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Braille Converter and Text-To-Speech Translator for Visually Impaired People in Sri Lanka

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Abstract

This research aims to provide visually impaired people to better document controlling in their day to day life using natural language processing. It mainly consists with three main components including Text to speech, Brail converter and Language translator. Language translator, convert Sri Lankan mother languages into Braille language, such as Sinhala language into Sinhala Braille, English language into English Braille, and Tamil language into Tamil Braille. When the visually challenged people used text edition, users are capable to translate those words using mother language translator to translate the natural languages they prefer. Under the translator Sinhala, Tamil and English language could be translated. This system helps to any new user specially the visually challenged people to overcome their real communication issues and day today works efficiency. This system is tested with using three different types of users including school principal, teachers and blind students in Rathmalana Blind School in Sri Lanka. Satisfaction rates among the tested group are high.

Keywords

Braille Converter, Text-To-Speech Translator, Visual Impaired People, Language Translator

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1. Introduction

Braille Converter and Text-To-Speech Translator is a research project which has been done under the domain of Natural language processing. The aim of this research is to develop a "Braille Converter and Text-To-Speech Translator" for visual impaired people. Among the Sri Lankan population, visual impairment is becoming more common. There were many Braille converters and translators are developed but when it consider into Sri Lankan usage, Users are facing with some of the limitations and faults. Because of that they are facing difficulties. During this past dramatic improvement of Information Technology had contributed to the developed the new set of technologies facilities for visual impaired people. Therefore, this system mainly focused on employment and educational opportunities for the visual impaired people.

Software solutions introduced new way of handling real world problems. Software provides cost-effective, accurate, user-friendly and reusable solutions for almost all applications. Among other software technologies, programming, databases, web and multimedia have been the most widely used for development of software applications. Nowadays numerous software engineering tools are available for development of software applications. This research is presents the project to develop a software solution for Braille Convertor and Text-To-Speech Translator for Visually Impaired People.

This project mainly focuses on the Blind School situated in Ratmalana. There is no necessity to pay any cost for the use of this software. This software is basically designed for the aid of visually impaired people. Having such a system will provide an easy learning environment to the user and it will also self-direct the user. In the user's perspective, they can know whether they are typing right or wrong while they are typing. Through this system, they can translate the language that they

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typed into Braille language through this system. After converting the typed text to Braille language, they can get Braille printouts. They can make notes for their educational purposes and reuse them when they study. The system facilitates language translation function. It will help to improve the knowledge regarding languages. Moreover, system facilitates to save voice effect of typed text for their future purposes.

2. Literature Review

This literature review section is basically review on current existing braille systems that blind users can read the information's and text to speech output method.

2.1. Analysis of Existing Braille Systems

Braille is the language which helps to visually impaired people for communication and education. The Braille system is a combination of the embossed signs. In Braille system two types of dot systems are using to communicate. They are six and eight dot systems. Eight dot Braille system is limited used in computer applications. According to six dot Braille system, dots can represent 63 characters while setting and clearing the dots. As can be seen from this available number of combinations, but all characters may not be represented directly by this system. This is commonly termed as grade 2. This is also called as literacy Braille.

Following figure 1, 2 and 3 shown braille symbols used for English Sinhala and Tamil braily.

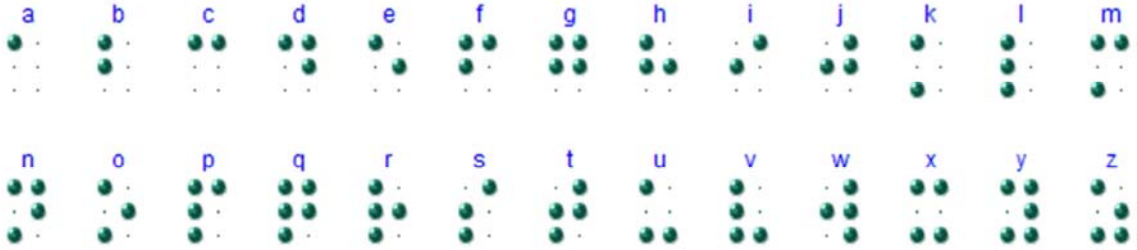

Figure 1. English Braille Alphabet - Simple letter.

