The Design of The Monitoring Tools Of Clean Air Condition And Dangerous Gas CO, CO_2 CH_4 In Chemical Laboratory By Using Fuzzy Logic Based On Microcontroller

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Abstract: There are many phenomena that human are exposed to toxins from certain types such as of CO2, CO2 and CH4 gases. The device used to detect large amounts of CO, CO2, and CH4 gas in air in enclosed spaces using MQ 135 gas sensors of different types based on the three sensitivity of the Gas. The results of testing the use of sensors MQ 135 on the gas content of CO, CO2 and CH4 received by the sensor is still in the form of ppm based on the maximum ppm detection range of each sensor. Active sensor detects CO 120 ppm gas, CO2 1600 ppm and CH4 1ppm "standby 1" air condition with intermediate rotary fan. Active sensor detects CO 30 ppm gas, CO2 490 ppm and CH4 7 ppm "Standby 2" with low rotating fan output. Fuzzy rulebase logic for motor speed when gas detection sensor CO, CO2, and CH4 output controls the motion speed of the fan blower. Active sensors detect CO 15 ppm, CO2 320 ppm and CH4 45 ppm "Danger" air condition with high fan spin fan. At the gas level of CO 15 ppm, CO2 390 ppm and CH4 3 ppm detect "normal" AC sensor with fan output stop spinning.

1 Introduction

Currently, a major concern of scientists is global warming, largely due to huge emissions of carbon dioxide (CO2). Considered as one of the main greenhouse gases inducing a warming climate, CO2 concentration in the atmosphere is under special scrutiny of many weather services in the world. The program involves capturing samples of atmospheric air at the Assekrem station twice a week, using 2 special bottles of 1.5 litres. These bottles are then sent to the NOAA laboratory (Boulder-USA) to determine concentrations of major greenhouse gases: CO_2 in ppm, CH_4 and CO in ppm.[1]

In human life can not be separated from the Gas carbon monoxide Gas CO, Gas Carbon dioxide CO_2, and Gas Methane is CH_4 hydrocarbons. The odorless CO gas is very dangerous, Methane (Methane) is the simplest hydrocarbon in the form of gas. Pure methane is odorless, colorless, extremely flammable, asphyxian, non toxic and non corrosive. Burning one molecule of methane with oxygen will release one molecule of CO_2 (carbon dioxide). [2]

At certain depths below the earth's surface there are dangerous gases such as Carbon Dioxide (CO_2) and Methane gas (CH_4). While carbon monoxide gas (CO) can be produced from leakage or emissions of fuel used as a source of propulsion power from the generator set and room temperature. Third gas is very dangerous if accumulate in the room without air circulation is not good. Hazardous gases that accumulate will often be inhaled by the workers who are in the room. [4]

Health problems will arise if inhaled methane gas in high concentrations. The symptoms are oxygen deprivation, rapid breathing, increased pulse rate, decreased muscle coordination, increased emotion, nausea, vomiting, loss of consciousness, respiratory failure, and death. [4]

To solve the above problem, it is necessary to design the toxic detector of toxic monoxide (CO) gas, Carbon Monoxide (CO_2) and Gas methane (CH_4) gas as human safety from poisoning. This research was built for gas leak detection tool CO, CO_2, and CH_4 which work using MQ-7 Sensor. The MQ-7 sensor is a gas sensor that can detect vehicle exhaust gases in air carbon monoxide (CO) gas. If the CO gas is detected, the MQ-7 sensor will provide input (insert) to the Arduino output of the microcontroller which has three types of outputs, Namely LCD display (Liquid Crystal Display), Motor Fan, and buzzer. LCD function information Gas CO, CO_2 and CH_4 in ppm quantities. The LCD is used to provide information on the occurrence of gas leak indoors when the sensor reads CO_2, and CH_4 through microcontroller. Exhaust Fan is used to neutralize air conditions in the room according to sensor readings against harmful gas gases in ppm. Fan motor rotation works based on fuzzy logic during low, middle, and high conditions. The larger the hazardous gas gases detected by the sensor in ppm size the microcontroller will send the information to the fan fan circuit with high conditions, as well as the low conditions the microcontroller will send the information to the fan at low speed. The fan driver is used to neutralize the condition of the room by removing air inside the room when it detects CO, CO_2 and CH_4 gas in the laboratory and workshop room in safe, standby, alert and danger conditions.

