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COMPUTER AIDED PRONUNCIATION LEARNING FOR AL-JABARI METHOD: A REVIEW(*)

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ABSTRACT

Speech processing for Quranic Arabic has been carried out, and has been such an active field of research, since a few years ago. We propose in this paper, a review that focuses on the use and on the potential of automatic speech recognition (ASR) computer-based technology to supporting Quranic learning processes. Thus, the aspects of Computer-Aided Pronunciation Learning (CAPL) will be discussed, focus towards the implementation on Quranic learning of *Al-Jabari* method. We believe this method is a fast, efficient method of learning, as well as a practical way of learning Al-Quran using ICT tools. The advantages and drawbacks of CAPL systems towards the implementation in Quranic learning, as well as Al-Jabari method will be discussed in details.

Keywords: *Automatic Speech Recognition (ASR), Computer-based Technology, Quranic, Al-Jabari, Computer Aided Pronunciation Learning (CAPL)*

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1. INTRODUCTION

The tremendous developments in current technology, especially advances in computer technologies have permitted 'computers' to effectively contribute in various fields of human lives, including learning. The contribution gain from it promotes the need of man-computer interaction, which allows them to interact between human and computers. Thus, the concept of Human Computer Interaction (HCI) has been introduced to human since last 20 years, mainly in conveying the messages, information and feedback response. Same goes to language learning process, where speech signal have been such the important medium in conveying message and information between human and another parties (either human, living creatures or computer/machine). However, the interaction between human and computers system is believed has undergone a very complex processes to be able to establish semi-natural conversations with human. Moreover, the complexity of interaction between humans and computers in the human learning field led to an obvious delay in the effective deployment of computers in these fields.

Here, one of the learning fields which closely related with speech and communication are referred to 'language learning'. Thus, the aspect of pronunciation learning is partly considered as a must (important) phase, in developing the speech interface. The component related to language learning is known as 'Computer-Aided Language Learning (CALL), meanwhile the aspects related to pronunciation learning is referred to other term known as 'Computer-Aided Pronunciation Learning (CAPL)'. These both terms are referring to the new achievements in the fields of computer aided learning systems, intelligent tutoring systems, speech recognition, speech synthesis and dialogue systems, which permits the ability to produce efficient computer aided systems in language learning fields. New systems not only target demos or prototypes but actual usable systems. These systems can present more easy, enjoyable, effective and available solutions than traditional learning systems.

Al-Jabari method also considered as one of the Quranic learning method that still used traditional learning systems in their learning process. Since this method has been introduced in Malaysia in earlier year of 2012, a lot of Muslim that categorized under the illiterate community before, able to read and write Al-Quran appropriately, after undergo 30 hours of learning. Currently this method has been taught by the experienced and well-trained teachers (Mudarris), but the numbers of them is still limited. Furthermore, today's busy lifestyle needs a modern and technological approach that able to optimize the study time, as well as improve the learning process. With the huge demanding of this learning approach in Malaysia, interactive and self-learning tools using ICT, particularly for Al-Jabari method could be the right choice to

be implemented nowadays. It is also mainly needed, due to support the Mudarris as well as students, particularly focuses on aspect of "know how to read" Al-Quran in a proper and a right manner (N.Jamaliah, Zulkifli, & M.Yamani, 2013).

Due to this phenomenon, the aspects of Computer-Aided Pronunciation Learning (CAPL) will be review and discussed in this paper, focus towards the implementation on Quranic learning of Al-Jabari method. This method has been proposed as learning tools, because we believed Al-Jabari method is a fast, efficient method of learning, as well as a practical way of learning Al-Quran using ICT tools. Besides, this paper also will review the problem of design, implementation aspects and evaluation of a complete-ready to use computer aided system.

2. LITERATURE REVIEW

2.1 Computer Aided Learning Systems

Computer Aided Learning (CAL) system or Computer Assisted Learning (CAL) Systems is a computer-based learning system, which particularly design for helping students in learning process. CAL is the process by which textual and graphic information is presented in some logical sequence to a student by a computer. The computer has serve as an audio, visual and tactile device and students learns by reading from the text materials presented or graphical information displayed and interrelating with the computer via keyboard or other input devices (Nga, 1986). In its purest form, CAL is carried out by an interaction between an erudite program and the student(s), with no teacher (human) being involved (Nihtilä, Sundqvist, Söderlund, & Östermark, n.d.).

