

# Architecture of Gurmukhi to Braille conversion system

**Er. Vandana,**  
Pursuing M.Tech  
From swami Vivekanand  
Engineering college, Punjab.

**Er. Nidhi Bhalla**  
Lecturer in swami Vivekanand  
Engineering college, Punjab

**Ms. Rupinderdeep Kaur**  
Lecturer in department computer  
Science & Engineering, Thapar  
University, Patiala, Punjab

**Abstract:** The aim of research paper is to convert Gurmukhi script to Braille to help the blind people for living a good life by learning well. It also helps Punjabi teachers to teach Gurmukhi through Braille. Braille lipi is very fruitful for the blind people. With the help of Braille lipi they can study. This paper addresses the various aspects of Braille lipi. It puts light on the origin and various levels of it which depends on type of user such as simple user, moderate user and expert users. In this paper the architecture of Braille system is also explained. Apart from these, it has a main focus on the conversion of Gurmukhi to Braille conversion system. To understand it in the better way brief introduction of Gurmukhi script, Gurumukhi alphabets is also given in this paper. This research paper is a humble contribution in this direction.

**Keyword:** Braille System, Grades in Braille, Gurmukhi, Gurmukhi alphabets, Architecture of Gurmukhi to Braille conversion system.

## I. INTRODUCTION

People in the world want to see the world. They want to enjoy it and want to learn something from the it and they want to learn new technologies which are coming in 21<sup>st</sup> century. But unfortunately blind people were deprived of all these dreams but their life was enlightened when the Louis Braille who gave the concept of Braille. Through this blind can educate. They can see the world. We cannot give eyes to the blind people. But we give the education. So they stand with the normal man. Firstly the Braille was developed by Charles Barbier for soliders for their communication without light at the night. But the problem is that Barbier's system is the sets of 12 embossed dots encoding 36 different sounds. It was too difficult for soldiers to perceive by touch. So this method is rejected. But once day in 1821 he visited the National Institute for the Blind in Paris , where he met Louis Braille. Louis Braille was the man who

lost his eye in the child age. He modifies the Charles barbiers method and set of 6 dot cell. 6 dot cell system is called the Braille system and today's it is very much popular through this system blind people can educate. A Braille system is a 6 dot raised cell [1]. It is arranged in a rectangle comprising 2 columns of 3 dots each. A dot may be raised at any of the 6 positions [3]. Counting a space in which there is no dot raised, there are 2 to the 6th power ( $2 \times 2 \times 2 \times 2 \times 2 \times 2 = 64$ ) possible combinations. A specific combination is described by naming the positions where dots are raised. The positions are numbered 1 through 3 from top to bottom on the left, and 4 through 6 from top to bottom on the right as shown in Fig.1. Braille is read by blind people by touch [2, 8].

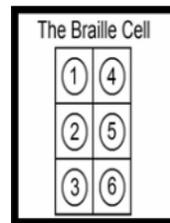


Fig.1 Braille Cell [2]

### For example

A. If a dot 1 describes a cell with one dots raised, those dots being at the top and at the left column as in fig.2 then it denotes the letter “ਅ” in Gurmukhi.



Fig.2 “ਅ” alphabet in Braille

**B.** If a combination of dots 1-2 describes a cell with two dots raised, and first dot is at the top and at the left column and second raised dot is second row and left column as in fig.3 then it denotes the letter “ੴ” in Gurmukhi.

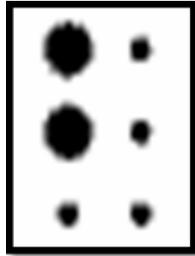


Fig.3 “ੴ” alphabet in Braille

## II. Grades of Braille.

**A. Grade 1:** Grade 1 is called the starting version of Braille. This is called letter by letter translation of Braille [1, 3] as shown in fig.4. This is the Braille which is read by starting people. Like normal students learn a, b, c in nursery.

*For e.g.* If we want to write ੴੴੴੴ in grade 1 then it can be represented as shown in fig.4.

