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An IOT- Based Gas Leakage Detection Bot

Ashwini Prasad S, Supriya K

Asst. Professor, Research Scholar

Asc Degree college

Abstract

The fear of failure of an event is the beginning of the development of a security system. Leakage of gas is a major issue in the industrial sector, residential buildings and gas-powered vehicles, the leakage of these gases have adverse impact to the lives and as well as to the heritage of people. This paper demonstrates the implementation and design of gas leakage detection system. The focus of this work is to propose a device that can detect gas leakage and alert the people, to avoid the fire and explosion. The alerting technique includes sending message to the authorised user. The system is based on a Micro-controller that employs a gas sensor, LCD display, GSM module and a Buzzer. This approach develops a security system that provides an early warning system to give a sign, if there is a smell of gas around the surroundings. In this paper, the proposed gas detection system is based on Arduino UNO, used to detect the site from where the gas is leaking. The MQ2 Gas sensor detect the gases like LPG, smoke, Propane, Hydrogen, Methane etc. The Sensor outputs the Active low condition and these low signals are overlooked by the Arduino module and gas leakage is been noticed. Once the proposed model is installed, it generates an identifiable buzzing sound alert using buzzer and an SMS through GSM Module after detecting the gas leakage. The proposed IOT based model comes out with huge inexpensive when compared to its defensive system. The output of the research will be significant in averting problems associated with gas leakages now and in future, indicates the effectiveness towards saving a significant part of the wasted gas in domestics. Safety plays a crucial role in day to day life as accidents are susceptible to happen anywhere. The aim of this paper is to automate the lives of the world by giving the path with or without human interference and provides a fast and cost effective solution by reducing risk to human life and environment.

Keywords

Arduino UNO, LPG, LCD Display, MQ2 Gas Sensor, IOT, GSM Module.

Introduction

Gas is the fuel that is used most frequently in homes and businesses. To prevent incidents like suffocation and explosions that are associated with its use, certain precautions must be planned. Ethyl mercaptans are added as an odorant to give a powerful scent so that when leakage occurs, it can be perceived. LPG is a highly inflammable gas that is made up of a mixture of butane (C4H10), propane (C3H8), butylene, propylene, and another hydrocarbon that is present in small quantities. Due to the fact that these chemical compounds are odourless, ethyl mercaptans are added. LPG is made by refining petroleum or wet natural gas. It is almost always made from fossil fuels that are made when crude oil is refined, as theory emerged from its natural state. LPG vapours is heavier than air thus care ought to be taken throughout storage in order that any run won't be sink to the bottom and find accumulated in a district that is low lying and tough to disperse. It was classified as hazardous material because of its explosive potentials when under pressure, due to this hazardous property leading to fire explosion.

Bringing technology into the home is crucial because it makes it more important to protect it from damage and accidents. One category of toxic gases is LPG that is used extensively which has serious effects on one's health. Monitoring of these gases is required; such an increase within their normal range must be known, and appropriate precautions must be taken. Due to the assumption that installing such precautionary systems will be more expensive and the lack of enforcement of standards, many hotels and restaurants do not keep a security mechanism to detect gas leaks. Fires break out in residential and commercial areas are the result of these kinds of activities. Keeping this in mind, our paper calls for an IOT-based gas leakage detection system.

The primary objective of the paper is to notify the people in the area of any gas leaks that may be present in homes, hotels, schools, and other domestic settings. Additionally, the device continues to display the temperature, humidity, and leakage on a display. A Micro-Controller is the foundation of the proposed IOT system, which makes use of a gas sensor, a display, GSM module and a buzzer. The MQ2 sensor is frequently used to detect gas leaks in a variety of applications in the vicinity. In this project, the system interfaces with the Arduino. The signals from the sensor are sent to the microcontroller, which is connected to the display. When there is a leak, the buzzer will send a signal to sound the alarm. Additionally an alert through SMS will also be sent to the authorised persons. For input, an LPG gas sensor is used. Along with the circuit, a Buzzer and GSM module is connected to indicate that the user in offline.

Literature Survey

Sensor based Gas leakage detector system [1]. This system presented how to detect the leakage using a gas sensor and gives alert message by buzzing the buzzer and through SMS to the house holder. This model also provide automatic doors and windows opening, so that the compressed gas can spread into air freely.

