Original Research Article

Ethanol Concentration Detector with Statistical Logger Using Iot Cloud Service

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ABSTRACT
Alcohol fermentation is the metabolic process through which organisms, mainly yeasts, generate ethanol and CO2 from sugars (such as glucose, fructose, and sucrose) in the absence of oxygen. A significant organic solvent and substrate, ethanol is widely employed in both research and business. It is the primary product created during the fermentation of fruits and other biomass-derived carbohydrates. Even after being bottled and packaged, many foods, especially unpasteurized foods and probiotics, may continue to ferment, which gradually raises their alcohol level. The main obstacle to the growth of the global market for halal foods has been highlighted as issues with halal product certification. One such problem is the variable levels of ethanol allowed in Halal goods as a result of the lack of an internationally accepted standard limit. This paper provides an overview of ethanol, including its varieties, uses, benefits, and drawbacks. This article provides a solution to achieve consensus on the concentration of alcohol in fermented grape juice and to display the statistical data in the form of a line graph using MATLAB. An app is designed to view the live feed of graphs from MATLAB.

Keywords: Alcohol, Ethanol, MATLAB, Fermentation

I. INTRODUCTION
Since recorded history, a complex relationship has been established between humans and ethanol. This complicated relationship continues to this day. Because it's probably the essence of wine, the intoxicating ingredient in many beverages, and one of the most important chemicals available in the industry. Ethanol's solvency power makes it particularly useful for extracting valuable natural compounds from plant and animal tissues. As an industrial raw material, ethanol is used to make adhesives, toiletries, cleaning products, explosives, inks, chemicals, hand creams, plastics, paints, thinners, textiles, and vinegar. There are two types of ethanol produced worldwide: fermented ethanol and synthetic ethanol. Fermented ethanol (bioethanol) is made from corn and other biomass materials and is primarily used as a fuel, although a small amount is also used in the beverage industry. Synthetic ethanol is made from ethylene, a petroleum by-product, and is primarily used in industrial applications. Since alcohol is widely used in food, pharmaceuticals, cosmetics and other industrial applications, there is a need to discuss the halal status of alcohol used in these industries.

A complicated connection between people and ethanol has existed since the beginning of recorded history. This complicated relationship still exists today, most likely as a result of the fact that it is the primary chemical used in the production of wine, as well as a key component of many alcoholic beverages. Extraction of valuable natural compounds from plant and animal tissues is a common application of ethanol due to its potency as a solvent. Ethanol serves as a major industrial raw material used in the manufacture of adhesives, cosmetics, detergents, explosives, inks, chemicals, hand creams, plastics, paints, thinners, textiles, and vinegar. Fermented ethanol and synthetic ethanol are two types of ethanol produced worldwide. It is also used as a food additive in limited amounts, but most fermented ethanol (bioethanol) is made from corn or other biomass feedstocks.

The creation of alcohol by human beings probably began with the use of naturally occurring enzymes that are capable of converting carbohydrates, such as grains and fruits, into ethanol. This process was repeated over time, eventually resulting in the production of beer and wine. The earliest evidence for this comes from early Neolithic villages in Iran (7000 BC) and central Turkey (6000 BC).

The fermentation technology evidently spread to ancient Egypt, ancient Greece and Rome, India, China and Korea. During the period known as Classical Antiquity (about 2000 years ago), the Romans made wine from a variety of fruits and grains.

II. LITERATURE SURVEY

This work is based on storing food in cold storage and detection of methane gas using MQ-4 sensor in box container with a constrained space and an IoT module to send detection of methane gas through Blynk App.[1]. In this work beer and wine is used as samples to find the ethanol content in alcohol drinks red and white wine is used for the detection using the spectrophotometric method, This method is applicable for both concentrated and diluted samples. Hexadecane was used to prepare the electrodes which resulted in better accuracy.[2]. This work is based on the detection of ethanol content from the preparation of various samples of Dates juice (Nabidh). Grind a sample containing seeds and mix it with distilled water (1:2) ratio the suspension is filtered through a cloth and refrigerated and taken out and ethanol and sugar concentration samples are measured once in five days.[3]. This work determines the Concentration of methanol and ethanol in alcoholic beverages and food in Japan and overseas by using the gas chromatography method.[4]. This paper talks about sodium bicarbonate and the detection of methane in the garbage bin where the MQ-4 sensor is used to detect the concentration level.[5]

III. METHODOLOGY

This paper helps in determining the concentration of ethanol in food products (grapes) by using the MQ4 sensor, which helps in the detection of the release of ethanol from various specifications of grapes.

