DEPARTMENT OF COMPUTER SCIENCE ENGINEERING,

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SHARDA UNIVERSITY, GREATER NOIDA

GSM-Based Automatic Alarm System for Disaster Management

A project submitted

In partial fulfillment of the requirements for the degree of

Bachelor of Technology in Computer Science and Engineering

By

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CERTIFICATE

This is to certify that the report entitled **"GSM-Based Automatic Alarm System for Disaster Management"** submitted by **"**VIBHU SINGH (2018006666), KARAN (2018014809), VANSH PANWAR (2018012744)**"** to Sharda University, towards the fulfilment of requirements of the degree of **"Bachelor of Technology"** is record of final year Project work carried out by him in the **"**Department of Computer Science and Engineering, School of Engineering and Technology, Sharda University**"**.

The results/findings contained in this Project have not been submitted in part or full to any other University/Institute for award of any other Degree/Diploma.

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Date:

Signature of External Examiner:

Date:

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A major project is a golden opportunity for learning and self-development. We consider our self very lucky and honoured to have so many wonderful people lead us through in completion of this project.

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ABSTRACT

Gas leakage is a big concern that may lead to a wide range of incidents in the home, workplace, and industrial sector. LPG pipes have a wide range of uses, but home security is one of the most pressing ones. The problem of gas leaks has become a prevalent one. A well-known fuel source in urban areas is Liquefied Petroleum gas (LPG). In addition, it is more hygienic than wood or coal because of this. Homes, studios, and vehicles, such as buses and gas-powered vehicles, are all concerned about gas leaks. An automated gas leak detection system that also sends a text message to the user, rings a buzzer alarm to notify nearby residents, and controls gas leakage are all discussed in this report scope (by exhaust functionalities). It is also hoped that the use of gas sensors, which can readily identify gas leaks such as LPG or smoke, would be promoted. Installing and deploying a gas leak detection system or kit as suggested work in high-risk locations is an easy approach to avoid gas-related dangers.

***Index Terms*----** GSM, Gas Leakage, Arduino, Buzzer, Disaster System, LPG

LIST OF TABLES

LIST OF FIGURES

Contents

Chapter1: INTRODUCTION

Leakage of Compressed Natural Gas (CNG) from vehicles, such as automobiles and buses, is now a common occurrence, and it may be seen in a variety of settings. Gas leaks have caused disastrous situations in the past. An LPG is a combination of butanes, propanes and pentanees (50 percent, 48 percent, 2 percent). It may be utilised in a variety of ways, including for heating, household appliances, and cars. Liquefied petroleum gas (LPG) is the most common fuel used in home kitchens. Any leaking of these gases might quickly ignite them, resulting in an explosion. There are also numerous mishaps that result in damage and loss of material goods because of this. Due to the LPG epidemic, deaths have grown and human health has been put at risk in recent years.

A gas cylinder explosion is caused by a lack of frequent gas cylinder checks, a lack of knowledge, a poor cylinder, and a worn-out regulator. There was a project called "LPG Leakage Detector," which was designed to help prevent any gas leakage that can cause explosion or other harm.

This project's goal is to detect gas leaks and provide an alarm to users so that an accident may be avoided. At a lowest cost and with maximum advantages, the proposed work aims to develop and build an autonomous alert system for disaster management using GSM (Global System for Mobile Communication). It can also detect LPG gas leaks using an LPG gas sensor built into an Arduino. When the system detects a gas leak, a buzzer will ring and a red LED (light-emitting diode) will light up. The GSM module will then send a message to the user. When a gas leak is detected, the exhaust fans will immediately switch on. Finally, it will link to local fire departments and obtain a call back from a fire extinguishing department to the owner as quickly as feasible to take further preventative measures.

Overview:

Inflammable gas amount present in air, when the amount reaches to dangerous level it triggers the exhaust fan, led light, buzzer alarm and sends a SMS to user along with the location of that area.

This project proposes an automatic buzzer alarm system for disaster management through the application of Arduino software and hardware with entrepreneurial skills and attributes injected with it. It is essentially a system that measures the developed through the software Arduino IDE. The hardware consists of Arduino nano, buzzer, GPS and GSM module and MQ 6 sensor.