For language learning, the above definition has been known as another term known as Computer-Assisted Language Learning (CALL) (also referred to as Computer-Aided Language Learning). It has been used of computers to help learn languages. However, in this paper the oral interaction between student and human teacher has involved. Pronunciation teachings methods is considered as a part of computer assisted language learning system and it is believed limited in their ability to produce feedback on pronunciation quality (Young & Witt, 1997). The CALL systems also consist of drawbacks and advantages as listed below:

Table 2.1: Advantages and disadvantages of CALL system ((Metwalli, 2005)

	Advantages
1.	In a traditional classrooms human teachers are supposed to give attention to each student part of the time. Whereas in CALL each user has his own session with the system having all its attention all the time. This increases time efficiency for the student.
2.	CALL systems can be equipped by automatic language assessment modules that can provide cheaper and less time-consuming tests all the time
3.	No matter how much patient a human teacher could be, he cannot be more patient than a computer system
4.	Even in fields where human teachers are easily available (which is not true in the case of teaching recitation of the Holy Qur'an) they cannot be as available as a computer system. Availability could be a crucial advantage of CALL over human teachers.
5.	CALL systems can be designed to adapt itself to each user needs. Users may even have freedom to select each session topics. Also CALL systems can adapt itself to the learning speed of each user individually which is certainly not available in regular classrooms.
6.	In CALL system students are more encouraged to try new topics without fear of making mistakes in front of others as the case in traditional classrooms.
	Disadvantages
1.	Computer systems are unable to motivate and encourage students the same way human teachers can do.
2.	A qualified human teacher is equipped with a large number of teaching techniques and he is able to optimize their use according to the students' needs.
3.	Language is a tool for communication and interaction between humans, so it is best learned through interaction with humans.

According to research made by (Banerjee, Beck, & Mostow, 2003; Banerjee, Mostow, Beck, & Tam, 2003), they had implemented a speech-recognition-based computer-guided oral reading coach (LISTEN). The system has demonstrated usability, user acceptance, assistive effectiveness, and even pre-test to post-test gains. It mimics human teacher actions during reading training sessions.

2.2 Aspects of Learning Recitation of the Holy Quran

Basic understanding of the main aspects and components of learning correct recitation of the Holy Qur'an is really necessary before starting to describe statistical methods for its assessment and correction by using speech recognition technology. It requires the brief discussion of 2 questions, (1) 'what' is the recitation of the Holy Quran and; (2) 'what' are the main aspects of teaching it. Besides, the main requirements of the Holy Quran recitation, regardless to the teachers (Mudarris) also really need to understand.

2.2.1 What is the recitation of the Holy Quran?

According to (Hosary, 2002), the correct recitation can be defined as; giving each letter its right properties and features (both original and contingent rights) and pronounce it with the correct articulation. Recitation of The Holy Qur'an is called 'Tajweed' "tajwi:d" in Arabic language, (Barkatulla) reached its definitions stemming from its linguistic meaning which is 'proficiency' or 'doing something well'. It comes from the same root letters as the word 'Jayyid' in Arabic (meaning 'good'). When applied to the Holy Qur'an, it means giving every letter of the Holy Qur'an its rights and dues of characteristics when reciting the Holy Qur'an and observing the rules that apply to those letters in different situations. Giving the letters their rights is by observing the essential characteristics of each letter that never leave it. And giving them their dues is by observing the characteristics of each letter that are present in them some of the time and not present at other times.

2.2.2 The purpose of Learning Correct Recitation of Holy Quran 'Tajweed'

Learning pronunciation of language is totally different than learning how to recite al-Quran correctly, in a way that we considered as 'correct'. According to the research made by (Witt, 1999), based on the implementation of a second language pronunciation teaching system has argued that there is no pronunciation existed, which considered as absolute 'correct' pronunciation. A wide variety of pronunciations can be accepted by native speakers as being correct. However, (Barkatullah) stated that, the recitation of the Holy Qur'an can be defined as words of Allah, and every syllable is from Allah. The purpose of science of Tajweed is to make the reciter recite the Holy Qur'an upon the way of the Prophet (PBUH) received it, from angel Gibreel, who had received it from Allah SWT in classical Arabic dialect.

2.2.3 Components of Holy Quran Recitation

According to (Trask, 1996), a phoneme is defined as "the smallest unit which can make a difference in meaning". However, in relation with phoneme in Al-Quran can be more accurately defined as "the smallest speech unit which can make a difference in correctness of recitation". Due to recite Al-Quran properly and correct way, each phoneme must have its proper characteristics, right place of articulation and relative duration.

