http://www.jctjournals.com ISSN(ONLINE):2278 – 3814

Volume-14, Issue-01, 2025
JOURNAL OF COMPUTING TECHNOLOGIES (JCT)
International Journal
Page Number: 01-05

LPG GAS DETECTION SYSTEM

Mayank Kumar
B.Tech Schollar
LNCT, Bhopal

Suraj Kumar Chauhan
B.Tech Schollar
LNCT, Bhopal

Sri krishna kumar
B.Tech Schollar
LNCT, Bhopal

Vaibhav Namdeo
B.Tech Schollar
LNCT, Bhopal

Dr. Arun Patel
Professor
LNCT, Bhopal

Abstract— Liquefied Petroleum Gas (LPG) is a main source of fuel, especially in urban areas because it is clean compared to firewood and charcoal. Gas leakage is a major problem in the industrial sector, residential premises, etc. Nowadays, home security has become a major issue because of increasing gas leakage. Gas leakage is a source of great anxiety with ateliers, residential areas and vehicles like Compressed Natural Gas (CNG), buses, and cars which are run on gas power. One of the preventive methods to stop accidents associated with the gas leakage is to install a gas leakage detection kit at vulnerable places. The aim of this paper is to propose and discuss a design of a gas leakage detection system that can automatically detect, alert and control gas leakage. This proposed system also includes an alerting system for the users. The system is based on a sensor that easily detects a gas leakage.

Keywords— LPG, CNG, Leakage, Gas Leak, Harmful Gas Detection.

I. INTRODUCTION

Gas leakage is a serious problem and nowadays it is observed in many places like residences, industries, and vehicles like Compressed Natural Gas (CNG), buses, cars, etc. It is noticed that due to gas leakage, dangerous accidents occur. The Liquefied petroleum gas (LPG), or propane, is a flammable mixture of hydrocarbon gases used as fuel in many applications like homes, hostels, industries, automobiles, and vehicles because of its desirable properties which include high calorific value, less smoke, less soot, and meager harm to the environment. Liquid petroleum gas (LPG) is highly inflammable and can burn even at some distance from the source of leakage. This energy source is primarily composed of propane and butane which are highly flammable chemical compounds. These gases can catch fire easily. In homes, LPG is used mainly for cooking purposes. When a leak occurs, the leaked gases may lead to an explosion. Gas leakage leads to various accidents resulting in both material loss and human injuries. Home fires have been occurring frequently and the threat to human lives and properties has been growing in recent years. The risks of explosion, fire, suffocation are based on their physical properties such toxicity, flammability, etc.

The number of deaths due to the explosion of gas cylinders has been increasing in recent years. The Bhopal gas tragedy is an example of accidents due to gas leakage. The reason for such explosions is due to substandard cylinders, old valves, no regular checking of gas cylinders, worn out regulators and a lack of awareness of handling gas cylinders.

Objective of the Project -

- To research an identify the appropriate gas sensors, wireless and GSM. Technology and microcontrollers needed to detect LPG Gas leakage.
- To design and develop Gas Leak Detection System that can detect the presence of LPG Gas and trigger an Alarm or Shut off the Gas supply in case of Gas Leak.
- To integrate the gas leak detection Systems with wireless and GSM technology to send an SMS alert to a designated phone number in case og gas leakage.
- To provide an effective solution to address the growing concern of LPG explosions and their catastrophic consequences enhancing the safety of households and industries.

II. LITERATURE SURVEY

Therefore, the gas leakage should be detected and controlled to protect people from danger. An odorant such as ethane thiol is added to LPG, so that leaks can be detected easily by most people. However, some people who have a reduced sense of smell may not be able to rely upon this inherent safety mechanism. A gas leakage detector becomes vital and helps to protect people from the dangers of gas leakage There are different gas detection techniques used . In this paper a low-cost advanced sensor-based gas leakage detector, alert and control system is proposed and discussed. The system is very efficient, user friendly, portable, small in size and cost effective.