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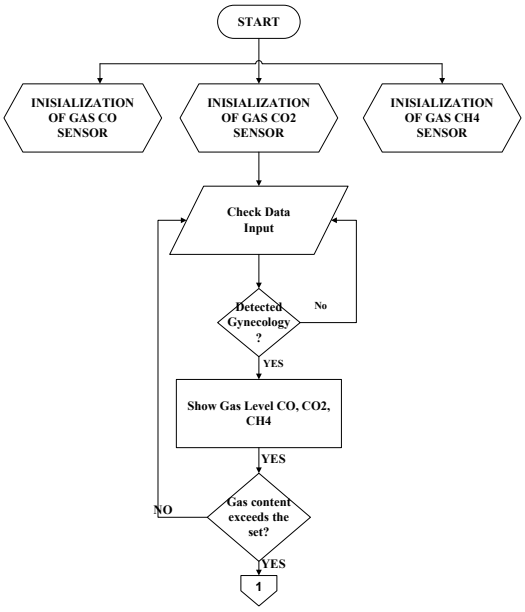
2. Experimental details

Stages done in this research is by the method of planning and design. Here is the design of CO gas detector using ATMEGA 8535. [4]
This CO gas leak detector will work with the MQ-7 sensor and MQ 135 is a gas sensor that detects exhaust gases in the air of Carbon Monoxide (CO), Carbon Dioxide (CO_2) and Methane (CH_4) gas. If the CO, CO_2 and CH_4 gases have been detected then the MQ-7 sensor will give input (insert) to the microcontroller, then from the microcontroller has four outputs, LCD (Liquid Crystal Display), Driver Motor fan, and buzzer. LCD is used to display information readings of sensor detectors CO, CO_2, and CH_4. Driver The fan motor is used to drive the fan blades when it is detected CO, CO_2 and CH_4 gases inside the room during Safe, Standby1, Standby and danger so that space will be neutralized toxic gas content in ppm. LCD gives message information to the user that there is a toxic Gas leak.

The driver acts as an additional link to connect between the microcontroller with the buzzer and the Exhaust Fan. Explanation of the flow diagram of the CO gas detector in the laboratory room Figure 1. the following:



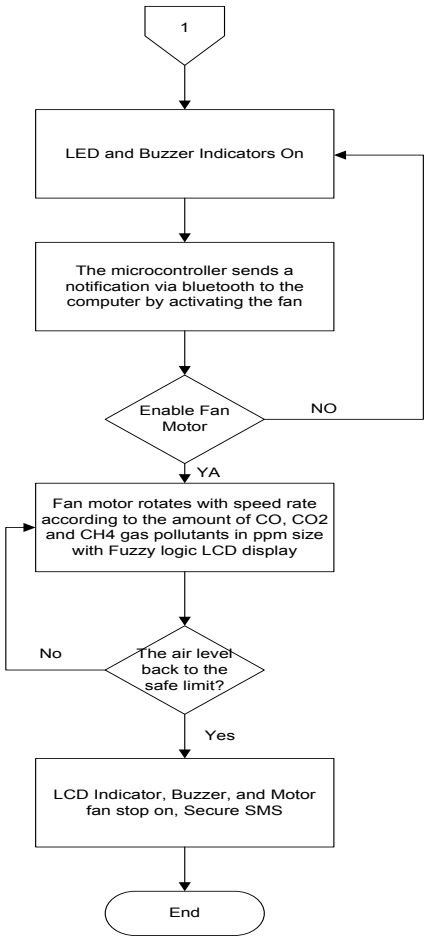


Fig. 1. Flowchart of How the Tool Works

The flow and work on the flow diagram is first to initialize the serial and then seen the input of the three gas sensors CO, CO_2, and CH_4 which will appear in gas levels. Then the sensor will work based on the smoke fumes detected by the MQ-7 and MQ-135 sensors. When the CO, CO_2 and CH_4 gases Active sensors detect CO 120 ppm, CO_2 1600 ppm and CH_4 1ppm air condition "standby 1" with medium spinning exhaust fan output. In active sensor detect CO 30 ppm gas, CO_2 490 ppm and CH_4 7 ppm "Standby 2" air condition with low rotating exhaust fan output. While the active sensor detects CO gas 15 ppm, CO_2 320 ppm and CH_4 45 ppm "Danger" air condition with High Spin Exhaust fan output. At the gas level of CO 15 ppm, CO_2 390 ppm and CH_4 3 ppm detected "normal" air conditioner sensors with the exhaust fan output stop spinning. To detect CO gas of 5 volt DC voltage sensor with ADC 0 - 1023 range for ADC value. For the detection of CO gas it is determined that the maximum value of the sensor to detect CO gas is connected to the microcontroller ADC at port D by 30 ppm [16]. From these provisions, the CO membership function for membership function is 0 - 30 ppm. So in order to scale the membership function accordingly ie 30 ppm then the ADC value must be divided by 34 which can be searched with the following equation: [5]