Efficient Model for Gas Leakage Detection Using IOT [2]. This project's aim is to show the design of an automatic warning system that can locate and stop liquefied petroleum gas leaks in a variety of locations. As soon as the gas leak exceeds, this system alert through SMS and sounds a buzzer alarm to notify the neighbours. The gas pipe valves are closed by the servo motor and ensures safety. It guards against explosion and asphyxia brought on by gas leaks.

IOT based Gas Leakage Monitoring System [3]. The main goal of this paper is to use gas sensors and the Spartan 6 FPGA process to detect gas leakage in an industry. A cloud-based monitoring system is deployed to lower the cost of maintaining servers, prevent data loss, and access from various internet-connected devices simultaneously and anywhere in the world. With IOT we can control any electronic equipment in homes.

LPG Gas Leakage Detection using IOT [4]. This study offers a novel method for discovering Arduino Uno microcontrollers that allow LPG discharge. Classification of the Leak's intensity categorised as LOW, MEDIUM, and HIGH. This model also displays the temperature and ratio over the display of characters. To alert on outpouring of LPG, This system uses a buzzing system.

A wireless Gas Leakage and level detection with auto renewal system [5]. In this system a relay-driven DC motor controls the stove knob automatically. The system also suggested the automatic rebooking of the cylinder when the gas level drops to cylinder weight is typical. This system avoids the outpouring of gas thereby reducing the risk to human life.

Proposed System

The Aurdino microcontroller detector system serves as the foundation for the proposed system, which uses a sensor to detect gas. Microcontroller provides power to the sensor, LCD, buzzer, and GSM module. The power supply for the main, fundamental Arduino Mega328P micro controller must be between 1.8 and 5.5 volts. An ac to dc adapter or a battery can provide power. Between 1.8 and 5.5 volts are supported by the board. On the off chance that voltage < 1.8 V, board becomes temperamental. Board damage occurs when voltage exceeds 5.5V.

MQ2 sensor is used to measure the amount of LPG in the air. It is able to detect flammable gas at concentrations between 200 and 10,000 parts per million, and its response time is extremely quick. The outcome of the sensors would be a simple power. The transition from an analog resistor to voltage is controlled by a sequential communication circuit. That voltage is reported by the microcontroller. This simple voltage is carefully changed over utilizing a 12-bit Simple to a computerized converter. The sensor sends an Active low signal to the Microcontroller board for further operation when the leak is detected.

When a leak of LPG gas is detected, the Arduino UNO sends the signal to the LCD, which then displays the alert message. In the event that the user is not present at home, the buzzer will sound an alarm and notify the neighbours. Additionally, the fact that the GSM module is a piece of hardware that connects to a remote network rather than the internet or a hotspot wifi makes it more appealing. As a result, users receive a text-based message alerting them to a gas leak so that they can take the necessary action.

