# WiFi-based Alcohol Monitoring And Detection

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**Abstract—**Processed beverage products containing alcohol flood the market. Many halal labeled drinks are abundantly available in the market, but the halal is doubted. The drinks are easily found by the consumers. For health and halal reasons, the alcohol content of these beverage products needs to be measured. Based on the problem, a tool for alcohol detection which can be monitored remotely using wifi technology was made. This tool consisted of an alcohol sensor, a microcontroller, an LCD viewer, a modem router and an Android used for remote monitoring. By using an alcohol detection tool, the alcohol content in the drink can be directly measured. The tool can monitor remotely using Android with wifi technology and directly display alcohol levels on the LCD viewer.

**Keywords—**microcontroller, alcohol detection, android, wifi

## I. Introduction

Processed beverage products containing alcohol can be found in the market. Halal labeled drinks are available in the market and easily found by the consumers. However, the halal of the halal labeled drinks is doubted. The alcohol content of these processed beverage products is necessary to measure for health and halal reasons. It can be known by measuring the content of the alcohol. By using the tool, the element and alcohol percentage can be measured and it can be concluded as whether edible or not for consumption.

Some previous researchers have conducted research on alcohol and alcohol detection. Gas detection system with MEMS gas sensors and integrated circuits was examined by Wang. The system consisted of highly sensitive MEMS gas sensors and CMOS integrated circuits for reading, processing data and interfaces. By packing MEMS gas sensors with integrated circuits using special packages, the system can detect various gases including ethylene glycol, ammonia and alcohol accurately at low concentrations (<1ppm). [1]. Analysis of accuracy, sensitivity, and specificity in near infrared fluoride using fiber-optic SPR sensor with graphene and Naf layers was examined by Sharma. Plasmon resonance (SPR) surfaces based on fluoride optical fiber sensors with graphene and sodium fluoride layers were simulated and analyzed in near infrared (NIR) to detect alcohol content. Fluoride fiber was used for the first time in SPR sensing applications. The specificity of the sensor against alcohol plus sensitivity and accuracy that is significantly increased is ensured by the politiophene layer [2].

Roy studied polymer-based MEMS photodetector with spectral response in the UV-Vis-NIR and Mid-IR areas. MEMS-based photodetector devices with broad spectral responses were presented. The design combined photoconductive and pyroelectric properties of nanomorphology controlled by polyvinyl alcohol as a photoactive layer. Low cost fabrication technology with single layer deposition of photoactive polymers on low MEMS thermal mass platforms was designed to increase heat loss to the substrate [3]. Tai studied the detection of the quality of alcoholic beverages using the tip of the fiber optic. It detected the quality of alcoholic drinks directly by simultaneously measuring the refractive index and the rate of evaporation using the tip of the optical fiber. The fiber end acts as the lens of the submicron axon. The difference in the optical path between the edge of the glass and the external media produced a focal point with the intensity modulated by the refractive index of the media [4]

The nanocomposite polyethylene adipate\carbon black sensor coated with surfactant for alcohol detection was investigated by Arshak. The effect of hypermer PS3 surfactant on the response of the PEA\CB sensor to 20000 ppm propanol was described [5] Themicroanalytic magnetron enhanced by spectroscopy for detection of explosive gas was examined by Yalavarthy. This device was proven to detect and differentiate HCl vapors, alcohols, and ammonia; these three materials were used to make homemade bombs [6].The EEG analysis and control of people consuming alcohol based on feature extraction was studied by Sun. Principal component analysis was applied to process original data to reduce EEG dimensions [6].

The ultralow-power alcohol vapor sensor using chemically functioned multiwall carbon nanotubes was examined by Sin. An alcohol sensor, a batch made by forming a chemically functioned (f-CNT) multi-function carbon nanotube bundle in all Au electrodes on the SiOP substrate using AC electrophoresis technique, was developed for alcohol vapor detection using ultralow input power from H HI IW, which is lower than the power needed for the commercially available alcohol sensor more than four times [8]. The detection of chemical vapor in the air using microdischarges pulsed optical emission spectroscopy from two microstructures and three electrodes was examined by Mitra. This concept was evaluated using a vapor of isopropyl alcohol (100



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ppm) whose lines were related to CH fragments detected by a handheld spectrometer even though there was an air spectrum [9] The determination of xylidineponceau 2R in red chili by hplc with solid phase was examined by Zhao. Quantitative tests for the determination of XylidinePonceau 2R were established by high performance liquid chromatography (HPLC) with solid phase extraction. XylidinePonceau 2R was extracted with alcohol-ammonia, while solid phase extraction was used for cleaning [10].

