Asian Journal of Information Technology 6 (6): 696-699, 2007

Bangla Braille Information System: An Affordable System for the Sightless Population

[1]Mohammad Abu Yousuf and [2]S.M. Saif Shams
[1]Department of Computer Science and Engineering,
University of Mawlana Bhashani Science and Technology, Santosh, Tangail-1902, Bangladesh
[2]Department of Computer Science and Engineering,
Shahjalal University of Science and Technology, Sylhet-3114, Bangladesh

Abstract: All over the world, persons with visual handicaps have used Braille as the primary means to reading information. Also, the concept of Braille has been accepted as a universal approach that works across the boundaries of the world. Different countries of the world have adapted the system of Braille to suit their languages. This study presents modern bangle Braille system that can be used by blind people to read and write. A Braille code is a code similar to a code page, that maps the characters of a writing system to the 6, raised dots (or bits) of a Braille cell. This study illustrates the idea to translate the texts in Bangal to the corresponding Braille documents.

Key words: Braille code, braille cell, pattern, line, dots

INTRODUCTION

The Braille system, devised in 1821 by Louis Braille, is a method that is widely used by blind people. Braille refers to an approach in which text is printed on a thick sheet of paper using special symbols representing the letters of the alphabet (David, 1999). The basic Braille symbol (or cell) is composed of 6 dots arranged in two vertical columns, each column being 3 dots high (David, 1999; Durre *et al*., 1991).

Text in Bangla is made up of the letters of the alphabet of vowels and consonant. There are some vowels and many consonants and others numerals and punctuation marks in Bangla language. All alphabets in Bangla language is shown in Fig. 1. We can represent these many letters of alphabet and symbols in Braille using just the 6 dots.

The 6 dots can be arranged in a total of 63 different ways. Six dots can form 64 different combinations but above we said that only 63 are possible. We must remember that a Braille dot has to be sensed by touch and the 64th symbol will be the one which will have no projections (dots) thus representing a space (Durre *et al*., 1991).

Thus we have 63 Braille codes consisting of dots in a 2 by 3 arrangement. We can visualize the dots by giving them a reference numeral. The dots are referred to as dot 1, dot 2 dot 3 and so on, or simply 1, 2, 3, 4, 5, or 6. In the rectangular arrangement, the dots are numbered serially from to top to bottom with the dots on the left side of the

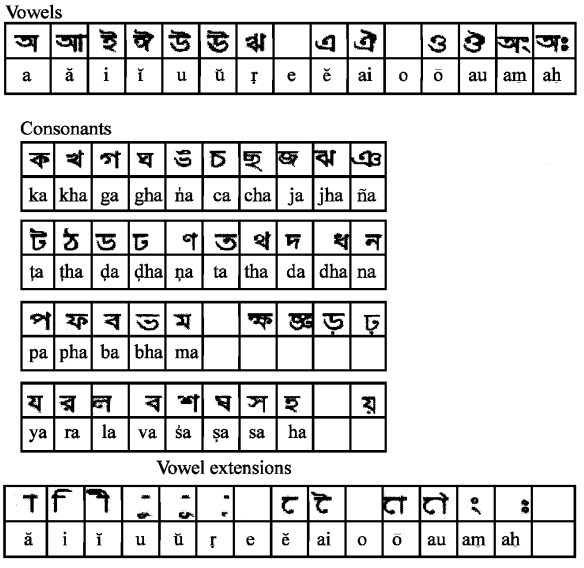

Fig. 1: List of alphabet in Bangla language

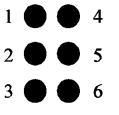

Fig. 2: Structure of basic Braille symbol

Corresponding Author: Mohammad Abu Yousuf, Department of Computer Science and Engineering,
University of Mawlana Bhashani Science and Technology, Santosh, Tangail-1902, Bangladesh

array numbered from 1-3 and the ones on the right from 4-6 (http://www.tiresias.org/reports; Barbara and Rochelle, 1997) (Fig. 2).

ARRANGEMENT OF BRAILLE CELLS

First we shall see the original assignment of dots for the different letters. Louis Braille's approach was to visualize the patterns in terms of 7 different groups, each group characterized by some geometrical property (http://www. acharya.iitm.ac.in/). For this purpose, Louis Braille divided the cell consisting of 6 dots into 2 sets, the first a square pattern with dots 1, 2, 4 and 5 and the second a set with 2 dots, dots 3 and 6.

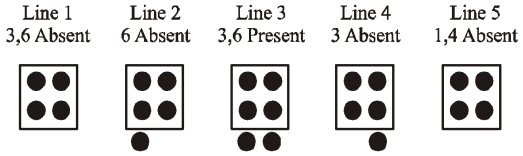

Fig. 3: Grouping of dots for making patterns

We observe that there will be 16 different combinations of the first set of 4 dots and 4 different combinations for the bottom set of 2 dots, thus giving a total of 4 times 16 or 64 patterns. The patterns are remembered in terms of 7 categories of dots where each category is called a line (http://www.acharya.iitm. ac.in/).

