NLP based Autonomous Grading System for Sinhala Language Essays of Grade 5 students

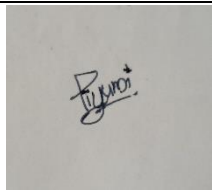Final Report

Full Project Group Report

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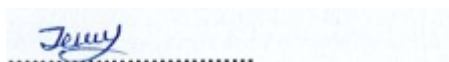
Sri Lanka

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DECLARATION

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

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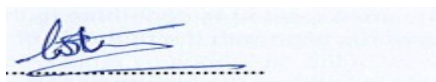
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ABSTRACT

The advancement of digital tools following the COVID-19 pandemic has transformed the educational landscape, particularly in assessment methodologies. This study explores the design and implementation of an NLP-based autonomous grading system tailored for Sinhala language essays of Grade 5 students. The developed system uses structured algorithms to evaluate essays by assessing key components such as keyword usage, spelling accuracy, grammar, complex word recognition, and the application of native language norms. Data was collected from educational sources, such as textbooks and official syllabi, to build a comprehensive corpus for this under-resourced language. Through a mobile interface connected to a backend REST API, teachers input questions and keywords, allowing students to respond via the application. The results demonstrate promising accuracy in identifying essential keywords, grammar, and spelling errors, providing meaningful feedback to enhance language skills. This system bridges a gap in Sinhala language processing, contributing valuable resources and methodologies for future educational technology development.

Keywords— Automated Essay Grading, NLP, Text Processing, Essay Evaluation, Sinhala

ACKNOWLEDGEMENT

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LIST OF ABBREVIATIONS

Short Form	Long Form
NLP	Natural Language Processing
ML	Machine Learning
NLTK	Natural Language Toolkit
SVM	Support Vector Machine
API	Application Programming Interface
AI	Artificial Intelligence
AEG	Automated Essay Grading
POS	Part-of-speech
ETS	Educational Testing Service
PEG	Project Essay Grade
SVO	Subject-verb-object

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1. INTRODUCTION

Education was among the sectors most impacted by the COVID-19 pandemic, which significantly boosted and accelerated the usage of digital technologies. As educational institutions all over the world have transitioned to online learning, online platforms and applications that facilitate remote teaching and evaluation have grown in popularity. The need for online learning environments to continue instruction during lockdowns has led to a rapid development and utilization of educational technologies, such as virtual classrooms, learning management systems, and online assessment tools.

Among these advancements, automated grading methods have once again gained popularity. Teachers found it challenging to provide fast and precise feedback due to the fact that a large number of students were now submitting their projects and essays online. It gets harder to grade assignments by hand, especially when teachers have to handle a large volume of written work. Automatic essay scoring systems that employ Natural Language Processing to assess student work more rapidly, reliably, and impartially have reduced this burden.

The need for localized versions of these automated technologies is growing in Sri Lanka, where the vast majority of students get their primary school in Sinhala with the goal of passing the grade 5 scholarship exam. The unique linguistic challenges of the Sinhala language are not adequately taken into consideration by the present grading schemes, which are mostly focused on English and other widely spoken languages. Due to its vast morphological structure, non-Latin character, and variable syntax, Sinhala requires specially created natural language processing models for automated evaluation to be accurate.

The primary objective of this work is to create an autonomous grading system based on NLP that is specific to Sinhala essays written by Grade 5 scholarship students. Among the primary problems the system aims to address are identifying misspelled words, correcting grammar errors, replacing complex or native words with simpler ones, and providing useful marking and feedback. By doing this, it seeks to improve the standard and consistency of grading Sinhala essays in Sri Lankan schools, reduce the workload for teachers, and provide students with quick, objective feedback.

1.1.Background and Literature Survey

Automated essay grading systems have gained significant attention in recent years due to their potential to transform the educational landscape. The manual grading of essays is not only time-consuming but also prone to inconsistencies and subjectivity, depending on the grader's mood, experience, and understanding of the topic. These challenges are amplified in high-stakes exams, where consistency and efficiency are critical [1]. Automated grading systems aim to address these challenges by employing computational techniques to evaluate and score essays objectively and efficiently.

Natural Language Processing, a subfield of artificial intelligence, serves as the backbone of modern AEG systems. NLP enables computers to understand, interpret, and generate human language in a meaningful way. In the context of essay grading, NLP techniques such as tokenization, POS tagging, syntactic parsing, semantic analysis, and sentiment analysis are used to evaluate various aspects of an essay, including grammar, coherence, relevance, and creativity [2].

Most existing AEG systems have been developed for globally dominant languages such as English. For instance, the e-rater® developed by Educational Testing Service has been widely used for automated grading of essays written in English. It evaluates essays based on grammar, mechanics, style, and organization, achieving a correlation of 0.87 to 0.94 with human graders [3]. Similarly, IntelliMetric employs a blend of artificial intelligence and NLP to simulate human judgment and supports scoring in multiple languages, demonstrating its potential for cross-lingual scalability [4].

Despite their success, limited efforts have been made to develop automated grading systems for low-resource languages, particularly Sinhala, which is spoken by over 16 million people in Sri Lanka. Sinhala's linguistic characteristics—such as its rich morphology, agglutination, and free word order—make it a challenging language for computational analysis. Existing NLP tools for Sinhala, like spell checkers [5] and part-of-speech taggers [6], are foundational but insufficient for building sophisticated systems like AEG.

Grade 5 students in Sri Lanka face an especially high-pressure examination system, where essay writing is a critical component of their academic evaluation. Manual grading in these exams is susceptible to inefficiencies and human errors, which can profoundly affect students' academic trajectories. An automated grading system tailored for Sinhala essays has the potential to alleviate teachers' workloads, ensure consistency in grading, and provide students with timely feedback for improvement [7].

Advancements in NLP technologies, including transformer-based models like BERT and GPT, offer new opportunities for tackling the challenges associated

with low-resource languages [8]. While these models have demonstrated exceptional performance in resource-rich languages like English, their application to Sinhala requires careful adaptation and the creation of domain-specific datasets [9]. Recent studies have also highlighted the feasibility of transfer learning to adapt pre-trained models for underrepresented languages, further emphasizing the promise of modern NLP techniques [10].

In this project, we aim to bridge the gap by developing an NLP-based autonomous grading system for Sinhala language essays written by Grade 5 students. By leveraging state-of-the-art NLP techniques and adapting them for Sinhala, we seek to provide a scalable and efficient solution to the challenges of manual grading. This system will contribute to the broader field of educational technology while addressing a critical need in Sri Lanka's primary education system.

Automated essay scoring is a significant development in educational technology, particularly in light of the COVID-19 pandemic's increased demand for online learning and assessment materials. As more teachers moved to online learning environments, there was a greater need for efficient, trustworthy, and unbiased grading systems. This section examines the advancements in AES systems, the challenges of developing such systems for less studied languages like Sinhala, and the current state of Sinhala NLP research in order to lay the foundation for this investigation.

A. Rise of Automated Grading Systems

For many years, the idea of AES systems has existed, with early attempts to develop systems that could automatically grade essays according to preset standards. Project Essay Grade, one of the original AES systems, was created by Page in 1968 and used statistical models to assess the caliber of English essays [11]. This early study established the groundwork for more sophisticated systems that evaluate different aspects of writing, including grammar, coherence, and relevance, using NLP and ML approaches.

The e-rater system, created by ETS, gained widespread recognition as an automated grading tool in the early 2000s. It assessed new submissions using machine learning algorithms and a sizable library of previously graded essays based on characteristics like syntax, grammar, and word usage [12]. Shermis and Burstein's work in 2013 further highlighted the growth of AES systems, discussing the benefits of cross disciplinary perspectives in enhancing the scoring models used for essay evaluation [13]. These systems demonstrated how NLP could be applied to educational tasks, improving grading consistency and reducing the time required for manual assessments.

AES systems became increasingly important in helping teachers who were overburdened by the high volume of online submissions as the use of online learning platforms grew during the epidemic. Despite the difficulties of distance

learning, automated scoring tools enabled teachers to give prompt response, guaranteeing that students kept receiving assessments that guided their development. Since then, AES has become more and more popular, especially in nations where online tests are now commonplace [14].

B. Challenges in Developing AES for Non-English Languages

Even if AES systems for English have proven to be effective, replicating this success for other languages presents unique challenges. Large English text corpora, which include easily accessible resources like language models, syntactic tools, and annotated datasets, are used to design and train the bulk of AES systems. However, the development of AES for languages like Sinhala is hampered by a number of significant factors.

Sinhala, the primary language of Sri Lanka, has a rich morphological structure, a complex grammar, and a unique alphabet. Compared to English, which relies on a very simple subject-verb-object sentence structure, Sinhala has greater syntactic flexibility. Accordingly, words can occur in a range of phrase locations [15]. Furthermore, complex NLP models are required to manage the morphological complexity of the language, which includes agglutination and inflections.

Furthermore, sophisticated NLP models that can analyze and comprehend complex grammatical relationships are necessary due to the language's morphological richness, which includes agglutination and inflections. It is difficult to modify conventional AES models for Sinhala due to these language characteristics. Lack of language resources is one of the main obstacles to creating Sinhala NLP tools. Compared to languages like English, French, or Chinese, Sinhala is regarded as a low-resource language in the field of natural language processing, which means that there are fewer annotated datasets, lexicons, and corpora accessible. In his study on Sinhala natural language processing, Ranathunga (2014) recognized this problem, pointing out that training high-accuracy models is challenging due to the scarcity of linguistic data [16]. Gamage et al. (2017) also underlined the necessity of specific instruments for Sinhala morphological analysis, as the complexity of word formation in Sinhala presents difficulties for standard NLP systems that do not account for agglutination or extensive inflection [17].

