“Growin’Up” a Mobile Application for Primary Students with Dyslexia to Improve Sinhala Language.

Project Id: 23-034

Project Proposal Report

BSc (Hons) in Information Technology Specializing in

Information Technology

Department of Information Technology

Sri Lanka Institute of Information Technology Sri Lanka

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“Growin’Up” a Mobile Application for Primary Students with Dyslexia to Improve Sinhala Language.

(Individual Component- Analyzing sequential difficulties faced by the kids of the age limit of 6-8 and the impact of visual dyslexia and provide solutions to overcome the difficulties)

Project Id:23-034

Project Proposal Report

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DECLARATION OF THE CANDIDATE AND SUPERVISOR

We declare that this is our own work, and this proposal does not incorporate without acknowledgment 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 acknowledgment is made in the text.

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The supervisor/s should certify the proposal report with the following declaration. The above candidates are carrying out research for the undergraduate Dissertation under my supervision.

Signature of the supervisor (Prof Samantha Thelijjagoda) Date

Signature of co-supervisor (Ms. Jenny Krishara) Date

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LIST OF ABBREVIATIONS

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Abbreviations	Description
AI	Artificial intelligence
API	Application programming interface
ICT	information and communication technology
NLP	Natural language processing
ML	Machine learning
IPP	Image-Pre-Processing
UI	User Interface

ABSTRACT

The proposed research aims to analyze the sequential difficulties faced by children between the ages of 6-8 and the impact of visual dyslexia on their Sinhala learning abilities. The study will investigate the challenges faced by these children in areas such as reading, writing, and arithmetic, with a focus on identifying patterns of difficulty that may be associated with visual dyslexia.

The research will employ a mixed-methods approach, including both quantitative and qualitative data collection methods. Quantitative data will be collected through standardized tests to assess reading and writing abilities, as well as cognitive and perceptual skills. Qualitative data will be collected through interviews with parents, teachers, and the children themselves, to gain insight into their experiences and perceptions of learning difficulties.

The study will also investigate the impact of visual dyslexia on these children's learning abilities. Visual dyslexia are a specific type of dyslexia that affects a person's ability to recognize and interpret visual information, such as letters, numbers, and symbols. By analyzing the impact of visual dyslexia on these children's learning, the study aims to identify effective strategies and interventions to support their learning and help them overcome their difficulties.

The results of the study will be used to develop recommendations for teachers, parents, and educational professionals on how to identify and support children with sequential difficulties and visual dyslexia. The recommendations will be based on evidence-based best practices and will aim to promote inclusive and effective learning environments for all children this proposed system will be designed to fill the gap od Sinhala language learning and dyslexic students.

Keywords

Reading, Visual attention, dyslexia, Parallel processing, Sequential processing

1. INTRODUCTION

Learning difficulties and disabilities, including dyslexia, are prevalent among children worldwide. Dyslexia is a specific learning disability that affects a person's ability to read, write, and spell, and it can significantly impact academic performance and socio-emotional well-being. Visual dyslexia are a subtype of dyslexia that affects a person's ability to recognize and interpret visual information, such as letters, numbers, and symbols.

There is a need for research that investigates the sequential difficulties faced by children with visual dyslexia and the impact of this condition on their language learning abilities. This proposed research aims to address this gap by analyzing the sequential difficulties faced by children between the ages of 6-8 and the impact of visual dyslexia on their Sinhala language learning abilities in Sri Lanka. The study will employ a mixed methods approach to collect both quantitative and qualitative data to gain a comprehensive understanding of the challenges faced by these children and identify effective strategies and interventions to support their learning.

Research conducted in Sri Lanka has highlighted the prevalence of dyslexia and the need for early identification and intervention to support affected children. A study by Jayasooriya [1] found that dyslexia is prevalent among primary school children in Sri Lanka, with a higher incidence among those attending government schools. Another study by Naseema [2] found that phonological processing and rapid naming are significant predictors of reading and spelling ability among Sinhala-speaking children.

In addition to Sri Lankan research, international research has also shown the impact of dyslexia on children's language learning abilities. For example, a study by Ramus [3] found that dyslexia affect the ability to process sequential information, which is essential for reading and spelling. Another study by Vellutino [4]found that early identification and intervention for dyslexia can improve children's reading and spelling abilities.

The proposed research aims to build on this existing knowledge by focusing on the impact of visual dyslexia on Sinhala language learning among children in Sri Lanka. By analyzing the challenges faced by these children and identifying evidence-based interventions, the study will provide insights that are valuable for teachers, parents, and educational professionals working with children with dyslexia in Sri Lanka. The findings of this study will contribute to the development of inclusive and effective learning environments for all children in Sri Lanka and potentially inform interventions for dyslexic children globally.

The proposed system is a mobile application designed to assist primary students with dyslexia in improving their Sinhala language skills. The application aims to provide a user-friendly and engaging platform for children to practice reading, writing, and arithmetic, with a focus on addressing the specific challenges associated with sequential dyslexia. The development of the application is based on research conducted on the learning needs and preferences of children with dyslexia. Several studies have shown that technology-based interventions, such as mobile applications, can be effective in improving reading and writing abilities in children with dyslexia [5].

In addition to addressing the unique learning needs of children with dyslexia, the application also aims to promote inclusive and equitable education. In Sri Lanka, like in many other countries, children with dyslexia often face social and academic exclusion due to a lack of understanding and support from their peers and educators (Dissanayake, 2018). By providing a tool that is accessible and tailored to the needs of these children, the application aims to promote greater awareness and understanding of dyslexia in the wider community.

Overall, the proposed mobile application for primary students with dyslexia has the potential to address an important gap in the education system and improve the educational outcomes and social inclusion of children with dyslexia.

