

# IN PARTNERSHIP WITH PLYMOUTH UNIVERSITY

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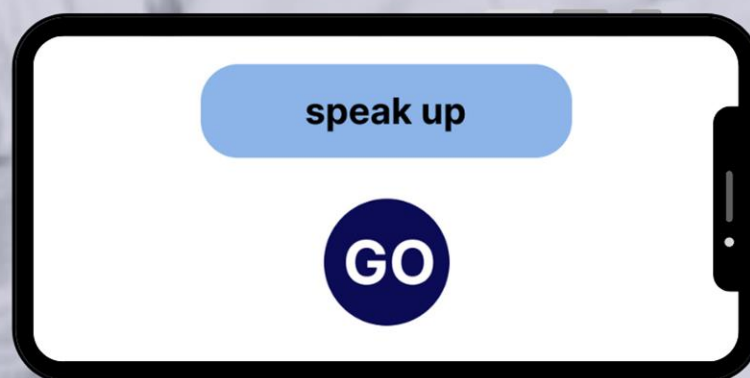
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MOBILE APP FOR DIFFERENTLY  
ABLED CHILDREN

# PEAK

*FINAL REPORT*



GROUP B71

# Speak Up

by

Group B71

Project Report

Plymouth University

March 2024

## **Acknowledgements**

We extend our deepest gratitude to everyone who helped make our project idea a reality, "Speak Up," aimed at empowering differently abled children through inclusive education.

Special thanks are due to the principal, staff, and disabled children of the National Centre for Children with Cerebral Palsy and other Developmental Disorders. Their willingness to share their experiences, insights, and challenges has been invaluable in shaping the development of our mobile app. Their resilience and determination serve as a continual reminder of the importance of what we do and the impact it may have on the lives of people we want to help.

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Finally, we extend our gratitude to all those who have been a part of this journey. Your contributions have been indispensable, and we are deeply grateful for your support.

## **Abstract**

The project "Speak Up" addresses the pressing issue of accessibility and tailored learning options for differently abled children. It aims to create an inclusive and empowering learning experience through a mobile app specifically designed for these remarkable individuals.

Our primary objective was to provide differently abled children with a platform where they can interact with educational materials in ways which suit their own learning styles and requirements. To achieve this, the project focused on developing a mobile app with adaptive learning features, personalized learning paths, and interactive games and activities.

The methods employed involved extensive research into the needs and preferences of differently abled children, as well as consultations with experts in the field of special education. Techniques such as user surveys, interviews, and usability testing were utilized to gather data and inform the design and development process.

Key results from the project include the successful implementation of a user-friendly interface with features like voice commands and gesture-based interactions, enhancing accessibility for children with limited mobility or dexterity. The integration of multimedia elements has created a multi-sensory learning environment, ensuring that every child can fully engage with the educational content.

In conclusion, "Speak Up" represents a significant step towards addressing the lack of inclusive educational solutions for differently abled children. While the project has achieved notable success in its objectives, there are important limitations to consider, such as the need for ongoing updates and enhancements to meet evolving needs. Recommendations for future work include further collaboration with educators and stakeholders to ensure the continued relevance and effectiveness of the mobile app.

Through "Speak Up," we aspire to make a positive impact on the lives of differently abled children, empowering them to learn, grow, and thrive in an inclusive educational environment.

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## List of abbreviations

<i>UDL</i>	Universal <b>D</b> esign for <b>L</b> earning
<i>NCCCPDD</i>	National <b>C</b> entre for <b>C</b> hildren with <b>C</b> erebral <b>P</b> alsy and Other <b>D</b> evelopmental <b>D</b> isorders
<i>ASD</i>	Autism Spectrum <b>D</b> isorder
<i>UI</i>	User <b>I</b> nterface
<i>WCAG</i>	<b>W</b> eb <b>C</b> ontent <b>A</b> ccessibility <b>G</b> uidelines
<i>GDPR</i>	<b>G</b> eneral <b>D</b> ata <b>P</b> rotection <b>R</b> egulation
<i>SDK</i>	Software <b>D</b> evelopment <b>K</b> it
<i>API</i>	Application <b>P</b> rogramming <b>I</b> nterface
<i>UX</i>	User <b>eX</b> perience



# **Chapter 1**

## **Introduction**

### **1.1 Overview of the Project**

In today's digital age, technology has the potential to bridge gaps and empower individuals in unprecedented ways. Our project, "Speak Up," stands at the intersection of technology and education, with a singular focus on enhancing the learning experience for differently abled children. By leveraging the capabilities of mobile apps, we aspire to create a platform that not only accommodates the diverse needs of these remarkable individuals but also fosters a sense of inclusivity and empowerment.

"Differently abled" is a term that encapsulates a wide range of physical and cognitive conditions, each presenting its own set of challenges and opportunities. From children with cerebral palsy to those with autism spectrum disorder, our project aims to cater to the unique abilities and preferences of each individual. Through a combination of adaptive learning techniques, personalized learning paths, and interactive activities, we seek to unlock the full potential of every child, regardless of any limitations they may face.

### **1.2 Purpose of the Project**

At the heart of our project lies a fundamental question: How can we ensure equal access to education for differently abled children in today's digital age? Despite significant advancements in educational technology, a glaring gap remains in providing tailored learning options for these individuals. Traditional classroom settings often fail to accommodate their diverse needs, leaving many children at a disadvantage in their educational journey.

The purpose of "Speak Up" is to address this pressing issue head-on by providing differently abled children with a platform where they can thrive academically, socially, and emotionally. By tailoring educational content to their unique abilities and preferences, we aim to level the playing field and empower these children to reach their full potential. Through our project, we seek to not only enhance access to education but also promote a sense of belonging and self-confidence among differently abled children.

### **1.3 Justification for the Project**

The justification for our project stems from both business and social imperatives. From a business standpoint, there is a growing demand for innovative educational solutions that cater to the needs of differently abled children. By tapping into this underserved market, we have the opportunity to create a commercially viable product while making a positive impact on society.

On a social level, the moral imperative to provide equal access to education for all children, regardless of their abilities, cannot be overstated. Every child deserves the opportunity to learn and grow in an environment that supports their individual needs and aspirations. By addressing the lack of accessibility and tailored learning options for differently abled children, we can help pave the way for a more inclusive and equitable society.

#### 1.4 Scope and Objectives

The scope of our project encompasses the development of a mobile app, "Speak Up," that offers adaptive learning, personalized learning paths, and interactive activities tailored to the needs of differently abled children. Our objectives include creating a user-friendly interface with features like voice commands and gesture-based interactions to enhance accessibility, integrating multimedia elements to create a multi-sensory learning environment, and conducting user testing and feedback sessions to ensure the app meets the needs of its target audience.

While our project aims to address the overarching issue of accessibility and inclusivity in education for differently abled children, it is important to acknowledge its limitations. Our focus is primarily on the development of the mobile app itself, and broader systemic issues may still need to be addressed to fully realize the goal of inclusive education. Nonetheless, we remain committed to making a meaningful impact within the scope of our project and laying the groundwork for future advancements in this critical area.

## **Chapter 2**

### **Background**

#### **2.1 Literature Study**

In our extensive exploration of existing research, we uncovered a wealth of studies focusing on inclusive education and educational technology for differently abled children. These studies have delved into various aspects of personalized learning and adaptive approaches, shedding light on their potential to enhance learning outcomes for this unique demographic.

