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The Use of MQ6 and Microcontroller of ATMega 2360 as a Leaks Detection Device of Liquid Petrolum Gas (LPG)

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Abstract: *In essence, an explosion from LPG gas cylinders can be avoided if precautions are taken early, when gas leaks occur through cylinders, regulators, hoses or gas stoves. Along with the development of increasingly modern science and technology, a security system is developed by providing an Early Warning System. If this system detects a system leak, it will give a signal to the LCD or buzzer. A gas leak gives a signal to the sensor to work, MQ-6 and a 2360 microcontroller to work detecting a gas leak which is then read on the LCD screen, and in certain circumstances the buzzer will sound. And turn off the relay so that the inlet voltage to supply the solenoid gas valve is cut off, and the gas line is closed. The maximum distance that the gas sensor can detect in this paper is 18 cm, if the voltage on the sensor is greater than 2.33 volts, the LCD will give a signal of a gas leak and the buzzer will sound.*
Keywords: *gas leakage; early warning; MQ-6; ATMEGA 2360 microcontroller*

I. Introduction

The number of fires and accidents caused by leakage and explosion of LPG (Liquid Petroleum Gas) lately, becomes a scary thing for most of the user community, in essence the explosion can be avoided if there is prevention that is done early, when gas out or when a gas leak occurs through a tube, regulator, hose or from the stove itself. Along with the development of increasingly modern science and technology in the 21st century, a security system was developed by providing an early warning system (Early Warning System) to give a sign if there is a smell of gas around the house, especially gases originating from LPG gas. If this system detects a leak and smells of LPG gas, the system will give a signal in the form of an alarm or buzzer where if there is a leak that smells of LPG gas the system will work and an early warning alarm of the system will turn on.

II. Review of Literature

In the previous paper for household gas leak detection devices using the ATMEGA 8 microcontroller, the sensor works if the gas level is 2000 ppm, the buzzer as an alarm will sound indicating a gas leak occurred, and the LCD will display a written warning of gas leak (Evalina & A Azis, 2020).Development of a wireless leak detection system using various sensors and microcontrollers that make the system Portable and nondestructive techniques. In this system parameters such as Humadity, temperature, pressure, sound detection around gas leaks are detected using sensors and microcontrollers (Adsul et al., 2017)

A new approach in the detection of LPG under ambient conditions, temperature and humidity that is kept constant during performance, integrated sensor fabrication is used to test different concentrations (in ppm) of LPG (Vasantakumaar et al., 2018). Design and application of SMS-based industry / home gas leak monitoring & detection system, this system is designed and implemented using MQ-9 gas sensors and microcontrollers verifying gas leakage, warning of gas leakage sent via SMS to homeowners (Ghosh, 2019), This research very important to overcome the negative impact of the occurrence of gas leaks in the home.

2.1 MQ-6 gas sensor

The MQ6 gas sensor is a sensor that has a fast response to LPG (Liquid Petroleum Gas), is stable and durable and can be used in a simple drive circuit. MQ-6 gas sensors are commonly used in equipment to detect gas leaks in household and industrial activities, which are suitable for detecting LPG, iso-butane, propane.

2.2 Arduino Mega 2560 microcontroller

Arduino is a microcontroller based board or open source electronic circuit board in which there are main components, namely a microcontroller chip with AVR type. The microcontroller itself is a chip or IC (integrated circuit) that can be programmed using a computer. The purpose of embedding the program in the microcontroller is so that the electronic circuit can read the input, process the input and then produce the desired output. So the microcontroller serves as the brain that controls the input and output processes of an electronic circuit. In this paper the Arduino Mega type 2560 is used, the Arduino Mega 2560 is an Arduino-based microcontroller development board using the ATmega2560 chip

2.3 Selenoid Gas Valve

Solenoid Valve is a tap that works electromechanically. The tap will actively work if the input of the solenoid valve circuit gets a signal which will activate the work of the valve contained in the electric tap. In this study, the solenoid valve functions to open and close the tap.

2.4 Buzzer

Buzzer is an electronic component that functions to convert electrical vibrations into sound vibrations. Basically the working principle of the buzzer is almost the same as the loud speaker, so the buzzer also consists of a coil mounted on the diaphragm and then the coil is flowed so that it becomes an electromagnet, the coil will be attracted in or out, depending on the direction of the current and the magnetic polarity, because the coil mounted on the diaphragm then each movement of the coil will move the diaphragm back and forth so as to make the air vibrate which will produce sound, buzzer is used as an indicator that the process has been completed or an error occurs in a device.

2.5 Power supply circuit

The power supply circuit is used to convert the PLN 220V AC voltage into a 5 volt DC voltage. (Azis et al., 2019) The 5volt DC will be used as a voltage source for the microcontroller device so that the input and output connected to the microcontroller will work. (Evalina et al., 2019)

2.6 LCD (Liquid Crystal Display)

LCD is a display that is used to display writing in the form of numbers or letters as desired (according to the program used to control it). The LCD used is a 2x16 character LCD (2 rows of 16 columns), with 16 pin connectors. LCD (Liquid Crystal Dispalay) is often interpreted in Indonesian as a liquid crystal display is a type of display media that uses liquid crystal as the main viewer.

2.7 Liquid Petroleum Gas (LPG)

Liquid Petroleum Gas (LPG) is gas produced from oil refineries or gas refineries, the main components of which are propane (C3H8) and butane (C4H10) containing about 97% and the rest is filled with Pentane gas (C5H11) liquefied. Pertamina began marketing LPG in 1969 with the trademark LPG. Comparison of the composition of propane and butane is

30:70. Mercaptane is commonly added to LPG to give a distinctive odor, so that gas leaks can be detected quickly. Based on the composition of propane and butane.