Figure 2. Sinhala Braille Alphabet.

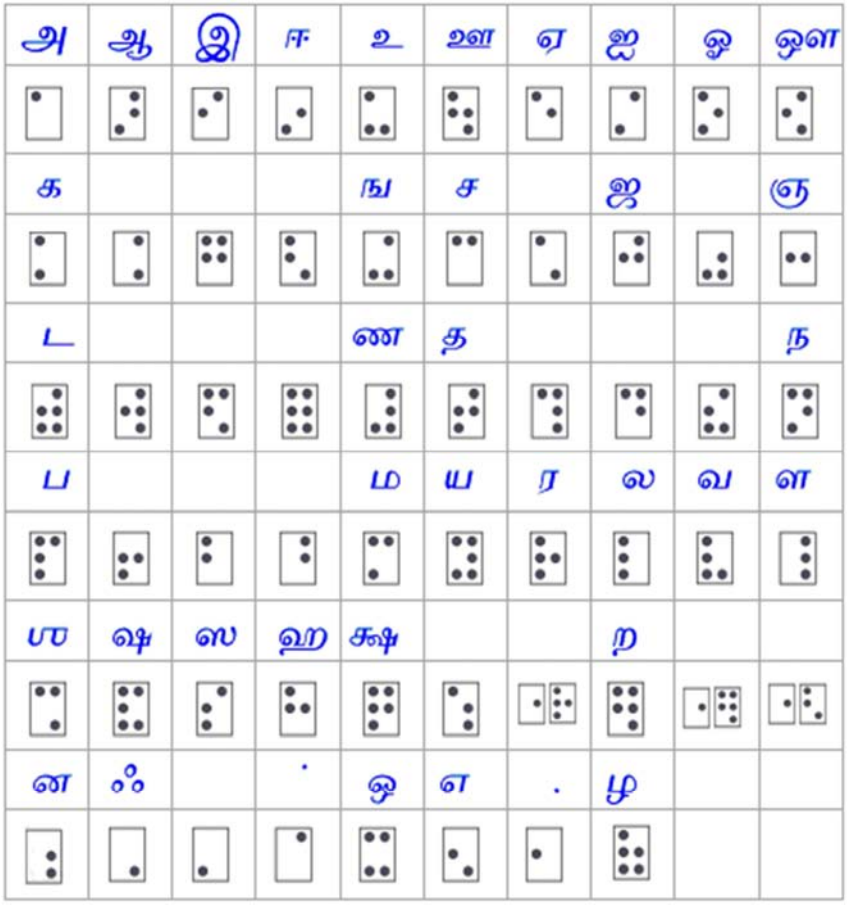

Figure 3. Tamil Language Braille alphabet.

Books written in Braille are used for visually impaired people's education. Braille is a written system that uses pattern of raised dots to inscribe characters on paper. This is always used by visually impaired people to read and write using touch instead of vision. A few other commercial translators are also available such as win Braille, Supernova, Cipher Braille translator and Braille master [1].

AMILA is the system which is currently used by the Council for Blind. But there are so many drawbacks. By using this system, it cannot be read each word correctly. And also, AMILA system does not allow to type letters and there is no any speech (narrator). Therefore, they have to type the document from outside and then they can convert the particular document by using AMILA.

In this system, it provided more features for convenient. This system also run on any platform and it support all three languages used in Sri Lanka such as Sinhala, Tamil and English. This system will vary from ones that are specially designed to satisfy a selected need such as transcription of blind children's examination, personal organizers or general purpose solutions that allow a user to access standard software on industry. In this system, which allow a visually impaired person to enter data using braille keyboard, there's a demand to convert the braille codes into standard text. This conversion will happen directly onto paper, because the data is spoken or written, or at the purpose at that it is stored in computer memory. According to the paper which is A system for Converting Braille into Print written by Paul Blenkhorn [2] provide a detailed description about the limitations and the algorithms that has been designed to deal with a huge number of languages and characters, mainly discussed the context of the conversion of English braille to text.

