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Development of mobile application for Malay translated hadith search engine

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Article Info	ABSTRACT
	This paper presents the development of mobile application for Malay Translated Hadith search engine. Limitations of current Hadith web application are the design is to optimize its usage on desktop computer but not on mobile devices, which requires simple and user friendly interface. Besides that, web application also needs internet connection to use. Due to increase usage of mobile application among mobile phone users, many existing web applications have moved to mobile based applications to cater for increasing numbers of mobile users. In this study, a mobile application for Android and iOS mobile application has been developed using Flutter framework, a hybrid mobile application framework. A Malay Translated hadith search engine mobile application can easily assist those who are seeking knowledge to learn more about certain topics in hadith, a second source of Islamic knowledge. This mobile application has search and directory features for users to browse the 2028 Sahih Bukhari hadith collection. Users can enter their query using search features to find selected hadith in Malay language. Queries will be processed for searching relevant hadith and display the results to the user. Evaluation using Recall and Precision shows that on the average Recall is 73% and Precision is 33%. Functionality testing is also conducted to test against the functional requirements or specifications. Results shows all requirements are successfully tested.

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1.   INTRODUCTION

Current records showed approximately 4.68 billion people worldwide own a smartphone [1, 2]. Mobile app usage is growing 6% Year-on-year [3, 4]. There are a few mobile operating systems. The top popular mobile operating systems are Android and iOS, but others include BlackBerry OS, webOS, and watchOS [4, 5].

Malay language has been a spoken language widely especially for countries in Southeast Asia. Malay language became the lingua franca among traders who travelled through Malacca in the 15th century [6]. The language is still widely spoken in Malaysia, Indonesia, and Brunei, many Singaporean and Southern Thailand also speak the language [7]. According to Khairul et. al., Malay language is among the top ten most used languages on the web [8].

Sunnah refers to all that is narrated from the Prophet Muhammad: his acts, his sayings and whatever he tacitly approved [9]. Many of the companions of the Prophet Muhammad memorized and wrote down Prophet's statements and actions to pass down the hadiths to their students. Several Muslim scholars collected these hadiths into compilations which have become widespread and are the main sources of hadiths

until today [10]. As the technology is prospering, an effort to accommodate Muslims from Malay speaking countries can be done by developing a mobile application to retrieve Malay Hadith text [11].

Hadith Collection from Greentech Apps Foundation [12] contains more than 41,000 hadith from most accepted and authentic Hadith, available in English and Arabic Language only. Partial match query for Hadith Collection application is very lagging [12]. Hadith Collection - Sahih Bukhari, Muslim & More from Quarter Pi: Best pro-Islamic apps for Muslim Ummah features powerful search engine for pro version only and does not support search engine for the free version [13]. Hadith Sahih Al Bukhari Malay from Ar-Rahman Labs features Complete Sahih Bukhari book in Malay but this application only supports keyword search [14]. Mutiara Hadis is the pioneer of the Malay Hadith Information Retrieval [15-20]. It is one of the web-based application search engines for hadith translated in Malay language. Portal myHadith is a web-based application search engine developed by Jabatan Kemajuan Islam Malaysia (JAKIM) for hadith translated in Malay language [21]. Users need to have internet connection to use this website. By having a mobile application, users do not need any internet to use the application. There is a need to have a simple and easy search engine in mobile platform with an attractive interface to attract more users to use this application [11]. The hadiths collections that are published either in form of digital sources or books are limited for other languages except Arabic, English and Indonesian [22, 23]. This research aims to develop a mobile application search engine for Malay translated hadith for fast and easy searching in assisting targeted users to satisfy their information needs.

