Implementation microcontroller-based bioethanol levels measurement tool on bioethanol purification equipment

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Abstract. In bioethanol purification device, result of process has to measure the level of alcohol usually by alcohol meter or by picnometer but need more then 100ml sample and need much time to measure. The measuremet alcohol level by sensor detecting the vaporized alcohol in the air that will caught gas sensor TGS 2620. Therefore, development of simple and quick detection of alcohol level in purification result is strongly required. The alcohol equipment detection consists of a microcontroller module, a sensor module, output module and a bioethanol tube. There are two tubes that are used as a container for the bioethanol purification. The first container is automatic alcohol sensor tube, and the second container is storage tube for result bioethanol purification. Bioethanol data detection is displayed through the LCD and a computer. The microcontroller modul regulate the delay time, process sensing and display results. After alcohol levels are detected, then the alcohol sensor will be cleaned by blowing the fan so that the alcohol vapor attached will disappear. The delay time is set so that the sensor reading has an accurate value with the smallest error detection

1. Introduction

In bioethanol purification device, result of process has to measure the level of alcohol by alcohol meter or by picnometer. The measurement by that equipment need sample more then 100ml. the bioethanol purification device use rectification distillation sieve tray type and can produce 90% bioethanol[4].

The measurement alcohol level by sensor for detect the vaporized alcohol in the air that will be caught gas sensor TGS 2620 type. The sensing process, coverting analog to digital data and displaying data to LCD [3][5]. Alcohol level detection consist of a microcontroller module, a sensor module and output module. The microcontroller module regulates the detection time, detection delay, process sensing and display results. The sensor module consists of a sensor circuit and fan circuit. And the output module consists of LCDs, and ports for connection devices to the computer [1]. The detection alcohol content is affected by humidity and room temperature [2]. Therefore, development of simple and quick detection of alcohol level in purification result is strongly required.

In this paper, we have studied on making automatic detectiong alcohol on storage tube for bioethanol purification system using a TGS 2620 sensor.

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2. Methodology

The implementation of bioethanol level detection devices to improve the performance of bioethanol purification equipment as follows:

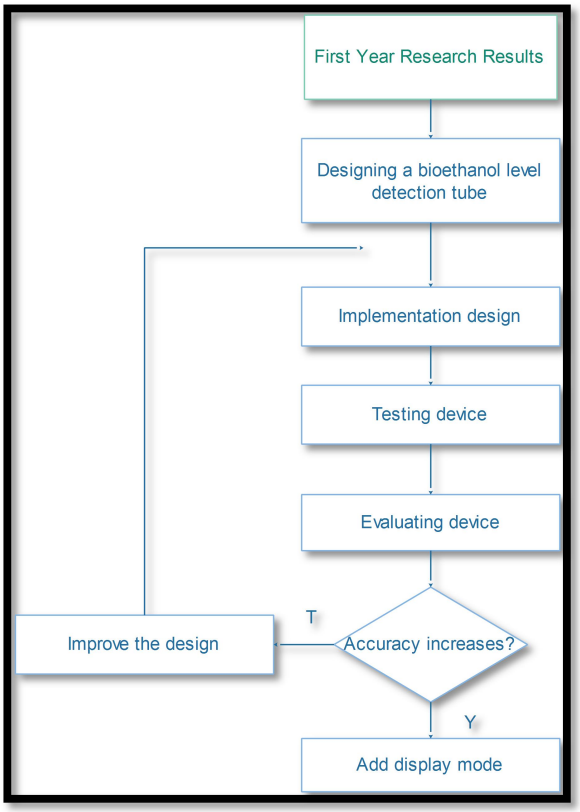

Figure 1. Research method for implementing bioethanol level detection devices.

Caption 1 as follows:

- The first research is determine alcohol sensor that has a faster response and good accuracy. Measurement bioethanol levels requires closed room and at normal room temperature condition.
- The design stage make a tube design with an alcohol sensor and an automatic faucet.
- The implementation of the design by making a continer tube from bioethanol purification result and placing a sensor to detecting alcohol levels automatically. The device is driven the sensor by motor forward and backward to the hole in the tube. The sensing process requires setting the timer detection.
- Testing has purpose to see the results of the implementation.
- Evaluation is carried out for repairing bioethanol level detection devices.
- If the sensor tube has an inaccurate test it will change the design and implementation of the sensor tube. If it has an accurate, the other output data display mode is added.

