Prevention from Gas Devastation

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Abstract: LPG leakages are the most common issues found in household and gas plants. This issue is life threatening not only for the humans in the vicinity but also for the surrounding areas. The idea behind our project is to save the lives of those innocents who can get affected due to the carelessness of certain people. So, as soon as the gas gets detected by the system, the concerned people around will receive messages as well as the alarm rings.

Keywords— Liquidified Petroleum Gas; Arduino UNO; mechanism; GSM Module; Bluetooth; V Model; microcontroller board; debugging; Atmega328P; High-Level Design; low-level design; sensor; SMS Alert; Death Rate.

1. INTRODUCTION

LPG, which is Liquefied Petroleum Gas, refers to the combustible gases of hydrocarbons. It is also found naturally along with many other hydrogen-carbon compounds. Petroleum gas is mostly used over petrol as it decreases the emission of carbon dioxide by 35%. LPG is a crucial alternate fuel for many purposes. They are also used in many automobiles for it has the property of burning without causing dirt. LPG is not only used in household chores but also in automobiles. In this project we are trying to portray the loss due to the leakage of LPG gas in houses or manufacturing unit and also how we can overcome this issue. [1,5,6]. According to TIMES OF INDIA, AUGUST 8, 2020, at New Delhi there was a massive LPG blast which cost the life of 14 people and affected the vicinity as well. Even many other cases have happened over time that showed LPG leakage has proved to be fatal for many innocent lives. A graph also shows around 17-18% of deaths in India are due to gas leakage accidents. Since years, Arduino has been the life of many technicians, programmers, students, as this has made invention much easier. Many researchers as Didpaye and Nanda, Soundarya and K. Vinoth, has also designed something similar to our project that will spot the leaking of Liquidified Petroleum Gas by the use of Arduino and motor [5,7,9,10]. In this project named “Prevention from gas devastation”, we have tried designing a system that not only shuts the gas using a solenoid valve but also helps alarm the concerned people. The main mechanism of this project is the method in which the machine can detect the gas leakage and alarm the surroundings with the help of its alarming sensor as well as send messages to those numbers which have been saved in the Arduino with the help of programming. Moreover, the solenoid valve will be triggered which will lead to the shutting of the gas. When the people will be informed, they can either save themselves by opening windows and doors, or they can also leave the vicinity so that even if fire catches, their lives will be saved. This device will not only help save lives but also show the level of gas before leakage as well after leakage in the LCD screen. The knowledge about this feature of the machine will help the individual to keep a track on the level, so that even after a little change in it the individual can take precautions accordingly, before the indication of the leakage detector.

1.1 THE MAIN PURPOSE OF THIS PROJECT ARE STATED BELOW:
This system has a layout that can detect the leaking gas, alarm the people concerned, shut the gas cylinder and also sends virtual text messages to the people in charge.

2. SCOPE AND LIMITATIONS

2.1 SCOPES:

It can detect all types of gaseous material like methane, butane, LPG, petroleum etc. This system can work by using Bluetooth in place of GSM module for sending alerts. The proposed system also sends virtual messages to the phone number that has been set in the Arduino using code. It generates a sound alarm when excessive outflow of gas is noticed, to alert people around. Moreover, it displays the status of the gas leakage.

2.2 LIMITATION:

In this device the portable gas cook top cannot be used and LPG hand wheel cannot be controlled.

3. METHODOLOGY AND TECHNICAL ENVIRONMENT

3.1 SDLC MODEL

The SDLC model also known as V-model is a process which is a raised version of the “waterfall model”. In this process the phases of coding do not go down in a linear manner instead it bends sideways forming a “V shape”. The V-Model explains the relation between each phase of the process [2]. This project was acquired by using the V-model technique. This technique is easy to use. The next stage starts only after completion of the previous stage.

3.1.1 Unit Test: Starting from the very end, the first part is known as “Component Test”. The other name for component test is “unit testing”. It examines the usage of every single component.

3.1.2 Integration Test: This test is essential as it checks the whole process from the software point of view.

3.1.3 System Test: Once the gas detector is ready, it must be tested against its system specifications to know how its features work.

3.1.4 Acceptance Test: This part of the project checks whether the device can be used against its incapability, in other words, it checks the requirements that an user might need to run this device.

4. REQUIREMENT ANALYSIS

The hardware’s used are:

4.1 Arduino software makes it easier to input the written code into the Arduino UNO. This runs on an object-oriented program, namely, JAVA. Its software works in Windows, Mac operating system as well as Linux operating system.

4.2 The Arduino UNO is a micro-controller unit which is based on the single-chip controller named ATmega328. It supervises almost every step included in our setup. This controls the hardware. Arduino
UNO takes an input voltage ranging from 7 to 12 volts. It has 14 digital input-output pins and 6 analogy inputs. It has a flash memory of 32k and a clock speed of 16 megahertz. The USB interface is user friendly.

