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A BARCODE SCANNING MOBILE APPLICATION FOR SEARCHING HALAL INFORMATION OF FOOD PRODUCTS

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ABSTRACT. The rapid growth of Muslim population and global halal food market has increased the need for mobile applications that capable of checking the halal status of the food product. For this purpose, Jabatan Kemajuan Islam Malaysia (JAKIM) developed a mobile application named myJakim. The application is useful, and it provides the information that consumers need. However, it uses text-based searching which is prone to input errors. Consumers might key-in the wrong spelling of the product which causes the system to return null searching results. This paper proposes a solution to this problem by implementing a barcode scanning functionality that allows the mobile application to capture the product information automatically. A mobile application named Halal Detector was developed. An evaluation was conducted to measure the usability of Halal Detector. The results suggest that the barcode scanning facility in Halal Detector is usable and helps consumers to search the halal status of food product faster than the text-based application.

Keywords: Product Barcode, Barcode Scanner, Usability Evaluation, Halal Industry, Mobile Application.

INTRODUCTION

Malaysia has become a global halal hub that leads research, development, and infrastructures for halal products (Fallis, 2013). Jabatan Kemajuan Islam Malaysia (JAKIM) is the authorized department that responsible for all halal related affairs in the country (JAKIM, 2016a). Due to the rapid growth of halal food consumers and halal food products globally, JAKIM has invented an e-Halal web-based application that was fully implemented by the end of 2007 (Junaida et al., 2014). The department has also introduced a short message service application called “Jakim My SMS” in 2010 (JAKIM, 2016c). In 2012 JAKIM introduced a native mobile application called “myJakim” that runs on smartphones and computer tablets (JAKIM, 2016b). All of these applications provides consumers with the halal information of food and cosmetics products manufactured in Malaysia.

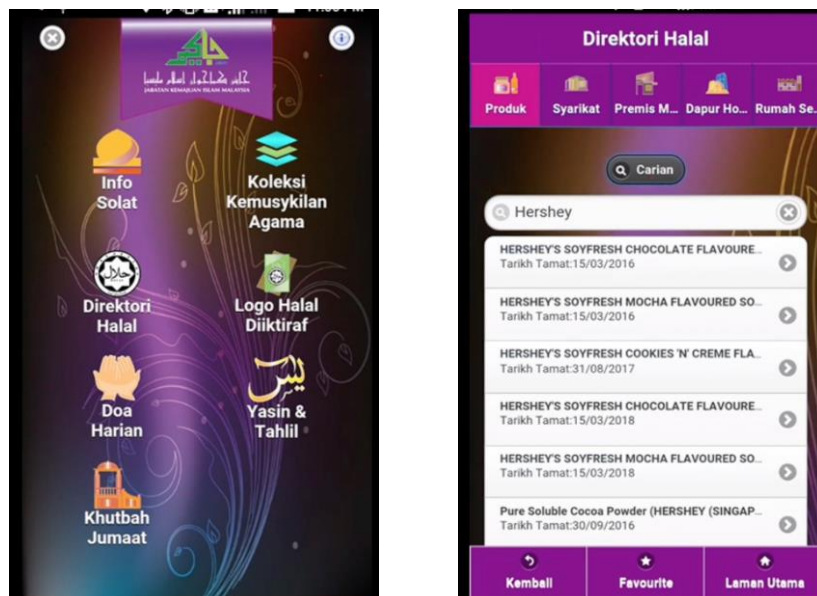
The current version of myJakim application employed a text-based searching of the product name. In general, the application meets the purpose of providing consumers with the halal information of the products. However, the text-based searching leads to three major problems. First, the searching process is time-consuming if there are similar product names in the database. In this case, consumers have to go through the list of the results and choose the correct product name. Second, the product names that consumers choose may not be correct (as it may include brand and tagline); hence, the searching results could return null results.

Consequently, consumers may think that the products are not halal-certified. The third problem is related to the small touch-screen keypad of the smartphones that highly leads to input errors, and therefore returns the incorrect searching results.

The main objective of this study is to improve myJakim application by proposing a barcode scanning facility in the mobile application. A mobile application called Halal Detector was developed to allow consumers to search halal status of the food products. An evaluation study was conducted to measure the usability of Halal Detector. The detail of this study is explained in the remaining sections. The paper is organized as follow: Section two gives an overview of the existing myJakim application. Section three reviews the technical details of Halal Detector. Section four discusses the usability evaluation of Halal Detector, and the results are presented in section five. The last section concludes the work.