1.1 Background Study and Literature Review

Dyslexia is a common learning difficulty that affects children's language learning abilities and can lead to social and academic exclusion. Early identification and intervention, as well as personalized and technology-based interventions, have shown promise in improving the educational outcomes of children with dyslexia. In addition, interventions that promote inclusive and equitable education, such as teacher training and support, can improve the academic and social outcomes of children with dyslexia and promote greater understanding and support for these children in the wider community. Visual dyslexia, a subtype of dyslexia, affects a person's ability to recognize and interpret visual information, such as letters, numbers, and symbols.

Research has highlighted the prevalence of dyslexia in Sri Lanka and the need for early identification and intervention to support affected children. A study by Jayasooriya (2011) [1]found that dyslexia is prevalent among primary school children in Sri Lanka, with a higher incidence among those attending government schools. Another study by Naseema [2]found that phonological processing and rapid naming are significant predictors of reading and spelling ability among Sinhala-speaking children.

Studies have shown that dyslexia affect the ability to process sequential information, which is essential for reading and spelling (Ramus, 2003). Sequential processing is the ability to perceive, process, and remember information in a particular order or sequence. Children with dyslexia often struggle with this type of processing, which can lead to difficulties with reading comprehension and spelling accuracy.

A growing body of research has investigated the impact of dyslexia on children's language learning abilities and identified effective interventions to support their learning. For example, a study by Fumagalli and colleagues (2020) found that a multicomponent intervention program, including phonological and orthographic training, improved reading, and spelling abilities in children with dyslexia.

Technology-based interventions, such as mobile applications, have also shown promise in improving reading and writing abilities in children with dyslexia. A study by Gatt and colleagues (2019) found that a mobile application that provided personalized reading practice significantly improved reading speed and accuracy in children with dyslexia. Another study by De Luca and colleagues (2019) found that a mobile application that provided phonological and orthographic training improved reading and spelling abilities in children with dyslexia. A study by Boyle and colleagues (2021) found that teacher training and support can improve the academic and social outcomes of children with dyslexia and promote greater understanding and support for these children in the wider community.

Furthermore, phonological processing and rapid naming have been identified as significant predictors of reading and spelling ability among Sinhala-speaking children with dyslexia (Naseema, 2019). Phonological processing refers to the ability to recognize and manipulate sounds in words, while rapid naming refers to the ability to quickly retrieve and name familiar items, such as letters or numbers.

Despite the prevalence of dyslexia and the need for early identification and intervention, children with dyslexia in Sri Lanka often face social and academic exclusion due to a lack of understanding and support from their peers and educators (Dissanayake, 2018). This exclusion can lead to significant long-term consequences for children with dyslexia, including lower academic achievement and limited employment opportunities. To address the challenges faced by students with dyslexia, various interventions have been developed. For example, a multicomponent intervention program, including phonological and orthographic training, improved reading, and spelling abilities in children with dyslexia (Fumagalli et al., 2020). Technology-based interventions, such as mobile applications, have also shown promise in improving reading and writing abilities in children with dyslexia (Gatt et al., 2019; De Luca et al., 2019).

In addition to interventions that target the specific learning needs of children with dyslexia, there is also a need for interventions that promote inclusive and equitable education. Teacher training and support have been shown to improve the academic and social outcomes of children with dyslexia and promote greater understanding and support for these children in the wider community [6].

In conclusion, dyslexia are a prevalent learning difficulty that affects children's language learning abilities, particularly their ability to process sequential information. Early identification and intervention personalized and technology-based interventions, and interventions that promote inclusive and equitable education can improve the educational outcomes of children with dyslexia and promote greater understanding and support for these children in the wider community.

1.2 Research Gap

In today's world, technology has revolutionized every aspect of life, including education. Many mobile apps are available that cater to children's learning and development needs. In this research, we will focus on comparing the features of six different mobile apps, namely Easy Lexia, Dyslexia Beca, Yalu, The Hope, Alexza, and Arunalu, with a new app, Growin'up. The new app has unique features that the other apps do not possess. The objective of this research is to identify the gaps in the current mobile learning apps and how Growin'up fills these gaps.

One of the significant features of the new app, Growin'up, is its focused letter learning sequence. This feature is not present in any of the other apps mentioned above. The letter sequence helps children learn letters systematically, making it easier for them to understand and remember. Furthermore, the sound effects and visual feedback in Growin'up enhance the learning experience and make it more engaging for children. In contrast, the other apps do not have such features, making the learning experience less interactive.

Voice recognition is another unique feature of Growin'up, enabling it to track responses to sequencing. This feature is not present in any of the other apps, making Growin'up stand out. Additionally, the use of auto-correction algorithms in Growin'up helps track progress, making it easier to identify areas where children need help. This feature is also absent in the other apps, making it harder to track progress and identify areas of improvement.

Another unique feature of Growin'up is the use of text generation methods to predict the next letters. This feature is not present in any of the other apps, making it easier for children to predict the next letter, enhancing their learning experience. Furthermore, the use of word jumbling, and puzzles focused on sequencing in Growin'up makes it easier for children to learn letter sequences. These features are not present in the other apps, making the learning experience less interactive and engaging.

Most of the apps mentioned above, including Easy Lexia, Dyslexia Beca, The Hope, Alexza, and Arunalu, are mobile solutions. The new app, Growin'up, is also a mobile app, making it convenient and accessible for children to use. However, The Hope and Arunalu are the only two apps that support the Sinhala language. This feature makes these apps stand out for children who speak the Sinhala language, making it easier for them to learn.