Different text-to-braille converter software is currently available in different languages. But there is no such converter for Sinhalese. As a result, visually impaired people in Sri Lanka have to face problems while working with the Sinhala language. Because of this, a research done by Soma Chattergee [3] which is Creating of IT enabled Sinhala to Braille Conversion Engine gives a solution for this problem up to some extent. They need to be manually operated to obtain the desired output, which is a time-consuming process. This software conversion engine will easily convert Sinhala texts into corresponding Braille documents and will contribute to the learning process of visually impaired people in Sri Lanka. An added benefit of the software is, it can produce Braille output, allowing the user to print Braille using the windows printing mechanism.

The main focus of a research done by Capt. Dr. S Santhosh Baboo and V. Ajantha Devi [4] is to create Tamil to Braille conversion systems. Tamil Braille aims to help for visually impaired people who use Tamil language to interact with the computer and to help visually impaired users to communicate with the computers. It was first developed in the nineteenth century, consisting of eight and six points, arranged and numbered. Eight-point braille is used in a limited number of computer applications and is used to display text attributes. Therefore, this eight-point Braille will not be further considered. Each braille character consists of six dots arranged in two columns and three rows. Any point can be raised to give 26 or 64 possible characters. Although Braille units are used throughout the world, the meaning of each of the 64 cells depends on the language in which they are used for description.

Braille is not a language, it is simply a code that can be used to write and read English, Tamil and more. Different languages have their own braille codes that map letters, numbers, and punctuation to braille cells as needed. In addition, there are mathematical and musical Braille codes. A user from the Tamil Braille system, Level 1 has some drawbacks because of the use of paper and time more than Level 2 or Contract Braille. When using a 2-level Braille system, reading time is also reduced. Tamil Braille's 2-level approach has not yet been implemented. The scope of the work was studied in Level 2 Tamil Braille script.

Gujarati is one of the Indian languages, in which a very modest amount of research is conducted in each field. A research done by Nikisha B. Jariwala and Bankim Patel [5], focus is on the basis and nature of the Gujarati script and the Braille language

The research done by Iain Murray and Andrew Pasquale detail discussed about the translation of Braille to literacy text.[6] This paper presents the development of a portable device Embossing Braille translation to the text.

2.2. Analysis of Similar Existing Systems for Text-To-Speech (TTS)

When analyzing existing systems using TTS, a research done by Lin-Shan Lee, Chiu-Yu Tseng and Ming Ouh-Young developed a The Synthesis Rules in a Chinese Text-To-Speech [7]. An attempt to develop a Chinese text-preliminary floor system was made recently. Design approaches are based on a concept of syllable concatenation because of the particular characteristics of the syllabic nature of the rhythm of the Chinese language.

Multilingual Text Analysis for TTS Synthesis done by Richard Sproat [8] described the basis of text analysis model state sensor unlimited TTS synthesis, as a multi- lingual TTS system Bell Labs text analysis module. The sensor uses the vocabulary kit that allows vocabulary declarative description, the shape, the digital expansion rules, phonological rules in the construction. The model has been used in eight languages: Spanish, Italian, Romanian, French, German, Russian, Chinese and Japanese.

A research done by N. SWETHA and K. ANURADHA [9] is about Conversion Text-To-Speech. Text to Speech (TTS) is the generation of synthesized speech from text. Our goal is to make the synthesized speech clear, natural and enjoyable as human language.

Another existing system is High Quality Text-To-Speech synthesis done by Thierry Dutoit [10]. This system attempts to highlight its digital signal processing (DSP) and Natural Language Processing (NLP) components to give a comprehensive introduction to the most advanced TTS synthesis countries.

Furthermore, X. Huang, A. Acero, H. Hon, Y. Ju, J. Liu, S. Meredith and M. Plumpe [11] invented a Trainable Text-To-Speech System. It called as Whistler. It has recently improved by Microsoft. Whistler purpose text-to- speech engine is so that it can automatically build the model parameters from training data. This system will focus on the rhythm and the recent improvement in acoustic modeling.

