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QURAN VIBRATIONS IN BRAILLE CODE

Abdallah M Abualkishik, Dr. Khairuddin Omar

Department of System Science and Management, Faculty of Information Technology
abed1182@hotmail.com, ko@ftsm.ukm.my

Abstract:

This article concerned with reorganize new Braille symbols to represent the vibrations in the Arabic Quran, the aim of this study is building a system that translate the Quran verses to Braille symbols including new vibrations. This study limited for the (Noun + Scoon) vibrations, (Meem + Scoon) vibrations and (Lam + Scoon) vibrations. It builds on an existing translation system that combines a finite state machine with left and right context matching and a set of translation rules. This allows to translate the Arabic language from text to Braille symbols after detect the vibration for the Quran verses.

Keywords*: Braille, Quran vibration, Finite State Machine, Decision Table*

Introduction

Today; Computers, Internet, and information explosion provide an informational structure which has changed the way people interact with the outside world. These rapid changes in this area have the potential to reduce the differences between disabled and normal individuals. In the early days of computers, visually impaired users had little or no access to the information in the computer screen. Since then, software developers of screen readers have been able to cope with the text-based environment of early operating systems. However, most modern operating system environments are now GUI. Hence, the information on the screen is no longer accessible to users who rely on screen readers or Braille displays [1].

Braille is the system of touch reading and writing which utilizes raised dots to represent the print alphabet letters for persons who are blind. The Braille system also includes symbols to represent punctuation, mathematic and scientific characters, music, computer notation, and foreign languages. The Arabic language is one of the languages that have been translated to Braille system and this system has been used by blind Muslim persons to read the Quran. However the current system [2] is not complete; it does not include special vibrations that are required in reciting Al-Quran which it different at the reciting for the Arabic language. Also in [3], the study was concentrated at the (Noon + Scoon) vibrations only, whereas this study will include more vibrations that didn't include at the last study.

These vibrations are: اظهار (Edhare) for (Noon sakenah , Meem sakenah and Lam sakenah), ادغام (Edgham) for (Noon sakenah , Meem sakenah and Lam sakenah), اخفاء (Ekhfa') for (Noon sakenah and Meem sakenah), اقلاب (Eklabe) for (Noon sakenah), and قلقلة (Kalkala) for (scoon). Therefore there is a need to develop system for translating special vibration into Braille symbols for the Quran verses.

By using of Braille symbols, the blind are able to review and study the written word. It provides a vehicle for literacy and gives a blind the ability to become familiar with spelling, punctuation, paragraphing, footnotes, bibliographies and other formatting considerations. Braille cell is consist of 6 dots, 2 across and 3 down, is considered the basic unit for all Braille symbols. For easier identification, these dots are numbered downward 1, 2, 3 on the left, and 4, 5, and 6 on

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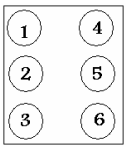

Fig 1: The Dot that represents Braille symbols

Sixty-four probabilities are represented from these six dots, which include the space symbol. The sixty four patterns represent at the below equation:

$P = 2^n$

Where

P: number of Braille symbols,

n: number of the dot

This study concentrates on reorganized Braille symbols to include new vibrations in the Arabic Quran. The system will use FSM that allows the application of rules to be controlled by comparing left and right contexts. This system will translate the input text by using a set of character rules, determining what characters are valid for the language and their attributes, FSM, decision table; and a set of translation rules containing wildcards for matching input text. These parts together constitute a complete language rules table. Contraction and different types of translation can all be supported within the same language rules table.

The Decision table will use to controls the operation of the finite state machine (FSM) and provides more flexibility for it. Grad 2 to the Arabic Quran Braille creates, where it will cover the shortage of the vibration that not exists in the existing systems. Suitable FSM that handle the new grade of Braille within the same language will develop to allow a single set of rules to double as translation to Braille for a language, and a simple list of character translation rules that can be edited directly by non-technical users. Then proof the efficiency of this flexible technique at the new Arabic Quran Braille generation.

Literature review

1854 was the starting with adoption of Braille as the official communication method for the blind in France. By the end of the nineteenth century; English language translate in the United Kingdom, Australia and many other countries. In the United States, Braille was not adopted until 1932. Early in the nineteenth century there were five tactual systems in use throughout the United States, including American as well as British Braille [4].

