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Case Study Carbon monoxide and Hydrocarbon Leakage Detectors Cabin Automotive Vehicle

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Abstract

The function of construction study case carbon monoxide and hydrocarbon leakage detector cabin automotive vehicles is for human safety. The purpose of this study was to provide a leakage detector based on the study on Indonesian drivers in the cabin using Arduino through telegram. The passenger or driver could die if they consume Carbon monoxide gases above 2 percent circulation in their blood. Hydrocarbons (HC) gases can also occur when the exhaust system is not functioning correctly. This research uses a development approach or Research and Development (R&D). There are two stages for the tool's design and construction: first, to create the software, and second, to create the hardware. CO and HC gas detector work when CO and HC gas leakage can be sensorized from the MQ7 sensor and MQ2 sensor. It will be sent to the telegram. When CO and HC gas is too high on the cabin of an automotive vehicle, so the buzzer will produce a sound beep. DC motors are represented as power window systems that can be rotated. This tool is located on the dashboard of the automotive vehicle.

Keywords: *Carbon monoxide, Hydrocarbon, Automotive Vehicle Cabin, MQ7 sensor, MQ2 sensor, Arduino, Telegram*

INTRODUCTION

The population in Indonesia has led to an increase in the economy and the community's growing needs. One of the people's basic needs in Indonesia today is an automotive vehicle to facilitate people's daily activities in moving from one place to another. Automotive vehicles are any vehicles driven by mechanical equipment in the form of engines than vehicles running on rails (Government Regulation No. 55 of 2012 concerning Vehicles, 2012). The primary function of automotive vehicles is to make it easier for us to reach distant areas easily because with the presence of automotive vehicles, the distances that we originally traveled for a long time become faster. Passenger cars will be equipped with several facilities for the comfort and safety of the driver. There have often been cases of leaks in exhaust ducts that have caused oxygen to run out in the car cabin, and the air inside the car cabin has been filled with toxic gas, which can cause death to the driver in the automotive vehicle cabin. Carbon monoxide and Hydrocarbon gas poisoning can occur when the driver stays in the car to stop and simultaneously the air conditioner and car engine are turned on, as in the case that occurred in three students in Malaysia who died from Carbon monoxide poisoning while sleeping in their car without turning off the engine (Revelation, 2020).

Carbon monoxide gas released in the exhaust system does not work properly. Usually, poor exhaust circulation is caused by untreated pipes, aka leaking. Carbon monoxide and Hydrocarbon gases are among the most common causes of poisoning for human health (Reinaldi Teguh

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Setyawan, Prototype tool can be detected for Carbon monoxide and Hydrocarbon gas content in an automotive vehicle cabin using an Arduino microcontroller). Carbon monoxide gas is a gas that can cause tissue damage and even death if you inhale it for too long. This gas is colorless, odorless, and tasteless. Hydrocarbon Gas is a gas that causes lung infections so that the body does not bind oxygen which will cause death if inhaled for a particular time. Carbon monoxide and Hydrocarbon gases can enter the car cabin due to a leak in the air conditioner or car exhaust. This can happen to cars that lack maintenance and attention or old cars. Therefore, based on the gas cases and hazards above, it is necessary to have a system that is able to work automatically to detect CO and HC gas levels in car cabins and provide warnings or information to motorized vehicle users to prevent poisoning in car cabins. In this study, a design for CO and HC gas level detectors in Arduino-based car cabins will be made via telegram.

LITERATURE REVIEW

Carbon Monoxide is produced from the incomplete combustion of carbon compounds, which often occurs in internal combustion engines, vehicle exhaust emissions, and waste combustion. CO gas has units per million (PPM), a unit often used in the world of analytical chemistry for a chemical compound in the form of a gas. CO is a toxic chemical gas but plays an essential role in modern technology as a precursor for many compounds that the naked eye cannot detect by the human sense of smell or sight. Therefore, CO can be very dangerous if it appears in a closed space with minimal oxygen, its exposure to humans can cause side effects of dizziness, nausea, loss of balance, and if in high amounts, it will cause loss of consciousness, shortness of breath, seizures and even cause death. This can happen because the internal combustion engine generates power to produce carbon monoxide as a result of incomplete combustion (Nurfauzi, PROTOTYPE OF CO DETECTOR SYSTEM IN CAR CABIN, 2020). Carbon monoxide is an invisible killer because its presence cannot be detected by sight or smell. Carbon Monoxide is a twin molecular compound in the form of a gas, colorless, odorless, and flammable, used to manufacture various organic and inorganic compounds (Jannah, 2019). This gas is also very toxic to humans. After inhaling the air, carbon monoxide binds to hemoglobin molecules in red blood cells, displacing oxygen. Carbon monoxide binds to hemoglobin two hundred times more effectively than oxygen. This prevents the red blood cells from carrying oxygen to the body's tissues. Therefore, carbon monoxide is a fast-acting poison. Carbon monoxide is formed when compounds containing carbon are burned in air containing little oxygen. Carbon monoxide is formed when compounds containing carbon are burned in air containing little oxygen (poor oxygen). At the height of busy streets on the highway, carbon monoxide in the air can reach 100 ppm. In the USA, new cars must be equipped with a catalytic converter, which converts toxic carbon monoxide into non-toxic carbon dioxide. Carbon monoxide is also found in cigarette smoke and wood burning. After smoking a cigarette, someone takes a few hours to replace the carbon monoxide bound to the hemoglobin. During rush hour, the air on the streets contains carbon monoxide, which causes a headache or feeling of vomiting. Hydrocarbon compounds are one of the most important compounds in our daily lives. Hydrocarbon compounds are generally used as fuels, and some chemicals can be reprocessed. For example, plastic, rubber, petroleum, natural gas, and others. This hydrocarbon (HC) is one of the most common causes of poisoning for human health. Hydrocarbon Gas (HC) is not much different from CO gas which enters the car cabin through exhaust leaks or leaks in the tank so that the vapor from the fuel enters the car cabin.

