

**ORIGINAL ARTICLE****Intelligent Mass-Prayer Assistant for Muslims (IMAM)**

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ABSTRACT - Quran recitation and listening are the fundamental pillars of Muslim worship. In the Masjid, the head of prayers (Imam) will lead the prayers follow with the congregation (Mamooms). Imam will recite some verses from the Quran in every Raka'ah (a part of the prayer). The mamooms, especially the non-Arabic native speakers will face some challenges such as understanding the meaning of the verses knowing the name and the number of the recited Surah. That may result in prayer experiences that are less engaging and lack intense concentration or wholeheartedness among the congregation members. With the advancement in cloud-based speech recognition technology and wearable computing devices; an opportunity to develop a system that can instantly translate and display Quran verses into any language can be presented. That does not interfere with the congregation's strict praying physical movements. Although there are some efforts to bridge this gap, the need for a smart and high effective system still exists. Thus, this study aims to develop an integrated intelligent system including a mobile app, far-field microphone, and intelligent eye-glasses. The proposed system is expected to be developed and demonstrated at selected learning environment in Sibul, Sarawak. It can enable congregation prayer members to understand deeply the entire Quran recited by the Imam in their language of choice (either English or BM), especially during prayers, providing them with a spiritual experience that is deep, engaging, and meaningful.

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INTRODUCTION

Quranic language and intricacies fascinate every Muslim, and they all want to learn more about it. At the same time, more than four of every five Muslims come from non-Arab backgrounds and do not speak Arabic [1]. In Malaysia, the people are non-Arabic speakers who suffer from their inability to understand the meaning of the recited Quran during the congregation prayers, despite their keen interest in attending the congregation prayers. This problem is not only faced by non-Arabic speakers in Malaysia. Consequently, providing a practical translation application will increase the number of attendees.

A survey of non-Arabic-speaking worshipers in 15 mosques in the UAE showed that 73 percent said they did not understand the meaning of the Quran because they did not understand what was being recited [2]. The Abu Dhabi Statistics Center collaborated with the Department of Community Development and the General Authority of Islamic Affairs and Endowments on this study to investigate methods to improve worshipers' experiences. Most non-Arab respondents said they would like to see the Quran translated into their language. According to the result, non-Arabic speakers desire to read the Quran in their language despite living in an Arabic context, demonstrating a critical need for Quran translation in Malaysia. With

these findings in mind, a smartphone app concurrently with a smartwatch and glasses will be promised tools to bridge this gap.

In the same context, there are different approaches for developing applications for Quran translation. Some were dedicated to multi-language translation, while others were committed to a single language. The methodologies of the previous studies are varied from text classification and artificial intelligence networks. For instance, in the studies [3]–[6], the authors use the traditional text classification approaches, whereas the studies [7]–[9] use neural networks to classify and text recognition for Quranic verses.

Many applications are dedicated to the Quran reading, searching, and translation in the developed applications. The majority of these applications relied on traditional text classification techniques. Some were used for cross-operating systems, while others were not. Therefore, the developed approaches are different from one application to another. The current method is the creation of artificial intelligence (AI).

Despite all the developed approaches and applications, an effective and reliable system, including an application to detect, trace, and translate the recited Quran during the prayer, is still highly required. This paper aims to develop a reliable and autonomous system to capture the IMAM voice, detect, translate, and trace the recited Quran shown on the follower device, whether intelligent eyeglass, smartphone, or smartwatch.

METHODOLOGY AND MATERIALS

The methodology section is divided into three parts which are (1) the integrated intelligent systems, (2) components of IMAM, and (3) the system architecture of IMAM.

(1) Integrated Intelligent System (IIS) of IMAM

The IIS system of IMAM is divided into two parts: (1) audio system (IMAM smart speaker and microphone) and (2) mobile application (IMAM app) (refer to Figure 1). Audio systems have two components: the far-field microphone and the speaker. While using a standard microphone stand found in Muslim prayer halls, the microphone can pick up voices from up to five meters away (i.e., mosques and Tahfiz schools). Meanwhile, the speaker will generate a high-fidelity sound of the IMAM's recitation. On the other hand, the IMAM mobile application works as the speech-to-text instrument available in Google Play and Apple Store.