4.3 This project needs a SIM 800 GSM module for virtual text alert messages, a buzzer for sound alarm, an LCD module for display. Sim 800 is a quad-band general packet radio service (GPRS) module. Sim 800 is very useful for data transfer applications. It supports a sim card ranging from 1.8V to 3V. This is also used for debugging purposes. It has improved spectrum efficiency, SIM phonebook management, fixed dialing number (FDN), High-quality speech.

4.4 MQ5 is a stable, low-priced electronic and chemically run gas sensor suitable for the detection of a wide range of volatile organic compounds commonly known as VOC and many other gases. It can sense gases like ammonium nitrate, oxygen, sulfides, smoke, etc. This sensor has been implemented in our machine to detect all types of gas leaks. Some of these gases are hydrogen, liquefied petroleum gas, methane, carbon do-oxide, alcohol etc. It has a fast response setup so as to help the concerned people efficiently. It works for a long time without showing any mechanical errors. The MQ5 sensor can detect gases at a range of 300 to 5000 parts per million and works on a maximum input voltage of 5 volts. It has a dimension of 18mm diameter, 17mm height and 6mm high pins. It has an allotted span and is cost-effective.

4.5 In this device the coding is done in C++ programming language. The coding is based on the course of action and pattern. The code undergoes through a number of examinations before finalization.

4.6 We also used Arduino IDE is a coding software that makes it simpler to code and burn the written code. This deals with the programming language and the wiring project.

5. METHODOLOGY

5.1 THE SENSING UNIT: The main unit of this system is the sensing unit. The work of this unit is to use the MQ5 gas sensor and diagnose the gas if it is leaking. The detection done by it helps the other units to maintain their own functionalities.[5]

5.2 THE PROCESSING UNIT: A microcontroller unit has been used which is built on the ATmega328 controller. It also has an alternate current to direct current adaptor to receive power supply in the Arduino. The LCD is then connected with the output port which further sends signals to the GSM module. After the digital signal sent by the sensing unit, these units start working. The GSM module will then send SMS alert to the concerned user of the LPG.[5]

5.3 THE COMMUNICATION DISPLAY: The user is communicated by the machine in two ways—Firstly; it will ring the alarm so that the people in the vicinity will be enlightened about the leakage of the gas. Secondly, a virtual test message saying, “THE GAS LEAKAGE HAS BEGAN AND THE LEVEL OF GAS LEAKAGE IS: ****”, will be sent. This message will be sent to those phone numbers whose data will be burnt in the Arduino and it will inform the later about the level of the gas.[5]
5.4 **THE POWER SUPPLYING UNIT:** The system takes input power in two ways, namely, through direct plugging of the device with the power supply and through a rechargeable battery. This unit of the system consists of a bridge rectifier which converts the Alternate Current voltage to Direct Current voltage, one step-down transformer, one capacitor which filters the repulse of alternate current and a voltage regulator to provide safety from short circuits [5].

6. **ARCHITECTURAL DESIGN:**

The architectural design is the root of the whole device as without a design one cannot build anything. It helps the designer as well as the user to get hold of the knowledge of the machinery parts and to understand the work of it in a pictorial form.

![CIRCUIT DIAGRAM OF THE LPG GAS LEAKAGE DETECTOR](image)

Figure 1: CIRCUIT DIAGRAM OF THE LPG GAS LEAKAGE DETECTOR

7. **SYSTEM SETUP**

This is the complete design of the project. Here all the components are completely comprehensive and locative. The communicating part of the project is designed under the hardware and software system [6]. When the device is switched on and the gas level is detected to be high, the GSM module is activated. This further sends information about the gas leakage and its concentration in parts per million as a text message to the numbers which have been saved in the Arduino through programming. The system also rings the buzzer or the alarm which alerts the nearby people and gives them time evacuate the vicinity.
When the gas level comes back to its normal concentration, another text message is sent to the concerned user which says, “GAS LEVEL IS NORMAL NOW”, along with the level of the gas in parts per million and the ringing stops.

7.1 DEATH RATE:

According to research per day average 62 deaths happen cause of fire accidents. 17% of people die because of gas leakage accidents. It means due to gas leakage accidents approximately 330 people die in a month, 3960 people in a year. If this kind of gas leakage happens in any plant then at a time a huge number of people will be in danger. Recent times this kind of accidents happen in Vijack, Bhopal, Visakhapatnam and all over India. Many cases are found where accidents happen at home. The after effects of this accidents are too much dangerous. It takes too long to recover the whole condition of the situation. So if LPG gas leakage detector will be used by people then the percentage of accidents cause of gas leakage will be decreased by time.

Figure 3: NUMBER OF DEATHS DUE TO FIRE ACCIDENTS
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