A research done by Mohd Bilal Ganai and Er Jyoti Arora [12] have discussed through the use of continuous phoneme library technology, it achieved a text-to-speech conversion. In this model, it uses phoneme audio libraries and develop a system that generates more human speech. The system is superior to the available text-to-speech system and has the advantage of generating very human sounds in our system.

3. Technology Used

The technologies which are used to implement the system are developed using NetBeans 8.0.2 as an Integrated Development Environment (IDE) and Java coding, Natural language processing and Yandex translator

This system is mainly based on Java. By using java, it will reduce extra cost that need to be bared for purchasing some components and tools. Because java is open source and all components are free to use. To develop this system “java” with “NetBeans” platform is more suitable. Because Java is fully object oriented by design and more flexible in handling. Java is used in programming with NetBeans platform which provides an easier and flexible environment for the programming purposes and GUI developments. Java is able to run in any platform, so it will be able to reuse the system components in effective manner.

4. Model Design

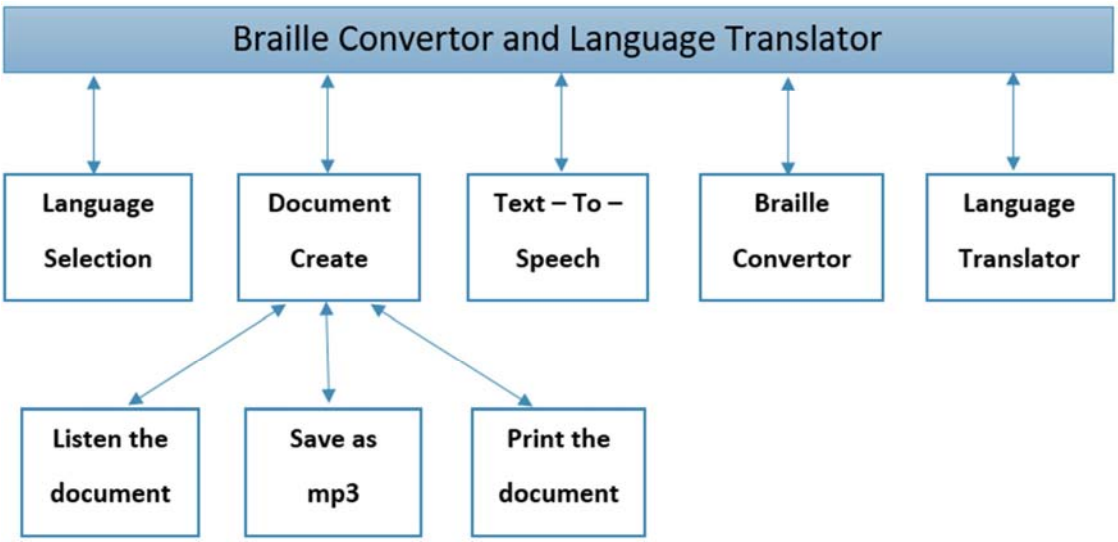

Figure 4. Module Design.

4.1. Text to Speech

The main user group target in this application are the principal, teachers and students of Ratmalana Blind School, therefore mainly questionnaires, interviews and observations were conducted in order to gather the data needed.

This system contains the following main functionalities including the produce sound of letter while typing on keyboard.

a) The system is ability to read the typed text to the user at the end of the typing.

b) The system is having a convertor to convert English, Sinhala and Tamil languages into the Braille language.

c) The system is having a translator to translate text into English, Tamil and Sinhala language.

d) The system should have ability to save voice effect of typed text as mp3 format.