All the elements discussed above is due respect towards the accuracy of recitation of Al-Quran. It can be determined by both segmental and supra-segmental features. The segmental features are concerned with the distinguishable sound units of speech, i.e. phonemes. Whereas the supra-segmental features of speech comprise of intonation, pitch, rhythm and stress. Recitation rules that govern supra-segmental features of the Holy Qur'an as well as their effects are very little, compared to the rules that governing the segmental features. These are the only reasons that the advanced reciters of Al-Quran are really concerned with.

2.2.4 Requirements of Muddaris (Al-Quran teachers)

The requirements of Mudarris need to identified, in order to recognize the aspect needed by a CAPL system in teaching Al-Quran recitation. The knowledge and capabilities that each of Mudarris should have, includes:

1. The details knowledge about phonetics in the Quranic recitation, including phonemes, characteristics and articulation. This knowledge constitutes a basic part of both brief and detailed studies for the Holy Qur'an recitation rules (Hosary, 2002). Besides, the phonetics of common recitation errors is required for accurate detection and effective correction (Safaaquisi 1974).

2. General knowledge about speech production system, characteristics of numerous phonemes, as well as their proper points of articulation need to clarify and understanding clearly.

3. Rules of Al-Quran recitation and their differences than standard Arabic pronunciations need to clarify clearly. Mudarris also should memorize a numbers of examples for each recitation rules for demonstrate purposes in front of students while teaching process. He laso should able to produce pairs of recitation errors and correct it, due to illustrate the differences between them.

4. Mudarris should be able to identify recitation errors and determine their attributes accurately.

By identifying the advantages of CALL system and its relations with the requirements needed and methodologies that essential with Al-Quran teachers (Mudarris), the main aspects of the targeted CAPL systems can be determined. Basically, CAPL system is required to imitate the tasks of teachers (Mudarris) and use the advantages identified from CALL systems, due to enhance the performance of learning by adding extra capabilities to the system such as accurate error localization and multimodal feedbacks. Thus, speech recognition technologies should be the right option and perfect learning delivery, which offer powerful tools for analyzing the students' speech of language and providing detailed feedback.

3. PREVIOUS WORKS & LEARNING METHOD

3.1 Previous Research Effort of CAPL

In the past 20 years there have been stimulated efforts to use advances in the fields of human language processing, especially speech recognition in the field of CALL. Meanwhile, CAPL speech recognition technologies offered powerful tools for analyzing students' speech and providing detailed feedback. Since these technologies were built originally with recognition in mind, thus many modifications were needed to be able to deploy them in the field of pronunciation verification.

From the study made by (Kawai, 1999), CALL system has been introduced mainly to teach the pronunciation of a second language. Three areas of pronunciation skills have been addressed: phone quality, phone duration and pitch. For phone quality assessment, a speaker-independent bilingual phone recognizer has been used to compare L1 (native language) and L2 (target language) phones in order to identify insertions, deletions and substitutions of L2 phones (Kawai, 1998a; Kawai, 1998c; Kawai, 1998d). Here, we found that the degree of the learner's foreign accent can be measured based on the number of alternate pronunciations the learner uses; the number decreases as learning progresses. Meanwhile, for phone duration assessment, speech recognition has been used to measure the durations of each phone and compare them with distributions of native speakers while correcting for different speech rates (Kawai, 1996; Kawai, 1998b). The system tells the learner the likelihood of native speakers understanding the learner's utterance as the learner intended. From their results of evaluation experiments using Japanese and American English, conclude that the system is an effective component technology for computer-aided pronunciation learning.

3.2 Previous Research Efforts of Computer Aided in Al-Quran Recitation Learning

According to this research, the basic of speech recognition technology was mainly focus here. However, the implementation is totally different, in which applied to the different type of application or languages, such as Al-Quran. The different contents of input, would probably affect the percentage of accuracy during the recognition process. Thus, the reliability and effectiveness of the system was depending on the language and system design created. The algorithms used for the certain application using the basic principle of speech recognition technique has been explored in (Mourtaga, Sharieh, & Abdallah, 2007; Tabbal El-Falou, W. & Monla, B., 2006) and (Morgan, 2000). The implementation of speech recognition technology for recognizing the Quranic Arabic has been started since early year of twentieth century. Computer Aided Pronunciation Learning (CAPL) has been introduced, where it received a considerable attention in recent years. Many research efforts have been done for improvement of such systems, especially in the field of second language teaching (Franco, Neumeyer, & Bratt, 1999; Witt, 1999) and (Hiller et al., 1994). However, in these recent years, researchers took serious actions after experiencing some challenging problems and difficulties in recognizing Quranic letters, especially in checking the Tajweed rules. At the same time, CAPL also facing a same problem, in order to be automatic training for correct recitation of the Holy Quran for Arabic speakers (N. Jamaliah, Zulkifli, & Zaidi, 2011).