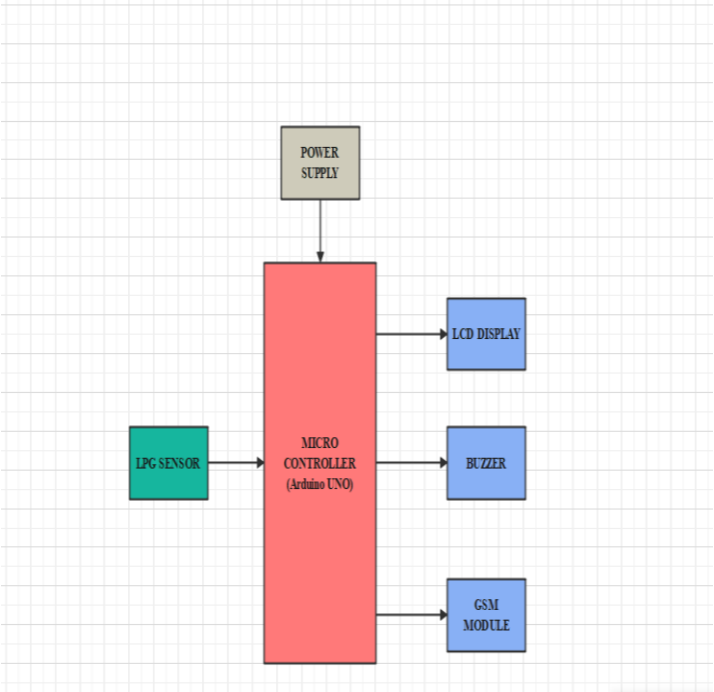

Fig 1. System Architecture

System Requirements

LCD

Fig 2. Liquid Crystal Display

Liquid crystal display is spelled LCD. It is one kind of electronic display module that is used in a wide variety of circuits and devices like mobile phones, calculators, computers, televisions, and others. Seven segments and multi-segment light-emitting diodes are the primary uses for these displays. The main advantages of using this module are its low cost; simply programmable, animations, and the display of custom characters, special effects, and even animations, among other things, is unrestricted. Here, electrical currents cause the liquid crystal molecules to align at the same time, allowing varying levels of light to pass through to the second substrate and produce the colours and images you see.

Buzzer

Fig 3. Buzzer

Electric sounding devices that produce sounds are known as buzzers. They fall into two categories: magnetic buzzers and piezo buzzers, and they are typically powered by DC voltage. They can produce a variety of sounds based on their various designs and applications. An audio signal device known as a buzzer or beeper can be piezoelectric, mechanical, or electromechanical. Alarm clocks, timers, and confirmation of user input such as a mouse click or keystroke are all common applications for buzzers and beepers.

Gas Sensor

Fig 4. MQ2 Gas Sensor

Typically, LPG gas is detected by semiconductor sensors. In this approach, a MQ2 semiconductor sensor is used. The MQ-2 gas sensor's sensitive material is SnO2, which has lower conductivity in clean air. When there is the combustible gas that you want. As the concentration of the gas rises, so does the sensor's conductivity. The MQ-2 gas sensor responds to natural gas as well as propane, butane, and LPG with high sensitivity. The sensor is capable of detecting a variety of combustible gases, particularly methane. It is affordable and suitable for a variety of applications. The MQ-2 is capable of detecting gas concentrations between 200 and 10,000 ppm. The analogue resistance is the sensor's output.

GSM Module

Fig 5. GSM Module

The gas sensor shows whether gas is present, the weight sensor shows how much gas is in the cylinder, and the microcontroller will take any necessary or corrective actions. The system's owner or other housemates must be informed of the current situation. By connecting the GSM module to the RX and TX pins of a microcontroller, the technology that makes it easy to send and receive messages works on simple at commands. The GSM module is used, and it uses SIM memory to store the number of system owners, housemates, distributors, and whoever else needs to receive messages. It works with a straightforward 12 Volt adapter and requires very little memory to send and receive text messages.

Arduino UNO

Fig 6. Arduino Uno

The ATmega328 is the foundation for the microcontroller board known as the Arduino Uno (datasheet). It has a reset button, six analogue inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and 14 digital input/output pins, six of which can be used as PWM outputs. It has everything the microcontroller needs to be supported. To get started, simply connect it to a computer using a USB cable, or power it with an AC-to-DC adapter or battery. The fact that the Uno does not utilize the FTDI USB-to-serial driver chip sets it apart from all of the other boards before it.

Results and Discussion

The paper's ultimate goal is to create a finished gas leakage detection system. The safety can be improved with the spread of the internet in houses expanded even more with the advent of the IOT. The Arduino UNO continuously monitors the gas leakage using the sensor. If this sensor's values alter in any way, the buzzer starts buzzing and the GSM module sends the notification for the user. The LPG gas in the environment is measured using a MQ2 gas sensor. If the leak is discovered, the application gas indicator level increase to particular value. When a value exceeds the threshold value system examines the value of MQ2 sensor. When gas leaks the alarm is set on, alert system is turned on, and how much gas is leaking is seen on an LCD. By doing so, numerous people, including the neighbourhood can be connected, so that when there is problem anyone in the area learns about, can act instantly[6].

If the leak is the result of an accident or deliberate opening of the head, the developed system will not only be able to identify leaks of LPG but also go further to prevent additional leaks. Using GSM infrastructures, a brief SMS is simultaneously sent to a pre-defined phone number to alert concerned individuals of the gas leakage incident.

