

Transliteration of Braille Character to Gujarati Text – The Model

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Abstract— In the present epoch of Information and Communication Technology, it has been witnessed that there are very less amount of work found for Braille script. So in this paper, the concentration is done on the work carried out in various Braille languages along with their special properties, their method of conversion and recognition techniques. The paper also describes the model that transliterates Braille characters to Gujarati Text, the characteristics of Gujarati script and Braille language. It also focuses on the technique used for the transliteration of Braille Character to Gujarati Text.

Keywords— Gujarati Text, Braille Script, Character Mapping, Text Transliteration

I. INTRODUCTION

In our daily activities, language plays a vital role for communication and expressing our emotions. It can be either in verbal or written form. Braille is an important form of written communication for visually impaired people [1]. Visually impaired people are also an important part of the society, and can play an integral role in its prosperity. Therefore, it has been a must to provide those people with means and systems through which they may communicate with the world. Technology has shown great promise in providing access to textual information for visually impaired people. Braille text transliteration will allow people with visual impairment to write the text and forward that to the sighted people in regular text format and language that can be read by them.

1) Braille Script

Braille is a tactile writing system that enables visually impaired people to read and write. Braille can be read through touch with the fingers using a series of raised dots. It is traditionally written in embossed form. Braille is named after its creator, Frenchman Louis Braille, who went blind following a childhood accident [2], [3], [4], [5] and [6]. In 1824, at the age of 15, as an improvement in night writing; Braille developed his code for French alphabet [2]. His system was published, which subsequently included musical notation, in 1829.

Standard Braille is an approach to create documents of a Braille cell consisting of raised dots on thick sheet of paper through a process of embossing. A cell is made up of six dots arranged in the form of a rectangular grid i.e. two dots horizontally (row) and three dots vertically (column). With six dots arranged this way, one can obtain sixty four different patterns of dots. Each arrangement of dots is known as a cell

and will consist of at least one raised dot and a maximum of six [7] and [8]. The layout of Braille cell is shown in fig. 1.

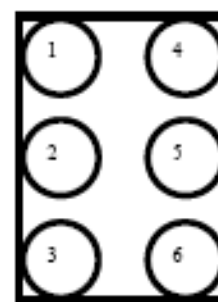


Fig. 1 Braille Cell

A printed sheet of Braille normally contains twenty five rows of text with forty cells in each row. The dimension of a standard Braille sheet is approximately 11 inches by 11 inches. The Braille cell also has standardized dimensions but it may slightly vary according to the script used in the country. There is some script which is written through Braille cell made up of 8 dots. The dimension of a Braille cell, as printed on an embosser is shown in fig. 2 [7], [8] and [9].

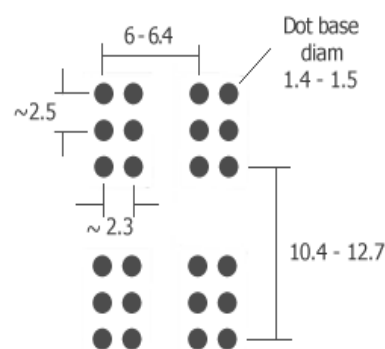


Fig. 2 Dimension of Braille cell (in millimetres)

Bharati Braille or Bhartiya Braille is a largely unified Braille script for writing the languages of India. Eleven Braille scripts were in use, for different languages and in different parts of the country [10], when India gained independence. Gujarati Braille is one of the Bharati Braille which is similar to Hindi Braille. Fig. 3 shows Gujarati characters as written in Braille.

અ	આ	ઇ	ઈ	ઉ	ઊ	એ	ઐ	ઓ	ઔ
ક	ખ	ગ	ઘ	ઙ	ચ	છ	જ	ઝ	ઞ
ટ	ઠ	ડ	ઢ	ણ	ત	થ	દ	ધ	ન
પ	ફ	બ	ભ	મ	ય	ર	લ	વ	શ
ષ	સ	હ	ળ	ણ	ઋ	ૠ			
અં	આં	ઇં	ઈં	ઉં	ઊં				

Fig. 3 Gujarati Braille [10]

2)Gujarati Language

Gujarati is a script which is derived from Devanagari script. It is descended from Sanskrit. The glyphs of Gujarati characters are also very peculiar. Worldwide there are over 60 million people who use Gujarati language for speaking and writing.

The Gujarati alphabet contains overall seventy-five distinct legitimate and recognized shapes, which mainly comprises of 59 characters and 16 diacritics. Fifty-nine characters are divided into 36 consonants i.e. 34 Singular and 2 Compound - means ornamented sounds, 13 vowels i.e. pure sounds, and 10 digits [11]. Sixteen diacritics consist of 13 vowel and 3 other characters. There is logical grouping of the vowels and the consonants in the Gujarati language character set based on their pronunciations [12].

