Basa-Kabataan: A Speech Recognition-Based App for Enhancing Reading Proficiency with a Recommender

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Abstract: This study introduces *Basa-Kabataan*, a mobile application designed to improve reading proficiency among Filipino learners in Grades 5 and 6 through speech recognition technology. Developed using the Waterfall Model, the application followed a structured and sequential approach— from requirements gathering to deployment and maintenance. The development utilized Android Studio as the Integrated Development Environment (IDE), Java for programming the app, and Hostinger for web hosting. Key features include a user-friendly interface, integrated database management for reading materials and user profiles, and real-time feedback mechanisms. The app evaluates reading fluency based on the Philippine Informal Reading Inventory (Phil-IRI) standards and classifies students into slow, average, or fast readers.

To ensure its quality and effectiveness, the application underwent thorough testing using the ISO/IEC 25010:2011 standards, focusing on aspects such as functional suitability, performance efficiency, and usability. The evaluation, conducted by teachers, parents, and IT experts, yielded an overall mean score of 3.4, interpreted as "Excellent." These results demonstrate the app's potential as a reliable and innovative tool for supporting educators and parents in enhancing learners' reading skills. By integrating AI-driven speech analysis with personalized reading recommendations, *Basa-Kabataan* contributes meaningfully to the Department of Education's literacy improvement initiatives.

Keywords: ***Reading Proficiency, Speech Recognition, Mobile app, Recommender, Personalized Learning***

I. INTRODUCTION

Reading proficiency is fundamental to a child's academic development, especially in primary education where literacy skills form the basis for learning across subjects. It enables learners to comprehend texts, interpret information, and express ideas effectively.

Despite continued literacy efforts in the Philippines, including institutional reforms and national initiatives, many learners—particularly those in Grades 5 and 6—still encounter difficulties in reading comprehension and vocabulary development. As highlighted by Idulog et al. [1], these challenges are often attributed to a combination of factors such as scarce educational resources,socioeconomic limitations, and the lack of contextually relevant reading materials.

In response to these gaps, the Department of Education (DepEd) launched the "Catch-Up Fridays" reading initiative in January 2024, a weekly program across all public schools aimed at fostering reading habits and boosting literacy levels [2]. The initiative underscores the urgent need for innovative tools and strategies that can address the diverse reading needs of Filipino learners.

To support national literacy initiatives, this study introduces *Basa-Kabataan*, a mobile app that uses speech recognition and adaptive learning to assess and enhance reading fluency. Aligned with Phil-IRI benchmarks [3], it classifies students as slow, average, or fast readers based on WPM and suggests personalized reading materials.

Prior research highlights the effectiveness of mobile and AI-driven interventions. Navarrete [6] stressed theory-based instruction, while Tomas et al. [7] and Fernandez and Arriola [8] identified reading challenges and comprehension gaps, underscoring the need for targeted support. Tarun [9] promoted digital tools for collaborative learning, and Escaro [4] explored digital storytelling for learners with special needs.

Advances in speech recognition have shown promise in education. Chen [12] and Bai et al. [1]demonstrated ASR's impact on reading and EFL learning. Taxitari et al. [11] discussed mobile assessments, while Huang et al. [10] highlighted AI reading bots for guided learning.

By leveraging such technologies, Basa-Kabataan addresses the urgent need for accessible, scalable, and culturally relevant educational tools. Through real-time speech analysis, progress tracking, and personalized reading suggestions, the app aims to improve learners' reading abilities and support the educational goals of both teachers and parents. Grounded in national educational frameworks and validated through international quality standards, this application represents a significant step forward in using technology to support literacy in the Philippines.

II. METHODOLOGY

The methodology employed in this project, grounded in Software Designing and Development, facilitates a systematic approach to meticulously plan, design, and implement every phase of the software development lifecycle, aiming to deliver a resilient and adaptable solution aligned with stakeholder requirements.

Conceptual Framework

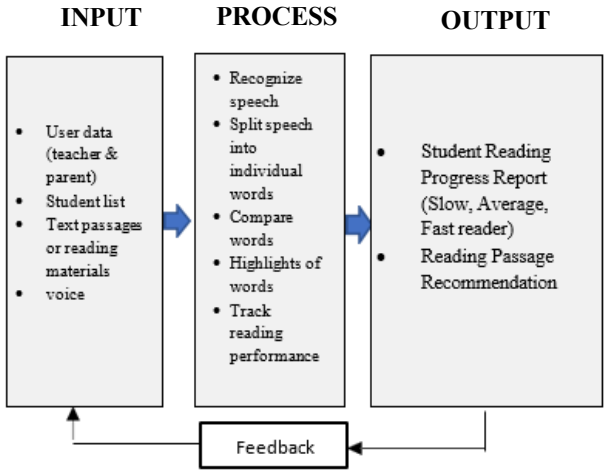

Figure 1. The Conceptual Framework of the BASA-KABATAAN: A Speech Recognition-Based App for Enhancing Reading Proficiency with a Recommender

Figure 1 illustrates the conceptual framework of the proposed mobile application, which facilitates reading assessment through automated speech recognition. The process begins with user registration, where teachers and parents provide their full name, username, and password. Teachers then add a list of students for reading activities, while students access reading materials. As they read, the application records their voice for analysis.