Table 2 comparison table

Feature	**Easy Lexia** [7]	**Dyslexia Baca** [8]	**YALU** [9]	**The Hope** [10]	**ALEXZA** [11]	**ARUNALU** [12]	**Growin'Up**
Focused on letter sequencing.	✗	✗	✗	✗	✗	✗	✓
Sound effects and visual feedbacks	✗	✗	✗	✗	✗	✗	✓
Voice recognition to track responses od sequencing.	✗	✗	✗	✗	✗	✗	✓
Included phonic based games in sequencing.	✗	✗	✗	✗	✗	✗	✓
Use of word jumbling, and puzzles focused on sequencing.	✗	✗	✗	✗	✗	✗	✓
Use of auto correction algorithms to track progress.	✗	✗	✗	✗	✗	✗	✓

Use of text generation methods to predict the next letters.	✗	✗	✗	✗	✗	✗	✓
Mobile solution	✓	✓	✗	✓	✓	✓	✓
Support Sinhala language	✗	✗	✗	✓	✗	✗	✓

In conclusion, the comparison of features in mobile learning apps highlights the gaps that exist in current apps. The unique features of Growin'up, such as focused letter learning sequence, sound effects, and visual feedbacks, voice recognition, auto-correction algorithms, text generation methods, and word jumbling, make it stand out from the other apps. Furthermore, the use of mobile solutions in these apps makes learning more convenient and accessible. However, the lack of support for the Sinhala language in most of the apps is a significant gap that needs to be addressed. Growin'up is a mobile learning app that fills the gaps that exist in current mobile learning apps and provides a better learning experience for children.

1.3 Research Problem

What are the sequential difficulties faced by children aged 6-8 with visual dyslexia in learning the native language Sinhala, and how can these difficulties be overcome?

Visual dyslexia refer to difficulties in reading and writing that are related to visual processing. Children with visual dyslexia may struggle with letter and word recognition, letter reversals, and reading comprehension. These difficulties can have a significant impact on a child's academic performance and overall development, particularly in their acquisition of their native language. The age range of 6-8 is a critical period for learning to read and write in any language, and any difficulties during this period can have long-term consequences. However, there is limited research on the specific sequential difficulties faced by children with visual dyslexia in learning the native language Sinhala, and effective interventions to address these difficulties.

Same as this some other researchers have also focused on such problems children learning English as a second language may be at increased risk for visual dyslexia, which can impact their ability to read and write in English [13]. However, there is limited research on the prevalence of visual dyslexia among these children and its impact on their language acquisition and academic achievement.

The next problem that would be accessed through this research is What is the effectiveness of assistive technology in supporting children with visual dyslexia in language learning, and how can it be integrated into language learning programs?

Assistive technology, such as text-to-speech software and speech recognition software, has the potential to support children with visual dyslexia in language learning by providing alternative ways to access and process information [14]. However, there is limited research on the effectiveness of these technologies in supporting language learning for children with visual dyslexia, as well as how best to integrate these technologies into language learning programs. By exploring these different aspects, we can gain a more comprehensive understanding of the challenges faced by children with visual dyslexia and how best to support their language learning.

Therefore, the research problem is to identify the sequential difficulties faced by children aged 6-8 with visual dyslexia in learning the native language Sinhala and to develop effective interventions to help them overcome these difficulties. The findings of the study will provide valuable insights into the challenges faced by children with visual dyslexia in learning Sinhala and inform the development of effective interventions to support their learning and development.

2. OBJECTIVES

2.1 Main objectives

Objective 1: The first objective of this research is to analyze the sequential difficulties faced by children with visual dyslexia between the ages of 6-8 in Sri Lanka. The study aims to identify the specific challenges that these children face in recognizing and interpreting visual information, such as letters, numbers, and symbols. By understanding the sequential difficulties faced by children with visual dyslexia, the research aims to contribute to the development of effective interventions and support mechanisms for these children.

Objective 2: The second objective of this research is to investigate the impact of visual dyslexia on the Sinhala language learning abilities of children in Sri Lanka. The study aims to identify how visual dyslexia affects children's ability to read, write, and spell in the Sinhala language, which is the official language of Sri Lanka. By understanding the impact of visual dyslexia on Sinhala language learning, the research aims to inform the development of targeted interventions and strategies to support the language learning needs of these children.

Objective 3: The third objective of this research is to identify effective strategies and interventions to support the learning of children with visual dyslexia in Sri Lanka. The study aims to explore evidence-based interventions and strategies that have been effective in improving the language learning outcomes of children with visual dyslexia in other countries. By identifying effective strategies and interventions, the research aims to inform the development of targeted and evidence-based interventions to support the learning needs of children with visual dyslexia in Sri Lanka.

Objective 4: The fourth objective of this research is to develop a mobile application to assist primary students with dyslexia in improving their Sinhala language skills. The mobile application aims to provide a user-friendly and engaging platform for children to practice reading, writing, and arithmetic, with a focus on addressing the specific challenges associated with sequential dyslexia. By developing a mobile application tailored to the specific needs of children with visual dyslexia, the research aims to improve the educational outcomes and social inclusion of these children.

Objective 5: The fifth objective of this research is to promote inclusive and equitable education for children with dyslexia in Sri Lanka by providing a tool that is accessible and tailored to their needs. In Sri Lanka, children with dyslexia often face social and academic exclusion due to a lack of understanding and support from their peers and educators. By providing a tool that is accessible and tailored to the needs of these children, the mobile application aims to promote greater awareness and understanding of dyslexia in the wider community and improve the educational outcomes and social inclusion of children with dyslexia in Sri Lanka.

2.2 Sub Objectives

The proposed mobile application for primary students with dyslexia has several sub-objectives that aim to address the specific challenges associated with visual dyslexia and improve Sinhala language learning. One of the sub-objectives is to incorporate sound effects and visual feedback to help children understand sequencing. Children with visual dyslexia struggle with interpreting visual information, such as letters, numbers, and symbols, which can impact their ability to understand and remember sequences. By incorporating sound effects and visual feedback into the learning process, the application can help children with dyslexia better understand the order and arrangement of letters, numbers, and other symbols.

Another sub-objective is to use voice recognition methods to track correct and incorrect responses. This feature will allow the application to provide immediate feedback to children, helping them identify and correct errors as they learn. Additionally, this feature will allow teachers and parents to track progress and identify areas where children may need additional support.

The application will also include phonics-based games and activities, such as word jumbling and puzzles, to improve learning. Phonics is an important component of reading and writing, and these activities can help children with dyslexia develop phonemic awareness and improve their reading and spelling abilities.