There are many researches of Braille system was done lately to the English symbols. The market-leader in commercial translation products is produced by the Duxbury Company in the USA [5]. They provide many functions, including translating word-processed documents and plain text, integration with other applications, bulk translation and graphical interfaces. There are versions for individual users, integrated with the Microsoft Windows and Apple Macintosh desktop operating systems, as well as large-scale volume translators. They are feature-rich, constantly updated but relatively expensive. Some fourteen languages are supported.

Another system designed for desktop computers is Win Braille. This is produced by the Index Braille company [6] which manufactures embossers and thus produces a free text-to-Braille product to encourage Braille use. This supports 18 languages in a WYSIWYG word-processor style, allowing Braille code to be edited directly. It is designed to produce output for the Index embosser. It uses a rule-based translation system, and the rules can be edited by users for local variations. It also supports grades of translation, straight character or abbreviation.

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The Qur'an (Muslim Religion Book) is a Message from Allah to humanity. It was transmitted to us in a chain starting from the Almighty Himself to the angel Gabriel to the Prophet Muhammad. This message was given to the Prophet in pieces over a period spanning approximately 23 years. The Prophet was 40 years old when the Qur'an began to be revealed to him, and he was 63 when the revelation was completed. The language of the original message was Arabic, but it has been translated into many other languages [7].

The Arabic language from the important language in the world, where it the main language for the Quran in the Islam religion, The Custodian of the Two Holy Mosques' Braille Press for the production of the Holy Quran was initially known as the Regional Bureau Press and was established in 1973 under the purview of the Middle East Committee for the Affairs of the Blind. The print house initially started producing educational books using manual Braille equipment which however was considered to be primitive and thus incapable of printing the Quran. The period between "1985 – 1986" (1406 hijri) saw the first Quran being produced in Braille in Saudi Arabia by the special Education Press of the Ministry of Education a fatawa given by the Grand Mufti of Sudi Arabia, Sheikh Abdulaziz Bin Baz. The Regional Bureau Press also produces its first copy of the Braille Quran between "1986 – 1987", [8].

The Existing Braille Systems

1) Duxbury Braille Translation (DBT) Software

In [5], DBT is window-based software that automates the process of conversion from regular print to Braille (and vice versa.) It provides translation and formatting facilities. It also provides word-processing facilities directly in the Braille mode where the user can treat the keyboard as Perkins machine to enter Braille text as well as using the software for ordinary word processing tasks. Also, the software can translate Arabic text to Braille. With this supplement, one can create and edit natural Arabic text using Microsoft Word (Arabic version), and then import and translate the file into Arabic Braille using the DBT software. English text may also be intermixed, and both languages may be contracted, or no contracted, or any combination. Although Duxbury Translation software supports all of the above features, yet, there was a small bug; the translation of Arabic characters in DBT was not 100% equivalent to the Arabic character set supported by Windows 95/98/NT/2000. Perhaps this was due to the difference in character code page used by DBT and our Windows 95/98/NT/2000. Moreover, DBT does not support any type of sound that is essential for the blind to interact with computer.

2) IBSAR

Al-Sharekh,, reported in [9], that a Braille translator, a window-based application that was developed by Aramedia, Jordan. The software is designed for the sighted users, it have the ability to translate Arabic and English text into Braille without contractions. It uses MS-Word as its platform.

3) Printing System with Braille Software

The Kuwait institute for scientific research has developed software called Printing system with Braille. It is a window-based application that is oriented to sighted people to convert Arabic text to Braille (one way translation), [2]. The software supports multi-level contractions as well as the conversion of Holy Quran files into Braille.

Finite State Machine

FSM is a useful data structure to express actions with a given sequence of events. FSM concepts are used for pattern recognition, artificial intelligence studies, language and behavioral psychology. The basic concepts are easy to understand and immensely powerful. The idea behind

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the FSM is that a system such as a machine with electronic controls can only be in a limited (finite) number of states. Consider some simple systems that you encounter every day: a door may be open or closed; a light may be on or off; a light bulb may be on, off or broken; a cassette player may be playing, stopped, rewinding or fast forwarding.