The top groups of 4 dots give 16 different combinations. Out of these, ten patterns have been identified as the basic symbols representing a line of Braille dots. The first four lines of Braille codes are obtained by grouping these ten patterns with each of the 4 possible combinations of the bottom 2 dots (http://www. acharya.iitm.ac.in/). This is shown in Fig. 3.

Line one: Ten patterns with only the top 4 dots.

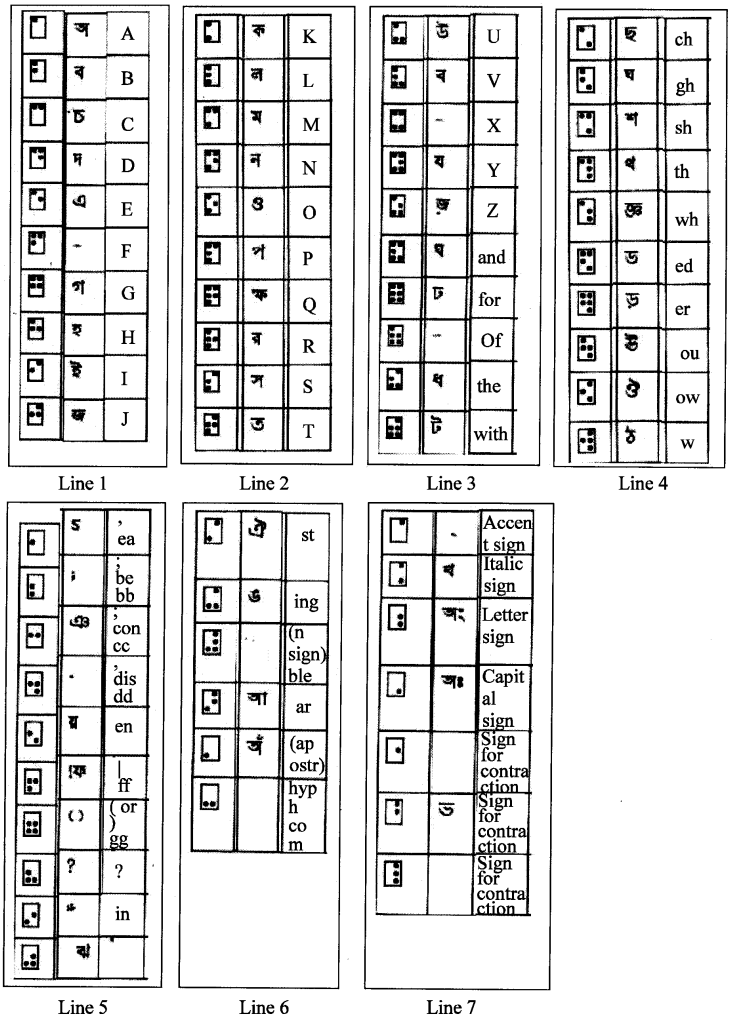

Fig. 4: Total 63 bangle letter of alphabet and others numerals and punctuation marks

Fig. 5: All alphabet of Bengali language and their corresponding Braille code

Line two: Ten patterns as in line 1 with bottom dot 3.

Line three: Ten patterns as in line 1 with bottom dots 3 and 6.

Line four: Ten patterns as in line 1 with bottom dot 6.

Thus far, 40 different patterns have been covered. Line five is similar to line 1 with the 10 patterns made up with the bottom 4 dots instead of the top 4 dots. That is line 5 is consists of dot 2, dot 3, dot 5 and dot 6.

Line five: Ten patterns made up with the bottom 4 dots instead of the top 4.

Thus far, 50 different patterns have been covered.

Line six of braille consists of 6 patterns using dot 3 and the dots on the right. There are 8 possible combinations for the right side dots. Line six uses 6 of these.

Line six: Six patterns using dot 3 and dots on the right that is dot 4, dot 5 and dot 6.

With line six we have covered 56 dots.

Line seven: There are 7 patterns in this line which are identified by the absence of dots in the left column of each cell.

Thus the 63 are accounted for. The total 63 bangle letter of alphabet and others numerals and punctuation marks are illustrated in Fig. 4. Altogether all alphabets in Bengali language and their corresponding Braille code are shown in Fig. 5.

PROPOSED PATTERN TO IDENTIFY THE BANGLE ALPHABET (ALGORITHM)

Here is a simple algorithm to do this. It allows us to check for the line the cell falls in. There are seven lines which together cover the 63 cells.

