MONITORING AIR QUALITY AROUND USERS WITH IOT BASED NODEMCU ESP8266

[1*]ZAKY WAHYU OKTAVIANTO, [2]ANTON BREVA YUNANDA

[1, 2]Department of Informatics Engineering, Universitas 17 Agustus 1945 Surabaya

Jl. Semolowaru No.45, Menur Pumpungan, Kec. Sukolilo, Surabaya, Jawa Timur, 60118

e-mail: [1]zayuto33@gmail.com, [2]antonbreva@untag-sby.ac.id

[*]Corresponding author

ABSTRACT

For regional issues and issues related to a healthy environment, there were issues related to water and air quality. The biggest source of air pollution is vehicle exhaust fumes, and the increase in the number of vehicles in Sidoarjo City grows by an average of 18 percent per year. To overcome this problem, an air quality monitoring device is needed. The goal to be achieved by creating an air quality monitoring system as an Internet of Things application is to become a prototype for monitoring environmental health problems related to air quality in Sidoarjo City. Monitoring is carried out online through the Thingspeak IoT platform. This tool applies Ohm's law theory to reading conversion calculations when the MQ sensor operates as a CO, CO2, and Acetone gas detector. NODEMCU ESP8266 as microcontroller. This tool can be used as a prototype for monitoring in highway areas with high vehicle intensity.

Keywords: *MQ135, NODEMCU ESP8266, AIR QUALITY, Internet of Things*

1. INTRODUCTION

Sources of air pollution can come from various kinds, including industry, transportation, offices and housing. Sources of air pollution can also come from natural such as forest fires, volcanic eruptions, and toxic natural gas.[1] Two of the air pollution parameters are carbon monoxide (CO) and carbon dioxide (CO2) in the air. Within certain limits, the concentration of these substances can still be reduced, but if they exceed certain limits, the contents of these substances can endanger human health. According to new data from the World Health Organization (WHO), one in ten people worldwide breathe highly polluted air, and around 7 million deaths worldwide are caused by air pollution. The formulation of the problem in this research is monitoring the surrounding air quality and recording air quality data through IoT.[2] The goal of this research is to raise awareness of the importance of good air quality and the level of awareness related to gas or ozone pollution. To optimize air quality notifications, we need better resolution (more monitors used) and better sensors. That's why we developed a tool that monitors air quality with all its functions. The tools we build use carbon monoxide (CO), carbon dioxide (CO2), and Acetone (Acetone).[3]

2. RESEARCH METHOD

2.1 Air Quality

Air is a mixture of gases found in the layers that surround the earth. The composition of the gas mixture is not always constant.[3] Water in the form of water vapor (H2O) and carbon dioxide (CO2) is the component whose concentration varies the most. Natural air is not free of pollutants, for example several air pollutants, namely gaseous sulfur dioxide (SO2), hydrogen sulfide (H2S), and carbon dioxide (CO), are always released into the air as by-products. Examples of natural processes such as volcanic activity, decay of plant residues, forest fires, etc. Apart from this natural pollution, air pollution can also be caused by human activities such as land burning, engine combustion residue, or industrial exhaust fumes. number: KEP-45/MENLH/1997 focussing Air Pollution Standards. [3]This decision is used as free material to help people at a certain place and time with consistent air quality information and as free material in air pollution control. ISPU is a number without a unit that explains the condition of air quality at a certain place and time in terms of its impact on public health, aesthetic values and other lives. The standard air pollution index is determined by converting the measured air pollution value into a dimensionless number. The air quality measurement parameters based on the quality of the Air Pollutant Standard Index accordings to KEPMEN LH NUMBER: KEP-

45/MENLH/10/1997 can be seen in Table 1. But this time I used the air quality index from the MQ135 tool which will add 400 PPM to match ISPU.

Table 1. Index Range of Air Pollutant Standard

KEPMEN LH NUMBER: KEP-45/MENLH/10/1997	
Values	Range
Good	0-50
Moderate	51-100
Unhealty	101-199
Very Unhealty	200-299
Dangerous	300-3000

2.2 NodeMCU

NodeMCU is an Internet of Things (IOT) hardware or platform like Arduino that can be used by free. The platform includes firmware that runs on the Espressive System ESP8266 Wi-Fi SoC and hardware based on the ESP-12 module or the ESP8266-12E chip. [4] NodeMCU is basically an ESP8266 development with e-Lua based firmware. [4] NodeMCU has a feature that supports TCP/IP communication. This board is based on the ESP8266 series WiFi SoC (single on chip), the WiFi used is IEEE 802.11 b/g/n. In addition, NodeMCU supports WEP and WPA encryption, making this chipset very safe to use.[4] NodeMCU runs on 3.3V, has 11 GPIO pins for input and output, 1 analog to digital converter (ADC). The physical form of NodeMCU is shown in Figure 1.

