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Methane Gas Detection Using IOT

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Abstract: Methane gasses are colorless, odorless and flammable gaseous. The methane gas is highly flammable and can lead to a pit fire at the landfill site. In Malaysia, there are numerous landfills that produce a lot of waste. This situation can lead to an increase in methane gas production. A monitoring system will help the worker to avoid a fire at the landfill. The purpose of this project is to detect the methane gas release and monitor the gas in a certain area in order to prevent fire. This project uses using MQ-4 sensor to detect the methane gasses at the landfill site. The system will collect the data from the sensor and store it in the Blynk application to monitor the methane gas in real-time. The results show that the suitable range from the source of the methane gas and the MQ4 gas sensor is within 1 to 2 cm. The test that has been done is to examine the performance and its reliability to ensure the device worked well. In addition, the collected data can be displayed and stored in the Blynk application.

Keywords: Gas Detection, Methane Gas, Monitoring System

1. Introduction

The introduction of hazardous elements into the environment is pollution caused by either natural pollutants or human activities. The quality of the air, water, and land is harmed by pollutants [1]. The most affected element that is caused by the pollution is environment. The increase of the carbon dioxide in the atmosphere can be caused by smog which can prevent the sunlight from reaching the earth [2]. The increasing of the pollution is also affecting the life on this earth. For example, water pollution results in the death of aquatic species. Air pollution happens because of the presence of substances in the atmosphere that are harmful to the health of life on Earth [3]. Gases pollution happens because there is a type of gas that traps heat in the atmosphere. The most produced gas that traps heat in the atmosphere is carbon dioxide followed by methane gases [4]. The effects that can happen from gas pollution are asthma, chronic bronchitis, heart attacks and strokes along with cancer [2]. In Malaysia, the main method for waste disposal is by using the landfill. When the load of the waste keeps increasing at the landfill, this situation will lead to the production of methane gasses and the risk of fire in the landfill is

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high. Thus, a monitoring system is required at the landfill site because it can help the workers at the site monitor the production of methane gasses and the temperature around the area.

2. Materials and Discussion

2.1 Materials

This system will use the MQ-4 sensor to collect the data and for monitoring purposed. The target gas that this device wants to detect is the Methane gas at the landfill site. The microcontroller is ESP 8266 and the Blynk application to collect and show the data that have been collected from the device.

2.2 Methods

The MQ4 sensor senses the presence of the methane gas and measures the methane gas at the landfill site. The data is stored in the Blynk application so that it can be monitored in the application. The interface of the system would be a basic interface of showing the level of methane gas at the landfill site. The ESP8266 acts as a microcontroller that receives the input signal from the methane gas and the MQ4 sensor and sends the data to the Blynk application. The system flowchart is shown in Figure 1.

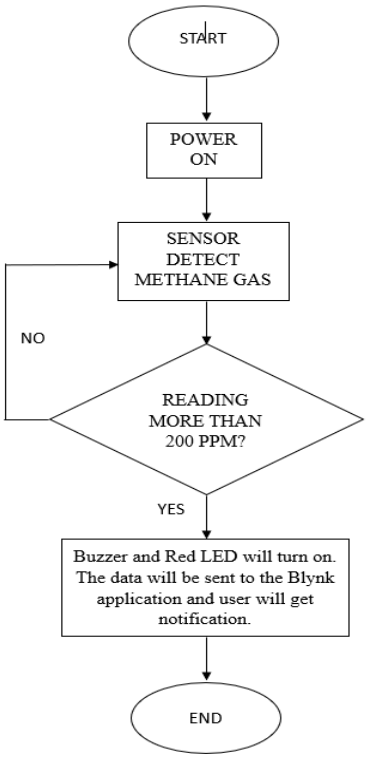

Figure 1: The flowchart of the device

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3. Results and Discussion

3.1 The Range Test

The first test that has been done on this prototype is the suitable distance or range for the gas sensor to detect the gas efficiently. Figure 2 shows the result of the test. The test was carried out by placing the gas at a different distance or range from the gas sensor. The distance or range value that has been selected is between 1cm to 14cm. The sensor will be installed at the bottom of the prototype and the gas source will be placed at the selected range that has been marked during the test. When the gas source is producing gas the gas sensor will detect the presence of the gas and the data that are collected from

the sensor will be transferred to the microcontroller and the data will be displayed at the Blynk application.