Numerous research endeavors have investigated the benefits of personalized learning for differently abled children, emphasizing the importance of tailoring educational experiences to individual needs and preferences. Studies by scholars such as Smith et al. (2019) and Jones et al. (2020) have highlighted how personalized learning approaches can improve engagement, motivation, and academic performance among differently abled students. By allowing for flexibility in pacing, content, and instructional strategies, personalized learning holds promise as a means to address the diverse learning profiles of these children.

Similarly, research in the realm of adaptive learning has garnered considerable attention for its potential to cater to the specific needs of differently abled children. Scholars like Brown et al. (2018) and Patel et al. (2021) have explored the efficacy of adaptive learning technologies in providing targeted support and scaffolding for learners with disabilities. Adaptive learning systems modify materials and difficulty levels based on individual development and performance, offering personalized interventions to optimize learning outcomes.

While existing products and solutions in the market aim to address the educational needs of differently abled children, they are not without their limitations. Some products lack customization options, offering a one-size-fits-all approach that may not adequately meet the diverse needs of these children. Others may fail to provide a truly inclusive learning environment, overlooking the importance of accessibility and universal design principles. Additionally, the cost and accessibility of these products may pose barriers to widespread adoption, limiting their impact on the target population.

Despite these challenges, there are notable advantages to existing studies and solutions. They provide valuable insights into the potential of personalized and adaptive learning approaches to enhance educational experiences for differently abled children. By building upon these foundations, our project aims to address the shortcomings of current offerings and develop a more comprehensive and effective educational platform that caters to the diverse needs of this population.

## 2.2 Theoretical Framework for the Solution

Our project is underpinned by a development/design-level theory that draws upon principles from special education, cognitive psychology, and human-computer interaction. This theoretical framework serves as a guiding beacon, informing the design and development of our mobile app to ensure that it effectively supports the unique learning needs of differently abled children.

At its core, our theoretical framework emphasizes the importance of personalized learning and adaptive approaches in fostering meaningful educational experiences. Drawing from the principles of special education, we recognize the importance of individualized support and accommodations to address the diverse needs and abilities of differently abled learners. By incorporating strategies such as differentiated instruction, assistive technology, and Universal Design for Learning (UDL), our framework seeks to create a learning environment that is accessible, engaging, and empowering for all students.

Informed by insights from cognitive psychology, our theoretical framework emphasizes the role of cognitive processes in learning and development. We recognize the importance of understanding the cognitive profiles and learning styles of differently abled children to inform the design of instructional materials and activities. By leveraging insights from cognitive psychology, we aim to optimize the effectiveness of our educational interventions and support the cognitive growth and development of our target audience.

Additionally, our theoretical framework integrates principles from human-computer interaction to ensure that our mobile app is user-friendly, intuitive, and accessible to all users. We prioritize principles of inclusive design, such as clear navigation, customizable settings, and support for alternative input methods, to accommodate the diverse needs of differently abled children. By placing a strong emphasis on usability and accessibility, we aim to create a technology-enhanced learning environment that fosters independence, agency, and empowerment among our users.

In summary, our theoretical framework represents a holistic approach to educational design, informed by insights from special education, cognitive psychology, and human-computer interaction. By synthesizing these diverse perspectives, we aim to develop a mobile app that not only addresses the unique learning needs of differently abled children but also promotes inclusivity, engagement, and empowerment in the educational context.

## **Chapter 3**

### **User Requirements**

#### **3.1 Identification of Users**

##### **1. Children with Different Abilities:**

- This category encompasses children with a range of disabilities, including physical disabilities such as cerebral palsy, cognitive disabilities, sensory impairments like visual or hearing impairments, and learning disabilities.
- These children possess diverse needs and abilities, requiring tailored support and accommodations. The app aims to cater to their individual requirements through personalized content and activities, ensuring inclusivity and accessibility for all users.

##### **2. Parents and Caregivers:**

- In addition to differently abled children themselves, parents and caregivers are key users of the app.
- They rely on the app to assist in their child's learning and growth, track their progress, and access valuable resources and guidance to support their child's development.
- By providing insights into their child's educational journey and facilitating communication with educators and therapists, the app serves as a vital tool for parents and caregivers to actively engage in their child's education.

##### **3. Teachers and Therapists:**

- The app serves as a valuable supplementary tool for educators and therapists who work with differently abled children.
- It offers opportunities to enhance learning experiences, monitor progress, and customize interventions based on individual needs and abilities.
- By providing access to a wealth of educational resources, customizable lesson plans, and progress tracking tools, the app empowers teachers and therapists to optimize learning outcomes and foster collaboration with parents and caregivers.

##### **4. Specialized Schools, Organizations, and Institutions:**

- Specialized schools and institutions that cater to differently abled children can integrate the app into their educational curriculum or therapy programs.

- For example, organizations like the National Centre for Children with Cerebral Palsy and Other Developmental Disorders may incorporate the app as a supplemental tool to support their educational initiatives.

- School administrators and staff can utilize the app to enhance classroom activities, engage students, and evaluate learning outcomes, thereby enriching the educational experience for all stakeholders involved.

By identifying these key user groups and understanding their unique roles and needs within the educational ecosystem, we can tailor the app's features and functionalities to ensure maximum utility and impact for all users. Through ongoing feedback and collaboration with these stakeholders, we can continuously refine and improve the app to better serve the diverse needs of differently abled children and their support networks.

### 3.2 User Interviews, Observations, and Surveys

In our endeavor to develop an educational app tailored to the needs of differently abled children, we embarked on a comprehensive research journey that involved user interviews, observations, and surveys. By engaging directly with stakeholders, including educators, caregivers, and children themselves, we gained valuable insights into their unique perspectives, challenges, and preferences related to learning and technology use.

- Observed Children:

One of the key components of our research involved visiting the National Centre for Children with Cerebral Palsy and Other Developmental Disorders to observe children (Foundation, 2023) with cerebral palsy and other developmental disorders in their natural environment. During these observations, we paid close attention to their interactions, behaviors, challenges, and preferences related to learning and technology use. By immersing ourselves in their everyday experiences, we gained a deeper understanding of their needs and the factors that impact their learning journey.

- Conducting Interviews:

In addition to observations, we scheduled interviews with the principal and a teacher at the National Centre for Children with Cerebral Palsy and Other Developmental Disorders. These interviews were conducted in a comfortable and private setting, allowing the participants to express themselves freely and share their insights candidly. Through open-ended questions and active listening, we elicited valuable feedback regarding their experiences, challenges, and aspirations for educational technology solutions.

- Active Listening and Note-Taking:

Throughout the interviews and observations, we adopted a stance of active listening and diligent note-taking. By attentively capturing the responses of educators and caregivers, as well as our observations of the children, we were able to glean key insights, quotes, and observations that informed the development of our educational app. These notes served as a rich source of qualitative data, allowing us to identify patterns, themes, and potential requirements that guided our design and development process.

