



SMART SYSTEM SENT GAS LEAK DETECTION MESSAGE BY USING ARDUINO

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Abstract

Prevention and safety are very needed in every areas of life today, both for personal and residential environment. Considering that home is an asset and also place where we live, for that needed safety in every sector, not except in the kitchen where we cook, that now use gas as the fuel. Very often we know many house fire occur, one of them caused by gas leak. Seeing it and considering the current technological developments, so created a smart system based Arduino UNO that can solve that problem. With Arduino UNO, MQ-2 sensor, SIM800L, and buzzer, this smart system can detect gas levels that contained in the room, and gas leak levels, and then if system detect excess gas levels (leak) this system will send message notification to the phone of the owner. Therefore this system can solve the problem with LPG gas leak, also can provide a sense of safe and comfort for the owner.

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Key-word: Smart System, Arduino UNO, Gas Leak, SIM800L, MQ-2 Sensors

1. Introduction

LPG is a production hydrocarbon gas from an oil refinery and a gas refinery with main components of propane gas (C₃H₈) and butane (C₄H₁₀). At atmospheric pressure, LPG is gaseous, but for the ease of its distribution, LPG is converted into liquid by applying pressure. In liquid form, LPG is easily distributed in tubes or tanks. In Indonesia, LPG is used primarily as fuel for cooking. LPG consumers vary, ranging from households, commercial circles (restaurants, hotels) to industry. Among industries, LPG is used as fuel for the food industry, ceramics, glass and forklift fuel. In addition, LPG can also be used as raw material in the aerosol industry as well as environmentally friendly refrigerant.

Now role of LPG (*Liquefied Petroleum Gas*) is very important for human life, especially households, not only the cheap price but also the use is also easier and practical, so the use of LPG gas is not only used by urban society but also in villages have also switched to using LPG gas in their daily lives, especially in terms of cooking. Because by using this LPG gas they get so many benefits. Among them is to save on expenses because the price is relatively cheaper if we compare with the use of kerosene. And the use of this LPG gas also make the results of cooking healthier, because the fire that generated from LPG gas itself is a clean fire, so it does not cause symptoms as if using kerosene (Widyanto, Deni Erlansyah).

Although like that this LPG gas has negative impact for its users if not used carefully, especially if there has been a leak from the LPG gas or gas place that we use. For that there are things we need to consider when using LPG gas in terms of safety (*keselamatan*). This is because the gas is very volatile and very potential to cause explosion and very likely to be cause of the fire. Gas leaked normally maybe easy to detect by smell, but if the gas perolate to carpet or electrical instalation it will be very difficult to be detected by human smell sense.

Beside that, this LPG gas is also very sensitive and flammable, so if there is a leak that not detect by human sense smell, then there is a source of fire that burn, then will be cause of the dangerous (Ikramullah; Widyanto, Deni Erlansyah; Mifza Ferdian Putra, Awang Harsa Kridalaksana, Zainal Arifin, 2017). Gas leaks have caused various accidents, material losses and human injuries. The number of deaths from gas tube explosions has increased in recent years. The causes of the explosion include old valves, broken regulators and the biggest reason for the accident due to gas leakage is the lack of awareness in handling the gas cylinder. For that there is a serious problem about this gas leakage (E. Jebamalar Leavline, D. Asir Antony Gnana Singh, B. Abinaya, H. Deepika, 2017).

According to (Ashish Shrivastava, Ratnesh Prabhaker, Rajeev Kumar dan Rahul Verma, 2013), the largest gas industry accident in the world was the Bhopal gas tragedy in India in 1984 that killed thousands of lives. Because of the nature of gas is very sensitive and flammable, and then it needs special attention for this type of fuel. Therefore, required a system that can help to detect the gas leak as well as transmit information immediately (Joko Christian, Nurul Komar, 2013). Therefore, made "**SMART SYSTEM SENT GAS LEAK DETECTION MESSAGE BY USING ARDUINO**", that equipped with gas sensor, buzzer and GSM module that will help to detect if there is a gas leak and provide a sign in form of sirine and then send a notification message to the owner, so the dangers that caused by the gas leakage can solved and anticipated as early as possible.