Figure 3.1: System feedback for emphasizing letter "ب" (adapted from (Metwalli, 2005)

Under the same field of speech recognition, the basic stages of speech

processing need to be considered. Generally, there are 5 main stages of the speech recognition process, which includes; (1) Pre-processing (2) Feature Extraction (3) Training (4) Identification (5) Verification. Based on the research conducted by (Ahmad, Ismail, & Samaon, 2004) and (Noor Jamaliah Zaidi, R., Zulkifli, M.Y., M. Yamani I., Emran, M.T., 2008), Mel Frequency Cepstral Coefficient (MFCC) algorithm has been used for feature extraction process. The survey provides recognition rates and description of test data for the approaches considered between LPCC and MFCC. From the results obtained from (Ahmad et al., 2004), LPCC is the best performance for recognizing the Arabic alphabets of Quran, with the percentage of 99.3% more efficient compared to MFCC. However, MFCC is still the most popular feature set with 98.6% efficient, in which computed on a warped frequency scale based on known human auditory perception.

Meanwhile for training, identification and verification stages the algorithm used is mainly stress on the Markov Chain Code algorithm for speech recognition. A Markov chain is characterization of a system that transits from one state to another, in a chainlike manner. It concerns any random process endowed with the Markov property. It is a useful tool for statistical modelling in almost all fields of modern applied mathematics. Markov chain is the basis for Hidden Markov models, which are an important tool in such diverse fields in speech recognition application of this proposed research. It involves with states, transitions and observations map into speech recognition task (Juang & Rabiner, 1991). This Markov Chain algorithm was used in developing the software part by using mathematical modelling of MATLAB program. MATLAB program has become the preferred language of computing for the researchers.

(Omar, 1999) take a step forward to use Hidden Markov Model (HMM) based speech verification system, in verifying the acoustic model of Arabic phonemes. Here, the Arabic phoneme set was clustered to a group of clusters and the pronunciation assessment was accomplished in 2 steps, which are detection step of substitution, insertion and deletion errors, as well as, tested by discriminatively trained HMM models against the units. Same approach also recommended by (I N. Jamaliah, 2010), but the implementation was directly focus towards Quranic verse recitation. In this research, the Tajweed rules of Quranic verse recitation is verified by using HMM and confidence score values. The implementation of confidence score values is based on the Log-Likelihood Ratio values, known as LLR. The acoustic model likelihoods are scaled by the likelihood of the first alternative path model of decode model, using Viterbi decoder for recognition part. Meanwhile, Baum-Welch algorithm is based on combination of forward and backward algorithm, mainly for HMM training

model. Besides, Hidden Markov Model (HMM) based speech recognizer also has been used by (Salah & Mohsen, 2006). Here, the most probable pronunciation error hypotheses is generated from CAPL system, that are fed to this HMM speech recognizer, in order to test them against the spoken utterance. It also generates mapping information to determine the appropriate location for the feedback of each candidate hypothesis.

Beside the HMM technique, Maximum Likelihood Linear Regression (MLLR) also has been used in Speaker Adaptation block diagram while developing a HAFSS system. It is mainly used for adapting acoustic models to each user acoustic properties, in order to boost the system performance. Originally, (Abdou et al., 2006; Witt, 1999) developed the HAFSS system for teaching Arabic pronunciation to non-native speakers. However, this application has been used, due to solve the challenging task in teaching the correct recitation of the Holy Quran. Here, the pronunciation error hypothesis in HAFSS© represented in the form of a linear lattice that is flexible enough to support error hypothesis addition, deletion and overlapping of probable mispronunciation. Most Quranic learners are not familiar with the phonemes, and thus in HAFSS system, it will generate user helpful feedback that use lattice unit similar with the one used in traditional methods of the Holy Quran recitation teaching.