The first step in any FSM design is to identify the significant states of the system; you need to include all the important states but avoid including unnecessary states. Hence, the door may be "Opening" or "Closing", but "3/4 open" or "1/4 closed" would most likely be overkill, [10].

Alasdair King is concerned with the translation of text to and from Braille, by using the matching of left and right contexts of the translation windows, with FSM to handle grades of Braille within the same language and to allow a single set of rule to duple as translation to and from Braille for a language, decision table controls the operation of the finite state machine, and simple list of character translation rules that can be edited directly by non-technical users, [11].

The UMIST translation system [12], is one of the few published of work on text and Braille translation in recent years. Where the engine state controlled by FSM, using the contents of the decision table, and regulates which subset of the language translation rules can be used. The translation engine can use any language rules table, so any language can be translated to or from Braille code if the language rules table is constructed.

Theory Building

Theory building is a process of developing methods or models, and the translation algorithm that used to develop Quranic Braille system, see the Figure 3:

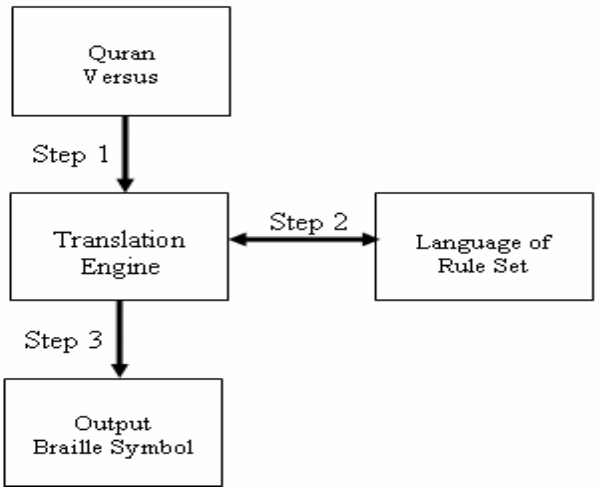

Fig 3: Methodology approach for translation algorithm

During translation the engine works along the input text, character by character. It attempts to match a window of input text starting with the current character with one of the translation rules in the language rules table.

FSM, involve the complications of state, control tables and many rules. An alternative approach using only the matching of left and right contexts of the translation window was developed. The former contains the translation algorithms and functions, and the latter all of the translation information for translation of one language in one direction. The translation engine can use any language rules table, so any language can be translated to or from Braille code if the language rules table is constructed. The language rules table consists of a set of translation rules and a decision table.

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A successful match with a translation rule must match a segment of text, the context - the text to the left and right of the window - and the state of the engine. The engine state is controlled by the FSM, using the contents of the decision table, and regulates which subset of the language translation rules can be used. The translation rule then provides the translation for that window of input text, which is appended to the growing output text, and the engine moves along the input text to the next unmatched character.

Develop the Rule set

i. Create New Vibration

The recitation for the Quran verses, is not similar to the Arabic language reading, where the Quran verses have special vibrations that help the Quran reader to get the right meaning for the verses, In this study we create 5 new vibrations that was not exist in the previous systems.

The standard world Braille that founded is represented the English character, so that the developers, who develop the Arabic Braille systems, used the English characters to represent the Arabic character then translate it to Braille symbols.

Therefore; the process to create the new vibration that used in Quran Braille (اظهار (Edhare), ادغام (Edgham), اقلاب (Eklabe), اخفاء (Ekhfa')) for the Noon, Meem and lam characters; and قلقلة (Kalkala) for the Scoon, by finding all the possible probability symbols that not duplicate with other existing Arabic symbols, then put it for the new 5 vibrations.

As shown in Table I, the Noon Sakenah, Meem Sakenah, and Lam Sakenah are have similar tow vibration (Edhare and Edgham), the Ekhfa' vibration occurs just at the Noon Sakenah and Meem Sakenah, the Eklabe occur at the Noon Sakenah, and the Kalkala occur at the Scoon, where the Noon Sakenah, Meem Sakenah, Lam Sakenah and Scoon have different rules for each vibration that detected.

