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O2 Gas Generating Prototype In Public Transportation

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ABSTRACT

Air is a layer of gas that covers the Earth. Clean air is air that is free of impurities or substances that can poison the body and is commonly found in areas where there are many plants. The realization is done through a combination of the TGS 2442 sensor on the detector with a high voltage system on the T-Box. The TGS2442 sensor is a high sensitivity sensor to carbon monoxide gas. Thus, the resulting carbon monoxide gas exhaust that has gone through the process will produce oxygen gas because the steel plate on the T-Box functions as a carbon binder. The amount of smoke, which is the output form, is already in the form of ppm, which can be found using the display on the serial monitor and by calibrating using a gas analyzer. The gas analyzer is in the lowest range, namely 100ppm, the sensor detects 116ppm with a percent error of 16%. And when the gas analyzer is in the highest range of 600ppm, the sensor detects 603ppm with an error of 0.5%

1. Introduction

The level of demand for public transportation is closely related to the distribution pattern of trips (distribution trips) of public transportation service users [1]. Public transportation is one type of public facility built by the district government to provide access for the public, especially in the field of transportation services. As with other types of public transportation, the current route is also degenerating. This degeneration of the use of transportation services is caused by several factors, namely: (1) the condition of the line is far from the element of feasibility; (2) smoking passengers were still found in the transportation; (3) the crowded passenger lining has the potential to produce CO gas, where the CO gas comes from the results of human biological oxidation.

In terms of this, the authors plan to design a transportation model for producing oxygen gas (O2) through the utilization of CO gas cycle waste products which are managed by designing a tool[2]. The prototype was built using two designs, namely the carbon monoxide (CO) gas detector and the T-Box. A carbon monoxide (CO) gas detector is an electronic device that senses the presence of carbon monoxide (CO). Meanwhile the T-Box is a carbon monoxide gas separator. The technology used to detect carbon monoxide was originally developed for industrial applications. The technology application will be applied to the lin route through a combination of the TGS 2442 sensor on the detector with a high voltage system on the T-Box so as to make the resulting carbon monoxide (CO) exhaust gas into oxygen gas (O2)[3][4]. The applied model that is made does not change the shape of the vehicle so that the vehicle remains in an open condition and the device is able to process carbon monoxide (CO) gas outside the system (the surrounding environment). This prototype application will increase public interest in choosing the type of transportation line so that it will answer partner problems through increasing revenue because the lin condition is considered suitable for use[5].

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2. Method

Techniques in solving problems In order to solve partner problems in terms of income, the authors solve through system improvements by creating a prototype.

1. Realization of sensors on Route Lin G

a. Use of a CO gas sensor (TGS 2442)

The selectivity of TGS 2442 for displaying carbon monoxide levels is very good, making it ideal for monitoring CO gas. In the presence of CO, the conductivity of this sensor increases. A simple electrical circuit operating on one cycle of the second circuit voltage can convert the change in conductivity to an output signal corresponding to the gas concentration[6].

When the prototype is in the cigarette smoke area, the smoke sensor will immediately detect it. When the smoke sensor detects cigarette smoke, the T-BOX will light up to inhale the smoke and will be neutralized for 10 seconds. After 10 seconds, the prototype returns to the exploration flowchart. If there is still smoke around the prototype, the prototype will suck up the smoke again for 10 seconds. This will happen continuously until the prototype is turned off. Realization of the T-box.

