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LPG SAFETY SYSTEM FOR IIOT AND HOMES SAFETY USING MQ-2 SENSOR

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Abstract

A robust Liquefied Petroleum Gas (LPG) leakage detection device is developed using Internet of Things (IoT). This system is shown to be much more cost-effective, efficient, and helpful for disaster management as a part of Industrial IoT (IIoT) and domestic safety purposes when compared to the cost of production. With the help of flammable MQ2 and CO gas detection sensors, methane (CH4) and carbon monoxide (CO) gas concentrations are measured. These sensors are coupled with an Arduino, Wi-Fi, microprocessor, low voltage, and current. The embedded arrangement uses a fan arrangement as a safety safeguard that won't run and ignite when it starts or runs, and a warning alarm is activated as soon as a gas leak is discovered. This system has advantages over the conventional, outdated safety system, which has drawbacks and a higher risk of fire or explosion and includes data reading with time stamping, quick response times, precise emergency detection, and faster spread of the critical conditions.

Keywords: Internet of Things, IIoT, Industrial safety, gas leakage detection, LPG, disaster management.

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Introduction

The use of Liquidized Petroleum Gas (LPG) causes significant complications both at home and at work. LPG is an ignitable gas that is utilized excessively in homes and workplaces. Dr. Walter Snelling, a chemist, first identified LPG in 1910. LPG is a blend of industrial gases, including propane and butane, with saturated and unsaturated hydrocarbons. Because of possible risks, such as petrol leakage, LPG threatens the safety of many houses and people. It is vitally essential to be aware of your surroundings and attentive in order to avoid potentially dangerous risks. Humans need accurate information about when LPG leaks will occur in order to prevent potential concerns to their home's safety. People, users, or residents can lessen the risks and potential consequences of the petrol leak by having access to this warning information, especially when they are away from their homes.

In order to protect the workplaces, we have decided to design an examination system that detects LPG leaks and takes the proper precautions at the appropriate moment. This system gives data such as when a gas leak is detected, employing sensors in the project with Arduino nano are used to detect the leak and quickly turns ON the buzzer about the ambient conditions to the gas level for the danger indicator. Buzzer is an obvious sign of gas leakage. The importance of finding the gas leak and stopping it are both significant. The primary goal of this project is to be the most accurate system at the lowest possible cost.

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Literature review:

The subject of gas leakage detection techniques has been the subject of numerous reviews in the past, either as part of research articles or technical reports on specific leak detection techniques and other gas-related topics.

In 2008, Ch. Manohar Raju and N. Sushma Rani suggested a prototype for a small mobile robot that could detect gas leaks in potentially dangerous areas. They also introduced an android-based autonomous gas detection and indication robot. When there is a petrol leak in a certain location, the robot gathers the information and uses a Bluetooth wireless connection to deliver notifications to the customer's Android mobile device [1].

Ajay Rupani, Dikshant Pandey, and Gajendra Sujediya published a review paper on the study of Field Programmable Gate Array (FPGA) implementation of the Internet of Things and discussed the future vision of IoT with increasingly sophisticated techniques in sensing, actuation, communications, and control for knowledge creation from data mining with FPGA applications alongside IoT [2].

Kareem Jumaa, Younus Mohammed Abdulkhaleq, Muntadher Asaad Nadhim, Tariq Aziz Abbas proposed that Proteus design suite was used to propose an Internet of Things (IoT)-based gas detection prototype. The Blink IoT platform was used for data visualization. The proposed technique wirelessly transfers alert notifications to the user, enabling the user to connect the devices with ease using a smartphone from any location [3].

Falohun A.S., Oke A.O., Abolaji B.M. suggested in their study by using a variety of MQ series sensors that operate with voltages between 5V and 12V and preferred a 5V supply voltage. It was found that once powered, the sensor's output is typically HIGH but changes to LOW when gas is detected [4].

In 2018, T Alex Stanley Raja, R Senthil Kumar, A Nandhakumar, K V Santhosh Kumar suggested that the GSM Modem can be used to deliver SMS notifications to the user regarding the rise in temperature and the completion status of the LPG gas. GSM (Global System for Mobile Communication) is a modern digital mobile phone system [5].

Methodology:

The system's primary component, the Arduino NANO (Atmega-328), carries out the following functions. The output signal of the sensor, which is supplied as input to Arduino, performs signal conditioning. The findings of the detection are shown on LCD. warns individuals of danger at work, at the factory, and at home. There is buzzer activity and a beep (siren) sound.