The real time monitoring and alcohol detection using microwave sensor technology was examined by Wendling. The detection of ethanol in a mixture of water/ethanol was tested using non-invasive electromagnetic waves that operated at frequencies ranging from 1GHZ to 10GHz (microwave frequency domain) and a very low power [11]. The research on infrared alcoholic breath test based on differential absorption was investigated by Li. This technique was based on the fact that alcoholic breath gases have unique absorption characteristics that are well defined in the infrared region of the electromagnetic spectrum [12]. An alcohol sensor based on multi-wall carbon nanotubes were investigated by Sutthinet. Multi-wall carbon nanotube based sensors (MWCNTs) which are capable of detecting alcohol vapors was demonstrated [13].

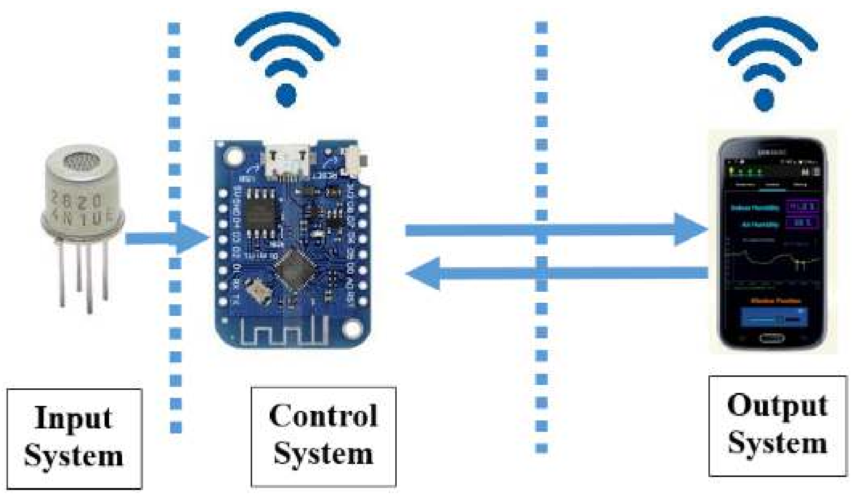
The detection of BCI-based alcohol patients was examined by Vinothraj. The research investigated the difference between the signals of the brain of drunk and non-drunk people using an Electroencephalogram (EEG) [14]. The detection of drunk driving and drowsiness was examined by Charniya. It used a visual feature approach along with motion sickness detection using alcohol sensors [15]. The potential for reliable alcohol intake detection was studied by Omura based on the Lissajous curve and chaotic analysis, applies to the detection of alcohol intake [16].

The portable alcohol detection system with recognition function was examined by Wakana. This device can determine whether the gas put in it is human breath and alcohol level at the same time [17]. The detection of functional conditions after alcohol consumption with the classification and machine learning technique was investigated by Evin. The work of this study aimed to assess various classifications and machine learning techniques in predicting alcohol consumption and related functional conditions [18]. Monitoring the risk assessment of congestive heart failure through the internet and the personal cellular health system was examined by Spanakis. The most important effects of pathogenesis are: age, gender, high blood pressure, alcohol and smoking, lifestyle and diet patterns, genetic predispositions and family history, diabetes, and atherosclerosis [19].

The alcohol detection systems used in the previous studied were MEMS sensors, fluoride fiber-optics, photoplethysmogram signals, electronic noses, and nanocomposite polyethylene. The system presented in this paper is different from the system in the previous paper. This system uses ArduinoWemos to detect alcohol using the TGS2620 sensor. The data from the TGS2620 sensor were processed using Wemos and then displayed on an Android cellphone. The purpose of this paper is to present a pedestrian security system when crossing a crossroad.

