

Heuristic Evaluation on Barcode Scanner Mobile Application for Halal Food Product in Malaysia

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Abstract: Conventional barcode scanner shows the price of the item without any detailed description. The primary issue is the usage of fake Halal logos among product manufacturers that has caused a major concern among Muslim consumers. Consequently, consumers become skeptical in purchasing food and related products. Hence, this study made an attempt in developing a “*Halal Food Product Barcode Scanner*” application based on the waterfall methodology. Heuristic evaluation has been conducted to evaluate the usability of the application. The result indicates that the application works flawlessly in some heuristic aspect although some minor usability issues are still present which does not impair the overall experience when using the application.

Keywords: Halal, Barcode Scanner, Heuristic Evaluation, Mobile Apps

1. Introduction

Malaysia is known as a Muslim country and also known as a global hub Halal country. As a Muslim, the most important aspect when it comes to food is the Halal status of the food product. In addition, foods that are nutritional, healthy and safe to consume are highly emphasized in Islam and it is often referred as “*toyyib*” [1], [2]. In Malaysia, the Department of Islamic Development (JAKIM) is responsible for Halal certification and logo, which means any products including foods and drinks product must pass and meet JAKIM’s requirements. However, many food product manufacturers fake Halal logos on their products instead of getting verification approval from JAKIM. This is mainly because their products do not pass and meet JAKIM’s requirements. This scenario has caused uncertainty and doubts among consumers regarding the Halal status of the food they consume.

Food products in supermarket comes with a unique barcode numbers which represents the information and details of the product. The barcode number can be checked using the barcode scanner which read the price of the product. However, other than price, a Muslim also need information

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regarding the Halal status of a product in order to ensure the product is Halal before buying it since faking Halal logos and labels has been a major issue.

There are a few existing applications in both Android Play Store and Apple App Store which serves the same functionality as the “*Halal Food Product Barcode Scanner*” application. The applications are reviewed to elicit common features in Halal applications before developing the application as listed in **Table 1**.

Table 1: Comparison between existing applications

Comparison Criteria	Halal Check	Scan Halal	App Scan Halal	QR & Barcode Reader
Halal Product Sharing Option	Yes	Yes	No	No
Information About Food Ingredient	Yes	Yes	Yes	No
Analysis Approach Sources	Camera scan App Store and Play Store			
Database Connection Subscription	Yes Free	Yes Free	Yes Free	No Free

Halal Check application is very simple to use as it is a camera-based application. However, Halal Check application is distinctive compared to other Halal scanner application for allowing users to easily search for their product information such as food additives and Halal status by entering the E-Numbers and E-Codes of the product. The use of E-Numbers and E-Codes gives this application the ability to describe a specific ingredient in details including the originated source. This application is directly connected to a database which allows it to store information about food additives and their Halal status which is then retrieved by users when they scan the product barcode or just by entering the E-Numbers and E-Codes.

On the other hand, instead of entering E-Numbers or E-Codes as in Halal Check application, users can scan the ingredients details which is printed on the product packaging using Scan Halal application. This application will analyze each ingredients words by words and describe each ingredients in details if there is a match. Users also have the option to immediately scan the barcode if they want to skip the ingredients details and enquire the Halal status of the product in general.

App Scan Halal is an application that assist Muslims in identifying additives or preservatives used in food that has been approved by the authorities. This application refers the Halal status of the product based on the users local food authorities which is JAKIM in Malaysia whereas countries that are located in Europe or America will consult some of the most well-known food authorities which is American European Union. This app is convenient especially for Muslim travelers who travel to a non-Muslim country as they can identify whether the product they are buying is either Halal or not.