2. Methodology

2.1 Hardware Design

The working of this tool can be explained as the follow. A sensor that installed to the tool will detect gas is there a leak or not. If no leak occure so this system will not issued any sign, this tool only show the post from gas content that detected by censored on the LCD and the output of the LED that indicate censored is continues but does not detect any gas leakage. But if gas leakage occure so censored will detect there is gas leakage that exceeds the predetermined limit, and then this tool will give a sign that has been occure gas leakage through a buzzer that has been installed to this tool, after that this tool also will send notification message that has been occure a leak on gas used to the specified phones then it will show on LCD that status of gas is in high condition. With there a sign from buzzer, gas status from LCD, and message notification so somebody will direct check the condition of LPG gas cylinder. So the room will be safe from fire dangerous.

The components required for the LPG gas leak detector are as follows.

1. Arduino UNO
2. Gas Censor
3. Buzzer
4. Relay
5. GSM module
6. Regulator Switching (DC to DC)
7. LCD
8. Potentiometer

2.1.1 Arduino UNO

This tool is full controlled by microcontroller, for that in this system the function of arduino is as the brain of the system that controls all other components. in this arduino also has some ports to plug other components, such as censored, lcd, led, etc.



Figure 1

2.1.2 Gas Censor

The sensor used in this system is MQ-2 gas sensor. The sensitive material used in the MQ-2 gas sensor is tin oxide (SnO₂). If the gas leakage is detected then the sensor conductivity rises with the detection range of the MQ-2 sensor is 300-5000 ppm (T.H.Mujawar, V.D.Bachuwar, M.S. Kasbe, A.D. Shaligram and L.P. Deshmukh, 2015).

Censor that used in this system is MQ-2 gas censor. This Censor is used to detect LPG gas, i-butana, propana, metana, alkohol, hidrogen, dan smoke, In this system, we use itu to detect LPG gas.

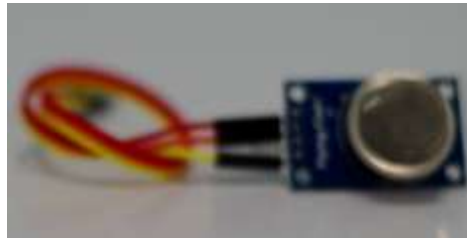


Figure 2

2.1.3 Buzzer

It is a device that can convert electric current into sound vibration. In this system it has a function as an alarm or a sign.



Figure 3

2.1.4 Relay

Has function is as an automatic switch to deliver electrical current.



Figure 4

2.1.5 GSM Module

Actually there are many GSM Module, in this system we use GSM SIM800L Module, is a module that can we use with arduino, that in this system has a function to send a message.



Figure 5

2.1.6 Regulator Switching

This tool has a function to decrease the voltage obtained from the arduino by 5v, to be between 3.7 and 4v to run sim800l maximally.

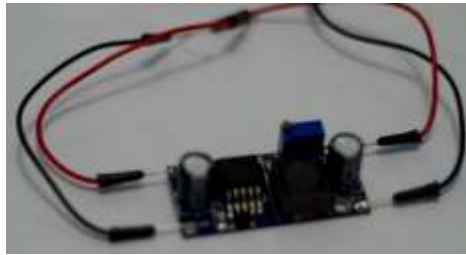


Figure 6

2.1.7 LCD

Is a display that showing the process results of this system.



Figure 7

2.1.8 Potentiometer

In this system, this tool has a function to set the dark or light of the lcd.



Figure 8

2.2 Hardware Design

2.2.1 Tool Design

In Scheme this gas leak detection tool can be seen like the following image.