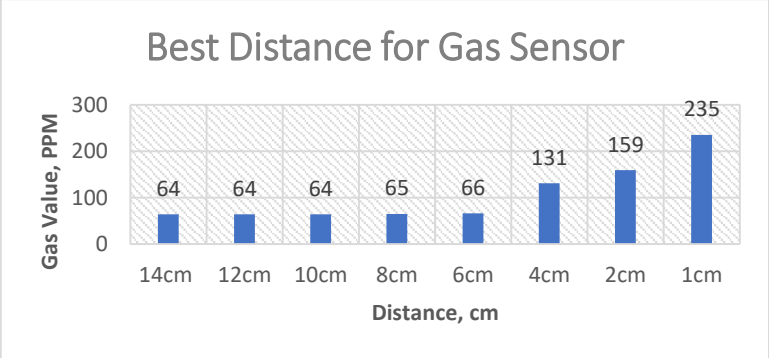

Figure 2: The results of the test

3.2 Type of Gas Test

Figure 3 shows the result of the type of gas that can be detected by the selected type of gas sensor. The gas that has been used to do this test is methane gas, LPG, and carbon monoxide gas. The results show that the selected gas sensor has the highest sensitivity towards Methane gas so the value of the data is the highest among the other gases while the carbon monoxide gases cannot be detected using this type of sensor.

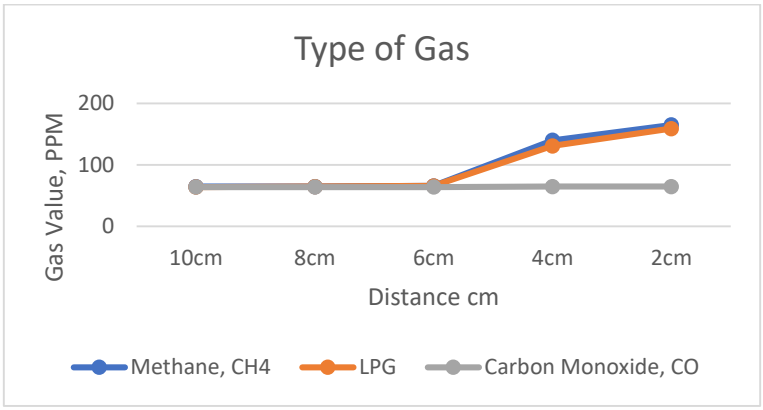

Figure 3: The test results

3.3 Circuit Design

Figure 4 shows the circuit installation that has been done for this prototype. There are several types of important components in the circuit installation such as the gas sensor and the microcontroller. These two components are important for this device to function. Other components that have been included in this device are the buzzer, the LED, and the LCD display. The actual circuit design for the Methane Gas Detection device is also can be seen in Figure 5 and Figure 6.