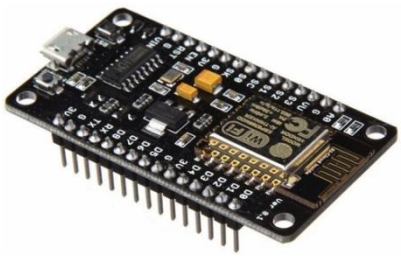

Figure 1. NODEMCU ESP8266

2.3 MQ-135

The MQ-135 sensor is the chemical sensor type which is sensitive to NH3, NOx, alcohol, benzene, smoke (CO), CO2 and others. This sensor is operated by receiving changes in the resistance value (analog) when exployed gas arilas. [5] This sensor has the advantage of good resistance to the use of a hazard signal because it is convenient and does not consume or require a lot of power. The sensitivity setting of the sensor is determined by the resistance value of the MQ-135, which is different for different gas concentrations. Therefore, sensitivity adjustment is required when using this component. In addition, the calibration detects CO2 concentrations of 400 ppm or 50 ppm CO2 in the air.[5] The physical form of MQ-135 can be seen in Figure 2 and the Characters from MQ-135.

The MQ-135 sensor has characteristics such as its graphical scale, which is log_log on a linear scale where the behavior of gas concentrations is relatively relative to exponential resistance, then the distance between gas concentrations is only between 0 ppm to above 1000 ppm, and the relationship between gas concentration and resistance ratio looks linear can be seen in Figure 3.

Figure 2. MQ-135 Censor

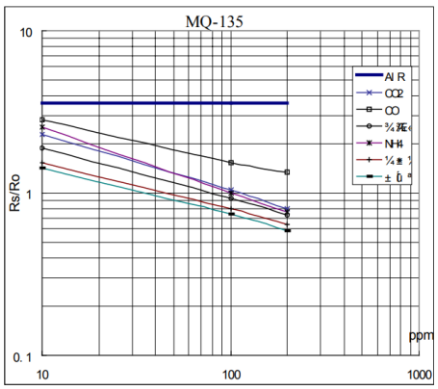

Figure 3. Sensor Character MQ-135

2.4 Algorithm

The algorithm of designing a tool to detect air quality is show in Figure 4 the MQ-135 sensor will detect the surrounding air quality according to Index Range of Air Pollutant Standard. After that the air quality data from the MQ135 sensor used will be stored into the microcontroller which will be processed to be sent then the air quality results will be displayed on the LCD.

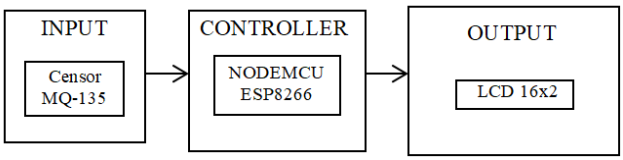

Figure 4. Algorithm Tools

2.5 FlowChart

This main system uses a NODEMCU ESP8266 microcontroller which already has a wifi configuration feature and the programming language used is C language. The overall microcontroller programming flow diagram is as follows:

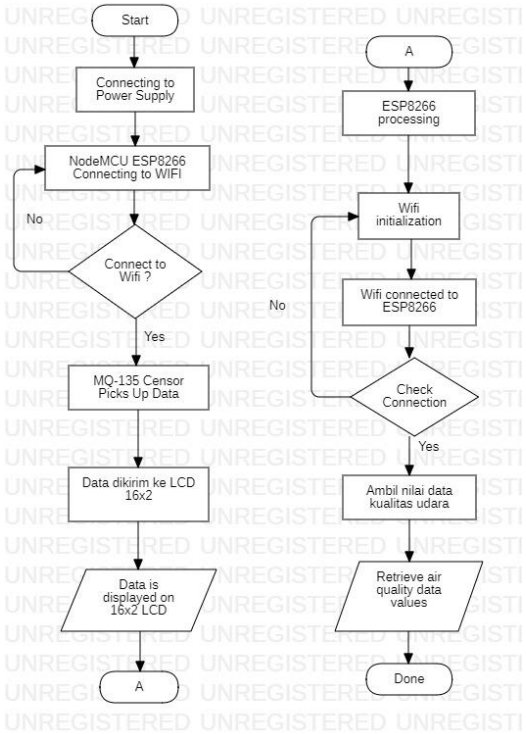

Figure 5. FlowChart

3. RESULT AND DISCUSION

3.1 Testing

In this section, an air quality test will be carried out based on the requirements of gas conditions in general using the MQ-135 sensor and the results from the sensor will be equated with the Index Range of Air Pollutant Standard. In this test there are three stages, normal conditions, conditions with smoke gas, and vehicle exhaust

