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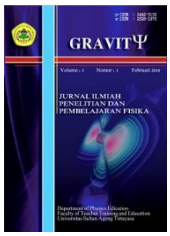

Portable urine alcohol detector fabrication with arduino microcontroller-based MQ-3 sensor

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ABSTRACT

An alcohol detector in urine is a tool that can detect alcohol in a person's urine. This tool detects Ethanol gas using the MQ-3 sensor. The MQ-3 sensor is an analog sensor that has a 5 volt DC power supply specification. Arduino Uno as a data processor obtained from reading the MQ-3 sensor and displayed on the LCD. This tool detects alcohol in a person's urine until it is known whether liquor is in the urine or not. From the design of this urine alcohol detector, the test results show an increase in the ADC sensor value when the sensor detects alcohol. It is known that it takes a different time for the sensor to return to the initial value of various alcohol concentrations. This study concluded that the sensor worked well until the alcohol concentration was 0.1%. The sensor also needed time to return to the starting point, directly proportional to the alcohol concentration examined.

Keywords: Alcohol, Microcontroller Arduino Uno, Sensor MQ-3, Urine.

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INTRODUCTION

In a previous study, we discussed the design of an alcohol detector in the blood. This condition is considered more complicated and impractical in practice in the field. Research that has never been studied is to make alcohol detectors that are more flexible and easy to use. Therefore, an in-depth study was carried out for the manufacture of urine alcohol detectors in this study. This will make it easier for users to determine whether the person consumes alcohol or not by using this tool. This tool is designed to be portable or easy to carry anywhere so that it becomes the novelty of this research.

Urine filtered blood by the kidneys and excreted through the body through the urinary tract, one part of the urinary system. Urine is removed from the body to get rid of metabolic waste and toxins from our body. The remaining alcohol that has been consumed is also part of the urine (Mukarammah, 2018). Based on the Regulation of the Minister of Health of the Republic of Indonesia No. 86/1977, alcoholic beverages are divided into three groups, namely Group A with an alcohol content of 1% - 5%, Group B with an alcohol content of 5% -

20%, and Group C with an alcohol content of 20% - 55% (Ministry of Health Regulation, 1997).

The effects of consuming alcohol on the body in low quantities of alcohol will reduce tension, relax muscles, decrease reflexes, and reduce reaction time and coordination. Medium consumption of alcohol causes drowsiness and mood swings. High alcohol consumption causes difficulty breathing, vomiting, panic attacks, unconsciousness, causes coma and death (Tritama, 2015).

Alcohol can be detected in a breath through a breathalyzer test up to 24 hours after drinking alcohol. In the urine for 3-5 days through the ethylgluconoride (EGT) test (Maulana, 2017). Through traditional methods, alcohol levels will still be detected in the urine up to 10-12 hours after drinking alcohol (Haryowati, 2015). In the blood for up to 12 hours after drinking alcohol, while in a saliva test, alcohol levels can still be detected positively for up to 1-5 days (Adnyana, 2015).

A urine alcohol test is one of the easiest and cheapest ways to determine whether a person is consuming alcohol or not (Naid, 2014). This is because alcohol or ethanol in urine is more volatile. Therefore, this study uses a sensor that is sensitive to ethanol gas, namely the MQ-3 sensor.

Where the output of the MQ-3 sensor is an analog voltage that is proportional to the alcohol received. I am using the ADC function to be able to communicate with the microcontroller. ADC can respond to voltage 0-5 volts. The image of the MQ3 sensor can be seen in Figure 1. (Adnyana, M. P. Y, 2015)

Figure 1. Sen sor MQ-3

RESEARCH METHODS

The research design will be described in Figure 2. A literature study is used to learn about the methods used in research to create an Arduino-based alcohol detection system in the urine. In addition, a literature study was also carried out to collect several datasheets of the components used. Next, prepare several features such as sensors, Arduino, and other elements that will be used to conduct research and urine samples, where this urine sample is divided into two, namely pure urine and urine mixed with alcohol (Tarman, 2014).

After the components and urine samples, the next stage is prepared to start designing a urine alcohol detector module or device. The next step is to test the tool whether the machine can detect alcohol or not. (Wurst FM, 2006)

After testing the tool, the next step is testing the device on the urine. The first is testing the sensitivity of the sensor in detecting alcohol with various variants of alcohol content. (Swofford HJ, 2014)

It is, furthermore, testing the device with pure urine (urine without alcohol) and testing the tool with urine mixed with alcohol. This test uses 15 urine samples. This test is carried out in a hospital laboratory.

The device design procedure shown in Figure 3 is the steps in designing a portable urine alcohol detector to produce a suitable tool for use.