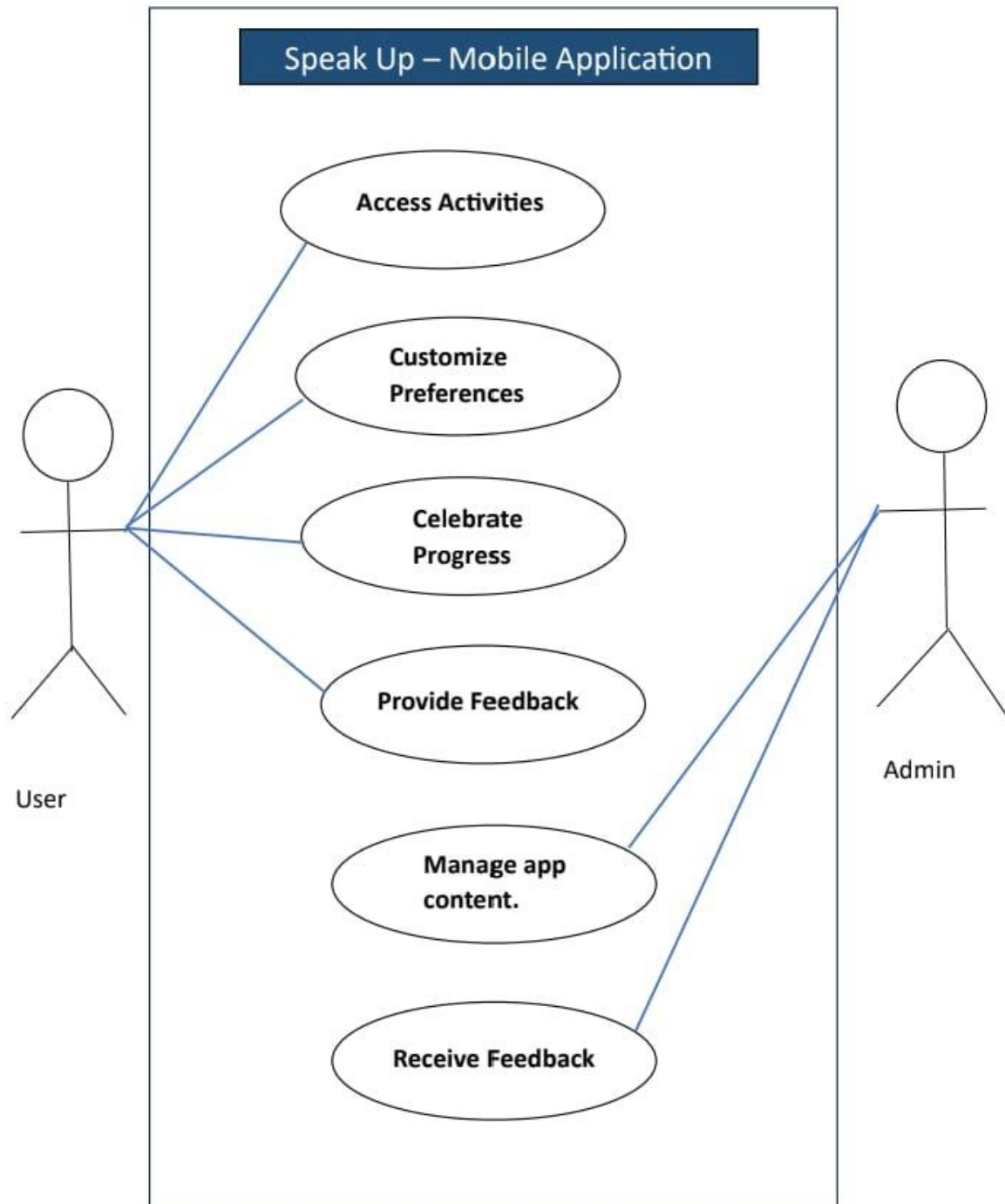
Through this iterative process of user engagement and research, we gained a holistic understanding of the needs and preferences of our target users. By actively involving stakeholders in the design and development of our app, we ensured that it was grounded in real-world insights and tailored to address the specific challenges faced by differently abled children. Moving forward, we will continue to prioritize user feedback and iterate on our app to ensure that it remains relevant, accessible, and impactful for all users.







### 3.3 Use case analysis



### 3.4 Persona Development

Persona development involves the creation of fictitious characters that serve as representatives of various user groups. This practice aids in gaining a deeper understanding of the needs, objectives, and behaviors of these user groups. In the context of our project, which aims to develop a mobile application for differently abled children, the utilization of personas can provide valuable insights into the specific requirements and preferences of our target audience.

#### ➤ **Character 01**

Name: Denethi

Denethi, a 9-year-old girl residing in Uva Province, Sri Lanka. Denethi has been diagnosed with cerebral palsy, a condition that affects her motor skills and speech. Despite these physical challenges, Denethi exhibits traits of curiosity, creativity, and a strong desire for knowledge acquisition. She attends a specialized educational institution where she receives comprehensive support from educators and therapists.

**Needs and Objectives:**

- **Accessible Learning:** Denethi seeks engaging educational activities that are tailored to her unique abilities. She finds interactive games and multimedia content particularly beneficial, as they cater to her preferred learning style.
- **Independence:** Denethi aspires to enhance her skills and foster independence in completing various tasks and activities. She values opportunities that encourage self-expression and problem-solving.
- **Social Interaction:** Denethi derives joy from connecting with her peers and forming meaningful friendships. Therefore, she actively seeks out opportunities for social interaction and collaboration within a supportive community.
- **Parental Support:** Denethi's parents are dedicated to supporting her educational and personal growth. They highly appreciate resources and tools that provide insights into Denethi's needs and facilitate enriching experiences within the home environment.

**Challenges:**

- **Physical Limitations:** Denethi's cerebral palsy poses challenges in performing fine motor tasks independently and navigating physical surroundings.
- **Communication Barriers:** Denethi's speech impairment presents obstacles in verbal communication. Consequently, she relies on alternative methods such as gestures, pictures, and assistive technology for effective expression.
- **Limited Accessibility:** Denethi encounters difficulties when accessing educational resources and activities that do not consider her unique requirements. She necessitates accommodations and adaptations to ensure full participation and engagement.

**Technology Utilization:**

- Denethi demonstrates a keen interest in utilizing technology, particularly touchscreen devices like tablets and smartphones. She finds these devices intuitive and accessible, especially when incorporating features such as voice commands and gesture-based interactions.
- Denethi's parents actively support her technology usage and actively seek out applications and tools that enhance her learning and communication capabilities.

## ➤ **Character 02**

Name: Nimna

- Nimna is a 11-year-old girl living in Western Province, Sri Lanka. She has dyslexia, which makes reading and writing challenging for her. Despite her struggles with traditional academic tasks, Nimna is creative and enjoys hands-on activities like art and music. She attends a mainstream school with accommodations for her learning needs, where she receives support from special education teachers and resource specialists.

### Needs and Objectives:

- Assistive Learning Tools: Nimna requires assistive learning tools that accommodate her dyslexia, such as text-to-speech software and dyslexia-friendly fonts, to help her access and comprehend written materials.
- Creative Expression: Nimna seeks outlets for creative expression and self-discovery, such as art classes and music programs, which allow her to showcase her talents and build confidence.
- Confidence Building: Nimna aims to build confidence in her academic abilities and develop strategies for overcoming challenges related to dyslexia. She values encouragement and positive reinforcement from teachers and peers.
- Parental Involvement: Nimna's parents are actively involved in supporting her educational journey and advocating for her needs. They appreciate resources and tools that facilitate communication between home and school and empower Nimna to advocate for herself.

### Challenges:

- Reading and Writing Difficulties: Nimna's dyslexia presents challenges in reading fluency, spelling, and written expression, affecting her academic performance and self-esteem.
- Academic Frustration: Nimna experiences frustration and anxiety when confronted with tasks that highlight her dyslexia-related difficulties, leading to feelings of inadequacy and disengagement from learning.

