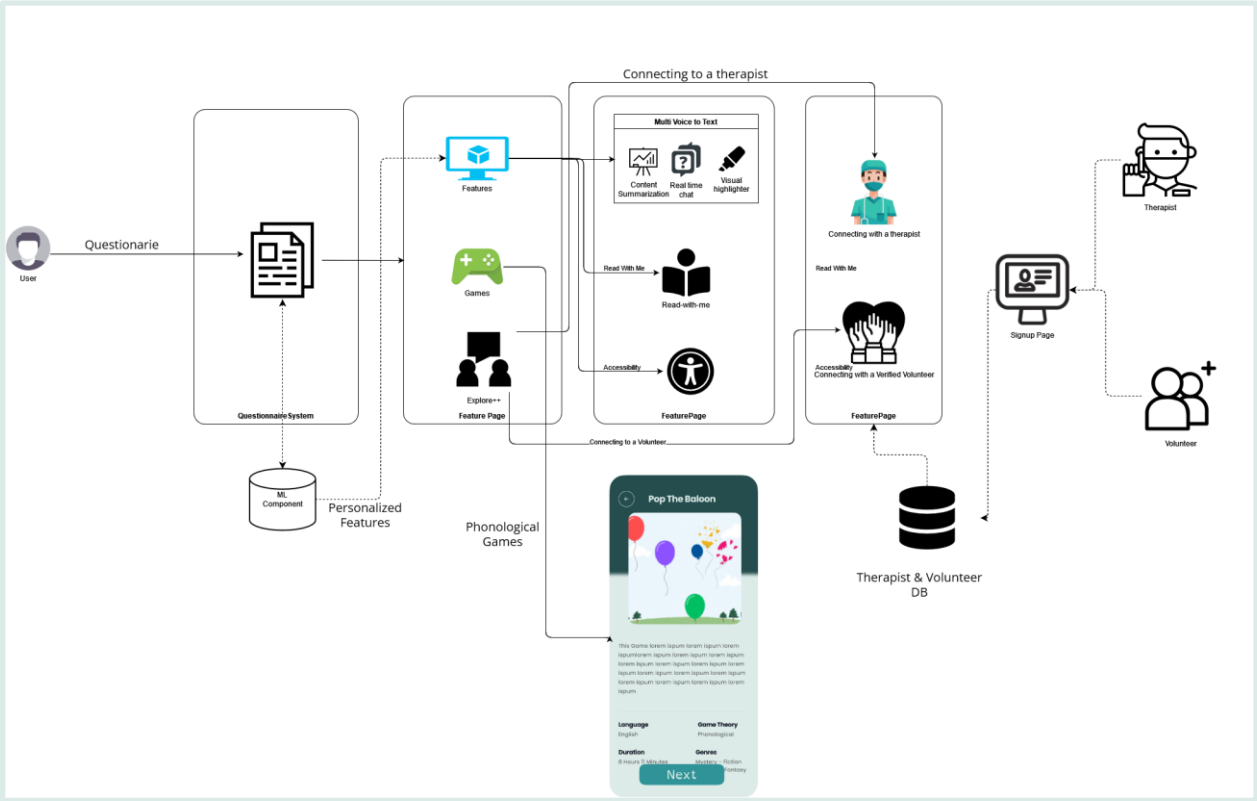

Figure 5: Rich Picture Diagram

1.8 Resource Requirements

To successfully develop the minimum viable product (MVP) of the Lexi mobile app, Here are the hardware and software requirements for the project, along with data requirements.

1.8.1 Hardware requirements

The hardware requirements for the app are minimal, ensuring it is accessible to both users and developers.

Devices

For Users:

Smartphones or **Tablets**: Compatible with both iOS and Android to ensure broad accessibility.
Headphones (Optional): For better audio clarity during text-to-speech interactions.

For Developers:
Standard development machine: Suitable for coding and testing.
Mobile devices: These are used to test the mobile app on both iOS and Android platforms.

Servers

Backend Server: A cloud-based server (Microsoft Azure) for hosting the app's backend services, APIs, progress reports, user data, and AI processing.

Database Servers: Cloud-hosted databases (Firebase) for storing user information, progress data, game scores, and other app-related data.

1.8.2 Software requirements

Integrated Development Environment (IDE):

Android Studio: Primary IDE for Flutter.
Visual Studio Code: A lightweight editor for backend development for Python.

Version Control:
Git: For source code management.
GitHub: For repository hosting, collaboration, and CI/CD pipelines.

Testing Tools:
Flutter Testing Framework: For UI and unit tests.
Postman: For API testing and integration testing.

Cloud Services:
Firebase: For real-time database, authentication, and app analytics.

UI/UX Design Tools:
Figma: For designing the app's UI and creating wireframes, prototypes, and user flows.

1.8.3 Technology Stack

To ensure scalability, maintainability, and performance.

Frontend (Mobile App):
Flutter: Chosen for cross-platform mobile app development (iOS and Android), allowing a single codebase for both platforms.
Dart: A programming language for Flutter app development.

Backend (API and Logic):
Python: The primary programming language for developing backend services.
Flask: Lightweight web framework used to build backend APIs and handle logic such as user interactions.
Firebase Realtime Database: For user data storage and real-time interactions.
Firebase Authentication: For user authentication and account management.

Game Engine for Therapy Games:
Flame (Flutter): A simple game engine to create interactive therapy games and habit-forming tools.

Deployment and Hosting:
Mobile App Distribution: Google Play Store for Android, Apple App Store for iOS.
Firebase Hosting: For web and mobile app hosting, if needed.

1.8.3 Data requirements

User Data:

User Profiles: Information about the users (Gender, Age, Learning level, Preferences, etc.), which will be collected during the onboarding progress.
Dyslexia Tests: Data for building the detection system that categorises levels of users.
Progress Data: This includes information about the user's performance.
Speech Data: For features like VoiceFlow, ReadWithMe that involve voice recognition and text-to-speech interactions.

External APIs:

Speech Recognition APIs: For converting speech to text.

DeepSpeech: This is an open-source Speech-To-Text engine, using a model trained by machine learning techniques based on Baidu's Deep Speech research paper. (RoastMe.ru | Mozilla/DeepSpeech)

Text-to-Speech APIs: For reading documents aloud.

eSpeak NG Text-to-Speech: The eSpeak NG is a compact open-source software text-to-speech synthesiser.