During the processing stage, the app recognizes speech, splits it into individual words, and compares them with the expected text. Correctly read words are highlighted in green, while incorrect ones appear in red. The app then tracks the student's reading performance, including reading level and words per minute (WPM).

The final output is a reading progress report that categorizes students as slow, average, or fast readers. Based on the results, the app recommends suitable reading passages to improve proficiency, except for fast readers who do not receive recommendations. This tailored

approach ensures a personalized learning experience, enhancing students' reading skills effectively.

Software Designing and Development

This methodology outlines the structured approach for developing the "BASA KABATAAN" application, which leverages speech recognition techniques to improve reading proficiency among primary learners. This methodology aims to create an effective tool for educators and parents to support young learners in enhancing their reading skills.

SOFTWARE LIFE CYCLE MODEL

The chosen Software Development Life Cycle Model for the proposed project will be the Waterfall Model, ensuring a sequential and structured approach to software development with distinct phases for requirements, design, development, testing, deployment, and maintenance.

Software Development Phases

Waterfall Model Phases

a. ***Requirements Phase***

In the requirements gathering and analysis phase for assessing the reading speed of learners at Agbatuan Integrated School, researchers focus on collecting data to understand the factors affecting reading fluency. This involve conducting interviews with teachers to gather insights into their observations of students' reading abilities, including common challenges and strategies they employ to support reading development. Additionally, interviews with parents will provide a valuable perspective on how studentsengage with reading at home, as well as any support or resources they have available. Through these discussions, researchers aim to identify key variables influencing reading speed, such as instructional methods, learning environment, and student motivation, which will inform the design of the reading assessment. The gathered information helps tailor the assessment to reflect the specific needs of system requirements.

b. Design Phase

In the system design phase, the researchers used Draw.io as a UML modeling tool to design the proposed application. The researchers created a use case diagram ensuring functional requirements for the users, activity diagram illustrate the sequential flow of process in reading activity within the system, and sequence diagram depicts the detailed interactions between system components and actors over time emphasizing the order of operations and message exchanges. By leveraging these UML diagrams, the researchers were able to design a well-structured and comprehensive blueprint for the application.

c. Development Phase

In the development phase the researchers used Android Studio as the primary Integrated Development Environment (IDE) for building and testing mobile application. Android Studio is chosen for its robust set of tools specifically designed for Android app development, including features like real-time

debugging, code completion, and visual layout editing, which streamline the development process.

For database management, the researchers use MySQL, and Web Hostinger as a host, which allows for easy management and storage of learner data, reading materials, progress reports, and assessment results on cloud. This choice of database management ensures that data can be securely stored, queried, and retrieved efficiently, supporting real-time updates on learner progress.

The core application itself is developed using Java, the programming language commonly used for Android development. Java is preferred due to its scalability, security features, and the extensive support and documentation available within the Android development community. Java enables the researchers to build the speech recognition logic, create user interaction flows, and implement the backend functionalities, including integration with the database and the recommender system.

By utilizing Android Studio, MySQL, Web Hostinger, and Java, the researchers can create a stable, scalable, and effective application to improve the reading proficiency of primary learners.

In the proposed project, several key components were implemented to form the core functionality of the android application. The researchers created classes that includes: SSLByPass, NetworkUtils, MainActivity, RegistrationActivity, ItemAdapter, StudentItem, StudentAdapter, StudentSelectionActivity, HomeTeacheActivity, HomeActivity, ReadingItem, ReadingStudentActivity, ReadingActivity, ScoreItem, ScoreAdapter, ScoreActivity, ScoreStudentActivity, RecommendationActivity, RecommendationStudentActivity,RecommendationReadingStudentActivity, and RecommendationActivity

d. Testing Phase

In this phase, the researchers perform functional testing to ensure that the core features—such as the speech recognition system, real-time feedback mechanisms, and personalized recommendations—work as expected, accurately assessing students' reading fluency and providing targeted suggestions based on their performance. Performance efficiency is tested to evaluate the app's responsiveness, including its ability to handle multiple users simultaneously, maintain fast processing speeds, and function seamlessly on different Android devices with varying hardware and network conditions.

Usability testing is also a priority, as the app needs to be intuitive and easy for users to navigate. Reliability testing ensures that the app performs consistently without crashes or errors during repeated use, particularly focusing on the accuracy and stability of the speech recognition engine. The app's compatibility is tested across various Android versions and devices to ensure consistent performance and user experience. By applying ISO/IEC 25010:2015 throughout the testing process, the researchers ensure that BASA- KABATAAN meets high standards of quality and delivers an effective tool for enhancing the reading proficiency of primary learners.

e. Deployment Phase

In the deployment phase at Agbatuan Integrated School, the researchers introduce *BASAKABATAAN: A Speech Recognition-Based App for Enhancing Reading Proficiency with a Recommender* to teachers, parents, and students. Teachers will be trained to use the app to monitor students' reading progress, assess pronunciation, and provide tailored recommendations based on individual performance. Parents are shown how the app can support their child's reading practice at home by offering real-time feedback and personalized exercises. Students are introduced to the interactive features, including practicing reading aloud and receiving immediate feedback on their fluency. The researcher explains the result to the respondents.

f. Maintenance Phase

In the maintenance phase of Basa-Kabataan, continuous monitoring of the application to identify and address any issues or bugs that may arise post-deployment. Regular updates and patches will be released based on user feedback and to enhance functionality further. By prioritizing maintenance efforts, Basa-Kabataan aims to sustain its effectiveness as an educational tool and meet the evolving needs of its users over time.