2. RESEARCH METHOD

The whole process of Information Retrieval is illustrated in Figure 1 [23, 24]. In the Text Operations, Malay Translated Hadith corpus will be pre-processed by tokenizing, removing stop words and stemming to get the index terms and produce the inverted indexed file. Natural language queries that represent user's information need will be processed by text operations resemble those applied to Hadith text corpus to obtain the keywords which are used to search from the indexed file to retrieve the set of relevant Hadith documents. These retrieved documents will be ranked using selected ranking algorithm and return back to the user for further usage.
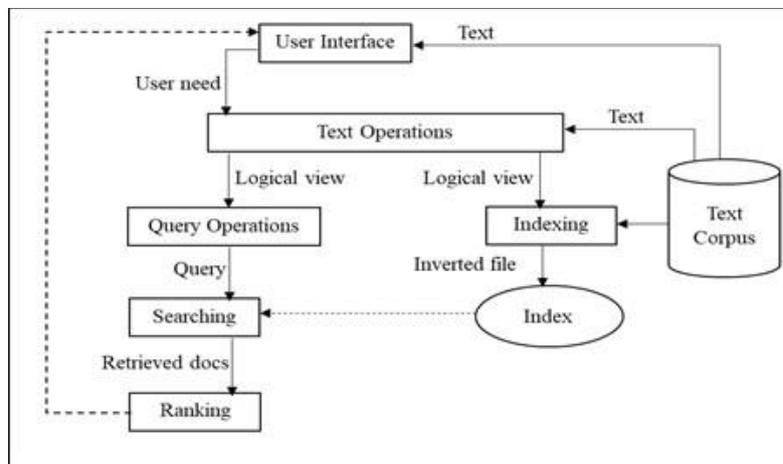

Figure 1. Information retrieval process [24]

This research focused on 2,028 hadith Sahih Bukhari documents [22, 25]. All documents are indexed using inverted indexed file. Stop words which carry no meaning, will be removed. Total Malay Language stop words used in this research is 365 words [25]. For example, token of strings "*Saya*", "*nak*", "*tahu*", "*mengenai*", "*makanan*" will be reduced to become "*makanan*" after removing stop words. Stemming is a process to reduce a word to its root form [25]. For example, term "*makanan*" will be stemmed to its root word "*makan*". Dictionary for Malay root word and morphological rules for Malay language are applied in the stemming process [16]. Lastly, the stemmed word are used as keywords to search from the indexed file before the retrieved documents are ranked and displayed to the user [16, 26, 27].

A proper user interface and user experience for mobile application are crucial. This is because by having a small screen on mobile devices, user must be able to interact with the application effectively. Activities or view

controller are referred to the interface for each event. Currently, there are five different activities or view controller as planned for the user interface. The activities are named as splash screen, menu activity, search pop up, type activity and hadith activity. Figure 2, Figure 3, Figure 4, Figure 5, and Figure 6, shows the user interface for splash screen, menu activity, search pop up, type activity and hadith activity, respectively.
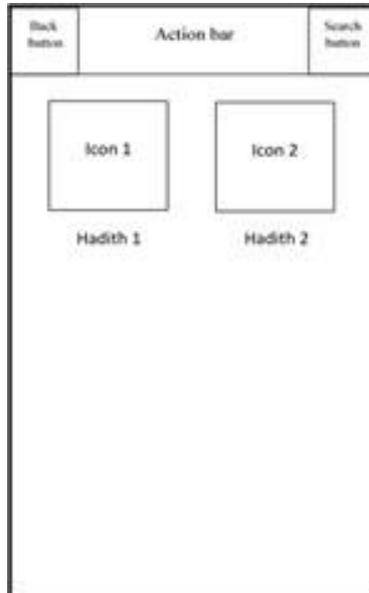
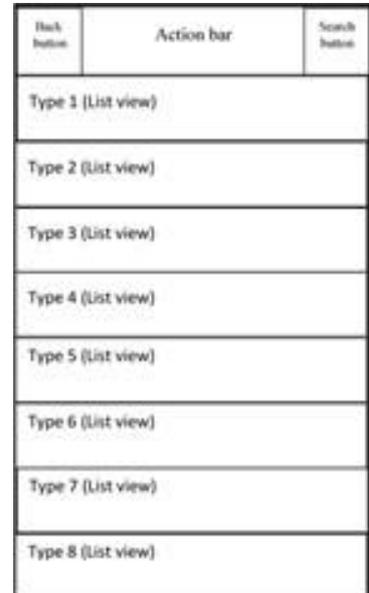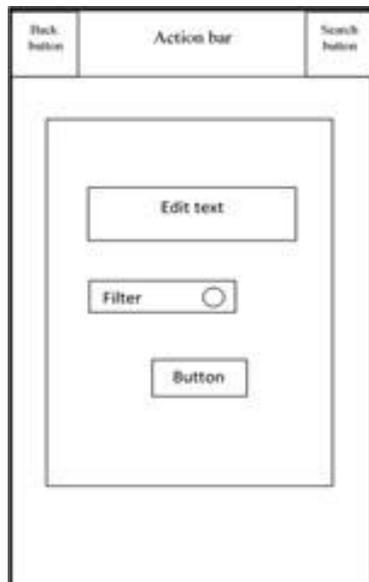| Figure 2. Splash screen | Figure 3. Menu activity | Figure 4. Search popup |