In contrast to CO gas, which is odorless, HC gas is easier to detect because it has an odor that can be identified by smell. Symptoms caused by hydrocarbons are usually coughing and choking after swallowing or inhaling the hydrocarbons. A burning feeling in the stomach and vomiting may occur. If the lungs are affected, the patient will continue to cough. Breathing becomes fast and the skin has a bluish color (cyanosis) due to decreased oxygen levels in the blood and increased carbon dioxide. Small children may appear cyanotic, hold their breath, and have a persistent cough. Sometimes difficulty breathing does not occur until several hours after the hydrocarbons have entered the lungs. Ingested hydrocarbons can also cause nervous system symptoms, such as impaired coordination, seizures, and decreased consciousness (Indonesia, 2016).

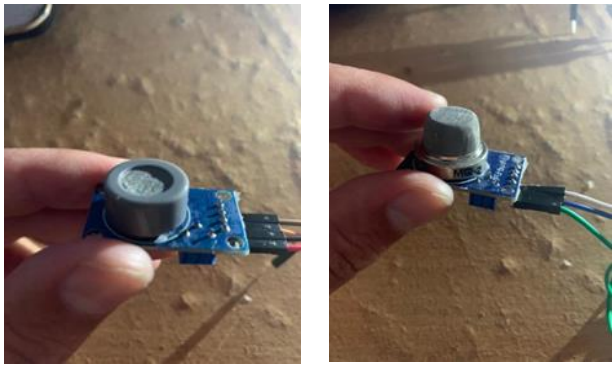
RESEARCH METHOD

The method (Research and Development) to produce and refine products that had been previously studied which were used as prototypes of CO systems in car cabins, because researchers were developing a tool and conducting research on research objects, researchers made CO and HC gas detectors on Arduino based car cabin via telegram. This research will use the Toyota Avanza vehicle as a research object. This research uses tools and material such as:

a. Laptop
b. Cellphone
c. Adapter 12
d. The Car

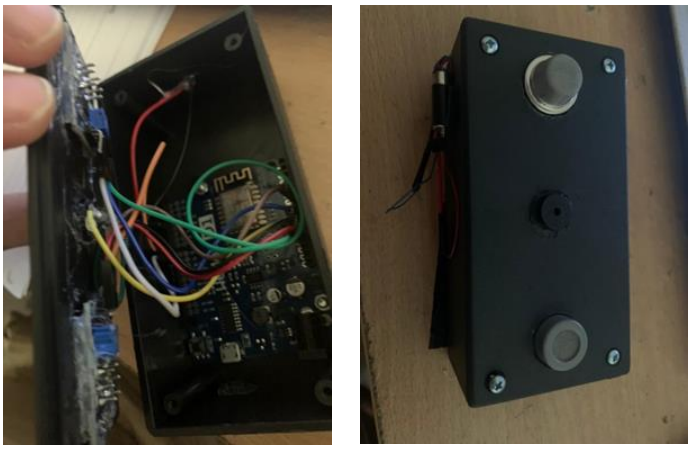
The material such as:

a. Arduino Wemos D1
b. MQ 7 Sensor
c. MQ 2 Sensor
d. Beardboard
e. Buzzer
f. Cable Jumper
g. Motor Power Window (DC Motor)
h. Smoke source of CO and HC



(a) (b)

Figure 1. (a) MQ7 Sensor (b) MQ2 Sensor



(a) (b)