TABLE I
New Quran Vibration Symbols

Noon and Scoon	Meem and Scoon	Lam and Scoon	Scoon	English Characters	Braille Symbols	Number Of Dots
Edhare	Edhare	Edhare		0	⠶	356
Edgham	Edgham	Edgham		8	⠦	236
Ekhfa'	Ekhfa'			7	⠷	2356
Eklabe				6	⠧	235
			Kalkala	p	⠯	1234

ii. Character Rules

1) Arabic character that need to translate.
2) Identify all the Arabic character that needs to translate.
3) Identify all the new vibrations to translate it.
4) English character that meet the Arabic characters.
5) Identify the new created symbols.
6) The world standard for Braille symbols for the English characters

iii. Vibration Rules

There around 20 reciting styles for the Holy Quran verses, but the most widespread reciting at the Islamic World is Huffes reciting style where as a mention at [14], it is followed for Ali bin Abi-Talib "Allah blesses him". The rules set for the Quran vibrations that will apply at this study is followed Huffes style reciting, and it is explaining comprehensive in this section.

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a. Noon Sakenah Vibrations

This vibrations occur, if the below character in each vibration coming after (Tanween or Noon Sakenah).

Table II

اظهار . (Edhare Vibration)

خ	غ	ح	ع	هـ	ء	أ	إ	ؤ	ئ
X	>	:	)	H	`	/	.	|	Y
⠭	⠽	⠱	⠐⠣	⠓	⠠	⠌	⠲	⠳	⠽⠂

Table III

ادغام (Edgam Vibration)

ن	ل	م	ر	ي
N	L	M	R	I
⠝	⠇	⠍	⠗	⠊

Table IV

اقلاب (Eklabe Vibration)

ب
B
⠃

Table V

اخفاء (Ekhfa' Vibration)

ظ	ض	ث	ف	ز	ط	د	س	ق	ش	ج	ك	ت	ذ	ص
=	$	T	F	Z	(	D	S	Q	%	J	K	?	!	&
⠿	⠎	⠞	⠋	⠵	⠦	⠙	⠎	⠟	⠩	⠚	⠅	⠹	⠮	⠯

b. Meem Sakenah Vibrations

The vibrations occur, if the below character in each vibration coming after ((Meem + Scoon)).

Table VI

اظهار . (Edhare Vibration)

Arabic Characters	ا	ت	ث	ج	ح	خ	د	ذ	ر	ز	س	ش	ص	ض	ط	ظ	ع	غ	ف	ق	ك	ل	ن	ه	و	ي
English Characters	a	t	?	j	:	x	d	!	r	z	s	%	&	$	(	=	)	>	f	q	k	l	n	h	w	i
Braille Symbols	⠁	⠞	⠹	⠚	⠱	⠭	⠙	⠮	⠗	⠵	⠎	⠩	⠯	⠎	⠦	⠶	⠐⠣	⠕	⠋	⠟	⠅	⠇	⠝	⠓	⠺	⠊

Table VII

ادغام (Edgam Vibration)

Arabic Character	م
English Character	m
Braille Symbol	⠍

Table VIII

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اخفاء (Ekhfa' Vibration)

Arabic Character	ب
English Character	b
Braille Symbol	⠃

c. Lam Sakenah Vibrations

The vibrations occur, if the below character in each vibration coming after ((Lam + Scoon)).

Table IX

اظهار . (Edhare Vibration)

Arabic Characters	أ	ب	غ	ح	ج	ك	و	خ	ف	ع	ق	ي	م	ه
English Characters	/	b	>	:	j	k	w	x	f	)	q	i	m	h
Braille Symbols	⠁	⠃	⠁	⠓	⠚	⠅	⠺	⠭	⠋	⠕	⠟	⠊	⠍	⠓

Table X

ادغام (Edgam Vibration)

Arabic Characters	ط	ث	ص	ر	ت	ض	ذ	ن	د	س	ظ	ز	ش	ل
English Characters	(	?	&	r	t	$	!	n	d	s	=	z	%	l
Braille Symbols	⠦	⠹	⠯	⠗	⠞	⠳	⠮	⠝	⠙	⠎	⠨	⠵	⠩	⠇

d. Kalkala Vibration

Table XI represents the characters that whom if followed by Scoon it will occur the (Kalkala).

Table XI

قلقلة (Kalkala)

د	ج	ب	ط	ق
d	**j**	**b**	**(**	**q**
⠙	⠚	⠃	⠦	⠟

Develop the Decision Table

Decision table is a powerful documentation tool for understanding and maintaining the documentation and useful in verifying the rules. Table XII below, declared the main table that will manage the process of apply the vibrations rule at the text.

