Implementation and design gas leakage detection system using ATMega8 microcontroller

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Abstract. In Indonesia and many countries for economic reasons and green energy LPG is widely used for cooking. This paper show implementation and design gas leakage detection system. The main objective of the project to build a gas LPG leakage detector using an LPG gas sensor and micro-controller. It developed a security system by providing an early Warning System to give a sign if there is a smell of gas around Home. If this system has been the existence of leakage and smell of LPG gas, then the system will give a sign of alarm or buzzer where if there is leakage of gas that smelling the LPG system will work and the early warning alarm of the system. That the presence of gas leakage signals on the sensors to work, the MQ-6 is the gas Sensor used to detect leakage gas LPG. The tool is designed to detect gas leaks that are then legible on the LCD screen and alarm, and in certain circumstances, the buzzer will sound. This MQ-6 sensor test is performed by measuring the sensor output with the Atmega8 microcontroller when the LPG gas is detected and then writes it on the LCD screen. This test was conducted to determine the contribution of the MQ-6 sensor. It becomes essential to protect gas leakage from damage and accident.

1. Introduction
It is very important to bring technology into home, by making home smart and safety, it becomes important to protect it from damage and accident [1], many countries for economic reason used LPG (Liquid Petroleum Gas) is a mostly used fuel in the world, people cannot know that the gas is leaking, it is a scary thing for most of the gas users. To avoid gas leakage is needed the fire detection and security system is needed as well the gas leakage detection system, of automatic security system, can make safe people from dangerous blast accidents and sometimes prevent the accident [1, 2].

In essence, the explosion can be avoided when the prevention is done early, when the gas comes out or when the gas leakage occurs through the tube, regulator, hose or the stove itself. Along with the development of more modern science and technology, then a security system is developed by providing an early warning system to give a sign if there is a smell of gas [2–4]. Especially from LPG gas. This design has a goal as a deterrent or early warning system where the goal is to prevent casualties or loss of material or non-material caused by a gas leak where the gas leakage can cause Fire when the LPG gas is not used carefully so that the level of accidents from the leakage of LPG gas can be reduced.

Companies or industries that are engaged in the oleochemical indeed booming, because community needs will be incessant oil. PT. Musim Mas is one company that has been the focus of the industry moving in the oleochemical or Palm oil processing industry into chemicals such as fatty acid (fatty
acid) and Glycerin. The industry, in the process of doing the processing of palm oil, has equipment that supports the company’s goals in order to produce a good product can be achieved. As for the equipment are a number of industrial machinery.

Along with the development of Science and Technology in particular automation system, PT. Season Mas has largely adopted the Mechatronics-based industrial machinery and automatic. However, the many automatic machines that are implemented on palm oil processing jobs in this industry are on the other side of which, according to researchers less effective in the workmanship of a process that is located on the process control of the heating system of the water jacket.

The water jacket is a system that functions as a water heater using the heat energy of the steam generated from combustion system where water is heated above that will be pumped to the outside pipes throughout the channel streamed palm oil that has processed previously in which case this is done to prevent freezing in the pipe oil its channels. On the process of this work still do manual work processes so less effective done because to do this job should still stand by in-room control and is monotone remains mindful of how the State monitors on display temperature of the water jacket that would do the process of opening or closing of the valve with the degree suggested by the needs of the system. In addition, the process of opening and closing a valve made by workers also spent a long time, while the needs of the heating systems should be immediately done. In addition, when arriving the distribution workers’ room must be wary of the challenge of a steam explosion overpressure sound reason can lead to a heart attack for the workers concerned.

2. Literature review

The mouth of the cylinder and the pipe are placed in front of the sensor. The solenoid is used to close the gas flow, while Arduino acts as a controller, Wi-Fi module uses ESP module, so Arduino Uno is connected, IoT devices are connected with Arduino signal. This process can prevent gas leakage because it is connected to Twitter, so the neighbors can find out if there is a gas leak [5].

Sahil Adsul, et al [6] describes that development of leakage detection system, gas leakage occurs because the equipment used is old, this paper presents leak detection with several sensor systems namely sound detection, pressure, temperature, gas leakage, zigbee wireless module used to transmit data to feel the gas leak. The MQ6 sensor module is used, 3 sensors are used to detect cigarette and cooking smoke whose concentration is 200-10,000 ppm LPG namely 20 kHz microphone, 40 kHz ultrasonic receiver and 40 kHz ultrasonic module.

Katole [7] study is based on a system used to detect many dangerous gases with Arduino coordination. We can change the systems currently available that are regulated by industrial estates and we can use systems at home and factories. The main objective of the activity is to design a gas leak-based detection system with Arduino, using gas sensors, the toxic gases like butane (also known as LPG), methane and carbon monoxide are sensed and displayed on the LCD display.

Study present the MQ6-used gas sensor is controlled with Arduino Uno R3 as the case of gas sensor gas leakage MQ6 will detect the gas leakage occurring so that there will be a voltage change in the gas sensor and will be read by the Arduino and will Be Ordered the LCD and GSM signal there is a gas leakage [8].