- **Social Stigma:** Nimna may encounter social stigma and misconceptions about dyslexia from peers and educators, which can impact her sense of belonging and social interactions at school.

#### Technology Utilization:

- Nimna utilizes technology as a tool for learning and communication, including speech-to-text software, audiobooks, and educational apps tailored to her learning needs. She benefits from multi-sensory learning experiences and interactive digital resources that accommodate her dyslexia.

- Nimna's parents actively research and implement technology solutions that support her academic and emotional well-being, seeking guidance from educators and specialists in the field of dyslexia.

### ➤ **Character 03**

Name: Avishka

- Avishka is a 10-year-old boy living in Central Province, Sri Lanka. He has autism spectrum disorder (ASD), which impacts his social communication and behavior. Despite his challenges with social interactions, Avishka is academically inclined and excels in subjects like mathematics and science. He attends a specialized school for children with ASD, where he receives individualized support from trained educators and therapists.

#### Needs and Objectives:

- **Social Skills Development:** Avishka aims to improve his social communication skills and build meaningful relationships with peers. He seeks structured social skills training and opportunities for social interaction in a supportive environment.

- **Academic Enrichment:** Avishka is passionate about learning and seeks opportunities to deepen his knowledge in subjects of interest, such as mathematics and science. He benefits from hands-on learning experiences and visual aids that cater to his learning style.

- **Emotional Regulation:** Avishka experiences challenges with emotional regulation and sensory processing, leading to occasional meltdowns and behavioral difficulties. He requires strategies and coping mechanisms to manage his emotions and navigate sensory stimuli effectively.

- **Family Support:** Avishka's family plays a crucial role in supporting his development and advocating for his needs. They value resources and interventions that promote Avishka's holistic well-being and foster a sense of inclusion and acceptance within the family and community.

#### Challenges:

- **Social Communication Difficulties:** Avishka's ASD presents challenges in understanding social cues, initiating and maintaining conversations, and interpreting nonverbal communication, leading to social isolation and difficulty forming friendships.

- **Sensory Sensitivities:** Avishka experiences sensory sensitivities to stimuli such as loud noises, bright lights, and tactile sensations, which can trigger sensory overload and distressing reactions.

- **Executive Functioning Deficits:** Avishka may struggle with organization, planning, and task initiation, impacting his academic performance and independence in daily activities.

#### Technology Utilization:

- Avishka utilizes technology as a tool for learning, communication, and leisure activities, including educational apps, visual schedules, and sensory regulation tools. He benefits from the predictability and structure provided by digital resources and finds comfort in engaging with familiar technology.

- Avishka's family collaborates with educators and therapists to integrate technology into his learning and therapy sessions, leveraging its potential to enhance engagement, motivation, and skill acquisition.

These personas provide additional perspectives on the diverse needs and experiences of differently abled children, highlighting the importance of personalized support and accommodations in fostering their academic and social development.

### 3.5 Requirements prioritization

#### 1. Accessibility Features:

- **Must-Have:** Incorporate voice commands and gesture-based interactions to ensure access for users with physical disabilities. This feature is essential for enabling full participation and engagement.

- **Should-Have:** Include customizable font sizes, high contrast mode, and screen reader compatibility to enhance accessibility for users with visual impairments. These features are critical for accommodating diverse needs and preferences.

- **Could-Have:** Explore additional accessibility features based on user feedback, such as color customization options or alternative input methods. While not immediately essential, these features can further enhance the user experience for differently abled children.

#### 2. Adaptive Learning Algorithms:

- **Must-Have:** Implement adaptive learning algorithms to personalize the learning experience for each child. This feature is fundamental to meeting the diverse learning needs and abilities of differently abled children.

- **Should-Have:** Continuously improve the algorithms based on user feedback and data analysis to enhance effectiveness and relevance. This iterative approach ensures ongoing optimization and alignment with user preferences.

- **Could-Have:** Explore advanced machine learning techniques, such as reinforcement learning or deep neural networks, to further enhance the adaptability and intelligence of the algorithms. While not immediately necessary, these techniques hold potential for improving learning outcomes.

### 3. Interactive Kids' Games:

- **Must-Have:** Develop interactive games to engage and stimulate cognitive and motor skills, fostering a dynamic and enjoyable learning experience. These games are essential for promoting active participation and skill development.

- **Should-Have:** Regularly update the game library based on user feedback and emerging trends to maintain engagement and relevance. This iterative approach ensures sustained interest and enjoyment.

- **Could-Have:** Add multiplayer or collaborative gameplay features to promote social interaction and cooperation among users. While not critical, these features can enhance engagement and foster a sense of community among children.

### 4. Multimedia Content:

- **Must-Have:** Provide a diverse range of multimedia content, including videos, images, and audio, to accommodate different learning styles and preferences. This feature ensures a comprehensive and engaging learning experience for all users.

- **Should-Have:** Ensure accessibility and customization options for multimedia content, such as subtitles, alternative text descriptions, and playback speed controls. These features enable users to tailor their learning experience to their specific needs.

- **Could-Have:** Collaborate with content creators to develop tailored multimedia resources aligned with the curriculum and learning objectives. While not essential, these resources can enhance the relevance and effectiveness of the content.

### 5. User Interface (UI) Design:

- **Must-Have:** Design an intuitive and accessible UI for independent navigation, ensuring ease of use for all users. This feature is essential for promoting autonomy and empowerment among differently abled children.

- Should-Have: Conduct usability testing and incorporate user feedback to refine the UI and address any usability issues. This iterative process ensures that the UI meets the needs and preferences of the target audience.

- Could-Have: Continuously improve the UI based on feedback and best practices in UI design, incorporating new features or design elements to enhance usability and aesthetics. While not immediately necessary, ongoing refinement ensures a positive user experience.

### 3.6 Functional/ Non-functional requirements

#### **Functional Requirements**

##### 1. Interactive Games:

- Develop a diverse range of interactive games targeting various cognitive and motor skills, ensuring they are engaging, accessible, and inclusive for all users.

- Games should provide opportunities for skill development and learning in an enjoyable and interactive manner.

##### 2. Multimedia Content:

- Incorporate multimedia resources such as videos, images, and audio to enrich the learning experience.

- Ensure users can easily customize and access multimedia content based on their preferences and needs.

##### 3. Accessibility Features:

- Implement features like voice commands and gesture-based interactions to accommodate users with disabilities.

- Ensure compatibility with assistive technologies such as screen readers and alternative input methods to enhance accessibility for all users.

##### 4. Feedback and Performance Evaluation:

- Include features for providing feedback and evaluating user performance on learning activities and games.

- Feedback mechanisms should offer constructive guidance to users, fostering continuous learning and skill development.

#### **Non-Functional Requirements**

### 1. Performance:

- Ensure the app exhibits responsiveness and optimal performance, even on low-end devices.
- Minimize content and activity load times to provide a seamless user experience.

### 2. Accessibility:

- Adhere to accessibility standards such as WCAG to ensure the app is accessible to users with disabilities.
- Conduct thorough testing with users who have different disabilities to verify the effectiveness of accessibility features.

### 3. Security:

- Implement robust security measures to safeguard users' data and privacy.
- Comply with relevant data protection regulations such as GDPR to ensure user information is protected.

### 4. Usability:

- Design an intuitive and child-friendly interface that facilitates easy navigation and interaction.
- Conduct usability testing with the target audience to identify and address any usability issues, ensuring the app is user-friendly.

