

Ceylon Translate: A Multimodal Translator for Sinhala to English and English to Sinhala Translations.

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Abstract: - This research article introduces ‘Ceylon Translate’ a novel method that employs a dynamic integration of a novel method that employs a dynamic integration of language translation and community interaction. Fundamentally, this application functions to dismantle linguistic obstacles. The translation interface, which is powered by Google Cloud services, enables users to seamlessly convert text across different languages. The application possesses the ability to translate Sinhala words that are written in either Sinhala or English and can translate the text to English and vice versa. In addition, it utilizes Optical Character Recognition and Document reading capabilities to translate photos and documents. The application also promotes a post system powered by community engagement, facilitating the posting of inquiries, and enabling users to engage with the inquiries of others. In addition to its translation capabilities, the application places significant importance on the conservation of translation records. This functionality not only simplifies future referencing but also allows users to seamlessly change and retranslate text as needed. A survey conducted on the usage of the app, showed that 72.8% of participants found the experience to be positive in their English learning environment.

Keywords: *sinhala to english translator, english to sinhala translator, image character recognition, pdf translation introduction*

1. Introduction

Sinhala is a language, which over sixteen million people use as their first language and another four million people speak Sinhala as their second language. Derived from the Sanskrit language, it has also been inspired by Tamil, Portuguese, Magandhi, Dutch.

However, English is a language that has its origins in England. It is utilized widely as a secondary language and functions as an official language on a global scale, [1] states that an estimated 1.35 billion individuals using it for communication. because of that proper knowledge in English has become a requirement, especially in higher education and professional settings.

For past few decades numerous research papers has been published indicating solution for the accurate Sinhala to English and English to Sinhala translation issue. Most of these solutions describe translators who could do the translation using unique techniques like breaking sentence to words, converting words to “Singlish”. And, in past few years, translation facility for Sinhala to English and English to Sinhala was available through online platforms which can be used for translating not only text inputs, but also image, voice, and files. With the rise of Artificial Intelligence in the past few years text and voice-based content generation is also available over the internet.

Even though all these facilities possessed great abilities, accurate translations of English to Sinhala and Sinhala to English became a tedious task, since extracting an accurate meaning from a non-similar language is hard.

In today's interconnected world, it is crucial for students to understand and speak multiple languages. However, current translation web apps often fail to cater to the specific needs and limitations of Sinhala-speaking students. Many struggles with understanding and using English, limiting their access to educational resources, and

hindering their academic growth. There are currently no translation web apps designed to meet the needs and interests of students, and they often struggle to find easy translation methods. Image-to-text translation services are often available for a fee, but they are not free and can be costly for young learners. Additionally, there are few accurate voice-to-text translators from Sinhala to English, making it difficult for them to communicate effectively.

The "Ceylon Translation" web app aims to address these issues by allowing Sinhala-speaking students to translate PDFs, convert images into text, and convert their voices into text. By creating a dedicated online group, the app aims to improve education and boost confidence in using multiple languages. By using the "Ceylon Translation" app, students can overcome language barriers, access valuable information, and develop essential skills in a globalized world.

The research presents a significant contribution in addressing the prevailing challenges experienced by Sinhala-speaking students within the context of today's globalized society. The "Ceylon Translation" web app stands as an essential tool aimed at ameliorating the linguistic barriers hindering their educational attainment and access to valuable resources. Of notable significance is the app's tailored design, specifically catering to the unique needs and interests of students, as it offers cost-free image-to-text and voice-to-text translation capabilities. This technology empowers young learners to surmount language obstacles, thereby facilitating their access to educational materials and fostering the development of crucial multilingual skills. Moreover, this research holds broader implications for the advancement of educational technology, contributing to the practical application of language translation tools. Ultimately, it has the potential to enhance global communication, cross-cultural exchange, and the cultivation of a more inclusive and interconnected global community.

The objectives of this research are twofold. Firstly, to establish a platform that enables students to openly share their thoughts and concerns, facilitating the exchange of answers and replies within a supportive community. Secondly, to provide a versatile platform that encompasses the translation of various content types, including texts, images, voices, and PDFs, to enhance students' access to information and learning materials.