QR & Barcode Reader application includes a modern QR code scanner and barcode scanner. This application scans the barcode or QR code provided on the packaging of the product and redirects to details from common websites such as Google, Shopee, and Lazada. These websites provide users with product details such as information about the ingredients, Halal status, expiry date and the manufacturer of the product. This application uses a different approach compared to other Halal scanner application. Most of these applications refers to local food authorities to verify the Halal status of a product. Meanwhile, QR & Barcode Reader uses the Internet to search for the scanned product and display the details to the users. If a user wants to know the Halal status of a food product in general, this application is reliable to do the task.

This study developed the “*Halal Food Product Barcode Scanner*” application to resolve issues faced by Muslim consumers regarding the authenticity of a product’s Halal status especially with the increase amount of fake Halal logo usage among product manufacturers. This application allow users to scan product’s barcode with their smartphone’s camera and display a detailed description about the product such as the name of the product, Halal status, category, manufacturer and ingredients. Therefore, consumers have the ability to own a barcode scanner that is mobile and easy to use. The following section discusses the materials and methods used in this study.

2. Materials and Methods

The “*Halal Food Product Barcode Scanner*” application is developed using the Waterfall methodology as shown in **Figure 1**.

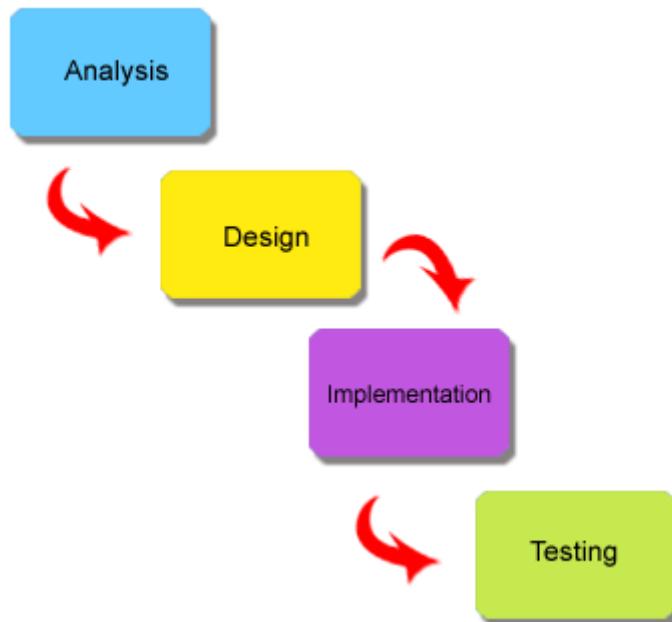


Figure 1: Waterfall model [3]

The first phase is carried out to identify the target users, user’s tasks, User Interface (UI) component and system environment needed to develop the “*Halal Food Product Barcode Scanner*” application. This application is targeted for Muslim consumers who purchase food products from any convenience store. Few similar applications are reviewed to identify main user task in using the application.

The second phase is designing the Flowcharts, Data Flow Diagram (DFD), Entity Relationship Diagram (ERD), user interface and database. In addition, the hardware requirements are also determined.

In the third phase, the diagrams from the design phase are converted into a real-life application by using Java programming language in Android Studio. Database connection is also implemented in this phase. The application is developed using MySQL database and PHP programming language. The application is installed on both virtual device and compatible hardware devices to identify any errors before proceeding to the testing phase. The identified requirements during the analysis phase is applied to develop the “*Halal Food Product Barcode Scanner*” application. **Figure 2** shows the user’s page in the application. The user can scan product’s barcode by pressing the “SCAN” button and information about the product will be displayed.