3. Experimental

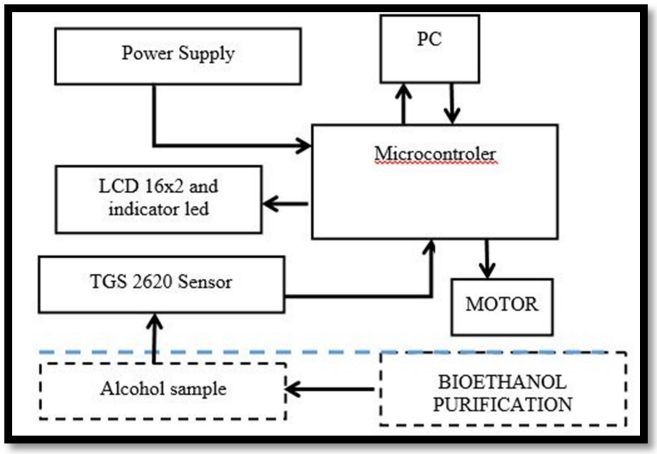

Figure 2. Bioethanol detection system

3.1 Results of the implementation the actuator instructions

The actuator is the output of the process, and it is a motor. It is useful for pushing and pulling the slider in scanning process. The implementation device by conducting instructions through the interface that has been connected to Arduino. The initial setting are time, date and scanning delay. The slider will move forward when starting scanning and re-enter the box when scanning delay or scanning alcohol ends. Time synchronization can be seen in table 1.

Table 1. Synchronize delay timer

Start/Stop scanning	*Scanning delay*	time(*stopwacth*)	Time difference
Start	00:15:00	00:14:59	1 second
Start	00:05.00	00:05.01	1 second
Start	00:10:00	00:10:01	1 second

3.2 Determination sensor height from the surface of bioethanol liquid

The position of sensor in the alcohol detection devide is determined by measuring the voltage value of sample bioethanol with a difference height on 1 cm, 2 cm, 3 cm and 4 cm from bioethanol liquid surface. Measurements were made 3 times and results that were not different from 1, 2, and 3 testing, see table 2 more clearly.

Table 2. Determination sensor height

Height (cm)	testing 1 (V)	testing 2 (V)	testing 3 (V)
1	3.02	3.06	3.07
2	3.04	3.06	3.06
3	3.03	3.06	3.06
4	2.85	2.90	2.90

From the results testing, the sensor placement is good between 1 cm to 2 cm from surface of bioethanol liquid.

3.3 The results of device

The bioethanol detection system can be seen in Figure 2. The flowchart process can be seen in Figure 3.

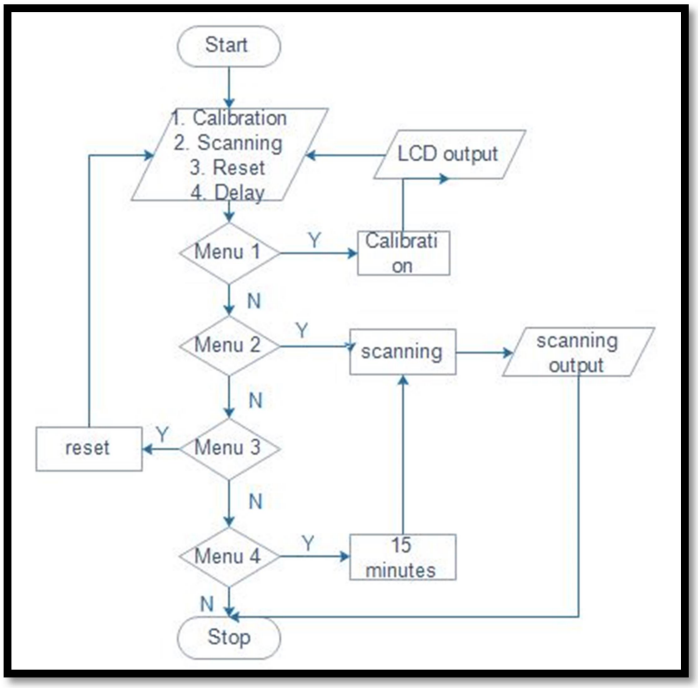

Figure 3. Flowchart process alcohol detection device.