Project Description:

Based on a gas sensor, the gas leakage security system quickly and simply identifies a leak (LPG, smoke, etc.). Installing a gas leak detection kit in high-risk locations is an easy method to reduce gas-related accidents. This is what we plan to do. Project goals are to discuss and execute a design, functionality, and future scope of a gas leakage detection system that can automatically detect, notify the user through GSM module, ring buzzer alarm and regulate gas leaking (by exhaust functionalities).

1.1 Problem Definition

Leakage of Compressed Natural Gas (CNG) is a major issue that may be found in a variety of settings, including manufacturing facilities, residential areas, and automobiles. Gas leaks have caused disastrous situations in the past. An LPG is a combination of butanes, propanes and pentanes (50 percent, 48 percent , 2 percent). It may be utilised in a variety of ways, including for heating, household appliances, and cars. Liquefied petroleum gas (LPG) is the most common fuel used in home kitchens. Any leaking of these gases might quickly ignite them, resulting in an explosion. There are also numerous mishaps that result in damage and loss of material goods because of this. Due to the LPG epidemic, deaths have grown and human health has been put at risk in recent years.

GSM (Global System for Mobile Communication) based automated alarm system for disaster management is the goal of the proposed work, which aims to minimise costs while maximising benefits. It can also detect LPG gas leaks using an LPG gas sensor built into an Arduino. When the system detects a gas leak, a buzzer will ring and a red LED (light-emitting diode) will light up.

The GSM module will then send a message to the user. When a gas leak is detected, the exhaust fans will immediately switch on. Finally, it will link to local fire departments and obtain a call back from a fire extinguishing department to the owner as quickly as feasible to take further preventative measures.

1.2 Project Overview/ Requirement Specifications

1.2.1 Functional Requirements

1.2.1.1 Introduction

Simple and easy to use, the MQ-6 sensor module is ready to detect LP GAS, which is mostly constituted of butane and propane. The MQ6 sensor has a range of 200 to 10,000 ppm and can detect gas. In a gas detection appliance, it is the primary sensor component. Gases are ionised when they come into touch with sensor material. As a consequence of this, the resistance in the circuit is altered. However, this sensor has a lower sensitivity to alcohol and cigarette smoke than other sensors.

This framework relies on an Arduino Nano, a gas sensor (MQ-6), a photoelectric detector, a GSM module, and an exhaust fan. Whenever the sensor detects gas, (it will offer a computerised yield of 1), the sensor will also give an advanced yield of 0. The sensor's output will be sent into Arduino through computer.) "Yes" will appear on the LCD screen next to "Gas recognition: Yes" if the sensor output is high. Sending out an alarm message and concurrently removing exhaust fumes is possible with the use of a GSM module and a nearby gas station. The ringer will not tune if the sensor yield is low, and the LCD will display "Gas distinguished: No." if that occurs.

Then with the aid of GSM module, a message will be transmitted to the use. The exhaust fans will automatically switch on anytime the gas leakage detected. Lastly, it will link to local fire departments and obtain a call back from fire extinguishing department to the owner as quickly as feasible to take additional actions of prevention.

When a catch is pressed or the predetermined time has passed, the device will often flash the catch value bulb or control board and emit a steady or unnatural rumbling or screaming noise to signal completion of the discipline.All of the associated equipment is necessary for the sensory-based gas system spillage identification and warning framework. The device has a variety of beneficial features and is portable, light, and simple to use.

1.2.1.2 Input

As we turn on the system the MQ6 sensor starts to sense the gas and send this data to the microcontroller which does the further operations. (Fig. 1)