Figure 5. Type activity   Figure 6. Hadith activity

Development of the mobile application prototype requires software such as integrated development environment (IDE), programming language and framework to use. This research is developed for iOS and Android operating system using a hybrid framework called Flutter framework. The software used for this research are Android Studio, Android emulator and iOS emulator. Dart programming language is used for Flutter framework. The hardware requirement to develop this research are in Table 1. It requires mobile phone with Android and IOS operating system.

Table 1. Hardware requirement

Computer	Android smartphone	iOS smartphone
MacBook Air	Oppo A3s	Apple iPhone 6S
macOS Mojave Version 10.14.5	Android version 8.1.0	iOS 12.2
1.8GHz dual-core Intel Core i5 processor	Qualcomm SDM450 Octa Core Processor	A9
8GB 1600MHz LPDDR3 memory	2GB RAM	2GB RAM
256GB SSD storage	16GB ROM	32GB ROM
Intel HD Graphics 6000		

3. RESULTS AND ANALYSIS

This section discussed on the evaluation of the results. A test is conducted by running 30 different queries from [25, 28-30]. Then, the displayed result will be compared with relevant judgment from [25]. The result presented in Table 2 is evaluated using standard Recall and Precision evaluation criteria [24].

Table 2. Query result analysis

Query No	Relevant Judgement (Rel)	Query Result (A)	(Rel∩A)	Recall $\frac{\|Rel \cap A\|}{\|Rel\|}$	Precision $\frac{\|Rel \cap A\|}{\|A\|}$
1	19	16	13	0.68	0.81
2	50	252	48	0.96	0.19
3	47	202	45	0.96	0.22
4	8	352	6	0.75	0.02
5	19	30	19	1.00	0.63
6	8	65	5	0.63	0.08
7	64	586	54	0.84	0.09
8	7	39	4	0.57	0.10
9	81	116	61	0.75	0.53
10	18	214	18	1.00	0.08
11	32	77	3	0.09	0.04
12	11	41	11	1.00	0.27
13	55	199	55	1.00	0.28
14	28	113	27	0.96	0.24
15	31	84	24	0.77	0.29
16	14	255	6	0.43	0.02
17	54	189	53	0.98	0.28
18	50	132	45	0.90	0.34
19	114	62	43	0.38	0.69
20	3	101	1	0.33	0.01
21	53	587	53	1.00	0.09
22	14	477	7	0.50	0.01
23	69	38	29	0.42	0.76
24	27	28	26	0.96	0.93
25	74	170	39	0.53	0.23
26	64	58	35	0.55	0.60
27	65	44	21	0.32	0.48
28	19	276	15	0.79	0.05
29	49	103	49	1.00	0.48
30	27	23	23	0.85	1.00
Average	39.13	164.30	27.93	0.73	0.33