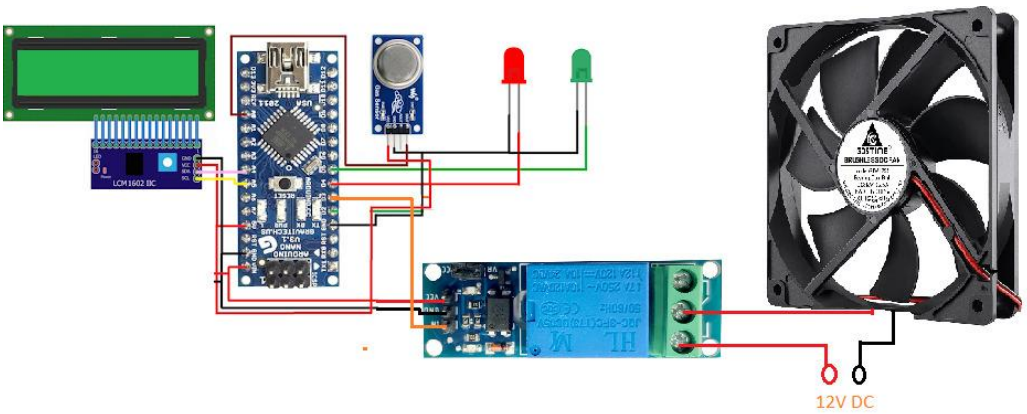

Figure 1: Actual System

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The MQ-2 Sensor continuously indicates on the LCD the amount of LPG that is present in the environment. The LED glows and the buzzer starts buzzing if the smoke level rises over the usual level, signalling that there is an LPG leak (the standard level can be decided by the user). We also included a relay channel that would automatically supply power to the exhaust fan when there was a gas leak in order to lessen the amount of gas that remained in a particular room following the breach. The buzzer will cease beeping and the exhaust fan will turn off automatically as soon as the amount of gas falls as per the acceptable limit.

We have also included a switch in our system so that the exhaust fan may be controlled manually. 9 Volt Power Battery with a supply LED indicator. To create a 5 Volt Supply with a voltage divider circuit, simple resistors with a 1/4 watt of power are needed. To prevent sparking and fire caused by LPG, on is used for the system's operation instead of 240 Volt AC with a step-down transformer for safety reasons.

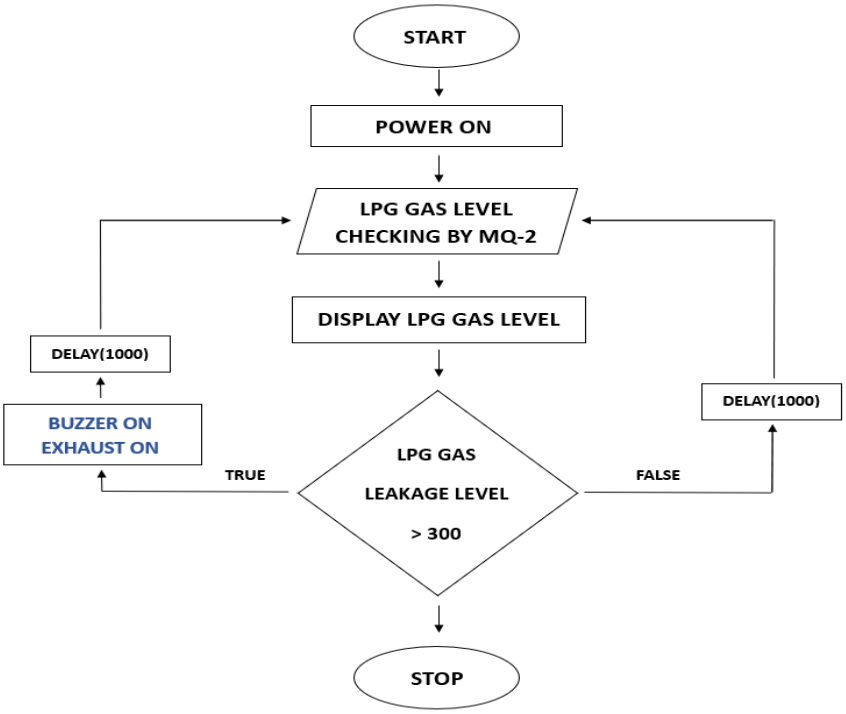

Figure 2: Flowchart of Algorithm

Costing:

The list of hardware components utilised, together with their number and cost, is shown in the table below. The system just costs a little over two thousand rupees.