Anindya Nag, et al discusses novel sensing approach for LPG leakage detection: Part I-Operating Mechanism and Preliminary results, the paper present a new approach in the detection of LPG at ambient conditions, temperature and humidity conditions were maintained fixed during experimentation, the fabricated integrated sensor was used to test different concentrations (in ppm) of LPG undercoated and uncoated conditions to analyze the difference in response in two situations [4].

Onengiye M, et al discuss detection and monitoring gas leakage with implementation SMS Based, this system is designed and implemented using MQ-9 gas sensor and embedded microcontroller test was conducted to verify if the sensor can trigger, from the test gas detector sensor the presence of gas leakage and sms alert sent to the service station or to the owner [2].
3. Methodology
Design system takes two major part by hardware module and software module, the hardware module is designed by schematic diagram, the software module is developed using C-language, in case of gas leakage [9], the gas sensor will detect the gas leakage and will then make the sensor output have a certain voltage value (analog voltage) (Figure 1). When the output voltage of the curtain has exceeded the specified limit value (settings) then this condition will microcontroller automatically activated the Buzzer to sounding to mark the people closest to the place is accompanied by an alert on the LCD screen of the device. This paper will be discussed how the MQ-6 gas sensor using the ATmega8 microcontroller is used as the detection of LPG gas leakage.

![Figure 1. Overview of the system](image)

**Power supply unit**: power supply is a device used to supply power to all chip and component of the system, the supply is regulated for constant +5 volt DC [10, 11], the Arduino Uno microcontroller based system requires a 9 ~ 12 V power supply with a maximum current of 1A. On the Arduino board itself 9 ~ 12 V voltage will be changed to +5V voltage.

**MQ-6 sensor unit**: The MQ-6 gas sensor is a sensor that has a fast response to leakage gas LPG (liquid petroleum gas) and can be used in a simple set of drives, MQ-6 sensors commonly used in equipment detecting gas leaks in household and industrial activities [1].

**Microcontroller ATmega8**: A microcontroller is often called a single microcomputer chip, it means that in a microcontroller IC there is used for microcontrollers to work, namely include microprocessor, ROM, RAM, I/O and clock as it is owned by a computer PC, given the packaging is only a chip with a relatively small size. Atmega8 is low power with 8 bit CMOS, a microcontroller that enables system designers to optimize power consumption versus processing speed. ATmega8 incorporates many instruction sets with 32 registers, all register amounting to 32 are directly connected to the logic unit arithmetic, which allows two independent registers to be accessed in one single instruction and executed in one cycle [2].

**Buzzer**: is a device that can emit a loud noise when active. Generally, buzzers are used to give signals to indicate certain conditions. In this experiment, Bel is used to indicating the condition of the detector has detected an LPG leak that [2], on this circuit, the buzzer will sound if there is a gas leak.
Resistor: Resistors are electronic components that function to inhibit or limit the flow of electricity flowing in an electronic circuit. As the function of the resistor which is as the name implies is resistive and includes one electronic component in the category of passive components. The function of the resistor here is to adjust the lighting on the LCD.

LCD: is a display the text of leakage gas, The LCD used is a 2 x 16 character (2 lines 16 columns), with 16 connector pins.

4. Result
The implementation a design gas leakage detection system takes two major part which is hardware and software as early explained, in hardware section power supply unit was designed, built and tested with multimeter to ensure supply constant of +5 volt DC to system, The MQ-6 sensor was tested by connecting the output pin to analog pin input port of ATmega8 microcontroller, the cigarette lighter gas was used to test the performance of the gas sensor when the gas is detected LCD show text leakage and security alarm triggered by microcontroller, can be seen in Figure 2.

![Figure 2. Testing of gas leakage detection](image1)

From the results of the experiment, if the MQ-6 detects the gas level exceeds 2000 ppm, the buzzer will sound along with it being detected as a leakage gas. But when the gas levels are reduced to less than 2000ppm, the buzzer will stop sounding, it is seen in Table 1.

| Gas level (ppm) | Buzzer | LCD |
|----------------|--------|-----|
| 0              | off    | Off |
| 1598           | off    | Off |
| 1765           | off    | Off |
| 1870           | off    | Off |
| 2540           | on     | Leakage |
| 3450           | on     | Leakage |
| 5087           | on     | Leakage |
| 9077           | on     | Leakage |
| 1970           | off    | Off |
5. Conclusion
After testing on a tool designed to detect the leakage of LPG gas by using an MQ-6-based ATMEGA8 sensor, the conclusions are, Tools designed to detect gas leaks on the LCD screen and the buzzer will sound. This MQ-6 sensor test is done by measuring the sensor output with the ATmega8 microcontroller when the LPG gas leakage is detected and the gas level is 2000 ppm, it will be automatically written on the LCD screen and the buzzer will sound. However, when the gas levels are reduced to less than 2000 ppm, it will be automatically will disappear on the LCD and the buzzer will stop sounding. This test was conducted to determine the contribution of the MQ-6 sensor. It became important to protect gas leakage from damage and accident.

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