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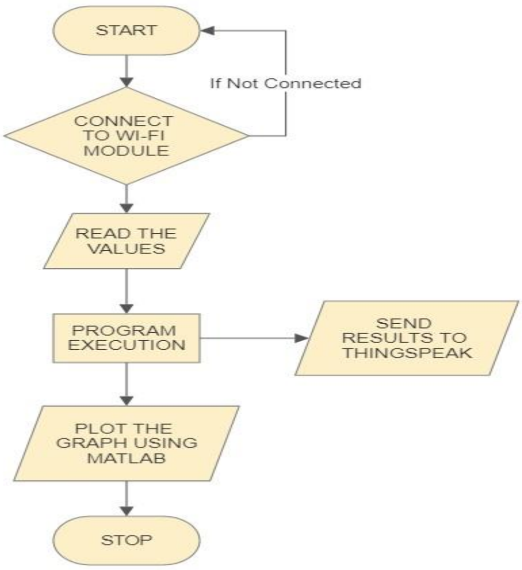

Figure 1: Flow Chart of Ethanol detection

A. Flowchart

Figure 1 explains the workings of the gas sensor MQ-4 when kept closer to the grape juices of different varieties, each emitting different concentrations of ethanol content.

Initially, the gas-detecting module is wired with the Node MCU IoT module, which is connected to WIFI. After the connection is established, the MQ-4 sensor starts to detect the ethanol content. The Node MCU is coded to detect a small amount of leaking ethanol content in the constrained environment of the surrounding air.

When the detecting starts, a graph is generated in a MATLAB environment using the Thing speak package. This package is used to develop graph simulations in a Node MCU environment.

B. Block Diagram

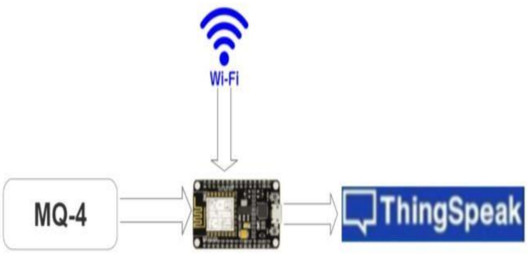

Figure 2: Block Diagram of the working module

Figure 3: Esp8266 IoT Module

In fig3 The ESP8266 WiFi module is a standalone SOC with a built-in TCP/IP protocol stack that allows any microcontroller to connect to your WiFi network. The ESP8266 can host an application or delegate control of all WiFi networking tasks to another application processor. Each ESP8266 module comes pre-programmed with AT command set firmware, so all you have to do is connect it to your Arduino device for WiFi functionality roughly equivalent to what the WiFi Shield offers. level (and it's just ready to go)! The ESP8266 module is an affordable board with a large and growing community.

With its GPIOs, the module can be paired with sensors and other application-specific devices with minimal development and runtime loads thanks to its storage and processing capabilities. Its powerful integrated logic. Due to the high degree of on-chip integration, it only requires a small amount of external circuitry, and even the front-end module is designed to take up little space on the PCB. The ESP8266 includes self-calibrating RF allowing it to operate in any operating environment and requires no external RF components. It also supports APSD for VoIP applications and Bluetooth coexistence interface. Due to the standard serial port interface of the ESP8266, it can be used as a peripheral with any microcontroller.
A 2.2 mm x 5.5 mm JST PH connector and the breakout board are included with this "ESP8266 Breakout Board" from Adafruit Industries, which ought to fit perfectly onto a Wemos D1 Mini! Since the WiFi module is effectively an Arduino with 802.11b/g/n networking capabilities, many of the same libraries and code samples can be used for your Arduino project! Out there, regarding this module, there are a tonne of Stack Exchange inquiries.

Figure 4: MQ-4 Sensor

In figure 4 the MQ4 gas sensor is a metal oxide semiconductor (MOS) type gas sensor, mainly used in home and industry to detect the concentration of methane gas (CNG) in the air. The sensor contains a mostly aluminum-based ceramic sensing element coated with tin dioxide and covered by a stainless steel mesh. Every time the gas comes in contact with the sensing element, the resistivity of the element changes. Then measure the change to get the current gas concentration. The detection range is 300~10000 PPM, suitable for gas leak detection. Combustion of methane is highly exothermic. H. Releases a lot of heat when ignited. This is beneficial in controlled use, but can be devastating in the event of an accident. To use the sensor module, the device must be supplied with he 5V and the power LED will light up.

You should give it a warm-up time before you start reading the output. During current gas measurement, the output LED lights up at a specific gas concentration. It can be changed by a potentiometer. Alternatively, you can also use the analog output to see how the program responds to the different concentrations of gases available. The power LED lights up when the module is powered on. The MQ-4 works by measuring the concentration of methane in the air.

The analog pin of the sensor generates an analog signal proportional to the amount of CH4 in the air. An ADC microcontroller can be used to measure the analog output of the sensor. Most microcontrollers these days have built-in ADC peripherals that can be used to read analog output from sensors like the MQ4. A microcontroller reads the analog output signal from the methane sensor and performs signal conditioning to convert the measured analog voltage into the methane concentration in the air. Based on this measurement, an appropriate action can be taken, such as

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sounding an alarm or whatever is coded. The same goes for the digital output pin of the MQ4 methane sensor. When methane is detected, the digital pin will go high and the onboard digital output LED will light up. This digital pen can also be used for various operations controlled by a microcontroller.