To further support learning, the application will include text editors and auto-correction algorithms that track individual progress. This feature will allow children to practice writing and spelling and receive immediate feedback on their work. Over time, the application will adapt to each child's individual learning needs and provide tailored activities and support.

Finally, the application will use text generation to predict the next letters of the alphabet, helping children with visual dyslexia develop an understanding of sequence and improve their ability to predict patterns. The application will also provide practice activities specifically designed to address sequencing problems and help children develop strategies for remembering and interpreting sequences.

Overall, these sub-objectives are designed to address the unique learning needs of children with visual dyslexia and provide a comprehensive and inclusive learning environment that supports their language learning abilities. By incorporating sound effects and visual feedback, phonics-based games and activities, voice recognition methods, and text generation, the application has the potential to improve the educational outcomes and social inclusion of children with dyslexia in Sri Lanka.

3. METHODOLOGY

The suggested mobile application "Growin'Up" intends to assist primary pupils with Dyslexia in developing their Sinhala language skills. The tool will examine sequential issues encountered by

children aged 6 to 8, particularly those affected by visual dyslexia, and will propose solutions to these challenges. The application will also address phonological dyslexia by providing answers to problems with letter recognition, spelling, and sound learning. Furthermore, the application will identify and address several learning issues encountered by dyslexic kids, as well as potential strategies to overcome them. Finally, the application will perform study on rapid naming dyslexia and will focus on reading issues that dyslexic pupils typically suffer. In the creation of the "Growin'Up" mobile application, each of these four components will be tackled separately.

The component of "Analyzing sequential difficulties faced by kids aged 6-8 and the impact of visual dyslexia and providing solutions to overcome them" in the proposed project aims to incorporate sound effects and visual feedback to help children understand sequencing. Additionally, voice recognition methods will be used to track correct and incorrect responses. The app will include phonics-based games and activities, such as word jumbling and puzzles, to improve learning. Text editors and auto-correction algorithms will be used to track individual progress, and the app will also utilize text generation through TensorFlow to predict the next letters of the alphabet and help students understand sequencing. Through these features, the project aims to develop an engaging and interactive mobile application that addresses the specific needs of children with visual dyslexia and provides effective solutions to overcome their sequential difficulties and enhance their language skills.

The sound effects and visual feedback can help children better understand sequencing by providing auditory and visual cues, making the learning process more engaging and interactive. Voice recognition methods can provide feedback on correct and incorrect responses, helping children self-assess their progress and improve their accuracy. Phonics-based games and activities can enhance the learning of letter sounds and word recognition, improving children's phonological awareness, which is a crucial component of reading development. The text editors and auto-correction algorithms can track individual progress and provide feedback, helping children identify and correct errors in their writing, thereby improving their writing skills, text generation through TensorFlow can help children predict the next letters of the alphabet, reinforcing their understanding of sequencing and improving their letter recognition skills. Overall, the mobile application with these features aims to provide effective interventions to address the sequential difficulties faced by children with visual dyslexia, helping them improve their language skills, academic performance, and psychosocial well-being.