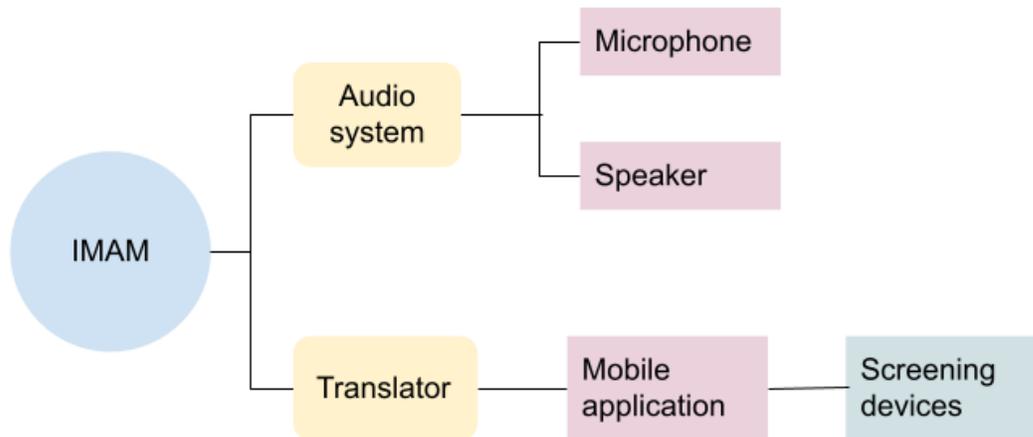


Figure 1. Systems in IMAM, including audio and translator systems

(2) System Components of IMAM

The IIS consists of mobile applications and smart audio systems that capture the Imam's voice and translate the recited Quran on computing devices (refer to Figure 2). This invention is a reliable and autonomous system to capture the IMAM voice, detect, translate, and trace the recited Quran shown on the screen devices, for example, intelligent eyeglasses. Each of the components is in the following details:

- **IMAM for Mobile**
A mobile app version of IMAM can be downloaded on Android and iOS. This comes in handy for self-practice and reference.
- **IMAM for Intelligent eyeglasses**
An IMAM wearable that displays the Quran text directly on the smart glasses, allowing for an entirely hands-free experience.
- **IMAM for Smart Speaker**
A small form factor smart microphone suitable for mounting on a standard microphone is used in mosques by integrating a far-field microphone that can capture voices as far as 5-metre radius and provide a frictionless and less-intimidating user experience for imams. The fabricated device is designed to be mountable or clipped on a standard 3/8" microphone stand installed inside most mosques, thereby providing a friendly, frictionless and non-intimidating user experience for imams. Apart from that, it will also be able to generate a high-fidelity sound of the Imam's recitation should the need arise.



Figure 2. Components of IMAM - Mobile App, smart speaker, and intelligent eyeglass

IMAM suite enables a hands-free viewing (since Muslims are strictly advised to place both their arms and hands in an embrace during prayers) of the translated Quran verses for the congregation members during prayers; wearable computing devices like smartwatches and smart glasses will be employed. An app to display the translated verses on readily available smartwatches and smart glasses in the market will be developed. As part of the overall integrated system, a step-by-step mass prayer guidance utility software will also be designed to assist the congregation members in following the Imam-led prayers. The utility version implemented on a Smart Glass will also enable any Muslim to become a de-facto Hafiz Imam (an Imam who can recite the whole Quran from memory) without needing to memorize the entire Quran. In most cases, whether among Arabic or non-Arabic Muslims, they do not memorize the whole Quran unless they are certified and trained by Hafiz Imams. This is especially useful during pandemics when mass-prayers are prohibited in mosques and the most elderly male member in a household are expected to become an imam.

(3) System Architecture

Figure 3 shows the main component of the IMAM smart speaker. Hardware Requirements for the IMAM smart speaker are A Raspberry Pi 4, 32GB SD card, MicroUSB cable, ReSpeaker 4-Mic Linear Array Kit for Raspberry Pi, and IEEE 802.11a/b/g wifi. Software Requirements are Android smartphones with min Android OS 4.2 and Internet connection.

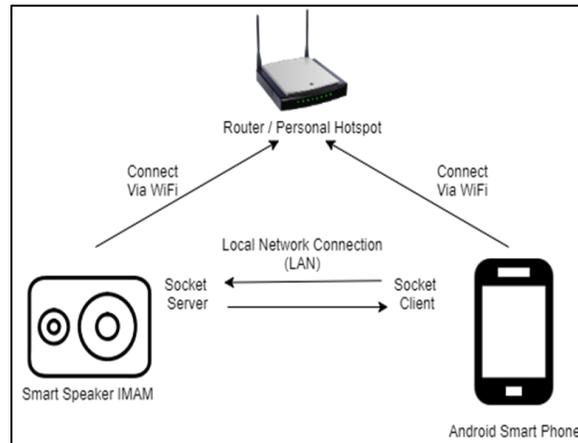


Figure 3. IMAM Smart speaker with outer and smartphone

The hardware requirements for IMAM Mobile Application are Vuzix Blade Smartglasses and IEEE 802.11 a/b/g wifi. The software requirements are a smartphone running on an Android (Android 5.1 or above) or iOS (iOS 11 or above) device and an Internet connection. Figure 4 shows the IMAM Mobile Application components and their relationships.