Step 1:

1. Get the Language Selection window and select the prefer language
2. The details will be forwarded to class
3. The details will analyze by system hardcodes
4. The search result will be forwarded by system hardcodes
5. Pass the result through class to UI
6. The result will be delivered to user through UI

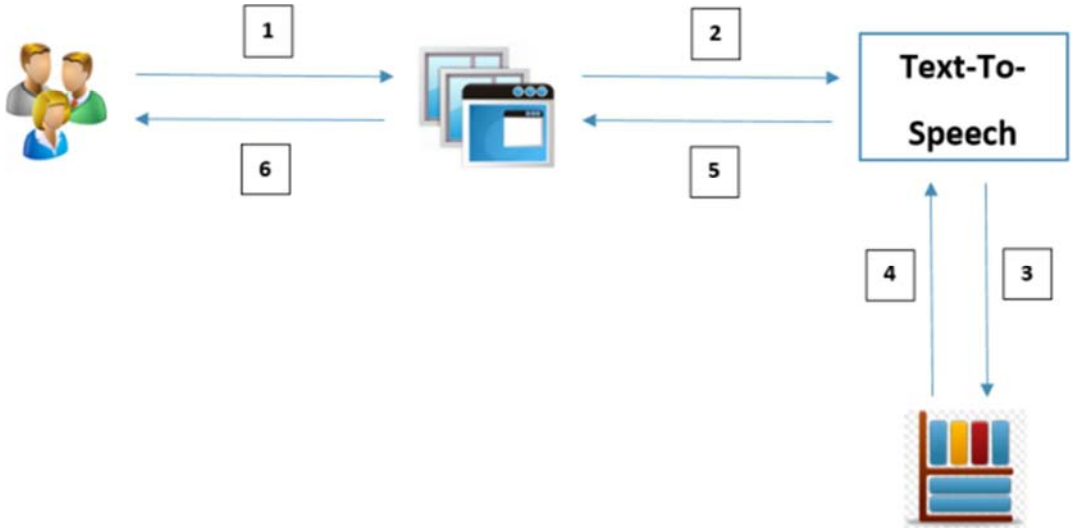

Figure 5. Steps in Text to speech process.

Step 2:

1. Get the document create window and type text
2. The text will be forward to class
3. The details will analyze and select libraries
4. The search result will be forwarded by system libraries
5. Pass the result through class to UI
6. The result will be delivered to user through UI

At the beginning user, can feed input into the system by using keyboard. When user use keyboard and type in text document in given text area the system will navigates the user according to selected languages.

4.2. Braille Converter Module

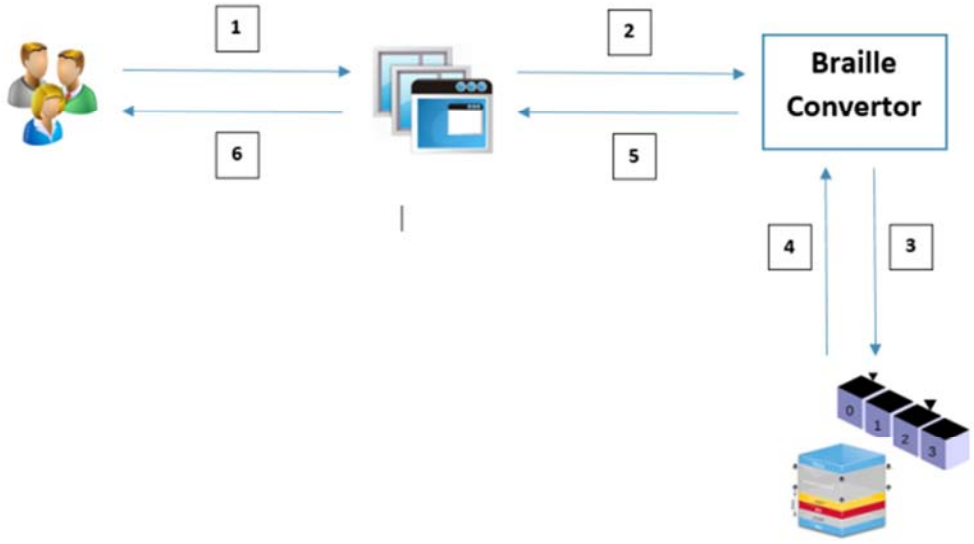

Figure 6. Braile converter module.