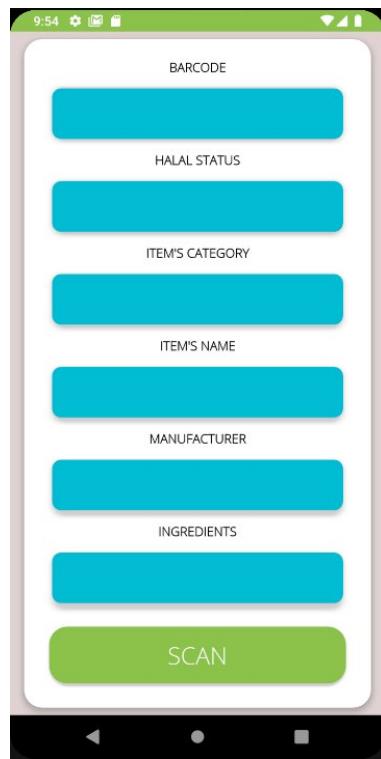


Figure 2: Scan Product's Barcode

Figure 3 shows the result displayed after scanning the barcode in **Figure 2**. User will be displayed with a detailed information about the product such as Halal status, item's category, item's name, manufacturer and ingredients.

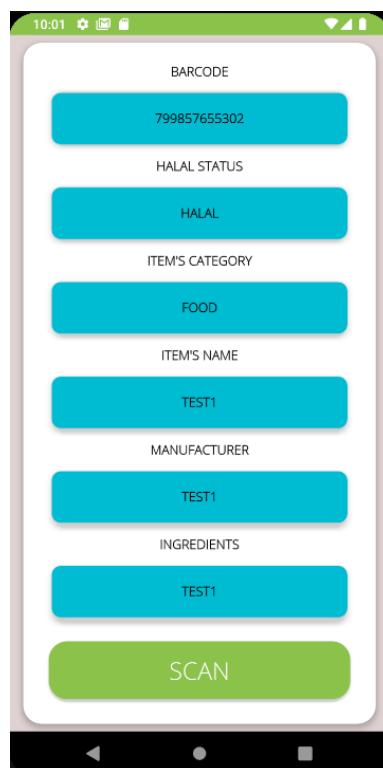


Figure 3: Scanning Results

The fourth phase evaluates the application usability. After the “*Halal Food Product Barcode Scanner*” application is fully developed, Heuristic evaluation was performed to evaluate the application. Five Information Technology (IT) students from the Center for Diploma Studies (CeDS) at Universiti Tun Hussein Onn Malaysia (UTHM) Pagoh Campus and one expert are invited to evaluate the application. The reason why these individuals are selected as the evaluator is because of their ease of reachability especially during this pandemic time where everything has to be done virtually and also their capability of being a judge to infuse useful information into the evaluation’s potential users [4]. Besides that, six individuals are a sufficient amount of number for evaluators whereas ten or more are excessive when conducting Heuristic evaluation. Consequently, each evaluator are given an .apk file via WhatsApp for them to install the application in their smartphones and an evaluation form to inspect the application. The evaluation form consists of three section for evaluator background profile, instruction to guide the assignment of severity scale on the subheuristics and the list of subheuristics. Evaluators are required to accomplish these subheuristic tasks individually at least once [5]. **Table 2** shows the section for each mobile usability heuristics [6].

Table 2: Mobile Usability Heuristics

No.	Heuristic	Number of Subheuristics
1.	Visibility of system status	16
2.	Match between system and the real world	8
3.	User control and freedom	10
4.	Consistency and standards	14
5.	Error prevention	7
6.	Minimize the user’s memory load	5
7.	Flexibility and efficiency of use	10
8.	Aesthetic and minimalist design	4
9.	Help users recognize, diagnose and recover from errors	2
10.	Help and documentation	5

3. Results and Discussion

In this section, the results from Heuristic evaluation are presented and discussed.