1.9 Business model canvas

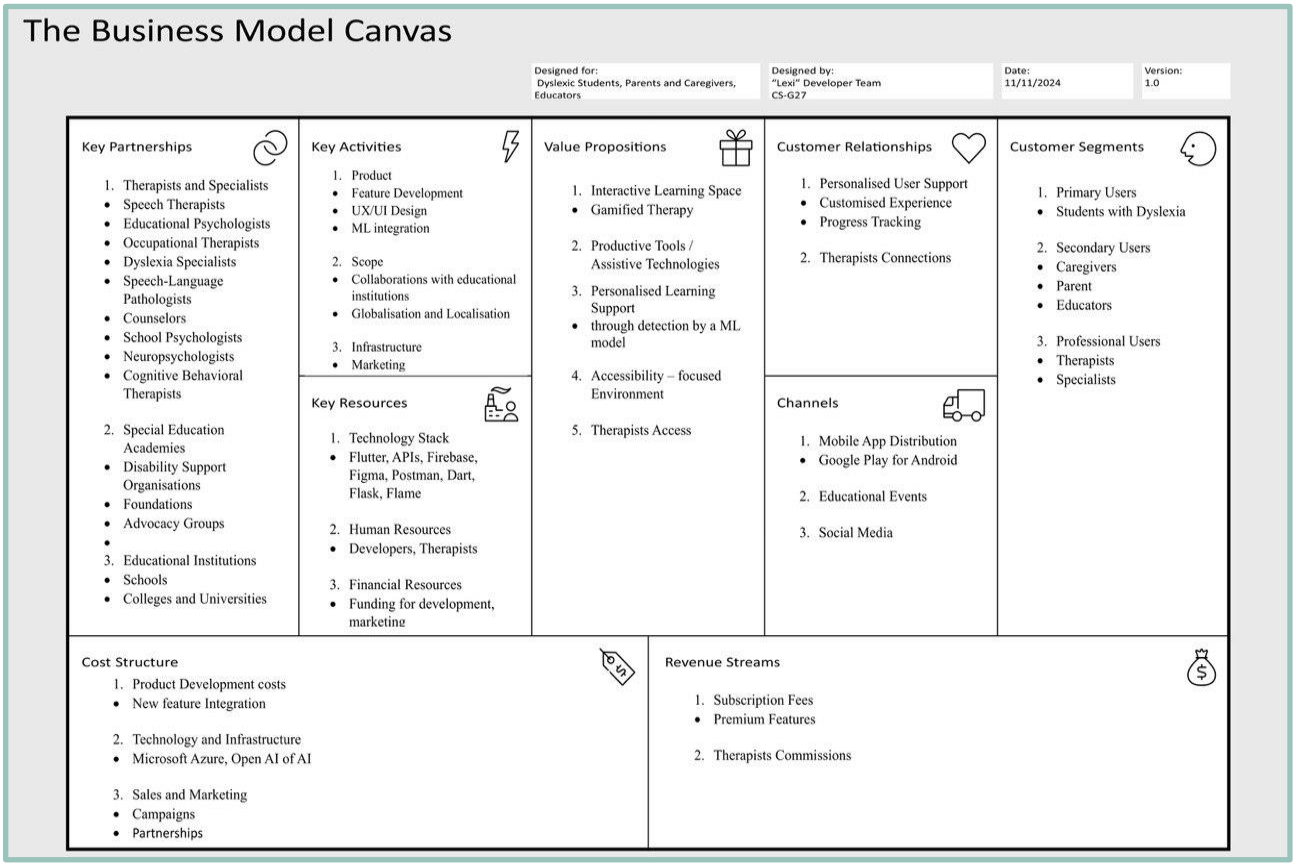

Figure 6: Business Model Canvas

1.10 Chapter Summary

In summary, Chapter 1 presented an overview of the significant barriers faced by individuals with dyslexia and the need for more accessible educational tools. It introduced Lexi as a proposed solution to address these challenges through adaptive learning, gamified features, and support for individualised needs. The scope of the project includes features like SmartRead, VoiceFlow, and PlaySpace, while key resources required for development, such as hardware, software, and a cloud-based infrastructure, were also identified. The following chapters will build on this foundation by exploring existing technological solutions and detailing the proposed system's design and development methodologies.

Chapter 2: Existing work

2.1 Chapter Introduction

This chapter guides the reader through a detailed exploration of existing solutions and competitors related to educational tools that support dyslexic students. The main objective of this analysis is to demonstrate the positive aspects and drawbacks of existing commercial and research-based applications, as well as their technology stacks.

This review helps us identify unaddressed gaps and problems affecting dyslexic students' needs, building a solid foundation for the development of the proposed app, Lexi, which aims to push the boundaries of current technology use in the special education sector.

2.2 Existing Work

2.2.1. Competitor Analysis

There have been some solutions established to help children with Dyslexia, but there are still gaps in successfully addressing their different requirements effectively. The following analysis provides a detailed comparison of existing commercial apps, as well as research-based applications (both designed only and implemented), emphasising their limitations and features.

The feature comparison of already existing commercial applications is demonstrated through the chart below:

2.2.1.1. Already Existing Commercial Apps

App Feature	**Learning Ally**	**Capti-Voice**	**Easy Dyslexia Aid**	**Proposed App- *Lexi***
Customisable Speed Adjustments	Yes (Adjustable Speed)	Yes	Yes(basic speed adjustments)	Yes
Content Extraction and Analysis	No	Yes(Supports PDFs, web contents and documents)	No	Yes
Accessible for Learning Disabilities	Yes (Specially for Dyslexia)	Yes (Specially for Dyslexia)	Yes (Specially designed for Dyslexic students)	Yes
Gamified Therapy and Learning	No	No	Yes(Includes gamified learning activities)	Yes
AI-Powered Real-Time Conversation Generation	No	No	No	Yes
Understanding the stages of Dyslexia Using AI	No	No	No	Yes
Connecting with Real-World Therapists	No	No	No	Yes
Continuous fine-tuning of the features using AI	No	No	No	Yes

Table 3: Feature comparison of already existing applications

2.2.1.2. Research on Mobile Applications for Individuals with Dyslexia

Several research projects have aimed at developing Dyslexic-friendly mobile applications :

Title	Authors	Purpose	Findings	Notable Features	Status
A Mobile Application for displaying more accessible eBooks for people with Dyslexia	Luz Rello, Gaurang Kavinde, Ricardo Baeza Yates	To implement a mobile app that displays eBooks in a more accessible way based on user needs.	Complex language is a major challenge in Dyslexia; existing apps focus on design, not content.	Design content for eBooks; Text-to-Speech functionality; customisable font styles, colour contrast options.	Implemented
Designing Mobile Application for Dyslexia in Reading Disorder Problem	Siti Khatijah, Nur Hasni, Anis Zarah et al.	To validate ideas about Dyslexia characteristics and find effective learning systems	Provided insights about Dyslexic children's behaviours and the demand for mobile app design.	Interactive learning, Gamification Elements, Progress tracking	Designed
D-Lexis: Alphabet Mobile Learning Application for Dyslexia in Reading Disorder Problem	Nor Nadia Bt Jamal Abd Nasar	To create a mobile alphabet learning aid for Dyslexic children using Singerland's technique.	This app addresses the various needs of Dyslexic learners.	Interactive activities for letter recognition, progress assessments	Implemented

Table 4: Comparison of notable features Research-based applications (both designed only and implemented)

2.2.2. Benchmarking

The following benchmarking provides in-depth guidance of evaluation of existing products' performance focusing on metrics like efficiency, usability and cost.This process aims to identify the development criterias of the proposed app 'Lexi' to bridge the gap between Dyslexic students and their accessibility challenges.

1.Efficiency

- Learning Ally: Efficient in providing high quality Text-to-Speech audiobooks, but it doesn't include personalised responses which can decrease the quality of learning experience.
- Capti Voice: Includes multilingual Text-to-Speech which will be beneficial for globalisation of the product with a wide range of users.
- Easy Dyslexia Aid: Simple Speech to text generation with limited functionality.
- Proposed App-Lexi: Designed with AI-driven customisation along with interactive learning.