The device which is used to detect the gas is already present the market which is widely used in many places like industries where there is plenty of chances of the explosion which may lead to massive destruction and the lose of man power; in homes, where the LPG gas used most widely in our daily necessity where it can detect the

leakage of LPG gas; in cars, where most of the vehicles contains the cylinder and many more places. Dr. Walter Snelling was the first to introduce LPG gas in 1910. It's a blend of butane and commercial propane. It is very combustible, and numerous accidents occur as a result of LPG leaks. As a result, it is necessary to identify and prevent gas leakage. Gas Detectors can be classified in a variety of ways. They're divided into categories based on the type of gas they detect, the technologies that power the sensor's output, and the components that impact the sensor's operation (semiconductors, oxidation, catalytic, photoionization, infrared, etc.). In our daily lives, we utilize a variety of gadgets for various purposes, and the majority of them have the ability to emit any type of gas or chemical when in operation in the air. In many scenarios, it is difficult for human to keep an eye on the levels of the concentration of the leaked gas or to detect whether there is leakage of gas or not. If there is any leakage in gas when there is no one around, it may cause explosion when there is even a spark or the surrounding will have the harmful gas which may lead to suffocation and will lead to have health issues in breathing. There are many application for detection and monitoring of the leakage of gas, but still the researchers will make the efforts in making the advanced application where the cost of the application will be lesser. Authors proposed system defines that detection and monitoring of the LPG gas is sensed using MQ – 5 sensors. In the system, when the leakage of gas is detected, the buzzer will be on, along with that the alert message will be displayed in the LCD. And while monitoring of gas based on the cylinder weight, which is measured using the load sensor, it will send the message to the owner of the application or system. Authors of proposed system, the authors used the push bullet for the rapid transfer of the data of the message using the Wi-Fi module which functions when there is leakage of gas which is connected to the Arduino UNO. Authors proposed system, the sensor which is used to detect LPG gas is MQ – 6, for methane gas, the sensor used is MQ – 4, and benzene is detected using the sensor using MQ – 135 respectively. The output of the sensors will be given in form of PPM. Further, ESP32 is used for the sending and receiving of the messages. Authors proposed system, the application is for the monitoring of the gas where it sends the message. Node MCU's is powered as the sensors where the load sensors always monitor the cylinder. If the weight is less, then it will be displayed using ubidots. Authors of

[5] proposed system, where the LPG gas management is proposed for the cost which is low. Along with detection and monitoring, the system also calculate the temperature and humidity concentration.

2.1 Scope Of Project

A gas detector is a device that detects the presence of gases in an area, often as part of a safety system. A gas detector can sound an alarm to operators in the area where the leak is occurring, giving them the opportunity to leave. This type of device is important because there are many gases that can be harmful to organic life, such as humans or animals. Gas detectors can be used to detect combustible, flammable and toxic gases, and oxygen depletion. This type of device is used widely in industry and can be found in locations, such as on oil rigs, to monitor manufacturing processes and emerging technologies such as photovoltaic. They may be used in firefighting.

In this work whenever the gas is leaked it is sensed by the sensor and it sends signal through the processor to buzzer. The ppm can be seen in the lcd display. Whenever the gas leakage reaches the ppm of 100 it will send signal to the buzzer and the buzzer will ring and it will alert the people around that the gas is leaking.

III. PROPOSED METHODOLOGY

In this semiconductor sensors are used to detect LPG gas. An MQ6 semiconductor sensor is used. Sensitive material of the MQ-6 gas sensor is SnO2, which has lower conductivity in clean air. When the target combustible gas exists, the sensor conductivity increases along with it.