MYJAKIM

The ideas on developing myJakim application were officially from JAKIM. The application is part of “my government” (myGov) Mobile and Malaysian Administrative Modernisation and Management Planning Unit (MAMPU) project. MAMPU is the government agency which helps to develop the application. myJakim application comprises menu such as “*info solat, direktori halal, doa harian, khutbah jumaat, koleksi kemasyarakatan agama, fatwa, logo halal diiktiraf, yasin, and tahlil*”. The features that help consumers to search for halal food product status is *direktori halal*. Figure 1(a) and (b) show the main interface and the example of searching results respectively.



(a) The Main interface

(b) The example of searching results

Figure 1. myJakim application.

As shown in Figure 1(b), the application has a text box that requires consumers to type the product name using the smartphone keypad. When consumers press the “*Carian*” button, the application will list all the products that have the similar name with the one that consumers supplied. Then, the consumers must go through the list and select the correct product that they searched. The list could be short or long, depending on the similar records available in the database. Hence, the time for the searching process highly depends on the accuracy of the product names supplied by the consumers. If the consumers unintentionally misspelled the

product names, the application will return no result. The no result will also be obtained when consumers provide incorrect or incomplete product names.

The above problems have inspired the researcher to improve the searching process by proposing an automated method for capturing product names. This can be done by using the smartphone cameras as a scanning device of the product barcode. The barcode provides accurate information about the product names; hence, avoiding the consumers from the input errors.

HALAL FOOD BARCODE SCANNING APPLICATION

This section describes the architecture, the development, and the user interface of a mobile application with barcode scanning features for halal food named Halal Detector.

The Architecture of Halal Detector

The architecture of Halal Detector is visualized in Figures 2. It contains four components as below:

- 1) Client devices. The client devices are smartphones and tablet computers that run on IOS and Android.
- 2) PhoneGap and Cordova API. The PhoneGap API is used for enabling the barcode scanning features on the smartphones while the Cordova API is to enable the features to run on cross-platform client devices.
- 3) MYASP.NET server. The cloud web server that hosts the mobile web version application and the mobile code for Halal Detector.
- 4) MySQL Database. The database that stores the product information.

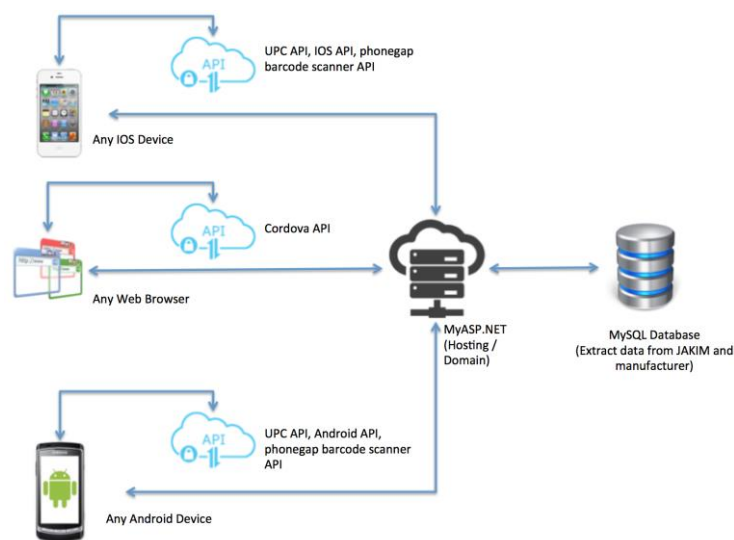


Figure 2. The Architecture for Halal Detector.

The Development of Halal Detector

The development of Halal Detector followed the rapid prototyping development method. It was developed using tools, programming language, hardware and software specified in Table 1.

Table 1. The client-side and server-side programming environment.

Client-side programming	Intel XDK version 3491, HyperText Markup Language 5 (HTML 5), Cascading Style Sheets (CSS), JavaScript, Asynchronous JavaScript and XML (AJAX), JavaScript Object Notation (JSON), PhoneGap barcode scanner API, Cordova API
Server-side programming	Hypertext Pre-Processor (PHP), MySQL database, MYASP.NET server (a cloud server)

The User Interface of Halal Detector

The Halal Detector user interface is straightforward and easy to use. Once the consumers run the application, the smartphone camera is automatically activated and ready to scan the barcode. When the camera detects the barcode, it will automatically capture the barcode image and transform the image into the barcode number. The application will search from the database about the product, the barcode number, the product name, the company name, and the halal status; then the information will be rendered in the corresponding text boxes. Figures 3 shows the Halal Detector main user interface.