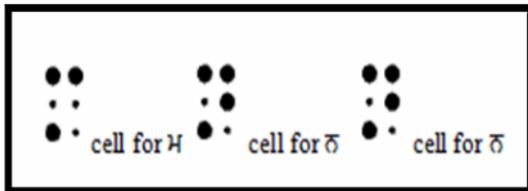
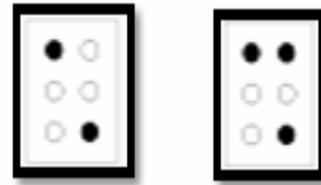


Fig.4 Grade 1 representation

**B. Grade 2:** Grade 2 is next version of grade 1. that is for those people who know about the letters or little bit about the Braille. This is the translation of combination words like “CH”, “SH” as in fig.5. The contractions are used to save space because a Braille page cannot fit as much text as a standard printed page. Books, signs in public places, menus, and most other Braille materials are written in Grade 2 Braille [1, 3].



Cell for “CH”      Cell for “SH”

Fig.5 Grade 2 representation [10]

**C. Grade 3:** Grade 3 is next version of grade 2. It is for that people who knows Braille very well and has good command in Braille. In this grade blind people use short cuts means which is used mainly in personal letters, diaries, and notes, and also in literature to some extent. It is a kind of shorthand, with entire words shortened to a few letters.

## III. Gurmukhi

Gurmukhi is the most common script used for writing the Punjabi language. This is the world’s 14th most widely spoken language. The populace speaking Punjabi is not only confined to North Indian states such as Punjab, Haryana and Delhi but is spread over all parts of the world. Gurmukhi was standardized by the second Sikh *guru*, Guru Angad Dev Ji. The name *Gurmukhi* is derived from the Old Punjabi term "guramukhi", meaning "from the mouth of the Guru" [9]. Punjabi is most commonly written in the Gurmukhi script which is the most complete and accurate way to represent Punjabi sounds. Gurmukhi is primarily used in the Punjab state of India [7].

### A. Gurmukhi Alphabets

Gurmukhi script, which is mainly used to write Punjabi language, consists of 35 basic characters. In addition to these 35 characters, there are 10 vowels and modifiers, 6 additional modified consonants, forming 41 consonants including 35 basic characters as shown in fig: 6. The three characters ੴ, ਅ and ਏ are called vowel carriers, because these carry all the vowels with additional modifiers (matras) [4].

Basic Character(Consonants)				
ੳ	ਅ	ੲ	ੳ	ੴ
ਕ	ਖ	ਗ	ਘ	ਙ
ਚ	ਛ	ਜ	ਝ	ਞ
ਟ	ਠ	ਡ	ਢ	ਣ
ਤ	ਥ	ਦ	ਧ	ਨ
ਪ	ਫ	ਬ	ਭ	ਮ
ਯ	ਰ	ਲ	ਵ	ੜ
Vowels and corresponding modifiers				
ਅ(none)	ਅ(ੌ)	ੲਿ(ਿ)	ੳਿ(ੀ)	ੴਿ(ੇ)
ੴਿ(ੇ)	ੲਿ(ੇ)	ਅੈ(ੈ)	ੳੈ(ੈ)	ਅੈ(ੈ)
Additional characters with lower bindi				
ਸ	ਖ	ਜ	ਭ	ਲ
ਮ				
Other symbols				
ੌ (tippi)	ੰ (bindi)	ੲ (adhak)	ੳ (halant)	ੴ (Visarg)

Fig: 6 Gurmukhi alphabets [4]

#### IV. Proposed Architecture of Gurmukhi to Braille conversion

This is the Gurmukhi to Braille conversion system in fig.7, which converts Gurmukhi to Braille through computer because today is the trend of computer [5, 6]. Every work has done through the computer. This proposed system is very helpful for a teacher who teaches the blind people.

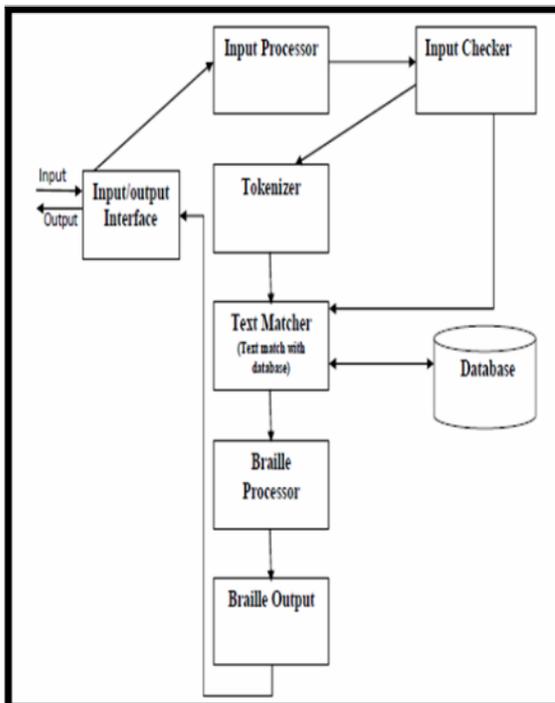


Fig.7 Gurmukhi to Braille conversion system [5]