4. PROPOSED IMPLEMENTATION & LEARNING APPROACH

4.1 Proposed Implementation of Computer Aided of Al-Jabari Method

The development of this research was been categorized as one of the application under Computer Aided Pronunciation Learning (CAPL) technology in Holy Quran recitation learning. In recent years, CAPL has received a considerable attention nowadays, and it has been considered as one of the research efforts, due for improvement in the field of second language teaching (Franco et al., 1999; Witt, 1999). The input content applied in this proposed research is quite different with the previous research, which has been performed by Sherif et al. (Samir, Abdou, Khalil, & Rashwan, 2007). Here, the method used by them, mainly for Quranic learning is based on *Al-Baghdadiah* technique, which covered the whole chapter of Al-Quran. This technique of learning Al-Quran itself is believed takes time to learn with a better understanding, especially to newly converted Muslim, as well as children. Besides, this system only compatible and do accept the performance from the native speakers, which is limited to the Arabic speakers. Means, the system capability to deal with non-native pronunciations should be investigated, especially towards the speakers from our region of South East Asia, like Malaysia and Indonesia.

In other hand, the development for this technology was stressed on Al-Jabari technique and modules only. The learning method of Quranic learning through Al-Jabari method is believed, more effective and efficient compared to *Al-Baghdadiah*, *Qiraati* and *Iqra'* method. Previously, the existing technology applied only focus towards the learning of Quran, through *Al-Baghdadiah* method, and currently in Malaysia, most of primary school used *Iqra'* method as their main syllabus in teaching and learning Al-Quran. The existing technology, product and ICT tools available right now, mostly focus on multimedia learning concepts (Drilling, quizzes, drag and drop learning) and only capable to show Al-Quran texts and/or play stored Al-Quran recitation, which totally different with the technology proposed in this concept paper. Here, the research will stimulates speech recognition technology, which incorporates with the various components in artificial intelligent, natural sciences, speech processing technology and computer human interaction. In other word, the system created in this research project, were mainly focus towards developing of automated and intelligent system, which able to recognize the recitation of Quranic, just only from the natural input of human (speech) for further processing.

The special intention in this paper, mainly to assist and educate the Muslim community by using the interactive learning system with Tajweed checking rules (Al-Quran reading rules) correcting capability function, based on Al-Jabari technique. The idea of this invention mainly focuses to present the easiest way to Muslim to recite and learn al-Quran with a better understanding of Tajweed rules. The approach used in the teaching and learning of the Qur'an must be aligned with the new innovation and technology, due to ensure Al-Jabari method is easy to understand, fun and really efficient to be implemented in current time, till the children are keen to learn the Quran. In current time, this option is more preferable to be used during the leisure time and suitable to be implemented with current lifestyle for self-learning and improvement method, due to optimize the study time with something more beneficial.

Focus towards the improvement of memorization aspect of Al-Quran, Al-Jabari has initiated and introduced learners with the basic and main core of learning, known as Memory Mind Mapping (*Titian Ingatan*). Here, the hija'iyyah letters need to be remembered by each of student through 'singing', which has a same rythm and melody with Solmization, through remembering of Badr Nasheed *(Selawat Badar),* as well as special nasyeed of a title "Holy Quran Book (Kitab Al-Quran)" (Irnawati, S.Sarah, & Zulkifli, 2012). Solmization is a system of attributing a distinct syllable to each note in a musical scale. The 7 syllables normally used for this practice are: **do**, **re**, **mi**, **fa**, **sol**, **la** and **ti**. This system is commonly used by musicians, and sometimes these

solfege syllables are introduced as part of the beginning music curriculum in school systems.

Experienced singers routinely engage in vowel modification depending on circumstance and register, in both solo and choral contexts. The extent to which both intonation and vowel production are emphasized in vocal and choral pedagogy acclimates singers to the modification process. With practice, the sensitivity and physical adjustments required to accurately sing various vowels across the entire vocal range can become habitual and comfortable (Neuerburg, 2012). Moreover, the method of learning through 'singing and rhythm' is recommended in teaching pedagogy, because it is considered as attractive approach, in which influenced the psychological and mood of the students. Rhythm is belived able to help children ease the memory. Moreover, children often enjoy singing and intoning, hence, learning process through this way able to increase their memorization level (Lam et al., 2001).

From literature investigation in previous part of 4.1, there is no published Quranic ASR (Automated Speech Recognition) research work yet produce, with new implementation based on Al-Jabari methods and modules. It is important to explore this approach, in order to find out its efficiency and effectiveness for Quranic ASR research. Moreover, there are 3 more criteria already identified, that will be going to be investigated in this research, which are:

1. Design and implementation towards the basic learning of Al-Jabari modules, based speech recognition system.

2. Configure the system capability to deal with non-native speakers (non-native pronunciation), and to ensure the system compatible to be used with non-arabic speakers.