3.1 System Architecture

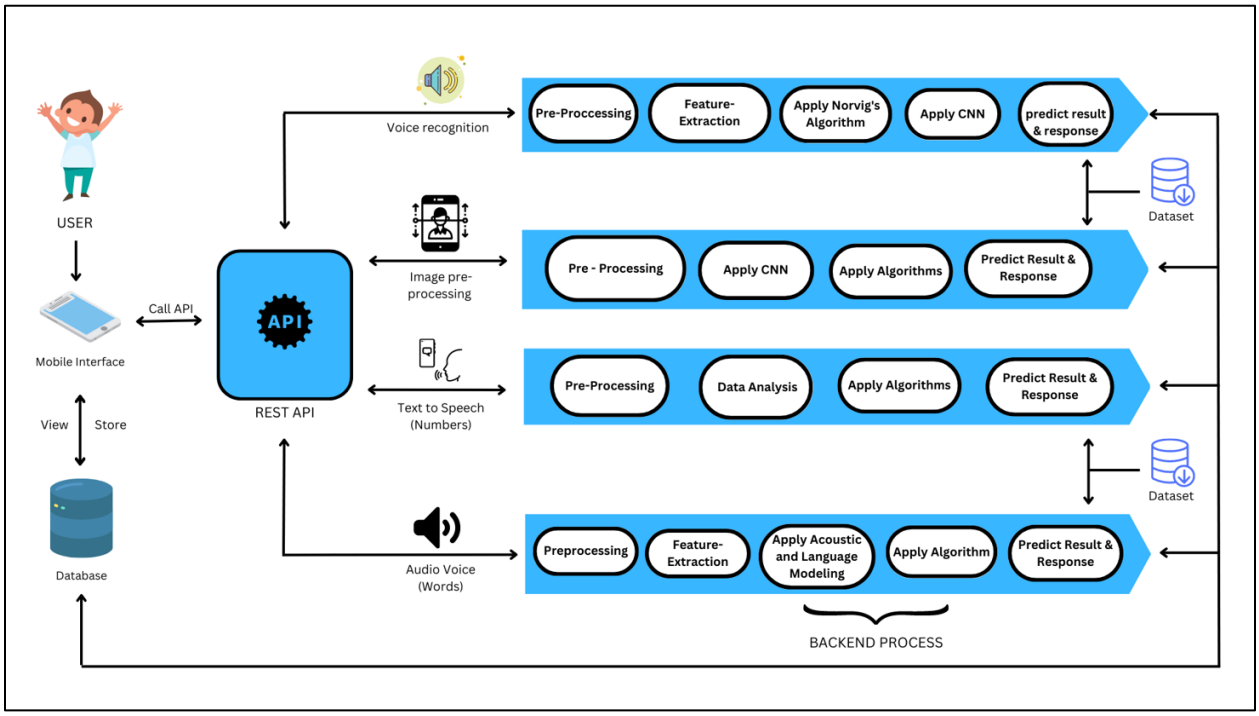

Figure 1 Full System Architecture Diagram

3.1.1 Individual Component Diagram

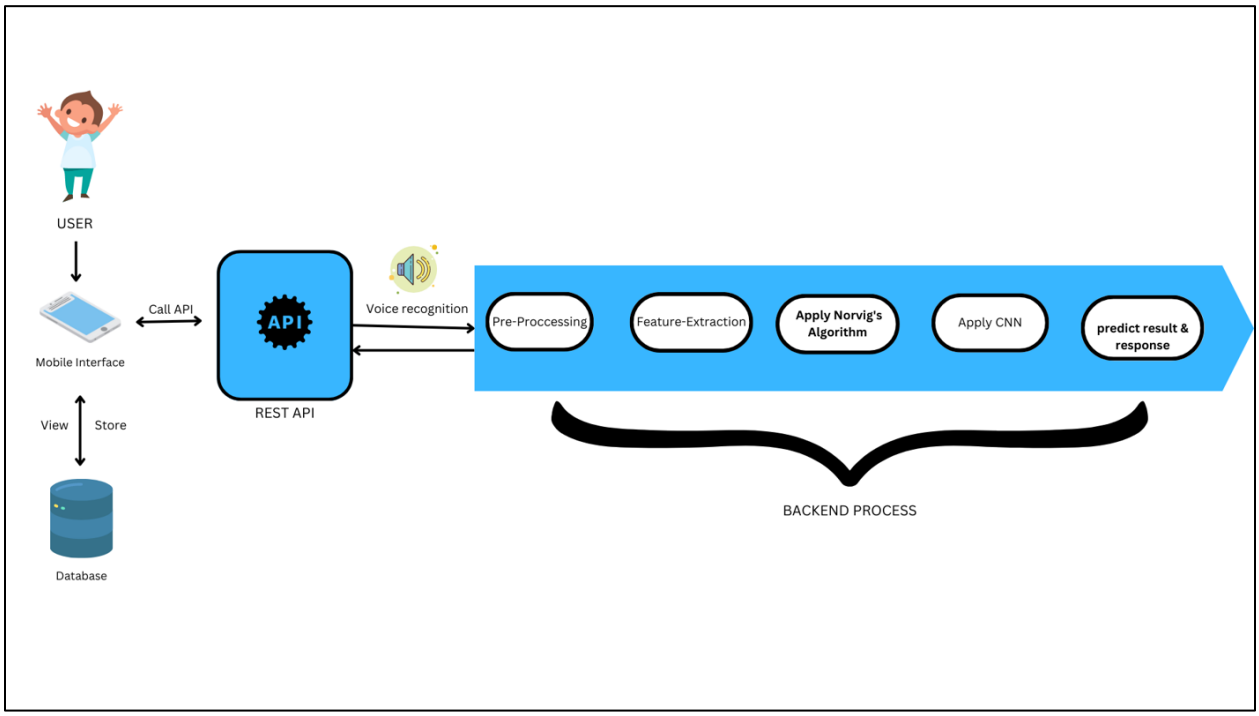

Figure 2 Individual Component Diagram

3.1.2 Commercialization of the Product

To commercialize the "Growin'Up" mobile application for primary students with dyslexia to improve Sinhala language, it is important to have a clear strategy that focuses on providing value to the final target audience and building a strong brand reputation. This can be achieved through targeted marketing, offering a freemium model, partnering with schools and NGOs, and incorporating in-app advertisements. However, it is crucial to ensure that the user experience is not compromised and to continuously gather feedback from users to improve the application. By following these strategies, the proposed application can be successfully commercialized and reach a wider audience while also improving the lives of primary students with dyslexia who struggle with Sinhala language.

3.2 Application Development Process

Agile methodology has become increasingly popular in recent years due to its flexible and adaptable approach to software development. It emphasizes continuous iteration and testing throughout the software development lifecycle, allowing teams to quickly adapt to changing requirements and deliver high-quality software. One of the most used agile methodologies is the Scrum Framework, which is known for its iterative and incremental development processes [15]. In this paragraph, we will explore the use of Scrum as the agile methodology in a software development project, with a focus on the implementation of changes based on the hypothesis generated from literature survey and surveys, as well as the key practices involved in Scrum.

Scrum is an agile development methodology that emphasizes the importance of inspecting and adapting to changing requirements. This means that throughout the development process, the team constantly reviews and evaluates the progress made, and adjusts as needed to meet the evolving needs of the project [16]. The use of the Scrum Framework in a software development project allows for a high level of flexibility and responsiveness to changing requirements, as the team can quickly adapt their approach and make necessary changes to the software being developed.

One of the key practices in Scrum is the use of time-boxed daily meetings, known as daily scrums, where the team members gather to discuss the progress made, challenges faced, and plans for the day. These short, focused meetings help the team members stay aligned and ensure that any issues or roadblocks are addressed promptly [15]. Daily scrums facilitate effective communication and collaboration among team members, which is crucial in an agile development environment where continuous feedback and collaboration are essential.

In addition to daily scrums, Scrum also includes other important practices such as sprint reviews and sprint retrospectives. At the end of each sprint, which is a time-boxed period of development typically lasting 1-4 weeks, the team holds a sprint review to demonstrate the work done to

stakeholders, gather feedback, and evaluate the results. This allows for quick validation of the work completed and provides an opportunity for stakeholders to provide input, which can inform future iterations. Following the sprint review, the team holds a sprint retrospective, where they reflect on the sprint and identify areas for improvement. This feedback loop allows the team to continuously learn and improve their processes, making Scrum a highly adaptive and iterative approach to software development [16].

To support the implementation of Scrum, many software development teams use tools such as Jira, which is a popular project management tool that is specifically designed for agile methodologies. Jira provides features such as backlog management, sprint planning, and progress tracking, which can greatly facilitate the implementation of Scrum in a software development project. Jira allows team members to collaborate, track progress, and visualize the development process, making it easier to manage and adapt to changing requirements in an agile environment [17].