Figure 7 shows the graph before it is interpolated. Figure 8 then illustrated the graph between interpolated recall and precision for each query [24]. Recall and precision are based on Table 2 above. On average, precision drops as recall increases. The average of relevant judgement frequency, query result frequency, total of both relevant judgement and query result hadith, recall and precision of 30 queries are 39.13, 164.30, 27.93, 0.73 and 0.33 respectively. Considered high recall and high precision value is the most relevant answer for the search query. That shown the Mobile Application of Malay Translated Search Engine may provide the best result of user needs. For future research, more Hadith documents should be added to Malay Translated Hadith corpus from other prominent and reliable Hadith Books, such as Sahih Muslim, Sunan Al-Tarmizi, Sunan Al-Nasai', Sunan Ibnu Majah and Sunan Abi Daud [30]. Covering this large collection, will surely be the focal point of references. Another possible area of research is to cover cross-lingual IR. This application will be able to support other language when user want to change the application language on setting menu. User will able to read the hadith and search in their own preference language. This will increase the target user range.
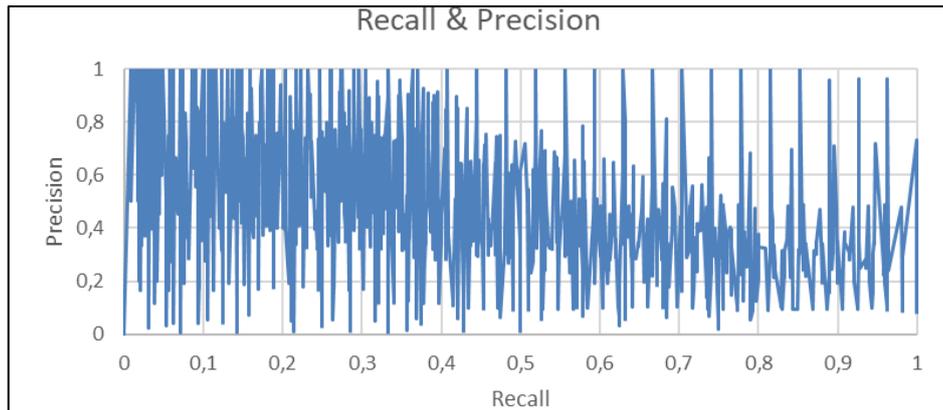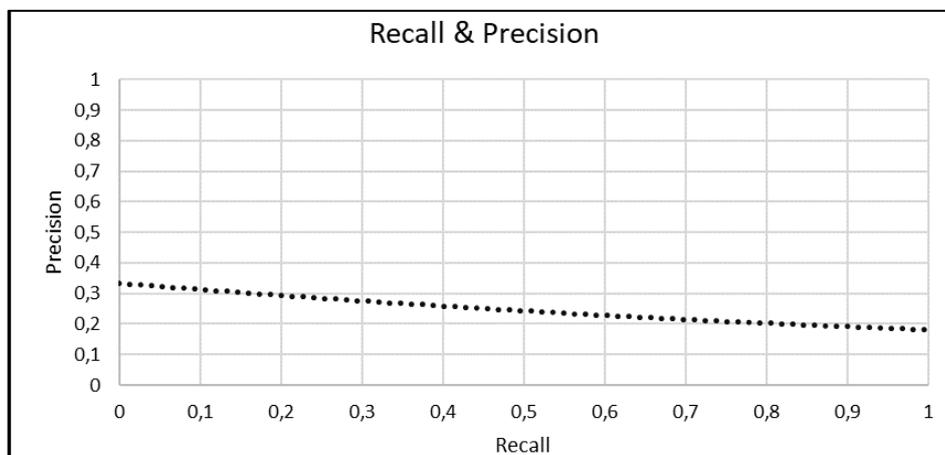
Figure 7. Recall and precision graph

Figure 8. Interpolated recall and precision graph

4.　CONCLUSION

In conclusion, the development of mobile application for Malay Translated Hadith Search Engine is highly needed to meet the proliferation of mobile users in the world generally and among Malay Speaking users in South East Asia specifically. Mobile platform offered easier way for users to search relevant information without the need for the internet.

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