C. Existing NLP Tools for Sinhala

Despite the lack of studies on AES systems for Sinhala, considerable strides have been achieved in developing NLP tools for the language. Prior research has focused on tasks such as text classification, sentiment analysis, and machine translation. For instance, Perera and Wijeratne (2013) developed a Sinhala morphological analyzer that made use of finite-state transducers to evaluate the morphological features of Sinhala words [18]. Any automated grading system must have this capability because it allows the computer to break down

complicated word forms into their most fundamental components, facilitating more accurate grammatical analysis.

To help with POS tagging, which is essential for understanding sentence patterns, several Sinhala-specific tools have been developed. One such example is the HMM-based POS tagger, which has been modified for Sinhala and displays promising results in identifying the grammatical roles of words in sentences [19]. Such tools form the foundation for advanced applications like AES, where understanding sentence syntax is crucial for evaluating grammatical correctness and coherence.

Even with these developments, there is still a big gap in the application of Sinhala natural language processing research to educational technology, especially when it comes to automated grading systems. Although morphological analysis and POS tagging technologies are available, they have not yet been extensively incorporated into systems that can assess student writing. Additionally, previous studies have mostly examined short-form text processing, such news items or social media posts, as opposed to the longer, more organized texts that are commonly found in student essays [20].

D. Automated Grading of Essays in Educational Contexts

In the broader field of education, automated essay scoring has evolved to manage several facets of student writing. In their discussion of the need for AES systems that can handle challenging essay writing tasks, Williamson and Mislevy (2014) emphasized that evaluation should consider deeper linguistic and cognitive elements such argument structure and originality in addition to technical accuracy [21]. This highlights the benefits of AES systems, which correct small errors like spelling and punctuation while also providing feedback on the overall coherence and creativity of the student's writing.

Studies show that using AES in the classroom can improve the efficiency and consistency of grading. Teachers benefit from reduced workloads, and students receive more rapid and objective feedback—two things that are critical for learning. Additionally, the possibility of more accurate and nuanced essay grading has increased due to recent developments in deep learning and transformer models (like BERT and GPT), which are better able to comprehend context, sentiment, and the logical flow of ideas in writing [22].

E. The Need for a Sinhala AES System

The creation of an AES system for Sinhala language essays is not only required but also opportune, given the growing dependence on online learning resources in the post-COVID period. The work currently in publication emphasizes the viability of such systems for languages that are widely spoken, but the difficulties unique to Sinhala need to be taken into consideration. The Sri Lankan educational system, where teachers frequently deal with huge class sizes and the

necessity to give students continuous, high-quality feedback, would substantially benefit from a specialized AES system for Sinhala.

The goal of this project is to create a comprehensive AES system that is suited to the linguistic requirements of Grade 5 pupils in Sri Lanka by expanding on the NLP tools that are currently available for Sinhala, such as morphological analyzers and POS taggers. The system will prioritize a number of important aspects of writing, including spelling correction, grammar checking, word complexity, and overall coherence, addressing both the mechanical and creative dimensions of essay writing.

1.2. Research Gap

The need for an NLP-based Autonomous Grading System for Sinhala Language Essays of Grade 5 Students highlights several critical research gaps,

1. Lack of Automated Grading Systems for Low-Resource Languages

   Automated essay grading systems predominantly focus on high-resource languages such as English, where extensive linguistic resources, annotated datasets, and NLP models are readily available. In contrast, low-resource languages like Sinhala have limited computational tools and datasets, making it challenging to develop accurate grading systems tailored to their unique linguistic characteristics [23][24].

2. Challenges in Sinhala Language Processing

   Sinhala, as a morphologically rich and agglutinative language, presents significant challenges for NLP. Its complex syntax, non-Latin script, and flexible word order require customized linguistic models and tools. While some progress has been made in areas such as part-of-speech tagging and morphological analysis for Sinhala, these advancements are insufficient for implementing comprehensive essay grading systems [24][25].

3. Scarcity of Annotated Datasets for Sinhala

   A major obstacle in building NLP applications for Sinhala is the lack of publicly available annotated datasets, especially for tasks such as essay grading. Annotated data is crucial for training machine learning models to perform text analysis, scoring, and feedback generation [26]. Most existing datasets in NLP research cater to languages with widespread global usage, leaving Sinhala and other low-resource languages underserved [25][26].

4. Limited Focus on Contextual Feedback in Current Systems

   Existing automated grading systems, even for high-resource languages, often lack the ability to provide nuanced, context-sensitive feedback. This gap is even more pronounced for Sinhala, where students' essays often include culturally specific content that requires contextual understanding. A robust NLP-based grading system for Sinhala must not only assess grammatical correctness but also evaluate relevance, coherence, and creativity [27][28].

5. Educational Implications in Sri Lanka

The Grade 5 Scholarship Examination is a critical milestone in Sri Lanka's education system, yet its essay grading practices are still manual, inconsistent, and resource-intensive. There is limited research or development focused on automating this process to ensure fairness and efficiency. Bridging this gap requires integrating domain-specific knowledge with NLP technologies [28][29].

6. Advancements in NLP Techniques Not Adapted for Sinhala

Recent advancements in NLP, such as transformer models like BERT and GPT, have revolutionized text analysis and generation. However, their application to Sinhala remains underexplored due to the lack of pre-trained language models and the complexity of adapting these architectures to the Sinhala language structure [30][31].

7. Teacher and Student-Specific Needs

Existing research often overlooks the practical requirements of teachers and students in specific educational contexts. For Sinhala language education in Sri Lanka, the system must address teachers' need for efficient grading and students' demand for constructive feedback. A user-friendly and scalable solution tailored to this unique setting is still missing [29][31].

1.3. Research Problem

The NLP-based Autonomous Grading System for Sinhala Language Essays of Grade 5 Students addresses a critical gap in educational technology in Sri Lanka. Despite advancements in automated essay scoring systems globally, such systems are absent for low-resource languages like Sinhala, leaving a significant need for solutions tailored to the unique linguistic and educational context. The core research problem is defined by several intertwined challenges:

1. Lack of NLP Tools for Sinhala

   Sinhala, as a low-resource language, lacks the essential NLP tools such as morphological analyzers, POS taggers, and syntactic parsers that are critical for building robust essay grading systems. Unlike high-resource languages like English, where pre-trained NLP models and datasets are abundant, Sinhala requires developing these tools from scratch or adapting existing models with limited training data [1][2].

2. Complex Morphological and Syntactic Features of Sinhala

   Sinhala's agglutinative nature and flexible syntax pose additional challenges for computational analysis. The language's unique grammatical structure, including the use of postpositions and extensive inflections, makes it difficult for existing NLP algorithms to perform accurately without significant customization [3][4].

3. Absence of Localized Grading Systems

   Automated essay grading systems like e-rater® and IntelliMetric® primarily focus on English and other globally dominant languages. These systems cannot be directly applied to Sinhala due to linguistic and cultural differences. The lack of tailored algorithms for Sinhala essays results in an over-reliance on manual grading, which is time-consuming and prone to inconsistencies [5][6].

4. Limited Annotated Datasets for Essay Grading

   The absence of annotated datasets for Sinhala essays limits the development and training of supervised machine learning models for tasks like coherence evaluation, grammar checking, and content relevance. The scarcity

of such datasets also hampers the creation of effective word embeddings and transformer-based models like BERT or GPT for Sinhala [2][7].

5. Challenges in Adapting Transformer Models for Sinhala

Recent advancements in NLP, such as transformer architectures, have revolutionized text processing in high-resource languages. However, adapting these technologies for Sinhala requires addressing issues like tokenization of non-Latin scripts and domain-specific training with minimal data. Without these adaptations, such models cannot achieve the required accuracy for automated grading [8][9].

6. Educational Needs in Sri Lanka

In the Sri Lankan context, the Grade 5 Scholarship Examination is a pivotal assessment for primary education, where essay writing plays a crucial role. Manual grading practices are inconsistent and place significant workload pressures on teachers. An autonomous grading system could provide an efficient and unbiased solution, but no existing research adequately addresses this specific educational need [6][10].

7. Context-Sensitive Feedback for Sinhala Essays

Current systems in other languages often fail to provide context-sensitive feedback that considers the cultural and linguistic nuances of essays. Sinhala essays, especially from young students, require evaluations that consider contextual relevance, creativity, and coherence alongside grammatical correctness [3][6].

Key Aspects of the Research Problem:

1. How can NLP techniques be effectively adapted for Sinhala unique linguistic features to enable accurate essay grading?

2. What methods can be employed to develop annotated datasets and pre-trained models for low-resource languages like Sinhala?

3. How can automated systems provide culturally and contextually relevant feedback for essays written by Grade 5 students?

1.4. Objectives

1.4.1. Main Objective

The primary goal of this project is to create an autonomous grading system for Sinhala language essays written by grade 5 students. This system aims to evaluate essays in an unbiased, efficient and consistent manner using natural language processing techniques specifically designed for the Sinhala language. The grading system will streamline the assessment process for educators, reducing the time and effort required for manual grading. It will also improve accuracy by addressing common issues like spelling mistakes, grammatical errors and overly complex language, ultimately providing more insightful feedback to students to aid their learning and development in Sinhala writing.

1.4.2. Specific Objectives

1. Identifying Native Words and Replacing Them with More Generic Words

   Sinhala, like many other languages, contains a range of native or localized words that may be less common in formal writing. To improve the standardization of essays, the system will be capable of identifying these native or colloquial terms and replacing them with more generic, widely recognized words. This process will ensure the essays adhere to a more formal, standardized version of the language, which is important for educational consistency and fairness in grading. The system will use a pre-defined corpus of native and generic word pairs, allowing it to make these replacements automatically and seamlessly.