The decision to use Scrum as the agile methodology in a software development project is based on the hypothesis generated from literature survey and surveys. The literature survey provides insights into the best practices and success factors of agile methodologies, including Scrum, which have been proven effective in many software development projects. The surveys conducted among team members and stakeholders can provide valuable feedback on the current development processes and requirements, which can inform the decision to adopt Scrum. By following the principles and practices of Scrum, the team can take advantage of its iterative and adaptive nature to effectively manage changing requirements and ensure that the software being developed meets the needs of stakeholders.

In conclusion, Agile methodology, specifically Scrum, is a popular and effective approach to software development that emphasizes continuous iteration and testing and supports adaptation to changing requirements. The use of Scrum, along with tools like Jira, enables the team to implement changes based on hypothesis generated from literature survey and surveys, and allows for effective communication, collaboration, and progress.

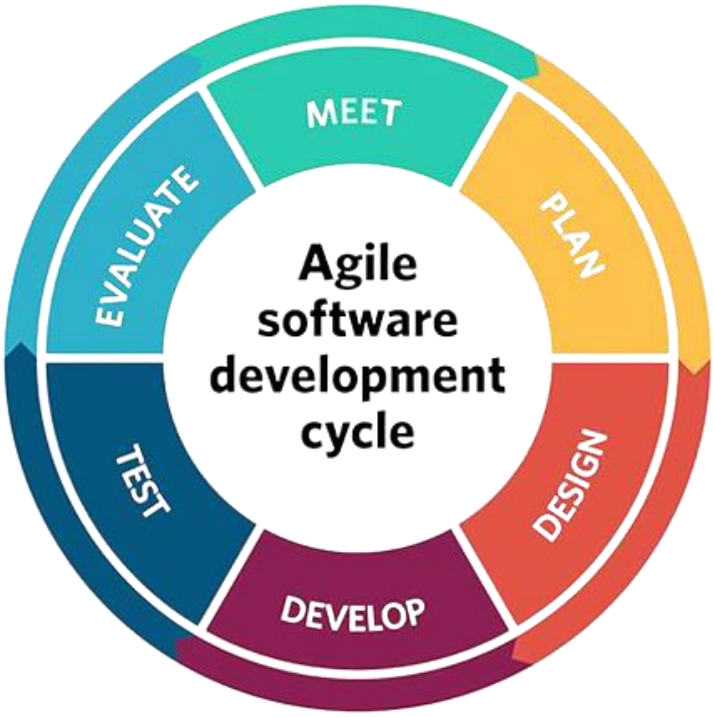

Figure 3 Agile Software Development Cycle

- Requirement Gathering and Analysis

In this initial phase of the research, our main objective is to gain a deep understanding of the expectations and needs of the end-users and stakeholders of the system, specifically children facing dyslexia in schools. To achieve this, we plan to conduct surveys or questionnaires as a means of gathering comprehensive feedback from the target audience. We have already initiated the research process by visiting Narahenpita Special Education School, which serves as a representative sample of the target user group. Through interactions with the students, teachers, and other stakeholders at the school, we aim to gather valuable insights into the requirements of the software system we are developing. The information gathered from this visit, along with data collected through surveys or questionnaires, will be documented in the software requirements specification (SRS) document, providing a comprehensive overview of the user expectations and needs for the system.

Our approach in this phase is centered on ensuring that the end-users and stakeholders are actively involved in the requirements gathering process, and their perspectives and expectations are carefully considered in the development of the software system. By understanding their needs, we aim to create a system that is effective, user-friendly, and meets the specific requirements of children with dyslexia in schools, ultimately enhancing their learning experience and addressing their challenges.

- Feasibility Study

As part of the research objective to identify the sequential difficulties faced by children aged 6-8 with visual dyslexia and their impact on academic performance, several technologies have been proposed for use. The feasibility of implementing these technologies in the research process can be assessed in the following areas:

1. Schedule Feasibility-The project timeline needs to be finalized to ensure that each phase of the research is completed within the defined timeframe. The expected results should be presented based on the planned dates to ensure that the research progresses as per the schedule.
2. Technical Feasibility-The proposed technologies for multimedia technologies (HTML5, CSS, and JavaScript), speech recognition APIs (Google Cloud Speech-to-Text, Amazon Transcribe), text editors and algorithms (TinyMCE, CKEditor, Norvig's correction algorithm), machine learning frameworks (TensorFlow), and mobile development platforms and programming languages (Android Studio, React Native (JavaScript), Python) should be evaluated to ensure that the researchers have the necessary knowledge and expertise in these technologies to effectively implement them in the research process.
3. Statistical Knowledge-Since multilinear regression will be used for analyzing the history with current lab reports and making predictions for future health, the researchers should possess background knowledge in statistics and analytical skills to accurately interpret the results and draw meaningful conclusions.

   This will help ensure the successful implementation of the research process and achieve the objective of identifying the sequential difficulties faced by children with visual dyslexia and their impact on academic performance.

3.2.1 Implementation

The proposed technologies for use in the research process are,

Multimedia technologies

HTML5, CSS, and JavaScript - These technologies are widely used for developing web applications and creating interactive multimedia content on the web.

Speech recognition APIs

Google Cloud Speech-to-Text, Amazon Transcribe - These APIs provide speech recognition capabilities that can be used to transcribe audio data into text, which can be useful for analyzing speech data in the research process.

Text editors and algorithms

TinyMCE, CKEditor, Norvig's correction algorithm - These text editors and algorithms can be used for editing and processing text data, and Norvig's correction algorithm can be used for spell checking and autocorrection.

Machine learning frameworks

TensorFlow - TensorFlow is a popular open-source machine learning framework that provides tools and libraries for building and training machine learning models, which can be used for analyzing and processing data in the research process.