Steps:

1. Get the document create window and type text
2. The text will be forward to Braille conversion class
3. The details will analyze and replace to braille
4. The search result will be forwarded by arrays and stacks
5. Pass the result through class to UI
6. The result will be delivered to user through UI

4.3. Language Translator

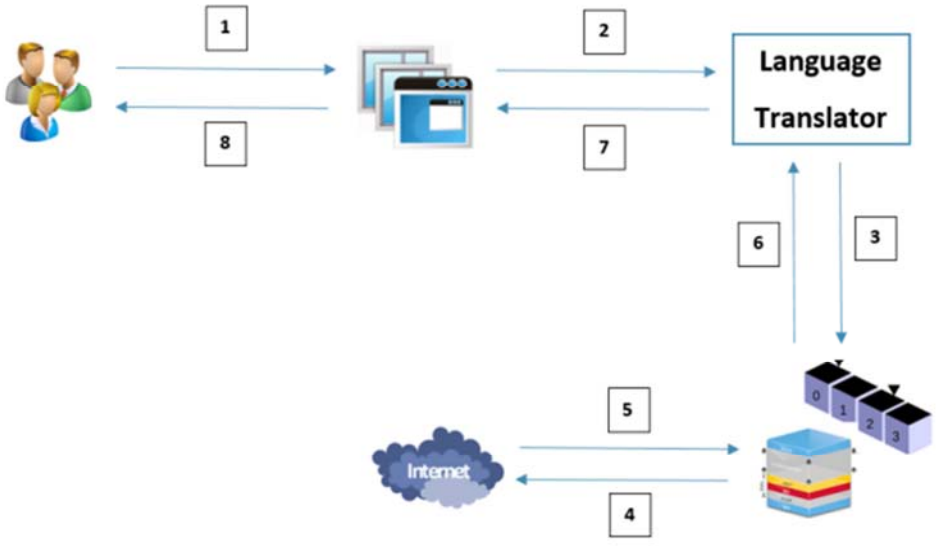

Figure 7. Brail converter module.

a) Get the document create window and type text

b) The text will be forward to class

c) The details will analyze and store in arrays and stacks

d) The text translates through Yandex translator

e) The search result will be forwarded to stack

f) Arrange the text and pass the result to class

g) Pass the result to UI

h) The result will be delivered to user through UI

When preparing the document that system provide three separate interfaces for generate a Sinhala document, Tamil document and English documents. In here system perform key release event. Key event indicates when user is typing at the keyboard. Specifically, key event is fired by the component with the keyboard focus when the user presses or releases keyboard key. There are two basic kinds of key event. The first kind of event is called a key-typed event most probably key-typed event use for typing of a UNICODE character. The second kind is either key pressed or key-released event this type of event used for pressing or releasing of any key on the keyboard. Each time when key is pressed and release corresponding sound clip will generated for the relevant pressed key.

In language translator part the system has capability to recognize keyboard input and convert English key words into Singles and Tangles. To perform these processes have been implemented UNICODE system. UNICODE is a computer industry standard for the consistent encoding, representation and handling of text expressed in most of the world's writing system. It can be implementing by different character encodings. In most commonly used encodings are UTF-8 and UTF-16. UTF-8 uses one byte for any ASCII character. After feed the input into system user can select the Braille translator to convert these Shingles and Tangles into Sinhala Braille or Tamil Braille.

The main purpose of having language translator visually impaired people can do effective communication between other people also. In here user can convert previously prepared Sinhala, Tamil and English document into another language. Usually language translator support Sinhala, Tamil and English languages only. Braille converter will convert previously prepared Sinhala document, Tamil document and English document into corresponding Sinhala Braille document, Tamil Braille document and English Braille document. At the end, final outcome will be printed Braille document. The following main objectives have been identified in order to success the project goal. But in this scenario, main objective is directly identifying what is UNICODE and how it is work alone with Sinhala, Tamil and English language. Other one is how to manage language translator for translate the relevant languages such as Sinhala, English and Tamil. These are main points researcher highly considered under this portion. After converted all text document into the Braille documents user can take a print out of converted Braille documents by using the Braille doted printer.