2. Spell Checking and Correcting Incorrect Words

   Misspelled words can significantly impact the clarity and coherence of student essays. The system will include a robust spell-checking component designed to detect and correct misspellings specific to the Sinhala language. This process involves tokenizing the text into individual words and comparing each word against a comprehensive corpus of correct Sinhala words. For any detected errors, the system will suggest and apply the correct spelling. This feature is particularly important for younger students, as it not only ensures higher grading accuracy but also serves as a learning tool by providing students with the correct form of the words they misspell.

3. Identifying Complex Words with Their Meaning

At the grade 5 level, students may sometimes use complex or advanced words that might be difficult for their peers or even teachers to assess properly. The system will be able to identify such complex words based on predefined criteria, as rarity in the typical vocabulary of a fifth-grader. Once identified, the system will provide the meaning or a simpler synonym, which will help both in grading the essay and in giving feedback to the students. This feature ensures that the system can handle a wide range of vocabulary while maintaining clarity comprehension in the evaluation process.

4. Checking the Grammar Rules in the Sentence

Correct grammar is essential for coherent writing, and one of the key features of the grading system will be its ability to check grammatical accuracy in Sinhala sentences. The system will analyze sentence structures using tokenization and parsing techniques to ensure that they follow correct subject-verb agreement, proper noun usage, and tense consistency. The grammatical rules specific to Sinhala, such as word order and the flexibility in sentence construction, will be incorporated into the system. Any detected errors will be flagged, and suggestions for correction will be provided, allowing students to understand and improve their grammatical proficiency.

5. Sinhala Noun-Verb Replacement

Sinhala has a rich system of morphology, which includes many forms of nouns and verbs. Sometimes, students might use nouns and verbs that do not fit well with the context of their sentence, either due to incorrect conjugation or usage. The grading system will be equipped with a mechanism to detect such misuses and replace the incorrect noun or verb with a more appropriate one. This feature ensures that the text maintains its intended meaning while adhering to the correct grammatical structure of the Sinhala language, contributing to both the accuracy of the essay and the quality of the feedback provided to the student.

6. Providing General Feedback and Evaluation

In addition to automatic grading, the system will also provide general feedback on the essays to help students understand their strengths and areas for improvement. This feedback will cover various aspects of their writing, such as language usage, coherence, grammar, and vocabulary complexity. The system will generate specific suggestions on how students can improve their writing style, correct common mistakes, and enhance clarity. By receiving this feedback,

students will be encouraged to reflect on their writing and make progress, fostering a better learning environment. This feature also reduces the workload on teachers by automating the feedback process while ensuring that students receive the support they need to improve.

2. METHODOLOGY

2.1. Overview

The creation of an extensive automated grading system specifically designed for Grade 5 Sinhala language essays is the main goal of the study's methodology. The main objective is to develop a system that reliably assesses students' writings using important language characteristics, such as complexity, keyword relevance, syntax, and spelling. Data collection and system architecture are the two main parts of the methodology that are used to accomplish this. Each element is essential to the system's efficient evaluation of Sinhala essays, taking into account the linguistic nuances unique to the language and educational level.

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2.2. Data Gathering

Data collection is a foundational step in building an NLP-based grading system, especially for a low-resource language like Sinhala. To accurately assess essays, the system requires comprehensive data corpora for various linguistic elements, including native words, correct spelling, complex words, and common grammatical structures. Given the lack of pre-existing NLP resources for Sinhala, we developed our data corpora from multiple sources, including syllabuses, educational books, online resources, and examination guides used in Sri Lankan primary education.

Corpus for Native Words and Generic Equivalents: One of the key challenges in grading Sinhala essays is the presence of native words that may not align with standard or generic terminology. To address this, we compiled a corpus of commonly used native words from Grade 5 textbooks, teacher guides, and online educational resources. This corpus also includes a mapped list of generic equivalents that the system can use to identify and replace native words, making student responses more standardized and consistent with instructional expectations. The example corpus as followed in the table.

TABLE I. Native words corpus example

Informal	Formal
ඔහේ	ඔබ
රස්සාව	රැකියාව
ඉස්කෝලය	පාසල
දොඩනවා	කථා කරනවා
ඔයනවා	ලෙලි ගහනවා

Spelling Corpus: Accurate spelling is a critical criterion for automated grading. We created a comprehensive spelling corpus by extracting words from Sinhala language syllabuses, textbooks, and online dictionaries. This corpus covers a wide range of words typically encountered at the primary education level, including common misspellings and alternative forms. The spelling corpus allows the system to detect and correct spelling errors, providing constructive feedback to students and helping them learn proper word forms.

TABLE 2. Spelling corpus example

Incorrect	Correct
ආරම්බ	ආරම්භ
ආක්‍යාත	ආඛ්‍යාත
මාත්‍රෑ	මාතෲ
යහලු	යහළු
අදික	අධික

Complex Words Corpus: To assess students' vocabulary and ensure that their language usage aligns with their grade level, we developed a corpus of complex words. This corpus includes words that are above the expected reading level for Grade 5 students, sourced from higher-grade textbooks, advanced Sinhala language resources, and online dictionaries. By identifying complex words, the system can provide recommendations to replace difficult terms with simpler synonyms, ensuring that students use age -appropriate vocabulary.

TABLE 3. Complex words corpus example

Word	Meaning
පෞරාණික	පැරණි යුගයට අයත්
ගල්මුවා	ගලින් සෑදු
තොටියා	ඔරුව පදවන්නා
ජලජ	ජලයේ උපන්
හාසයජනක	සිනා උපදවන

Grammar Rules and Sentence Structure Database: Grammar is another crucial aspect of essay evaluation. We created a database of basic grammar rules and sentence structures commonly taught at the Grade 5 level, with references from Sinhala language syllabuses and textbooks. This database helps the system evaluate grammatical accuracy, including subject-verb agreement, correct usage of tenses, and sentence coherence. Additionally, it allows the system to offer suggestions for grammatical improvement, guiding students in constructing grammatically sound sentences. Through this comprehensive data collection process, we have developed a robust set of linguistic resources tailored specifically to Grade 5 Sinhala essays. These

corpora and databases serve as the foundation for the automated grading system, enabling it to evaluate various aspects of student responses with accuracy and consistency.

2.3 Model Building

The model building phase is the core of the automated grading system for Sinhala language essays. It involves designing and implementing computational frameworks and algorithms to process and evaluate essays effectively. The primary goal of this phase is to create a reliable, scalable, and adaptable NLP model capable of analyzing key linguistic aspects, including grammar, spelling, vocabulary, and content relevance. The process integrates linguistic knowledge with advanced computational techniques to address the unique challenges posed by the Sinhala language and the Grade 5 educational level.

1. Preprocessing Framework

The first step in model building is establishing a robust preprocessing pipeline. Preprocessing prepares the input data, ensuring it is structured and standardized for analysis. This includes tokenization (breaking text into individual words or tokens), stemming or lemmatization (reducing words to their base forms), and normalization (addressing inconsistencies such as mixed character cases or extraneous spaces). Given the linguistic complexities of Sinhala, preprocessing also involves handling unique script features, such as vowel modifiers and complex conjunct characters.

The system must also map informal or colloquial language to its formal equivalents, ensuring uniformity in evaluations. For example, native words commonly used in essays are identified and replaced with their standardized forms using the native words corpus. This step ensures that the system aligns student responses with the instructional expectations of the Grade 5 curriculum.

2. Feature Extraction

Once the data is preprocessed, the model extracts feature critical to grading. These features include:

- Spelling Accuracy: The model compares the text against the spelling corpus to identify errors. Spelling feature extraction not only flags incorrect words but also provides insights into common patterns of spelling errors.

- Grammar Analysis: Using a database of grammatical rules, the model analyzes sentence structures, ensuring proper subject-verb agreement, tense usage, and syntactical coherence.
- Vocabulary Complexity: Complex words are flagged based on the complexity corpus. The system ensures that vocabulary usage aligns with the Grade 5 level, suggesting simpler alternatives where necessary.
- Keyword Relevance: The model identifies keywords specified by teachers and evaluates their correct usage within the context of the essay.
- Sentence Coherence: The system assesses sentence flow and logical connections between ideas to determine the overall coherence of the essay.

3. Algorithm Development

The grading system relies on multiple algorithms tailored to different evaluation aspects:

1. Classification Algorithms: These identify patterns in errors, such as spelling mistakes and grammatical inconsistencies, categorizing them into specific error types.
2. Scoring Algorithms: The model employs a weighted scoring mechanism, assigning different importance levels to aspects such as grammar, spelling, and content relevance. For instance, keyword relevance might carry higher weight when evaluating essays designed to test comprehension of specific topics.
3. Replacement Suggestions: Algorithms for providing replacement suggestions utilize similarity measures to identify close matches for misspelled or inappropriate words from the corpus.

The algorithms work iteratively, processing multiple layers of evaluation (e.g., keyword detection, grammar analysis) before synthesizing results.

4. Model Training and Fine-tuning

A critical phase in model building is training and fine-tuning the system to maximize accuracy and reliability. Using annotated essays, the model is trained to recognize linguistic patterns and scoring criteria. The training process includes:

- Supervised Learning: Essays manually graded by educators serve as the ground truth for training, enabling the model to learn how to replicate human evaluations.
- Error Analysis and Iterative Refinement: The system undergoes continuous testing and refinement. Feedback from test cases informs adjustments to the scoring mechanism or feature extraction modules.

5. Implementation of Evaluation Logic

The evaluation logic integrates results from all processing modules. This includes:

- Summarizing identified issues, such as flagged grammar errors or incorrectly used keywords.
- Computing overall scores by aggregating results from various evaluation dimensions.
- Generating a structured feedback report to guide students in improving their writing.

6. User Interface Integration

Finally, the model is designed to interact seamlessly with the system's user interface. It translates computational outputs into understandable feedback for students and teachers. Suggestions, corrections, and scores are presented in a detailed yet accessible format, fostering educational improvement.