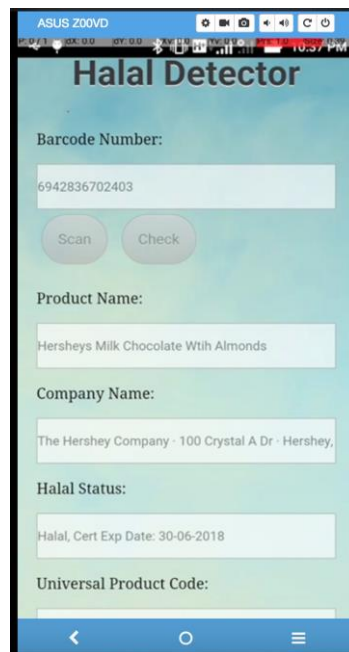


Figure 3. The user interface of Halal Detector.

USABILITY EVALUATION OF HALAL DETECTOR

An evaluation was conducted to measure the usability of Halal Detector. This section describes the method, hypotheses, respondents, materials, and procedure for conducting the study.

Method and Hypotheses

The usability evaluation was conducted following the between-subject design experimental study. Two hypotheses were formulated as in Table 2.

Table 2. Hypotheses list.

HA:	The time taken to search halal status of food product using Halal Detector is less than myJakim application.
HB:	Halal Detector has better usability (i.e., usefulness, ease of use, and satisfaction) than myJakim application.

Respondents

The study was conducted in the first week of October 2016 in Perlis. A total of 100 respondents were recruited from customers at supermarkets, and students and teachers at schools. They participated on a voluntary basis. As an appreciation for their participation, the respondents were given an RM10 food voucher.

Materials

The instruments used for the usability evaluation were myJakim application, Halal Detector application, and a usability questionnaire. The questionnaire was adapted from Lund (2001). It was divided into two sections: (1) Section A: Demographic information (10 items), and (2) Section B: Usability (27 items). Section B is divided into two sub-sections: (1) Time taken for completing the task (Lewis, 1995), and (2) Usability metrics (i.e., usefulness, ease of use, and satisfaction) (Lund, 2001) that were measured using a seven-point Likert Scale (i.e., one represent strongly disagree and seven represent strongly agree). This usability study followed Jakob Nielsen and ISO 9241-II model (Seffah & Padda, 2010) on evaluating mobile applications (Nielsen & Budiu, 2012).

Procedure

A pilot test was conducted on ten respondents to measure the level of difficulty and clarity of the given tasks. The evaluation session was performed by a team consisting of a moderator, timekeeper, and data logger. Prior to the evaluation, the respondents were divided into two groups at random where 50 respondents used the existing myJakim application (Group A) and the other 50 respondents used Halal Detector application (Group B). Table 3 shows the sequence of tasks that the respondents performed.

Table 3. The tasks sequence for the evaluation.

myJakim	Halal Detector
The respondents were given TWO (2) food products. a) Hershey's Creamy Milk Chocolate With Almonds b) Quaker Fruit Bites (Strawberries And Blueberries)	The respondents were given TWO (2) food products. a) Hershey's Creamy Milk Chocolate with Almonds b) Quaker Fruit Bites (Strawberries and Blueberries)
The respondents click “myJakim” application’s icon on the mobile phone.	The respondents click “Halal Detector” application’s icon on the mobile phone.
The respondents click “Direktori Halal” menu of myJakim application.	The respondents wait until the application is completely loading and the camera with barcode scanning features automatically activated.
The respondents type the first product name (i.e., Hershey's Creamy Milk Chocolate With Almonds) on the <i>Carian</i> text field and click the	The respondents point the smartphone camera directly on the product barcode (i.e., Hershey's Creamy Milk Chocolate with Almonds). The

“ <i>Carian</i> ” button.	barcode must be horizontally aligned with the camera.
Once the searching result is displayed, the respondents select the product information related to the product they are searching by clicking the > button. The halal certification information is displayed.	The camera will automatically detect the barcode and the product information will appear on the screen. The halal information is also displayed in the halal status text box.
The respondents switch back to the searching menu.	The respondents Click the “Scan” button. The respondents point the smartphone camera directly on the product barcode (i.e., Quaker Fruit Bites (Strawberries and Blueberries)). The barcode must be horizontally aligned with the camera.
The respondents type the second product name (i.e., Quaker Fruit Bites (Strawberries and Blueberries)) on the <i>Carian</i> text field and click the “ <i>Carian</i> ” button.	The camera will automatically detect the barcode and the product information will appear on the screen. The halal information is also displayed in the Halal Status text field.
Once the searching result is displayed, the respondents select the product information related to the product they are searching by clicking the > button. The halal certification information is displayed.	

