QURANIC BRAILLE TRANSLATOR (QBT) FRAMEWORK

Khairuddin Omar[1], Abdallah Mohammad Abualkishik[2], Mohd Zamri Murah[1], Ahmad Yunus Mohd Noor[3], Abbas Salimi Zaini[1], Mohammad Faidzul Nasrudin[1], Mohd Sanusi Azmi[4] and Juhaida Abu Bakar[5].

[1]Centre for Artificial Intelligence Technology,
Faculty of Information Science and Technology,
Universiti Kebangsaan Malaysia
ko@ukm.edu.my

[2]Faculty of Computing & Information Technology,
Sohar University, Oman
aabualkishik@soharuni.edu.om

[3]Pusat Akidah & Keamanan Global,
Fakulti Pengajian Islam,
Universiti Kebangsaan Malaysia
a_yunus@ukm.edu.my

[4]Department of Software Engineering
Faculty of Information and Communication Technology
Technical University of Malaysia, Malacca
sanusi@utem.edu.my

[5]School of Computing,
UUM College of Arts and Sciences, Kedah
juhaida.ab@uum.edu.my

ABSTRACT

This work proposed Quranic Braille Translator (QBT) framework to presents a specific translator to translate Quran verses and their reciting rules into the Braille code based on structure and method of PERTIS's Quranic Braille. Quran Extended Finite State Machine (QEFSM) model is used through this study, as it is able to detect the Quran reciting rules (QRR) from the Quran text. Basis path testing is used to evaluate the inner work for the model by checking all the test cases for the model. Markov Algorithm (MA) is used for translating the detected QRR and DILP Quran text into the matched Braille code. The data entries for QBT are Arabic letters and diacritics. The outputs of this study will automatically transliterate Quran Text into Braille code that similar with PERTIS's Quranic Braille.

.

Keywords: *Finite State Machine*, *Markov Algorithm*, *Quran reciting rules*.

INTRODUCTION

Quranic Braille Translator (QBT) framework has eight main processes as shows in Figure 1:

1. Identify Quran reciting rules based on structure and method of PERTIS's Quranic Braille (Mustaqim, 2013) - This study is included Quran reciting rules and six (6) Jawi characters;
2. Identify Arabic, Jawi and Roman characters-;
3. Mapping Braille symbols with Arabic, Jawi and Roman characters with standard Unicode Braille – see Table 1;
4. Representing Quran reciting rules by using Decision table method;
5. Applying Quran reciting rules in Decision Table by using Extended Finite State Machine T(EFSM) technique;
6. Controlling the integration works between Decision table method and EFSM technique;
7. Translating entry text by using Markov Algorithm - Through this process, the Quran reciting rules, script and Jawi characters was translated to Braille code by using Markov algorithm (MA), and
8. Evaluating QBT by using User Acceptance Testing.

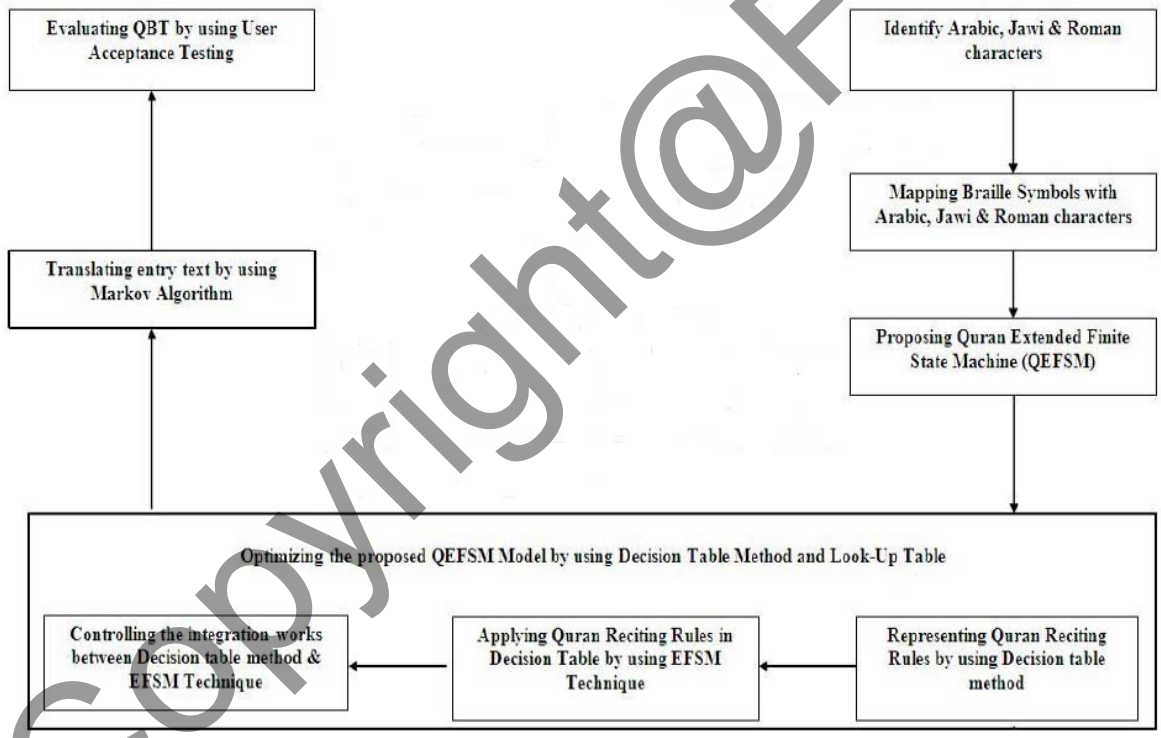

Figure 1: QBT Framework (Abdallah, 2011).