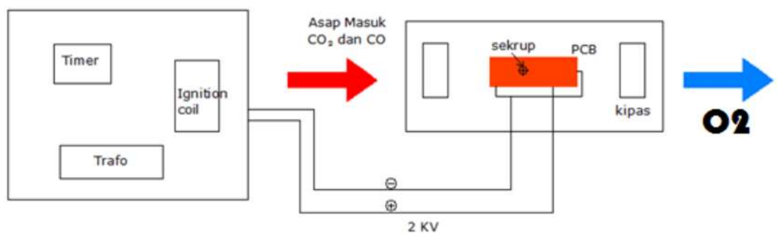

Fig 1. The Mechanism of The T-Box Working System

The T-box is made of parallel plates that are tucked in to produce an electric spark like lightning. To run this T-box requires a large enough voltage of 2000V. The generator from the coil will produce a voltage of around 1800V - 2500V and is used to run the T-Box. If through the T-Box the CO gas produced by the system will be converted into O2 gas. The change in O2 gas is obtained from the electric spark at the end of the screw on the steel plate which is given a 2000V voltage difference. The two systems above will be combined into one new system so that it has a dual function not only as a CO gas detector but as a filter that binds carbon and produces oxygen gas. So that the output of this system is a device capable of producing oxygen in the city area.

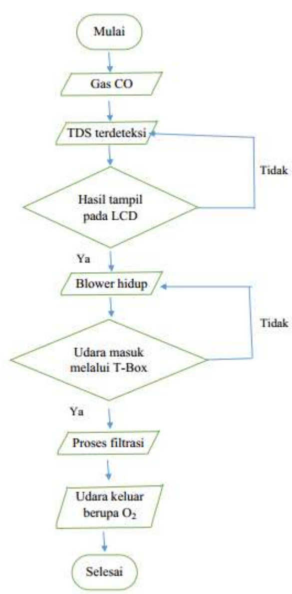

Fig 2. Flowchart sistem sensor gas CO (TGS 2442)

2. TGS 2442 sensor

The TGS 2442 sensor functions as a detector for CO (carbon monoxide) gas contained in smoke. In electronic design, the TGS 2442 sensor is connected to pins 4 and 5 on the microcontroller. There are 4 pins on the TGS 2442 sensor which are connected to analog pins, digital pins, vcc and ground.

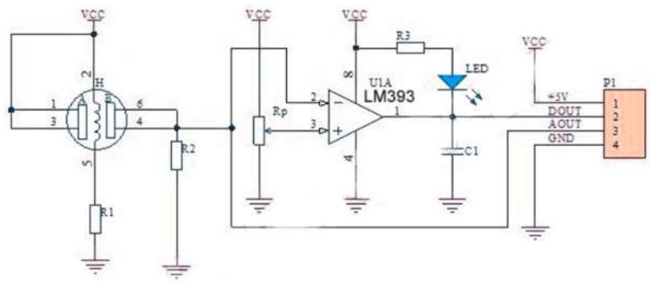

Fig 3. The TGS 2442 Circuit

3. Driver Motor

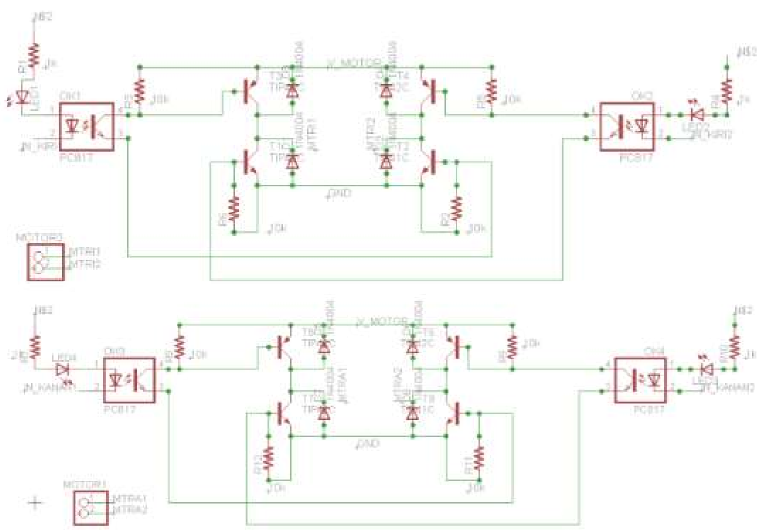

Fig 4. Motor Driver Circuit.