4.2 CAPL System Design for Al-Jabari Learning Method

Figure 4.1 shows block diagram of the speech verification module in the CAPL system used to teach correct recitation of the Holy Qur'an using Al-Jabari method. Most of its blocks resemble that of a typical automatic speech recognition system, where:

(1) Verification HMM models: The acoustic HMM models for the system. Speech signal modelling using HMM algorithms.
(2) Speaker Adaptation: Used to adapt acoustic models to each user acoustic properties in order to boost system performance. It uses speaker classification, Maximum Likelihood Linear Regression (MLLR) speaker adaptation algorithms and Canonical Correlation (CC), as well as supervised incremental

technique.

(3) Pronunciation hypotheses generator: To analyse the Holy Qur'an current prompt and generates all possible pronunciation variants that are fed to the speech recognizer in order to test them against the spoken utterance. It also generates mapping information to determine the appropriate location for the feedback of each candidate hypothesis.

(5) Confidence Score Analysis: It receives n-best decoded word sequence from the decoder, then analyzes their scores to determine whether to report that result or not.

(6) Phoneme duration analysis: For phonemes that have variable duration according to its location in the Holy Qur'an, this layer determines whether these phonemes have correct lengths or not.

(7) Feedback Generator: Analyze results from the speech recognizer and user selectable options to produce useful feedback messages to user.

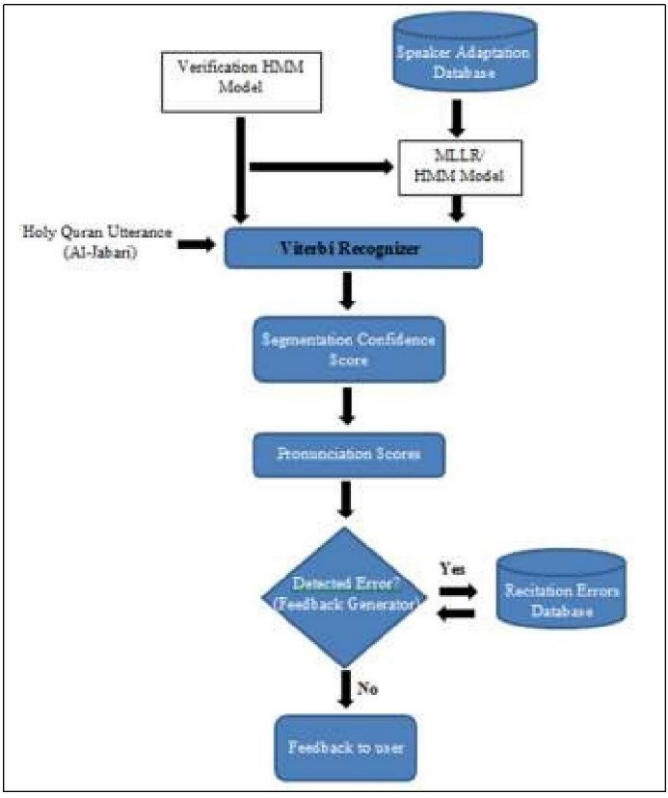

Figure 4.1: Block Diagram for online Automatic Speech Recognition (pronunciation error detection)

6. ANALYSIS AND DISCUSSION

The existing technology available right now only focuses on Quranic learning as a whole. Most of the products were only capable to show Al-Quran texts and/or play stored Al-Quran recitation. This computer media can be categorized as computer aided learning, but not the intelligent system. This system only capable to show Al-Quran text and/or play it, but unable to evaluate the user reading and produce feedback. In the table 5.1

Below, show the comparison and approaches used by previous researchers in recognizing the Quranic verse recitation.