In western India, Gujarati is a phonetic language. Gujarati script is written from left to right, with each character representing a syllable. The vowels are called Swar and consonants are called Vyanjan. Corresponding to each vowel, Gujarati language consists of set of special modifier symbols which are also known as Maatras. To change the sound of the consonants, they are attached to it. Modifiers are placed at the top, at bottom right or at bottom part of consonant. For different consonants the attachment position of the modifier also differs. They can also occur in different shapes. Gujarati language also contains conjunct characters. If two half consonants are joined, a character is conjunct [13].

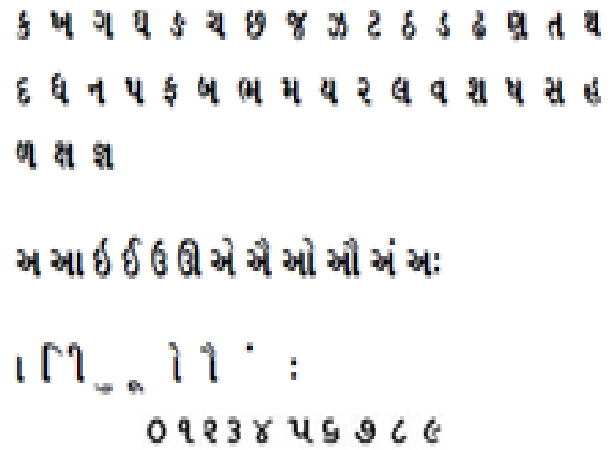


Fig. 4 Gujarati Characters and digits

3)Literature Review

In Braille to text transliteration, following are some of the research work carried out. It includes brief overview of different techniques used by the researchers and also what experimental result they achieved during their research:

J. Mennens, L. V. Tichelen, G. Francois and J. J. Engelen have developed a system that converts Braille to a computer readable form, but within acceptable constraints. So if there is a text on a computer, a printing house for Braille can regenerate it using an electronic Braille embosser [14].

P. Blenkhorn discussed a method for converting Braille which is stored in a computer as characters into print. It used predominantly table driven method to achieve it. The system has been designed and configurable for a wide range of character sets and several languages. The algorithm is described by considering the conversion of Standard English Braille into print. Author has also given the tables used for the conversion [5].

A. S. Al-Salman describes an Arabic Braille bi-directional and bi-lingual translation system which also contains editor. It does not need any expensive equipment. If appropriate rule file is present for any other languages, the system can be generalized to assist communication among literate people regardless of their disabilities (visually impaired or sighted), languages, and geographical locations [15].

P. Rajarapollu, S. Kodoligar, D. Laghate and A. Khavle present the implementation for the conversion of Braille to text / speech using FPGA (Field Programmable Gate Array) Spartan3 kit. In normal domain, the actual Braille language is converted into English language. The input to the system is given through Braille keypad which consists of different combinations of cells. Then further the input is given to the FPGA Spartan3 kit. According to the combinations generated, FPGA converts the Braille text into corresponding English text through the decoding logic in VHDL (VHSIC (Very High Speed Integrated Circuit) Hardware Description Language) language. Through the algorithm, the corresponding alphabet is converted to speech after decoding and it is also displayed by interfacing the LCD to the Spartan3 kit [16].

S. Halder, A. Hasnat, A. Khatun, D. Bhattacharjee and M. Nasipuri present a Bangla Character Recognition (BCR) system which converts a Braille Document into Bengali text. It is not attempted in research work so far. The system extracts Braille Characters from the Braille document. And then it decodes the Braille characters into Bengali characters. The decoded Bengali characters are converted into Bengali text which is in human-understandable form. The system is not only useful to the blind communities but also useful to the associated persons who want to learn the Braille system through Bengali language. The proposed methodology has been

tested on the Braille documents collected from the Jhunka Pratibondhi Alope Niketan, West Bengal and it shows satisfactory result[6].

II. PROPOSED MODEL

The proposed model contains seven components that helps in transliterating the input in the form of Braille cell and generates equivalent Gujarati characters. Figure 5 represents Transliteration Model for Braille to Gujarati. Following section provides description of the components of the proposed model.