The study delves into several key research questions designed to align with its specific objectives. Firstly, it investigates the impact of automated translation tools on the comprehension and retention of foreign language course materials. Secondly, it seeks to ascertain whether a discernible difference exists in study productivity when translating course PDFs as opposed to employing alternative language learning methods. Additionally, the research explores the influence of collaborative efforts with classmates in the translation of course materials on overall learning outcomes. It also examines the relationship between the frequent use of translation apps and enhancements in foreign language skills within the context of online learning. Furthermore, the study evaluates the efficiency of image translation technology compared to text-based tools for language learners. It also investigates potential disparities between machine translation tools and human translation services in the context of online interactions and research. Moreover, the research aims to determine the utility of online translation tools in aiding comprehension of course content. Lastly, it assesses the effectiveness of translation tools in facilitating communication with individuals of diverse ethnicities, cultures, and backgrounds. These meticulously formulated research questions provide a structured framework for the study's exploration into the multifaceted impact of translation tools on language learning and communication.

The paper will give a brief understanding of the existing translation models and applications, the process and methodology used to design and implement Ceylon Translate.

2. Literature Review

With the growth of the internet, people have become increasingly exposed to multiple languages as well as multiple cultures. Considering that English is a very common language in the South Asian region, many applications have been developed to translate local languages to English. However, given the advancement in Artificial Intelligence, very advanced language models have been developed that out-date previous ones that do not use artificial intelligence.

Machine translation models are a category of translation algorithms that use rule-based and example-based translation. Source [2] cites a Sinhala-to-English translator app that uses rule-based machine translation that can translate Sinhala texts to English with an accuracy of 87% in converting 500 wellstructured Sinhala sentences to

English. Sources [3] and [4] cite translation app that also follow a rule-based machine translation that has a 75% success rate of translating 150 wellbalanced sentences. On the other hand, source [5] references an example-based translation model, that uses a scoring algorithm to rate sentences of similar meaning to find an optimal translation for a given sentence. It has BLEU scores of 0.17 -0.26 for 3-gram.

Moreover, more complex models that use Neural Machine Translation (NMT) have been proposed as they perform well in high-resource settings. [6] Cites an English to Sinhala translator that use state-of-the-art neural machine translation techniques to power their translation. Global giants such as Google and Microsoft have also introduced NMT models. Google translate [7] has achieved an accuracy between 55% and 94%. Meanwhile Microsoft Translate boast an accuracy of 80%-90%. However, the drawbacks of these models are that they struggle to accurately translate the meaning of cultural or religious context.

3. Methodology

The system will have four main functionalities: a primary translation interface, PDF translation, image character recognition, and a translation-based community platform as shown in Fig. 1. The app was developed using the MERN stack [9] and other frameworks such as Mongoose, CORs, and Axios as well as the Google Translate API [10] as the main translation interface for the system.

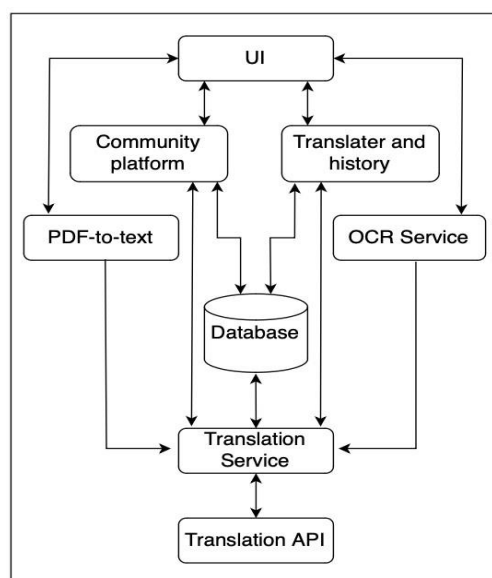


Fig. 1. System Overview

The translation Service is the main translating functionality of the system and is responsible for identifying languages from texts' and translating text. It works by taking in objects containing strings and processing them via accessing the Google Translate API and its methods [10]. It then returns the translated string in a language of one's choosing.

A. Text Translation and User History Management

Once a text is entered via the translation interface, text data is passed to the translation service in the form of a string object. Within the translation service, an automated language detection mechanism identifies the source language, and depending on the situation, the content is then translated into either English or Sinhala. Subsequently, both the translated text and the original input text are stored within the database as depicted in Fig. 2. Finally, the resultant translation is passed to the front-end user interface for presentation and interaction.