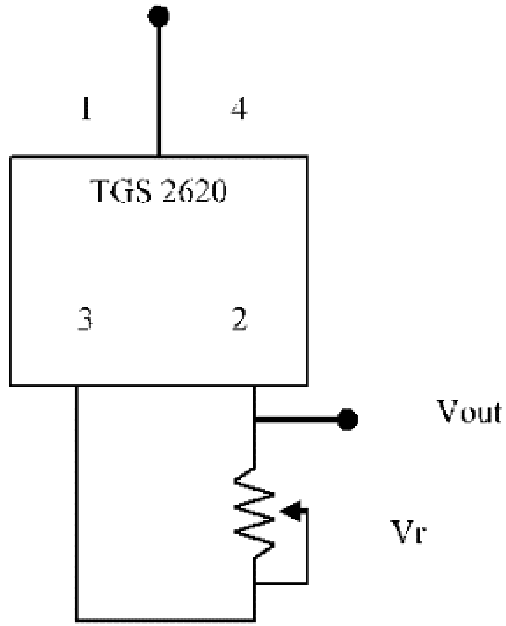
## RESEARCH METHOD

It is necessary to make a global picture of the system using the block diagram as shown in Figure 1 to make it easier to understand and plan the alcohol content measurement system. The system consisted of three parts, namely input system, control system and output system. The input system consisted of a TGS2620 sensor to detect alcohol levels. The control system consisted of a Wemos microcontroller [20]–[22] to process the data from the TGS 2620 sensor emitted by using Wi Fi. The output system was displayed on an Android cellphone communicated using Wi Fi.




Block diagram of the series.

In the TGS2620 sensor, alcohol gas was changed into electricity. The alcohol gas measured was converted into electrical signals by using an alcohol gas sensor that produced an electrical signal proportional to the change of the amount of alcohol gas mixed in the air. TGS 2620 gas sensor able to detect the presence of gas alcohol in the air was used to measure alcohol levels from 0% to 96% as shown in figure 2.




Simple TGS 2620 Sensor Series.

The figure shows that the first step to do is to find the VR values so that the alcohol gas sensor can work or measure alcohol gas with maximum intervals with reference to 5,000 ppm alcohol gas (5000/106) obtained by evaporating alcohol 5,000 cc in 1mm2 room. The decrease in resistance is affected by the amount of alcohol gas captured by the sensor. The TGS 2620 sensor changed the alcohol gas into electricity, and then produced an electrical signal proportional to the change of the amount of alcohol gas mixed in the air. If the supply voltage is 12volt, the sensor will work, and when the sensor catches alcohol vapor, the resistance will decrease. The decrease in resistance is proportional to the amount of alcohol captured by the sensor so that the sensor resistance will get smaller and vice versa. When the sensor given a voltage, the output voltage will get bigger and vice versa. The voltage given was 5 volts. The sensor has two heaters to provide heat to the alcohol gas captured by the sensor so that the sensor's performance is more optimal. There are also one electrode (-) and one electrode (+) connected to an analog pin on Wemos [23]–[26].

## RESULTS AND ANALYSIS

Tool and system testing were carried out in stages started from tool calibration, single component function testing, subsystem testing, and overall system testing.

### Tool Calibration

A sampling system, namely the alcohol percentage as the ADC data was used to calibrate the instrument using interpolation values between two points. This calibration system used 10% to 96% alcohol content because of the characteristics of the TGS 2620 sensor that is not linear. The ADC data obtained were entered into the calibration configuration file that had been stored in the Delphi program. If the calibration configuration data are okay, the tool can immediately measure the percentage of alcohol. Table 4.1 presents the calibration data of alcohol content.