2.Usability

- Learning Ally: Leverages a straightforward user interface,lacks in customisation for accessibility.
- Capti Voice: Offers multiple customisation options including voice pace adjustments and language.
- Easy Dyslexia Aid: Basic and simple which is very user-friendly specially for Dyslexic children.
- Proposed App-Lexi: Prioritise a user friendly interface with customisable assistive features to change fonts and speed adjustments.

3.Cost

- Learning Ally: Subscription-based platform which leads to narrow down user-experience
- Capti Voice: Basic features are free; and premium features include premium voices and more document types.
- Easy Dyslexia Aid: More affordable than other applications as it contains simple and basic features.
- Proposed App - Lexi: Designed as a "freemium" application; the main basic features are free which makes it accessible for a wide range of users. It includes paid options for

detailed progress reports, advanced therapy games built on different theories related to cognitive abilities.

The proposed app Lexi aims to outperform existing solutions by incorporating innovative AI powered features with personalisation alongside assistive features. This benchmarking demonstrates how Lexi can fulfil the gaps in efficiency and usability which are lacking in current products.

2.2.3. Technology Review

1.Learning Ally:

The Learning Ally is a web Application that uses mainly JavaScript Libraries like jQuery,KnockoutJS, React,Moment JS, and core JavaScript which are somewhat outdated and redundant. Additionally tools such as GSAP and Modernizr have been used to enhance interactivity. For content management, the application widely uses WordPress,NetSuite and DNN Software. Additionally PHP and ASP.NET have been used as frameworks to build the application. In order to fulfil Content Delivery Network requirements, Learning Ally has used Azure Edge, Cloudflare and jQuery CDN. For web hosting, Amazon AWS EC2 Infrastructure has been used .(Learning Ally Company Overview, Contact Details & Competitors | LeadIQ, 2024)

2.Capti Voice:

The Capti Voice employs a robust tech stack in their web application using HTML, CSS,JavaScript alongside IFrame with Syndication Techniques like Atom and RSS. In Particular, they have used WAI-ARIA; a way to make web applications more accessible to disabled people.(Crunchbase, 2023)

2.2.4. Used Algorithms

1. Learning Ally

Learning Ally uses Text-to-Speech Technology and its AudioBooks app uses Natural Language Processing to generate the voices.

2.Capti Voice

Capti Voice uses advanced AI and Natural Language Processing(NLP) with high-quality Text to Speech Technology.It supports multiple document formats with real-time scanning. Their Text to

Speech feature supports multi languages and its NLP algorithms can deliver advanced pronunciation.

3.Easy Dyslexia Aid

Easy Dyslexia Aid uses basic ML components which are mainly focused on reading experience and incorporates Speech to Text conversion.A simple NLP algorithm is used for voice recognition; and the app's algorithms are very simple and straightforward.

None of these apps use advanced ML algorithms or NLP techniques to amplify accessibility through Text to Speech technology.

2.3 Tools and Implementation plan

This section highlights the key tools and technologies selected for the project and outlines a phased approach for implementing the app's features.

Chosen Tools

Backend Development	**Python & Flask**: For developing backend services and APIs, handling user requests, and managing the app's logic. **Firebase**: Provides a real-time database, authentication, and hosting services, which will support user management and data storage.
Frontend Development	**Flutter**: Chosen for building a cross platform mobile app that supports both Android and iOS. **Dart**: Programming language for developing the app's frontend in Flutter.
Design and User Interface	**Figma**: For UI/UX design, wireframes, prototypes, and user flow creation, ensuring a user-friendly and visually appealing interface

Machine Learning and AI Tools:	**DeepSpeech**: Open-source speech-to-text engine used for real-time transcription in voice-based features. **eSpeak NG**: Open-source text-to-speech synthesiser for reading text aloud within the app.
Testing and Quality Assurance	**Flutter Testing Framework**: For unit and UI testing to ensure the stability of app features. **Postman**: API testing tool to validate backend endpoints and interactions. **Pytest**: A flexible testing tool for Python, ideal for testing individual functions and modules in the Flask app, as well as verifying how different parts of the backend work together.
Version Control and Collaboration	**Git & GitHub**: For source code management, version control, and team collaboration. **Frameworks and Libraries** **Flame**: Game engine for building interactive therapy games that support skill development. **Firebase Realtime Database**: For storing user progress data and game scores. **Firebase Authentication**: For secure user login and account management.

Table 5: Implemetaion Tools

Implementation Plan

This plan is structured into multiple phases to streamline development and allow for progressive validation of app features.

Phase 1: Requirement Gathering and Planning

- Conduct user research and gather insights from therapists, parents and potential users.
- Identify key functionalities that support reading and comprehension, such as speech-to-text, text-to-speech, and interactive learning games, based on user feedback.

- Collect data from dyslexic school-age children and adults, compiling responses into a dataset in .csv format for future analysis and training of machine learning models. (Refer to attached screenshots for the App Script code examples used to handle categorical data conversion.)

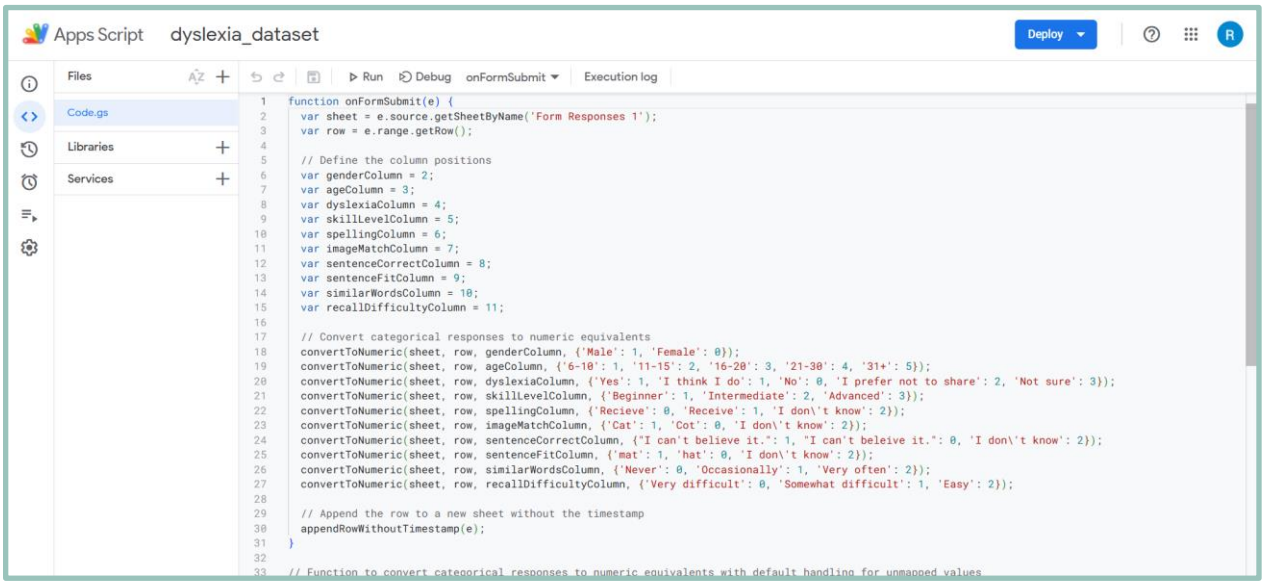

Figure 7: Converting Google Form Data

Phase 2: System Design and Architecture

- Develop a high-level architecture that integrates the frontend, backend, machine learning models, and data storage components.
- Set up Firebase for authentication, real-time database, and hosting.
- Design database schema in Firebase to handle user data, dyslexia assessments, and game scores.
- Outline API endpoints for features such as user registration, progress tracking, and game data handling.

