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Development of LPG Leakage detection system using Arduino with the Internet of Things.

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Abstract: LPG, methane, and other combustible gases, if leaked, can cause havoc as they will catch fire easily. The leakage of those gases is prevented by designing better containers and shipping equipment for the said gases just in case of a leakage, the simplest way to avoid an accident is to understand at the earliest that leakage has occurred so that necessary action may be taken. This project tackles this issue of gas leakage i.e. make people aware of gas leakage at the earliest, to prevent accidents. This project is useful to households where people spend their time outside the house or for those people that might need a lesser sense of smell. The main purpose of this project is to make a cost-effective and reliable Gas Leakage Detector. This project is made using an Arduino microcontroller, GSM module, MQ2 sensor, a buzzer, and a cellphone. All these equipment interact with one another with IoT and sound an alarm additionally to sending an SMS alert to the owner about the gas leakage using the cellular phone.

Keywords: IoT – Internet of Things, Arduino microcontroller, GSM module, MQ2 sensor, Buzzer

Introduction

Explosions occurring in households because of LPG are getting serious and more prominent as LPG is available to almost everyone Nowadays. LPG is employed mainly for cooking food in households, it's an efficient energy source composed of propane and butane but it can also be dangerous at the same time because it may contribute to an explosion or fire given its high flammability.

When 1% of gas leak occurs, it takes nearly 60 minutes to detect it[1][2], which suggests LPG leakage detection systems are deficient. To solve this problem a system must be developed which may detect LPG leakage. During this project, an embedded system is designed using Arduino Uno with a gas sensor MQ2 for the aim of detecting toxic gas leakage, which lowers the risks of an LPG leakage. This unit consists of a buzzer to alert everyone in event of LPG leakage, it then activates the exhaust to pump out the air additionally to all or any particular person this it sends a text message to the owner using its GSM module and cellphone about the LPG leakage.

This system is reliable and cheap and might be employed in factories, warehouses, households, and in localities that are surrounded by chemical industries.

1. System Overview

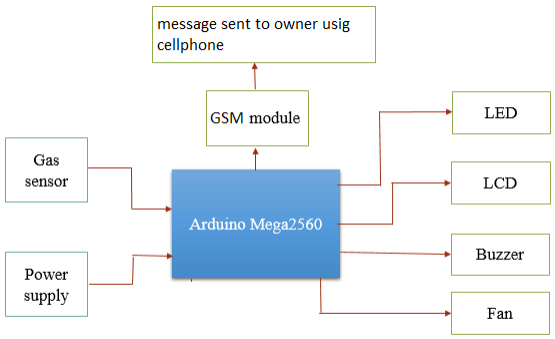


Figure 1: LPG Leakage Detector System

i. Microcontroller

Arduino is an open-source gadget stage insight of easy to-utilize instrumentation and programming. Arduino board will browse sources of data, as an example, light on a sensor, a finger on a button, and transform it into an output for initiating an engine, turning on a LED, distributing one thing on the net. It's an open-source physical PC stage that depends on a basic microcontroller board, and therefore the advancement of conditions for

composing programming for the board[3]. The Arduino board is affordable and economical compared with different microcontroller platforms. The least amount costly kind of Arduino module is typically assembled by hand, and even the pre-collected Arduino module value not the utmost amount as MYR 60. Apart from that, the Arduino board will cross platforms that the Arduino programming will run on Windows, Macintosh OSX, and Linux operating systems. It will add completely different in operating systems, however, the larger a part of microcontroller frameworks are restricted to Windows. Apart from that, Arduino makes an additional easy means toward operating with a microcontroller next thereto offers some advantage to educators and students. The Arduino software is easy to use even for beginners, and it's sufficiently flexible for innovative clients to require advantage of. For educators, it's useful in light of the Process programming condition for instructing, so the student will confirm some way to program in an exceedingly better condition.

The Mega 2560 may be a microcontroller board in light of the ATmega2560. It's 54 digital input/output pins that 15 are typically used as PWM yields, 16 simple data sources, 4 UARTs (equipment serial ports), a 16 MHz precious oscillator, a USB affiliation, an influence jack, an ICSP header, and a button. It contains everything expected to bolster the microcontroller, essentially interface it to a PC with a USB link, or power it with an AC-to-DC connector or battery to start. The Mega 2560 board is good with most shields supposed for the Uno and additionally the previous boards Duemilanove[3].

ii. Gas leakage Detector

A gas detector could also be a tool that detects the closeness of gasses in a very range, regularly as a significant aspect of a security framework. This sort of equipment is used to detect a gas leak or different emissions and may interface with an impression system so a method commonly mechanically stops working. A gas detector will sound responsive to the directors among the vary wherever the gap is going on, giving them the possibility to filter. This sort of device is vital because there are several
gases which can be harmful to organic life, like humans or animals.

Gas leak indicators are typically used to differentiate

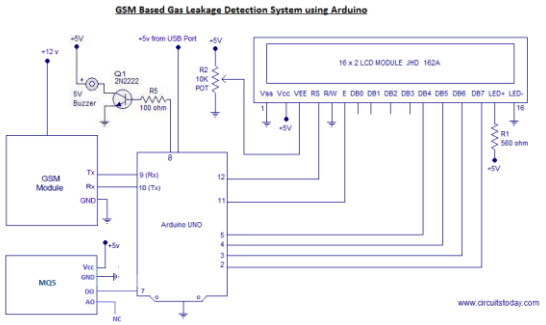
combustible, harmful gases, and oxygen consumption by sensors. These sensors are usually capable of being detected to caution people when a hazardous gas is detected. Exposure to toxic gasses will likewise happen in operations like fumigation, fuel filling, development, exhuming of tainted soils, and lowland operations. Regular sensors incorporate burnable gas sensors, photoionization identifiers, infrared purpose sensors, ultrasonic sensors, electrochemical gas sensors, and semiconductor sensors. Additionally recently, infrared imaging sensors have inheritable utilization.