DC motor drivers with the PWM (Pulse Width Modulation) method can control the direction of the DC motor rotation and the speed of the DC motor using PWM pulses given to input lines A and B [4]. To control the direction of the DC motor rotating clockwise with a PWM pulse controlled speed, input line B is always given TTL logic 0 (LOW) and input line A is given PWM pulses.

To control the direction of rotation of the DC motor counterclockwise with a speed controlled PWM pulse, the input line A is always given TTL logic 0 (LOW) and the input line B is given a PWM pulse. The rotation speed of a DC motor is controlled by the percentage of the ton-duty cycle of the PWM pulses supplied to the input line

3. Results and Discussion

The discussion of the results of the water purification device stimulation test consists of several discussions of the test results including sensor testing, Arduino Uno R3 testing, relay testing, power supply testing, sensors and testing the work system as a whole.

1. TGS 2442 sensor

In testing the smoke sensor, serial monitor readings were used in the Arduino IDE software. In this test, smoke from burning paper is used to act on the sensor. The amount of smoke which is the output form is already in the form of ppm (parts per million) can be found by using the display on the monitor serial and by calibrating using a gas analyzer. The smoke sensor used is TGS 2442. With the condition that the plastic burning smoke source is located at a distance of 5cm from the TGS 2442 sensor

Table 1. Test Results For The Front TGS 2442 Smoke Sensor

Theory Result (ppm)	Practical Yield (ppm)	*Error (%)*
116	100	16.00%
116	100	16.00%
118	100	18.00%
Rata-rata error		5.50%

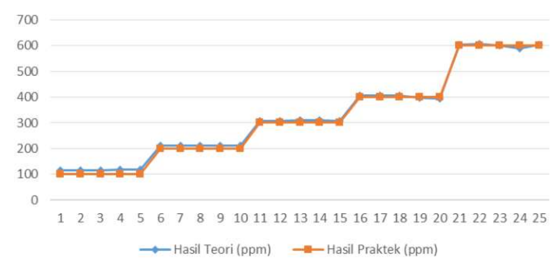

Fig 5. TGS 2442 Test Graph

From Table 1 and Figure 5, it can be seen that when the gas analyzer is in the lowest range, namely 100ppm the sensor detects 116ppm with a percent error of 16%. And when the gas analyzer is in the highest range of 600ppm, the sensor detects 603ppm with an error of 0.5%. Smoke Decomposition

In the conditions of decomposition of the smoke it should be understood that in this condition the gas sensor TGS 2442 has detected the presence of cigarette smoke. after cigarette smoke is detected, the prototype will stop and the T-Box starts working. The T-Box starts working marked with the DC fan starting to inhale cigarette smoke into the T-Box and the electric corona starting to filter out the existing carbon content.

The decomposition process of smoke occurs when the TGS 2442 gas sensor has detected 29ppm of CO gas. When the CO around the prototype is 29ppm or more, the prototype will stop. After stopping, the T-Box will light up to suck the smoke around the prototype from the front to the back. The lit corona will filter the carbon in the CO and let O out. Oxygen (O) which cannot stand alone as a gas combines with other oxygen so that the output is in the form of O2 gas (Oxygen) and O3 gas (Ozone). This is what causes this process called ionization.

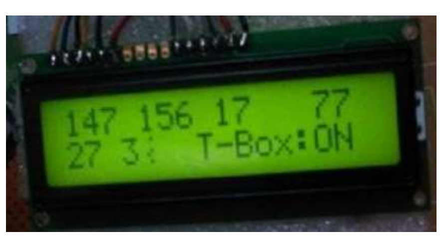

Fig 6. LCD display

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Table 2 Decomposition results during smoke decomposition

TGS 2442 (ppm)	T-Box		Voltage (V)	
	Corona	DC fan	Corona	DC fan
31	On	On	2,8	11,8
32	On	On	2,8	11,8
32	On	On	2,8	11,8

This test is conducted to determine the results of the smoke sensor when it detects smoke. The smoke given is in the form of smoke from burning tissue. This test is done by burning the material in a container box with a fan on one side. Then when the prototype enters a room, the smoke will be directed into the room. The prototype will detect the presence of smoke and will break down the smoke.