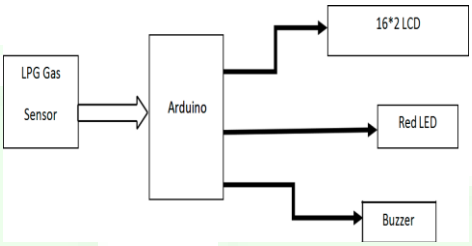

Fig 3.1- block diagram

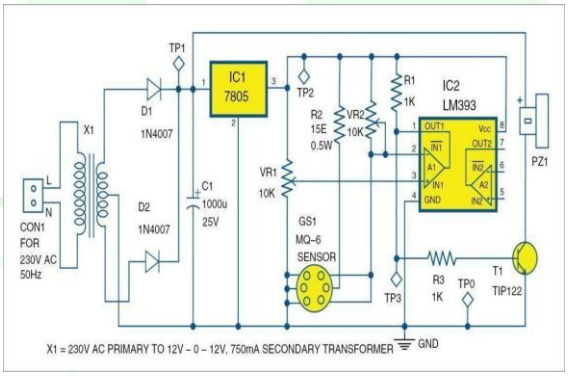

Fig 3.2- Circuit Diagram

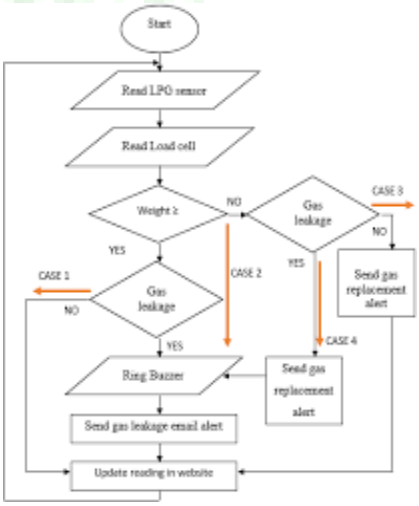

Fig 3.3- Flowchart

The MQ6 gas sensor has a high sensitivity to Propane, butane and LPG, and response to Natural gas. The sensor could be used to detect different combustible gasses, especially Methane; it has a low cost and is suitable for different applications. The MQ-6 can detect gas concentrations anywhere from 200 to 10,000 ppm. The sensor's output is an analog resistance. Figure above shows the block diagram of the gas leakage detection and alert system.

This system is based on the Arduino UNO R3 and MQ-6 gas sensor.

When the sensor detects gas in the atmosphere, it will give digital output 1 and if gas in not detected the sensor will give digital output 0. Arduino will receive the sensor output as digital input. If the sensor output is high, then the buzzer will start tuning along with the LCD that will show that "Gas detected: Yes". If the sensor output is low then buzzer will not be tuning, and the LCD will show that "Gas detected: No". The buzzer most commonly consists of a number of switches or sensors connected to control unit that determines which button was pushed or whether a preset time has lapsed, and usually illuminates a light on the appreciate button or control panel, and sounds a warning in the form of a continuous or intermittent buzzing or beeping sound.

3.2 Components Required

S.NO	EQUIPMENT	QUANTITY
1.	ARDUINO	1
2.	MQ-6 GAS SENSOR	1
3.	16*2 LCD	1
4.	BUZZER	1
5.	10 K V ARIABLE RESISTOR	1
6.	MALE TO MALE/FEMALE WIRE	40
7.	GAS LIGHTER	1
8.	9V BATTERY / CHARGER TO GIVE SUPPLY	1
9.	ATMEGA328P	1

Table 3.1: Components Required

3.3 Gas Sensor

A gas sensor is a device which detects the presence or concentration of gas in the atmosphere. Based on the concentration of the gas the sensor produces a corresponding potential difference by changing the resistance of the material inside the sensor , which can be measured as output voltage . based on this voltage value the type and the concentration of the gas can be estimated.

The type of the gas sensor could detect depends on the sensing material present in side the sensor. Normally these sensors are available as modules with comparators. These comparators can be set for a particular threshold value of gas concentration . When the concentration of the gas exceeds this threshold value the digital pins goes high. The analog pin can be used to measure the concentration of gas.

3.4 MQ6 Gas Sensor

The below image shows the MQ6 sensor pin diagram. However, the left image is a module-based MQ6 sensor for interfacing with the microcontroller unit, the pin diagram of the module is also shown in that image.

