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ECONOMIC PRINTING OF BRAILLE DOCUMENTS

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Abstract: The objective of the paper is to explain the process of printing Braille documents using a dot matrix printer. Braille language has been the only medium of communication for the blind without the help of other people. Hence this project was attempted to help them and create an efficient and economical solution for the same. The Braille documents were printed using a dot matrix printer after removing the ink ribbon. Due consideration was given to the standard braille size and the accuracy of the impression made on paper. Various trials were done by changing paper quality and the best out of them was chosen.

Keywords: Braille, aksharas, mastras, brailier

I. INTRODUCTION

Information is spread majorly through written documents where reading and comprehending are the sources of knowledge gathering. However, an alternative has to be developed for the visually impaired. Braille solves this problem by providing a means of communication for the blind. It makes them independent and confident as they do not require any assistance. This paper focuses on developing an economic method to print Braille documents using a dot matrix printer.

According to recent statistics taken by WHO, there are 285 million blind people all over the world. Majority of them use Braille as their only source of communication. Hence by providing an affordable method to print the Braille documents, this paper would significantly contribute to the Blind society.

Considering the English language, there are 26 Braille images corresponding to the 26 English alphabets. It is a one to one mapping where each alphabet can be uniquely mapped to its Braille image. However in case of the Tamil and Hindi language, the mapping is not unique.

The Tamil language has 12 vowels, 18 consonants and an additional character. The complete script contains 31 letters in its independent form and an additional 216 in the combined form representing a total of 247 combinations. There are Braille images mapped to the vowels and constants which are to be combined in order to get these 247 combinations.

The Hindi language has 10 vowels and 36 consonants. The Hindi script is represented as a combination of the consonants, aksharas and mastras through which vowel phonetics are added to the consonants. There is a one to one mapping for each of the consonants, aksharas and mastras with the Braille images.

The converted text to Braille is to be converted into printed format in the form of impressions that can be felt by the naked hand. The dot matrix printer the closest relative to the typewriter which works in a similar by leaving impressions. The typical dot matrix printer contains 9 or 24 pins which impact on an ink ribbon which in turn casts a visible print on the paper. By removing the ink ribbon we make the pins strike the paper directly. Care had to be taken to make sure that the pins were not damaged in the process. The Braille so generated was done in such a way that it was in accordance with the standard Braille dot size and spacing.

Being an experimental setup with a modified printer the paper chosen to be extremely thin so that the impressions could be felt. Also as the impressions would be felt on the other side of the paper where the impression was made so the conversion of the Braille to its mirror image is made. The following sections explain the printing process in detail. Section II gives a summary of the literature survey made in study of existing printing techniques, Section III talks in brief about the proposed methodology, Section IV explains the printing process in detail, Section V gives suggestion for future improvements and Section VI gives the conclusion.

II. LITERATURE SURVEY

We have researched and analyzed several Braille printing devices which have been developed earlier and that has helped significantly towards the printing of Braille documents. The list of devices based on chronological order is as follows:

A. First Generation: Slate and Stylus

The slate and stylus is the oldest device used to produce braille, an invention of Charles Barbier. A simple device, its main advantage is its portability. Slates come in basically two sizes: 27 and 41 cell width. Slates are basically two pieces of metal, connected by a hinge. The top metal piece serves as a guide for the stylus, a sharp metal awl held by a wooden handle. The back metal plate contains indented braille cells, which further serve to guide the stylus in the embossing of braille dots.

The main disadvantage of this type of model is its orientation. Since you are embossing the dots into the paper, it stands to reason that the dots need to be made inverted. Similarly, when writing, one needs to write from right to left, rather than from left to right. This is because when the paper is turned over to expose the upward dots, the braille is in a left to right order.

B. Second Generation: Braille writers

Perkins Braille: The standard Perkins braille writer has six keys (one for each dot in a braille cell), a space bar, a backspace key, a carriage return, and a line feed key. Braille writers use heavyweight paper. There are also uni - manual braille writers, for individuals using only one hand, electric braille writers, and "Next Generation" braille writers. It costs around \$700 - \$3000. This printer turns out to be very costly and portability is difficult.