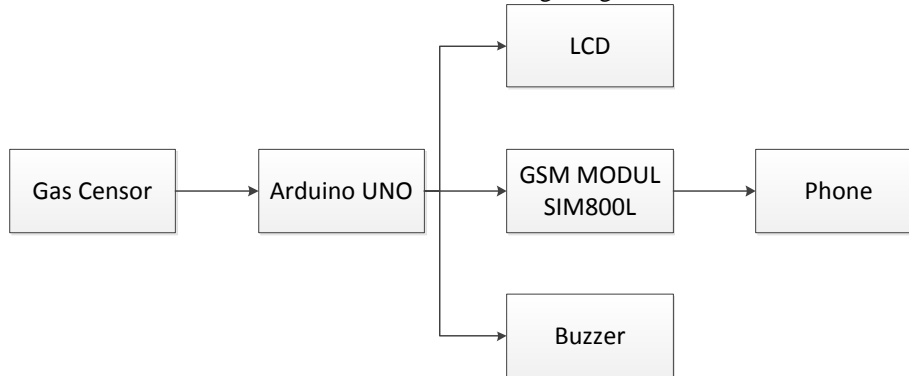


Figure 9

From the image can be seen that this tool has an input device in form of gas sensor, and an output device in form of LCD, GSM Module, and buzzer. How this tool work is as follows. When the tool switching on, the sensor will work to detect LPG gas and send data in form of voltage according to the level of LPG gas that it detects. The higher the LPG gas is detected the higher the voltage is sent. When the output of sensor that sent detect there a gas leakage, then Arduino will detect, and activate buzzer and display texts on LCD that the level of gas is in high condition which means there has been occurred gas leakage, then GSM SIM800L will work to send notification message to the handphone number that has been assigned in program. But if the sensor does not detect leakage, no output is generated, and the sensor will continue to work until it detects that there LPG gas leak.

2.2.2 System Design

The design of this LPG gas leak detection system consists of 2 stages. First is making the flowchart of LPG gas leak detection system. Then the process of making the program with Arduino IDE using C language, and this program will run the commands on the LPG gas leak detection system. When the program is run the system will directly detect LPG gas that detected by sensor. Then Arduino microcontroller will read LPG gas through LPG gas sensor. If detect there is gas leakage then red LED will light, buzzer will active, then system will send message notification that declare has occurred a LPG gas leakage. If no LPG gas leakage is detected then the system will continue to detect the existing gas level through the LPG gas sensor until it detects LPG gas leakage. System flow can be seen in the following flowchart.

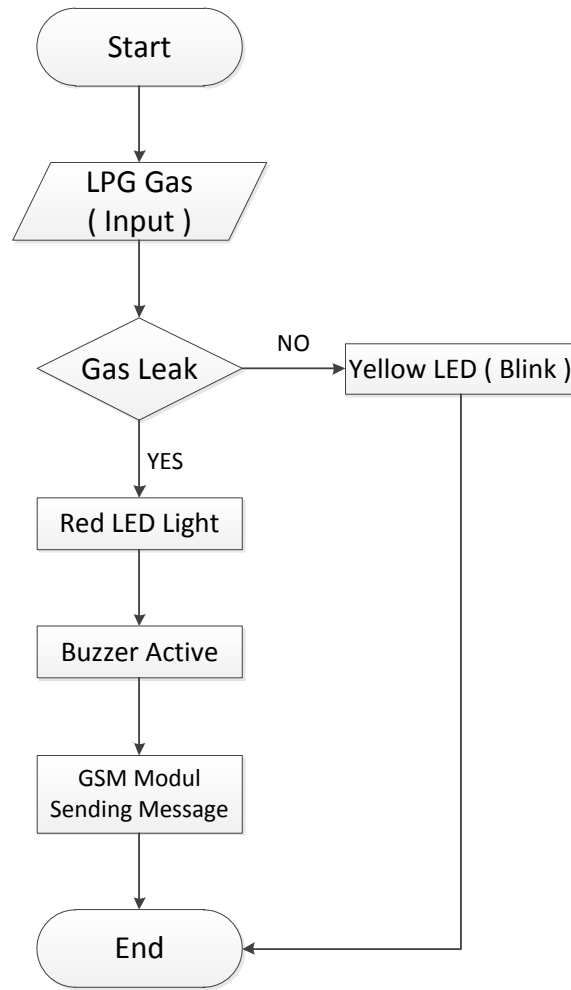
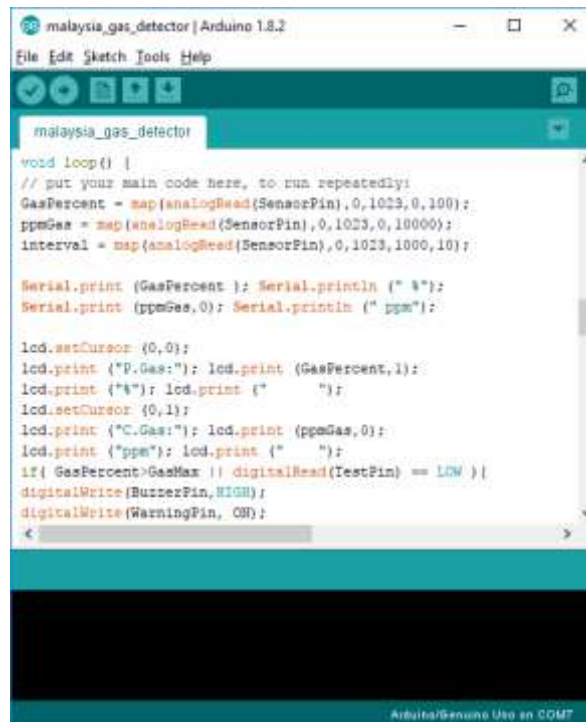


