



SMART GAS LEAKAGE DETECTOR USING ARDUINO GAS SENSOR

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ABSTRACT: *This project is carried out using the Methane Quality (MQ-2) sensor to detect Liquefied Petroleum Gas LPG, smoke and Carbon Monoxide (CO) leakage in the environment. The microcontroller used was an Arduino Uno for controlling the environmental temperature monitoring system. The results obtained from the sensor would be displayed on the 16x2 i2c Liquid Crystal Display (LCD). The new system with an Arduino microcontroller and MQ2 consists of the hardware design which includes the device design, as well as the software design which consist of the Arduino source code. They also consist of Internet of Things (IoT) enabled sensors, which work as a real-time indicator. After testing, we have 17.7% failure and 82.3% accuracy.*

KEYWORDS: Arduino, MQ2, Sensor, LCD, Embedded, IoT.



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 (Shrivastava A. et al. 2013). 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 (Kanaka et al. 2019). 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 have been growing in recent years. The risks of explosion, fire, suffocation are based on their physical properties such as 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. Therefore, the gas leakage should be detected and controlled to protect people from danger. An odorant such as ethane 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. Thus a gas leakage detector becomes vital and helps to protect people from the dangers of gas leakage. The aim of this project is to implement a Sensor-Based Gas Leakage Detector System to keep track of the gas level.

RELATED WORK

Sharma et al. (2021) device can detect LPG leakage and automatically cut off the power supply to nullify any accidents that may occur due to a short circuit. Using Arduino Uno R3 during LPG Leakage. The detecting concentration of the sensor lies in between 200 PPM and 10,000 PPM for LPG. According to the test procedures performed on the developed prototype with 100% accuracy in detecting the concentration of gas and in shutting down the AC mains supply of the house. **Muhammad Ahmad Baballe et al. (2021)** research aimed to construct a system in which the Arduino microcontroller reads the presence of gas in the environment in order to detect concentrations above the expected value, the GSM modem receives the data from the Arduino microcontroller and sends an SMS to the owner's mobile phone as well as sound an alarm with the help of a buzzer. **Nihal Gogoi et al. (2015)** project is an implementation of the MQ-5 gas sensor and DHT11 temperature sensor. The project provides a new approach to detect LPG leakage using a microcontroller based on Arduino. The device also keeps displaying the leakage amount and humidity & temperature on an LCD display as well as alert on LPG leakage. **Rajat Kumar Dwibedi et al. (2020)** use Arduino software to write the functionality of the system how and when it should work by feeding code in Arduino board to design and develop a Gas Leakage Detection System and send an alert message, automatically open the windows. It also include a solution in which the MQ2 sensor gas is used to regulate the device and to isolate the main power & gas source in the event of

leakage. **Mohammad Monirujjaman Khan (2020)** designed a low-cost, low power, lightweight, portable, safe, user friendly, efficient, multi featured and simple system device for detecting gas. This is a low-cost, low power, lightweight, portable, safe, user friendly, efficient, multi featured and simple system device for detecting gas with an MQ6 semiconductor sensor that can detect gas concentrations anywhere from 200 to 10,000ppm. **Dr.Suma et al. (2021)**, proposed a system which is a microcontroller based application of gas booking and gas detection systems using gas sensor MQ6 which is interfaced by arduino and automatic booking is designed and this device will be a single system with multiple applications for LPG consumers. The main intention of this work is to ensure a safe and easier way of gas booking and gas leakage detection to avoid disasters that may occur due to negligence. **Syeda, Rajendra (2020)**. **Designed a system** that provides information on gas leakage using Arduino UNO (Atmega-328) as the main unit of the system by sending alert SMS to those whose numbers are saved in SIM card by using GSM modem and immediately turning ON the buzzer for the danger indication.

MATERIALS AND METHOD

Materials Used in this Project

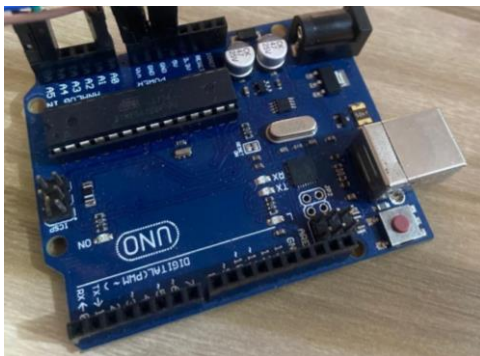


Fig 1: ARDUINO UNO BOARD



Fig 2: MQ GAS SENSOR

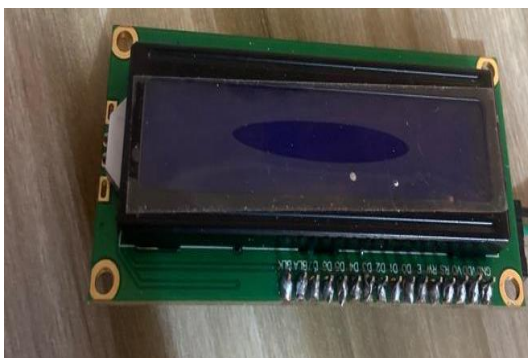


Fig 3: LCD (Liquid Crystal Display)

