Evaluation Form – Technical Background Review

Student Name: Emmy Pérez

Project Advisor: ______

Team Name: Blindle

Team Members: Jordan Altaffer, Cameron Davis, Dmitry Jean-Laurent, Annie Luo

______ / 30 Technical Content
- Current state-of-the-art and commercial products
- Underlying technology
- Implementation of the technology
- Overall quality of the technical summary

______ / 30 Use of Technical Reference Sources
- Appropriate number of sources (at least six)
- Sufficient number of source types (at least four)
- Quality of the sources
- Appropriate citations in body of text
- Reference list in proper format

______ / 40 Effectiveness of Writing, Organization, and Development of Content
- Introductory paragraph
- Clear flow of information
- Organization
- Grammar, spelling, punctuation
- Style, readability, audience appropriateness, conformance to standards

______ **/ 100 Total - Technical Review Paper**

Name: Emmy Pérez

Group: Blindle

Script to Braille Translation Software

Introduction

Due to the increased availability of software built to make existing technologies more accessible to people with disabilities, today’s market is at a shortage of affordable medical devices purely dedicated to assisting the blind or visually impaired. Technological advancements in the field of Assistive Technologies (AT) have allowed for decreased dependency on medical insurance for obtaining equipment that is not only cumbersome to operate, but also expensive to maintain. Instead, operating systems inside regular computers now have the ability to promote inclusivity amongst all users by way of affordable programs that have various assistive functionalities, such as converting readable, electronic material into Braille files that can be used in tactile displays and printers. This technical review will specifically focus on examining this type of translational software, also known as Braille translators, through the different products currently available in the market.

Commercial Software Applications

With over 170 languages supported, the Duxbury Braille Translator (DBT) is internationally recognized as the most distinguished product of its kind. The basic license for the program runs an automated process for converting plain text to Braille script (and vice versa) on a visual interface at the cost of $695 for both Windows and Mac OSX operating systems [1]. What makes it stand out from the rest, however, is its ability to import text documents in multiple different file types while also preserving the format of the original file, which is done by supporting formats like LaTeX to translate figures, tables, and mathematical formulas. The DBT is most commonly found already integrated within specialized printers that render text as tactile braille characters onto paper; this combination sells for a base price of $5,029 [2].

A notable competitor for the DTB is Liblouis, an open-source Braille translation library written in C [3]. This software solution running on Windows, Mac OSX, and Linux operating systems also offers support for text translation in hundreds of languages and provides the option to configure the braille translation into the formatting required to transcribe onto specialized paper. In addition, it includes tools for debugging and testing of translation tables, all the while being freely available to the public for continuous growth and improvement within the developer community.

Technology in Braille Translators

To understand the algorithm used in most Braille translators, one must first be well-acquainted with the Braille system. A Braille cell traditionally consists of 6 raised dots arranged in a 3 by 2 matrix that can be combined and configured differently to represent letters, symbols, or words. The Braille alphabet, depending on the language that is being translated, can be divided into multiple grades with varying complexities to help the mapping process of plaintext characters to Braille cells [4]. The most basic grade in the hierarchy, Grade 1, consists of all possible arrangement within a cell corresponding to a unique, single character. As the grade value increases, the alphabet becomes less verbose and more comparable to shorthand writing as single characters are combined to represent common words, prefixes, and suffixes.

In the translation process, a complex grade system is preferred for shortening the length of the document that is being written to or read from. The general algorithm makes use of translation tables unique to a language's Braille alphabet for matching the plaintext characters being read in with the longest Braille contraction inside of the table. Constant verification after translation also needs to be done to ensure that the contractions observed by the algorithm are context-specific and actually match that of the grade's translation table. For example, the letters 'th' in a Grade 2 alphabet form a contraction replaced by a single Braille cell; however, the matching and translation should only be performed for a words like '*th*ink', ' but not 'po*th*ole' [5]. A finite state machine is used to effectively deal with these kinds of rules and determine whether to translate a potential contraction by holding the current context with right context checking.

Implementation of Braille Translators

Braille translation software can be either used by itself or for embedded hardware running other Assistive Technologies, like Braille embossers and electronic Braille displays. The Refreshable Braille Display (RBD), for example, is a powerful tool that incorporates Braille translation software with electroactive polymers to give blind computer users the ability to actively read electronic text. Although very effective, this device can cost from $2,000 to $50,000 depending on the amount of Braille script that can be displayed at once [6]. Real innovation is accomplished through the use of new emerging technologies that do not require rare, expensive materials.

References

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[6] A. Russomanno, S. O'Modhrain, B. Gillespie, and M. Rodger, "Refreshing Refreshable Braille Displays," *IEEE Transactions on Haptics*, vol. 8, no. 3, September 2015. [Online]. Available: https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=7086320. [Accessed: Oct. 6, 2020].