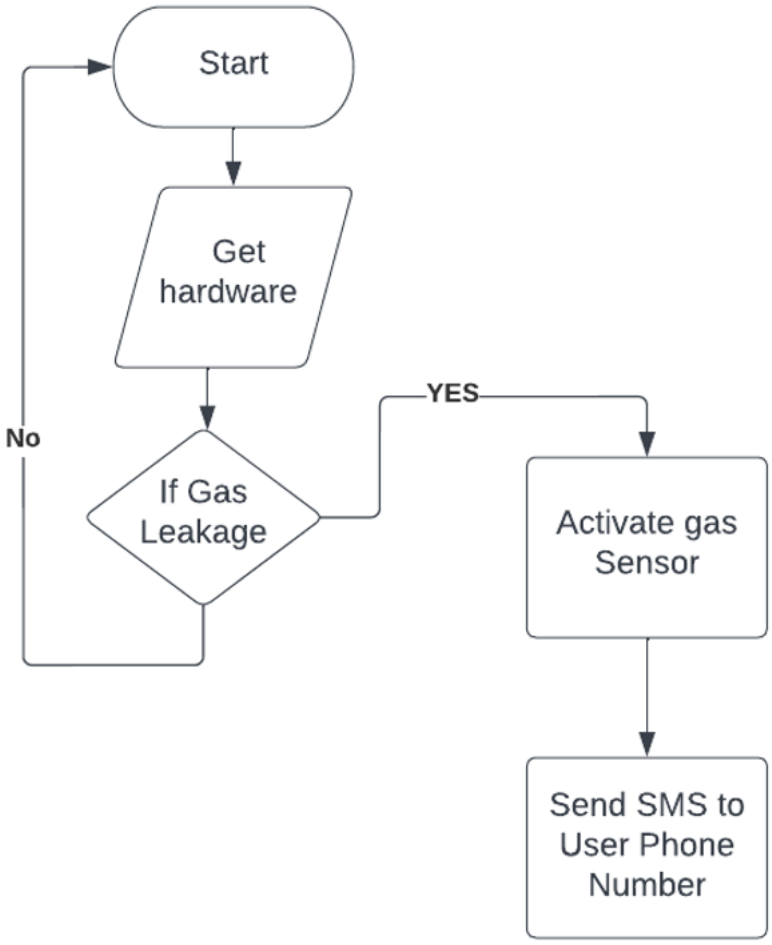


Figure 1: Flow Chart

1.2.1.3 Processing

Easy-to-use LPG sensor that is ready to detect LP GAS (mainly butane and propane) in the air with the MQ-6 sensor module. In the range of 200 to 10,000 ppm, the MQ6 sensor can detect gas. A gas detection appliance's primary sensing component, it may be found here. In order to detect gases, the sensor uses a sensing substance that ionises the molecules it comes into contact with. As a consequence of this, the resistance in the circuit varies due to the ionisation of the gases. There is just one drawback to this sensor; it is less sensitive to alcohol and smoking.

