

“LIGHTingU”: NEW TACTILE WRITING SYSTEM PROPOSAL

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ABSTRACT

Tactile writing system is a system for visually challenged people to get educated. It follows the concept of raised notations which are touched and sensed to perform written communication. In this paper a brief on “BRAILLE”, one of the most popular tactile writing system, has been presented along with the structure of English Braille notations. This paper proposes “LIGHTingU”: a new literacy concept in tactile system. LIGHTingU follows the same idea of raised notations with a new structural and logical design. The proposed system emphasises the set division and uniqueness of notations which expects to provide an ease in written communication.

KEYWORDS: Night Writing, Braille, LIGHTingU, Lightingu, Tactile Writing System, Lightingu Cell

INTRODUCTION

Nowadays, education is not confined till the people with sight. Visually challenged people do have right to get educated even by written communication. Talking about the written communication, there are various tactile writing systems that have helped blinds to communicate. Before talking about these tactile systems, let us know what this tactile system actually is.

Tactile means connected with the sense of touch. A Tactile writing system is a system which follows the concept of raised notation and is used by visually challenged people for written communication. Sometimes Tactile is confused with the term haptic [1]. Haptic is a scientific way of performing tactile act. Some of the tactile writing systems are Braille, New York Point, [2] Boston Line, [2] Moon, Fishburne, [2] etc. Among these, Braille is the most popular one. Now let us know more about Braille which is considered as an essential asset for visually challenged people’s education.

Till yet, Braille is the only tactile writing system which has made possible the education of visually challenged people. This embossed writing was introduced by Louis Braille in 1824 at the age of 15 and is accepted throughout the world for reading and writing by the blind community [3].

Braille which was an improvement over Charles Barbier’s (who was a French artillery captain) “Night writing”. Night writing was a tactile military code for soldiers to communicate with each other silently and without light during the night [5][6]. Charles Barbier’s system combined 12 raised dots to represent sounds and he called it as Sonography [4]. Night writing followed the concept of Polybius square to represent French literacy. Barbier created a 6x6 square which included French alphabets, diagraphs, trigraphs. Figure 1.1 depicts the Barbier’s 6x6 square.

	1	2	3	4	5	6
1	a	i	o	u	é	è
2	an	in	on	un	eu	ou
3	b	d	g	j	v	z
4	p	t	q	ch	f	s
5	l	m	n	r	gn	ll
6	oi	oin	ian	ien	ion	ieu

Figure 1.1: Barbier's 6x6 Squares

BRAILLE CONCEPT

Braille was initially developed in French language. Later it expanded to English Braille, Bharati Braille, Chinese Braille, and many more. A Braille cell is a rectangle formed of 6 dots arranged in three rows and two columns.

The dots are numbered 1 to 6: 1st column contain dots 1 to 3 and 2nd column contain dots 4 to 6. In Braille system, a dot may be raised at any combination for the six positions. This gives rise to $64(2^6 = 64)$ possible combinations [9]. These 64 Braille cells are arranged in 5 decades. 1st decade occupied top and mid row. 2nd to 4th decades are derived from 1st by adding dots in bottom row [2nd: left of bottom row, 3rd: both of bottom row, 4th: right of bottom row]. 5th follows same pattern as of first row but it is shifted downwards. Bottom row occupies only 4 patterns. Each decade have two additional mirror image patterns. Figure 3.1 shows 64 Braille cells arrangement.

decade	numeric sequence										shift right		
1st	⠠	⠡	⠢	⠣	⠤	⠥	⠦	⠧	⠨	⠩	⠪	⠠	⠡
2nd	⠠	⠡	⠢	⠣	⠤	⠥	⠦	⠧	⠨	⠩	⠪	⠠	⠡
3rd	⠠	⠡	⠢	⠣	⠤	⠥	⠦	⠧	⠨	⠩	⠪	⠠	⠡
4th	⠠	⠡	⠢	⠣	⠤	⠥	⠦	⠧	⠨	⠩	⠪	⠠	⠡
5th	⠠	⠡	⠢	⠣	⠤	⠥	⠦	⠧	⠨	⠩	⠪	⠠	⠡

Figure 2.1: 64 Braille Cells Arrangement

English Braille includes 26 English alphabets, punctuations, numbers, etc [8]. English Braille has three grades: Grade 1, Grade 2 and Grade 3.

Grade 1: it is a one to one representation of English characters.

Grade 1 Braille is a space and time consuming representation. Also, it is less popular with few books and documents [9].

Grade 2: consists of the standard alphabets of English, punctuations marks and contractions [5] like “but”, “can”, etc [9].