iii. MQ-2 Gas Sensor

The MQ-2 gas sensor module is useful for gas leakage detection whether or not among the home or industrial areas. It's highly sensitive to LPG, Propane, and Hydrogen, additionally may well be won't for Methane and different flammable steam. Because of its high sensitivity and fast time interval, measurements are taken as shortly as possible. The sensitivity of the sensor is commonly adjusted by mistreatment of the potentiometer. It's low value and appropriate for various applications.

iv. GSM module

A GSM/GPRS Module is often required to implement projects that involve SMS based mostly or web-based controlling of devices. A GSM modem may be a wireless modem that works with a GSM wireless network. A wireless modem behaves sort like a dial-up modem. The main distinction between them is that a dial-up modem sends and receives data through a fixed telephone line whereas a wireless modem sends and receives data through radio waves. If the LPG sensor senses any gas leakage from storage the output of this sensor goes low. This low signal is monitored by the microcontroller and sends the signal to the GSM module to send messages as "Gas Leakage" to a mobile number.



2. System Operation

The operating of the system is given within the flowchart below.

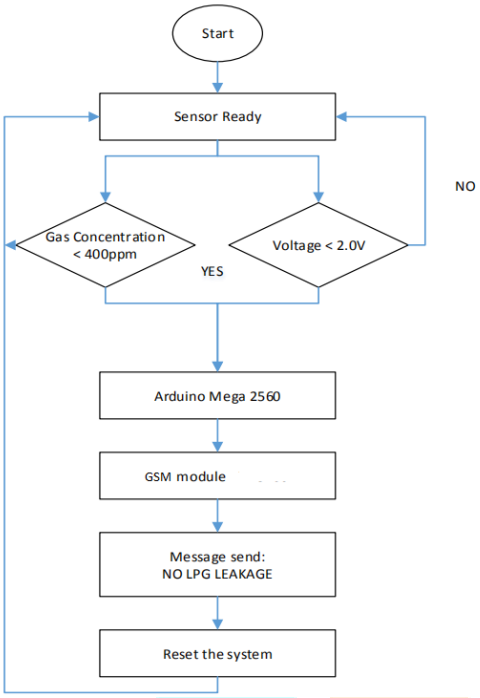
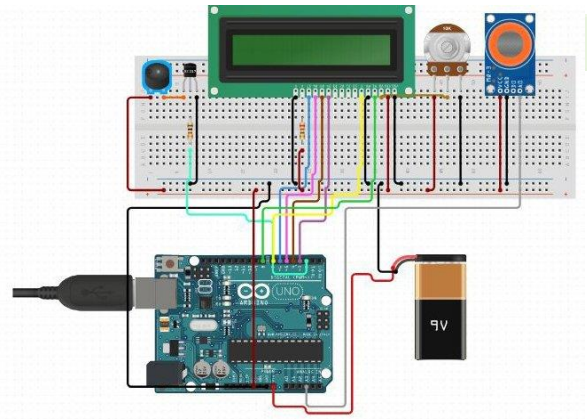


Figure 2: Workflow

LPG gas sensor module is used to sense LPG Gas. Once LPG gas leakage is sensed, it'll provide a HIGH pulse on its DO pin and Arduino repeatedly reads its DO pin.



When Arduino gets a HIGH pulse from the Gas sensor module it displays the "LPG Gas Leakage Alert" message on 16x2 LCD and alert a buzzer that beeps until the Gas sensor doesn't sense the Gas leakage in the environment. When Arduino gets a LOW pulse from the Gas detector module, then it shows on LCD "No LPG Gas Leakage" alert message.

Arduino manages the total process of this system from reading the LPG Gas sensor module output, sending a message to LCD, and aleet the buzzer. We can set the sensitivity of this sensor module by inbuilt potentiometer in it..

3. Technical Background

The validation stages during this model area unit are explained below.

Unit Testing: Unit tests are supposed within the module model area unit accomplished on the code throughout this validation phase. Unit testing is that the assessment of code level and it helps eradicate bugs at an early stage, although all deficiencies can not be exposed by unit testing.

Integration Testing: Integration testing is connected with the fine architectural design stage. Integration tests area unit accomplished to check the existence and transmission of the inner parts inside the system.

System Testing: System testing is brazenly related to the system design phase. System tests inspection the whole system ability and therefore the transmission of the system beneath improvement with external systems. The problem is uncovered throughout take a look at the execution by exploiting the software's and hardware's compatibility.

4. Results and Discussion

In IoT based automated LPG leakage detection with customer SMS alerts MQ-2 gas sensor, 5 kg load cell (for prototype) as input devices and piezoelectric buzzer, 16*2 LCD Display and GSM module used as output devices. SMS messages in user mobile phone which is sent by GSM module for different kinds of input reaction in our project. The message "Gas is Leaking alert" is sent to the user when the LPG gas leaks.

5. Conclusion

In a conclusion, this gas leakage watching system by Victim Arduino was successfully developed and works well. Gas leakage results in severe accidents resulting in material losses and human injuries. Gas leakage occurs mainly because of poor maintenance of equipment and inadequate awareness of the people. Hence, LPG leakage detection is crucial to prevent accidents and to save lots of human lives. This paper conferred LPG leakage detection and alert system. This system triggers LED and buzzer to alert people when LPG leakage is detected. It will additionally improve the protection of all users of Liquefied Petroleum Gas. This system is incredibly simple however reliable.

6. REFERENCES

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