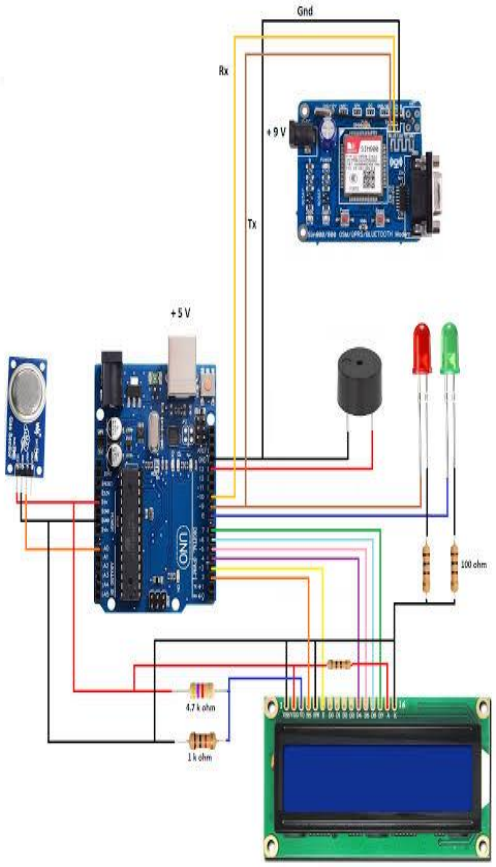

Fig 7. Hardware Connection

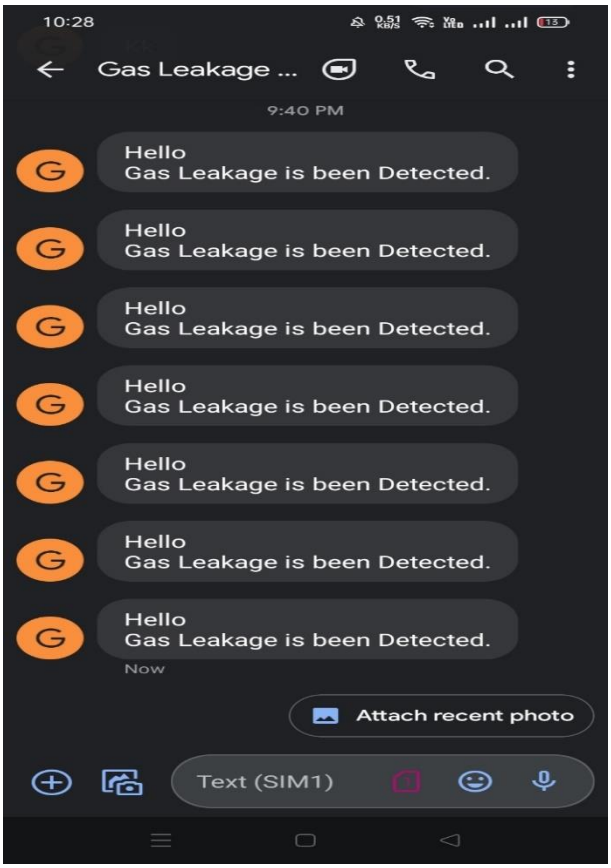

Fig 8. SMS Alert sent by GSM

Conclusion

Gas leakage leads to various incidental performing into both fiscal loss as well as mortal injuries. In human's daily life, terrain gives the most significant impact to their health issues. The threat of blasting, explosion suffocation all are grounded on their physical properties such as flammability, toxicity etc. The number of deaths due to the explosion of gas cylinders has been adding in recent times. Gas Leakage occurs mainly due to poor maintenance of equipment and inadequate awareness of the people. The proposed model provides a fast and cost-effective solution to avert the gas leak effect by reducing the risk to human life. Security is the main caution while employing this technology. Our model will demonstrate that it has resonance in both homes and businesses.

Future Scope

The systems' overall software and hardware have been developed and tested by placing a small amount of LPG close to the gas sensor module. Further the device can be incorporated with multiple functions. The addition of a subsystem that makes it possible to monitor gas use and waste is one of this system's notable future plans. The system is adaptable because more sensors and relays can be added based on the entire LPG supply setup. The monitoring system can be further enhanced by replacing Bluetooth in place of GSM module to send SMS, which assist another real-time applications. In the future, this system will have features that allow it to alert the emergency services in the event of an accident. Additionally, a web-based app and a mobile app for real-time monitoring will be added. Numerous intelligent features will be added to the system's user app. The system's overall features will increase users' safety. The system will be made to work best in a lot of places, like cars, homes, businesses, and many other places.

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