Grade 2 Braille is used in printing books.

Grade 3: it contains about 300 abbreviations [8] just like shorthand [5].

Grade 3 Braille is not standardised yet and is not used in official work [9].

Figure 3.2 depicts the English Braille notations.

	main sequence										shifted right	
1st decade	1 a	2 b	3 c	4 d	5 e	6 f	7 g	8 h	9 i	0 j	l (empty) ¹	o (empty) ²
2nd decade	k	l	m	n	o	p	q	r	s	t	u (empty) ³	v (empty) ⁴
3rd decade	w	x	y	z	and	for	of	the	with	-ing	man's	-ise ¹
4th decade	ch	gh	sh	zh	wh	ed	er	oo	ow	in	* (empty) ⁵	o (empty) ⁶
5th decade	-ea	-ob-	-oc-	* -oo ¹	em	f -ff	l -ll	pp	ty	in	o (empty) ⁷	o (empty) ⁸
bottom row	*										o (empty) ⁹	o (empty) ¹⁰

Figure 3.2(A): 64 English Braille Cells and Their Values

a	but	can	do	every	from-	go	have	just			
knowledge	like	more	not	people	quite	rather	so	that	still		
us	very	if	you	as							
child		shall	this	which		out		will			
	be,	con-	dis-	enough	to+ ¹	were	his	in	by+ ¹	com- ¹	into+ ¹
	be-										

Figure 3.2(B): One Letter Contractions

LIGHTingU

LIGHTingU is a newly developed idea of a new tactile writing system. Following the same concept of raised notations, it has a 3x3 matrix cell of 9 dots. Matrix cell is shown in figure blow.

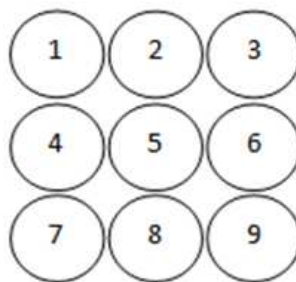


Figure: 3x3 Matrix Cell

There are total 512 possible combinations but currently LIGHTingU contains 108 out of 512 to represent digits, lower case and upper case English alphabets, punctuations and special characters. Remaining 404 are under consideration.

These 108 cells are arranged in 4 sets:

SET ‘A’ - Digits,

SET ‘B’ - Lower case alphabets,

SET 'C' - Upper case alphabets,

SET 'D' - Punctuations and special characters.

Set 'A' contains digits (1 to 9) and occupy 1 dot of the cell.

Set 'B' contains lower case alphabets and occupy two dots of the cell.

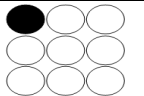
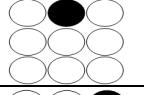
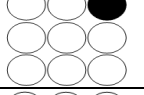
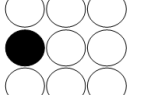
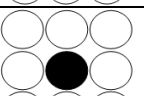
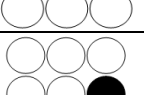
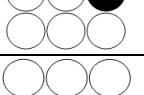
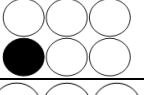
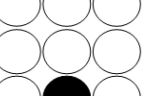
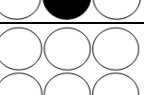
Set 'C' contains upper case alphabets and occupy three dots of the cell.

Set 'D' contains punctuations and special characters and occupy four dots of the cell.

Zero and space are two exceptions occupying all the dots in the cell and none of the dots in the cell respectively.

LIGHTINGU LITRACY

SET 'A' – DIGITS:

Digit	Symbol
1	
2	
3	
4	
5	
6	
7	
8	
9	
0	

SET ‘B’ – LOWER CASE ALPHABETS (a-z):

Alphabet	Symbol	Alphabet	Symbol	Alphabet	Symbol
a		j		s	
b		k		t	
c		l		u	
d		m		v	
e		n		w	
f		o		x	
g		p		y	
h		q		z	
i		r		space	

SET ‘C’ – UPPER CASE ALPHABETS (A-Z):

Alphabet	Symbol	Alphabet	Symbol	Alphabet	Symbol
A		J		S	
B		K		T	
C		L		U	
D		M		V	
E		N		W	
F		O		X	
G		P		Y	
H		Q		Z	
I		R		-	-

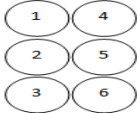
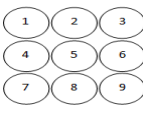
SET ‘D’ – PUNCTUATIONS & SPECIAL CHARACTERS:

Brackets		
Name	English Notation	Symbol
Square bracket open	[
Square bracket close]	
Curley bracket open	{	
Curley bracket close	}	
Round bracket open	(
Round bracket close)	
Quotation Mark		
Name	English Notation	Symbol
Single quote open	‘	
Single quote close	’	
Double quote open	“	
Double quote close	”	
Other Puncpuations		
Name	English Notation	Symbol
Apostrophe	’	
Comma	,	
Question mark	?	
Exclamation mark	!	