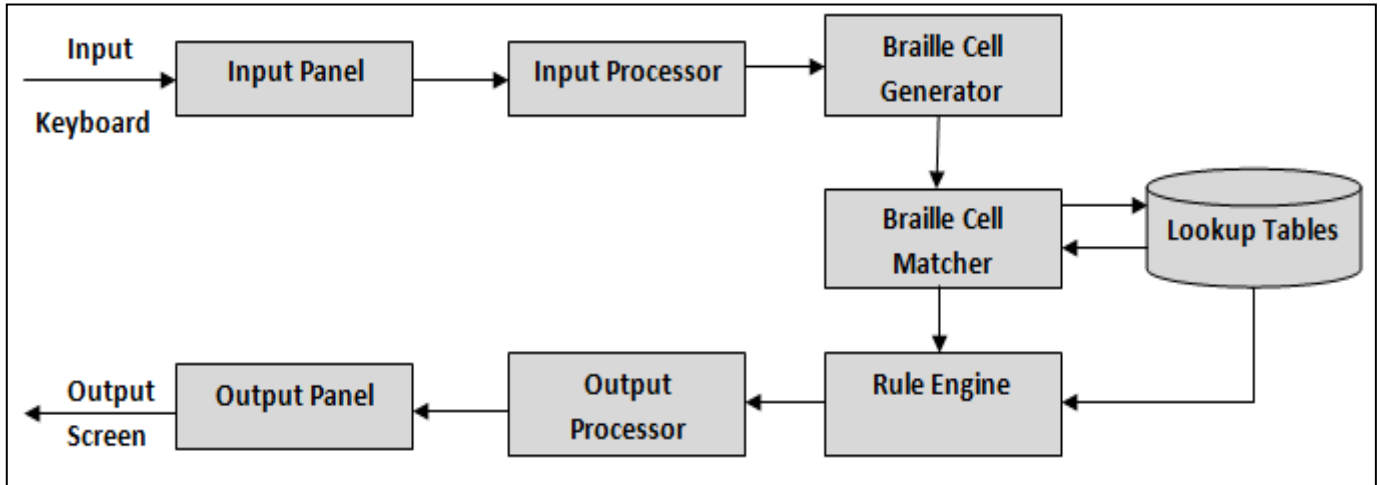


Fig. 5 Transliteration Model for Braille to Gujarati

1) Components of Model

1. Input panel – It accepts input in the form of keys through the keyboard from the user. The six keys (SDFJKL) represent six dots of the Braille cell. All the inputted keys are given to Input Processor.
2. Input processor –it processes the keys that are gathered in the stipulated time duration. The combination of keys gathered is given to Braille Cell Generator.
3. Braille Cell Generator – it generates the cell from the keys that are processed by the input processor. The Braille cell that is generated is passed on to the Braille cell Matcher.
4. Lookup table – it contains the collection of the Braille cell patterns and its equivalent Gujarati Character which is useful at the time of mapping the Braille cell.
5. Braille Cell Matcher – it matches the Braille cell with the look up table and fetches the equivalent Gujarati Character using character mapping technique. The Gujarati character retrieved from the lookup tables is given to the Rule Engine.
6. Rule Engine – according to the rules of Gujarati language it processes the character. If any extra characters are to be retrieve from the lookup table then it will retrieve and provides those characters to output processor.
7. Output Processor – it gathers all the Gujarati characters given by the Rule Engine and arranges it in the form that can be readable to the user and provides it to the output Panel.

8. Output Panel – it displays the output i.e. Gujarati equivalent of the Braille to the user.

2) Character Mapping Technique

Cross-language transliteration means transliteration from one script to another script. So, for the transliteration of Braille character to Gujarati, character mapping technique is used. During transliteration from source script to destination script there is a need to follow the rules and regulation of destination script.

3) Rules for Transliteration

Following are the rules that are need to be considered during transliteration [17]:

Braille is a script in which characters are made up of cells as shown in fig. 1. In a single cell there are 6 dots. So, total 64 characters can be formed. But in Gujarati language the character set consist of total 75 characters. So in Gujarati Braille, there are some characters that are indistinguishable as shown in fig. 3. So, assumptions are needed to be considered while writing Gujarati Braille.

For instance, digits 0 - 9 are characterized in the same way as some vowels and consonants i.e. ૧ is represented in the same way as ય, ૨ is represented in the same way as બ and so on. So, to distinguish it digit identifier ‘#’ character is used to indicate that the character written is digit or a consonant or vowels. Hence if # character encounters after space and before any character then the following characters are considered as digits.

Another example, to represent half or compound characters in Braille; there is no separate character available. So, to differentiate it; again here there is identifier i.e. 4th dot to specify that following character is half character.

In Gujarati Braille there are some characters which are written as a combination of more than one character. For instance, ઝ in Gujarati is written in Braille as combination of 4th dot, ળ, ર (3 characters).

Formation of word in Braille also depends on the pronunciation of the words. It is spelled as it is pronounced.

All the above mention points are to be considered, at the time of the transliteration of Braille character to Gujarati; otherwise the meaning may be changed.

III. CONCLUSION

The paper describes the basics of Braille script and Gujarati Language. It also describes that the moderate amount of work is found in Braille character recognition in various languages like Bengali, English, Hindi, Arabic etc. but transliteration of Braille to Gujarati is un-touched. So the researcher felt that there is a need for the transliteration of Braille to Gujarati text. The paper proposed the transliteration model that will transliterates inputted Braille cell into the Gujarati language characters. It will act as an aid to visually impaired people of the society.

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