Table 5.1: Comparison of approaches used by previous researchers (adapted by (N.Jamaliah et al., 2013; N.Jamaliah, Zulkifli, Zaidi, & Rosli, 2011))

AUTHOR	EXPERIMENT DATA	EXPERIMENTS	PERFORMACE/ACCURACY
(Abdou et al., 2006)	507 utterances	Developed a HAFFSS© system, that used HMM acoustic model and MLLR speaker adaptation, due to correct and correct recitation of the Holy Quran	Model Tuning result= 97.58% - 96.96% System Performance with confidence = 96.87% Message based sys. Performance with confidence = 80.13%
(Tabbal El- Falou, W. & Monla, B., 2006)	13 Professional recitors & 40 normal recitors	Implemented using MFCC feature extraction and Hidden Markov Model (HMM) for classification(Using Open Source Sphinx Framework) – tested against tajweed and tarteel	85% - 92%
(Mourtaga et al., 2007)	2000 distinct words	Developed an automatic speech recognizer for Quranicbased speaker independent. This system is based on the triphone HiddenMarkov Model and Maximum Likelihood Linear Regression (MLLR). The advantages of using the Quranic verse as the database – uniqueness of the words and high level of orderliness between verses	The level of accuracy from the tested range 68% - 85

The implementation through HAFSS© system (Samir et al., 2007) is believed able to improve the user performance based on Hidden Markov Model (HMM) acoustic model and Maximum Likelihood Linear Regression (MLLR) speaker adaptation, specifically for correction of Quranic recitation. The previous research project will be modified and added with additional features as in HAFSS© system, due to create the self-learning system in Al-Jabari lesson. This self-learning system, able to be improved and fully implemented for Al-Jabari method, as it is designated to this purposes.

From this new development of CAPL system of Al-Jabari method, automatic evaluation technique to evaluate speech-enabled computer able to be determined. Moreover, this CAPL system proposed is a part of a computer aided automatic training of correct recitation for the Holy Quran. This technique evaluates the system by measuring the degree of usefulness of its feedback to learners. Evaluating CAPL systems by this means forces system designers to try emphasized the system responses for confident decisions and make general feedbacks, or no comments for non-confident decisions to reduce deceiving effect of inherent speech recognition systems limited accuracy. Automation of the evaluation process is vital due to complexity of CAPL systems and the existence for many tuneable thresholds and parameters. Thus, the aim of this research to develop a complete Computer Aided Pronunciation Learning (CAPL) able to be achieved. It can be used to teach recitation of the Holy Qur'an to students by accepting their reading of a given verse and then assessing the quality of their recitation to produce a feedback messages to help them locate their mistakes and overcome it.

7. CONCLUSION

In this paper, several key approaches of speech recognition and verification (acoustic HMM model), speaker adaptation techniques, phoneme duration classification, as well as the response and feedback of learners based on CAPL systems evaluation, have been presented with some current improvement done by researchers. Here, a few possible methods and approaches have been reviewed, due to find the most suitable and significant approaches to be used with Al-Jabari method in Quranic learning. The approach used in the teaching and learning of the Qur'an must be aligned with the new innovation and technology, due to ensure Al-Jabari method is easy to understand, fun and really efficient to be implemented in current time, till the children are keen to learn the Quran.

With the value added and special uniqueness belongs to Al-Jabari,

makes this technique more preferable to be implemented and applied to the current and contemporary of Muslim community. Hopefully, this method will give benefits to Ummah, by solving and overcome the Quranic illiterate, due to ensure Al-Quran may be internalized and implemented to all aspects in human life.

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9. REFERENCES

Abdou, S. M., Hamid, S. E., Rashwan, M., Samir, A., Abd-elhamid, O., Shahin, M., & Nazih, W. (2006). Computer Aided Pronunciation Learning System Using Speech Recognition Techniques, 849–852.

Ahmad, A. M., Ismail, S., & Samaon, D. F. (2004). Recurrent Neural Network with Backpropagation through Time for Speech Recognition. In *ISCIT 2004* (Vol. 2004).

Banerjee, S., Beck, J. E., & Mostow, J. (2003). Evaluating the Effect of Predicting Oral Reading Miscues. In *Proc. 8th European Conference on Speech Communication and Technology (Eurospeech 2003)* (Vol. 2, pp. 3165–3168). Geneva, Switzerland.

Banerjee, S., Mostow, J., Beck, J., & Tam, W. (2003). Improving Language Models by Learning from Speech Recognition Errors in a Reading Tutor that Listens. In *Proceedings of the Second International Conference on Applied Artificial Intelligence*. Fort Panhala, Kolhapur, India.

Franco, H., Neumeyer, L., & Bratt, H. (1999). Automatic Detection of Phone-Level Mispronunciation for Language Learning. In *Proc. Of Eurospeech 99*. Budapest, Hungary.

Hiller, S., Rooney, E., Vaughan, R., Eckert, M., Laver, J., & Jack, M. (1994). An Automated System for for Computer Aided Pronunciation Learning. *Computer Assisted Language Learning*.