Colon	:	
Semi-colon	;	
Dash	-	
Hyphen	-	
Full-stop	.	
Ellipse	...	
Forward slash	/	
Special Characters		
Name	English Notation	Symbol
Backslash	\	
Hash	#	
Asterisk/star	*	
Ampersand	&	
At	@	
Copyright		
Dollar	\$	
Underscore	—	

Plus	+	
Minus	-	
Multiply		
Divide		
Percent	%	
Less than	<	
Greater than	>	
Equal	=	
Caret	^	
Vertical bar		
tilde	~	
Grave accent	`	
Rupees		
Pi		
Under root		
Decimal	.	

COMPARISION TABLE

Points of Comparison	English Braille	My Language
Number of dots	6	9
Representation of dots	2 columns of 3 dots each	3 columns of 3 dots each
Structure of cell	 <p>3x2 Braille cell</p>	 <p>3x3 matrix cell</p>
Levels of coding	3 levels [Grade 1: letter-by-letter transcription Grade 2: abbreviations and contractions Grade 3: shorthand]	1 level [letter-by-letter transcription]
Total possible combinations	64	512
Combinations in use	64/64	108/512 [remaining are under consideration]
Ambiguity	Ambiguity between 1-0 and a-j [used additional cell (number symbol) to distinguish them]	No ambiguity [each and every characters including digits and special symbol possess a unique matrix code]
Complexity	Punctuations and mathematical symbols uses two Braille cell to symbolize some single mathematical symbols and punctuations. Also an additional cell (caps cell) is used to represent upper case alphabets.	A single and unique matrix cell is used to symbolize all characters including digits, punctuation marks and special characters.
Arrangement of patterns	64 patterns are arranged in 5 decades & a bottom row [1 st decade, 2 nd decade, 3 rd decade, 4 th decade, 5 th decade, Bottom row]	108 patterns are arranged in 4 sets [Set ‘A’ Set ‘B’ Set ‘C’ Set ‘D’]
Pattern followed	1. 1 st decade occupied top and mid row. 2. 2 nd to 4 th decade are derived from 1 st by adding dots in bottom row [2 nd : left of bottom row, 3 rd : both of bottom row, 4 th : right of bottom row] 3. 5 th follows same pattern as of first row but it is shifted downwards. 4. Bottom row occupies only 4 patterns. 5. Each decade have two additional mirror image patterns.	Set ‘A’ contains digits (1 to 9) and occupy 1 dot of the cell. Set ‘B’ contains lower case alphabets and occupy two dots of the cell. Set ‘C’ contains upper case alphabets and occupy three dots of the cell. Set ‘D’ contains punctuations and special characters and occupy four dots of the cell. Zero and space are two exceptions occupying all the dots in the cell and none of the dots in the cell respectively.
Easiness (in terms of level 1)	Punctuations and mathematical symbols need time to memorise.	UNIQUENESS of code and SET based pattern provide ease in memorising.

CONCLUSIONS

Louis Braille’s invention of Braille literacy at that time was actually a very important and challenging inversion in the field of visually challenged people’s education. Through this paper we have tried to put under light the concept of English Braille with a new literacy concept “LIGHTingU”. Keeping in mind the same approach of raised dots notation, LIGHTingU follows a simple and easy pattern to learn English literacy. The main area of research was in increasing the possible combinations so as to cover more literacy notations and following a simple and easy pattern so that memorising the notations would be easy.

3x3 matrix cells gave more possible combinations which ultimately provided LIGHTingU with its two strengths: UNIQUENESS OF CODE and SET BASED PATTERN. These two strengths helped in avoiding any kind of ambiguity (through uniqueness of code) and a complex structure for a single notation (through set based pattern).

Currently, 108 cells of the matrix are in use that is divided into 4 sets:

SET 'A' – Digits (10),

SET 'B' – Lower case alphabets (27),

SET 'C' – Upper case alphabets (26),

SET 'D' – Punctuations and special characters (45).

The designed literacy concept is expected to have some more notations to represent punctuation marks. Since the proposed system limits itself to LEVEL 1 only, it is expected to cover LEVEL 2 and LEVEL 3 advancements soon.

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