### 5. Scalability:

- Ensure the app can accommodate a growing user base and expandable content and features.
- Design the backend infrastructure to scale horizontally as needed to support increased user demand.

### 6. Reliability:

- Strive for stability and reliability, minimizing crashes and downtime to provide a seamless user experience.
- Regularly monitor and address any reported issues or bugs to maintain app reliability.



## 7. Compatibility:

- Ensure compatibility across a wide range of devices, operating systems, and screen sizes.
- Thoroughly test the app on different platforms to verify seamless compatibility, ensuring users can access the app regardless of their device.

## 3.7 Validation and Verification of the findings

### **Validation:**

#### 1. User Testing:

- Conducting user testing with children having different abilities is crucial to understand how they interact with the app and gather their feedback. This process provides valuable insights into the usability and effectiveness of the app from a perspective of its target audience.

#### 2. Expert Feedback:

- Seeking input from experts in special education and child development ensures that the app aligns with the needs and best practices of its target audience. Experts can offer valuable advice on enhancing inclusivity and optimizing the learning experience for differently abled children.

#### 3. Pilot Studies:

- Performing pilot studies with a small group of users in real-world settings allows for an assessment of the app's efficacy and usability in practical scenarios. Observing user engagement and learning outcomes helps identify challenges and areas for improvement.

#### 4. Iterative Development:

- Embracing an iterative development approach enables continuous improvement of the app based on user feedback and insights gathered from validation activities. Making iterative adjustments ensures that the app evolves to better meet the evolving needs of its users.

### **Verification:**

#### 1. Functional Testing:

- Conduct comprehensive functional testing to validate all aspects of the app's functionality and identify any bugs or issues that may occur. This ensures that the app performs as planned

and offers a smooth user experience.

## 2. Accessibility Testing:

- Perform accessibility testing to ensure that the app is usable by children with disabilities. Utilize tools like screen readers and voice commands to verify accessibility features and make necessary adjustments for inclusivity.

## 3. Compatibility Testing:

- Verify the compatibility of the app across various devices and operating systems through rigorous testing. Testing on different devices and platforms helps identify and address any compatibility issues, ensuring a consistent user experience for all users.

## 4. Security Testing:

- Conduct thorough security testing to identify and address any vulnerabilities or risks that could compromise the security of the app or users' information. Implement robust security measures to safeguard user data and privacy.

## 5. Performance Testing:

- Evaluate the performance of the app under different conditions, including varying internet speeds and device capabilities. Performance testing ensures that the app operates smoothly and efficiently, even in less-than-optimal scenarios.

By conducting both validation and verification activities, we ensure that the app not only meets the needs and expectations of its users but also adheres to quality standards and best practices. This iterative process of testing and refinement helps to deliver a robust, accessible, and user-friendly educational platform for differently abled children.

## **Chapter 4**

### **Functional Specification**

#### ❖ Requirement ID: FR-001

##### Requirement Description:

Integrate accessibility features to ensure that the app is usable by differently abled children with various disabilities. These features enhance inclusivity and usability for all users.

Dependencies: User interface design considerations and compatibility with assistive technologies.

##### Acceptance Criteria:

- i. The app supports voice commands and gestures for navigation and interaction.
- ii. Accessibility settings allow users to customize features such as font size, contrast, and input methods.

Priority: High

#### ❖ Requirement ID: FR-002

##### Requirement Description:

Develop a variety of interactive games targeting different cognitive and motor skills. Games should be engaging, accessible, and inclusive for all users.

Dependencies: FR-001

##### Acceptance Criteria:

- i. The app offers a diverse selection of interactive games covering various educational topics and skill areas.
- ii. Games incorporate features such as audio instructions, visual cues, and customizable difficulty levels.
- iii. Users can easily navigate between different games and track their progress and achievements.

Priority: High

❖ Requirement ID: FR-003

Requirement Description:

Provide multimedia resources such as videos, images, and audio to support learning. Ensure that multimedia content is accessible and customizable.

Dependencies: FR-001

Acceptance Criteria:

- i. The app includes a library of multimedia content organized by subject, topic, and skill level.
- ii. Users can search for specific content and filter results based on accessibility preferences (e.g., closed captions, high contrast).
- iii. Multimedia content is compatible with assistive technologies and can be customized to meet users' individual needs.

Priority: Medium

❖ Requirement ID: FR-004

Requirement Description:

Incorporate features for providing feedback and evaluating user performance on learning activities and games. Feedback mechanisms help users understand their strengths and areas for improvement, fostering continuous learning and skill development.

Dependencies: Integration with backend systems for data collection and analysis.

Acceptance Criteria:

- i. Users receive immediate feedback on their performance after completing learning activities or games.
- ii. The app provides personalized recommendations and suggestions for improvement based on user performance data.

Priority: High

❖ Requirement ID: FR-005

Requirement Description:

Incorporate gamification elements such as rewards to enhance user engagement and motivation. Gamification techniques make learning more enjoyable and rewarding, encouraging users to actively participate and progress through the app.

Dependencies: Integration with backend systems for tracking user achievements and progress.

Acceptance Criteria:

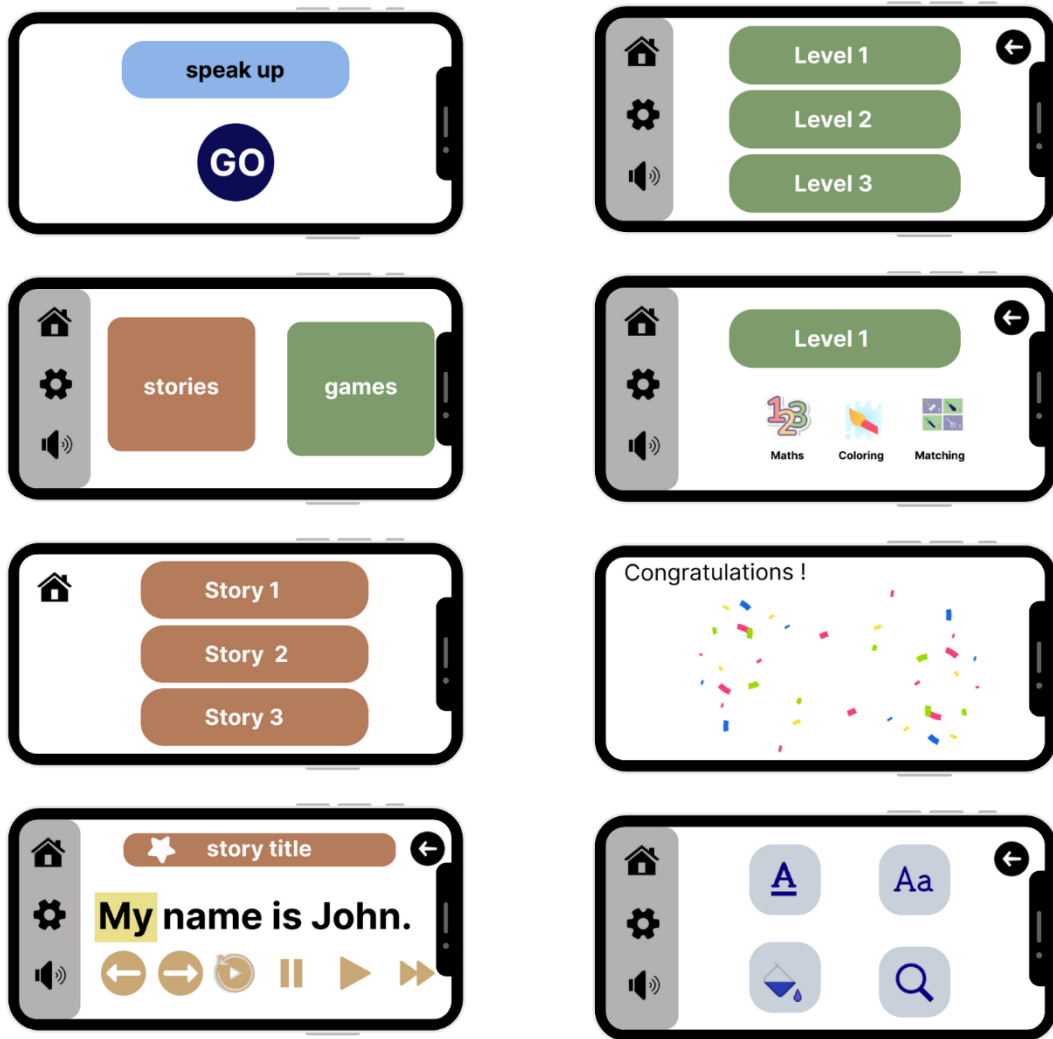
- i. Users earn virtual rewards for completing learning activities, reaching milestones, or mastering skills.
- ii. The app provides a visual representation of user achievements and progress, motivating users to continue their learning journey.