Mobile development platforms and programming languages

Android Studio, React Native (JavaScript), Python - These technologies can be used for developing mobile applications, with Android Studio for Android platform, React Native for cross-platform mobile app development using JavaScript, and Python for scripting and data processing tasks.

3.2.2 Deployment

Google Play Store is a digital distribution platform operated by Google that serves as a hub for users to download and access a wide range of digital content, including apps, games, movies, music, and books. It is available on Android devices and provides access to a vast collection of apps and games developed by various developers from around the world. Users can download and install apps for free or purchase paid apps, and the Play Store offers a wide range of categories and genres to cater to the diverse interests and needs of users globally. It has become a popular platform for developers to distribute their apps and reach billions of users worldwide, making it a key part of the Android ecosystem.

4. DESCRIPTION OF PERSONAL AND FACILITIES

4.1 Functional Requirements

1. User-friendly Interface for Children Aged 6-8

The system should have a visually appealing and intuitive interface that is easy for children aged 6-8 to navigate and interact with. The interface should be designed with age-appropriate graphics, colors, and fonts, and should be responsive to different screen sizes.

2. Assessment and Identification of Specific Sequential Difficulties

The system should include assessments or activities that can accurately identify the specific sequential difficulties faced by children with visual dyslexia. These assessments or activities should be designed in a way that is engaging and motivating for children, while also providing accurate results to identify the areas where the child may be struggling.

3. Targeted Interventions and Strategies

Based on the assessment results, the system should provide targeted interventions and strategies to address the identified difficulties. These interventions and strategies should be designed to cater to the individual needs of each child and should be presented in a clear and accessible manner.

4. Phonics-based Games and Activities

The system should include phonics-based games and activities, such as word jumbling and puzzles, to help children improve their phonics skills. These games and activities should be designed in a way that is engaging and interactive, allowing children to practice their phonics skills in a fun and enjoyable manner.

5. Sound Effects and Visual Feedback

The system should use appropriate sound effects and visual feedback to help children understand sequencing. For example, when a child arranges words or letters in a specific order, the system should provide feedback through sound effects or visual cues to indicate whether the sequence is correct or incorrect.

6. Voice Recognition Methods

The system should include voice recognition methods to track correct and incorrect responses. This could involve using speech recognition APIs, such as Google Cloud Speech-to-Text or Amazon Transcribe, to capture and analyze the child's verbal responses during activities or assessments. This would provide additional feedback and assessment data for evaluating the child's progress and identifying areas for improvement.

By incorporating these functional requirements, the system can provide a user-friendly interface for children aged 6-8, accurately assess and identify sequential difficulties faced by children with visual dyslexia, provide targeted interventions and strategies, include phonics-based games and activities, use sound effects and visual feedback, and utilize voice recognition methods for tracking responses.

4.2 Non-Functional Requirements

Accessibility

The system should be designed to be accessible to children with visual dyslexia, including those with visual impairments or other disabilities. This may include providing alternative text descriptions for images, using clear and easy-to-read fonts, and ensuring that the system is compatible with screen readers or other assistive technologies.

Performance

The system should be designed to perform efficiently and responsively, with fast loading times and minimal delays during activities or assessments. This is important to keep children engaged and motivated, and to ensure that their learning experience is smooth and uninterrupted.

Security

The system should prioritize the security and privacy of children's data. This may include using encryption to protect sensitive information, implementing secure authentication and authorization mechanisms, and complying with relevant data protection regulations, such as GDPR or COPPA.

Scalability

The system should be designed to handle many users and activities and should be scalable to accommodate potential future growth. This may involve using cloud-based technologies or other

scalable infrastructure, to ensure that the system can handle increasing demands without compromising performance or functionality.

Usability

The system should be designed with a focus on usability, ensuring that it is easy for children aged 6-8 to navigate, interact with, and understand. This may involve using simple and intuitive user interfaces, providing clear instructions and feedback, and minimizing the need for complex or advanced technical skills.

Reliability

The system should be reliable and available for use whenever children need to access it. This may involve implementing backup and recovery mechanisms, monitoring and resolving system issues proactively, and ensuring high system uptime to minimize disruptions to the learning process.

Customizability

The system should be customizable to meet the individual needs of different children with visual dyslexia. This may include allowing users to adjust settings, preferences, or difficulty levels, and providing options for personalization to cater to diverse learning styles and abilities.

By incorporating these non-functional requirements, the system can ensure accessibility, performance, security, scalability, usability, reliability, and customizability, resulting in a high-quality and effective learning experience for children with visual dyslexia.