**TABLE I.** CALIBRATION DATA

| Experiment | Alcohol Content % | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0% | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 96 |
| I | 0 | 205 | 215 | 225 | 228 | 230 | 231 | 232 | 234 | 235 | 236 |
| II | 0 | 206 | 216 | 225 | 227 | 230 | 232 | 233 | 234 | 235 | 236 |
| III | 0 | 20 | 21 | 22 | 2 | 2 | 23 | 23 | 23 | 2 | 2 |



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| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 7 | 5 | 28 | 31 | 2 | 3v | 4 | 35 | 36 |
| Average | 0 | 206 | 216 | 225 | 228 | 230 | 231 | 233 | 234 | 235 | 236 |
| I | 0 | 205 | 215 | 225 | 228 | 230 | 231 | 232 | 234 | 235 | 236 |

In table 4.1, the calibration of all alcohol content is taken from 10% to 96%. In experiment 1, it is seen in the table that numbers 205, 215, 225, 228, 230, 231, 232, 234, 235, and 236 show the values of the ADC 0804 levels and those values are read by the ADC as calibration data by assuming that the ADC 205 level represents 10% of the alcohol content detected by the sensor and so on. In experiment II, numbers 206, 216, 225, 227, 230, 232, 233, 234, 235, and 236 236 show the values of the ADC 0804 levels and those values are read by the ADC as calibration data by assuming that the ADC 205 level represents 10% of the alcohol content detected by the sensor and so on. In experiment III, numbers 207, 217, 225, 228, 231, 232, 233, 234, 235, and 236 236 show the values of the ADC 0804 levels and those values are read by the ADC as calibration data by assuming that the ADC 205 level represents 10% of the alcohol detected by the sensor and so on. Based on the three experiments, the average ADC level is taken. The results are 206, 216, 225, 228, 230, 231, 233, 234, 235, and 236. It is the level of the ADC assuming that the level of the ADC 206 represents 10% of the alcohol content detected by the sensor and so on.

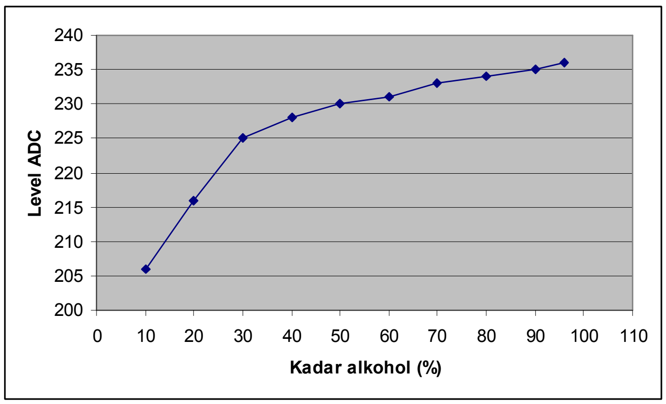


**Fig. 1.**Calibration Data.

Referring to graph 4.1, The increase of the level of ADC levels from 230 to 236 is small seen in alcohol content measurement of 50% to 96%, while the increase of the ADC levels from 206 to 228 is large seen in alcohol content measurement of 10% to 40%.

**Single Component Function Testing**

Testing the function of each components was performed to avoid system error caused by the malfunction of one or more components by using a digital multimeter measuring instrument and software for each device.

**Resistance values measurement on the sensor**

**TABLE II.** Resistance on the Sensor TGS 2620

| No | Alcohol % | Sensor Resistance | Voltage | Subject |
|---|---|---|---|---|
| 1 | 10% | 963,5 Ω | 3,87 Volt | Mixed Aqua + pure alcohol |
| 2 | 20% | 628,5 Ω | 4,20 Volt | |
| 3 | 30% | 475,7 Ω | 437 Volt | |
| 4 | 40% | 416,2 Ω | 4,44 Volt | |
| 5 | 50% | 374,8 Ω | 4,49 Volt | |

| | | | | |
|---|---|---|---|---|
| 6 | 60% | 350,4 Ω | 4.52 Volt | |
| 7 | 70% | 334,3 Ω | 4,54 Volt | |
| 8 | 80% | 310,5 Ω | 4,57 Volt | |
| 9 | 90% | 294,7 Ω | 4,59 Volt | |
| 10 | 96% | 279,1 Ω | 4,60 Volt | pure alcohol |

When measuring 10% alcohol content, the sensor resistance value is 963.5Ω with a sensor output voltage of 3.87 Volt. The higher the level of alcohol captured by the sensor, the smaller the resistance and the greater the sensor output voltage.