3.1.1 Normal Testing

In this section, the MQ135 sensor detects carbon monoxide gas in Normal Testing with a result of 2.24 ppm which is classified as good air quality.

Figure 6. carbon monoxide

In this section, the MQ135 sensor detects carbon dioxide gas Normal Condition with a result of 441.89 ppm which is classified as good air quality.

Figure 7. carbon dioxide

In this section, the MQ135 sensor detects the acetone gas content Normal Condition with a result of 0.29 ppm which is classified as good air quality.

Figure 8. Acetone

3.1.2 Smoke Gas

In this section, the MQ135 sensor detects the content of carbon dioxide on Smoke Gas in the presence of gas from a lighter with a yield of 1167.10 ppm which is classified as very unhealty air quality.

Figure 9. carbon dioxide

In this section, the MQ135 sensor detects the content of carbon monoxide on Smoke Gas in the presence of gas from a lighter with a yield of 8083.80 ppm which is classified as dangerous air quality.

Figure 10. carbon monoxide

In this section, the MQ135 sensor detects the acetone gas content in the room in the presence of gas from a lighter with a yield of 76.75 ppm which is classified as moderate air quality.

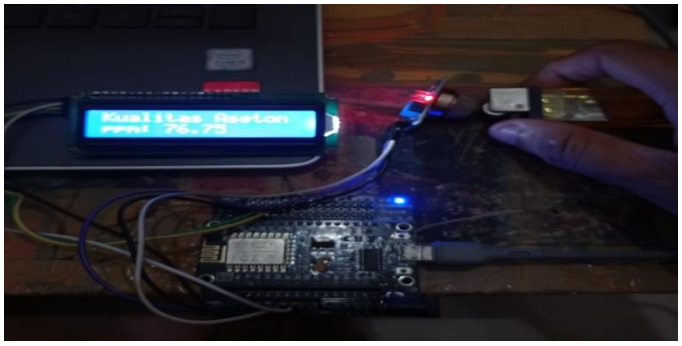

Figure 11. Acetone

3.1.3 Vehicle Exhaust

In this section, the MQ135 sensor detects the content of carbon monoxide which be produced from vehicle exhaust. Result of monitoring show that the content of CO is 10042.53 ppm and category of air quality is dangerous.

Figure 12. carbon monoxide

In this section, the MQ135 sensor detects the content of carbon monoxide which be produced from vehicle exhaust. Result of monitoring show that the content of CO2 is 1743.37 ppm and category of air quality is dangerous.

Figure 13. carbon dioxide

In this section, the MQ135 sensor detects the content of carbon monoxide which be produced from vehicle exhaust. Result of monitoring show that the content of Aceton is 24.64 ppm and category of air quality is dangerous.

Figure 14. Aceton

3.2 Tabel Result

From the experimental data above, it can be seen that the MQ-135 sensor that I made when tested with gas or smoke detects the presence of gas and smoke in the air, so it shows a warning sign by displaying the results on the LCD screen.

Table 2. Result Testing

No	Sensor testing	LCD (PPM)			LCD (Description)		
		CO	CO2	Aseton	CO	CO2	Aseton
1	Normal Condition	2.24	441.89	0.29	Good	Good	Good
2	Smoke Gas	8083.80	1167.10	76.75	Dangerous	Very Unhealty	Moderate
3	Vehicle Exhaust	18042.53	1747.37	24.64	Dangerous	Very Unhealty	Moderate

4. CONCLUTION

1. By using the MQ-135 sensor, the results you are looking for are quite complete compared to other MQ sensors.
2. The use of the NODEMCU ESP8266 microcontroller makes it easy to use in terms of programming and hardware design and has been integrated with the wifi module.
3. Using the internet of things (IoT) system by integrating the Thingspeak platform which can display and provide real air condition notifications anytime and anywhere.

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