5. GANTT CHART

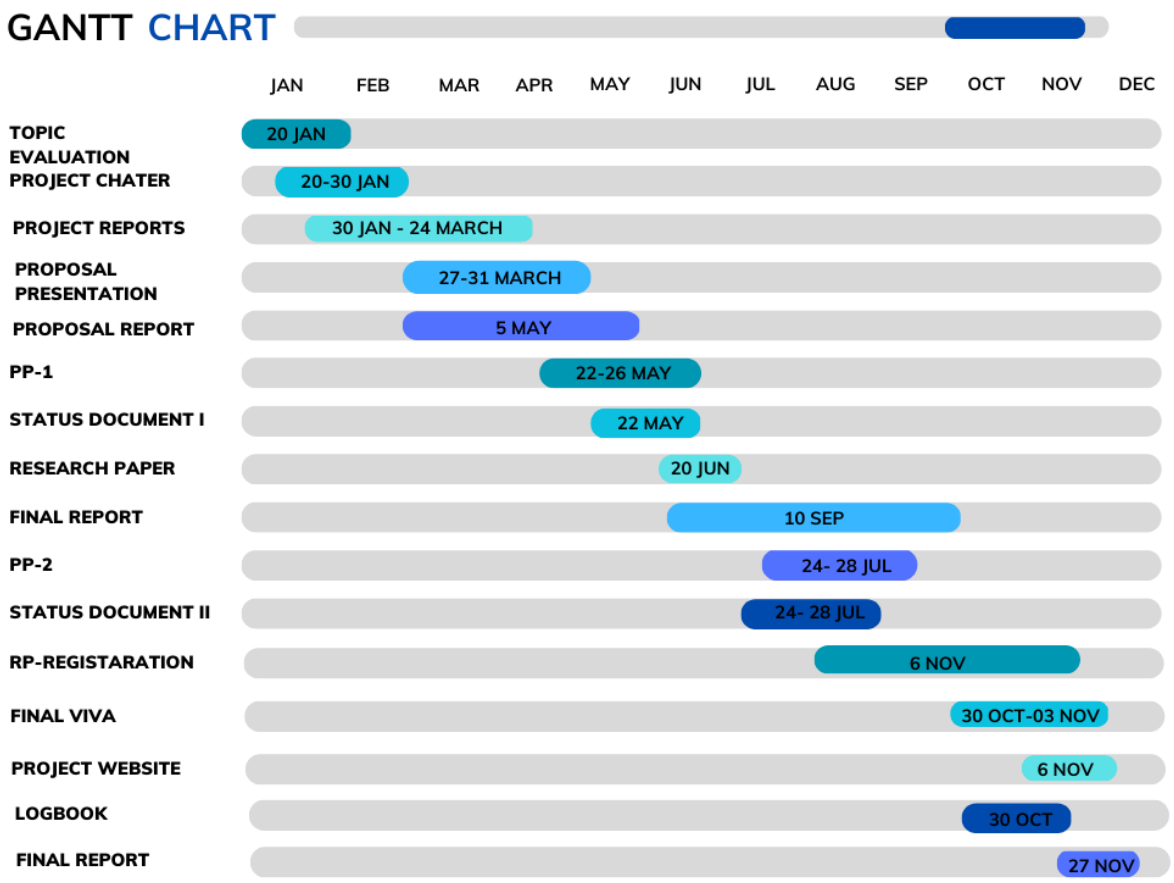

Figure 4 Gantt chart

6. BUDGET AND BUDGET JUSTIFICATION

Table 3 Budget table

Component	**Amount (LKR)**	**Amount (USD)**
Direct Cost		
Printing	2,000	6
Travelling	2,000	6
Indirect Cost		
Wi-Fi/Mobile Data	10,000	30
Electricity	5,000	15
Transport	2,000	6
Web Hosting	5,000	15
Total	26,000	78

7. REFERENCES

[1] N. M. W. N. A. &. E. P. A. Jayasooriya, "Prevalence of dyslexia among grade 4 students in a government school in Colombo district, Sri Lanka," *Sri Lanka Journal of Child Health,* vol. 46, no. 4, pp. 292-296, 2017.

[2] K. M. K. B. P. &. P. H. S. Naseema, "Predictors of reading and spelling abilities in Sinhala-speaking children in Sri Lanka," *Annals of Dyslexia,* vol. 68, no. 2, pp. 152-169, 2018.

[3] F. P. E. &. F. U. Ramus, "The relationship between motor control and phonology in dyslexic children," *Journal of Child Psychology and Psychiatry,* vol. 44, no. 5, pp. 712-722, 2003.

[4] F. R. S. D. M. &. L. G. R. Vellutino, "Differentiating between difficult-to-remediate and readily remediated poor readers: More evidence against the IQ-achievement discrepancy definition of reading disability," *Journal of Learning Disabilities,* vol. 37, no. 5, pp. 469-482, 2004.

[5] M. J. A. J. W. B. D. V. &. S. S. E. Snowling, "Educational attainments of school leavers with a preschool history of speech-language impairments," *International Journal of Language & Communication Disorders,* 2003.

[6] C. E. S. R. J. &. S. A. Boyle, "Dyslexia awareness, teacher training and support: A review of the literature.," *British Journal of Special Education,* vol. 48, no. 1, pp. 31-48, 2021.

[7] E. S. A. G. &. D. Z. R. Skiada, ""EasyLexia: A Mobile Application for Children with Learning," *ELSEVIER,* pp. 218-228, 2014.

[8] S. M. D. a. H. Abas2, "Dyslexia Baca' Mobile App - the learning ecosystem for Dyslexic Children," *ReasearchGate,* vol. 10, 2013.

[9] L. C. K. W. W. W. K. R. N. S. D. T. T. Kularathna, "Yalu: Computer Game Based Solution to Screen Learning Disabilities in Kids," *semanticscholar,* 2014.

[10] M. C. D. H. P. R. I. W. S. Thelijjagoda, "The Hope: An Interactive Mobile Solution to Overcome the Writing, Reading and Speaking Weaknesses of Dyslexia," *semanticscholar,* 2019.

[11] D. P. U. G. I. J. T. E. S. T. S. S. Rajapakse, "ALEXZA: A Mobile Application For Dyslexics Utilizing Artificial Intelligence And Machine Learning Concepts," *semanticscholar,* 2018.

[12] S. T. S. H. T. L. Sandathara, "Arunalu: Learning Ecosystem to Overcome Sinhala," *ReaserachGate,* 2020.

[13] M. Sally E. Shaywitz, "Dyslexia," *Yale University School of Medicine, 333 Cedar St., New Haven, CT 06510, where reprint requests should be addressed to Dr. Shaywitz.*, January 29, 1998.

[14] D. C. o. Utah, "Dyslexia Center of Utah," Utah, [Online]. Available: www.dyslexiacenterofutah.org.

[15] *. Hettiarachchi1, "An overview of dyslexia," *An overview of dyslexia Sri Lanka Journal of Child Health ,* 2021.

[16] P. M. A. N. T. F. S. Muhammad Dilshad, "Students' Difficulties in Learning English at Primary Level: A Teachers' Perspective," *JOURNAL OF EDUCATIONAL RESEARCH,* vol. VOLUME 19 , no. ISSUE NO 1, 2016.