Table XII

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General Table

IF Conditions	(Noon + Scoon) OR (Tanween) (Meem + Scoon) (Lam + Scoon) (Kalkala Char + Scoon) (ELSE)	Y N N N N	N Y N N N	N N Y N N	N N N Y N	N N N N Y
ACTION	GO To Noon Vibration D .Table XIII Go To Meem Vibration D .Table XIV Go To Lam Vibration D .Table XV Put the symbol of Kalkala RE - Check General D .Table XII	X	X	X	X	X

Tables XIII, XVI and XV, represent the action that will occur by applying the conditions at Table XII.

Table XIII
Noon Vibrations

IF Conditions	{((Noon + Scoon)OR (tanween)) + (Edhare Char) } {((Noon + Scoon)OR (tanween)) + (Edgham Char) } {((Noon + Scoon)OR (tanween)) + (Eqlabe Char) } {((Noon + Scoon)OR (tanween)) + (Ekhfa' Char) }	Y N N N	N Y N N	N N Y N	N N N Y
ACTION	Put the symbol of Edhare Put the symbol of Edgham Put the symbol of Eqlabe Put the symbol of Ekhfa'	X	X	X	X

Table XVI
Meem Vibrations

IF Conditions	{(Meem + Scoon) + (Edhare Char) } {(Meem + Scoon) + (Edgham Char) } {(Meem + Scoon) + (Ekhfa' Char) }	Y N N	N Y N	N N Y
ACTION	Put the symbol of Edhare Put the symbol of Edgham Put the symbol of Ekhfa'	X	X	X

Table XV
Lam Vibrations

IF Conditions	(Lam + Scoon) + ((Edhare Char) + (Not Shudah)) (Lam + Scoon) + ((Edgham Char) + (Shudah))	Y N	N Y
ACTION	Put the symbol of Edhare Put the symbol of Edgham	X	X

Develop the Finite State Machine

For each pair of state and input symbol there is one and only one transition to a next state, or each input symbol it will then transition to a state given by following a transition function. The first step was to develop the FSM is by determine the states that needed to do the translation process where it was five main states in this study, then determine the transition function that needed to transition from state to state.

The Figure 4, represent the diagram for the FSM method that used in the system to make

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monitoring at the translating processes.