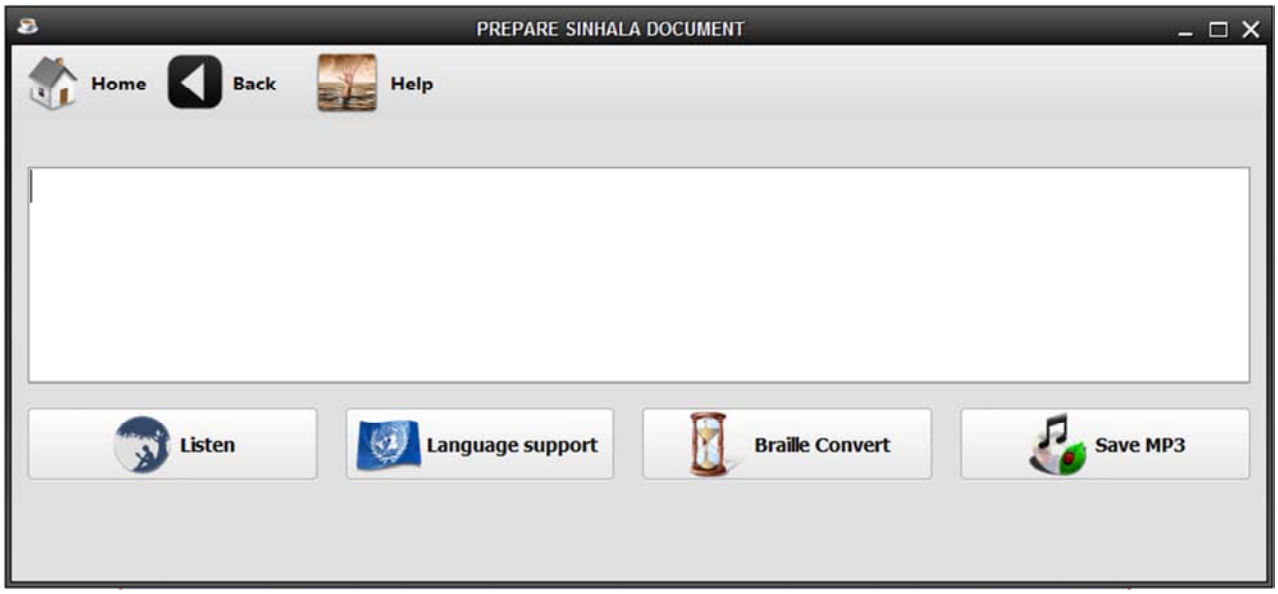

Figure 8. Create English document window.