Irnawati, A., S.Sarah, I., & Zulkifli, M. Y. (2012). Kaedah Al-Jabari: Suatu Pengenalan. In *International Seminar on al-Quran in Contemporary Society (SQ2012)* (pp. 1–16).

Juang, B. H., & Rabiner, L. R. (1991). Hidden Markov Models for Speech Recognition. *Technometrics*, *33*(3), 251–272.

Kawai, G., & Hirose, K. (1999). A CALL system for teaching the duration and phone quality of Japanese tokushuhaku. *IEEE*, (00), 2981–2982.

Lam, H. C., Ki, W. W., Law, N., Chung, A. L. S., Ko, P. Y., Ho, A. H. S., & Pun, S. W. (2001). Designing CALL for Learning Chinese Characters. *Journal of*

Computer Assisted Learning, 17, 115–128.

Metwalli, S. E. H. M. (2005). *Computer Aided Pronunciation Learning System Using Statistical based Automatic System using Statistical based Automatic Speech Recognition Techniques*. Cairo University.

Morgan, N. (2000). *Speech and Audio Signal Processing: Processing and Perception of Speech and Music*. John Wiley & Sons, Inc.

Mourtaga, E., Sharieh, A., & Abdallah, M. (2007). Speaker Independent Quranic Recognizer Based on Maximum Likelihood Linear Regression. In *World Academy of Science, Engineering and Technology* (pp. 61–67).

N. Jamaliah, I. (2010). *Automated Tajweed Checking rules engine for Quranic verse Recitation. Department of Computer System & Technology, Faculty of Computer Science & Information Technology*. University of Malaya.

N. Jamaliah, I., Zulkifli, M. Y., & Zaidi, R. (2011). Improve Design for Automated Tajweed Checking Rules Engine of Quranic Verses Recitation: A Review. *International Journal on Quranic Research*, *1*, 39–50.

N.Jamaliah, I., Zulkifli, M. Y., Zaidi, R., & Rosli, S. (2011). Improve Design for Automated Tajweed Checking Rules Engine of Quranic Verse Recitation: A Review. In

The Annual International Qur'anic Conference 2012 (pp. 262–275). Kuala Lumpur, MALAYSIA: Centre of Quranic Research (CQR).

Neuerburg, T. (2012). *The Impact of Vowels on Pitch Finding and Intonation in the Movable-Do Solmization System*. University of Nebraska.

Nga, M. H. (1986). *Design and Implementation of a Generalised Computer Aided Learning System*. Durham University.

Nihtilä, K., Sundqvist, C., Söderlund, K., & Östermark, R. (n.d.). Developing Robust Computer Assisted Learning Systems.

Noor Jamaliah Zaidi, R., Zulkifli, M.Y., M. Yamani I., Emran, M.T., I. (2008). Quranic verse Recitation feature extraction using Mel-Frequency Cepstral Coefficients (MFCC). In *The 4th International Colloquium on Signal Processing and its Application (CSPA) 2008* (pp. 13–18). Kuala Lumpur, MALAYSIA.

Omar, M. K. (1999). *Phonetic segmentation of Arabic speech for verification using HMM. Department of Electronics and Communications*. Cairo University, Faculty of Engineering.

Salah, E. H., & Mohsen, R. (2006). *Automatic Generation of Hypotheses for Automatic Diagnosis of Pronunciation Errors. Department of Electrical Engineering*. Development of Computer System, RDI, Higher Tech. Institute & The Engineering Company.

Samir, A., Abdou, S. M., Khalil, A. H., & Rashwan, M. (2007). Enhancing usability of CAPL system for Quran recitation learning. In *Interspeech 2007* (pp. 214–217).

Tabbal El-Falou, W. & Monla, B., H. (2006). Analysis and Implementation of a "Quranic" verses delimitation system in audio files using speech recognition

techniques. In *In: Proceeding of the IEEE Conference of 2nd Information and Communication Technologies, 2006. ICTTA '06* (Vol. 2, pp. 2979 – 2984).

Trask, R. L., "A Dictionary of Phonetics and Phonology", Routledge, 1996.

Witt, S. M. (1999). *Use of Speech Recognition in Computer Assisted Language Learning*. University of Cambridge.

Young, S., & Witt, S. (1997). Computer-assisted Pronunciation Teaching based on Automatic Speech Recognition. In *In Language Teaching and Language Technology* (pp. 25–35).

Zakaria Bashier, *War and Peace in the Life of the Prophet* Muhammad (UK: Markfield, the Islamic Foundation, 2006).