3.1 Results

Five Diploma students that enrolled in Information Technology (IT) course at Universiti Tun Hussein Onn Malaysia Pagoh Campus and one expert has been chosen as the evaluator for the “*Halal Food Product Barcode Scanner*” application. All of these students had taken both Human-Computer Interaction (HCI) and System Analysis and Design (SAD) subject in their studies and all of them also got an A grade for these subjects thus making them eligible being the evaluator for the application. Student 1 and Student 2 both have 2 years and 5 years of experience in Heuristic evaluation while Student 3, Student 4 and Student 5 have no experience in Heuristic evaluation. However, all five students are categorized as a novice when it comes to their level of expertise. Meanwhile, the expert who has a PhD and works as a lecturer can be categorized as an expert because his expertise includes usability, decision making and software engineering. Besides that, he has a long experience in Heuristic evaluation. The main purpose of Heuristic evaluation being conducted is to evaluate the application in terms of its usability and functionalities. The following evaluation is adopted from the Ten User Interface Design Heuristics [7]. **Table 3** shows the severity scoring results of five students and one expert as well as the total mean for both severity scoring results and the amount of usability problems found in the application [8].

Table 3: Severity scoring of usability and functionalities

List of Heuristic	Student1		Student2		Student3		Student4		Student5		Expert1		Mean ^b	
	S	P	S	P	S	P	S	P	S	P	S	P	S	P
1. Visibility of system status	1	9	0	6	1	14	1	11	1	12	3	10	1.17	10
2. Match between system and the real world	1	4	0	3	2	8	1	4	1	4	1	2	1.00	4
3. User control and freedom	1	4	0	0	2	8	1	6	1	6	2	6	1.17	5
4. Consistency and standards	1	7	0	0	1	8	1	5	1	6	3	9	1.17	6
5. Error prevention	1	4	0	3	2	6	1	3	1	3	2	4	1.17	4
6. Minimize the user's memory load	1	4	0	0	2	5	1	2	1	4	3	4	1.33	3
7. Efficiency of use and performance	2	8	1	4	2	8	1	7	1	7	2	6	1.50	7
8. Aesthetic and minimalist design	0	1	0	0	1	2	0	1	1	1	1	1	0.50	1
9. Help users recognize, diagnose, and recover from errors	1	2	0	0	1	2	0	0	1	2	4	2	1.17	1
10. Help and documentation	3	4	0	0	3	5	3	5	3	5	4	5	2.67	4

S : Five point rating scale of severity (0 = Not a usability problem, 1 = Cosmetic problem; fix only when there is extra time, 2 = Minor usability problem; fixing it should be given low priority, 3 = Major usability problem; important to fix and should be given high priority, 4 = Usability catastrophe; should be fixed before apps release), P : Number of usability problems.

Figure 4 shows the total mean of severity for all ten heuristics of six evaluators. Heuristic 10 (H10) which is “Help and Documentation” has the highest scale of severity mean while Heuristic 8 (H8) which is “Aesthetic and minimalist design” has the lowest scale of severity mean. The other remaining heuristic had a moderate scale of severity mean which is between 0.5 and 1.5.

