

Multiple Input Modality Mobile Application for Pilgrims

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ABSTRACT

Hajj consists of several rituals, which require the pilgrims to recite specific dua and zikr for each of them. Since there are so many dua and zikr involved, pilgrims who are not well versed in Arabic have difficulties to memorize them. This paper discusses the incorporation of voice recognition in an application that helps pilgrims to recite dua and zikr while performing all Hajj rituals, called Mobile Doa and Zikir for Hajj (MDZ4H). Android platform has been chosen due to the dramatic increased in the Android mobile phone users worldwide. MDZ4H displays the Arabic text, the translation in Malay and also the Arabic audio files of the dua and zikr, which has been gathered, compiled, and verified before the application could be developed using J2ME. After that it has been evaluated by experts. The findings show some of the limitations of incorporation the Google speech to text function and suggest the solutions and the future work. It is hoped that the developed application could be made available in order to help Hajj pilgrims to easily and conveniently recite the dua and zikr towards achieving Hajj Mabrur.

Keywords: Modality, Multi-modal, Voice Recognition, Speech to Text, Android, MDZ4H.

I INTRODUCTION

Hajj (pilgrimage) is the fifth pillar of Islam that must be carried out at least once in a lifetime by every able bodied Muslim. It is the largest annual convention of faith in the world that requires travelling to Makkah. Hajj is performed based on predetermined dates, times, and places. It is a demonstration of the solidarity of the Muslims and their submission to Allah. Hajj is an important event in every Muslims' life, which offers religious, educational, scientific, social, economical, political and other benefits that are rewarded by Allah to Muslims (Khan, 2007). Over three millions out of 1.5 billion Muslims around the world performed Hajj annually and the number increases yearly (Central Department of Statistics & Information, 2012b). Annually, Kingdom of Saudi Arabia allows each Muslims' country to send only 1% of the population for Hajj (Central Department of Statistics & Information, 2012a). However, countries such as Malaysia keep trying to increase the Hajj quota

(pilgrims' number), but always fail (The Star, 2012). In addition, the number of Umrah pilgrims reached 5.4 million in 2012 (Haj Ministry Portal, 2012).

Hajj literally means to resolve for visiting a sacred place. However, technically it means to visit a sacred place for performing certain acts of worship (Ibadah). In Islam, the term Hajj implies to visit the Kaabah for the sake of performing a particular kind of Ibadah that Allah (SWT) has made an obligation for those Muslims who fulfill certain conditions stipulated by him (Obaid, 2008).

Hajj involves several rituals which among others include Ihram, Tawaf, Saie, staying in Mina, staying in Muzdalifah, Wuquf, and stonning of the Jamarat (Ali, 2012). All these rituals are accompanied with duas that have to be recited by the pilgrims. Since there are so many duas, it is impossible that every pilgrim could memorize all of them (Al-Aidaros, Zulkifli, & Mat, 2013). Thus, several methods have been introduced to help the pilgrims to recite the duas while performing the rituals of Hajj. Among others include book, booklet, pamphlet, and etc. These are the most popular methods that have been widely used. Electronic gadgets have also been developed to cater for this, for example Hajj Player. It is a portable device like an MP3 Player containing only audio of dua and zikr for Hajj (Alibaba, 2012).

Today, mobile technology has been applied in a wide range of our daily activities. It is rare to meet a person who does not have a cell phone (Baharuddin, Singh, & Razali, 2013). In addition, the mobile devices are regarded as very flexible devices because they are easy to handle and to be used everywhere by the users. In fact, they have become powerful useful devices (Aram, Troiano, & Pasero, 2012). Statistical studies show that around the world there are more than 3.3 billion mobile connections, and the number is increasing daily (Baharuddin, et al., 2013). By employing the mobile applications, different interests can be gained in various domains such as health (Istepanian, Laxminarayan, & Pattichis, 2006), tourism (Brown & Chalmers, 2003), education (Ally, 2009), transportation (Lane et al., 2010), logistics (Chan & Chan, 2008), disaster (Hasegawa, Sato, Matsunuma, Miyao, & Okamoto, 2005), and management activities as well as monitoring projects (Ochoa, Bravo, Pino, & Rodríguez-Covili, 2011). Since mobile applications support the requirements of various users, it is

essential that the mobile applications are useful as well as usable in order to be successful (Baharuddin, et al., 2013). In the same context, usability of any product is crucial to ensure that the product is useful (Jordan, 1998). Mobile applications which are able to enhance knowledge and taking full advantage of improved capabilities are still limited and that include applications related to dua and zikr for Hajj (Al-Aidaroo, Zulkifli, et al., 2013). This study believes that it could be equipped with speech recognition (SR) facility.