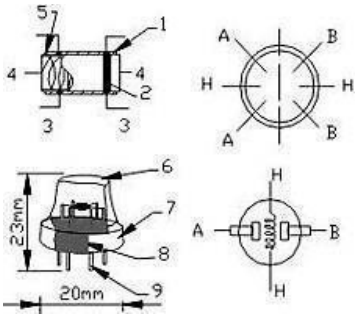

Fig 3.4- Gas Sensor Pins

Pin 1 is VCC, Pin 2 is the GND, Pin 3 is the Digital out (Logic low when gas is detected.) and Pin 4 is the Analog output. The pot is used to adjust the sensitivity. It is not RL. The RL resistor is the right resistor of the DOUT LED.

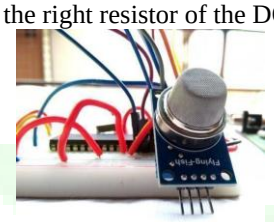

Fig 3.5-Gas Sensor

Each MQ series sensor has a heating element and a sensing resistance. Depending on the concentration of the gas, the sensing resistance gets changed and by detecting the changing resistance, the gas concentration can be measured. To measure the gas concentration in PPM all MQ sensors provide a logarithmic graph which is very important. The graph provides an overview of the gas concentration with the ratio of RS and RO.

3.6 Arduino

Arduino-uno is a low-cost, flexible, and easy-to-use programmable open- source microcontroller board that can be integrated into a variety of electronic projects. This board can be interfaced with other Arduino boards, Arduino shields, Raspberry Pi boards and can control relays, LEDs, servos, and motors as an output.

3.7 LCD Display

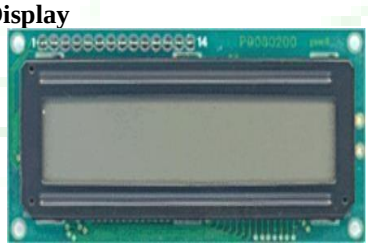

Fig 3.6-16x2 line Hitachi HD44780 display

More microcontroller devices are using 'smart LCD' displays, as shown in fig 2.12 to output visual information. The following discussion covers the connection of a Hitachi LCD display to a PIC microcontroller. Hitachi LCD displays have a standard ASCII set of characters plus Japanese, Greek and mathematical symbols.

IV. RESULT AND DISCUSSION

4.1 ATmega328

The ATmega328 is a single-chip microcontroller created by Atmel in the megaAVR family (later Microchip

Technology acquired Atmel in 2016). It has a modified Harvard architecture 8-bit RISC processor core. The Atmel 8-bit AVR RISC-based microcontroller combines 32 KB ISP flash memory with read-while-write capabilities, 1 KB EEPROM, 2 KB SRAM, 23 general-purpose I/O lines, 32 general-purpose working registers, 3 flexible timer/counters with compare modes, internal and external interrupts, serial programmable USART, a byte-oriented 2-wire serial interface, SPI serial port, 6-channel 10-bit A/D converter (8 channels in TQFP and QFN/MLF packages), programmable watchdog timer with internal oscillator, and 5 software-selectable power-saving modes. The device operates between 1.8 and 5.5 volts. The device achieves throughput approaching 1 MIPS/MHz.

Parameter	Value
CPU type	8-bit AVR
Maximum CPU speed	20 MHz
Performance	20 MIPS at 20 MHz[2]
Flash memory	32 KB
SRAM	2 KB
EEPROM	1 KB
Package pin count	28 or 32
Capacitive touch sensing channels	16
Maximum I/O pins	23
External interrupts	2
USB interface	No

Table 4.1 : Parameters of ATmega328

4.2 Simulation Using Tinkercad

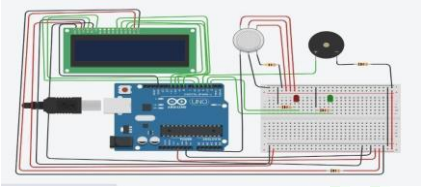

Fig 3.1 Simulation Diagram

5. HARDWARE

4.1 Hardware Diagram

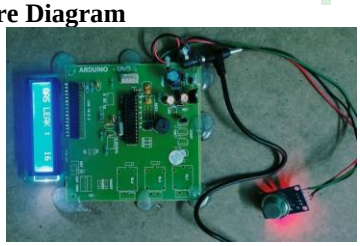

Fig 4.1: Hardware Connection

The above fig shows the hardware connection of sensor based gas detection system .

