

Halal food identification with neural assisted enhanced RFID antenna.

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Abstract

Halal food identification in Muslims community is of high worth. However, the process of identifying and verification of halal food is difficult and time consuming for traders to help Muslims particularly. Accordingly, traders need to develop suitable verification strategy/tool to ensure halal product available in the market. The current research proposed a model that employs Radio Frequency Identification (RFID) technology in collaboration with neural networks. The features of the food product are extracted with RFID passive tag that is fed to train ANN (back-propagation algorithm) to verify halal product in stores to assist traders, sellers, and consumers. Promising results are thus obtained based on real users evaluation in terms of usability, satisfaction, and efficiency.

Keywords: RFID antenna, Halal food, Classification, Features mining, Back-propagation learning.

Accepted on June 14, 2017

Introduction

Muslims are strictly advised to use halal foods and products as per the direction of Holy Quran [1]. The term “Halal” which is Arabic word, refers to permitted or lawful meaning. Accordingly, all manufacturers are requested for halal logos [2-5] in their products that could be investigated and verified by authorities. However, halal logo confuses the consumers due to the unreliable attitude of manufacturers and traders [6-8].

Currently, RFID technology is popular for halal food verification, accordingly, RFID tag is attached to each product for its verification through RFID tag reader [9-11]. The RFID tag is basically a chip that contains all basic information about the product such as its manufacturing date, expiry date, ingredients detail and their ratio. The RFID tag is efficient than bar code in speed and response points of view [12-17].

To verify the halal product, the current research presents neural approach with RFID tag [18-21]. The further paper is organized into three main sections, section 2 presents proposed methodology, section 3 deals with results and discussion, finally section 4 concludes the research.

Proposed Neural Model

In the proposed model, all food products are supposed to have RFID passive tags; passive tags contain all necessary information such as manufacturing date, expiry date, price, ingredients detail and their ratio. All tags have unique ID, created and embedded in all products from manufacturers [22]. These features are extracted from tags using RFID reader that are fed to the input layer of trained neural network using back-propagation learning algorithm that has several inputs but two

outputs: halal and haram. The trained neural network votes for either halal or haram finally. Due to trained neural network, there is no need of internet availability and to maintain databases. However, neural network training is required. The readers are referred to [23] for detail training and testing of the neural network. The proposed model is exhibited in Figure 1 [24,25].

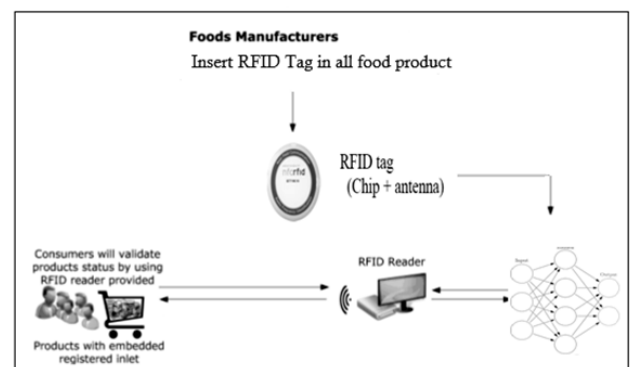


Figure 1. Proposed research layout.

Results Analysis and Discussion

Automated halal food status identification with ANN verification is a new relatively concept. It will be assisted significantly for Muslim customers to discriminate food products into halal/haram. The proposed research layout is exhibited in Figure 1. The model consists of three main parts: RFID tag, features extraction from tag and verification of halal status using trained neural network.

To evaluate the proposed model, a questionnaire is developed that is filled by the three hundred real consumers/buyers. The detailed questions are presented in Table 1.

Table 1. Presentation of queries.

Queries	Average value	S.D.
The model provides assistance on halal food verification?	4.81	0.19
Getting information is simple and fast?	5	0
Can reject fake information?	4.93	0.07
Is it helpful for the authorities to classify halal and haram products?	4.28	0.72
Could consumers use this model free of cost to confirm food status?	5	0
Could the model be used worldwide?	4.52	0.48
Could the model be helpful to attract Muslims customers?	4.64	0.36
Will the model generate high revenue for the food mart?	4.76	0.24

1: Agree; 2: Partially agree; 3: Disagree; 4: Partially disagree; 5: Don't know.

In the light of response collected from 300 consumers as presented in Table 1, it could be seen that above 95% consumers agree that the proposed model is helpful in making the decision for halal food selection. Above all, there is no need of internet connection and huge database/update database to check the halal status of food products. The only required parameter is a well-trained neural network, once it is trained it is perfect.

In comparison with other approaches reported in the state of art such as a barcode, SMS, RFID passive/active tags are slow and are time-consuming that are not practical in urgent case. Normally, the barcode of food products is a 13 digits number that is sent *via* SMS, it needs balance in mobile phones and typo mistakes misleads the customers. It is also reported in the state of art, that sometimes, customers are unable to receive verification SMS and are also charged for it. Additionally, fake barcode cases are observed that have shaken trust of halal food consumers. In a survey reported in [5,6], it is highlighted that technology advancement has brought illegal means to deceive barcodes while in the case of RFID tags it is really hard. However, active tags is a fast option yet need batteries that are not long term solution. RFID tags verification also needs an internet connection that is supposed to have with customers as no shopping mall provides this facility for verification of the halal status of food products [7,8]. Hence, to overcome all these above-mentioned problems, a model is developed that does not need SMS, internet connection rather only a trained neural network is enough. Additionally, the proposed model is free, fast and is helpful to avoid fake halal tags/logos. Above 92% respondent expressed their full satisfaction about the free of cost proposed model performance.

Conclusion

In most countries of the world where there is mix community, Muslims are normally provided facility to verify halal food

products as per their religion. This facility is in form of bar code verification, SMS services, portal/website services and RFID tags (active/passive). The authorities also check regularly the halal status of the products. However, modern communication and image processing techniques have created problems of the fake bar code, halal logos, fake SMS and so forth. Web/portal verification through the internet are less popular due to many reasons, most of the time, consumers do not have internet facility on their mobiles or they do not know how to use it. Internet illiteracy is another issue of old age group. Hence, such conditions have badly affected the economy of halal industry. Currently, industry required efficient and cost effective systems for halal food verification that could win the trust of halal product consumers.

Accordingly, this paper has presented a neural RFID-based model to assist consumers. It is free and fast, the RFID reader reads all basic information from RFID tags and feeds to the neural network, already trained using back propagation learning algorithm. The trained neural network immediately votes for halal or haram. In the light of survey collected by 300 real consumers, it could be seen that proposed model will be most usable in the halal industry and will raise consumers trust, consequently, it will increase halal industry revenue. Imported products could also be verified using this model.

Acknowledgement

I am thankful to RTC Prince Sultan University Riyadh KSA for providing equipment to conduct this research.

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