Table 1: Quran Braille with Standard Unicode Braille

Braille	Arab Al-Quran	Unicode (Braille)
a	ا	2801
b#	ب	2803
t	ت	281e
?	ث	2839
j#	ج	281a
:	ح	2831
x	خ	282d
d	د	2819
!	ذ	282e
R	ر	2817
Z	ز	2835
S	س	280e
%	ش	2829
&	ص	282f
$	ض	282b
)	ط	283e
=	ظ	283f
(	ع	2837
<	غ	2823
f	ف	280b
Q	ق	281f
k	ك	2805
L	ل	2807
m	م	280d
N	ن	281d
w	و	2825
h	ه	2813
V	لا	2827
'	ء	2804
/	أ	280c
|	ؤ	2833
y	ئ	283d

>	آ	281c
*	ة	2821
o	ى	2815
1	◌َ	2802
e	◌ِ	2811
U	◌ُ	2825
2	◌ً	2806
9	◌ٍ	2814
5	◌ٌ	2824
3	◌ْ	2812
'	◌ّ	2820
>	◌اً	281c
@	◌ا	2808
~	◌ٓ	2818
+	◌ٔ	282c

Combination of process 4 to 6 will form Quranic Extended Finite State Machine (QEFSM) is a powerful model for verification and test derivation; it is composed of states, transitions and actions. The model can detect and check the Quranic reciting rules or Jawi text sequentially until it find match between the windows and one of the states. The decision and look-up tables will optimize QEFSM process. Through the optimization processes; the Model works parallel, the redundant states were removed and the number of states, the number of independent paths and test cases were reducing.

CONCEPTS BUILDING

Concepts building are processes of developing methods or a translation algorithm that are using in QBT development see Figure 2.

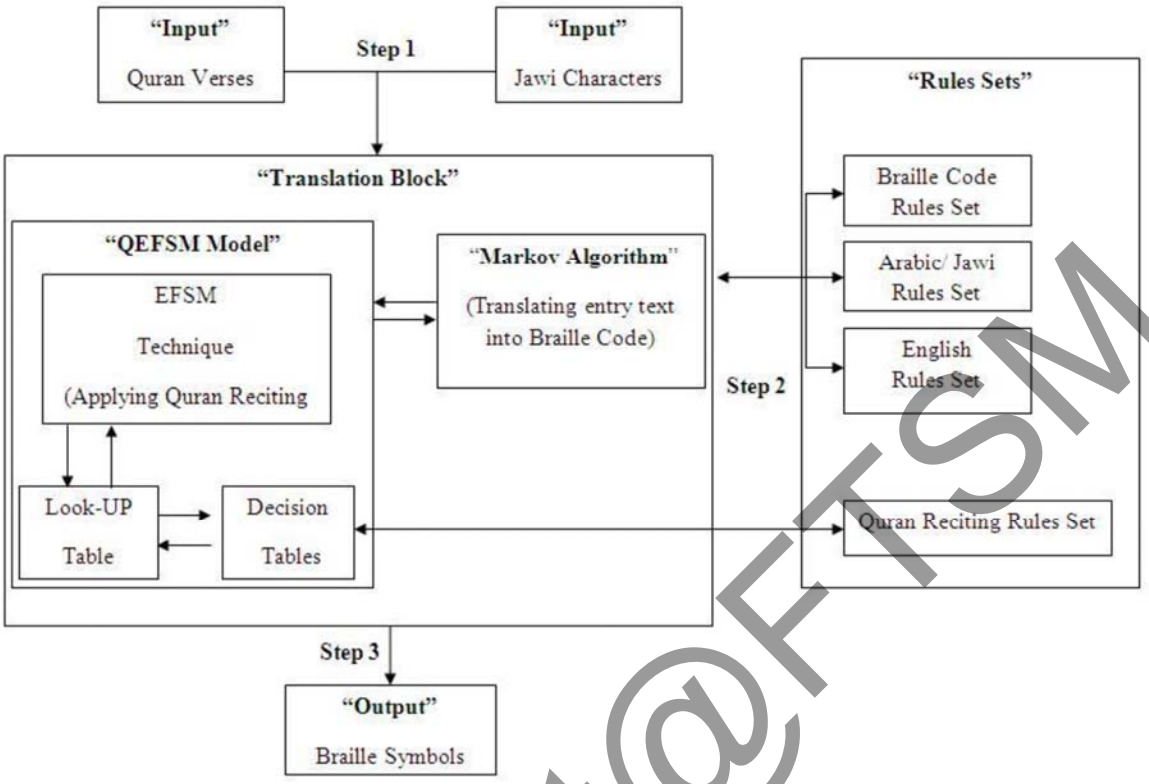

Figure 2: Concept approach for translation process (Abdallah, 2011)

