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Development of a Test Board for a Non-Dispersive Infrared Gas Sensor

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Abstract **– In this paper, we newly developed a NDIR sensor modules using a non-dispersive infrared gas sensor and optical path with shape of rectangular parallelepiped. The test board was equipped with a designed NDIR gas sensor and a catalytic sensor from a Japanese company. The test was carried out with standard methane gases of seven different concentration. When standard methane gases are injected to sensors, voltage and concentration of the sensors through predicted algorithm are measured on LCD in real time. The gas leak detector used the proposed algorithm is verified that accuracy is improved.**

Keywords **– Calibration, Gas Sensors, Infrared Gas Sensors, Calibration Function.**

I. INTRODUCTION

According to the yearbook of accident in 2016, liquified natural gas accidents are increased by from 10 to 29 numbers in 2015, and similar incidents have been occurred in the same year. These gas accidents has caused enormous physical and personal damage. Safety of gaseous users should be ensured. Prevention activations have to continue for reducing gas accidents. [2] A gas detector is a typical equipment to prevent gas accidents. This is a prior study for developing a gas detector. This research is intended to help develop gas detectors.

II. MAIN

A. The Design of Board to Test Gas Sensors

At present, gas detectors that detect methane gas are mainly equipped with non-dispersive infrared flammable sensors. Therefore, a non-dispersive infrared light source and detector for detecting methane gas were purchased and developed as a module. A test board was fabricated to test the developed non-dispersive infrared flammable sensor module. The test board can exchange data with PC through bluetooth communication and serial communication. An intake motor was installed so that combustible gas could be quickly diffused into the sensor.

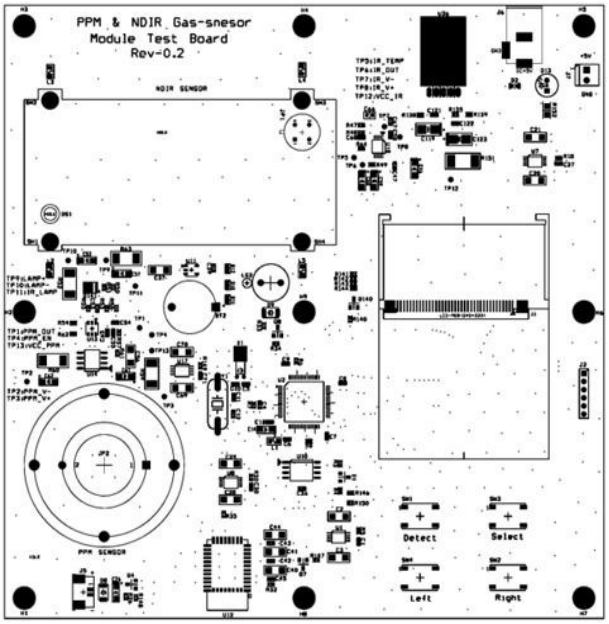


Fig. 1. Pattern of PCB for the test board

Fig. 2. The test board with PCB

The designed test board displays sensor voltage and predicted concentrations on a LCD window in real time. It also shows measurement time, selection mode, and board states such as battery voltage, brightness, and connection of bluetooth.

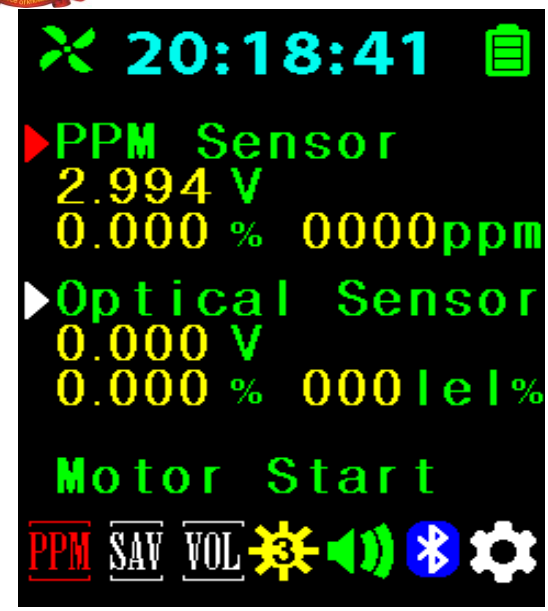


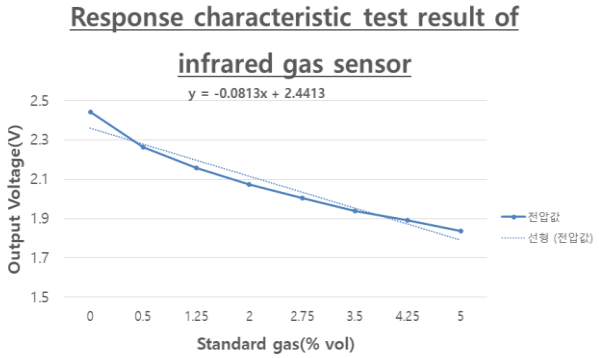
Fig. 3. Concentration on test board

B. Characteristic Test of the NDIR Sensor

The sensor voltage was measured using standard methane gases with several different concentrations. Concentrations were measured at seven concentrations of 0.5, 1.25, 2, 2.75, 3.5, 4.25 and 5% vol. The motor of the test board was turned on and the methane gas was injected for 5 minutes. After 5 minutes of injection, it was exposed to clean air for 20 minutes and then the test was repeated.

C. Calibration of the NDIR Sensor

The optimal equation was obtained from the linear regression equation with the measured values. The measured voltage values were estimated by using the linear regression equation. [3]



Graph 1. The derived equation by calibration

Table 1. Predicted value of standard gas concentration

Standard Gas (% vol)	Predicted Value (% vol)
0	0.00001
0.5	0.49996
1.25	1.24996
2	1.99996
2.75	2.74996
3.5	3.49995
4.25	4.24995
5	4.99995

III. Conclusion

In this study, we proposed the method to manufacture the modules using a NDIR gas sensor and measuring circuits. Also, we developed a circuit board for testing of performance a designed NDIR combustible gas sensor. The characteristic test of the NDIR flammable sensor was conducted by injecting standard methane gases. Above all, the calibration equation of our NDIR sensor is derived by using the linear regression and look-up tables. The NDIR sensor is applied by induced calibration equation. It demonstrated the better accuracy other than sensors. If results of the proposed research are utilized to other gas detectors, they have excellent accuracy and will create parts of better gas leak detectors. We hope them help prevent gas accidents.

Acknowledgment

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