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JAKIM Halal Logo Verification using Image Processing

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ABSTRACT

In Islam, choosing halal products is important. This is because according to the dietary rules, Muslims can only consume halal (lawful) foods and are prohibited from eating haram (unlawful) foods. Department of Islamic Development Malaysia (JabatanKemajuan Islam Malaysia, JAKIM) has introduced two methods to verify halal logos, namely 'e-Halal' system and Verify Halal mobile application. These two methods are useful, but users have to pay if they want to use them. This paper proposed an image processing method to identify the similarity between the original halal logo by JAKIM and other halal logos. The halal logo is retrievable from the internet or can be captured using a digital camera. Then, users can verify the logo using the proposed system to see any similarity matches between the original halal logo and other halal logos in the system. Fifty different halal logos were tested, it was shown that the proposed method is practical to determine the originality of halal logos. These methods are then integrated into an application known as Halal Logo Verification.

Key words: Canny, Edge Detection, Halal Logo, JAKIM, Otsu Segmentation

1. INTRODUCTION

Islam, like other religions Islam, like other religions, require the believers to follow the rules set by God in leading their own life. One of the practices is to observe their dietary laws. Muslims have certain rules where they can only consume lawful food, known as halal and are prohibited from eating an unlawful one, which is haram. There are about 1.6 billion Muslims worldwide, which accounts for 23% of global population [1]. Muslims do take the issue of halal food seriously. Therefore, the halal logo is a crucial tool in the market to verify halal products [2]. Through an Islamic body in Malaysia, Department of Islamic Development Malaysia (JabatanKemajuan Islam Malaysia, JAKIM) has introduced its own halal logo years ago. This logo acts as a certificate to approve the product lawfulness according to Islam. Hence, Malaysia is pushing its halal certification to be a standardized one at the international level [3]. This helps the Muslim consumers to purchase any products in the market as the logo makes them feel confident and comfortable when they are labeled with the halal logo from JAKIM [4,5]. In fact, the halal logo from JAKIM is one of the aspects that help products to successfully penetrate the market [1]. JAKIM halal logo is one of the criteria that verify the product lawfulness in Malaysia. However, some of the halal logos in the market are fake. For example, a chicken processing and packaging factory in Kampung Changkat Dain, Jawi, used to operate using the fake halal logo from JAKIM [6]. There are syndicates who are involved in selling fake halal logos to small and medium enterprises (SME) without approval from JAKIM [7]. There is a system to detect the halal logo known as e-Halal developed by JAKIM. To use this system, the GS1 (Global Standard One) number needs to be keyed via the search engine. The program will search for the GSI number stored in JAKIM's halal database. Then, the information regarding the item will be extracted and appear on the screen. Nevertheless, there are drawbacks of using this program. The user will be charged 65 cents to use the system. Furthermore, it takes a longer time for the results to appear due to server issues. Lack of implementation in monitoring the usage of halal logo has affected the community, in which they start to question the validity of some products claimed to be halal [8]. There are many fake halal logos used in the market nowadays. Figure 1 shows the examples of the halal logo from JAKIM and other organizations.

Figure 1: (a) JAKIM halal logo

Figure 1: (b) Halal logos which are not from JAKIM

This paper proposes a halal logo verification prototype that will use image processing to identify the similarity between the original halal logo by JAKIM and other halal logos. This paper is structured as follows; the related studies are reviewed in Section 2, with an overview of the existing image processing methods in detecting fake logos. Section 3 describes the approaches used in this study. The results and discussions are described in Section 5. This study is concluded in Section 6.

2. RELATED WORKS

Recently, there are ongoing researches on techniques to detect fake logos, utilizing image processing methods to fulfill the objective. Halal logo detection and recognition system is developed by [9]. In this case, the image of 'halal' logo is captured by a digital camera from many angles of the product surface before being manually uploaded to the system. Next, the Gaussian Blur effect is used to remove the noise in the image until the logo can be detected by the system. The image is stored in RGB format, to indicatered, green, and blue for each individual pixel. Lastly, the neural network is used to determine whether the halal logo is true or not. Automated halal logo recognition is developed by [10]. In the first phase, the system read the halal logo from the database. Then all these images are resized to 210×210 pixels. Next, the system converted those images from RGB to grayscale form. Then, each image is divided into 5×5 fractions where each fraction is stored in block location of the images. 1D Fourier transform is applied to each fraction of the 2D halal image. To achieve that, the 2D image is converted to the 1D array. Lastly, the KNN classification is applied to this system.