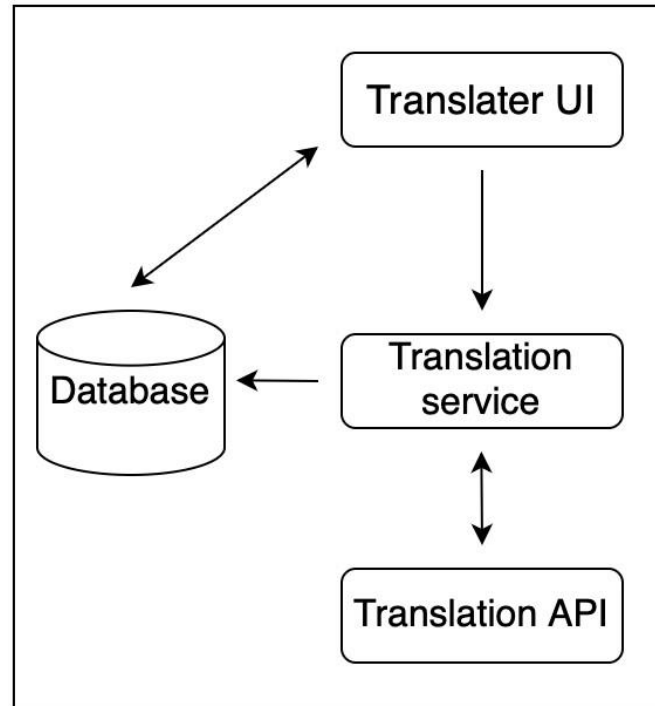


Fig. 2. Demonstration of how image-to-text translation works.

Translation history management feature allows users to access their past translations, facilitating future usage. This is particularly advantageous when dealing with comparable content or phrases, as it eliminates the need for users to repeatedly translate identical text. Moreover, this feature is highly valuable in cases where users unintentionally lose or delete their translations.

According to this feature, users can review their past translations by navigating to the history page. With a single click, users can import past translations into the translator interface, subsequently allowing them to edit and re-translate as needed. Additionally, users have the option to delete their translation history if they wish.

B. PDF-to-Text Translation

The PDF translation feature works via taking in a PDF file using React as shown in Fig. 3. This file is then parsed to the server, where it will be read using PDF parse [11] and its content will be stored as a string object. This allows the translation service to translate this stored string to the required language (specified). The translated text is then handled by a write service that will write the translated text to a file/PDF.

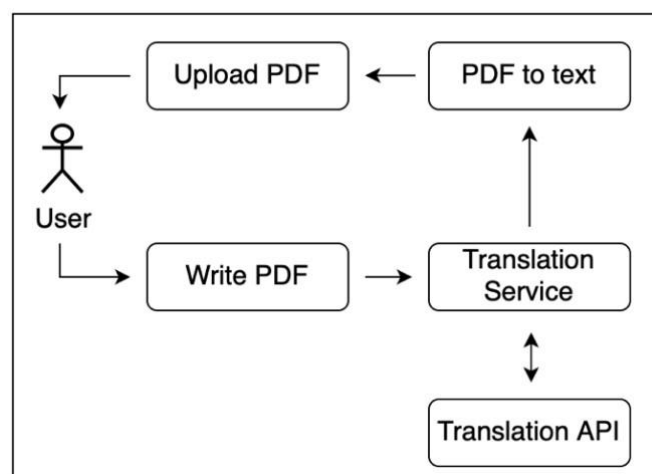
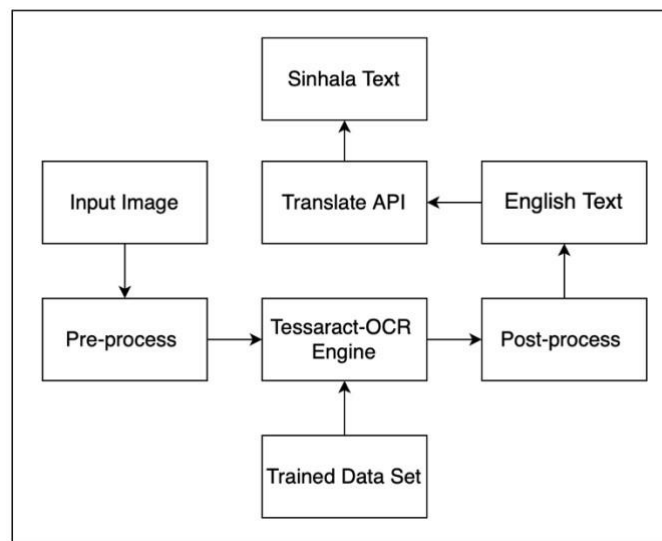


Fig. 3. Demonstration of how PDF translation works.**C. Image-to-text translation**

Using the MERN stack and Optical Character Recognition (OCR) to do image-to-text translation from English to Sinhala is a multi-step process. First, the front end is made with the MERN (MongoDB, Express.js, React, Node.js) stack, which makes it easy for people to add images. The frontend talks to the backend, which was built with Node.js and Express.js, to handle picture requests and uploads. The backend stores the picture and starts the OCR process when an image is uploaded.