The input in step-1 can be Quran versus or Jawi characters. In step-2, the processes of reading rules from the look-up-table block, and sending every single rule to focus and left contexts-check are keeping work to find the next entry letters. Translation block (Markov algorithm) is sending signal for output rule block if the rules satisfy the letters. The find entry is sending signal for output rules to check the addresses of the translated letters in order to get new entries from controller block. The output-rule block sends a signal to the decision table to get one rule then send it for the focus check and left-contexts-check blocks. If the rule does not match, then an output rule block request another rules from decision table, the output-rule block gets the next rule and sends it. This process continues until found a match output and the input is successfully translated. Step-3 is the final translated braille Symbols.

EXPERIMENTATION

We hope that we can test as many as we can through this experiments phase. The Accuracy for detecting and translating processes will measured by using indirect measurements equations that proposed through this research.

The Accuracy for detecting and translating processes was measured by using indirect measurements equations that proposed through this research. The experiments have three types: which are:

Experiment I: Detecting Quran Reciting Rules by QBT - Through this experiment, the accuracy for the Quran reciting rules that detected from the Quran verses was calculated by using equation (1) which divided the number of the detected reciting rules by QBT at the number of the whole reciting rules in the entered Quran text.

M (RA) is abbreviation for Reciting Accuracy. QBT (Q.R.R) is for Quran reciting rules that detected per each verse by Quran Braille Translator. Q (Q.R.R) is for Quran reciting rules that exist per each verse at the original Quran text.

Suppose z = M (R.A), x = QBT (Q.R.R) and y = Q (Q.R.R) then:

$$z = (x/y)*100\%. \quad (1)$$

Experiment II: Translating the entry data into Braille code by QBT - the accuracy for the translation process calculated by divided the number of the translated characters by QBT at the number of characters for the entry text as stated in equation (2).

TA is abbreviation for Translating Accuracy. QBT (T.L.V) is for translating letters per each verse by Quran Braille Translator. Q (Q.R.R) is for Quran reciting rules that exist per each verse.

Suppose; v = M (R.A), u = QBT (Q.R.R) and w = Q (Q.R.R) then:

$$v = (u/w)*100\%. \quad (2)$$

Experiment III: Detecting Quran Reciting Rules by Expert - the accuracy for detecting Quran reciting rules from the Quran verses by experts are calculate by using equation (3). We hope that we can handle experiment as many as we can.

RA is abbreviation for Expert Reciting Accuracy. QBT (U.Q.R.R) is for Quran reciting rules that the Expert successfully detect and recite per each verse after the translation by using QBT. Q (Q.R.R) is for Quran reciting rules that exist per each verse at the original Quran text.

Suppose; a= M (R.A), b = QBT (Q.R.R) and c = Q (Q.R.R) then:

$$a = (b/c)*100\%. \quad (3)$$

SOURCE OF DATA

Through this research, QBT Quran data are texts was adopted from (DILP, 2003) which it is fully searchable Multilingual Quran with Arabic text, English translations and commentary by (Puya, 2004) and (Ali, 1996).

CONCLUSION

Through this project, QBT will be developed, tested and evaluated in order to introduce a useful Quran Braille for Muslim Blind people. QBT framework is proposed for giving the researcher and reader an overall overview about the integrations between the proposed Quran Extended Finite State Machine (QEFSM) model, Decision and look up Tables, Markov Algorithm, Quran rule set

and the inspired research methodology based on structure and method of PERTIS's Quranic Braille.

ACKNOWLEDGEMENT
The research is funded by Research Grant DCP-2018-01.

REFERENCES

Abdallah Mohammad Mustafa Abual Kishik, 2011. Extended Finite State Machine and Markov Model for Converting the Holy Quran Reciting Rules to Braille Code. Tesis Doktor Falsafah Fakulti Teknologi dan Sains Maklumat.

Ali. A. 1996. A Commentary on the Holy Qur'an. http://www.goodreads.com/book/show/8338620-a-commentary-on-the-holy-qur-an, [2 July 2019].

DILP. 2003. The Noble Quran, Ahlul Bayt Digital Islamic Library Project, *Al-Islam Orgnization.* http://quran.al-islam.org/, [2 July 2019].

Muhammad Mustaqim Mohd Zarif. 2014. Braille Al-Quran: Sejarah dan Kaedah. Nilai: Universiti Sains Islam.

Puya. Agha. 2004. The Holy Qur'an. goodreads Book, ISBN:187940219X, http://www.goodreads.com/book/show/232346.The_Holy_Qur_an. [06 July 2019]