The smart halal recognizer is introduced by [11]. The proposed system can recognize halal images from ten countries. The acquired images are obtained directly from product packaging using a digital camera. The images are preprocessed to remove noise, increase contrast and get restored. Then, the images are fed into neural network classifier to be classified into categories. The system is able to recognize the halal logo with 75% accuracy.

Latiff [12] has introduced halal logo watermarking based on spread spectrum techniques. The authors have used discrete cosine transform (DCT) and the insertion of one-bit value into the halal logo images. This method caused changes in the size of the halal logo images due to the DCT and embedding processes.

3.METHODOLOGY

The processes involved in methodology are depicted in Figure 2.

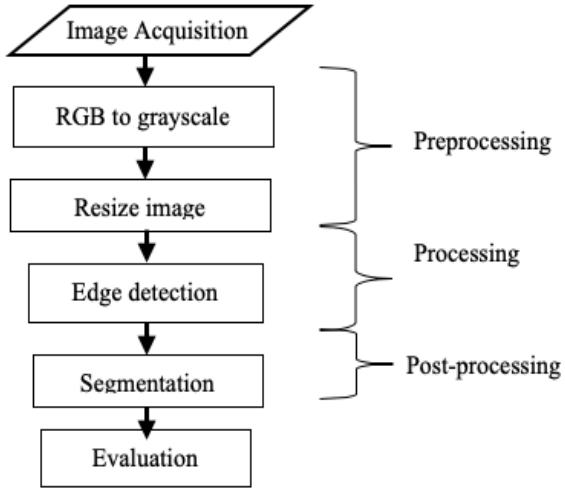


Figure 2: Halal logo verification flowchart

3.1 Image Acquisition

In this proposed system, the images of halal logo are acquired using a digital camera or directly downloaded from the internet. The images are saved in JPEG or PNG format. All the uploaded images are compared to the original halal logo stored in the system. Images that are uploaded to the system earlier underwent grayscale processing with intensity range between 0 and 255 using Equation (1).

$$0.2989 * R + 0.5870 + 0.1140 * B. \qquad (1)$$

Before algorithm processing, the image is resized to 600×600 pixels. If the image size is larger than the range, it is shrink into smaller sizes and vice versa. This is shown in Figure 3.

1024×1024 600×600

Figure 3: Images after being resized to 600×600 pixels

3.2 Edge Detection

Edge detection is a fundamental technique in image segmentation. It divides the digitized image into several pixels or regions. In this study, the edge detector is responsible for detecting JAKIM's halal logo features, as listed in Table 1. In this paper, Sobel, Prewitt and Canny edge detectors were used to detect these features.

A. Sobel Edge Detector

The operator is extensively used in edge detection due to its simplicity and efficacy [13]. Even though Sobel is sensitive to noise, this operator has a random noise smoothing effect [14],[15]. Sobel edge detection calculates the image gradient using the discrete difference between 3×3 row and column as illustrated in Figure 4.

+1	+2	+1
0	0	0
-1	-2	-1

-1	0	+1
-2	0	+2
-1	0	+1

G*x*G*y*

Figure 4: Sobel masks

B. Prewitt Edge Detector

This is the oldest and easiest to understand edge detection methods of an image [16]. Prewitt operator is similar to the Sobel operator but has different kernel values. This technique offers a better detection of the horizontal and vertical edges of an image and has a high response [14]. The Prewitt operator consists of two 3×3 kernels, as illustrated in Figure 5.

-1	-1	-1
0	0	0
1	1	1

-1	0	1
-1	0	1
-1	0	1

Figure 5: Prewitt masks

C. Canny Edge Detector

Canny edge detection is commonly used in image processing tools, it detects edges in a robust manner. This method finds the edges by partitioning noise from an image. It extracts the features of an image without compromising any features. There are three criteria for Canny edge detector. First is the low rate of error. Second, the edge points are well localized. Lastly, it produces one response on every single edge [17].

Based on the result in Figure 6, the Canny edge detector gives the best output since it can mark all the existing edges as compared to Sobel and Prewitt. This algorithm is also adaptable to any environment [18].

Table 1: Features and specifications of JAKIM Halal Logo [1]

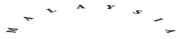
No.	Image	Feature and specification
1		The word ‘Malaysia’ in the circle
2		Eight-pointed star in the middle of the circle
3		The Arabic word "Halal" in the middle of the star
4		Two little five-pointed stars to separate Roman and Arabic characters
5		“HALAL” word below the Arabic word
6		Arabic version of ‘Malaysia’

Figure 6 (a): Canny

Figure. 6(b): Sobel

Figure 6(c): Prewitt

After edge detection, the logo image must go through the segmentation process to be converted to binary form. In this study, Otsu segmentation, which is known as the global thresholding selection method was used because of its effectiveness [19].This process is important in order to differentiate the halal logo and background image [20]. The result of Otsu segmentation is shown in Figure 7.