In practical whenever the supply is in on condition and the MQ-6 sensor if detects the gas it shows the ppm value in LCD display .when the ppm value reaches the value of 190 ppm the controller gives the signal to the buzz.

V.CONCLUSION

5.1 Conclusion

The design of a sensor-based automatic gas leakage detector with an alert and control system has been proposed and discussed in this paper. This is a low-cost, low power, lightweight, portable, safe, user friendly, efficient multi featured and simple system device for detecting gas. Gas leakage detection will not only provide us with significance in the health department but it will also lead to raise our economy, because when gas leaks it not only contaminates the atmosphere but also wastage of gases will hurt our economy. The proposed system will cost only USD 10 which is easily affordable even for poor people. In the open literatures it is noticed that much work has not been done for a smart gas detection system. In future, more advanced features will be integrated with this system which will provide users with more safety and relaxation. The proliferation of handheld devices has led to developments in the field of smart gas sensors, which has considerably widened their scope of application. The need for ensuring safety in workplaces is expected to be the key driving force for the market over the coming years.

5.2 Future Scope

Overall, software and hardware parts of the systems have been developed and tested by introducing a small amount of LPG near gas sensor module. The authors of this paper are currently working to include multi functions with this device. One of the notable future functions of this system is to add a sub system where wastage of gas and the uses of gas can be monitored using this system. The system is flexible as a greater number of sensors and relays can be added to it according to the whole LPG supply setup in those premises. The author is adding more software based intelligent functions with this system. This is an automatic gas detection, control and alert system. In future this system will have a feature where it can notify the emergency services if any accidents happen. A mobile app and web-based app for real time monitoring also will be added. In the user app for this system many smart features will be added. The overall features will make the system safer for the users. The system will be optimized for use in many places like the car, the home, industries and many other places. After designing the final prototype with smart multifunctional features, the system will be implemented in real life scenarios as a pilot project. A survey will be done soon before using the system and another one will be done after implementing the system to discover the KPI. Summarizing all the results, finding and analyzing a research article will be done and author has plans to submit itto the MDPI sensors journal for review. In the future paper the features of this final product will be compared with the available gas detector systems presented in other articles.

REFERENCES

[1] M Athish Subramanian, Naveen Selvam, Rajkumar S, R Mahalakshmi, J Ramprabhakar , “Gas Leakage Detection System using IoT with integrated notifications using Pushbullet-A Review”, Proceedings of the Fourth International

Conference on Inventive Systems and Control (ICISC 2020) IEEE Xplore Part Number:CFP20J06-ARTI; pp.no 359 – 363.

[2] Ravi Kishore Kodali, Greeshma, R.N.V, Kusuma Priya Nimmanapalli, Yatish Krishna Yogi Borra, "IOT Based Industrial Plant Safety Gas Leakage Detection System", International Conference on Computing Communication and Automation (ICCCA), pp.no, 1-5, published in 2018.

[3] Suma V, Ramya R Shekar, Akshay Kumar A, "Gas Leakage Detection Based on IOT," Proceedings of the Third International Conference on Electronics Communication and Aerospace Technology [ICECA 2019] IEEE Conference Record # 45616; pp.no 1312 – 1315. Conference.

[4] https://sist.sathyabama.ac.in/sist_naac/documents/1.3.4/1923-b.e-eee-batchno-interdis-2.pdf

[5] https://www.electronicsforu.com/electronics-projects/lpg-gas-leakage-detection