Figure 10

And the program on this LPG gas leak detection system is made using the Arduino IDE application with C language.



```

malaysia_gas_detector | Arduino 1.8.2
File Edit Sketch Tools Help

malaysia_gas_detector

void loop() {
  // put your main code here, to run repeatedly:
  GasPercent = map(analogRead(SensorPin), 0, 1023, 0, 100);
  ppmGas = map(analogRead(SensorPin), 0, 1023, 0, 10000);
  interval = map(analogRead(SensorPin), 0, 1023, 1000, 10);

  Serial.print (GasPercent ); Serial.println (" %");
  Serial.print (ppmGas,0); Serial.println (" ppm");

  lcd.setCursor (0,0);
  lcd.print ("P.Gas:"); lcd.print (GasPercent,1);
  lcd.print ("%"); lcd.print (" ");
  lcd.setCursor (0,1);
  lcd.print ("C.Gas:"); lcd.print (ppmGas,0);
  lcd.print ("ppm"); lcd.print (" ");
  if( GasPercent>GasMax || digitalRead(TestPin) == LOW ){
    digitalWrite(BuzzerPin,HIGH);
    digitalWrite(WarningPin, ON);
  }
}

```

Figure 11

3. Result And Discussion

3.1 System Description

The smart system sent LPG gas leak messages with Arduino, MQ-2 sensor, and SIM800L module. It is a smart system that designed to provide a sense of security and comfort to people, especially those using LPG gas as fuel when cooking. The benefits of this system is able to provide early warning signals that provide by the buzzer and provide information in form of a message if occur a LPG gas leakage. With the MQ-2 sensor as an indicator and input in detect the gas levels in the room. This tool will run automatically according with the command that implanted on the microcontroller that directly using Arduino. When in gas leak condition then the system will send a command to active the buzzer as an early warning sign that has been occurred LPG gas leakage. Then the system will also send a notification message to the owner's phone that indicating LPG gas leak.

3.2 System Testing



Figure 12

At this stage all the components are connected well to each other and the microcontroller also has been embedded program. This test uses the fountain gas to activate the MQ-2 sensor. The workings of this system is by connecting to the power source, in this system using the power directly from laptop. When the system is connected to a power source, the system will be directly active which is marked with a green led flame. Led yellow indicates the sensor that installed on the system has been active to detect the LPG gas levels.



Figure 13

After this stage is complete, then the microcontroller works by running the commands as embedded in the microcontroller. This stage is useful to see does the sensor, microcontroller and the program we planted running well. When microcontroller and sensor is active then the sensor will continue to work to detect the levels of gas. The maximum value of the gas leakage percentage rate given, if it exceeds or equal to 50% then the MQ-2 sensor will read that there has been a gas leak and will immediately provide a warning alert by active the buzzer that installed on the system as an alarm and also marked by lighting of the red LED. Can be seen at the picture.



Figure 14

Then the system will also directly send a notification message that there has been occur leak of LPG gas.



Figure 15

4. Conclusion

Based on the whole system from designing, making tools and testing “Smart System Sent Gas Leak Detection Message By Using Arduino”. The conclusions are as follows.

1. Tool works well. Proven with functioning the components when LPG gas is provided. Like the buzzer active, the red led is lights up and then the system sends a notification message (Mifza Ferdian Putra, Awang Harsa Kridalaksana, Zainal Arifin, 2017).
2. MQ-2 sensor work well. Sensor will detect gas leakage if the value is more than or equal to 50% (Ikramullah).
3. These system and tool can provide a sense of security and comfort for its users.
4. These system and tool are especially intended for household needs.

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