Phase 3: Core Development

- Develop the main app features, focusing on user interaction, voice recognition, text-to-speech, and game elements.
- Frontend: Use Flutter to build screens for onboarding, user profile, reading activities, games, and progress tracking.
- Backend: Implement Flask-based API endpoints and integrate Firebase for data storage.

Phase 4: Testing and Iteration

- Conduct thorough testing on app functionality, user experience, and data flow to ensure a stable release.
- Perform unit and integration tests on backend APIs.
- Run UI and user experience tests using the Flutter testing framework.
- Use Postman to validate API responses and error handling.
- Conduct beta testing with a small user group to gather feedback and identify improvements.

Phase 5: Deployment and Launch

- Prepare the app for release and make it available on major app stores.
- Deploy the backend server on Microsoft Azure or Firebase Hosting.
- Set up Firebase Analytics to monitor user engagement and retention.
- Submit the app to the Google Play Store and Apple App Store, following their respective submission guidelines.

Phase 6: Post-Launch and Maintenance

- Gather user feedback and ensure the app remains up-to-date and bug-free.
- Monitor Firebase Analytics for user insights and identify areas for improvement.
- Implement regular updates based on user feedback, adding new features, improving accessibility, and fixing bugs.
- Plan for additional features, such as multisensory learning games and new accessibility tools.

This implementation plan ensures a structured approach to the Lexi mobile app development. Each phase builds upon the last, allowing for a progressively refined product that aligns with user needs.

2.4 Chapter Summary

In summary, Chapter 2 provided a detailed analysis of existing solutions aimed at supporting dyslexic students, including commercial apps and research-based applications. The team identified the gaps and limitations in the current tools, such as the lack of personalization, inadequate AI-powered features, and limited connectivity with real-world therapists. These gaps emphasize the need for Lexi, which aims to incorporate innovative features, such as real-time AI-powered assistance and gamified therapy, to better address the needs of dyslexic learners. The tools, methodologies, and technologies outlined in this chapter will contribute to building a more advanced and comprehensive product that meets the specific needs of individuals with dyslexia

Chapter 3: Methodology

3.1. Chapter Overview

This chapter outlines the methodologies and approaches used in the development of the Lexi project. The purpose is to explain how the selected development, design, and project management methodologies help achieve the project's objectives effectively. The chapter also describes the tools used for collaboration, the work breakdown structure, milestones, risk management, and other related strategies. By using Agile - Kanban, Object-Oriented Analysis and Design (OOAD), and collaborative tools, this chapter aims to provide a clear roadmap for managing and executing the project efficiently.

3.3. Development Methodology

For the project, **Agile - Kanban** software development life cycle (SDLC) model has been selected. This model provides a flexible and iterative approach to managing the development process, making it ideal for the project's requirements.

3.3.1 Reason for Selection

The Agile Kanban model was chosen because it allows for **continuous feedback** and **incremental improvement**. With Kanban, the workflow can be visualized, and tasks managed efficiently, ensuring transparency in every aspect of development. This approach also facilitates **unit testing** for each module, allowing us to identify and fix issues early in the process.

The weekly feedback sessions with mentors are a critical part of the project journey, and Kanban's flexibility enables us to incorporate the improvements suggested during these sessions seamlessly.

3.3.2 Steps of the Kanban Model

The key phases in the Agile Kanban model include:

1. **Planning**: Defining the tasks and goals for each iteration.
2. **Development**: Develop features incrementally, with specific members working on one module at a time.

3. **Testing**: Perform unit testing for each module to ensure quality and stability.
4. **Feedback and Improvement**: Gather feedback during weekly mentor sessions and implement necessary improvements.
5. **Deployment**: Once all modules are tested and improved, the final solution will be deployed.

The Kanban model is integrated into the project timeline through an iterative cycle of planning, development, testing, and feedback. The project will start in November and is expected to be completed by next February. Each week, specific goals are set for what needs to be developed and tested, followed by mentor feedback sessions. This approach ensures continuous improvements, adapts based on evolving requirements or feedback, and maintains a steady pace. The iterative nature of Kanban allows us to break down the timeline into manageable sprints, ensuring that key milestones are met each month. By visualising the workflow, progress can be effectively tracked, bottlenecks can be identified, and necessary adjustments can be made to ensure the timely completion of the project.(Lemuria, 2023)

3.4 Design methodology

For the project, **Object-Oriented Analysis and Design (OOAD)** has been selected as the design methodology. This methodology is well-suited for the project because it ensures that the system's design aligns with real-world objects and processes, making it intuitive and easy to understand for both developers and users.

The primary reason for selecting **OOAD** is its ability to model the system based on real-world entities, which makes it a natural fit for projects involving multiple interconnected modules, like ours. Using **OOAD**,it allows for breaking down the system into smaller, more manageable objects that correspond to real-life entities, ensuring that the overall system is modular and easy to maintain. Additionally, OOAD supports **reuse** and **scalability**, which will be crucial as the project evolves and grows over time.

To effectively use **OOAD**, several key diagrams are utilised, including:

1. **Class Diagrams**: To represent the structure of the system by defining its classes, attributes, methods, and relationships.
2. **Sequence Diagrams**: To illustrate how objects interact over time, showing the flow of logic in the system.
3. **Use Case Diagrams**: To capture the functional requirements of the system and depict the interactions between users and system components.

4. **Entity-Relationship (ER) Diagrams**: To model the data relationships within the system, ensuring that the database structure supports all required functionalities.

The design of the system follows several key principles to ensure maintainability and scalability:

- **Modularity**: By breaking down the system into smaller, independent modules,each part of the system becomes easier to understand, develop, and test.
- **Abstraction**:Focusing on abstracting the complexities of the system allows developers to concentrate on higher-level functionality without worrying about the underlying implementation details.
- **Encapsulation**: Each object will contain its own data and behaviour, which helps to protect the internal state and reduce complexity.
- **Reuse**: OOAD allows us to create reusable components, reducing development time and improving consistency across the system.

By using **OOAD**, the goal is to create a well-structured, scalable, and maintainable system that effectively meets the project's requirements while providing flexibility for future enhancements.

3.5 Project Management Methodology

The Agile-Kanban methodology has been used to manage the project. This approach suits the project's dynamic nature, allowing us to adapt to changes and improve iteratively based on ongoing feedback. The Kanban model offers a visual representation of tasks, ensuring that the workflow is transparent and that team members can easily track progress.

The Agile Kanban method is an ideal choice for the project because it provides flexibility, continuous improvement, and real-time monitoring of tasks. With Kanban, the team can visualise all stages of the workflow, from planning to deployment, using a Kanban board. This method also allows for incremental progress, meaning the team can incorporate feedback as needed, ensuring that the project evolves and improves continuously. The iterative nature of Agile, combined with the visual flow of Kanban, makes this method perfect for handling changes and accommodating new ideas throughout the project lifecycle.