Figure 4. Detection bioethanol level

3.4 Testing detection with and without delay time

The bioethanol sample is used in testing 5 times in an hour and the length of each measurement is 2000 times the arduino machine cycle.

a. Measurement 44% alcohol level

The data will be taken on average as a result of alcohol measurement, more clearly can be seen in table 3.

Table 3. Results alcohol measurement 44%

alcohol sample	testing	without delay	with delay 15"
	1	46.38%	47.82%
	2	49.31%	48.13%
	3	47.53%	50.20%

44%	4	46.80%	45.92%
	5	50.01%	47.66%

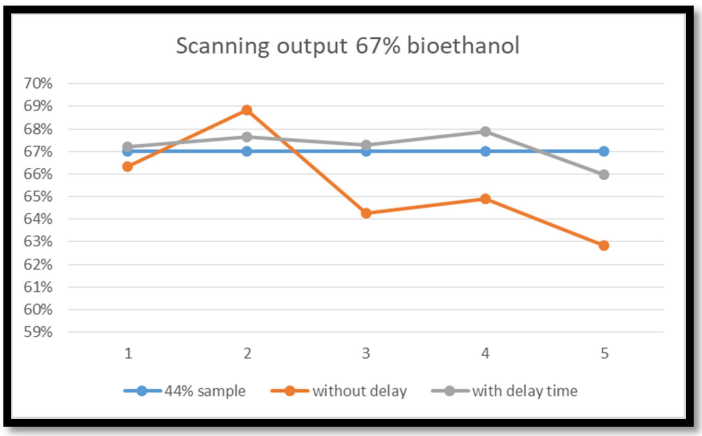

Figure 5. Scanning output 44% bioethanol

b. Measurement 67% alcohol level
60% alcohol level is measured with an alcohol meter and will be detected through a closed tube, the measurement results can be seen in table 4.

Table 4. Results of alcohol measurement 67%

alcohol sample	testing	without delay	with delay 15"
	1	66.33%	67.22%
	2	68.82%	67.63%
67%	3	64.28%	67.29%
	4	64.91%	67.89%
	5	62.83%	65.96%

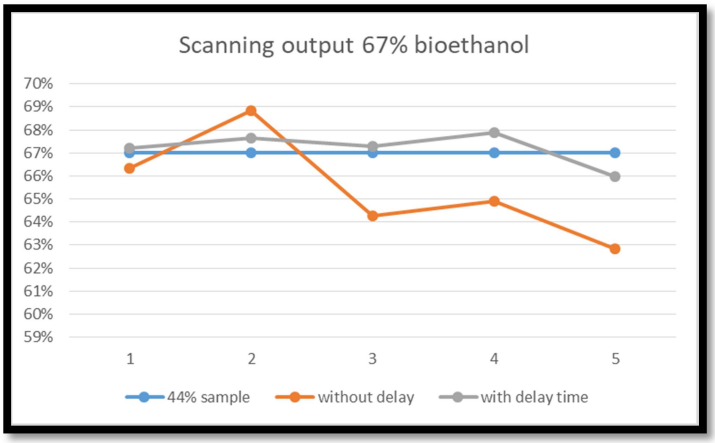

Figure 6. Scanning output 67% bioethanol

One of measurements result through the interface can be seen in Figure 7.

Figure 7 Measurement by interface

4. Conclusion

The height of sensor placement above the surface bioethanol liquid is 1cm to 2cm. Scanning alcohol level in bioethanol need delay time, it is 15 minutes. Device can display the scanning output by LCD and by computer interface.

Acknowledgements

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