Next came the Mountbatten Braille printer which is an electronic braille writer, note taker and embosser. This provided multiple functions and proved to be versatile. It integrates modern computer technology and has applications to support embossing, reading and file storage - and it has audio support for all its operations. It is adaptive technology that has been designed to meet the needs of blind students in today's environment, especially in early braille instruction, as a foundation tool for literacy. However, the quality of output and the impressions made on the paper was not very prominent.

After that came 'The Perkins SMART Braille' that has a small video screen attached to the front of the braille writer

which displays SimBraille and large print, combined with audio feedback. It allows users to edit, save and transfer

electronic documents via USB, and it also features built-in software with lessons for braille beginners. The main disadvantages of Perkins braille writers are that they are very expensive and difficult to afford by a normal person.

They are very heavy with an average weight of 10 pounds which makes it very difficult to carry.

C. Jot a Dot

Jot a Dot is the newest innovation in Braille writing, available at a fraction of the cost of a traditional Braille. Until now, the choice has either been a slate and stylus or a standard Braille Writer. Jot a Dot gives you the best of both worlds, combining portability with functionality. Jot a Dot enables regular Braille writing from the left hand side of the page to the right, a major advance in simple manual Braille writing. It has both line and cell indicators. The cell indicator shows the position of the embossing head on the line. The line indicator gives instant feedback on which line you are writing. Weighing less than a pound, Jot a Dot is easily carried as a personal item by both children and adults. One piece construction means there are no parts that can be lost. Again this kind of model turns out to be very expensive and not affordable for normal users.

D. Tatrapoint

Tatrapoint is another invention that came into existence which is a six-key braille writer that is lightweight, robust and easy to use. It is suitable for students and adults of any age, Tatrapoint features an adjustable keyboard. Simply slide the width adjuster to increase or decrease the spacing between keys. Bright, contrasting colors make Tatrapoint's key features easily identifiable, as well as make the braille appealing to younger students.

All the above mentioned printers do not show promising results in areas of portability and quality whereas the cost effective printer that we have designed by modifying the dot matrix printer proves to be very economical and productive. The method which we adopted to help achieving satisfactory results is explained in the next section. This shows why our Braille printer is very much cost effective and economical to everyone compared to the other generation printers explained previously.

III. PROPOSED METHODOLOGY

Dot matrix printer works by injection of ink on paper which is done by pins hitting an ink ribbon which falls on the paper and the document is printed as a pattern of dots. Printing braille with special braille printers is expensive. Dot matrix printer that makes use of pins was used in our project to create impressions for braille

dots on paper. Changing the print head of a dot matrix printer will also cost more than a new printer. The ink ribbon could be removed and the pins will directly hit the paper, thus forming impressions. The pin specification and the paper had to be decided in accordance with the braille unit size, impression quality and accuracy.

IV.EXPERIMENTAL SETUP

The braille images in the braille documents are to be converted to its standard size which was done using CAD. Each braille character is designed in standard size as already mentioned. Every major braille-producing country has standards for the size and spacing of braille embossed on paper as a setting of uniqueness to their language. The nominal height of braille dots shall be 0.019 inches [0.48 mm] and shall be uniform within any given transcription. The nominal base diameter of braille dots shall be 0.057 inches [1.44 mm]. Cell spacing of dots shall conform to the following: The nominal distance from center to center of adjacent dots (horizontally or vertically, but not diagonally) in the same cell shall be 0.092 inches [2.340 mm]. The nominal distance from center to center of corresponding dots in adjacent cells shall be 0.245 inches [6.2 mm]. The nominal line spacing of braille cells from center to center of nearest corresponding dots in adjacent lines shall be 0.400 inches [1.000 cm]. Most braille embossers support between 34 and 37 cells per line, and between 25 and 28 lines per page. These specifications were followed by using CAD.

Once the braille units were got as images in the standard size, printing had to be done. The ink ribbon was removed from the dot matrix printer so that the pins directly hit the paper. The impression was dependent on the pins and also the paper quality. Standard dot matrix printers have 9X21 print head. Since changing the print head was not the idea, different types of paper with varied thickness was used as trials. Thinner the paper, more accurate were the impressions.

