Intelligent LPG Gas Leak Detection Tool with SMS Notification

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Abstract. Gas is a molecule that is not bound, formless, invisible and can turn into search or solid at certain temperature pressures. LPG gas is one of the needs for industry and household needs, namely for cooking. LPG gas in Indonesia is the cause of many fires, a factor that often causes LPG gas fires is a damaged gas regulator. Therefore prevention and security are needed to minimize fires. Seeing this and given the technological developments, an intelligent Arduino-based device was created that was able to overcome this problem. This tool is equipped with MQ-2, SIM800L, and buzzer gas sensors. In an embedded device the system that can convert input data received from the sensor MQ-2 sensor works to detect propane and butane gas, then the system will send the actual data in the form of short messages (SMS) to the mobile number that has been registered into the system. Besides being able to send SMS the system also emits a sound that is generated from the buzzer.

1. Introduction

The use of gas fuel in Indonesia is now a major requirement for household appliances. LPG (Liquefied Petroleum Gas) / LPG is used as fuel for cooking, besides that the use of LPG in the present is very economical, especially for households, not only cheap but also easy to use and easy to use, easy to use, LPG gas for the Indonesian people. The LPG gas usage program is the government’s movement to divert subsidies from Kerosene to Gas because of cheaper gas prices. Using LPG gas in their daily lives, especially in terms of cooking, can make cooking products healthier, because the fire produced from LPG gas itself is a clean fire, so it does not need to produce as needed using resistant oil [1]. For this reason, there are things we need to question when using LPG gas in terms of safety. This results in a very volatile gas that is very arising, which is very likely to be the cause of a fire. Normal leakage gas may be easily removed by smell, but if the leaky gas seeps under the carpet or electrical installation it will be very difficult to detect by the sense of smell of humans. In addition, LPG gas is also very sensitive and flammable, so that it is easy to occur which is not indiscernible by human olfactory, then the fire source is lit, then this will be the cause of increasing hazards obtained [1] [2]. The number of deaths from the explosion of gas cylinders has increased in recent years. The cause of the explosion was because the old valve, the regulator was damaged and also the biggest reason for causing damage due to gas which was a challenge in the gas cylinder. For this reason, there is a serious problem with this gas leak [3]. The biggest gas accident in the world is the Bhopal gas tragedy in India in 1984 which killed thousands of lives [4]. Due to the very sensitive and flammable nature of the gas, special attention is needed for this type of fuel. Therefore we need a system that can
help save the gas when sending information immediately [5]. Therefore an LPG Gas Leak Detection Smart Tool was made with SMS Notification, which is equipped with gas sensors, buzzers and GSM modules that will help prevent gas leaks and provide sirens then send a notification message to the owner so that the dangerous gas leaks can be overcome and anticipated as early as possible. In making this tool is needed, among others.

1. **Sistem Embedded**

Embedded systems or embedded systems are computer systems designed to carry out certain tasks that are integrated with hardware [6]. One platform that supports embedded systems is Arduino. Arduino was created to simplify the circuit process and microcontroller programming so that it becomes easier to learn. Arduino is compiled on an Arduino IDE software. This software is the one that proclaims machine language to be the language of logic to do the tasks we command. In this study, the Arduino that we use is a type of Arduino Uno R3. With Arduino, researchers can assemble devices that have systems that can detect gas.

2. **Gas Sensor MQ-2**

He uses of the MQ-2 sensor is for the detection of LPG gas, LPG gas consists of propane gas and butane. The sensitive material used in the MQ-2 gas sensor is a tin oxide (SnO2). If a gas leak is detected, the sensor conductivity rises with the detection range of the MQ-2 sensor is 200 - 5000 ppm [2] [4]. This sensor is used to detect gas, i-butane, propane, methane, alcohol, hydrogen, and smoke. In this system, sensors are used to detect LPG gas.

3. **GSM sim800l Modul**

The GSM module with type SIM800L is a module for sending actual data from the system to the SIM card with a GSM network. This module can be used in conjunction with Arduino, which makes it easier for users to create programs related to sending and receiving SMS messages.

4. **Buzzer**

In addition to sending data in the form of short messages or SMS, the tool will also issue a sound generated by the Buzzer. The buzzer is a device that can emit a sound when active. In this series, the buzzer is used as a marker indicating that will sound when the gas leak detector detects a gas leak.

2. **Methodology**

In this study it can be described how the tool can work to capture the gas received by the sensor, then the sensor is processed in an Arduino program that can display data in the LCD, emit sound and send a short message to the registered mobile number. The scheme can be seen in the block diagram in figure 1.

![Block Diagram](image-url)  
**Figure 1. Block Diagram**

From the picture above it can be seen that this tool has an input device (input device) consisting of a gas sensor and an output device (output device) which consists of an LCD, GSM Module, and buzzer. The way this tool works is when it is turned on, the sensor will work to transfer LPG gas and send data...
according to the LPG gas level it detects. The higher the LPG gas is detected, the higher the voltage released. When the sensor output is moved the presence of gas, then Arduino will activate, and activate the buzzer and display the writing on the LCD stating the gas is high (high), which means there has been a gas leak, then the GSM SIM800L module will send a notification message to the handphone number specified in the program. However, if the sensor does not detect a leak, the sensor will not remove the output, and the sensor will continue to work until it is proven that there is an LPG gas leak. The system design in this study is described in the form of a flowchart to facilitate the reading and understanding of the system that will be made in this study. When the program is run the system will immediately detect LPG gas detected by the sensor. Then the Arduino microcontroller will read LPG gas through an LPG gas sensor. If it detects a gas leak, the red LED will light up, the buzzer will activate, then the system will send a notification message stating that there has been an LPG gas leak. If no LPG gas leak is detected, the system will continue to detect the gas level through the LPG gas sensor until it detects an LPG gas leak. System flow can be seen in Figure 2.