SR in Electrical Engineering and Computer Science refers to the process of spelling the spoken words to written words or text (Konno, Kato, & Kosaka, 2013). It is part of voice recognition, which concerns about distinctive voices to determine either speaker's identity (speaker recognition: who is the speaker?) or the spoken words (speech recognition: what the speaker says?) (Sandilyan & Darley, 2013). This is widely referred to as speech to text. Nowadays, voice recognition is used in many daily life fields such as education (Jones, 2005), car systems (Graham & Carter, 2000), healthcare (Sandilyan & Darley, 2013), telephony (Balentine & Morgan, 1999), and military aircraft (Wurgler, 1987). It is used in many forms such as speech-to-text (e.g., emails, SMS, or word processors), aircraft (usually called direct voice input), data entry (e.g., entering a dates or credit card number), and voice dialing (e.g. "Call home").

There are two mechanism used to realize and detect the spoken words which are the Speaker Independent Speech Recognition (SISR) and Speaker Dependent Speech Recognition (SDSR) (Mehla & Aggarwal, 2014). In the SDSR mechanism, each new user of the system is required to read a specific text in order to train the system to the user's voice these systems, known as speaker dependent systems such as Microsoft Word 2007. The system analyzes the user's voice into tones which is used to adjust the voice recognition of that user in order to get the best accurate transcription (Merrow et al., 2013). While the systems that use SISR mechanism which are known as speaker independent systems do not use the training, but give a list of words converged in pronunciation for example Speech to Text app in Google Play (Sinha, Agrawal, & Jain, 2013).

With regards to the discussions in the previous paragraphs, this paper attempts to incorporate the voice activated function in a mobile assistant for pilgrims to recite the supplications of Hajj rituals (dua and zikr) called Mobile Doa and Zikir for Hajj (MDZ4H). Believing that Allah SWT needs no specific language to understand the believers' supplications, all the texts and audios for the dua and

zikr are in Arabic. This is because the Muslims want to follow what has been done by Prophet Muhammad SAW. Since this study has been conducted in Universiti Utara Malaysia, the translations of the supplications are in Malay. In addition, MDZ4H was developed to work on Android and iOS platforms, since the development language is Java and both platforms have the Java Virtual Machine.

After a brief introduction on the importance of Hajj and the problems faced by the pilgrims while performing the rituals, we review some of the current approaches which have been developed to facilitate those problems; we then provide a brief summary about the voice recognition and the possibility of turning it into a text and some uses. The rest of this paper is organized as follows; section II explains the problems faced by the non-native Muslims concerning Arabic language and the limitations of the current approaches used in the recitation of dua and zikr for Hajj. In addition, the mobile penetration issues were presented in this section too. Section III reviews some of the related studies in the field. Section IV explains and reviews the proposed application. The methods used in the MDZ4H evaluation process were described in section V, while the finding and conclusion was discussed in section VI. Finally, the suggestions and future work was discussed in section VII.

II PROBLEMS AND ISSUES

A. Arabic Language and Non-Native Muslims

Since Arabic is the Quran's language, Muslims need the Arabic language to understand the commandments and the doctrines of Islam. Many approaches and methods of teaching and learning Arabic language such as grammar-translation, reading, and memorization were utilized to ensure that Islam is understood well by new Muslims (Mat & Muhamad, 2010). Regrettably, those approaches resulted in neglecting of some skills in the Arabic language (Haron, Ahmad, Mamat, & Mohamed, 2010).

As a result, non-Arabic Muslims face a lot of awkwardness in applying the Arabic language rules in the language tasks (speaking, spelling, writing, and reading) (Abdul-Hamed, 2009). Accordingly, some countries such as Malaysia integrate grammar with orthographic and morphology systems in the Arabic language curriculums. As a result, the students could not read the Arabic text correctly without morphology. Besides that, they cannot write their spoken expressions without orthographic mistake (Su'aidi, 1997). Furthermore, non-native Arabic speakers face difficulties in writing and pronouncing some Arabic characters such as

Hamza, Elgin, ha "ح", eye, Z "ض" and "ظ". They also have awkwardness in differentiating and identifying the similar forms of letters such as (ج"ج", h"ح",x"خ"). Even though it is hard, Muslims are required to use the Arabic language in their prayer (Solat) and also while performing the Hajj. While memorizing is necessary in prayer (Solat), reciting the supplications for Hajj can be simplified by using some forms of tools.