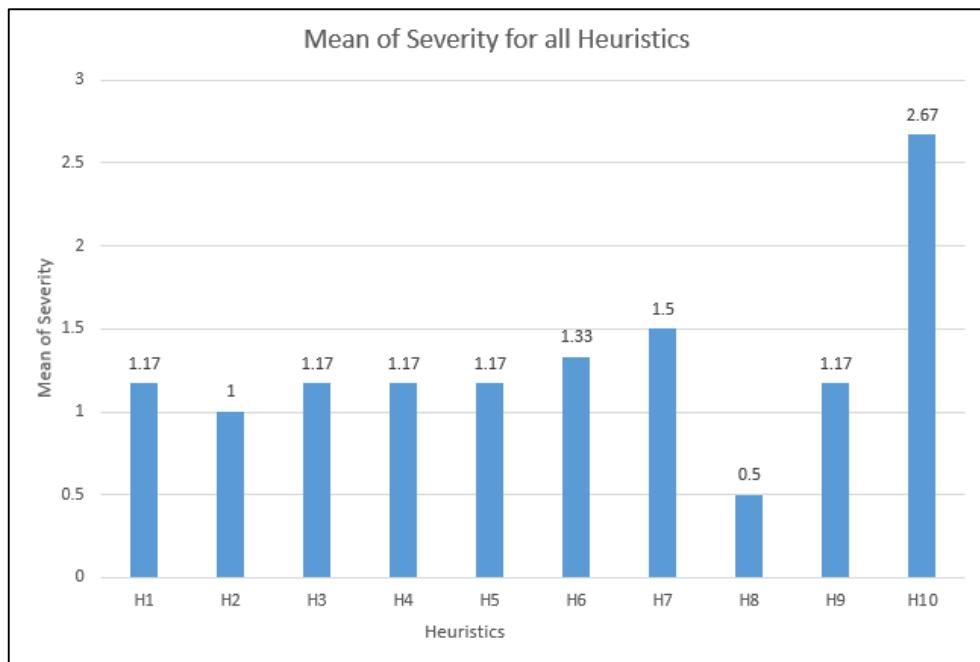


Figure 4: The mean of severity for all heuristics from six evaluator.

3.2 Discussions

The Heuristic evaluation conducted showed in what aspect this application is lacking. Heuristic 10 (H10) has the highest scale of severity mean which is 2.67 while both Heuristic 6 (H6) and Heuristic 7 (H7) had the second highest scale of severity mean which is 1.33 and 1.50. This shows that these heuristic aspects are not implemented perfectly in the application. Meanwhile, Heuristic 8 (H8) has a 0.50 scale of severity mean which means this heuristic is implemented flawlessly in the application. Number of usability problems mean differs between 1 to 10 for all six evaluators. This shows that the “*Halal Food Product Barcode Scanner*” application still has some minor usability issues that can be fixed in the future.

4. Conclusion

This study has developed a “*Halal Food Product Barcode Scanner*” application for Muslim consumers for Halal status of a food product in Malaysia. A review of existing Halal apps has been done to identify the important features for Halal applications before developing the “*Halal Food Product Barcode Scanner*” application. The implementation of a camera-based barcode scanner in this application made it effortless for users especially Muslim consumers to scan food products for information such as Halal status, product’s food category, food product name, the manufacturer and its ingredients. This application is directly connected to a live database which allow users to retrieve data on the scanned product. However, this application is currently available only for Android users to install. A heuristic evaluation has been performed to evaluate the usability of the product. The result concludes that the application works flawlessly in some heuristic aspect although some minor usability issues are still present which does not impair the overall experience when using the application.

Appendix A

Heuristics and Subheuristics in Heuristic Evaluation Form

Heuristic 1

Visibility of system status
User is affirmed upon completion of an action.
Pop-up notification is reserved for occasions where a timely response is required.
User is notified when changing orientation is not supported.
Every display begins with a title or a header that describes screen contents.
There is some visual cue when the user is scrolling to the boundary of an element (e.g., listview).
The app provides informative progress disclosure when performing an action that the user needs to wait (percentage of completion or time to wait to complete the task).
Operating system's status bars mostly (or always) visible, except for multimedia content.
Operating system's buttons (e.g., back button, home button) mostly (or always) visible, except for multimedia content.
The apps utilize screen space appropriately when displaying information.
The article title is not anchored when the content is long and needs scrolling.
The app does not use too much or too little padding or margin between elements.
The apps provide an expand-collapse element for sub-content (to save scrolling time).
The response time is appropriate for the users' cognitive processing.
The user are kept informed of the system progress if there are observable delays (greater than five seconds) in the system's response time.
There is visual feedback in menus or dialog boxes about which choices are selectable.
Menu labels for expandable menus clearly indicate that they expand to a set of options.