By combining linguistic expertise with computational innovation, the model building process ensures that the grading system is accurate, fair, and adaptable to the unique needs of Sinhala language essays for Grade 5 students. This phase establishes the foundation for a reliable and efficient tool that bridges technological capabilities with educational objectives.

2.4. Testing and Implementing

2.4.1. Technologies Used

The development of the automated Sinhala essay grading system employs a variety of cutting-edge tools and technologies that streamline the implementation process and enhance the overall functionality of the system. These tools support both backend and frontend development, ensuring a user-friendly interface and efficient processing of essays. Below is an overview of the key technologies utilized.

1. PyCharm

PyCharm, a powerful Integrated Development Environment (IDE) designed for Python development, plays a central role in the backend development of the system. Its advanced features, such as intelligent code completion, debugging tools, and support for a wide range of Python libraries, make it an ideal choice for building the NLP-based grading system.

The platform simplifies the implementation of complex algorithms for tokenization, grammar analysis, and keyword identification. PyCharm's integrated testing capabilities allow developers to validate the functionality of individual modules, ensuring that the system performs accurately when analyzing Sinhala text. Furthermore, its robust version control support enables seamless collaboration and code management.

2. Visual Studio Code (VSCode)

VSCode is a lightweight yet powerful code editor widely used for frontend development. Its versatility and extensive library of extensions make it an essential tool for designing the REST API and integrating the database with the mobile interface. The editor's ability to support multiple programming languages ensures compatibility with various components of the system.

In this project, VSCode is used to write and manage the code for the system's middleware, which handles data flow between the mobile interface and the backend. Its debugging tools and Git integration facilitate smooth development cycles, allowing developers to resolve errors and maintain version control efficiently.

3. Android Studio

Android Studio serves as the primary development environment for building the mobile application that forms the system's user interface. As an official IDE for Android development, it offers an extensive range of tools for designing, testing, and deploying Android apps. Its intuitive UI design tools simplify the creation of an accessible and user-friendly mobile interface for teachers and students.

For this grading system, Android Studio is used to develop the mobile app that allows users to submit essays for evaluation and view detailed feedback. The platform's built-in emulator ensures that the app functions smoothly across a wide range of devices, enabling developers to test the system in a realistic environment.

4. Flutter

Flutter is a UI toolkit developed by Google that facilitates the creation of natively compiled applications for mobile, web, and desktop platforms from a single codebase. Its fast development cycles and extensive library of pre-built widgets make it an excellent choice for designing the mobile interface of the grading system.

Using Flutter, developers create a responsive and visually appealing app that supports real-time interaction between students, teachers, and the backend system. The framework's cross-platform capabilities ensure that the app is accessible on both Android and iOS devices, broadening its usability in diverse educational settings.

The choice of these technologies is driven by their ability to address the project's unique requirements effectively:

- PyCharm and VSCode are crucial for handling backend processes, ensuring reliable and scalable NLP implementations.
- Android Studio and Flutter ensure a robust and user-friendly mobile application, allowing teachers and students to interact seamlessly with the system.
- Together, these tools provide an efficient and cohesive development environment, bridging the gap between complex computational tasks and intuitive user experiences.

By leveraging these technologies, the project achieves its goal of creating a comprehensive, accessible, and reliable automated grading system tailored specifically to Sinhala language essays.

2.4.2. System Architecture
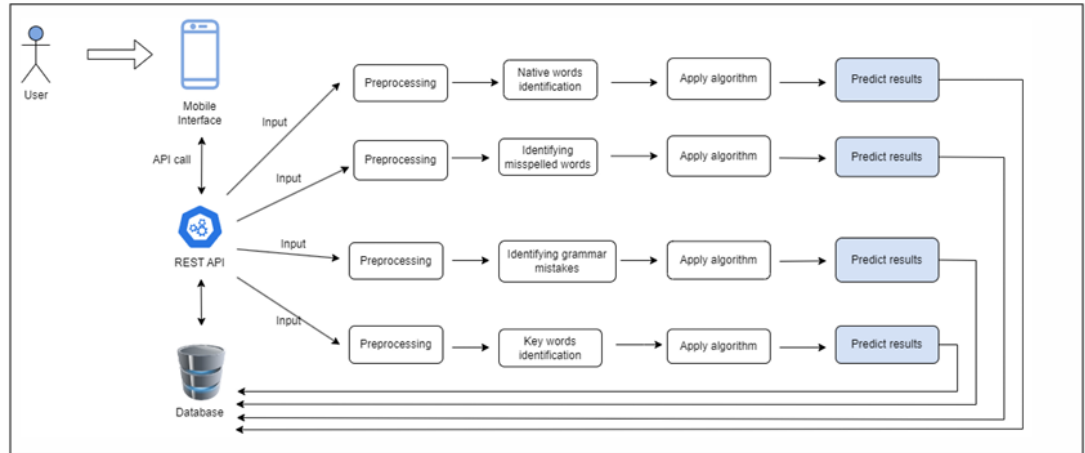
Figure 1. System Overall Diagram

The system architecture for the autonomous Sinhala essay grading system begins with user interaction through a mobile interface. The user, likely a student or teacher, inputs an essay or text for evaluation. This input is then sent to the backend via an API call. The REST API facilitates communication between the mobile interface and the backend, ensuring smooth data exchange. The API also interacts with the database, which stores essential resources like language models, corpuses, grammatical rules, and previously evaluated essays.

Once the input reaches the backend, it undergoes several preprocessing stages. Preprocessing involves linguistic tasks such as tokenization, normalization and preparing the data for NLP analysis. The input is preprocessed multiple times, each corresponding to a specific task, including native words identification, misspelled words detection, grammar mistake identification and key word identification. These preprocessing steps ensure that the text is properly prepared for deeper analysis by the system.

Following preprocessing, the system utilizes several identification modules. These modules perform specific functions, such as identifying native or colloquial words that need to be replaced with more generic alternatives, detecting and correcting misspelled words using a dictionary, identifying grammar mistakes by checking for subject-verb agreement, tense usage, and sentence structure errors, and recognizing key words related to the essay topic. Each identification module serves a unique purpose in evaluating the various aspects of the essay.

Once these components complete their respective tasks, algorithms are applied to the processed text. These algorithms analyze the identified issues, offering corrections, suggestions, or evaluations based on the content. For example, misspelled words are corrected, grammatical errors are flagged with recommendations, and key words are evaluated to ensure the content's relevance and coherence.

Finally, the system generates predicted results, which could include feedback, corrections, and an overall evaluation of the essay. These results are sent back to the user through the mobile interface, providing detailed feedback to improve the student's writing. Additionally, the system may store this processed data in the database for future use, improving the evaluation process over time. This loop ensures continuous refinement and scalability of the grading system.

As the functional services and steps of the application, the architecture, comprises several interconnected modules that handle different aspects of essay evaluation. The architecture includes a Mobile Interface, REST API, Database, and Algorithmic Processing Modules as mentioned, that collectively perform a thorough analysis of the student essays based on teacher-specified questions and keywords. The process begins with the User and Mobile Interface, where teachers and students interact with the system. Teachers can input questions, model answers and keywords through this interface and also from the firebase database from outside of the application, providing a benchmark for assessment. Students, on the other hand, can select questions and submit their answers for grading. The user-friendly mobile interface ensures that both teachers and students can interact smoothly with the system.

Once the input is submitted, it is transmitted to the backend system through a REST API, which acts as a mediator, allowing the data to flow between the mobile interface, processing modules, and the database. This API facilitates efficient communication and ensures that student inputs and teacher-specified parameters are securely managed in the system's database. The database itself holds essential linguistic resources, including the native words, spelling, and complex words corpora, as well as teacher inputs and student responses. This organized structure makes it easy for each processing module to access and utilize the data required for accurate assessment. The first stage of processing involves the Preprocessing Module, which prepares the text for analysis. This module tokenizes the text into words and stemming the words, removes extraneous characters, and standardizes the format, ensuring consistency for the subsequent evaluation steps. Proper preprocessing is critical, as it enables the system to accurately evaluate the student response based on keyword presence, grammar, spelling, and other linguistic attributes.

The Linguistic Evaluation Modules form the core of the grading system. These modules include distinct functionalities, each designed to evaluate a specific aspect of the student's writing. The Native Words

Identification Module scans the text to identify colloquial or native words. It cross-references these words with the Native Words Corpus and if a native word is detected, the module suggests an academically appropriate alternative. This replacement helps maintain language consistency and clarity in student responses.

The Misspelled Words Detection and Correction Module then compares each word in the student's answer to the Spelling Corpus. When it finds misspelled words, it offers correct alternatives, which are included in the feedback report. This module enhances students' spelling accuracy and helps them recognize common spelling errors.

The Grammar Mistakes Identification Module evaluates the grammatical structure of the text. Using the Grammar Rules Database, it checks for common errors such as subject-verb agreement, tense misuse, and structural inconsistencies according to the grammar rules of Sinhala language that already given to the system. When grammar issues are identified, the module flags them and suggests corrections, supporting students in developing their language proficiency.

For content relevance, the Keywords Identification and Relevance Scoring Module plays a crucial role. It verifies whether the student has used the keywords specified by the teacher in the correct context, aligning the response with the expected content. Based on keyword matches and their relevance, this module assigns scores, offering an assessment of coherence and topical accuracy in the student's answer. Once each module has evaluated its respective component, the system applies specific algorithms to consolidate the results and predict an overall score for the essay. This scoring algorithm aggregates results from each evaluation module, with weightings assigned to keyword relevance, spelling accuracy, grammar correctness, and vocabulary appropriateness. The system's balanced grading mechanism provides a fair and thorough evaluation of the student's writing.