These Braille documents will be read by the feel of the impression of braille dots. The printing should be done on the backside of the page, so that the braille is projected in the front side of the paper. After a series of experiments we found that printing mirror image of the output on the back side of the paper results in printed braille on the front side suiting the reader to feel the dots. The mirror image of the output is obtained using CAD, which is then sent to the printer for printing process. In the dot matrix printer, the pins hit the paper to make projections on the opposite side, mirror image is fed to the printer and the printer prints the projections on the paper.



Braille for hello world



Mirror image of the braille

The printer which was used for experimentation is as shown in Figure 1. Various textures and types of paper were taken as samples for testing and the results and accuracy were studied accordingly.



Figure 1: Dot Matrix printer

As a first trial, bond papers were used. The thickness of this paper is high hence the impressions of the pins were hardly visible. It was not even close to original braille documents which on comparison would give a very less accuracy of

20% approximately. Next a4 sheets were used to print the braille dots. Though it was better than the case of bond papers, the impression was very mild. On a comparison with original braille documents they gave an accuracy of 35%. As a next trial, in order to reduce the thickness of the printing paper, butter papers were used. The pins hit the paper harder in this case, and the impressions were better visually measuring the accuracy it was close to 50%. As a final trial, papers used for billing purposes were used, in which impressions were felt properly. They seemed very close to the original braille documents and gave accuracy up to 84%.

The final output that we achieved is as shown in Figure 2. Accuracy percentage were measured by giving the printed documents to blind people organizations and checking how many of the printed words were read correctly by the reader. The printed Braille document was tested against 100 visually impaired people out of which 70-80 people could decipher the text correctly.



Figure 2: Printed Braille document

Since the billing paper gave the best results from the trials, it was chosen to be the correct choice of paper to be used along with a dot matrix printer for braille printing.

V. FUTURE IMPROVEMENTS

Braille printing need not be costly and can be made cheap by just modifying the print head of a dot matrix printer at the manufacturing stage itself. It benefits the blind and also by adding an ink ribbon one can use it as a multipurpose printer. A modified printer head can be made with pins capable of leaving impressions on thicker papers thus making the Braille documents generated to be of higher quality and thus can last longer. Braille documents can be made cheap and available as easily as a normal printed document.

VI. CONCLUSION

The main purpose of economic braille printing is to provide a cost effective solution for the blind and the needy. This printer can also be integrated to be used as a normal purpose printer hence the necessity for purchasing this printer separately is not required. By providing this dual purpose in a dot matrix printer we will be able to benefit a significant amount of blind people by helping them to read and interpret letters and words.

REFERENCES

1. *Methods for Braille Writing and Braille Note-taking*. March 6 2002 . <http://www.dotlessbraille.org/braillewritemethods.htm>
2. Gately, Rosemary and Gotwals . *BRL: Braille through Remote Learning* <http://www.brl.org/intro/session02/perkins.html> ,July 1997
3. Evan, Monte *BRL: Braille through Remote Learning* <http://www.brl.org/intro/session02/slate.html> ,July 1997
4. Miller, Cyral Betsy McGinnity .*For paths to literacy for the visually impaired* <http://www.pathstoliteracy.org/tools-writing-braille>
5. DeafblindTelecommunications ,18 February 2011. <http://www.dbt.org.au/Accessibility/Braille%20Devices/Braille%20writers.html>
6. Bleach,Kelly , *American Foundation for the Blind* , <http://www.afb.org/afbpres/pub.asp?DocID=aw060106>
7. Bleach,Kelly , *Braille Writing Tools and Tools for Tactile Graphics* <http://www.afb.org/info/living-with-vision-loss/using-technology/reading-and-writing/braille-writing-tools-and-tools-for-tactile-graphics/1235>
8. *INDEX BASIC-D* , <http://www.synapseadaptive.com/braille/basic.htm>
9. *Single Sided Braille Embossers from Enabling Technologies* .April 1998,. <http://www.brailleur.com/single.htm>

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