***ADC divider value* = *ADC Value*……[5]**
CO (ppm)

Information :
CO (ppm) = Levels maximum desired CO gas
ADC value = 1023
So, can we enter the value
ADC divider value = 1023 / (30 ppm)
ADC divider value = 34

The divisor value of ADC = 343.2 Metode Fuzzy

Rule evaluation process In this process the specified rules will be applied. Or it could be said function is to find the value of the fuzzy output of fuzzy input. Rule made to control the work of the sensor in detecting sensor in order to generate value in accordance with the expected output. The process is a fuzzy input of the process fuzzyfication included in a rule that has been created to serve fuzzy output. There are several methods of decision making in fuzzy logic Mamdani among which methods Figure 2.[2]. The following picture:

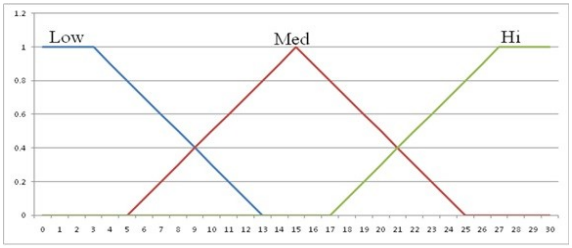


Fig. 2. Decision Methods Mamdani

Implications functions used in decision-making with Mamdani method by using MIN and in doing composition using MAX. The composition method is often called MAX-MIN. decision with Mamdani method. Here is a ten-rule evaluation that can be determined:
Table 1. Rule Evaluation
The following is stage of detection

1. If CO is low and CO_2 is low and CH_4 is low then condition is normal, blower OFF.
2. If CO is low and CO_2 is medium and CH_4 is low then blower is SPD_1.
3. If CO is medium and CO_2 is low and CH_4/CH_4 is low then blower is SPD_1.
4. If CO low and CO2 is low and CH_4/CH_4 medium then blower is SPD_1.
5. If CO is medium and CO_2 medium and CH_4/CH_4 is high then blower is SPD_2.
6. If CO is medium and CO_2 high and CH_4/CH_4 is medium then blower is SPD_2.
7. If CO high and CO_2 is medium and CH_4/CH_4 is medium then blower is SPD_2.
8. If CO is not low and CO_2 high and CH_4/CH_4 is high then blower is SPD_3.
9. If CO is high and CO_2 is not low and CH_4/CH_4 is high then blower is SPD_3.
10. If CO is high and CO_2 is high and CH_4/CH_4 is not low then blower is SPD_3.

Is not low , mean high or medium
SPD = Exhaust fan rte

3. Results and discussion

Based on tests conducted with test samples consisting of sources of pollutants ie gas originating from clean air, vehicle fumes, livestock manure and cigarette smoke for CO and CO_2 sensor testing, and gases derived from animal waste to compute the CH_4 sensor response, the following

Table 1. test for each input response.

No	Type of Gas	Clean air (ppm)	Vehicle emission (ppm)	Animal waste (ppm)	Cigarette smoke(ppm)
1	CO	2	1150	159	9206
		2	1132	156	9340
		3	1211	153	9604
		5	1256	154	9113
		7	1252	148	9480
Average value :		**3.8**	**1200.2**	**154**	**9348.6**
2	CO_2	320	1750	390	5200
		300	1671	387	5440
		295	1455	391	5105
		310	1723	387	5201
		312	1559	391	5130
Average value :		**370.4**	**1631.6**	**389.2**	**5215.2**
3	CH_4	1	90	70	25
		2	87	73	23
		1	89	71	24
		2	88	73	22
		1	98	72	21
Average value :		**1.4**	**90.4**	**71.8**	**23**

The result of the room condition test on the CO gas, CO_2 and CH_4 gases in the Graph using Fuzzy Logic Rulebase as described below:

1. High CO_2, CH_4 Low and CO High Standby conditions

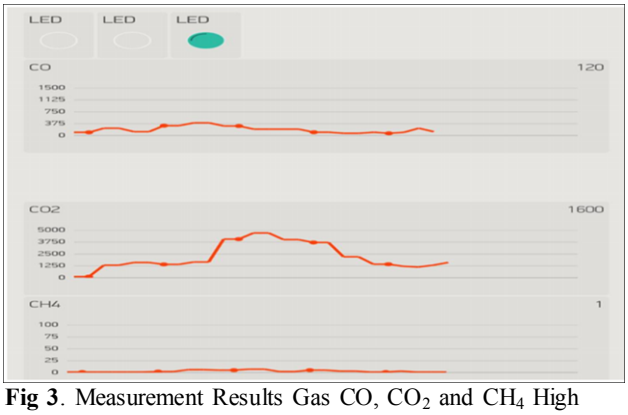


Fig 3. Measurement Results Gas CO, CO_2 and CH_4 High Standby conditions

2. Condition of CO_2 med, CH_4 Low and CO med standby output 2

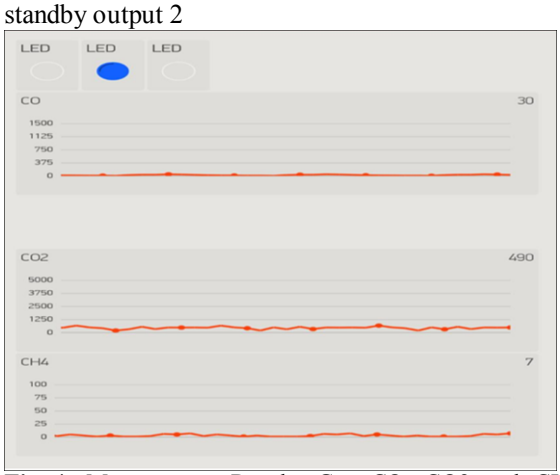


Fig 4. Measurement Results Gas CO, CO2 and CH4 Standby conditions

3. Condition of CO_2 med, CH_4 high and low CO output hazard

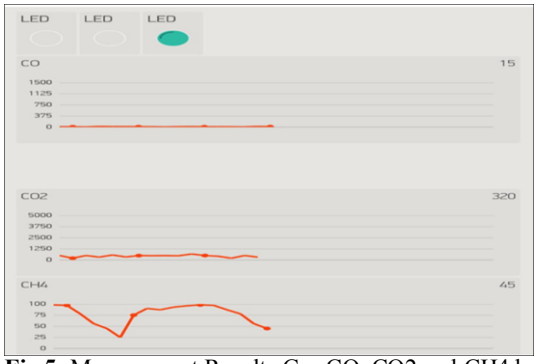


Fig 5. Measurement Results Gas CO, CO2 and CH4 hazard conditions

4. Low CO_2 conditions, Low CH_4 Low and low CO output are safe

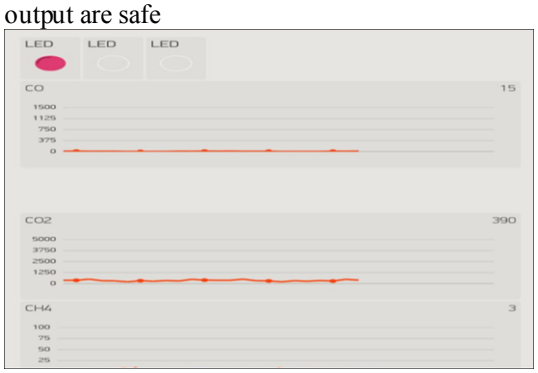


Fig 6. Measurement Results Gas CO, CO2 and CH4 Safe conditions

4 Conclusion

In conclusion, this study shows that the test results of the system when the active sensor detects CO 120 ppm gas, CO_2 1600 ppm and CH_4 1ppm air condition "standby 1" with a medium spinning exhaust fan output. In active sensor detect CO 30 ppm gas, CO_2 490 ppm and CH_4 7 ppm "Standby 2" air condition with low rotating exhaust fan output. While the active sensor detects CO gas 15 ppm, CO_2 320 ppm and CH_4 45 ppm "Danger" air condition with High Spin Exhaust fan output. At the gas level of CO 15 ppm, CO2 390 ppm and CH_4 3 ppm detected "normal" air conditioner sensors with the exhaust fan output stop spinning.

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