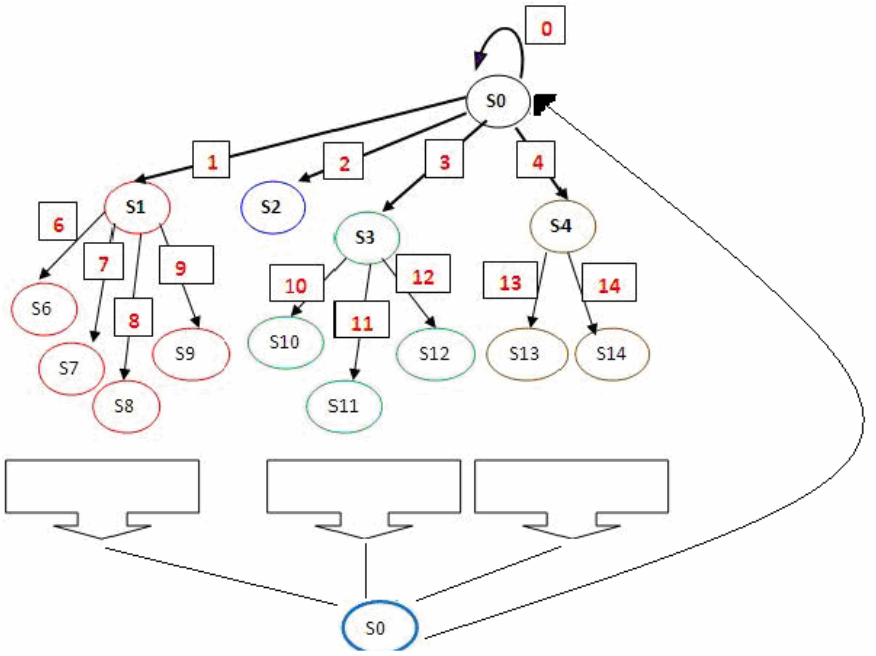

Fig 4: Finite state Machine Diagram

As example to declare the FSM work, the verses (فمن يعمل) took to apply it at the technique. The initial state is S1, the curser will read the first character in the versus and because it haven't any vibrations, the transaction function will be (0) which will translate the character to Braille symbol, then the current state for the algorithm will be S0, then the cursor will move to the second character, and it will find it also haven't vibration so that, the transaction function will be (0) also, and the current state will still S0, the cursor will move to the third character, so it will find (Noon followed by Scoon), and then apply the transaction function (1), that will check the character after it, to determine the special vibration for the character, and then move to S1, the curser will check the next character to determine the type of the vibration that founded then translate the characters and put the symbol of the special vibration under this vibration location. In the previous example, the character that followed the Noon Sakenah was (Ya) where it considered as one of the Edgham vibration, so that the curser will move to S6 after translate the Edgham vibration, after that the current state will back at S0 after the vibration translation process was done to continue the translation and detect process for the rest of the verses and so on.

The Table VII below represents the truth table for the finite stat machine status, for each state and each possible input from the user.

Table XVI
Truth Table

Status	Transition Function														
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
S0	S0	S1	S2	S3	S4	S5	-	-	-	-	-	-	-	-	-
S1	-	-	-	-	-	-	S6	S7	S8	S9		-	-	-	-
S2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S3	-	-	-	-	-	-	-	-	-	-	S10	S11	S12		-
S4	-	-	-	-	-	-	-	-	-	-	-	-	-	S13	S14

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The Table VIII below is described the transition for each state. The transition function is to determine the next state based on the current inputs and state.

Table XVII
Transition Function Description

Transition Function	Description
0	Normal character
1	(Noon + Scoon)OR(Tanween)
2	Kalkala
3	Meem + Scoon
4	Lam + Scoon