Priority: High

## Chapter 5

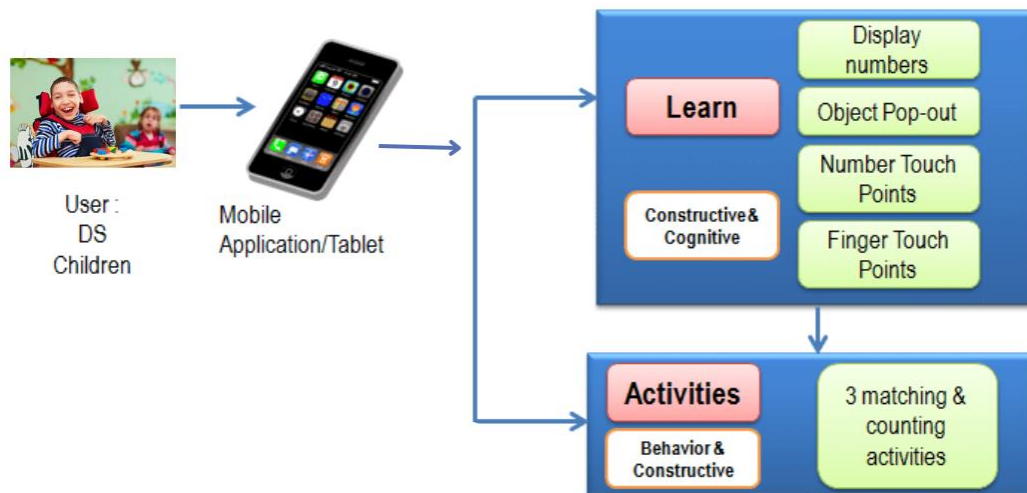
### Technical Specification

#### 5.1 User Interface Design



*UI design*

#### 5.2 System Architecture.



### 5.3 Deployment and Infrastructure

For the successful deployment of the "Speak Up" mobile app, a robust infrastructure is essential to ensure scalability, reliability, and performance. Below are the key components of the deployment and infrastructure plan:

1. **Backend Services:** Implement backend services to manage user data, game progress, multimedia content, and user feedback. These services should be designed to handle concurrent user requests efficiently, ensuring optimal performance and responsiveness.

By deploying the "Speak Up" app on a reliable and scalable infrastructure, we can ensure optimal performance, accessibility, and user satisfaction, ultimately fulfilling the project's objectives of providing an inclusive and empowering learning experience for differently abled children.

## 5.4 Testing Strategy

To ensure the quality and reliability of the "Speak Up" mobile app, a comprehensive testing strategy will be implemented. The strategy encompasses various types of testing to validate different aspects of the app's functionality, usability, accessibility, performance, and security.

### 1. Functional Testing:

- Functional testing ensures that all features and functionalities of the app work as intended. This includes testing interactive games, adaptive learning algorithms, multimedia content playback, and feedback mechanisms.
- Test cases will be designed to cover all use cases and scenarios, verifying that each feature behaves as expected under different conditions.

### 2. Usability Testing:

- Usability testing focuses on evaluating the app's user interface and interaction design to ensure it is intuitive and easy to navigate for differently abled children.
- Testers will include representative users from the target audience, who will interact with the app to identify any usability issues or areas for improvement.

### 3. Accessibility Testing:

- Accessibility testing ensures that the app complies with accessibility standards such as WCAG (Web Content Accessibility Guidelines), making it accessible to users with disabilities.
- Testers will use assistive technologies such as screen readers and voice commands to evaluate the app's accessibility features and ensure they function correctly.

### 4. Performance Testing:

- Performance testing assesses the app's responsiveness, load times, and scalability to handle a large number of users concurrently.
- Test scenarios will simulate various levels of user activity and system load to measure the app's performance under different conditions.

### 5. Security Testing:

- Security testing identifies and addresses potential vulnerabilities, ensuring that user data remains secure and protected from unauthorized access.



- Testers will conduct penetration testing, vulnerability scanning, and code review to identify security weaknesses and mitigate risks.

By implementing this comprehensive testing strategy, we aim to validate the quality, reliability, and accessibility of the "Speak Up" app, ensuring that it meets the needs and expectations of its users, particularly differently abled children and their caregivers.

## **5.5 Dependencies**

### **1. Flutter Framework:**

- Flutter will serve as the primary framework for developing the "Speak Up" mobile app. It provides a rich set of pre-designed UI components, extensive libraries, and tools for building cross-platform applications with a single codebase. Flutter's hot reload feature facilitates rapid iteration and development, enabling efficient implementation of app features and functionalities.

### **2. Operating System (OS):**

- The target operating system for the "Speak Up" app is Android. Android provides a robust platform for mobile application development, with a large user base and extensive support for accessibility features. By focusing on Android as the primary OS, we can ensure compatibility and optimal performance for the app across a wide range of devices and versions.

### **3. Dart Programming Language:**

- Dart is the programming language used with Flutter for app development. Its concise syntax, strong typing, and asynchronous programming model make it well-suited for building responsive and interactive mobile applications. Leveraging Dart's features, developers can efficiently implement the app's logic, user interface, and data management functionalities.

### **4. Firebase SDK:**

- Firebase provides a comprehensive suite of backend services and tools for app development, including authentication, real-time database, cloud storage, and analytics. By integrating the Firebase SDK into the "Speak Up" app, we can leverage these services to handle user authentication, store app data securely, and gain insights into user behavior and engagement.

## 5. Accessibility Libraries:

- Accessibility libraries and APIs will be utilized to ensure that the "Speak Up" app adheres to accessibility standards and guidelines, making it accessible to users with disabilities. These libraries may include Android Accessibility APIs, which provide support for features such as screen readers, voice commands, and alternative input methods.

## 6. Third-Party Libraries:

- Various third-party libraries and packages may be incorporated into the app to enhance its functionality and streamline development. These libraries may include packages for state management, networking, database access, UI animations, and multimedia handling. Careful consideration will be given to the selection of third-party libraries to ensure compatibility, reliability, and adherence to project requirements.