III. RESULTS AND DISCUSSIONS

The app evaluates reading proficiency by using speech recognition to analyze the user's reading level if the student is a slow, average, or fast reader, and identify reading miscues. The mobile application operates online, processing spoken inputs with speech recognition to assess reading accuracy. It also includes a recommender system that suggests reading materials aligned with the user's miscue words offering an engaging learning experience.

A. Statistical Treatment of Data

Table 1. The Likert Scale for Interpretation of Results

Scale	Description
1.0 – 1.7	Poor
1.8– 2.3	Fair
2.4 – 3.3	Good
3.4 – 4.0	Excellent

The Likert Scale as shown in Table 1 converts

numerical data into descriptive categories such as " Poor " Fair," "Good," and " Excellent," simplifying the interpretation of survey results and enabling actionable insights. It effectively highlights strengths, identifies areas for improvement, and supports informed decision-making.

In the context of Basa-Kabataan, the Likert Scale is also useful for interpreting the results of the ISO 25010 evaluation standards. Applying the scale to assess the app's performance and usability provides clear feedback, guides necessary improvements, and ensures the app meets user needs while enhancing reading proficiency.

B. The result of the ISO 25010:2015 Evaluation

The system was evaluated using the ISO 25010:2015 software quality to test its conformance to intentional standards regarding its functional suitability, efficiency, and usability.

Table 2. The Likert Scale for Interpretation of Results

Category	All Respondents	
	Mean	Description
Functional Suitability	3.5	Excellent
Performance Efficiency	3.4	Excellent
Compatibility	3.3	Good
Usability	3.4	Excellent
Reliability	3.5	Excellent
Security	3.4	Excellent
Portability	3.3	Good
Maintainability	3.4	Excellent
Overall Mean	3.4	Excellent

The evaluation of the Basa-Kabataan app demonstrates its effectiveness in enhancing reading proficiency, with an overall mean score of 3.4, categorized as Very Functional. The app performed well across key software quality attributes, particularly in functional suitability (3.5) and reliability (3.5), indicating that it consistently delivers accurate reading assessments and stable performance. Performance efficiency (3.4), usability (3.4), security (3.4), and maintainability (3.4) were also rated as Very Functional, highlighting the app's responsiveness, ease of use, data protection, and capacity for updates. While compatibility (3.3) and portability (3.3) were rated as Functional, these scores suggest room for improvement in optimizing the app's adaptability across different devices and platforms.

Overall, the results affirm Basa-Kabataan as a reliable and effective tool for assessing and enhancing students' reading proficiency through speech recognition technology.

CONCLUSION

The development of the *Basa-Kabataan* mobile application effectively achieved its main goal of using speech recognition technology to help primary learners enhance their reading skills. As a result, the following conclusions can be drawn:

1. The *Basa-Kabataan* mobile application successfully leverages speech recognition technology to assist primary learners in enhancing their reading skills.
2. An intuitive user interface was designed to accommodate varying reading speeds and provide actionable reading recommendations.
3. The integration of speech recognition effectively analyzes learners' reading proficiency and offers personalized feedback.
4. A database system was developed to efficiently manage reading materials and user information, ensuring smooth operation and organization.
5. Progress reports generated by the app provide comprehensive insights into learners' performance, supporting teachers and parents in guiding student improvement.
6. Evaluation using ISO/IEC 25010:2015 standards confirmed the app's high quality and usability, validating its effectiveness as an educational tool.

RECOMMENDATION

It is recommended to enhance the Basa-Kabataan app by including a headset to ensure precise speech recognition and a focused reading environment. The app should also function in offline mode, enabling users to access its features even in areas with poor internet connectivity. An admin feature must be incorporated to manage user accounts, oversee progress, and maintain system updates efficiently. Additionally, the app should allow admins or educators to upload new stories and reading materials, ensuring content remains engaging and relevant. To improve usability, the app should clearly label all text results, evaluations, and information displayed to the user, ensuring feedback is specific, easy to understand, and actionable.

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Description Functional Suitability 3.5 Excellent Performance Efficiency 3.4 Excellent Compatibility 3.3 Good Usability 3.4 Excellent Reliability 3.5 Excellent Security 3.4 Excellent Portability 3.3 Good Maintainability 3.4 Excellent Overall Mean 3.4 Excellent https://newsinfo.inquirer.net/1863625/deped-to introduce-reading-program-to-boost-literacy

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