Characterization of Mobile e-Nose for Halal Detection Device

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Abstract

Electronic Nose (e-nose) is an instrument used to detect odor or aroma. The system is built on gas sensor arrays known as electronic olfactory systems, because e-noses have the ability to mimic the workings of the human sense of smell. Since the output of this e-nose system is a signal, the signals represent patterns representing each of the scents so they can be applied for identification, comparison, quantification and aroma-based classification applications. In this study an e-nose was made to detect alcohol content in food / beverage using MQ-3 gas sensor connected ADC ADS1256 on Raspberry Pi and send its data directly to database server on Raspberry Pi. E-noses and servers are located on a wireless computer network. In the detection results obtained alcohol detection results with the detection of sensors in a standard solution of 200 ppm produces an average voltage detection of 1.6 Volts.

*Keywords:*e-nose, raspberry pi, halal detection;

1. Introduction

Alcoholic foods / beverages are strictly prohibited in Islam, even in very small amounts it would be illegal [1]. However, detection of ethanol content that is naturally occurring, or is intentionally added in food processing, is permissible if the amount is sufficient to not cause toxicity. The permissibility of ethanol is based on the concept of Al Istihlak (assimilation or consumption), which if a small prohibited substance is mixed with the dominant permitted substances and the prohibited substance loses all its attributes such as taste, color and odor, this substance loses qualification to impure [2]. In general, 0.5% ethanol levels are allowed in foodstuffs [3], but acceptable limits for food products differ for different countries and organizations. Most halal certification bodies receive small amounts of inherent alcohol, generally less than 0.1% and sometimes up to 0.5%. The Islamic Food and Nutrition Council of America (IFANCA) organization received a rate of 0.1% [1]; MajlisUlama Indonesia, 1% [4] and Thailand, does not exceed 1.5% in the final product by natural fermentation. On the other hand, JAKIM Malaysia does not state the allowable level, while Brunei Standards for Halal Foods does not even permit the use of alcohol-based carriers. This consistent limit of ethanol for halal certification of food products has proven to be one of the issues that can affect the growth of global halal markets. This encourages the need to set global standard limits that apply to all countries and halal certification bodies.

Electronic Nose (e-nose) is an instrument used to detect odor or aroma. This system is built on a gas sensor array known as electronic olfactory system because e-nose has the ability to mimic the work of the human sense of smell. Since the output of this e-nose system is a signal, the signals represent patterns representing each of the scents so they can be applied for identification, comparison, quantification and aroma-based classification applications. In addition, e-nose also uses the basic pattern recognition pattern (pattern recognition) resulting from a series of gas sensor array as a method of analysis. Identification of electronic nose analysis can also be done through Artificial Neural Network (ANN) such as Backpropagation (BP) and some other ANN method. From some researches on e-noses that have been conducted among others are in the field of food (food) such as see rapid test of the quality of aromatic rice [5], Beverage [6], black tea classification [7], and Environment [8]. Based on its type electronic nose (e-nose) is divided into two types namely direct and indirect [9]. Direct (direct) E-nose model is e-nose with direct aroma-capture model to the sample, the measurement is done on direct system of steady state value achieved by the sensor. E-Nose on a direct aroma pickup system by way of exposing the sensor directly to the sample test object. The advantage of e-nose with direct model is that the sampling is very easy and the distance between sensor and aroma is very close. However, the weakness in this system there is still interference from the air-air aroma around so that the sensor readings are still disturbed. While the indirect system model of aroma through the airflow brought from the sample room. In the e-nose system of this indirect model, the test sample is placed in the sample chamber and the resulting aroma comes from the sample chamber. the resulting aroma in the sample chamber is brought to the sensor by utilizing the airflow through a hose and valve hose regulated by its use. The advantage of e-nose indirect system is the influence of other aromas that come from outside can be minimized. While the weakness of this indirect model is the sample preparation stage which is longer than in the direct model [9]. During this time electronic nose indirect system is used to detect samples with volatile compounds such as alcohol, after the new volatile compound is readable by the gas sensor. Alcohol are volatile compounds.

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2. Method

2.1 Tools and Devices

There are some tools dan devices used in this reseach, such as :

a. Raspberry pi
b. Alcohol sensor or MQ-3 sensor
c. Database Website server
d. Alcohol content materials
e. ADC ADS 1256 24 bit
f. Wireless acces point Xiaomi
g. Personal Computer for Control
h. Power supply
i. Structure

2.2 Work Procedure

The work procedures for this research are :

a. Assemble / fabricate e-nose by pairing MQ-3 sensor on ADC ADS 1256 which is then connected to #1 Raspberry pi, then synchronized.
b. Created a program to control e-nose using #1 Raspberry Pi with Python Programming Language .
c. Characterization of e-nose device with alcohol content materials

3. Results and Discussion

3.1. Fabricated Mobile e-nose

The tested of fabricated mobile e-nose while used alcohol content material yields voltage ± 1.6 Volt see figure 1.

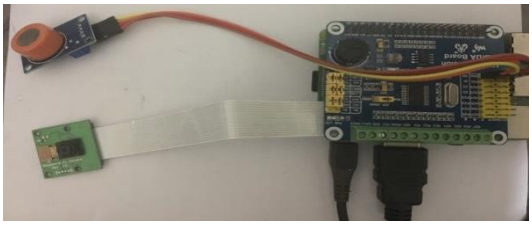

Figure 1. Fabricated Mobile e-nose

3.2. Characterization of Mobile E-Nose

MQ-3 sensor in no alcohol state has voltage of 1.5 Volts.The sensor is calibrated by using standard alcohol solution with a content of 0.4mg / L or equivalent to 200ppm. The sensor generates a voltage of: 1.6 Volts and continues to rise up to a voltage of 1.7 Volts when held close to alcohol content material as we can see at Table 1.This sensor can work on a range of alcohol content of 0.05mg / L to 10mg / L.

Table 1 : Tested e-nose with alcohol content materials

Number of test	Voltage (Volt)
1	1.602
2	1.610
3	1.623
4	1.607
5	1.650
6	1.645
7	1.676
8	1.648
9	1.689
10	1.692

From the results of the research at Table 1 above, an electronic nose with the following characteristics of the MQ-3 sensor as a sensor to detect the level of alcohol associated to ADC ADS 1256 as an analog signal converter into digital. Raspberry Pi is installed with ADC ADS 1256 so it functions as aquisition data that converts and collects data of alcohol content (where volatile compounds released by detected alcohols) become potential difference data or voltage data. The increase in readable voltage indicates the alcohol content read by the MQ-3 sensor. Previously the MQ-3 sensor was first characterized so that it was found that with a standard solution of 200 ppm would result in a 1.6 Volt voltage.

4. Conclusion

It has been fabricated and built a mobile e-nose and data transmission system on the ADC ADS 1256 that is connected to Raspberry Pi. Detection results with the detection of sensors in a standard solution of 200 ppm yields a 1.6 Volt detection voltage

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