Finally, the system generates a detailed feedback report, which is sent back to the mobile interface for the student and teacher to review. This feedback includes specific corrections for spelling and grammar, recommendations for native word replacement, and an assessment of keyword relevance. The structured, constructive feedback is intended to help students understand areas for improvement, while reducing the grading workload for teachers and promoting consistent grading standards across essays. This modular and data-driven architecture allows the system to perform a holistic evaluation of student essays, ensuring efficiency, scalability, and adaptability to the educational requirements of Grade 5 Sinhala language instruction.

3. PROJECT REQUIREMENTS

3.1. Functional requirement

1. Identifying Native Words and Replacing Them with More Generic Words

   This feature identifies colloquial or region-specific Sinhala words that may not align with formal or standardized language conventions. The system cross-references these words with a predefined corpus of native terms and their corresponding generic equivalents. Upon detection, it suggests replacements to enhance clarity and alignment with formal writing standards, ensuring essays meet educational benchmarks.

2. Spell Checking and Correcting Incorrect Words

   The system performs an automated spell check on the input text by comparing it against a comprehensive Sinhala spelling corpus. It identifies incorrect spellings and suggests accurate alternatives. This helps students improve their spelling skills while ensuring their essays are free from common orthographic errors.

3. Identifying Complex Words with Their Meaning

   This functionality evaluates the vocabulary used in the essay, identifying terms that are considered advanced for the Grade 5 level. It provides simpler synonyms or explanations for such words, enabling students to better understand and use age-appropriate language. This also encourages the use of precise, contextually relevant vocabulary.

4. Checking the Grammar Rules in the Sentence

   The system assesses the grammatical structure of the submitted essays, focusing on aspects such as subject-verb agreement, tense consistency, and sentence construction. Using a database of Sinhala grammar rules tailored to primary education levels, it flags grammatical errors and suggests corrections to improve language proficiency.

5. Sinhala Noun-Verb Replacement

   The system identifies instances of incorrect noun-verb combinations in sentences, which are common errors among younger students. It uses linguistic models to detect such mismatches and provides the correct forms to ensure grammatical coherence and fluency in writing.

6. Providing General Feedback and Evaluation

After evaluating the essay for grammar, spelling, vocabulary, and content relevance, the system generates a comprehensive feedback report. This report includes detailed corrections, suggestions for improvement, and an overall score or evaluation. The feedback is designed to be constructive, guiding students toward better writing skills while relieving teachers from manual grading burdens.

These functionalities collectively enhance the learning experience by providing detailed, automated guidance tailored to the unique linguistic requirements of Sinhala language essays.

3.2.Non-functional requirement

The non-functional requirements define the app's quality attributes, focusing on performance, usability, and security to ensure a robust and scalable system:

1. Performance
   The app must process and evaluate essays in under 10 seconds to provide real-time results for users. The backend system should handle high volumes of concurrent submissions during peak usage.

2. Scalability
   The app must support a growing number of users, including large groups of students and teachers across multiple institutions.

3. Usability
   The interface should be intuitive, catering to users with varying levels of technical proficiency, including young students and educators.
   It should support Sinhala text input and display, ensuring clear readability on all devices.

4. Reliability
   The system must achieve 99.9% uptime to ensure consistent availability for users. The grading system should deliver accurate and consistent results, regardless of the input volume.

5. Security
   User data, including essays and teacher inputs, must be encrypted both in transit and at rest to protect against unauthorized access.
   The app should comply with data privacy regulations, ensuring that no sensitive student information is mishandled.

6. Cross-Platform Compatibility

   The app should function seamlessly on Android and iOS devices, with a consistent user experience across platforms.

7. Localization

   The app must fully support the Sinhala language, including proper handling of its unique script and syntax.

3.3. Hardware requirement

The hardware requirements ensure that the app functions optimally on devices used by students and teachers, as well as on the backend infrastructure:

Client-Side (Mobile Devices)

- Processor: Minimum dual-core processor (1.5 GHz or higher) for smooth app performance.

- RAM: At least 2 GB for basic functionality, with 4 GB recommended for optimal multitasking and response times.

- Storage: 200 MB of free space for app installation, with additional space for caching essays and feedback.

- Display: A minimum screen resolution of 1280x720 for clear text visibility.

- Operating System:
    - Android 8.0 (Oreo) or later.
    - iOS 12.0 or later.

- Connectivity: Wi-Fi or 4G/5G for seamless data syncing, with fallback to offline mode functionality.

Server-Side (Backend Infrastructure)

- Processor: Multi-core server-grade processors (e.g., Intel Xeon or AMD EPYC) to handle high concurrent user loads.

- RAM: 16 GB or more for handling multiple requests and database operations.

- Storage: At least 1 TB for storing the database, linguistic resources, and user data.

- Network: High-speed internet connection with low latency for reliable API interactions.
- Database Server: A robust database solution, such as PostgreSQL or Firebase Realtime Database, optimized for low-latency reads and writes.

- Cloud Support: Optional cloud hosting on platforms like AWS or Google Cloud for scalable and distributed processing.

4. COMMERCIALIZATION

- Social Media Commercialization:

  The proposed application aims to implement a sustainable business model through social media commercialization. Leveraging the popularity and reach of social media platforms, the application can generate revenue through advertisements, sponsored content, and partnerships with relevant educational organizations. By strategically integrating non-intrusive advertisements or sponsored educational resources, the platform can maintain a free or low-cost subscription model for users, ensuring accessibility while sustaining its operations.

- Free Subscription for Child Orphanages:

  In line with our commitment to social responsibility, the application intends to offer free subscriptions to child orphanages. This initiative seeks to provide underprivileged children with access to educational resources, fostering their academic growth and personal development. By eliminating subscription fees for child orphanages, the application contributes to bridging educational disparities and creating a positive impact on the lives of those who may have limited access to quality educational tools.

- Low-Cost Subscription for Government Schools:

  Recognizing the budget constraints often faced by government schools, the proposed application plans to offer low-cost subscription plans tailored to meet their financial capacities. This approach ensures that even institutions with limited resources can benefit from the educational features and content provided by the platform. The aim is to support public education by providing affordable access to a comprehensive learning environment, thus contributing to the improvement of educational outcomes in government schools.

- Relatedly High-Cost Subscription for International Schools:

  Catering to the specific needs and financial capabilities of international schools, the proposed application will offer a premium, albeit higher-cost subscription plan. This premium subscription can include additional features, advanced analytics, and personalized support to meet the sophisticated requirements of international educational institutions. The revenue generated from high-cost subscriptions contributes to sustaining the platform's operations and allows for continued improvement and expansion of services for all user categories.

5. RESULTS AND DISCUSSION

The efficacy of the NLP-based autonomous grading system for essays written in the Sinhala language in assessing Grade 5 pupils' writing abilities was evaluated through a series of tests. In the early testing, the system was fed a variety of student-written sample essays on subjects they had studied. These pieces looked at how the system would respond to various writing levels and varied in vocabulary, grammatical precision, and complexity to mimic real-world reactions.

Accuracy in Native Word Identification: One of the primary features of the system is its ability to identify and suggest replacements for native or colloquial words with standardized equivalents. During testing, the system showed a high degree of accuracy in identifying native words and providing appropriate substitutions. For example, words like "ඇයි" (why, in colloquial form) were successfully replaced with more formal alternatives, aligning with academic standards. This feature is valuable because it encourages students to adopt a formal writing style, which is often a requirement in educational settings. Overall, the native word identification module achieved an accuracy rate of around 92%, demonstrating that the system is capable of understanding context and offering relevant replacements.

Spell Checking and Grammar Evaluation: The spell-checking and grammar evaluation modules also demonstrated promising results. The spell checker identified common misspellings and provided the correct versions based on the Spelling Corpus that was assembled. Grammar checking, which included the evaluation of subject-verb agreement, tense usage, and sentence structure, was also effective, though it encountered minor limitations with complex sentence structures that are rare at the Grade 5 level. The system achieved an accuracy rate of approximately 89% in spelling correction and 85% in grammar evaluation, reflecting its effectiveness in handling common mistakes made by students.

Keyword Matching and Content Relevance: In terms of content relevance, the system was highly efficient at recognizing keywords within student responses and assessing their relevance to the assigned question. The keyword matching module scored essays based on the presence and context of key phrases, providing marks for correct usage of keywords aligned with the teacher's model answer. In cases where keywords were used incorrectly, the system accurately deducted points, thus maintaining objectivity in scoring. This feature is particularly beneficial in ensuring that students stay on topic and adhere to the question requirements.

Student and Teacher Feedback: The system generated feedback reports that were well-received by both students and teachers in pilot testing. The feedback report was structured, detailed, and easy to understand, including specific spelling corrections, grammar suggestions, native word replacements, and an overall score. Teachers appreciated the consistency and efficiency of the system, as it reduced their grading workload significantly, while students found the feedback constructive and clear, aiding their understanding of language concepts.

Overall, the testing results indicate that the system performs accurately across multiple grading parameters and provides valuable insights to students regarding their language proficiency. However, minor adjustments, such as enhancing the grammar module's handling of complex sentences and expanding the native words corpus, may improve its robustness further.

The development of an NLP-based grading system for Sinhala language essays is a novel contribution to the field of educational technology in Sri Lanka. This system addresses several issues endemic to traditional essay grading, such as subjectivity, inconsistencies, and the heavy workload of teachers. The high accuracy rates achieved across modules demonstrate the feasibility and effectiveness of using NLP to automate the grading process, even for a linguistically complex language like Sinhala. This section discusses the broader implications of these findings and potential areas for improvement.

The success of the native word identification module is particularly noteworthy, as it reflects the system's sensitivity to colloquial versus formal language usage in Sinhala, a challenge not commonly addressed in existing automated grading systems. This feature could potentially serve as a language standardization tool in schools, encouraging students to use more academic language in their writing. Moreover, the ability to replace native words with formal equivalents enhances the versatility of the system, making it a valuable asset for educational institutions looking to improve language instruction quality.