Figure 2. (a) and (b) Tools CO and HC Leakage Detector

Figure 3. Tools CO and HC Leakage Detector on the dashboard

FINDINGS AND DISCUSSION

In the early stages of testing the tool, a sensor voltage measurement is carried out with a multimeter to know that the sensor is functioning properly. The automotive vehicle cabin equipment was tested using two tools, namely the engineering design and the gas analyzer. The two tools are inserted and placed in the car cabin. The gas analyzer is used to compare the results of CO gas in the design. The testing tool uses a hose from the vehicle exhaust inserted into the cabin. Then the tool will detect changes in CO gas levels and HC gas status in the cabin every 5 minutes 6 times. Sensor testing is carried out with a multimeter to measure the voltage on the sensor when it detects gas levels. Measurements are made by connecting the positive (red) cable on the multitester to the DO sensor leg. The following table shows the results of the MQ7 sensor voltage test:

Table 1. MQ7 Sensor Voltage Test Results

Trial To-	CO Gas Content (PPM)	Voltage (mV)
1	3,20	192,6
2	3,38	209,6
3	8,12	380,1
4	16,20	400,2
5	57,6	1.002
6	69,4	1.156
7	83,4	1.406

The following table shows the result of the MQ2 sensor voltage test:

Table 2. MQ2 Sensor Voltage Test Results

Trial To-	Status	Voltage
1	Normal	180,7
2	Normal	213,8
3	Normal	364,5
4	Danger	403,9
5	Danger	984,3
6	Danger	1.048
7	Danger	1.259

Test result for tools in the cabin, at this stage, the tool is tested directly on the vehicle cabin to find out whether it shows the result of CO gas levels and HC gas status in the vehicle cabin is also used gas analyzer as a calibration for the design that has been made. The following table shows the result of testing CO gas level in the automotive vehicle cabin:

Table 3. Test Results for CO Gas Levels in the Automotive Vehicle Cabin

Trial To-	CO Gas Rates On Building Plans (PPM)	CO Gas Levels in Gas Analyzer (%)	Buzzer	Power Window
1	5,72	0,00	OFF	OFF
2	7,88	0,00	OFF	OFF
3	12,75	0,00	ON	ON
4	20,96	0,01	ON	ON
5	30,88	0,01	ON	ON
6	45,95	0,01	ON	ON

The following table shows the results of the HC gas test in the Automotive Vehicle Cabin:

Table 4. Test Result for HC Gas Status in the Automotive Vehicle Cabin

Trial To-	HC Gas Status	Buzzer	Power Window
1	Normal	OFF	OFF
2	Normal	OFF	OFF
3	Danger	ON	ON
4	Danger	ON	ON
5	Danger	ON	ON
6	Danger	ON	ON

The Gas Analyzer display the result in percent (%) so it must be converted into PP< (Part Per Million) in the following way: 0.01%= 100 PPM= 0.01 x 10.000.

CONCLUSION AND FURTHER RESEARCH

There are two stages for the tool's design and construction: the first is to create the software, and the second is to create the hardware. CO and HC gas detector work when CO and HC gas leakage can be sensorized from the MQ7 sensor and MQ2 sensor. It will be sent to the telegram. When CO and HC gas is too high on the cabin of an automotive vehicle, so the buzzer will produce a sound beep. DC motors are represented as power window systems.

REFERENCES

Amrullah, M. (2020). Rancang Bangun Alat Pendeteksi Kebocorangas Karbon Monoksida pada Kabin Kendaraan dengan Sensor MQ7 berbasis Arduino. Skripsi, 128.

Hamdan, A. (2018, Desember 23). *Variabel Penelitian (Pengertian, Jenis, Ciri, dan Contoh)*. https://www.alihamdan.id/variabel-penelitian/

Indonesia, I. D. (2016, November 26). Keracunan Hidrokarbon. Retrieved Januari 15, 2022, from idai.or.id: https://www.idai.or.id/artikel/klinik/keluhananak/keracunan-hidrokarbon

Nurfauzi, A. (2020). Prototype Sistem CO Detector Pada Cabin Mobil. *Jurnal Pendidikan Vokasi Otomotif, 13*

Peraturan Pemerintah (2012). *PP No.55 Tahun 2012 tentang Kendaraan*. Jakarta

Setyawan, R., Dewanto, Y., & Zariatin, D. (2018). Prototipe Alat Deteksi Kandungan CO dan HC Dalam Kabin Kendaraan Menggunakan Mikrokontroler Arduino*. Jurnal Ilmiah Teknobiz, 8*(2).

Wibawa, I. N. G. P., Supardi, I. W., & Adnyana I.G.A.P. (2016). Perancangan Alat Ukur Gas Hidrokarbon (HC) dengan Menggunakan Sensor MQ-4 Berbasis Mikrokontroler AT89S52. *Buletin Fisika, 17*(1), 7-13.