The stages of designing an alcohol detector in this study are as follows:

1. Creating tools or assembling components such as MQ-3 sensors, ADCs, power supplies, and so on, as shown in Figure 4.
2. Coding the tool design using the Arduino IDE software
3. *Upload* the code on the circuit and test it with the available alcohol. If the alcohol content is not available in the market, then do the dilution process. Where the dilution formula, M1 x V1 = M2 x V2 with a concentration of 0.5%, the choice of this concentration is expected to be very small to test the sensitivity of

the sensor.

4. If it is successful, the last step is to enter the component circuits into the case or box to protect them from collisions and shocks.

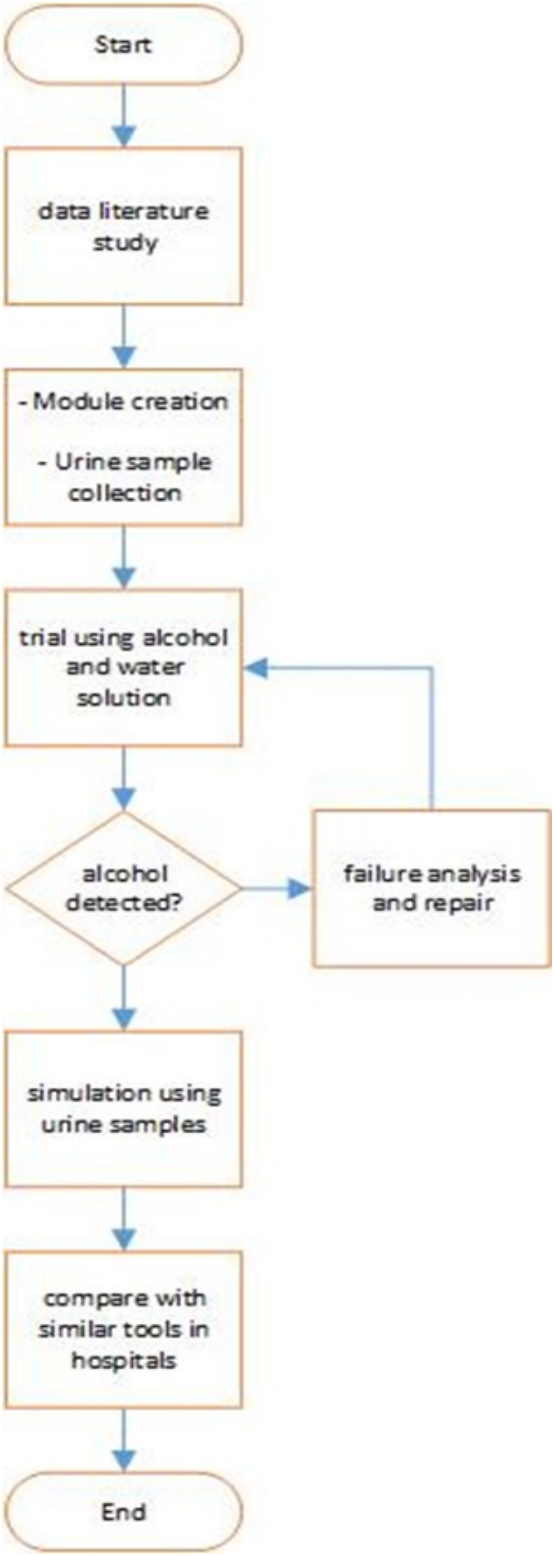

Figure 2. Research Flowchart

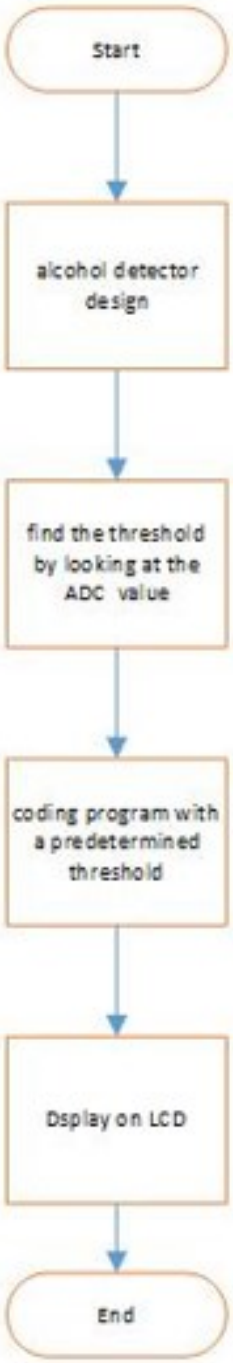

Figure 3. Flowchart of the process in designing an alcohol detector

In the process of testing the presence of alcohol content in a person's urine, usually, it cannot be known directly, but it takes at least 2 hours to detect the presence of alcohol (Arsyad, 2015).