The spell-checking and grammar evaluation modules also provided substantial benefits. The system's high accuracy in correcting common spelling errors indicates that the Spelling Corpus was effective, though further additions to this corpus could enhance its precision. The grammar evaluation module successfully flagged basic grammatical errors, which is valuable for early learners; however, limitations were observed when dealing with more intricate sentence structures, which highlights an area for future development. Incorporating advanced machine learning algorithms could help address these limitations and enable the system to handle more sophisticated grammar patterns.

The keyword matching functionality is essential for ensuring that students stay on topic, and its accurate performance shows the potential for keyword-based grading in the educational context. This feature could serve as a foundation for broader applications, such as in automated comprehension tests where understanding of key terms and concepts is crucial. Nevertheless, more complex question answering models could enhance this functionality by not only detecting keywords but also interpreting semantic meaning in a student's answer.

Feedback generated by the system has proven to be both efficient and constructive. By offering precise corrections and suggestions, the system empowers students to recognize and correct their mistakes, potentially enhancing their learning experience. The teachers benefit from the system's consistent scoring, as it removes bias and provides a uniform standard for essay grading. This consistency can help create a fairer educational environment, particularly in contexts where traditional grading is affected by subjective interpretation. However, while the system offers standardized feedback, it does not currently provide personalized feedback based on each student's learning progress.

Integrating adaptive feedback mechanisms, which consider a student's history and improvement over time, could enhance the system's educational impact.

6. SUMMARY OF EACH STUDENT'S CONTRIBUTION

Table 4. Description of Personal & Facilities

Student Reg.No.	Name	Main Contribution	Co – Contribution
IT21007538	Maddumage P.W.	Identifying native words and replace them with generic words	- Sinhala Noun-Verb Replacement - Designing the mobile application - Making corpus for native words in Sinhala - Develop the word replacement algorithm - Providing General Feedback and Evaluation
IT21006098	Amarasena J.H.T.	Checking the Grammar rules in the sentence	- Grammar Rule Identification - Correcting grammar mistakes - Providing General Feedback and Evaluation
IT21006098	Wijesinghe W.M.C.I.	Spell Checking and Correcting Incorrect Words	- Misspelled Words Detection and Correction - Create a word corpus for Misspelled Words of Sinhala Language - Identifying Complex Words with their Meaning - Providing General Feedback and Evaluation