B. The Crowded Environment and The Current Approaches

Every year over three million Muslims come to Makkah to perform the Hajj and 5.4 million for Umrah (Haj Ministry Portal, 2012). Islamic communities in countries such as Malaysia and Indonesia conduct a month of training on ways to perform the hajj rituals. Hajj pilgrims need to know and memorize the important prayers that need to be recited in every rituals such as in Tawaf (Anad, 2009). Normally, the dua and zikr are available in the form of books, booklets, leaflets, and even pages. Some of the dua and zikr are grouped together as a book while some are separated based on the rituals to be performed. Even though these approaches have been the most popular and widely used approaches, there are some limitations to them. Among the limitations include difficulty to find pages of the required dua and zikr especially while performing ritual such as Tawaf which involve large crowd. Some of the pilgrims are not able to read Arabic thus they are not able to recite the dua and zikr properly. When performing Tawaf and Saie, difficulty arises when identifying the exact number of rounds. On top of that, most of the approaches do not provide detail step-by-step recitation of the dua and zikr.

Electronic gadget has been developed to cater for this, such as Hajj Player. It is a portable device like an MP3 Player containing only the audio of the dua and zikr (Alibaba, 2012). The users are required to refer to a booklet for the Arabic and translation texts of the dua and zikr. By using this player, the pilgrims have to carry the player as well as the booklet. This does not really help the pilgrim especially while in a large crowd. Thus, mobile phone has been considered as a practical choice for developing the MDZ4H application.

C. The Mobile Penetration

In 2013, the number of mobile subscriptions around the world has reached 6.8 billion and more than the half of this number is in the Asia-Pacific region with 3.5 billion subscriptions (Page, Molina, & Jones, 2013). The global mobile phone penetration rate has reached 96% with 128% in developed countries and 89% in developing countries (Union, 2013). Meanwhile, in 2013, the number of mobile phone

subscribers in Malaysia is expected to reach 41.9 million with a mobile penetration of 132.9% (Forest Interactive, 2013).

III PREVIOUS STUDIES

In previous studies, several tools and devices have been developed to facilitate the pilgrims in performing the Hajj. We did three studies to develop an android application to help the pilgrims in the recitation of supplications associated with pilgrimage rituals. The first study explains the development process of the application MDZ4H, the study shows how the contents of MDZ4H has been prepared and validated and how the experts and users evaluated MDZ4H (Al-Aidaroo, Zulkifli, et al., 2013). While the second (Al-Aidaroo, Mutalib, & Zulkifli, 2013) and third (Al-Aidaroo, Mutalib, Zulkifli, & AbuHassira, 2013) studies focused on the users' perceptions and usability of MDZ4H, where both studies showed that MDZ4H (Figure 1) had won the attention of users and their satisfaction.



Figure 1. Snapshots of MDZ4H

Additionally, researchers from GadjahMada University in Indonesia have developed web-based Hajj Simulation software. It is an interactive application to enhance the Hajj performance's usefulness by delivering a new media in the education of Hajj for pilgrims. Their study indicated that although benefits could be gained from their work but there would be an increased in the management system of Hajj organizing process. The cost of organizing Hajj would be reduced and the surplus cost will be used to support other training activities (Fathnan, Wibowo, Hidayat, Marenda, & Ferdiana, 2010).

Meanwhile, researchers at the Universiti Utara Malaysia have developed V-Hajj, a courseware for learning to perform Hajj, Umrah, and Ziarah. V-Hajj encompasses all the requirements, steps, and procedures in performing Hajj and Umrah. It

incorporates interactive multimedia and virtual environments which enable users to learn and understand the Hajj and Umrah procedures step-by-step as well as participate in 3D environments in enhancing user experience in performing the Tawaf, Sa'ie and stoning of the Jamarat (Yusoff, Zulkifli, & Mohamed, 2011).

A research on developing a comprehensive module for Hajj has been conducted by Hameed (Hameed, 2010). He proposed a comprehensive Hajj model, which consists of three components; Hajj database module, Hajj educational module, and Hajj emergency and guidance module. This comprehensive solution offers religious, educational, scientific, social, economical, political, and other benefits for Muslims. Besides that, architecture for a Web service-based Hajj Information System has been proposed by Harmain and friends. The implementation of this system provides background knowledge about Hajj and its environments to most of the pilgrims. The system also helps on updating the latest information on Hajj and guiding people during the Hajj season.

On the other hand, Google has developed a voice recognition service which enables users who have difficulties in writing texts by using the keyboard. This service can convert speech to text and text to speech. There are many applications in Google play using this service to help the smartphone's users in sending and receiving SMS. One example of these applications is voice to text, which is designed for those users who write slowly, the only thing that they need now to say the text that they want to write and then send it as e-mail or SMS or save it as note in their mobile. Figure 2 shows two snapshots of the voice to text application.