Table 3 TGS 2442 Smoke Sensor Test Results

TGS 2442 Front (Ppm)	TGS 2442 Rear (Ppm)	Front And Back Differences	% Decomposition	Time Needed
31	26	4	12.90%	3.20
32	26	3	10.34%	3.21
32	26	3	10.34%	3.21
Average		4.2	12.495%	3.20

It can be seen in table 3 that the results of the smoke decomposition test. In the first experiment there was a reduction of 4 ppm which means 12.9% of the initial sensor reading of 31 ppm. And the prototype clocked 3 minutes 20 seconds for one round with 1 minute 30 seconds when it reached smoke. Then the second experiment occurred a reduction of 3 ppm which means 10.34% of the initial sensor reading of 29 ppm. And the prototype clocked 3 minutes 21 seconds for one lap with 1 minute 29 seconds when it hit smoke. The third experiment saw a reduction of 3 ppm which means 10.34% of the initial sensor reading of 29 ppm. And the prototype clocked 3 minutes 21 seconds for one lap with 1 minute 29 seconds when it hit smoke. The fourth experiment saw a reduction of 6 ppm, which means 18.75% of the initial sensor reading of 32 ppm. And the prototype clocked 3 minutes 20 seconds for one round with 1 minute 28 seconds when it reached smoke. The fifth experiment occurred a reduction of 4 ppm, which means 13.33% from the initial sensor reading of 30 ppm. And the prototype clocked 3 minutes 23 seconds for one lap with 1 minute 30 seconds when it reached smoke. The sixth experiment saw a reduction of 5 ppm which means 15.62% of the initial sensor reading of 32 ppm. And the prototype clocked 3 minutes 23 seconds for one lap with 1 minute 31 seconds when it hit smoke

4. Conclusion

From this research it can be drawn that the overall error results of the decomposition of carbon gas into oxygen from tgs 2442 are 5.50% and from the decomposition of smoke using tissue materials, the prototype is able to reduce the carbon content (C) on average by 12.495%. When it reaches the smoke, the prototype takes 1 minute 29 seconds and the prototype takes 3 minutes 20 seconds to reach one round

References

[1] T. Dyr, P. Misiurski, and K. Ziółkowska, "Costs and benefits of using buses fuelled by natural gas in public transport," *J. Clean. Prod.*, vol. 225, pp. 1134–1146, 2019.

[2] T. Muddemann, D. R. Haupt, M. Sievers, and U. Kunz, "Improved Operating Parameters for Hydrogen Peroxide-Generating Gas Diffusion Electrodes," *Chemie Ing. Tech.*, vol. 92, no. 5, pp. 505–512, 2020.

[3] E. M. W. Ng, Z. Song, C. D. Yau, O. W. Liew, and T. W. Ng, "Safe Handling of Gas Generating Experiments Using Disposable Plastic Syringes," *J. Chem. Educ.*, 2020.

[4] M. L. P. Vidallon *et al.*, "Gas-Generating, pH-Responsive Calcium Carbonate Hybrid Particles with Biomimetic Coating for Contrast-Enhanced Ultrasound Imaging," *Part. Part. Syst. Charact.*, vol. 37, no. 2, p. 1900471, 2020.

[5] A. T. Nugraha, "DIRTY AIR FILTER SYSTEM USING BOXED EQUALIZER MQ-8 AND MQ-9 WHEELED ROBOT," *JEEMECS (Journal Electr. Eng. Mechatron. Comput. Sci.*, vol. 1, no. 1, pp. 23–26, 2018.

[6] A. Dey, "Semiconductor metal oxide gas sensors: A review," *Mater. Sci. Eng. B*, vol. 229, pp. 206–217, 2018.