Design and developing the translation engine

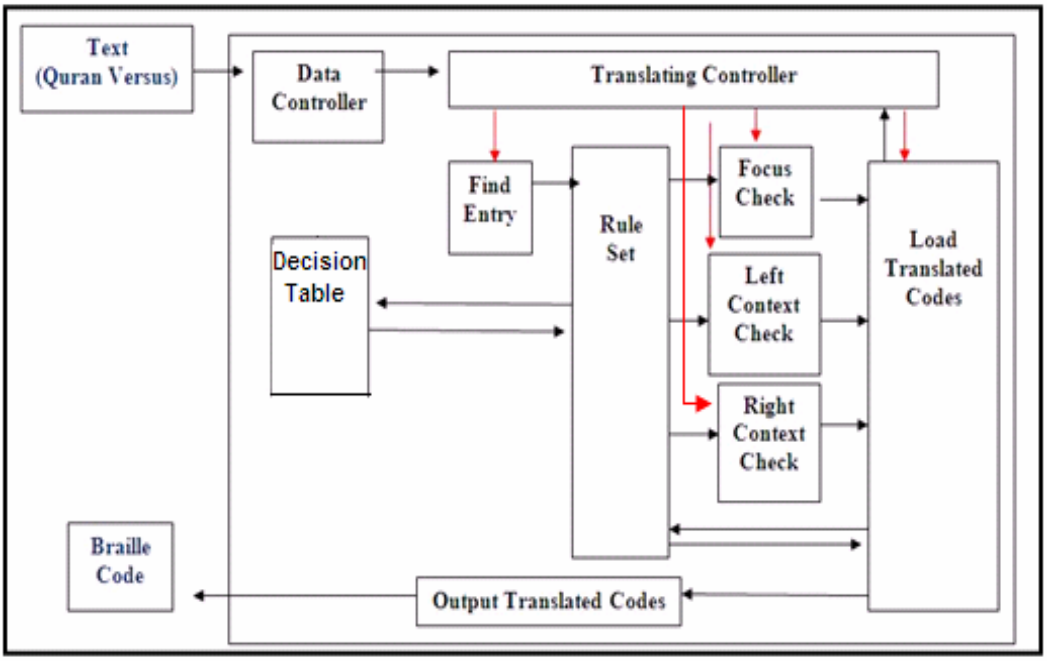

Fig.5 Translation Block

In Figure 5, the find-entry block receives one entry character from the translating-controller block and outputs a particular address to the output-rule block. Two operations keep running in the output-rule block. One is reading rules from the Decision table block, and the other is sending every single rule to focus-check, right-context-check, left context-check, and load-translated-codes blocks. The output-rule block receives signals from the find-entry block obtaining addresses, and signals from the load-translated-codes block that indicate if the output rule can be used. The output-rule block sends an address to the Decision table to read one rule at a time and sends it separately to focus-check, right context-check and left-context-check blocks. If the rule does not find a match, then a signal is generated and the output-rule block gets the next rule and sends it. This process continues until a match is found and the focus is successfully translated. The focus-check and right-context-check blocks receive not only the rule from output-rule block, but also the whole group of words to be translated from the translating controller because more than one letter of focus and right context might need to be checked. Each block generates signals for the load-translated-codes block indicating if the focus, the right context or the left context were successfully matched. If one of the three fails, then a signal is sent back to the output-rule block requesting the next rule. If the focus, right context and left context match one of the rules, then the load translated- codes block sends the translated codes to the output translated- codes block, and informs to the translating-controller block

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how many characters were translated. After one group of characters has been translated, the output-translated-codes block transmits the corresponding Braille ASCII characters one by one. Then the translation of a new set of characters begins.

Significance / Contribution

The study about translate the Quran verses to Braille symbol included new 14 vibration, the Quran as main book to the Islam religion from Allah, have some special vibrations, and the existing Braille systems that done before don't involve this property to recite the verses of the Quran, so that, this study come out with new generation from Braille system cover some miss compatible that found in the existing systems. It's for the blind Muslim people to uncover the way forward them to have the ability to be more understanding for the Quran with his entire requirement.

Conclusion And Future Directions

To reach the quality of outstanding systems, contributions from many institutes and research centers nationwide are required. Also, there is the need to standardize the Braille system to the Quran, because it have own contractions rules and it missing in the previous studies that done before at the Quran field.

The Quran have many vibrations that should be under the researcher considered, where the Quran is GOD book for more than billion Muslim are spread around the world, and the blind Muslim have the right for understanding his religion. In this research, there 5 new Braille symbols was reorganized to cover 14 vibrations that have different rules. The study at the rest of the Quran vibration still under concern and it will produce in the next step of this research.

APPENDIX I

Table I below, declare the original Arabic characters and what match it in English characters and Braille Symbols.

Table I
Arabic Character & Braille symbols

Braille	Arabic	Braille. Dots	Dot	English	Braille
⠁	ا	1	100000	a	⠁
⠃	ب	12	110000	b	⠃
⠞	ت	2345	011110	t	⠞
⠹	ث	1456	100111	؟	⠹
⠚	ج	245	010110	j	⠚
⠓	ح	156	100011	:	⠓
⠭	خ	1346	101101	x	⠭
⠙	د	145	100110	d	⠙
⠫	ذ	2346	011101	!	⠫
⠗	ر	1235	111010	r	⠗
⠵	ز	1356	101011	z	⠵
⠎	س	234	011100	s	⠎

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⠩	ش	146	100101	%	⠩
⠱	ص	12346	111101	&	⠱
⠹	ض	1246	110101	$	⠹
⠽	ط	23456	011111	)	⠽
⠿	ظ	123456	111111	=	⠿
⠷	ع	12356	111011	(	⠷
⠯	غ	126	110001	<	⠯
⠋	ف	124	110100	f	⠋
⠟	ق	12345	111110	q	⠟
⠅	ك	13	101000	k	⠅
⠇	ل	123	111000	l	⠇
⠍	م	134	101100	m	⠍
⠝	ن	1345	101110	n	⠝
⠓	ه	125	110010	h	⠓
⠺	و	2456	010111	w	⠺
⠊	ي	24	010100	i	⠊
⠕	ى	135	101010	o	⠕
⠯	ة	16	100001	*	⠯
⠧	لا	1236	111001	v	⠧
⠁	أ	34	001100	/	⠁
⠊	إ	46	000101	.	⠊
⠗	آ	345	001110	>	⠗
⠁	ء	3	001000	'	⠁
⠳	ؤ	1256	110011	|	⠳
⠿	ئ	13456	101111	y	⠿
⠂	ـَ	2	010000	l	⠂

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