3.5.1 Task Planning, Assignment, and Monitoring

The Team will manage tasks using **GitHub Projects**, which is directly integrated with the code repository. This platform will be used for task planning, assignment, and maintaining the project timeline. GitHub Projects allows us to create cards for each task, move them across different stages

on the Kanban board, and assign them to team members. This makes it easy to keep track of which branch and pull request each team member is working on, as well as to have different discussions for each task, ensuring that all development activities are well-documented and organised.

The Kanban board includes the following statuses:

- Backlog (tasks that are planned but not yet started)
- To-Do (tasks that are ready to be worked on)
- In Progress (tasks currently being worked on)
- In Review (tasks undergoing review)
- Testing (tasks that are being tested)
- Done (tasks that have been completed)

These stages help in monitoring the progress of each task effectively.

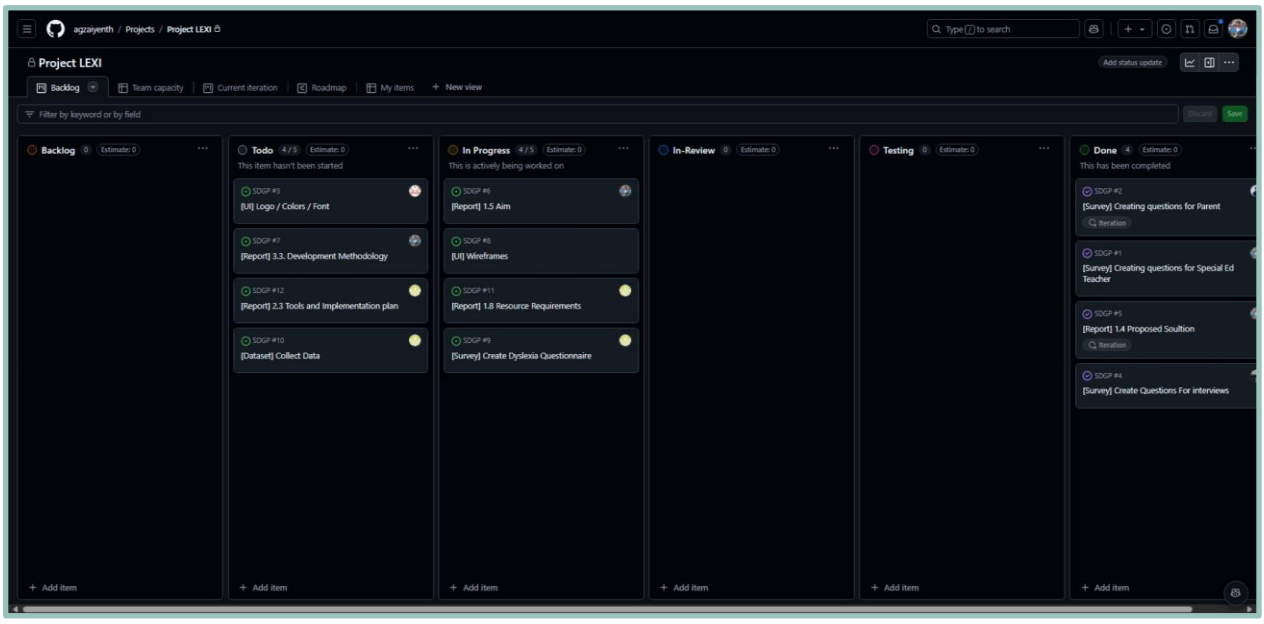

Figure 8: GithubProject - Kanban Board for Task Management

All communication among team members will be conducted using **Google Chat**. This tool has been chosen because of its ability to connect with **Google Meet** for virtual meetings, Schedule events on **Google Calendar** and its integration capabilities with the **GitHub repository**. Within Google Chat, the team can create tasks directly from discussions, ensuring that any new requirements or changes are immediately captured and tracked. This integration keeps the Google

Chat discussions, Google Meet virtual meetings, and GitHub Projects tasks all in sync, enabling seamless collaboration and efficient project management.

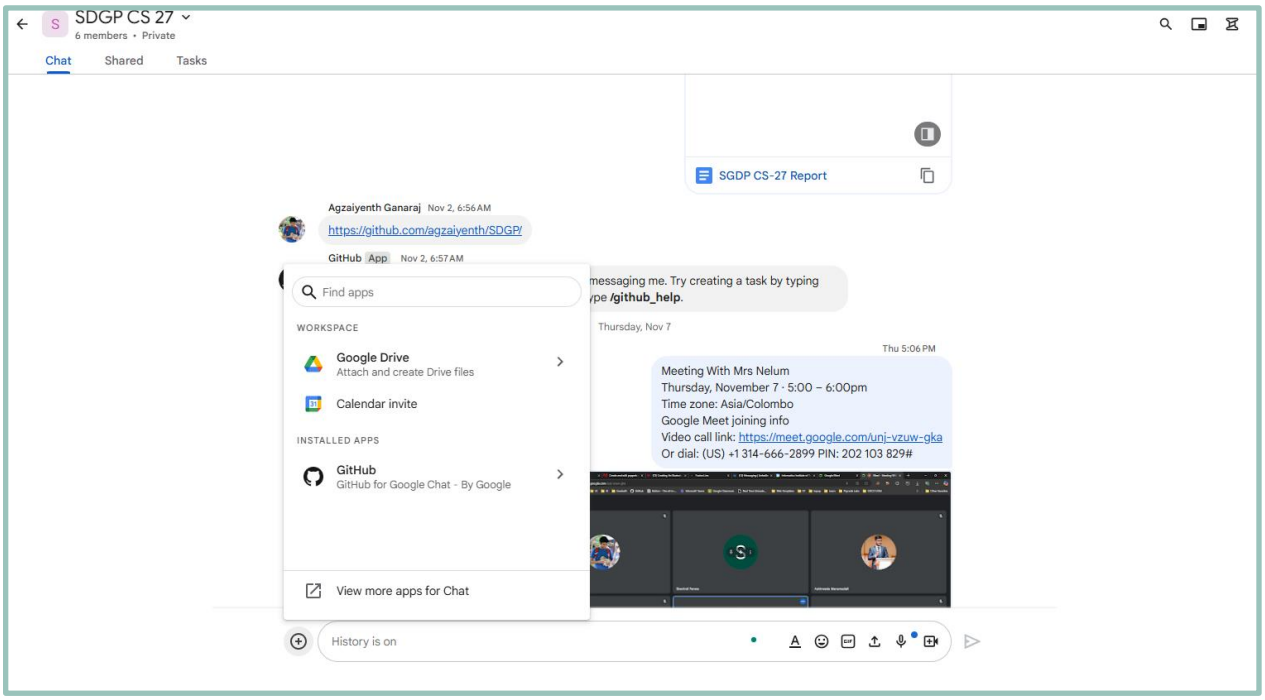

Figure 9: Google Chat with Google Drive,calendar,meet and Github access natively

3.5.2 Milestones and Timeline

To ensure that the project stays on track, the team have established several key milestones. These milestones will help guide the progress and provide clear objectives for each phase of the project.

Below is an example of the milestones:

Project Setup and Planning (Week 3: October 2024)

- Set up GitHub repository and initialise GitHub Projects.
- Assign initial tasks for research and requirement gathering.
- Create a project proposal.