Components	Quantity	Cost (In Rs.)
Arduino Nano	**1**	**600**
MQ-2 Sensor	**1**	**400**
LCD (16x2)	**1**	**300**
Fan (Exhaust)	**1**	**150**

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Arduino Nano Cable	**1**	**50**
Relay channel (5 V)	**1**	**50**
PCB Board (6x4 inch)	**1**	**50**
Wires	**14**	**50**
Power Battery (9 V)	**1**	**50**
Buzzer (5 V)	**1**	**30**
Switch	**1**	**10**
LED	**2**	**5**
Resistors (1/4 Watt)	**2**	**5**
Total Cost		**1750**

Results and discussion

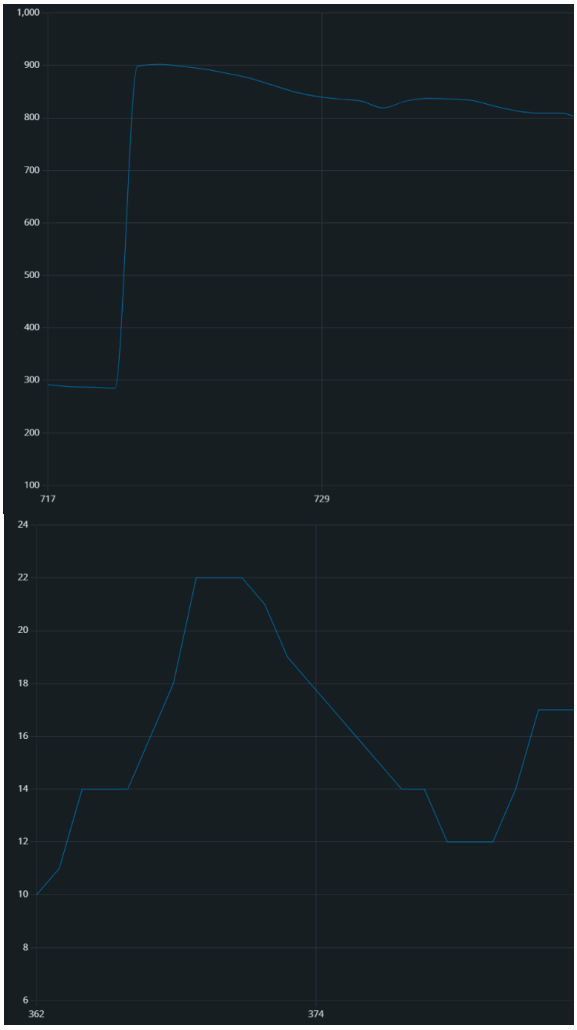

Figure 3: initial settings for the MQ-2 sensor and the upper limit

After detecting gas leakage, the simple working technique utilised and tested in this system for LPG leak using MQ2 and CO gas sensor delivers the signal to the Arduino UNO. The above figure also shows the initial settings for the MQ-2 sensor and the upper limit graphs, which show pick following LPG limit crossing in the second graph as opposed to the first. Arduino to an externally connected device such as an LCD and buzzer. In reality, results being seen by the people surrounding by the area are displayed on the LCD and the buzzer sound shows the risk to the people by creating the buzzer alert. This system has advantages over the traditional, outmoded safety system, which has disadvantages and a larger danger of fire or explosion and includes data reading with time stamping, short response times, precise emergency detection, and faster spread of critical circumstances.

Conclusion:

In this research can conclude that detection of the LPG leakage system at low concentration is described which is incredible in the industrial and domestic purpose. In danger situations we are able to save the life by using this system. An alert is indicated by the buzzer The leakage is detected using the MQ-2 gas sensor. A sensor node senses gas like CO2, oxygen, propane. The estimated range of transmission and consumption of power is obtained The sensor sends a signal to Arduino nano microcontroller In the next step, microcontroller sends an active signal to other externally connected device which performs alert indicated by the buzzer. This easy control over the devices like exhaust fan makes the environment less accident- prone Using the microcontroller nano also makes the system cheaper. Quick access and control make the system very useful.

Acknowledgement:

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