For OCR, a library or API from Tesseract.js [12] is used to pull text from a picture. The English text that was taken out is then sent to a translation service, which turns it into Sinhala. The Sinhala text that has been translated is sent back to the front end and shown to the user. The overall process operates as depicted in Fig. 4. The translation data and user activities are kept in a MongoDB database, which makes it easier to make changes and do research in the future. This method uses a mix of current web development tools, optical character recognition (OCR), and translation technologies to translate images to text from English to Sinhala.

**Fig. 4. Demonstration of how Image-to-Text translation works.****D. Community Post Platform**

The post community platform system is responsible for the task of knowledge sharing. It is like a simple social media platform. Users of the application can share the problems, ideas and thoughts related to the translations and the languages. Users can publish articles. Once a user publishes an article fellow users can add their thoughts as a comment in an integrated comment system. A User can view, update, delete the respective articles and comments, while the users only can view and comment on other users' posts. In this manner user authorization and authentication facility is also enabled.

In a diverse linguistic landscape, this system stands out by addressing potential communication challenges head-on. By enabling interactions in both Sinhala and English, it empowers users to express themselves in their preferred language, fostering a more inclusive and accommodating environment. This thoughtful approach not only enhances the overall user experience but also promotes cross-cultural understanding and knowledge sharing among a broader community.

4. Results and Discussions

Based on the conducted survey, it was noted that 72.8% of the users had a positive effect when understanding and remembering course material in a foreign language via a translation application. Furthermore, 81.7% of the respondents utilized translation tools in their coursework, with 70% of these users acknowledging the benefits

of these tools for their overall learning experience. Surprisingly, almost 30% of the respondents expressed a preference for humanbased translation over machine translation, citing their belief in its higher accuracy. Conversely, approximately 65% of the respondents favored the convenience of machine translation.

It is also worth noting that 72% of the users indicated a preference for image-based translation over text translation. These findings highlight the significance of incorporating user preferences and perceptions into the development of translation applications, emphasizing the need for a balanced approach that integrates the strengths of both human-based and machine translation methods to enhance the overall user experience.

A. Flaws in the Current System

One flaw in the current translation system is its inability to accurately translate certain words from English to Sinhala and vice versa. Fig. 5 denotes such an instance, where the system does not accurately convey the translation as intended. This behavior is common in instances where a Sinhala word translates to 2 or more words and words that are unique to Sri Lankan culture. Additionally, in cases where new terms emerge in the Sinhala language, this flaw becomes apparent. Identifying these types of words is a tedious task, and replacing the correct translation with the translations provided by Google translation services is an essential task that needs to be addressed.

To address this issue, integrating a separate database system with the application is crucial. This database should contain the accurate translations of these intricate words. Consequently, the application needs to have the capability to filter out the correct translations of the words using the database system. This integration will help improve the accuracy and reliability of the translation system, ensuring that users receive the most precise and contextually appropriate translations for their needs.

Input	Output	Expected Output
ජම්බු	Jambu	rose apple
rose apple	රෝස් ඇපල්	ජම්බු

Fig. 5. Inaccuracies in the translation model

B. Future Research Directions

In the pursuit of enhancing the application's accuracy, there exists an intention to implement a feature designed to identify, store, and precisely translate intricate Sinhala and English words carrying cultural significance and nuanced vocabulary. To achieve this, a dedicated database model will be created, ensuring systematic storage and retrieval of these words. However, recognizing culturally significant words in Sinhala is a complex task, given their layered context, and deciphering their meanings in diverse contexts adds another level of intricacy. Despite these challenges, the team is devoted to employing advanced algorithms, aiming to deliver translations that are linguistically precise, culturally sensitive, and contextually accurate. This approach underscores the application's commitment to fostering genuine cross-cultural understanding, setting a new standard for language translation applications.

In the same vein, the team will also implement the Text to Speech feature using the Google Text to Speech API [13] in the future. This implementation will enable the synthesis of both Sinhala and English text into their respective audio formats, catering to a diverse audience. This addition will accommodate users who prefer either Sinhala or English as their language of choice for consuming auditory content.

5. Conclusion

This system helps break down language barriers for native Sinhala speakers. By facilitating instant translation of diverse content and empowering individuals to share information across the user community of the application, it enhances the efficiency of workers and students by translating documents and simplifies the process of extracting information from printed materials. With the ability to identify and translate text through a simple photograph, the system promotes a streamlined workflow, saving valuable time and effort. Moreover, this platform goes beyond mere translation, it fosters meaningful discussions and deeper understanding among users. By providing accessible for discussions and articles, it becomes a catalyst for knowledge sharing and cross-cultural interactions. In essence, this innovative solution bridges language gaps and assist users to discuss and better understand the subject matter being discussed.

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