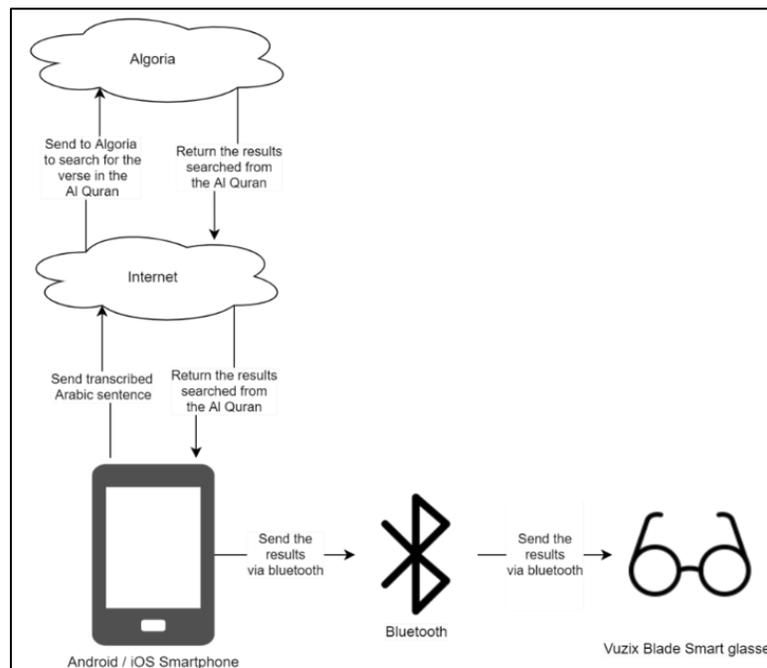


Figure 4. IMAM Mobile Application components and their connections

RESULTS AND DISCUSSION

IMAM is a low-power, miniature smart microphone system that combines far-field Arabic voice recognition, speech-to-Quran text matching, and real-time natural language translation capability. This invention can translate and display the Imam's Qurans recitation during mass prayers to English and Bahasa Melayu on wearable computing devices like smart glasses and smartwatches (refer to Figure 5). Additionally, IMAM smart device provides convenience, optimized energy consumption, and is self-operated, making the recitation translation easier, centralizing, and saving energy. All three innovative and eco-design features offer competitive marketability elements in the market. Other than that, a reasonable price is offered so that any individual or group can afford it to perform their spiritual activities.

Aligned with the Sustainable Development Goals 4, i.e., Quality Education, IMAM Smart System would contribute to equal and quality education for all Muslims in developing or developed countries. Muslims who lack facilities in learning and understanding Al Quran recitation could use IMAM as a teaching and learning device to reduce the cost of hiring religious teachers —on the other hand, using recycled materials in designing the shell of IMAMs that originate from the waste materials of Sarawak. Using recycled materials in a spiritual product could trigger the potential users on environmental awareness while focusing on their religious learning.

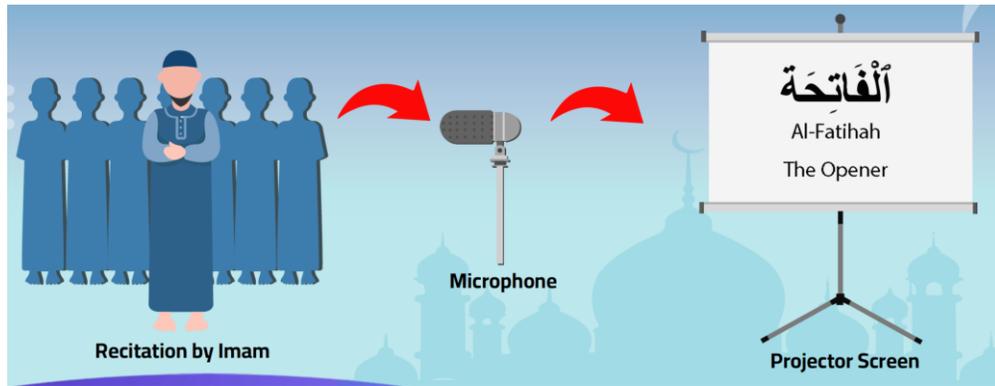


Figure 5. Congregation of Imam and jumma during prayer

CONCLUSION

IMAM's intelligent system will provide an excellent assistant for the prayers in Malaysia and worldwide. Thus the feasibility of that system will be applicable due to the abundance of used smartphones, smartwatches, and smart glass. In addition to that, most mosques nowadays have wifi networks. Only the focus will be on how to develop an intelligent speaker and Quran text recognition.

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