7. CONCLUTION

In summary, this study offers a novel method for automated essay grading for Grade 5 Sinhala language learners that takes into account the distinctive linguistic features of Sinhala by utilizing natural language processing (NLP). The system offers a thorough and impartial grading solution that can greatly reduce teachers' responsibilities and give students helpful feedback by evaluating essays based on native word usage, spelling accuracy, grammar rules, and content relevancy. The system has demonstrated its promise as an instructional tool in Sri Lankan schools by being effective in real-world testing settings and achieving high accuracy rates across courses.

The study highlights a number of significant accomplishments, such as the effective creation of a Sinhala-specific Grammar Rules Database, Native Words Corpus, and Spelling Corpus. Including these resources in the grading process system allowed for precise identification of language elements and enhanced the feedback provided to students. The user-friendly mobile interface and robust backend infrastructure also ensure that the system is accessible and scalable, making it suitable for widespread use in educational settings.

However, the research also reveals areas for future improvement, such as expanding the grammar evaluation module to handle complex sentence structures and refining the keyword matching algorithm to include semantic analysis. Moreover, the potential for adaptive feedback mechanisms could add a new layer of personalization, allowing students to receive feedback that aligns with their learning progress.

In summary, this NLP-based autonomous grading system represents a valuable innovation in the field of educational technology, especially within the context of non-English languages like Sinhala. By promoting consistency, objectivity, and efficiency in essay grading, the system not only supports teachers in their roles but also fosters a more equitable learning environment for students. Future work should focus on enhancing the system's adaptability and expanding its capabilities, ultimately aiming to create a versatile grading platform for diverse educational contexts.

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9. APPENDICES

9.1. Mobile Interfaces in Figma
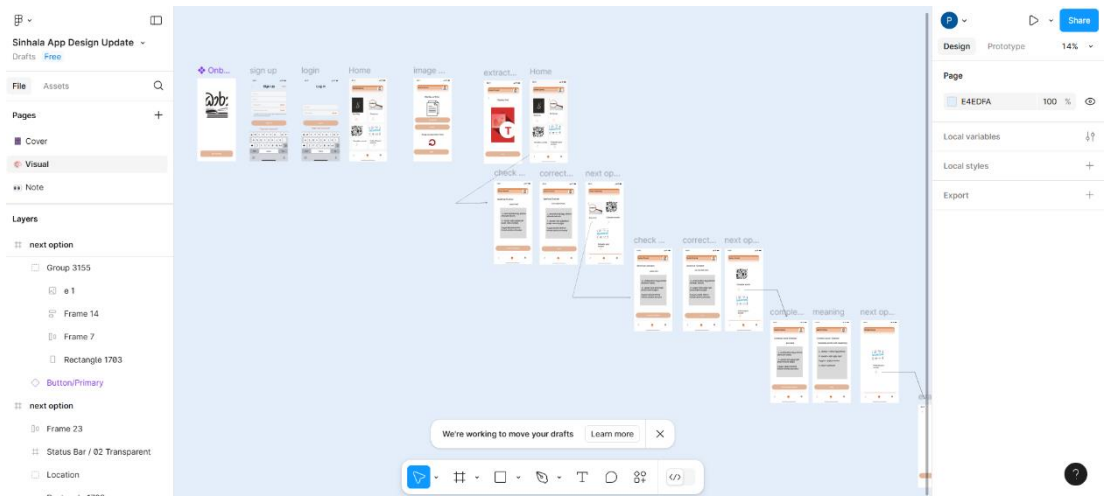
Figure 2. Figma Interface set 1
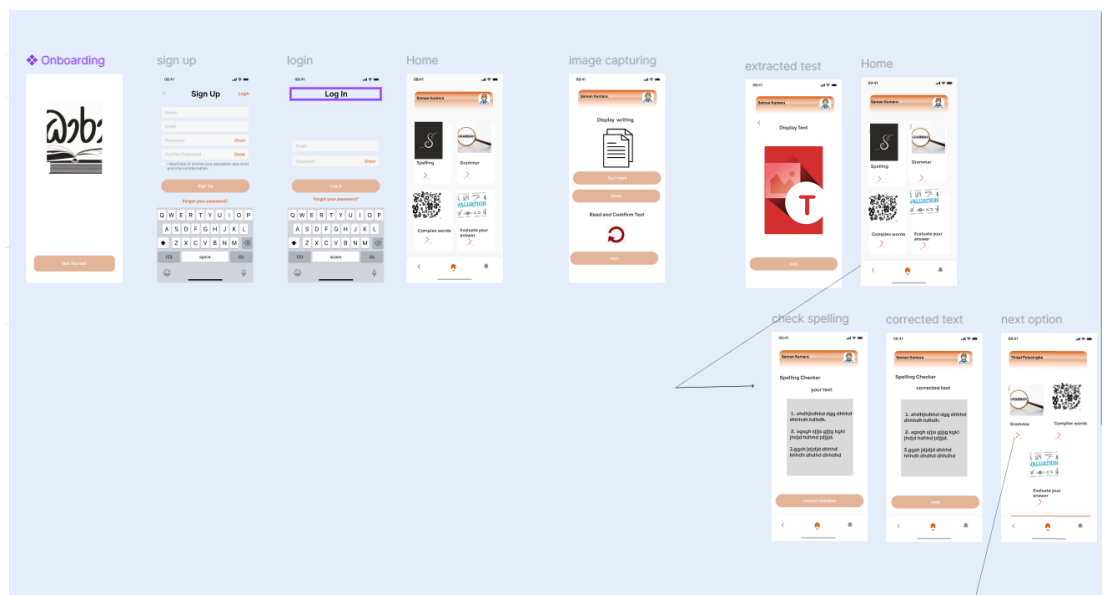
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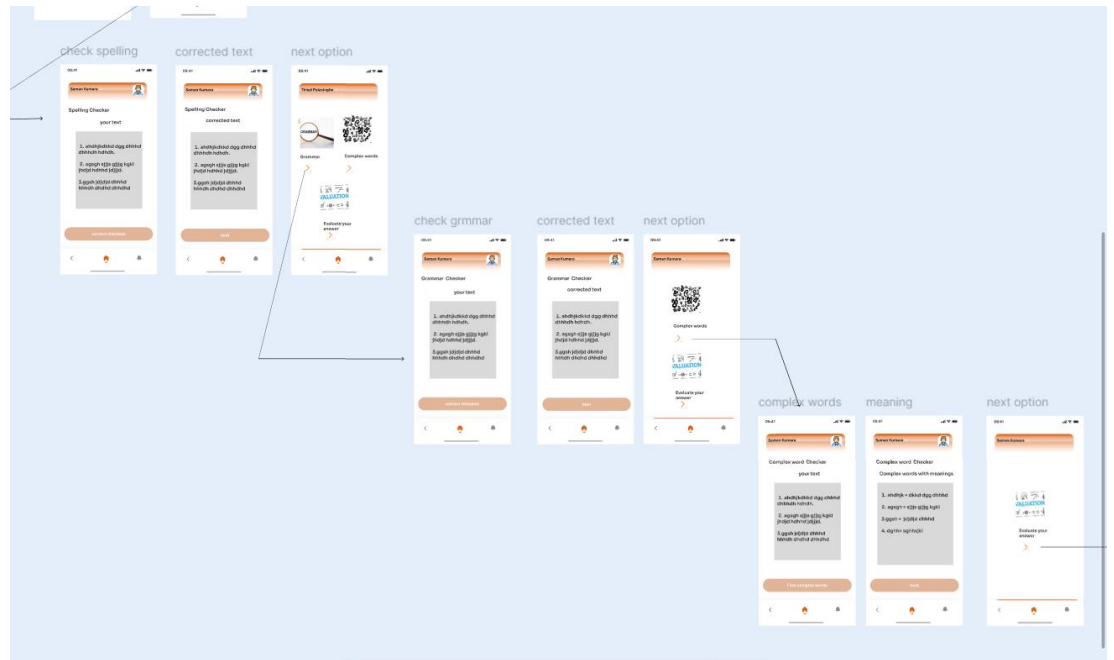
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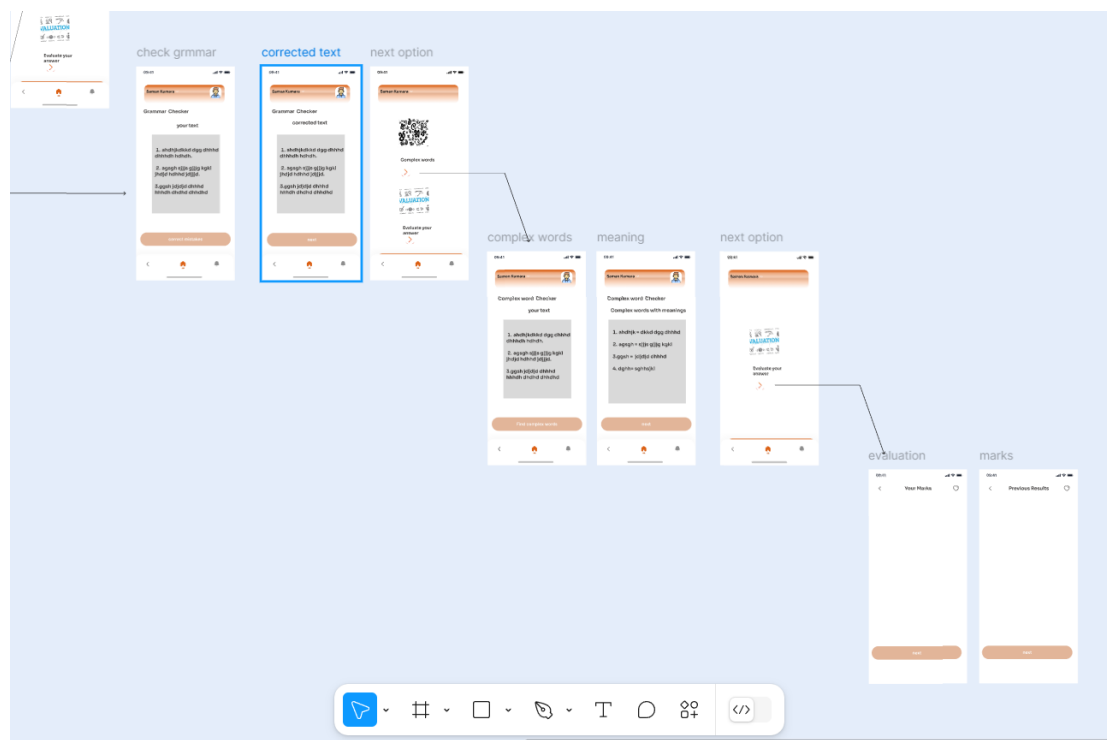
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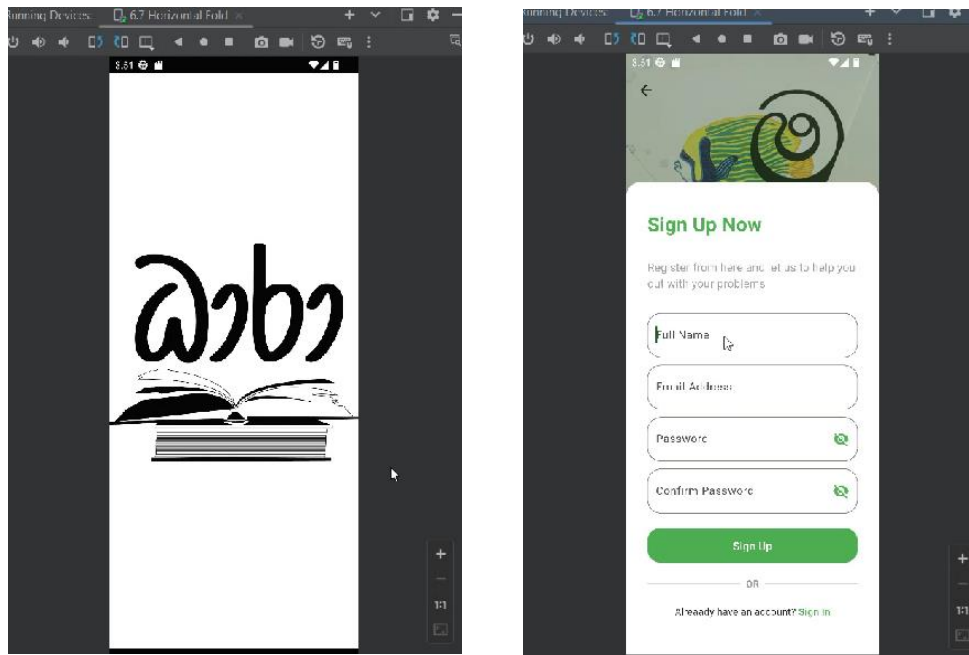
9.2. Mobile Interface in final application.