Figure 7: Image after using Otsu segmentation method

4. EVALUATION

To evaluate the accuracy of the proposed method, the similarity match of the binary image based on the exact pixel matching [21] was used. First, the algorithm will read the input (JAKIM halal logo image) and the value of each foreground and background pixels are obtained. The pixel values will then be compared to the pixel values of JAKIM's halal logo according to the corresponding pixel location. If the image pixel value of a position is similar to the image database, this will be considered as a hit count. If the pixel value is different, it will be interpreted as a miss count. The similarity matches are calculated by dividing the total hit pixel of a tested halal logo (binary image) with the total pixel of the original halallogo. Then, the result of the division will be multiplied by 100. This similarity match is in the form of a percentage.

5. RESULTS AND DISCUSSION

Graphical user interface (GUI) in Figure 8 is designed to implement the algorithms using MATLAB. The system interface is divided into three parts; input, algorithm and result. First, the user loads the logo from a file through the input area. The selected image will appear in the output window. Then, the user needs to click on the Grayscale button to convert the image to grayscale form. To ensure the image has a standard size, it has to be resized to 600×600 pixels by clicking on the Resize button. Next, the user can select the edge detection algorithm, either Canny, Robert or Prewitt. The user needs to choose at least one algorithm, otherwise the system will not run. The output window will then display the edge detection result. To convert the result into binary form, the userneeds to click on the Otsu segmentation button. The segmentation helps to separate the image into bright and dark regions. The outcome is used to calculate the number of black and white pixels.

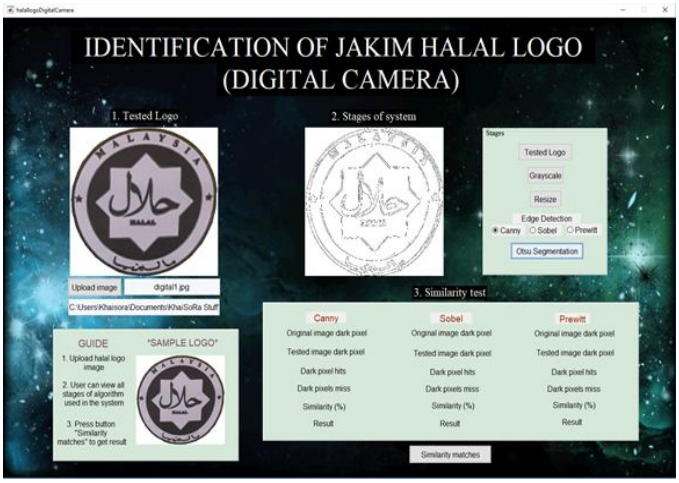


Figure 8: The graphical user interface of the halal logo verification system

The system is tested with 50 halal logos obtained from the internet and captured using the digital camera. The halal logos from the internet are deemed accurate if the similarity match is in the range of 95-100 %. The value of 100% is regarded as the most accurate. As shown in Table 2, the system can successfully verify whether the halal logos are from JAKIM or not. The system recognizes JAKIM's halal logos (No. 1-4) with at least 95% similarity. It also recognizes the halal logos not from JAKIM (No. 5-7) with a similarity of less than 95%. Nevertheless, the proposed system fails to detect JAKIM's halal logo if the image is captured via a digital camera. This is due to low contrast and noise. It is suggested the image to go through preprocessing to increase the contrast and remove noise in the image before being fed into the system as an input. Other algorithms such as machine learning can be used to improve the performance of the verification.

Table 2. Sample of results

No.	Logo	Logo Type	Similarity (%)	Result
1		JAKIM Halal Logo	100.00	Successful
2		JAKIM Halal Logo	95.46	Successful

				
3		JAKIM Halal Logo	95.38	Successful
4		JAKIM Halal Logo	99.42	Successful
5		Non-JAKIM Halal logo	9.82	Successful
6		Non-JAKIM Halal logo	13.53	Successful
7		Non-JAKIM Halal logo	4.64	Successful

6. CONCLUSION

The Muslim community sees the use of the halal logo as a very important benchmark. This paper verifies the halal logo based on JAKIM's halal logo characteristics. After several testing is done on this system, it is concluded that this system can successfully detect the JAKIM's halal logo accuracy. In the future, this system will be further developed into mobile application, so it is easier for users to verify the halal logo anywhere.

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