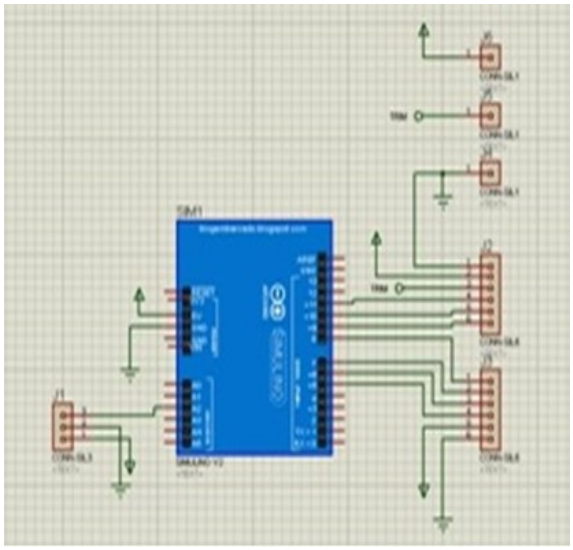

Figure 4. Detector alcohol's circuit scheme

RESULT AND DISCUSSION

The results of the design of an alcohol detector in urine are shown in Figure 5.

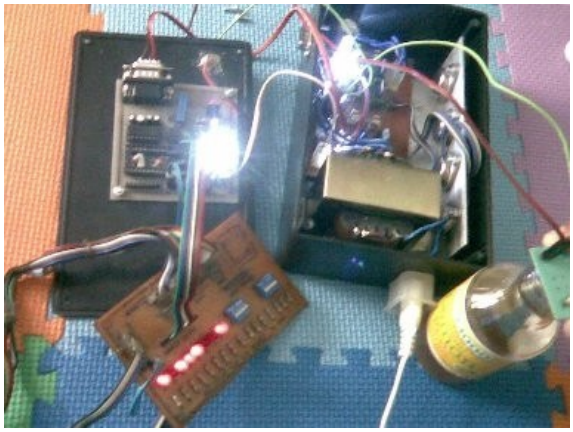

Figure 5. Alcohol Detector On Urine

System testing and analysis aim to determine the performance of the tool can work optimally or not. Therefore, testing the MQ-3 sensor on alcohol variants and testing the tools that have been designed in the hospital laboratory.

1. MQ-3 Sensor Testing Against Alcohol Variants

At the testing stage, the MQ-3 sensor was tested on the alcohol content variant. This MQ -3 sensor functions as ethanol or alcohol gas. They tested the MQ-3 sensor on this alcohol variant by measuring the sensor voltage and the ADC value of the MQ-3 sensor, as shown in Figure 6.

(a) (b)

Figure 6. (a) MQ-3 Sensor's voltage measurement, (b) MQ-3 Sensor's ADC value

In testing the MQ-3 sensor, it was carried out with five variants of alcohol content. The results of measuring the voltage and ADC values from the MQ-3 sensor for five variants of alcohol content are shown in Table 1.

Table 1. MQ-3 Sensor Test Result

Minuman	Kadar alkohol (%)	Perhitungan ADC	Pengukuran tegangan
Smirnoff	4.5	0.14	0.14
Hatten Wines	10.5	0.26	0.29
Iceland vodka	40	0.84	0.83
Alkohol 70%	70	1.13	1.20
Alkohol 95%	95	1.21	1.30

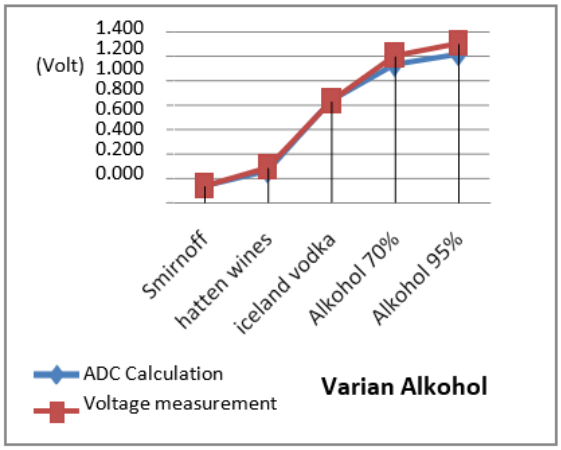

Figure 7. MQ-3 Sensor's Value Reading

In Figure 7, it can be seen that there is a change in the ADC value and voltage from the

MQ-3 sensor to the increase in the percentage of detected alcohol content. This reflects the sensor is working correctly according to the plan.