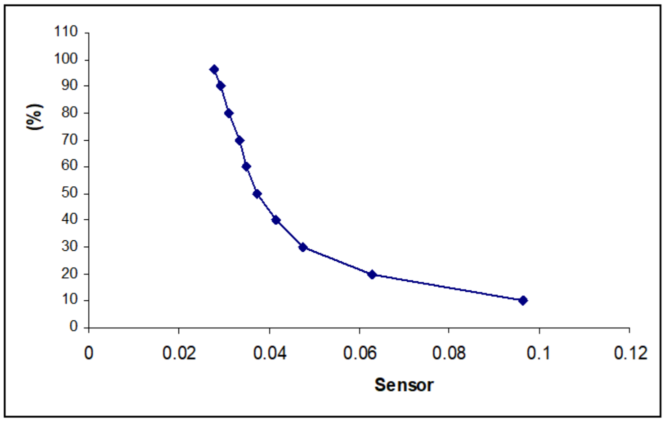


**Fig. 2.**Sensor resistance.

Th graph shows that the decrease in resistance is caused by the greater content of alcohol captured by the sensor. Measuring the levels of alcoholic gas objects with different distances

Measurement of different levels of alcoholic gas with distance sensors using digital alcohol gas level meter

| Experiment | Alcohol Content % (cm) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | $\overline{X}$ |
| 10 | 10.8 | 10.8 | 10.7 | 10.5 | 10.0 | 9.0 | 8.0 | 8.5 | 5,3 | 4.0 | 8.8 |
| 20 | 21.0 | 21.0 | 20.3 | 19.2 | 19,1 | 19.0 | 18.8 | 17.0 | 16.3 | 12.0 | 18.3 |
| 30 | 30.0 | 30.0 | 29.7 | 29.0 | 28.9 | 28.8 | 26.9 | 26.0 | 24.0 | 22.3 | 27.5 |
| 40 | 40.0 | 40.0 | 39.8 | 39.7 | 39.0 | 37.6 | 37.2 | 35.0 | 33.0 | 31.2 | 37.2 |
| 50 | 50.0 | 50.0 | 49.7 | 49.6 | 48.0 | 47.6 | 45.2 | 45.0 | 43.1 | 40.0 | 46.8 |
| 60 | 60.0 | 60.0 | 58.4 | 58.1 | 50.0 | 49.8 | 49.7 | 47.0 | 45.0 | 40.0 | 51.8 |
| 70 | 70.0 | 70.0 | 69.0 | 67.8 | 65.0 | 64.5 | 63.0 | 60.0 | 50.8 | 50.1 | 63.0 |
| 80 | 80.0 | 80.0 | 79.8 | 79.0 | 77.1 | 77.0 | 75.3 | 62.0 | 60.0 | 52.0 | 72.2 |
| 90 | 90.0 | 90.0 | 88.1 | 80.0 | 79.8 | 79.0 | 75.6 | 70.0 | 69.0 | 60.0 | 78.1 |
| 96 | 96. | 96. | 95. | 90. | 87. | 85. | 84. | 80. | 78. | 77. | 87 |



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| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 0 | 0 | 0 | 6 | 0 | 8 | 0 | 0 | 9 | .0 |

Table 3 displayed the results of measurements of alcohol gas level with different distances. The results found that the TGS 2620 alcohol gas sensor is a short-range measurement sensor. It relates to the sensitivity of the sensor. The table shows the sensor sensitivity that is 5cm. The change in measurement is affected by the air around it. The more air enters, the more gas of the alcohol evaporates. This alcohol sensor will be more sensitive if the sensor distance measurement is closer to the surface of the alcohol, about 1 cm. The next step is to compare the existing measuring instrument, alcoholmeter, with the proposed tool.

## CONCLUSION

Based on the analysis discussed, it can be concluded that the TGS 2620 sensor resistance decrease if the sensor catches alcohol gas. The more alcohol caught, the smaller the resistance. The tool has an average percentage error of 3.39%. The distance of the sensor with the object being measured is also very influential in measuring the gas level. Changes in measurements are affected by the air around. The more air enters, the more gas of the alcohol evaporates.

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