Figure 5: Think speak

In fig 5 we see Thing Speak is a federated IoT analytics platform service that allows you to combine, visualize, and analyze live information flows in the cloud. you will send information to Thing Speak from your device, create instant live information visualizations and send alerts to victim network services such as Twitter and Twilio. With MATLAB analysis in Thing Speak, you will write and run MATLAB code to perform preprocessing, visualization, and analysis. Thing Speak enables engineers and scientists to model and builds IoT systems while not putting in place servers or developing net package. The Thing Speak instrumentality for MATLAB provides a MATLAB interface for the Thing Speak platform. The Thing Speak instrumentality for MATLAB mechanically configures things, channels, associate degreed fields victimization an easy-to-use MATLAB perform. you'll discovered your entry credentials within the MATLAB perform, then use the perform to make new things and channels on Thing Speak. The instrumentality conjointly allows you to write down MATLAB code that updates channel information on Thing Speak™.

RESULT AND DISCUSSION

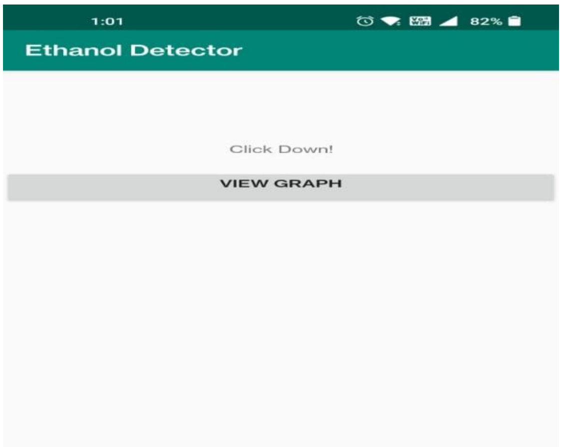

Figure 6: Application for Viewing Graph

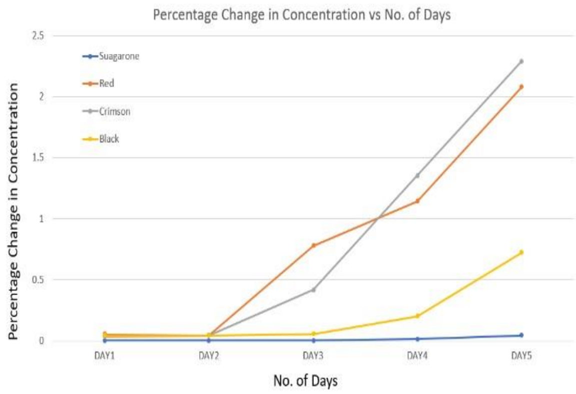

Figure 7: Output Graph

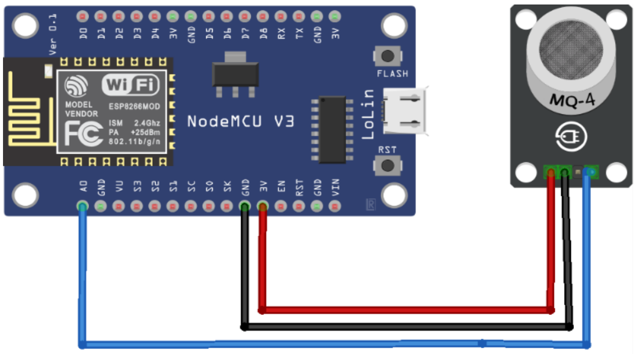

Figure 8: Schematics Diagram

Samples Type	Specification	Days Count	Ethanol Content
Grapes	Sugarone	1	0.0041
		2	0.0035
		3	0.0011
		4	0.0122
		5	0.0454
Grapes	Red	1	0.0423
		2	0.0481
		3	0.7771
		4	1.1412
		5	2.0781
Grapes	Crimson	1	0.0312
		2	0.0403
		3	0.4185
		4	1.3567
		5	2.2911
Grapes	Black	1	0.0394
		2	0.0415
		3	0.0515
		4	0.2016
		5	0.7209

Table 1: Ethanol concentration

In figure 6, We have created an application named an Ethanol detector which acts as an interface to connect to the thing speak and shows us the concentration of ethanol .In figure 7 this graph, we see the different concentrations of ethanol content from different samples. The concentration of this sample is inferred at different periods of time. We see the percentage of change vs the number of days in the graph. In this figure, we see the schematic diagram of the components which are

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connected to get the output. Table 1 briefs regarding the various samples used and the observation time period taken to get the concentration of ethanol. Each sample has been observed for a period of five days and the results are tabulated.

CONCLUSION

We presented a system model based on IoT and cloud storage in this paper. We used MQ4 gas sensor, Thing Speak to deploy the model. The MQ4 gas sensor detects the presence of alcohol in the air, indicating that the fruit juice has begun to spoil. Thing Speak is used to store data in the cloud, and the graph is used to see the live concentration of ethanol in juice ingredients. We have found that, compared to other previously proposed models in the field, our proposed system will make a breakthrough in the Halal market by providing a native alternative method. low-cost location to measure ethanol concentration limits. This could also provide a solution to the revolving issue of global standardisation of the standard allowable limit of ethanol for Halal certification. However, additional research needs to be carried out for methodology validation and to reduce statistical uncertainty during measurements, which mainly depend on temperature and humidity factors.

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