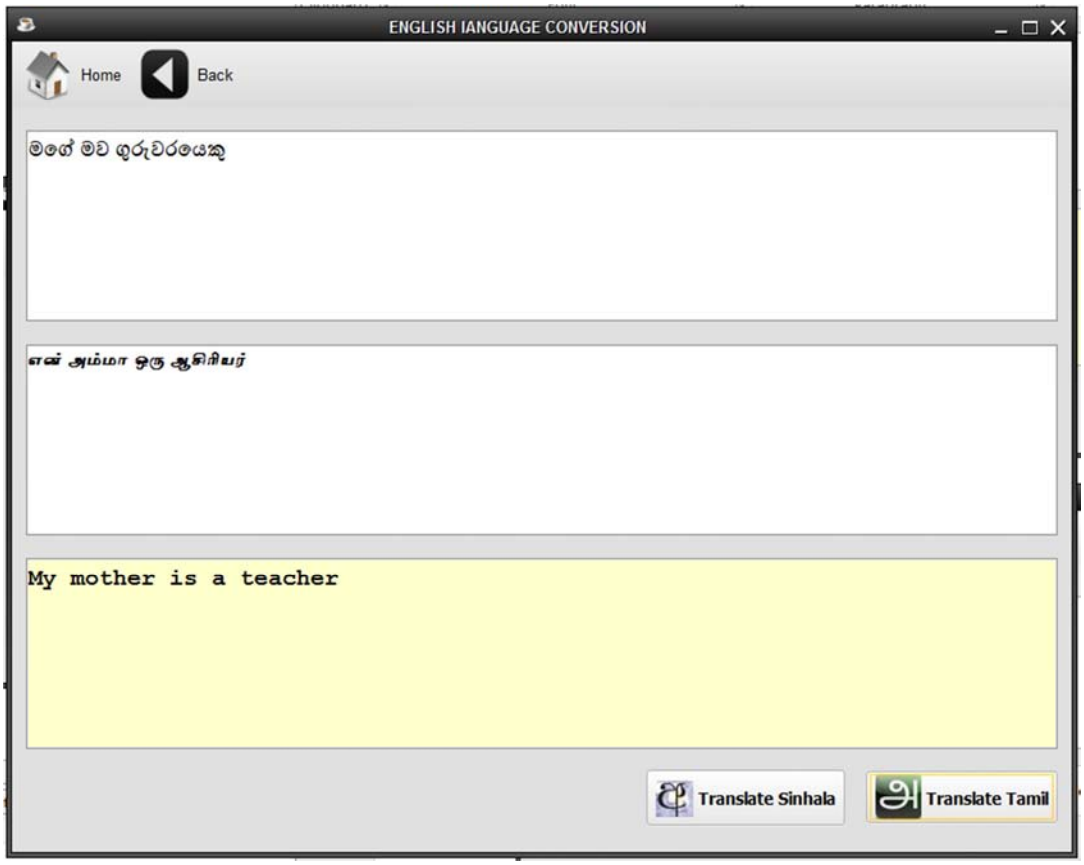

Figure 9. Language converter.

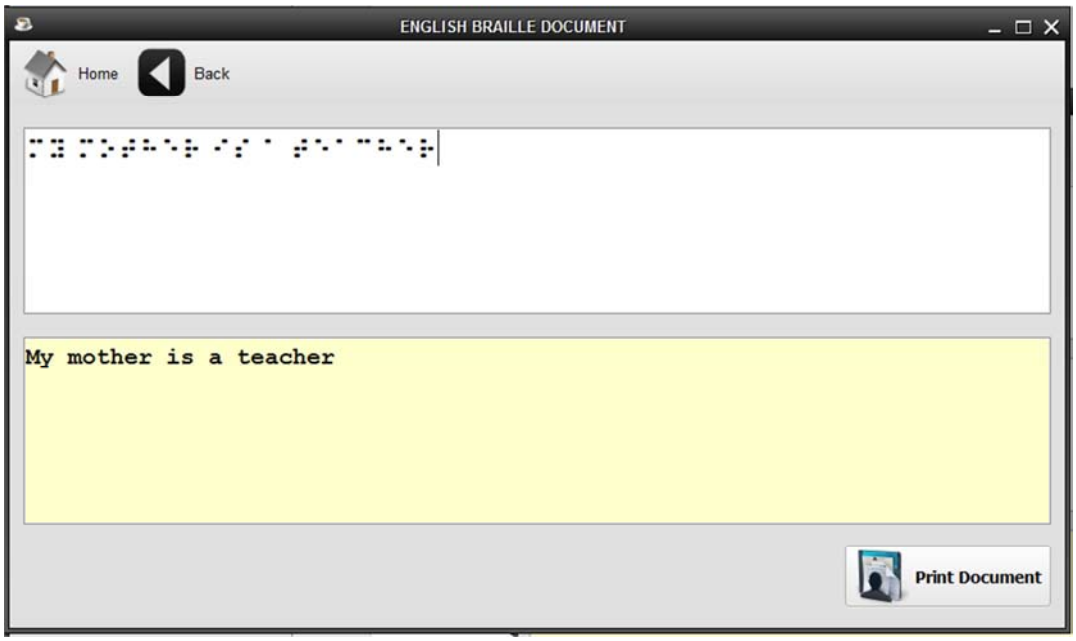

Figure 10. Brail Converter.

5. Summary and Conclusions

The target of this project is to offer a Braille Converter and Text-To-Speech Translator for visually impaired students in Ratmalana Blind School. The main targeted functions of this system are Braille Converter, Language Translator, Text reading, save mp3, print document and etc. It is recommended to use this system for visually impaired people since using this kind of automated system; visually impaired people can achieve their challenges easily and through this system can increase user satisfaction easily. The other main

benefit of using this system is, visually impaired user can engage with typing process without others help.

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