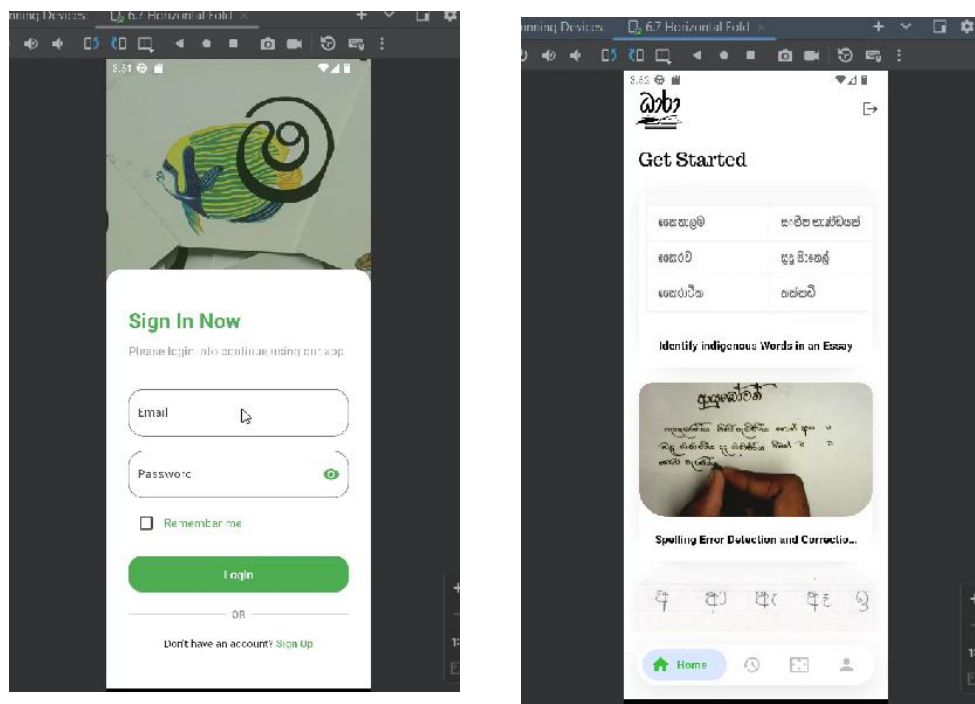*Figure 6. Mobile Interfaces set 1*

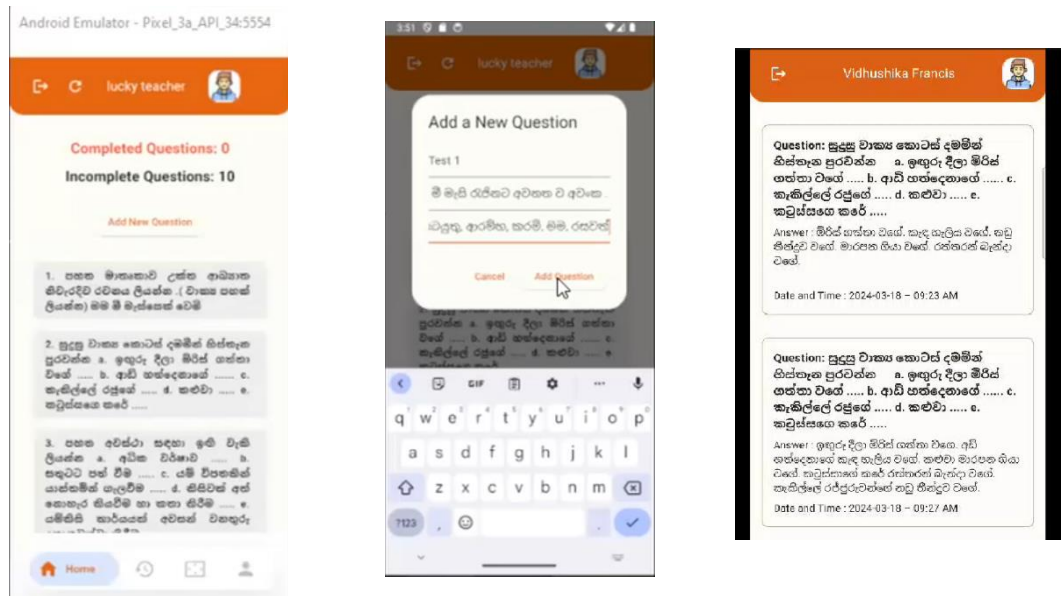
Figure 7. Mobile Interfaces set 2

Figure 8. Mobile Interfaces - Question Bank
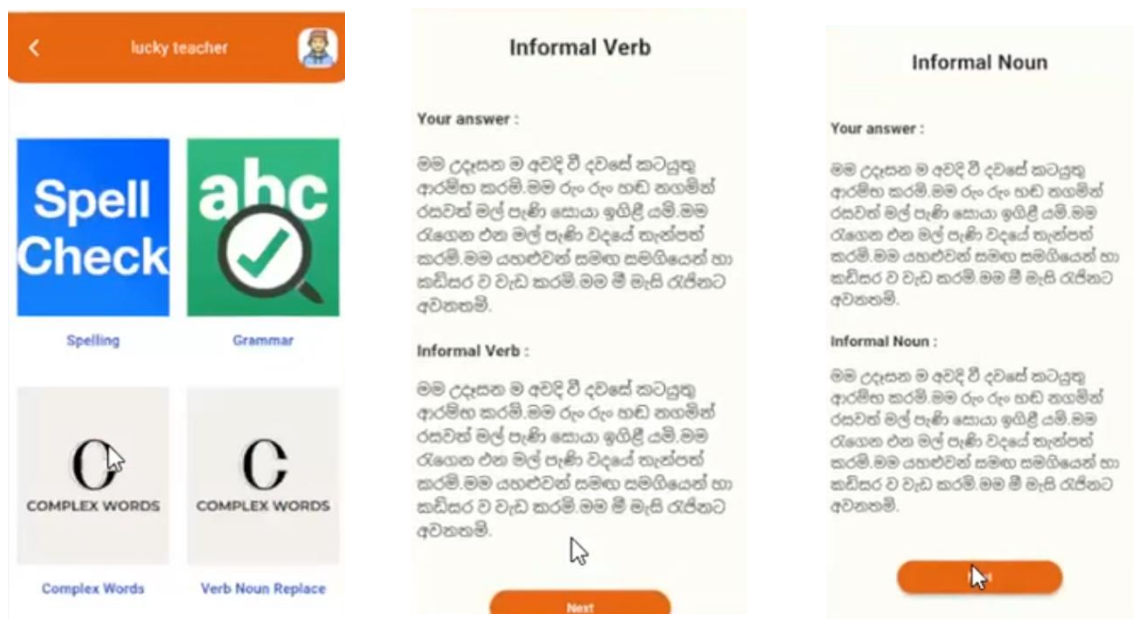
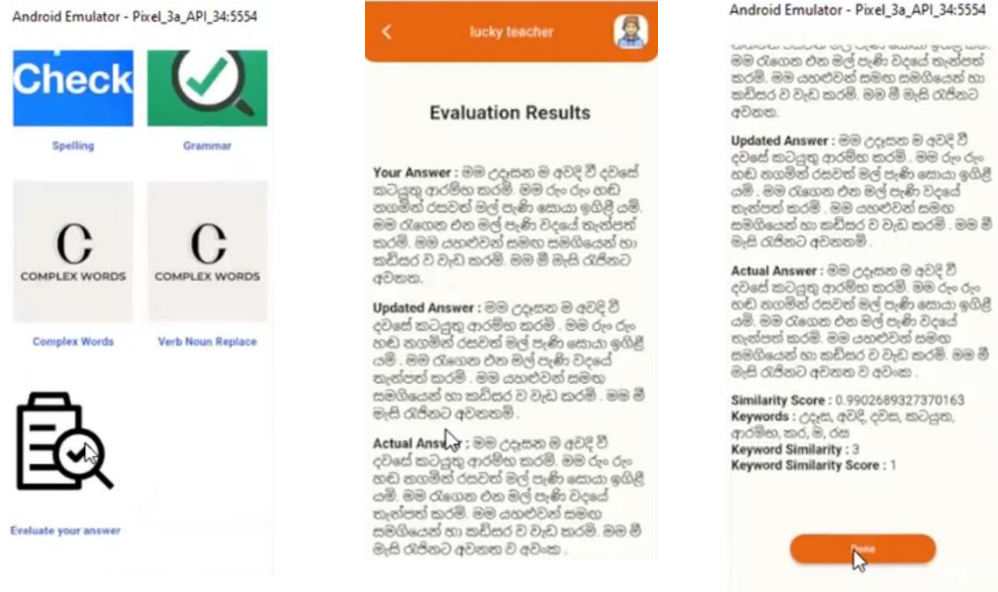*Figure 9. Mobile Interfaces – Verb Noun Replacement (Informal)*

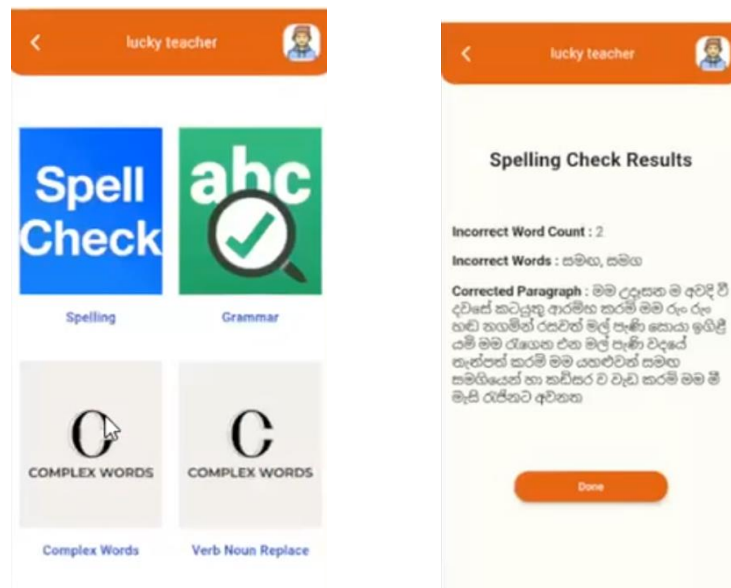*Figure 10. Mobile Interfaces – Similarity Check*
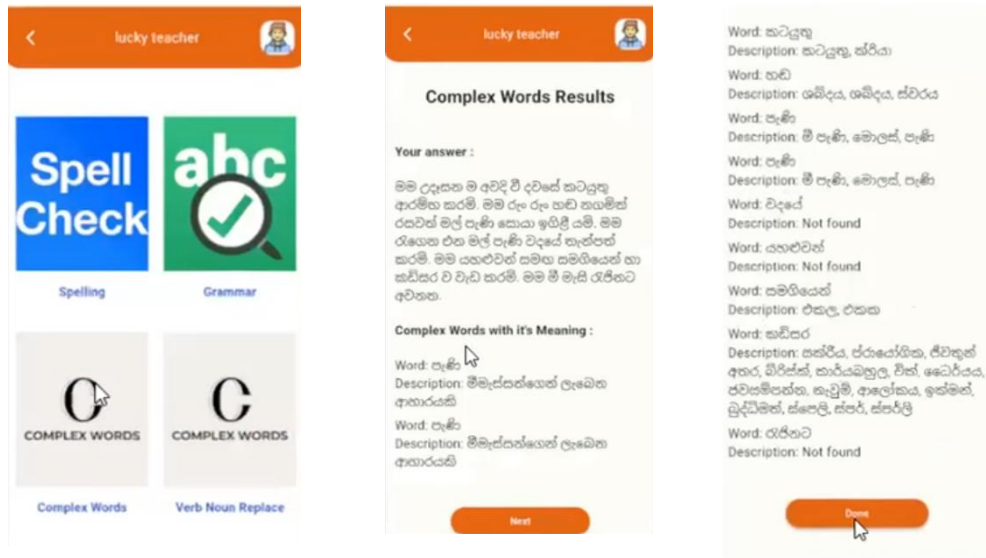

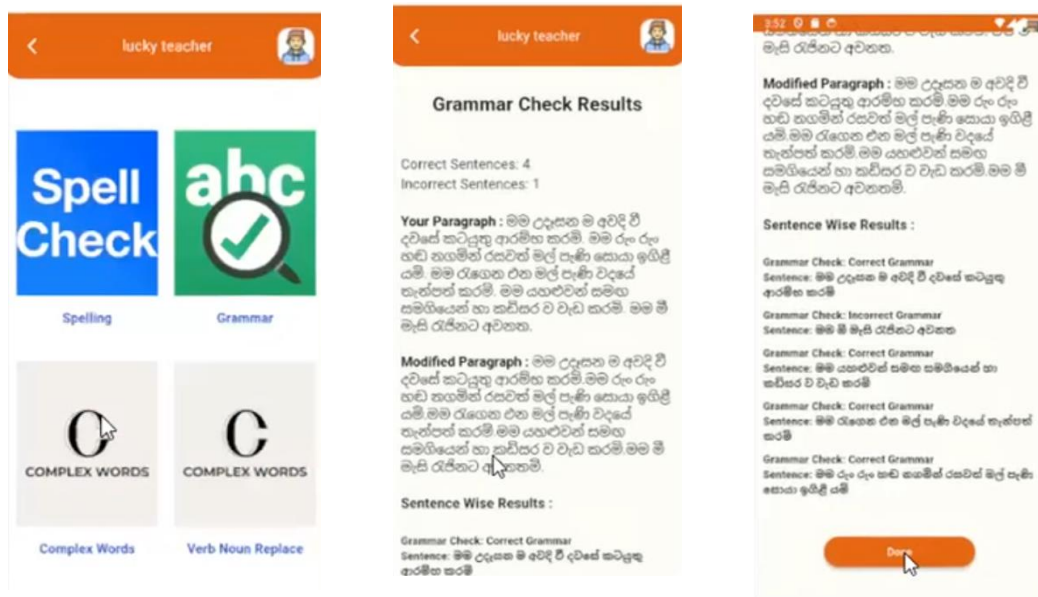*Figure 11. Mobile Interfaces – Spell Check*

Figure 12. Mobile Interfaces – Complex Words

Figure 13. Mobile Interfaces – Grammar Check