1) **Input interface:** It refers to the communication between an information processing system (such as a computer), and the outside world, possibly a human, or another information processing system. Inputs are the signals or data received by the system, whenever you enter data into your computer, it is referred to as input as in fig: 8. This can be text typed in a word processing document, keywords entered in a search engine's search box, or data entered into a spreadsheet. Input can be something as simple as moving the mouse or clicking the mouse button or it can be as complex as scanning a document or downloading photos from a digital camera.

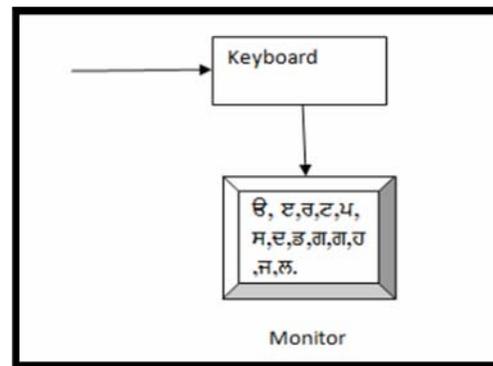
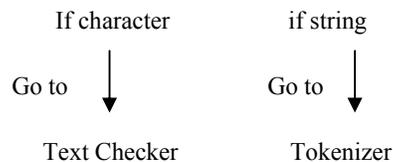


Fig.8 Input through user

2) **Input Processor:** A hardware device or software processor whose sole function is to handle input.

3) **Input Checker:** Input processors give their problem to input checker. The main purpose of input checker is to find whether the input is string or character. If the input is a character it directly gives to the text checker. If input is string, it gives their output to Tokenizer.



4) **Tokenizer:** The main purpose of tokenizer is break the string and converts it into characters. The process of forming tokens from an input stream of characters is called **tokenization**.

e.g.   
After tokenization:

5) **Text matcher:** Text matcher matches the input with the database. Whether the input character is present in the database or not.

6) **Database:** The term "database" may be narrowed to specify particular aspects of organized collection of data and may refer to the logical database, to physical database as data content in computer data storage or to many other database sub-definitions. A collection of information organized in such a way that a computer program can quickly select desired pieces of data. Text matcher matches the input data in the database. If the database contains that input. Then it gives the output to Braille processor, otherwise shows item is not in the database. Because the database stores all Gurmukhi alphabets and corresponding mapping of Braille alphabets.

7) **Braille Processor:** Braille Processor converts the character input into the Braille code or we can say in a Braille language. That language is mainly used for blind people.

8) **Braille output:** Braille Processor gives their final output to Braille output Part. Braille output checks whether the output is according to the input or not, and then it final output to output interface so that user can see it through output device.

9) **Output Interface:** The opposite of input is output, which is what the computer produces based on user input . The expected output of the proposed system is as shown in fig: 9.

ੳ	ਅ	ੴ	ੲ
⠠	⠠	⠠	⠠

Fig: 9 Proposed output

**Conclusion:**

On a whole, it can be said that this humble effort of an individual may make a great for the blind people. We are on the way to develop Braille Lipi by introducing new methods for building systems which can do conversion of any language to Braille. Efforts in this direction may make the life of blind people more fruitful and easy for them.

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Er. Vandana is currently pursuing her M.Tech in computer science & engineering from swami Vivekanand institute of engineering and technology, Banur. She holds the degree of computer science & engineering from Desh Bhagat engineering college from Mandi Gobindgarh. She was topper of her college during B.Tech.



Rupinderdeep Kaur is Lecturer in the department of Computer Science and Engineering at Thapar University, Patiala. She has almost two years of academic experience. She has received her B.Tech in Computer Sciences from Chandigarh Engineering College, Mohali and M.E. in Software Engg. Form Thapar University, Patiala. Her area of interest include Natural Language Processing and Database Management System.



Nidhi Bhalla is Lecturer in the department of Computer Science and Engineering at swami Vivekanand engineering college. She has almost six years of academic experience. She has done her B.Tech in information technology from Punjab technical university and M.Tech. From lovely professional university.