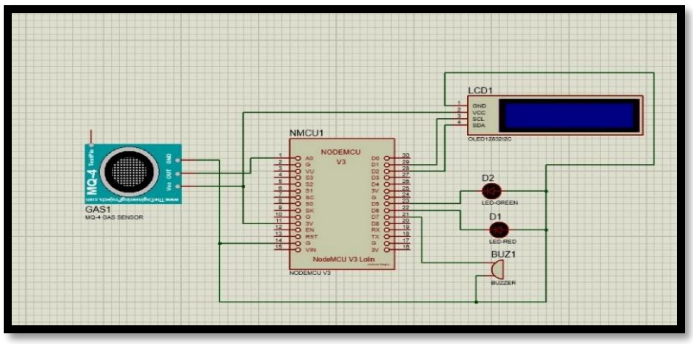

Figure 4: The circuit design

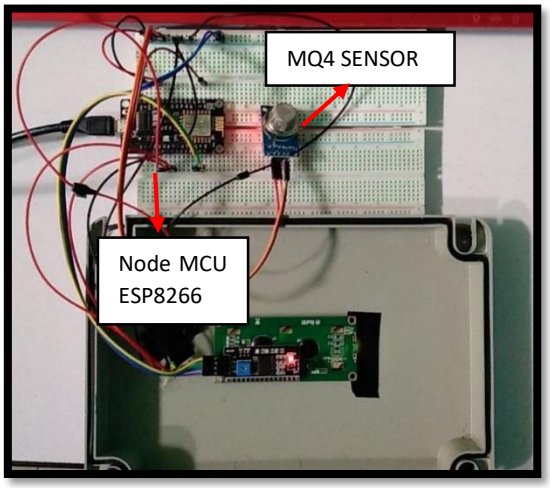

Figure 5: The Methane Gas Detection by using IOT circuit design.

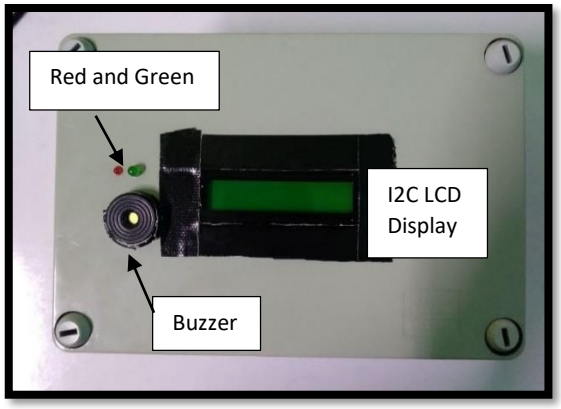

Figure 6: The front view of the Methane Gas Detector device.

3.4 Collected Data

Figure 7 shows the different gas situation from the graph. We can see that whenever the gas is at a low level the graph indicates the lowest half of the graph and the gas value at the gouge meter also will display the low value. When the gas is at the highest or at the caution value of the gas the graph is indicating at the highest half of the graph and the gas value at the gauge meter also will display the high value. When the gas level is increasing more than 200 PPM an email will be sent to notify the user that the gas has the pass the limit of the safety gas concentration.

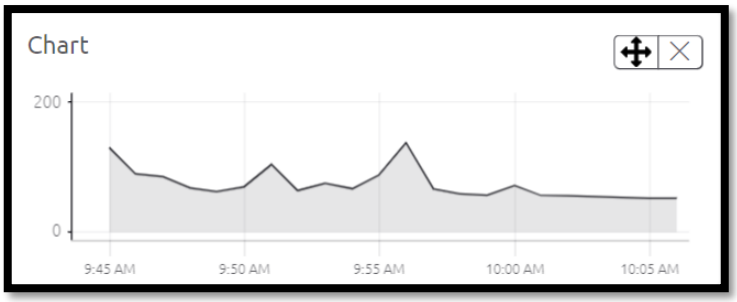

Figure 7: Data from the Blynk application.

4. Conclusion

In conclusion, the device is working successfully through the testing on its device prototype. The test that has been done is to examine the performance and its reliability. In addition, the data that have been collected from the gas sensor can be displayed and stored in the Blynk application.

Acknowledgement

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References

[1] *Pollution*. National Geographic Society. (n.d.). Retrieved January 31, 2023, from https://education.nationalgeographic.org/resource/pollution

[2] Mattern, F., Staake, T., & Weiss, M. (2010, April). ICT for green: how computers can help us to conserve energy. In *Proceedings of the 1st international conference on energy-efficient computing and networking* (pp. 1-10)

[3] Lipfert, F. W. (2020). Air Pollution and Mortality: Timing Is Everything. *Atmosphere*, *11*(12), 1274.

[4] Dones, R., Heck, T., & Hirschberg, S. (2004). *Greenhouse gas emissions from energy systems: comparison and overview* (No. CH--0401).