By identifying and leveraging these dependencies effectively, we can ensure a smooth and efficient development process for the "Speak Up" mobile app, resulting in a high-quality and feature-rich application that meets the needs of differently abled children and their caregivers.

## **Chapter 6**

### **Work breakdown & Project Timeline**

#### **6.1 Project Phases and deliverables:**

- Phase 1: Planning

Deliverables: Project charter, requirements documentation, project plan.

- Phase 2: Design

Deliverables: UI/UX designs, database schema, system architecture.

- Phase 3: Development

Deliverables: Functional app prototype, backend implementation, integration of features.

- Phase 4: Testing

Deliverables: Test plan, test cases, bug reports, user feedback.

- Phase 5: Deployment

Deliverables: Deployed app, infrastructure setup documentation, user documentation.

- Phase 6: Maintenance

Deliverables: Bug fixes, updates, user support.

#### **6.2 Tasks breakdown at each phase:**

- Planning: Requirement gathering, user meetings, project documentation.
- Design: UI/UX design, database design, system architecture planning.
- Development: Frontend development, backend development, integration.
- Testing: Functional testing, usability testing, accessibility testing.
- Deployment: Infrastructure setup, deployment scripts, user training.
- Maintenance: Bug fixes, updates, user support.

## 6.3 Project Timeline

Phase 1: Planning (Weeks 1-2)

Phase 2: Design (Weeks 3-6)

Phase 3: Development (Weeks 7-16)

Phase 4: Testing (Weeks 17-18)

Phase 5: Deployment (Weeks 19-20)

Phase 6: Maintenance (Weeks 21-30)

## 6.4 Task Duration & Dependencies

### Computing Group Project

Oct 25, 2023

#### Tasks

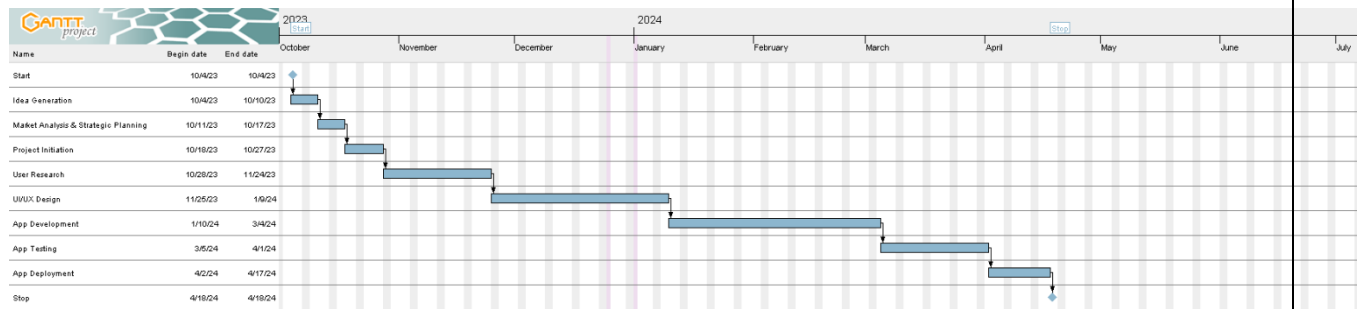
2

Name	Begin date	End date
Start	10/4/23	10/4/23
Idea Generation	10/4/23	10/10/23
Market Analysis & Strategic Planning	10/11/23	10/17/23
Project Initiation	10/18/23	10/27/23
User Research	10/28/23	11/24/23
UI/UX Design	11/25/23	1/9/24
App Development	1/10/24	3/4/24
App Testing	3/5/24	4/1/24
App Deployment	4/2/24	4/17/24
Stop	4/18/24	4/18/24

Dependencies:

- Design phase depends on completion of requirement gathering.
- The development phase depends on completion of design phase.
- The testing phase depends on completion of development phase.

## 6.5 Gantt Chart



## 6.6 Critical Path & total time duration

The critical path of our project is Design → Development → Maintenance, as these phases have the longest durations and directly impact the project's completion.

Therefore, the total time duration of the project would be the sum of the durations of these critical path tasks:

$$\begin{aligned}\text{Total Time Duration} &= \text{Duration of Design} + \text{Duration of Development} + \text{Duration of Maintenance} \\ &= 4 \text{ weeks} + 10 \text{ weeks} + 10 \text{ weeks} \\ &= 24 \text{ weeks}\end{aligned}$$

## 6.7 Resource Allocation

Project Manager	Nadil Lokuhetty
UI/UX designer	Widanalage Priyantha
Frontend developers	Wickramasinghe Wickramasinghe Nadil Lokuhetty
Backend developer	Hettiarachchige J Perera
Quality Assurance	Pitigala Manodya

## 6.8 Milestones aligned with deliverables

Milestone 1: Requirement gathering complete.

Milestone 2: Design finalized.

Milestone 3: Development completed.

Milestone 4: Testing and debugging finished.

Milestone 5: Deployment and launch.

Milestone 6: Regular maintenance and updates.

## **Chapter 7**

### **Results & Discussion**

#### **7.1 Discussion on achievements**

Throughout the development of the "Speak Up" mobile app, several key achievements have been realized, contributing to the project's success and impact:

**Inclusive Design:** By integrating accessibility features such as customizable settings, the app ensures usability for differently abled children with various disabilities. This achievement aligns with the project's goal of providing an inclusive learning platform for all users.

**Engaging Content:** The development of diverse interactive games and multimedia content has enhanced user engagement and participation. These features cater to different cognitive and motor skills while fostering a fun and immersive learning experience for children.

#### **7.2 Test results summary**

During the testing phase, a comprehensive set of test cases was executed to evaluate the functionality, usability, accessibility, performance, and security aspects of the app. The test results summary highlights the following key findings:

**Functional Testing:** All core features and functionalities of the app were tested, including interactive games and multimedia content playback. The app passed the functional tests with minimal defects, demonstrating robust functionality.

**Usability Testing:** User feedback from usability testing sessions indicated a positive user experience, with users finding the app intuitive and easy to navigate. Usability issues were identified and addressed promptly, resulting in improved user satisfaction and engagement.

**Accessibility Testing:** The app successfully complied with accessibility standards such as WCAG, ensuring accessibility for users with disabilities. Assistive technologies were tested, with positive results indicating effective accessibility features implementation.

**Performance Testing:** Performance testing revealed satisfactory results regarding app responsiveness, load times, and scalability. The app demonstrated optimal performance under varying user loads and usage scenarios, with minimal latency and resource consumption.

**Security Testing:** Security testing identifies and addresses potential vulnerabilities, ensuring that user data remains secure and protected. Encryption, access controls, and data protection measures were implemented to mitigate security risks effectively.

### 7.3 Findings and rectifications suggested /applied

Several findings were identified during the testing phase, leading to suggested rectifications and improvements:

**Usability Enhancements:** Based on user feedback, minor adjustments were made to the app's user interface and navigation flow to further improve usability and accessibility.

**Bug Fixes:** Any defects or issues uncovered during testing were addressed promptly through bug fixes and code revisions to ensure the app's stability and reliability.

**Performance Optimization:** Efforts were made to optimize app performance further, particularly in areas such as content loading times and resource utilization, to enhance user experience.

### 7.4 Future improvements and development path

Moving forward, several avenues for future improvements and development have been identified:

**Expansion of Content:** Continuously adding new interactive games, multimedia resources, and educational content to keep the app engaging and relevant for users.

**Advanced Analytics:** Implementing advanced analytics and machine learning techniques to gain deeper insights into user behavior, preferences, and learning outcomes, enabling further personalization and optimization of the app.