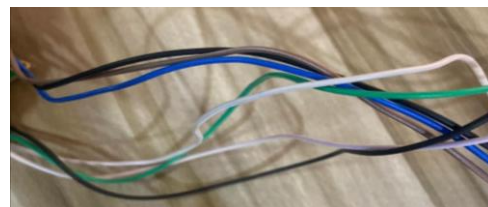


Fig 4: JUMPER WIRES



Fig 5: WIRELESS BATTERY



Fig 6: BATTERY CASE HOLDER

METHODOLOGY

The pin assignment of the whole system connection is as follows below:

The LCD (Liquid Crystal Display) Connection

The LCD GND pin (white jumper wire) to Analog pin GND of Arduino.

The LCD Vcc pin (white jumper wire) to Analog pin Vin of Arduino

The SDA pin (green jumper wire) to Analog pin A4 of Arduino.

The SCL GND pin (Black jumper wire) to Analog pin A5 of Arduino.

MQ-2 SENSOR

The Ao (brown jumper wire) of theMQ-2 sensor connected to Ao pin of the Arduino.

The GND (White jumper wire) of theMQ-2 sensor connected to GND pin of the Arduino.

The VCC (black jumper wire) of theMQ-2 sensor connected to 5v pin of the Arduino

When activating the sensor, powering the MQ-2 and LCD, the Arduino will read the data transmitted through the MQ-2 sensor when it detects a gas leakage. The Arduino will then activate and send a signal to the LCD Display. To complete this study, the whole component must work together efficiently. Arduino programming is used to develop the program for the Arduino application.

This designed system has been tested by leakage of gas sensors; MQ2 gas sensor sends the signal to the Arduino UNO after detecting the gas leakage. Arduino to other externally connected device such as LCD for display

The LPG display was designed to recognize and read three main types of LPG which includes LPG, Smoke, and CO. A smart system positioned inside the container uses sensors and artificial intelligence to do this. The new system with an Arduino microcontroller and MQ2 consists of two designs, namely hardware design, including device design, and software design including Arduino source code. They consist of IoT enabled sensors, which work as real-time indicators to determine if the gas leak or not, and help to customize the gas reading accordingly.

SETUP OF THE PROPOSED SYSTEM

Table 1: TESTING AND RESULT

S/N	TESTING CONDUCTED	RESULT OBTAINING
1	System activated	Initializing
2	When there is no gas detected	Check <i>Fig 7</i>
3	When gas is detected from cylinder	Check <i>Fig 8</i>
4	When tested with smoke coming from exhaust pipe	Check <i>Fig 9</i>

Selected Snapshots from Testing



Fig 7: NO GAS DETECTED



Fig 8: GAS DETECTION



Fig 9: SMOKE DETECTION

Table 2: TESTING ANALYSIS

S/N	TESTING	NO OF TESTING	NO OF FAILURE	CONCLUSION
1	When the sensor is tested with gas from the cylinder.	Twenty(20) times.	Five (5) times.	The device cannot detect gas outdoors due to the air but only indoors.



2	When the sensor tested with the lighter gas.	Fifteen (15) times.	Three (3) times.	When the fire mistakenly touched the sensor, the LCD went off. Avoid that for the better function of the device.
3	Sensor tested with smoke from exhaust pipe(from car).	Seven (7) times.	Three (3) times.	The whole device went off when the smoke coming out was much but normal with little smoke.
4	When testing for CO with the sensor.	Twenty times.	No failure.	The LCD displays well and the whole system is normal.

SUMMARY

The proposed system, LPG display devices that was designed is to detect gas leakage and others such as Co and smoke. Liquefied Petroleum Gas commonly known as LPG consists of a mixture of Commercial Propane and Commercial Butane having saturated as well as unsaturated hydrocarbons. LPG is commonly used in homes for heating and cooking because it is highly flammable chemical compounds. In this proposed system, MQ-2 sensor is being used to sense the leakage with the use of Arduino Uno board and other materials in order to carry out this designed work.

CONCLUSION

The Internet of Things has gained its wide popularity in recent days due to its various streams of applications which has paved the way for a smooth, safe and easier mode of living for human beings. One such area of applications includes gas leakage detection for both domestic and commercial purposes. Though, several techniques are existing for the same, yet gas leakage detection is one major concern and a challenge always. The new proposed system which is microcontroller based application of gas detection systems using IOT. The sensor used in this model can sense and detect the leakage of the gas. This proposed system can be useful in marketing sectors like hotels, shop etc. The main intention of this work is to ensure safe and easier way of gas leakage detection to avoid disasters that may occur due to negligence.

FUTURE WORK

In future, this system design can be improved by sending signals to mobile devices, to trigger an alarm. Some other wireless technology can be used to sense gasses and can be helpful for control of gas leakage. The designed system can be used as an embedded system in a robot. Using this proposed system in most homes and marketing sectors like hotels, shops etc. will ensure safety and detection of gas leakage that may occur due to negligence. Both home and



commercial should make use of this proposed system because it will be of great help to both the community and offices.

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