Initial Project Report Creation (Week 3: November 2024)

- Conduct interviews with professionals to gather insights.
- Perform field visits for requirement gathering.

- Decide how the app works.
- Plan wireframes, rich picture, and methodology studies for the Semester 1 coursework report.

Wireframe and Documentation Development (Week 5: November 2024)

- Develop detailed wireframes and supporting documentation.
- Gather feedback and adjust the design accordingly.

Feature Development - Core Modules (Week 6: November 2023 - January 2024)

- Implement key features, such as SmartRead, VoiceFlow, and Read With Me.
- Conduct unit testing for each feature.

Mid-Project Review (January 2024)

- Conduct a full review of completed modules.
- Incorporate feedback and adjust timelines if needed.
- Final Testing and Refinement (February 2024)
- Perform system integration testing and usability testing.
- Refine features based on user testing feedback.

Project Completion and Deployment (End of February 2024)

- Finalise documentation and deploy the finished product.
- Prepare a project presentation for stakeholders.

The Agile Kanban methodology, with its visual workflow and flexible approach, will ensure that the project progresses smoothly while accommodating changes. By leveraging tools like GitHub Projects for task management and Google Chat for communication, the team can effectively collaborate, stay organised, and meet their goals. The defined milestones will keep the project on track, and the iterative feedback cycle will allow for continuous improvement until the project's successful completion.

3.6 Team Work Breakdown Structure (WBS)

For the project, the team divided the work into smaller, manageable modules using a **Work Breakdown Structure (WBS)** approach. This division ensures that each team member has clear responsibilities and contributes effectively to the overall project goals.

Module-Based Task Distribution

- **Wireframes and User Interface Research**: The wireframes are being created collectively by the team, with each member contributing to different parts.Shavindi Perera is leading the research on colours, UI design theories, and fonts, especially considering the needs of individuals with dyslexia. This deep research is crucial, as there are many specific dos and don'ts in UI design for dyslexia compared to standard UI design. Zion Ashirwada Manamudali is assisting by creating UI components, colour palettes, mascots, logos, and advertising materials.
- **Front-End Design (Flutter):** The front-end design is primarily led by asra ameer and Agzaiyenth Ganaraj using Flutter, with contributions from other team members based on their respective modules. This collaborative effort ensures a cohesive design and a consistent user experience across all components.
- **Machine Learning Module**: Rikas Ilamdeen is handling this module, with Amanda Hansamali assisting in its development. Tasks include developing the ML model that fine-tunes features based on user inputs, integrating it with other components, and gathering datasets. Other team members also contribute by helping gather relevant data for training the model.
- **Authentication and Security Module**: The implementation of user authentication, access control, and security features is being managed by Zion Ashirwada Manamudali and Amanda Hansamali. This module ensures that user data is protected and that only authorised users have access to specific features.
- **Data Management Module**: asra ameer and Shavindi Perera are responsible for setting up the database, designing data models, and ensuring efficient data storage and retrieval. This module is crucial for maintaining user data, content, and other essential information.
- **Testing and Quality Assurance Module**: Shavindi Perera and Agzaiyenth Ganarajare leading the efforts in testing and quality assurance, which include unit testing, integration testing, and user acceptance testing. These tasks are vital for ensuring the quality of each feature and module.
- **Project Documentation Module**: The documentation is a shared responsibility among all team members. Each member documents their respective subtasks as they progress, and these individual contributions are compiled to create the final project documentation, ensuring comprehensive coverage of all aspects of the project.
- Project Management and Coordination Module: Agzaiyenth Ganaraj and Zion Ashirwada Manamudali are managing the overall workflow, including setting up and managing the Kanban board in GitHub Projects, monitoring task progress, and ensuring the project

stays on schedule. Coordination tasks also include organising meetings via Google Chat and Google Meet to discuss progress and address any roadblocks.

- **Features Work Breakdown**: the team have broken down the features into smaller tasks, with multiple team members working on one module at a time:
    - **VoiceFlow**
    - **Read With Me**
    - **Pop the Balloon Game**
    - **VoxBuddy**
    - **SmartRead**
    - **Insights and Reports**
    - **Therapist Finder**

Tracking Contributions

The contributions of each team member are tracked using **GitHub Projects**, where tasks are assigned, and their statuses are updated regularly. Additionally, all documentation and written reports are managed through **Google Docs**, which allows us to monitor changes and contributions via the document history. This transparency ensures accountability and keeps the entire team informed about the progress of individual tasks and overall project milestones.