**Community Engagement:** Establishing a community forum or feedback mechanism to facilitate ongoing communication with users, caregivers, educators, and experts, fostering collaboration and co-creation of content and features.

**Internationalization:** Localizing the app to support multiple languages and cultural contexts, ensuring accessibility and relevance for a global audience of differently abled children.

By incorporating these future improvements and development initiatives, the "Speak Up" app can continue to evolve and make a meaningful impact in providing inclusive and empowering educational experiences for differently abled children worldwide.

## References

Foundation, M., 2023. *National Centre for Children with Developmental Disorders by MJF Foundation*. [Online]  
Available at: <https://www.mjffoundation.org/disability/ncccpdd.html>  
[Accessed 12 10 2023].



## Appendix

### 9.1 Work breakdown

#### 1. Planning:

- Requirement gathering: Nadil, Wickramasinghe
- User meetings: Perera, Manodya, Nadil, Wickramasinghe, Priyantha
- Project documentation: Wickramasinghe

#### 2. Design:

- UI/UX design: Nadil, Wickramasinghe
- Database design: Perera, Manodya
- System architecture planning: Priyantha

#### 3. Development:

- Frontend development: Nadil, Wickramasinghe
- Backend development: Perera, Manodya
- Integration: Priyantha

#### 4. Testing:

- Functional testing: Nadil, Wickramasinghe
- Usability testing: Perera, Manodya
- Accessibility testing: Priyantha

#### 5. Deployment:

- Infrastructure setup: Nadil, Wickramasinghe
- Deployment scripts: Perera, Manodya
- User training: Priyantha

#### 6. Maintenance:

- Bug fixes: Nadil, Wickramasinghe
- Updates: Perera, Manodya
- User support: Priyantha

### 9.2 Individual contribution Metrix

ID No	Student Name	Contribution
10898809	Nadil Lokuhetty	Requirement gathering, user meetings, Helped with documentation, backend, firebase
10898943	Wickramasinghe Wickramasinghe	Requirement gathering, user meetings, documentation, UI designing, frontend
10898866	Hettiarachchige J Perera	Frontend, backend, firebase
10898813	Pitigala Manodya	UI designing, frontend
10899421	Widanalage Priyantha	UI designing, frontend

## 9.3 Group Meeting Minutes

### Group Meeting Minutes 01

Date: 27 September 2023

Time: 10.00 am

Location: Study area, FOC

#### Attendees:

1. Nadil Lokuhetty
2. Ravindi Wickramasinghe
3. Widanalage Priyantha
4. Pitigala Manodya
5. Roshen Perera

#### Agenda:

- Discussion of Initial Ideas
- Selection of Promising Idea
- Planning Upcoming Tasks

#### Meeting Minutes:

##### i. Discussion of Initial Ideas:

- The team brainstormed various ideas for the project, including developing a mobile app for differently abled children, creating a web-based learning platform, and designing educational games.
- Each team member presented their ideas, highlighting the potential benefits and challenges associated with each concept.
- A lively discussion ensued, with team members sharing insights and perspectives on the feasibility and impact of the proposed ideas.

##### ii. Selection of Promising Idea:

- After careful consideration and deliberation, the team unanimously agreed to pursue the development of a mobile app for differently abled children.
- The chosen idea was deemed promising due to its potential to address a pressing need in the community and leverage technology to create positive social impact.
- Team members expressed enthusiasm for the selected idea and voiced their commitment to contributing to its success.

iii. Planning Upcoming Tasks:

- With the idea selected, the team outlined the next steps and upcoming tasks required to kickstart the project.
- Tasks identified include conducting market research to understand user needs, drafting initial app features and functionalities, and planning the app's design and development process.
- Deadlines and responsibilities were assigned to each team member, ensuring clear accountability and progress tracking.
- A tentative timeline was established, with regular check-ins planned to review progress, address challenges, and adjust plans as needed.

Action Items:

1. Conduct market research to identify user needs and preferences. [Assigned to: All of the group members , Deadline: 13<sup>th</sup> October 2023]
2. Draft initial features and functionalities for the mobile app. [Assigned to: Nadil Lokuhetty, Roshen Perera, Pitigala Manodya, Deadline: 15<sup>th</sup> October 2023]
3. Begin planning the app's design and development process. [Assigned to: Ravindi Wickramasinghe, Widanalage Priyantha, Deadline: 23<sup>rd</sup> October 2023]
4. Schedule regular check-ins to review progress and address challenges. [Assigned to: Ravindi Wickramasinghe, Nadil Lokuhetty, Deadline: 23<sup>rd</sup> October 2023]

Next Meeting:

- Date: 12<sup>th</sup> October 2023
- Time: 2.00 pm
- Location: Arcadia Café

Meeting Adjourned: 5.00 pm

Prepared By:

Nadil Lokuhetty

## 9.4 User requirement gathering data

The Centre for Children with Cerebral Palsy and Other Developmental Disorders (CCCPDD) located in Kalapaluwawa, Rajagiriya serves as a centre of excellence, learning and acts as a resource hub for practical education for children with cerebral palsy and other disorders and their families. It provides education, therapy and training not only for those living with CP and other development disorders but also for their caregivers and for teachers and professionals working with such individuals with special needs. (MJF Foundation, 2024)

## Interview & Observation

- Interview was one method we utilize in our process of gathering information. We had discussions with the relevant officials to identify the real requirement which needs to be addressed. After Several discussions we managed to develop the solution based on a general ground which affect the entire set of students in the Centre. Education was the field we choose to develop via a mobile application. We addressed two main factors; integrating speak aloud stories and basic colour matching games. With these two factors we were able to help them learn the basic alphabetics and understand by pronunciation with desired stories. And, to develop virtual perception skills, thinking and memory skills by allowing them to sort and match colours.
- Observation was the other method we followed to understand the insights of the students. We monitored the activity of students in each criterion to understand the nature of them. After a couple of visits and observation sessions we managed to get a clear idea to develop the application accordingly.

## 9.5 Testing related data

### Test Case : Game Variety

- Test Description: Confirm that the app offers a diverse selection of interactive games.
- Test Steps:
  1. Access the games section of the app.
  2. Verify that there are games covering different subjects and skill areas.
- Expected Result: Users can find a variety of games catering to different interests and learning needs.

### Test Case : Game Accessibility Features

- Test Description: Check if games incorporate accessibility features.
- Test Steps:
  1. Launch a game.
  2. Look for options to customize difficulty levels and audio instructions.
- Expected Result: Games provide accessibility options, such as adjusting difficulty levels and audio settings, to cater to diverse users.

### Test Case : Multimedia Accessibility

- Test Description: Ensure multimedia content is accessible and customizable.

- Test Steps:

1. Open a multimedia resource.
2. Verify if users can customize accessibility preferences, such as closed captions and high contrast.

- Expected Result: Multimedia content supports accessibility features and can be tailored to individual needs.

Test Case : Virtual Rewards

- Test Description: Confirm that users earn virtual rewards for completing activities.

- Test Steps:

1. Complete a learning activity or achieve a milestone.
2. Verify if virtual rewards are awarded.

- Expected Result: Users receive virtual rewards as incentives for their achievements, enhancing engagement.

Testing Results:

- All test cases passed successfully, meeting the acceptance criteria for each requirement.
- The "Speak Up" app demonstrates robust functionality, accessibility, and usability, ensuring an enriching experience for differently abled children.