Now let us see how we can remember the patterns and identify a letter of the alphabet or a punctuation mark given its dot pattern. The 10 patterns which make the first line are

1 : A
1,2 :B
1,4 :C
1,4,5 :D
1,5 :E
1,2,4 :F
1,2,4,5 :G
1,2,5 :H
2,4 :I
2,4,5 :J

Observe that we have arranged the ten in four different groups. It will suffice for us to remember the dots in the first two groups. That means a basic set of 5 patterns. The first 3 cells in the second half of the ten are actually the same of the 3 preceding dots with dot 2 added. The remaining 2 are obtained by removing dot 1 from the previous group. Thus knowing the first 5, 1 should be able to construct fifty cells and identify all the letters of the alphabet, punctuation and some commonly occurring words (http://www. acharya.iitm.ac.in/).

Observe that the first eight cells in the pattern include dot 1 but the last two do not. It is also useful to remember that all the letters of the alphabet (in fact all the cells in the first four lines) will always include a dot at the top i.e., dot 1 and/or dot 4. So if we see a cell without dot 1 or 4, we will know that it will not be a letter of the alphabet. In fact the ten cells in line one have been a clever choice to allow people attempt some simple recognition algorithm.

We noted that out of 16 patterns possible with the top 4 dots, line one uses only ten. We can now give a rule to identify the ten by quickly specifying those six which are not included in the ten.

Any cell with missing dot 1 is excluded from line one if it also contains two successive missing dots horizontally or vertically. In other words, either a horizontal pair or a vertical pair will be missing in these. The missing combinations are

- 2 - missing dot 1 and without dots 4 and 5
- 3 - missing dot 1 and without dots 2 and 4
- 5 - missing dot 1 and without dots 1 and 4
- 2, 5 - missing dot 1 and without dot 4
- 4, 5 - missing dot 1 and without dot 2

In this way, we can remember the ten patterns of line one. Line two is the same combinations of the top 4 dots as in line one but has dot 3 added to each cell. Line three is the same combinations of the top 4 dots as in line one but has dot 3 and dot 6 added to each cell. Line 4 is the same combinations of the top 4 dots as in line one but has dot 6 added to each cell. Line five is similar to line one with the ten patterns made up with the bottom 4 dots instead of the top 4. Line six is characterized by the absence of dots 1 and 2. However, you will also check if dot 4 is absent and dot 5 present. If so the cell does not fall in line 6. Line seven is characterized by the absence of the left column of dots, i.e., dots 1, 2 and 3.

APPLICATION

Most of the sightless population in the developing world is deprived of the modern technologies that could help them in their educational infrastructure and consequent joining the mainstream life through employment opportunities. Most of the sightless people are unskilled. To make them skilled the bi-directional communication between the sightless and sightless community is required. In order to make the bi-directional communication between the sightless and sightless community feasible, it is required to transliterate the text documents of a language to the corresponding Braille documents (Anupam, 1998). The idea of this study can be used to develop a system that can transliterate texts in Bangle to Braille and converted texts can be printed out through an indigenously developed Braille printer. A simple example that demonstrates the use of Braille code in bangle sentence is illustrated in Fig. 6.

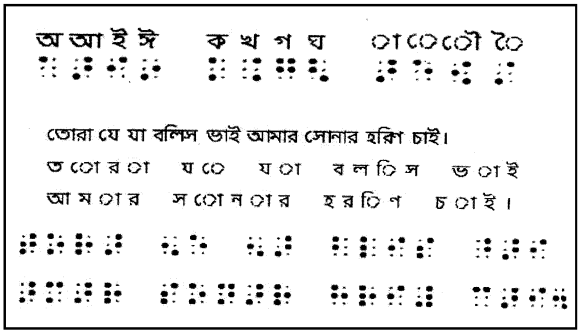

Fig. 6: Application of Braille code in bangle sentence

CONCLUSION

The sightless population in the developing world is deprived of the modern technologies that could have helped them in their educational infrastructure and consequent joining the main stream life through employment opportunities. This study presents bangle Braille system that can be widely used by visually impaired population to read and write.

REFERENCES

Anupam Basu, 1998. Bharati Braille Information System, IEEE Transactin on Rehabilitaion Systems.

Barbara O'Connor and Rochelle Draper, 1997. The world at his Fingertips: A Story about Louis Braille, New York, McGraw-Hill.

David, A. Adler, 1999. A picture Book of Louis Braille, New York, McGraw-Hill.

Durre, K.P., W. Tuttle Dean and Dyrre Ingeborg, 1991. A Universal Computer Braille Code For Literary And Scientific Texts. International Technology Conference.

World Wide Web at URL http://www. acharya.iitm.ac.in/

World Wide Web at URL http://www.tiresias.org/reports/