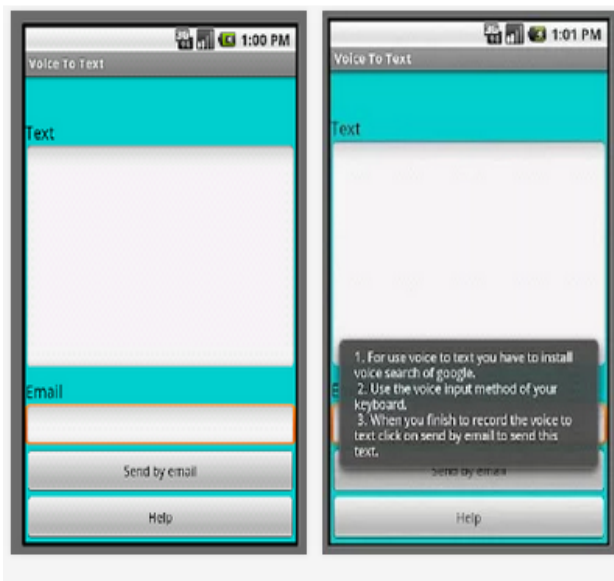


Figure 2. Snapshots of Voice to Text Application

IV THE PROPOSED SYSTEM

This paper aims to incorporate the voice recognition activated in MDZ4H which is developed in our previous studies. The function converts speech to text which developed by Google will be used in MDZ4H to convert the user's voice commands into text. This function needs an internet connection to send the recorded voice to Google servers to do the conversion process and then return all the possibilities of the recorded text. The system then will compare the results of Google Speech to Text function with the list of different activities names in MDZ4H to earn the matches of these results with the activity names. After getting the activity names, the system will open the required activity and so on. This is illustrated in the architecture diagram in Figure 3.

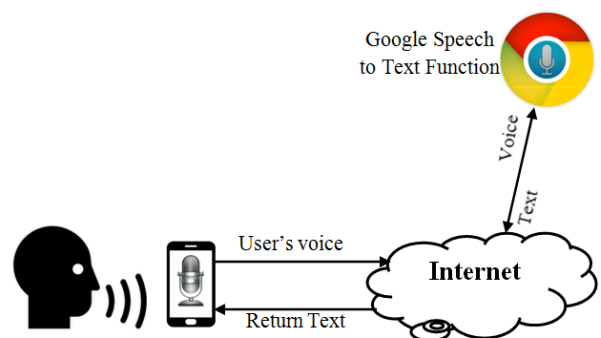


Figure 3. The Proposed System Architecture

The new version of MDZ4H has been divided into several sections. Logo Screen is the first screen (splash screen) of the application. It shows the system name and logo with background sound. This screen is displayed in a few seconds only, and then it automatically disappears to show the mode selection screen, the version of MDZ4H has two modes voice mode and normal mode (Figure 4 (A)). When user select the voice the activity shown in (Figure 4(B)) will display, the user is required to click the button at the top of the activity and named the required Dua that he/she want to recite. The system will send the user request to Google speech to text function to retrieve the possible matches and then will open the selected Dua activity. But if user selects the normal mode the main menu (Figure 4(C)) will display. It allows users to navigate the MDZ4H by clicking on the required dua to be displayed. The user can only exit from the system through the main menu. The last screen contains dua in Arabic with Malay translation at the bottom plus audio of the dua recitation (Figure 3(D)). The user can play or pause the audio at any time by clicking the speaker icon on the top of the screen. The back, home, and forward buttons are also provided in this screen.