2. Testing the urine alcohol detector in the hospital laboratory

The testing of this designed tool was carried out at the Panti Wilasa Citarum Hospital Laboratory, Semarang. In testing urine readings in the laboratory, urine from 15 patients (pure urine) was used, and then alcohol was added to the urine with variants of alcohol content of 0.1%, 0.25%, 0.5%, 1%, and 5%. The results will be displayed on the computer layer. Figure 7 shows the computer layer capture of pure urine (without alcohol), while Figure 8 shows the effect of urine with 5% alcohol added.

As seen in Figure 8, the urine reading without alcohol shows the information on the "user negative alcohol" computer layer. This indicates that the urine tested does not contain alcohol.

In Figure 9, the computer reading of urine with alcohol shows the "user positive alcohol" layer information. This indicates that the urine tested contains alcohol.

The results of the urine reading test can be seen in Table 2. In Table 2 it can be seen from 15 patient urine samples that the tool can detect alcohol with several variants of alcohol content. Starting from 5% alcohol content to as little as 0.1% can be read by this tool. This shows that the designed tool can accurately detect alcohol with a maximum alcohol content of 0.1%.

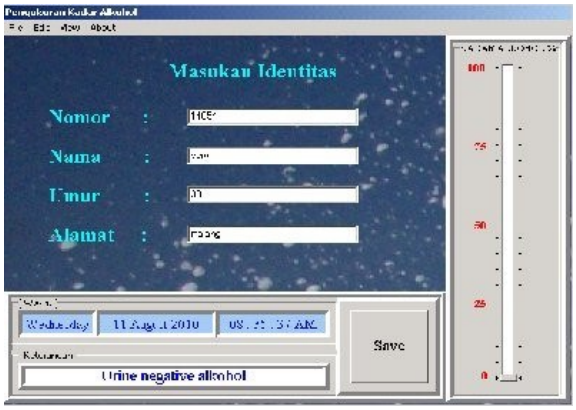

Figure 8. display urine without alcohol

Figure 9. disp lays urine with alcohol 5%

Table 2. Urine reading test result in the laboratory of panti wilasa citarum hospital semarang

Date	Urine indentity	Urine Murni	Alcohol level 0,1%	Alcohol level 0,25%	Alcohol level 0,5%	Alcohol level 1%	Alcohol level 5%
		Result	Result	Result	Result	Result	Result
August 3, 2020	Urine A	No alcohol detected	Alcohol detected	Alcohol detected	Alcohol detected	Alcohol detected	Alcohol detected
	Urine B	No alcohol detected	Alcohol detected	Alcohol detected	Alcohol detected	Alcohol detected	Alcohol detected
	Urine C	No alcohol detected	Alcohol detected	Alcohol detected	Alcohol detected	Alcohol detected	Alcohol detected
August 4, 2020	Urine D	No alcohol detected	Alcohol detected	Alcohol detected	Alcohol detected	Alcohol detected	Alcohol detected
	Urine E	No alcohol detected	Alcohol detected	Alcohol detected	Alcohol detected	Alcohol detected	Alcohol detected

	Urine F	No alcohol detected	Alcohol detected	Alcohol detected	Alcohol detected	Alcohol detected	Alcohol detected
	Urine G	No alcohol detected	Alcohol detected	Alcohol detected	Alcohol detected	Alcohol detected	Alcohol detected
August 5, 2020	Urine H	No alcohol detected	Alcohol detected	Alcohol detected	Alcohol detected	Alcohol detected	Alcohol detected
	Urine I	No alcohol detected	Alcohol detected	Alcohol detected	Alcohol detected	Alcohol detected	Alcohol detected
August 6, 2020	Urine J	No alcohol detected	Alcohol detected	Alcohol detected	Alcohol detected	Alcohol detected	Alcohol detected
	Urine K	No alcohol detected	Alcohol detected	Alcohol detected	Alcohol detected	Alcohol detected	Alcohol detected
	Urine L	No alcohol detected	Alcohol detected	Alcohol detected	Alcohol detected	Alcohol detected	Alcohol detected
August 7, 2020	Urine M	No alcohol detected	Alcohol detected	Alcohol detected	Alcohol detected	Alcohol detected	Alcohol detected
	Urine N	No alcohol detected	Alcohol detected	Alcohol detected	Alcohol detected	Alcohol detected	Alcohol detected
	Urine O	No alcohol detected	Alcohol detected	Alcohol detected	Alcohol detected	Alcohol detected	Alcohol detected

CONCLUSION

From the results of testing the Alcohol Detector in Portable Urine With an Arduino-Based MQ-3 Sensor, the following conclusions can be drawn:

The tool has been successfully made and works well on alcohol levels ranging from 5%, 1% to as little as 0.1%. This shows that this tool can detect alcohol content in urine with a maximum of 0.1% alcohol content.

Using this designed tool, it is hoped that it will assist the police in detecting the person who is consuming alcohol.

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