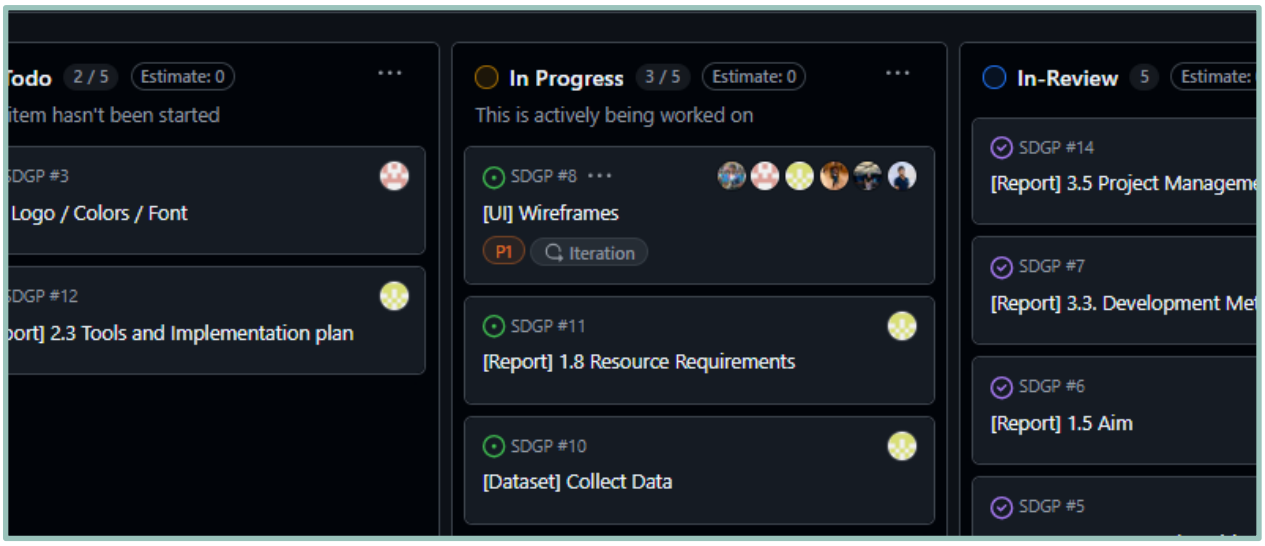

Figure 10: Tracking the task status and assignees

3.7 Gantt chart diagram

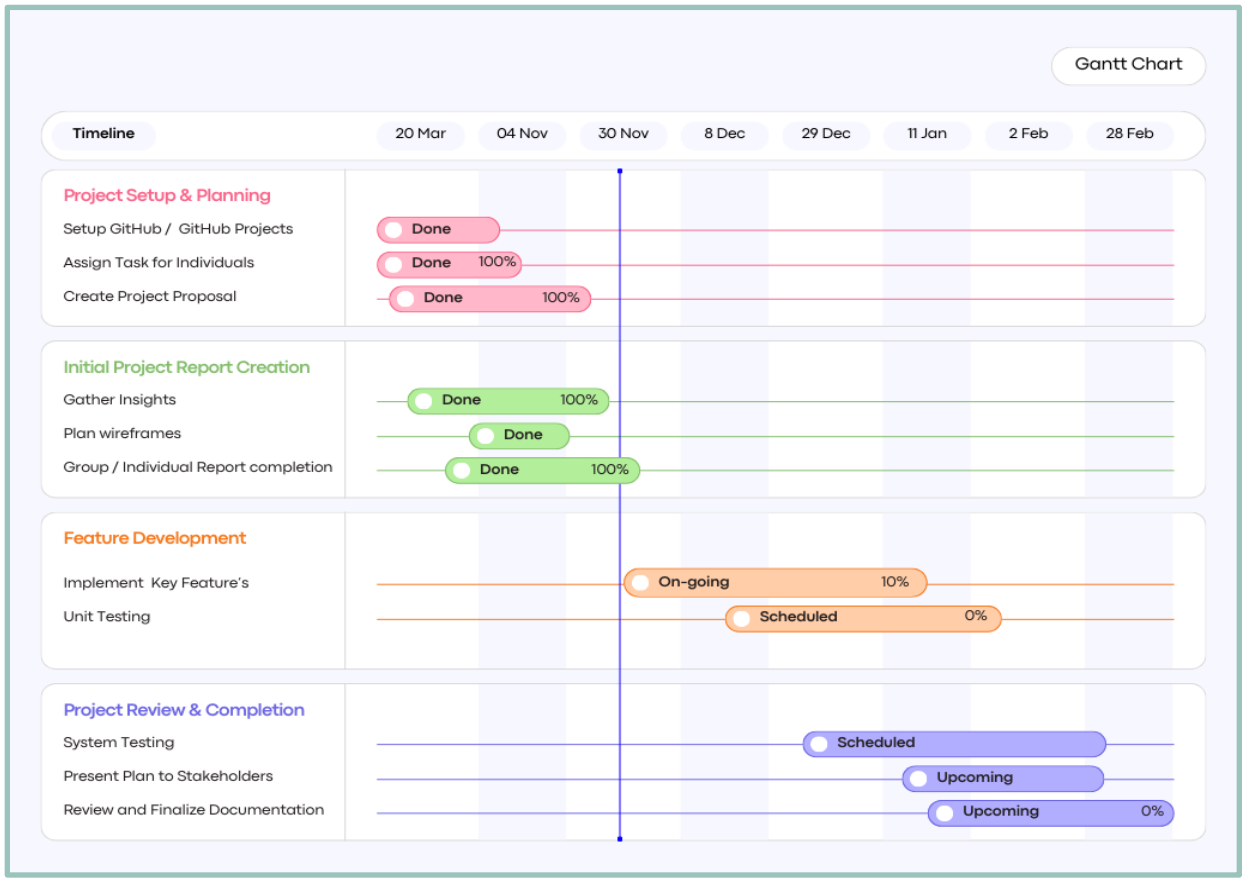

Figure 11: Gantt Chart Diagram

3.8 Usage of Project Management and Collaboration Software In the project

1.Task Tracking and Progress Management with Github

The team uses GitHub Projects ,where the team organises tasks into categories like “To Do”,”In Progress”,”In Review” and “Done”.This setup helps us easily see the status of each task and keeps everyone on the same page with project goals.

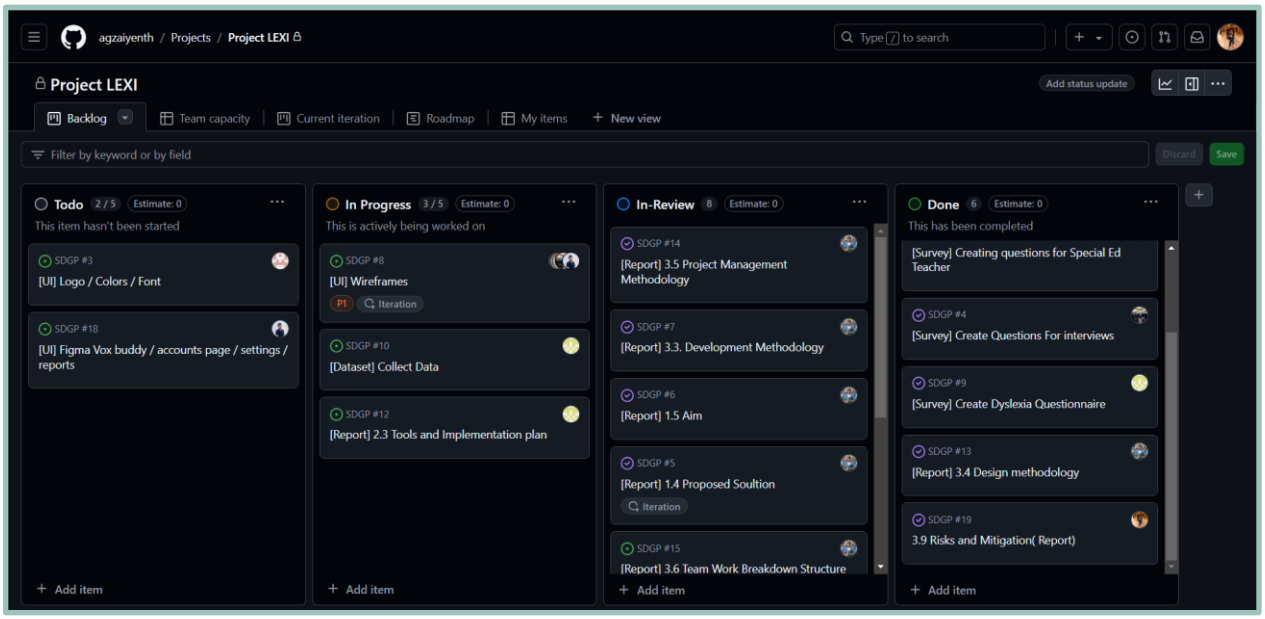

Figure 12: Screen Shot of Managing Projects flow in Github

2.Communication and Meetings via Google Meet:-

The team meets three times a week on Google Meet to discuss what needs to be done next,brainstorm efficient ways to complete tasks on time ,and make any adjustments as needed.During these meetings,the team breaks down the tasks ,sets priorities ,and makes sure everyone knows their role in the projects. (See Appendix A , for meeting evidences)