The usability evaluation was conducted using an ASUS Zenfone Go ZC500TG with 8MP digital camera. The screen size is 5” with 720 X1280 MP. The operating system for the smartphone was Android v5.1 (i.e., Lollipop). The smartphone had 2GB RAM and Quad-core 1.3GHz Cortex-A7 processor. The mobile broadband Internet service with minimum of 2Mbps for downloading was used during the study. The smartphone cache memory is cleared after the completion of the session for each respondents.

RESULTS

IBM SPSS Statistics version 23 was used for the data analysis. First, a reliability test was conducted and the Cronbach’s Alpha Coefficients for the 27 items was 0.987 (i.e., range from 0.728 to 0.920) suggesting that the data has high internal consistency. Next, a normality test using Shapiro-Wilk test suggested that the data was not normally distributed; hence, a Mann-Whitney U test will be used for the hypotheses test.

Table 4 shows the number of male and female respondents. The average age of all respondents was 25.72 years where the age range of respondents for the study is 13 to 62 years old.

Table 4. The gender distribution of the respondents.

	Male	Female	Total
Group A (myJakim)	23	27	50
Group B (Halal Detector)	18	32	50
Total	41	59	100

The respondents were students (55%), government staff (32%), private company staff (10%), and others (3%). 66% of the respondents accessed the Internet every day, 18% weekly, 14% fortnightly, and 2% monthly. Meanwhile, 73% of the respondents used their mobile phones to access the Internet. Further, 35% of the respondents go for shopping at the supermarket every fortnightly. 70% of the respondents have a high level of awareness towards halal food. 87% of the respondents know about the barcode. 77% of the respondents do not have any experience on using any mobile application or web application to check for halal product status.

A Mann-Whitney U test was conducted to see the difference in the time taken by the respondents to search halal status of the food product and the usability metrics. Table 5 shows the statistics values. The respondents who used Halal Detector took less time than the respondents who used myJakim. The difference in the time taken between these two applications was 209.06 seconds. The time taken to search halal status using Halal Detector is significantly less than myJakim. In terms of usability, the mean ranks for all usability metrics (usefulness, ease of use, and satisfaction) of Halal Detector are significantly higher compared to myJakim. The results suggest that Halal Detector can help consumers to search halal information more quickly. It is also useful, easy to use and satisfying the consumers.

Table 5. The Mean and mean rank for the usability study.

	Group A (myJakim) (n=50)		Group B (Halal Detector) (n=50)		Statistics values
	Mean	Mean Rank	Mean	Mean Rank	
Time Taken (seconds)	260.64	73.78	51.58	27.22	$z=-8.026, p=0.000$
Usefulness	5.3800	36.71	6.3750	64.29	$z=-4.765, p=0.000$
Ease of Use	5.2300	33.02	6.4460	67.98	$z=-6.036, p=0.000$
Satisfaction	5.4200	34.91	6.5600	66.09	$z=-5.408, p=0.000$

Based on the results presented in Table 5, both hypotheses A and B are supported. Hence, the time taken to search halal status of food product using Halal Detector is less than myJakim application (HA), and Halal Detector has better usability (i.e., usefulness, ease of use, and satisfaction) than myJakim application (HB).

DISCUSSION

The results of this study suggested that the time taken by the respondents to search the halal status of food product using Halal Detector was significantly less than myJakim application. The results also discovered that the Halal Detector outperformed myJakim in terms of its usability (i.e., usefulness, ease of use, and satisfaction). The observation made by the moderators showed that most respondents that used myJakim application required a longer time to find the accurate product information from the list when they supplied the product name in the searching bar. In addition, when the respondents type and search using full product name, the system returned null results, although the product information was known available in the database. Some of the respondents also experienced typing error due to the small touch-screen keypad on the smartphone.

CONCLUSION

The results of this study have shown that the time taken to search halal status of food products using barcode scanning feature was less than text-based searching method. The use of barcode scanning feature for searching halal status of the food product is easy and convenient to use. Further, the barcode scanning feature in Halal Detector has better usability compared to the existing text-based searching in myJakim application. The findings provide a guideline to the developers to consider offering alternative methods to search for the halal status of product for their websites or mobile application.

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