III. Research Methods

In hardware design, the gas leak detection device used is the MQ-6 sensor and the ATMega-2560 microcontroller. The output of this tool is a 2x16 LCD as the display output on the tool, the buzzer as the sound output from the tool when a gas leak is detected, and the selenoid gas valve will close the gas channel. The test is started by measuring the pressure of the gas first. When the sensor detects a gas leak, the buzzer will make a sound, and the LCD 16x2 will display the information of a gas leak, (Nag et al., 2016) then the solenoid gas valve will close the gas channel, so that the gas no longer enters the stove or the gas stove will die.

The workings of this tool are when the gas is detected by the MQ-6 sensor, and reaches a predetermined limit, then the gas sensor will work, giving analog signal information to Arduino via analog input pins. Furthermore, the analog signal is converted into a digital signal with a converter that is on Arduino and then it will be processed in accordance with the logic of the program. After that Arduino will give commands to the buzzer as sound output, the LCD will display the status of the gas leak and and the solenoid valve closes the gas channel by disconnecting the relay (Kaveeya et al., 2017)

In the Programming Software Design using arduino.ide software (Eltom et al., 2018) based on C. The program is included in the arduino mega board as a controller of this tool so that the microcontroller can carry out the commands written in the program. When the program is run, the microcontroller will do all the commands in the program, such as the initial configuration of the LCD which then displays the initial conditions or standby conditions. When the sensor detects a gas leak, the display on the LCD will change in the form of a notification if there is a gas leak (Shingan et al., 2018). The picture of the whole series of experiments is shown in Figure 1 below:

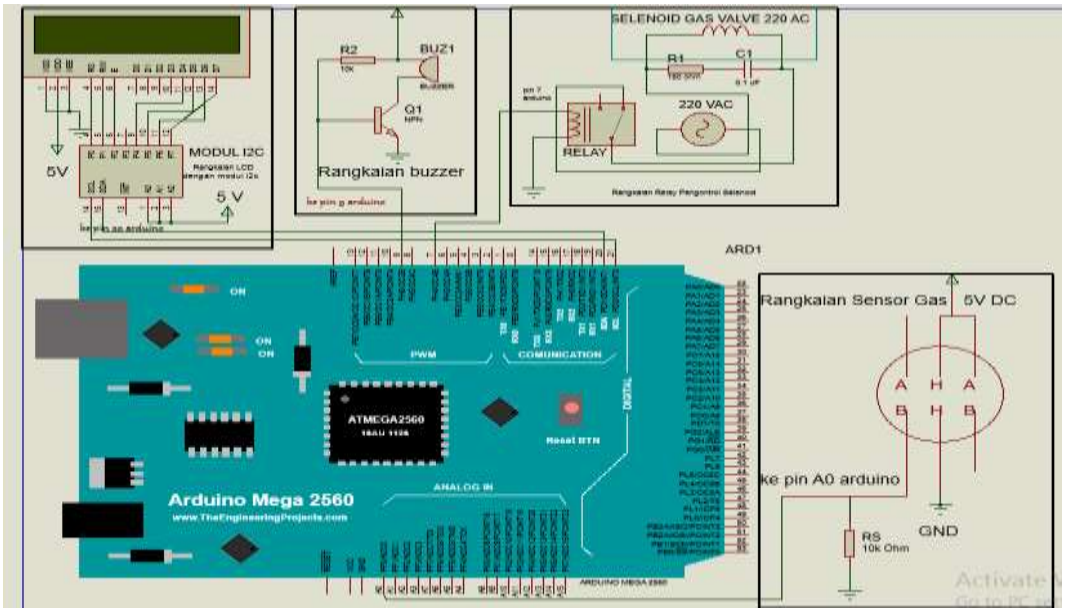

***Figure 2**. Overall Sequence*

IV. Result and Discussion

From the results of tests carried out it can be known the safe status or unsafe status which can be seen from the LCD display and the sound of the buzzer. The sensor voltage test is carried out to determine the working voltage of the sensor when there is a gas leak and in standby condition. This test is done by programming the microcontroller as needed, which then displays the voltage sensor on the LCD. The results of the test can be seen in table 4.1. below this.

Table 1. Sensor Voltage Test Results

Voltage Sensor (volt)	Display on the LCD
0.24	"Safe Status"
1.73	"Safe Status"
2.18	"Safe Status"
2.33	"Leaking Status"
3.38	"Leaking Status"

The gas leak is displayed if the sensor voltage is greater than 2.33 volts. Sensor reading distance testing is done to find out how far the distance can be detected by the gas sensor and how long it will take the sensor to detect the leak.

Table 2. Sensor Reading Distance Test Results

Distance (cm)	**Sensor Response**	**Time (Second)**
2	Detected	4.48
4	Detected	8.06
6	Detected	10.88
8	Detected	12.24
10	Detected	12.92
12	Detected	17.06
14	Detected	22.70
16	Detected	37.61
18	Detected	45.26
20	Not detected	-

V. Conclusion

The tool works well, when the gas sensor detects a gas leak, the sensor will give a command to turn on the buzzer, display the LCD, and turn off the relay so that the input voltage for supplying the selenoid gas valve is cut off, and the gas line is closed. The maximum distance that the gas sensor can detect in this paper is 18 cm, if the voltage on the sensor is greater than 2.33 volts, the LCD will give a signal of a gas leak and the buzzer will sound.

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