3. Result and Discussion

After conducting research and analyzing to produce, make and test the cases submitted in this final project, the results of this case study on the system and this tool can help humans to increase proven LPG gas reserves and provide assistance to their owners that they have LPG gas leak in the form of an alarm is also sent a message in the form of an SMS to the owner. While the circuit and cabling of this
tool will open a box that will be displayed as follows. This tool is equipped with a 16x2 LCD as a display to display the work process of the tool itself. Then the buzzer is active as an alarm marker in the event of a gas leak. And also equipped with the gas sensor itself, in this case, the MQ-2 gas sensor. This tool is also equipped with 3 complete LED lights - also a green power light that indicates the device is on, a yellow LED that indicates the active device is detecting the existing LPG gas levels, also a red LED that indicates the danger that gas leak LPG. Then this tool is also equipped with a GSM module, SIM800L, which functions to send SMS messages in the event of an LPG gas leak. The form and format of sending SMS messages from this tool can be seen in Figure 3.

Figure 3. visual tool
The way the system works and this tool is, first when the system is turned on and this tool will immediately detect the gas content, using a sensor that is designed to be able to detect LPG gas, namely the MQ-2 gas sensor. Then each LPG gas level detected by the sensor is directly processed or converted into an analog signal. Then the analog signal will be sent directly by the MQ-2 sensor to Arduino. Because the analog signal to be sent is a number of LPG gas levels detected by the MQ-2 sensor. Then this analog signal will later become the Arduino working parameter. Does the gas level exceed the limit or not.

If the level of LPG received by Arduino exceeds the predetermined limit of 5000ppm (part per million), then the Arduino will directly control the other connected ones, namely relay, buzzer, and SIM800L, by sending commands to the relay to turn on the LED (Light Emitting Diode) red which indicates danger. Then Arduino sends commands to control the buzzer to be active, to give an alarm signal as a marker in the form of sirens that there has been a leak of LPG gas that has exceeded a predetermined limit. Finally, Arduino will instruct the SIM800L module to send an SMS message to the owner, to provide information about leaked LPG gas.

However, if the gas content in the form of an analog signal received by the Arduino from the MQ-2 gas sensor does not exceed the limit of 5000ppm, then Arduino will not control other components. Or in other words, the system and this tool will work normally as when the initial system was turned on, which is detecting the existing level of LPG gas. Why in this case did the author make the gas parameter limit leak at the level of 5000 ppm? Because based on the MQ-2 gas sensor technical data, the range that can be measured by the MQ-2 gas sensor against LPG type gas ranges from 200ppm to 5000ppm. Therefore, in this case, the authors set a maximum limit of the level of LPG gas leakage at 5000ppm.
In this system and tool to enter the cellphone number for sending SMS messages, the author makes it by entering the destination number directly on the syntax code created in the Arduino IDE. In other words, the destination number cannot be replaced automatically except by directly replacing the code syntax that has been created (loading code).

In addition, the cellphone number that is the destination for sending SMS messages in the event of an LPG gas leak can only be entered by one cellphone number. In other words, the system and this tool will send an SMS message that the LPG gas leak notification is limited to only one destination mobile number.

In testing the sensor is done in two stages, namely, the testing phase in the room (closed) and the outdoor testing stage (open), to see the performance of the gas sensor MQ-2 itself. Given that the MQ-2 gas sensor is the main indicator of the work of this system and tool. The results of the testing of the MQ-2 gas sensor are as follows.

1. Indoor testing

| No | Distance       | Gas Level Detected | Percentage of Gas Detected |
|----|----------------|--------------------|-----------------------------|
| 1  | 1 – 1.5 Meters | 200 – 457 ppm      | 2 – 4 %                     |
| 2  | 0.5 – 1 Meters | 237 – 1027 ppm     | 2 – 10 %                    |
| 3  | 0 – 0.5 Meters | 459 – 7102 ppm     | 4 – 70 %                    |

2. Testing in an open room

The results of this test are that the sensor is unable to detect the presence of leaky gas levels unless the gas leak point is attached to the MQ-2 gas sensor, the sensor will detect the presence of gas with a level of 200-4000 ppm, or in percentage 2 - 40%.

This literature review aims to identify and analyze the trends, datasets, methods and frameworks used in the topic of attribute independence assumption assumptions on NB between 2010 and 2018. Based on the inclusion and exclusion criteria designed, it shows 71 study studies of attribute independence assumptions on the published NB between January 2010 and December 2018 are investigated in this literature review have been conducted as a review of systematic literature. A systematic literature review is defined as the process of identifying, assessing, and interpreting all available research evidence in order to provide answers to specific research questions.

The results of this study identified three of the most commonly used and influential framework methods in the topic of attribute independence on the NB. They are Menzies et al. Framework, Lessmann et al. Framework, and Song et al. Framework. They are Langley et al [20], Friedman et al [2], and Wu et al [28].

4. Conclusion

Based on the results of research, design, and testing of systems and tools, the authors obtain conclusions as follows:
1. This system and tool works as expected, and is able to detect LPG gas leaks that occur within the detection radius of the MQ-2 gas sensor which is attached to the system and the device, which is between 50 cm - 80 cm and placed in a relatively closed area.

2. With this system and tool, the people or people who use it feel safe and comfortable. In other words, do not worry about the danger if there is an LPG gas leak that is unknown to the owner. Because the system and tool are able to work in accordance with the second objective of the research that the author wrote in chapter 1, this system and tool can send information to the owner if an unknown LPG gas leak occurs through an SMS message sent to the owner's handphone.

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