Heuristic 2

Match between system and the real world
New notification is combined as a summary notification if the same type of another notification is already pending.
The app design use metaphors (e.g., icons that match actions).
Menu choices are ordered in the most logical way considering the user, the item names, and the task variables.
Related and interdependent fields appear on the same screen.
The terminology is consistent with the user's task domain.
The app use nomenclature on specific domain.
The apps employ user jargon and avoid system jargon.
The app automatically align format for numeric values (e.g., trailing spaces, enter leading, enter commas, enter currency symbol)

Heuristic 3

User control and freedom
There is an option to leave unwanted state.
The app allows reverting accidental activation.
User is not forced to download software that is inappropriate for their phone.
User can interact with the system continuously (without system hang or freeze).
User can move forward and backward between fields or dialog box options.
Operating system's buttons (e.g., back button, home button) can be used without blocking by the system.
The app use transitions to show relationships among screens.
The location of positive button (e.g., OK button, next button) of a dialog box is on the right and negative button (e.g., cancel button, back button) on the left.
The user can dismiss the prompted dialog box by touching any area outside the dialog.
The app avoids design element that looks like it can interact (e.g., GUI control) when actually it cannot interact or provide feedback to users.

Heuristic 4

Consistency and standards
The media controls are simple enough to effortlessly allow control of media content.
Purpose of swipe is consistent across different areas of the same screen.
There are no new, redefining gestures that might cause confusion.
The long press gesture is reserved for multi-select.
Grid item is cut off indicating scrolling orientation.
There is consistent location of menu across the app.
There is a consistent design scheme and stylistic treatment across the app.
There is consistent typography across the app.
There is consistent design on input element (e.g. textbox, dropdown).
There is consistent design on physical size (font size, element size) across the screen size, and screen density .
The same input element and the same state have the same interaction.
User can recognize how to interact with the styled input element.
The app font appearance (size, typeface) can be changed to be consistent with operating system font appearance.
The structure of a data entry value is consistent from screen to screen.

Heuristic 5

Error prevention
User is asked for permission before making connection.
User is asked for confirmation before deletion.
Notification is not created if it is possible for the app to recover from the error without user action
The menu choices are logical, distinctive, and mutually exclusive.
Touchable objects (e.g., buttons) in the screen is not placed too close
Data input types are appropriate for information types (e.g., use number input type for numeric information).
There are visual differences between interaction objects (e.g., buttons) and information objects (e.g, labels, images)

Heuristic 6

Minimize the user's memory load
Graphical password is used in login.
All data a user needs are on display at each step in a transaction sequence.
Required data entry fields are clearly marked.
The app provides an example input for format-specific or complex information.
The first word of each menu choice is the most important.

Heuristic 7

Flexibility and efficiency of use
Data entry does not require the use of both hand.
The app is secure to use while driving.
Have splash screens that do nothing (no background task, only show the image or video) been avoided?
The most frequently used menus is in the most accessible positions.
The app support both orientations (horizontal and vertical).
The app keeps location of the content on the screen when users switch orientation.
The app use device information such as date and time, geolocation as input data.
The user can move focus from one textbox to another textbox by pressing next on virtual keyboard in a data entry form.
The app enable users to interact with elements by swiping, gesturing, or pinching instead of only touching the elements (e.g., users can pinch the image element to zoom-in and zoom-out, users can swipe left to go to the previous screen).
The app provide tools for filtering items or scrolling faster when the list is too long.

Heuristic 8

Aesthetic and minimalist design
Dependency subscreen is used for managing setting options which availability based on value of another setting.
Only information essential to decision making is displayed on the screen.
The app does not use too many typefaces.
Unnecessary moving animations of information (e.g., zoom in, zoom out) are avoided.

Heuristic 9

Help users recognize, diagnose, and recover from errors
The prompts are brief and unambiguous.
There are signals on error elements in a form, and elements that need to be changed are marked for data entry screen.

Heuristic 10

Help and documentation
The instructions follow the sequence of user actions.
When users start using the system for the first time, does the app provide instructions (or tips)
The instructions provided for first time user are simple and clear.
The instructions provided for first time user are focusing on a few feature (e.g., frequently used feature).
The instructions provided for first time user are necessary for users to get started.

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