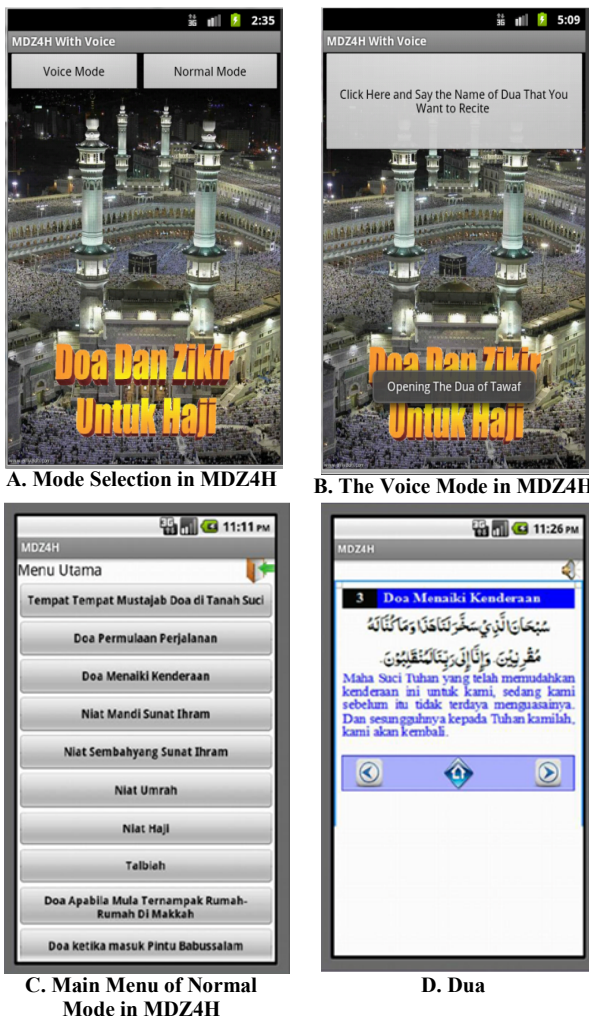


Figure 4. Snapshots of MDZ4H with voice activated.

There are three buttons at the bottom of each screen, which allow users to navigate the system and go through the system screens. The user can proceed to the next screen by clicking the forward button or return to the previous screen by clicking the back button. The user can also go to the main menu by clicking the home button. Some screens are information screens it does not have sound files at all. Those screens contain information and instructions, which are expected by the users. It informs users about the time and place where the dua is most acceptable (mustajab).

V EVALUATION METHODS

After the MDZ4H has been developed, it was evaluated by the experts and users. The purposes of the evaluations are to validate the contents and user interfaces of the MDZ4H as well as to measure the ease of use, usefulness, and outcome / future use among users. Two types of evaluation have been conducted as discussed in the following sub-sections.

A. The Contents Validation

The contents have been validated by a qualified Hajj trainer of the Lembaga Tabung Haji Malaysia, who is also a lecturer at the Islamic Studies department

of Universiti Utara Malaysia. The process involved checking the dua and zikr of the Arabic text, the Malay translation as well as the recitation in Arabic in order to ensure that they are correct and valid.

B. Expert Evaluation

Besides, the MDZ4H application has also been evaluated by six lecturers from the School of Computing and School of Multimedia Technology and Communication of Universiti Utara Malaysia. All of them have already performed Hajj and Umrah. They were asked to use the MDZ4H and later answered the user interface satisfaction questionnaire. The questionnaire, which was adapted from Chin and friends (Chan & Chan, 2008) comprise of system capabilities, learning, screen, terminology, system information, and overall reaction dimensions. A 6-point Likert scale anchored by "1 – Very Unsatisfied" through "6 – Very Satisfied" was used.

VI FINDING AND CONCLUSION

The development and evaluation of the MDZ4H and how the voice recognition is incorporated in MDZ4H have been elaborated in this paper. The application has been developed in more than one mode to help pilgrims to recite all the dua and zikr while performing Hajj and allow them to navigate through by using their voice. Briefly, it is perceived useful by the users as it is able to assist them make dua and zikr recitation easier regardless of their competency in reading the dua and zikr in Arabic. This application is not intended to replace the existing approaches of reciting the dua and zikr, instead to complement them through the utilization of smartphone technology and the Google speech to text function.

Google speech to text function is an online function so it needs internet connectivity and it is designed to convert the English speech to English text only. Besides that, the users' pronunciation affects the results returned by the function. Further the function does not support the Arabic names and the majority of the holy places have Arabic names such as Mount Arafat and Muzdalifah, so it is very difficult to the function to convert those names. As a solution to this problem, this study uses action name such as stoning to refer to Jamarat Stoning or the English part of the name such as mount to refer to Arafat Mount and so on.

VII SUGGESTIONS AND FUTURE WORK

Hence, it is hoped that the findings of this study will encourage more researchers to involve in finding new ways and methods to improve and help Hajj pilgrims to perform the rituals easily and conveniently. It is also hoped that we got offline and built-in function to convert speech to text and text to speech plus the ability to deal with multi-

languages such as Arabic and Malay. Furthermore, incorporate other technologies like GPS in MDZ4H, to add a new mode which enabling the application to select automatically the appropriate Dua according to the user's location. Finally it is also hoped that Hajj agencies of any country would be interested to incorporate MDZ4H into their existing services in order to improve and enhance the pilgrims' Hajj performance. Finally, the authors hoped that one day MDZ4H is widely used by all the Hajj pilgrims in helping them to achieve Hajj mabrur.

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