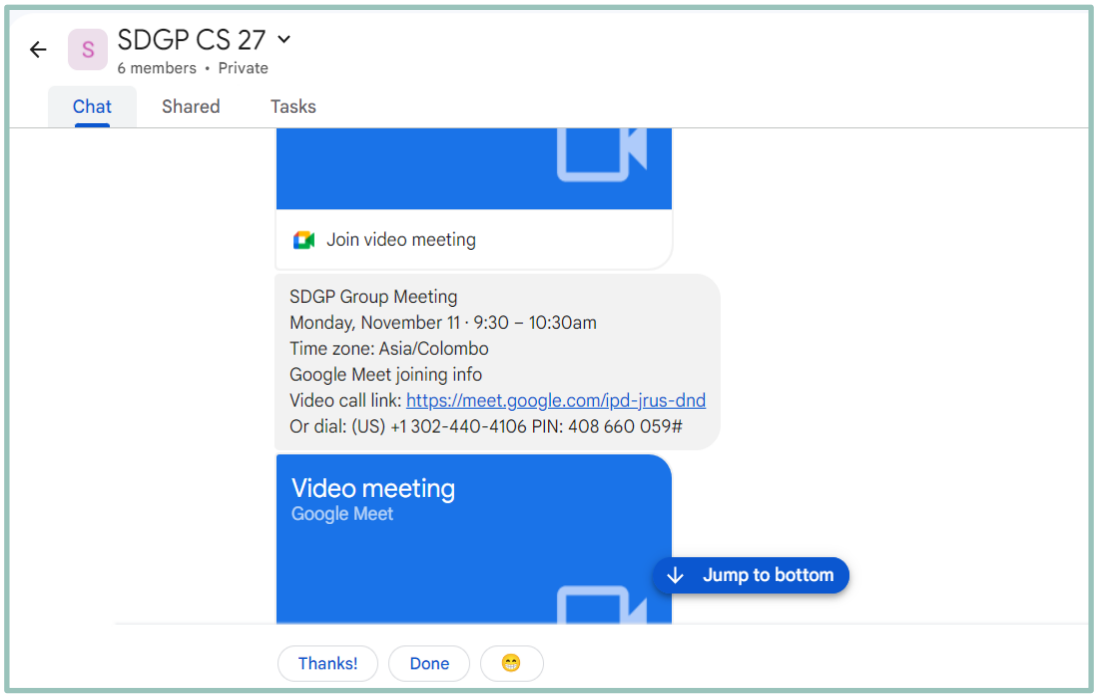

Figure 13: Usage of Google Meet

3. Resource Sharing and Collaboration on Google Chat

Google Chat serves for sharing reports,Github repositories,and other essential resources,ensuring all project materials are easliy accessible to the team.(See Appendix B , for Evidence of Resource Sharing on Google meet)

3.9 Risks and Mitigation

Risk Item	**Severity**	**Frequency**	**Mitigation Plan**
Training the model to identify dyslexia people	5	5	By creating our own datasets trying to train our prediction system .
Data Privacy Concerns	5	5	Implement strong encryption,anonymize data,and adhere to data privacy laws and regulations
Real Datasets to train the model	3	5	Creating our own datasets by sending surveys to special education centres.
User Engagement Issues	1	3	Use gamification to enhance engagement and tracking the progress of each student .
Timeline Delays	2	4	Initially, we'll focus on the core features :Read with me , Read Aloud ,Content summarisation, and phonological-based game. We'll divide tasks to implement these efficiently, adding further features as the project progresses.

Table 6: Risks and Mitigation

3.10 Chapter Summary

In summary, Chapter 3 discusses the methodologies chosen for the development and management of the Lexi project. The Agile-Kanban model ensures flexibility and adaptability during development, while OOAD provides a structured and modular design approach. The use of GitHub Projects and Google Chat facilitates task tracking, collaboration, and communication among team members. Additionally, a work breakdown structure (WBS) was implemented to ensure clear responsibilities for each team member, and risk mitigation strategies were established to handle potential challenges. These methodologies collectively ensure a smooth development process, continuous improvement, and effective project management.

For future scope, the team aims to expand the feature set to include advanced gamified therapies and localisation into native languages, addressing the broader needs of a global audience. Additionally, integrating offline functionality and leveraging emerging AI advancements could further enrich the user experience and broaden the application's accessibility

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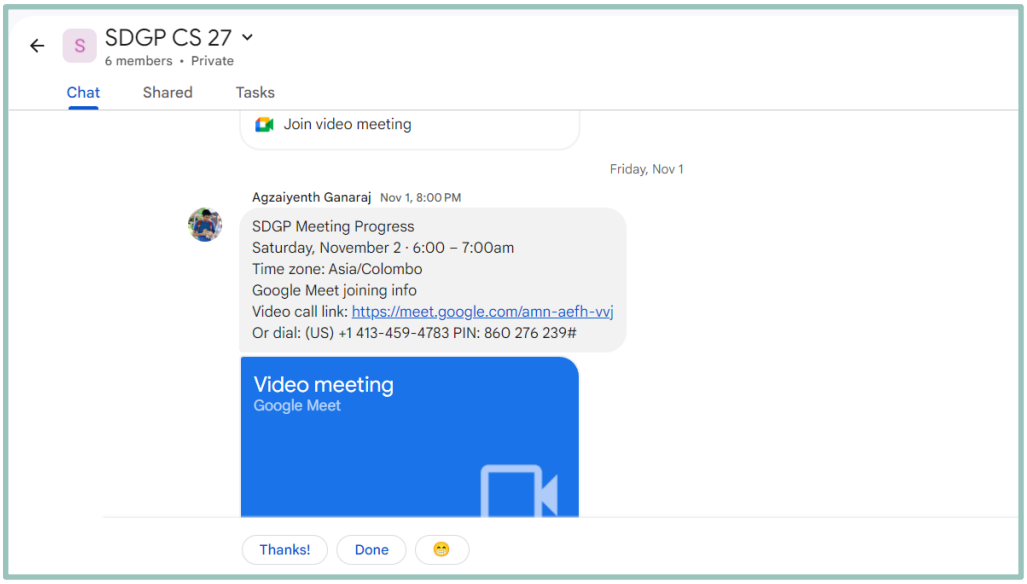
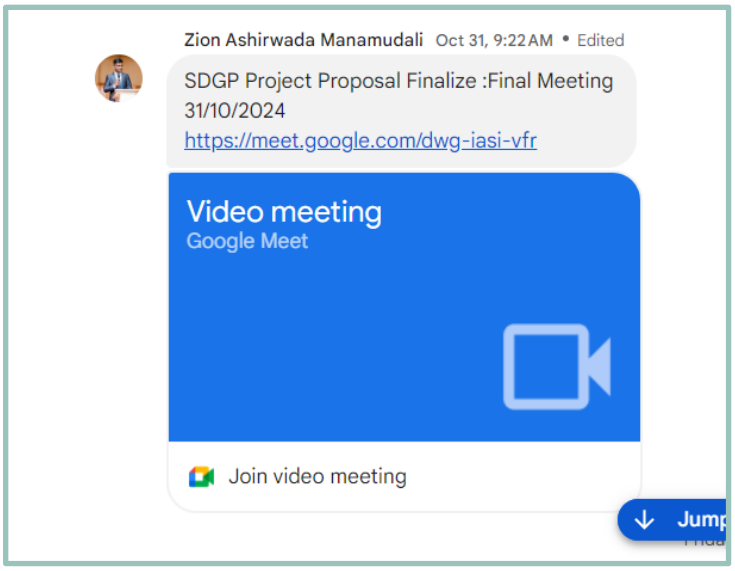
Appendix

Appendix 1 : Meeting Evidences




Zion Ashirwada Manamudali Oct 31, 9:22 AM • Edited
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31/10/2024
https://meet.google.com/dwg-iasi-vfr
Video meeting
Google Meet
Join video meeting

Appendix 2 : Evidence of Resource sharing on Google Meet