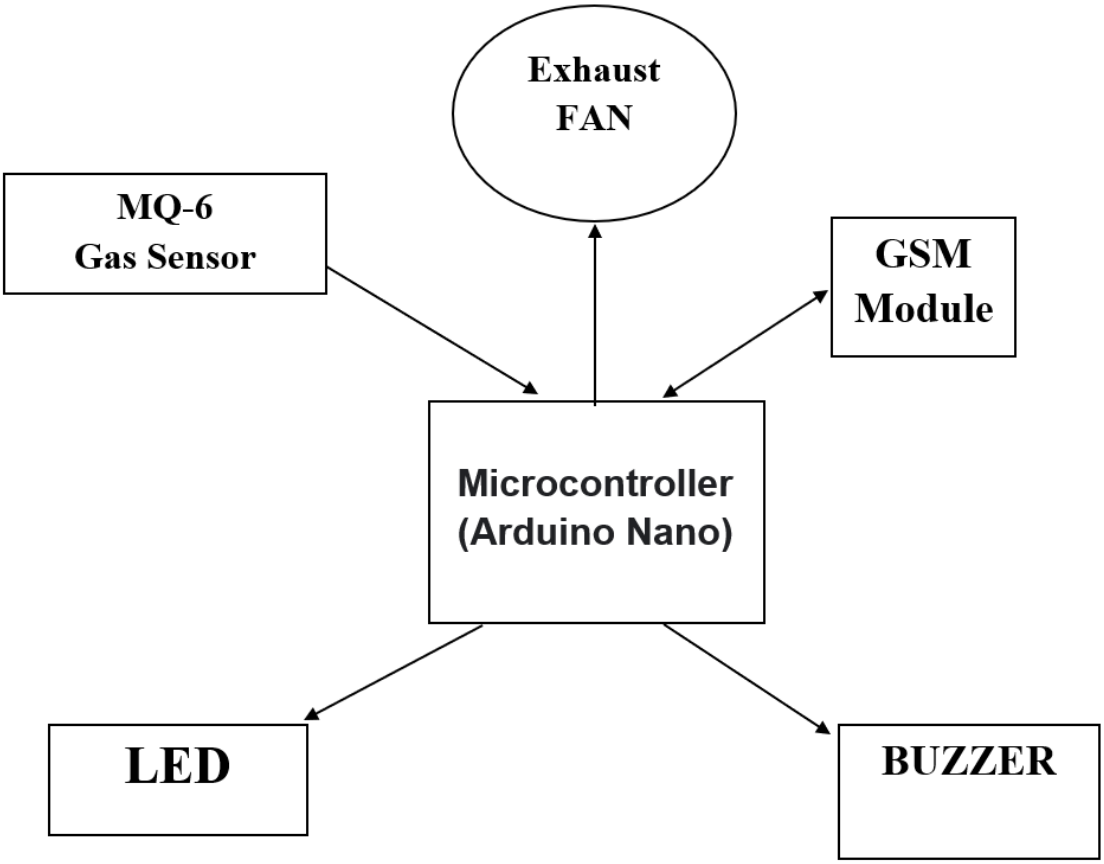


Figure 2: Block Diagram

1.2.2 Non-functional Requirements

These are the specifications, as the name implies, that are not specifically correlated with particular functions offered the device.

1.2.2.1 Performance Requirements

Execution based on the relation; high execution of the system may lead to higher usage of the batteries so we have connected our system to the direct AC supply.

1.2.2.2 Reliability

Our IOT based Automated alarm system for disaster management is very reliable in our daily lives as we do no need to take care of gas leakage on the daily bases, in fact we can check our mobile SMS for that and also its secure.

1.2.2.3 Availability

Availability is the major thing that is required to work with our project, as we would definitely make our product available and also support will be available to every user.

1.2.2.4 Ability of Learning

It is simple to operate by the user.

1.3 Hardware Specifications

Minimum Requirements	Windows
Operating System	Windows 7
RAM	2 GB RAM
Processor	Dual core, Intel i3
DISK Space	The amount of disc space available depends on the partition size and whether or not online help files are allowed. The Math Works installer would tell you how much disc volume your partition needs.
CD ROM Drive	For installation from CD
Graphics Adapter	8-bit graphics adapter and display (for 256 simultaneous colors)

Table 1: Hardware Specifications

1.3.1 Hardware Requirements

Tools	Amount
Gas sensor (MQ-6)	One
Arduino Nano	One
Exhaust fan	One
Male to male/female Jumper wire	Twenty
Buzzer	One
Resistor	One
GSM Module	One
Neo-6M GPS	One

Table 2: Hardware Required

1.3.1.1 Arduino Nano

Nano is a microcontroller board based on ATmega328p that is small, comprehensive, multifunctional, and breadboard-friendly There are 30 DIP30 male I/O connections on the board, which was developed by Arduino.cc in Italy in 2008.

Figure 3: Arduino Nano

1.3.1.2 Gas sensor (MQ-6)

The MQ-6 can detect gas concentrations ranging from 200 to 10000 ppm. The sensor's sensitivity and response time are both outstanding. Analog resistance is the sensor's output. The driving circuit is a simple one: connect an ADC to the output of the heating coil, provide 5V to the heating coil, and add a load resistance.

Figure 4: MQ-6

1.3.1.3 Buzzer

There are several different types of buzzers. In many cases, it is powered by DC voltage. It is used in alarm clocks, computers, printers, and other electronic devices as a sound source.

Figure 5: Buzzer

1.3.1.4 20 Female to Male

Female to male jumpers is especially handy for connecting standard 0.1″ male header pins like commonly found on breakout boards to female header contacts such as on a solderless breadboard. They also can be used to make extension cables by connecting the female end to the male end of another cable.

The cables have 10 different wire colors which repeat every 10 wires. The rainbow colors make it easy to match the same wire at both ends of the cable.

The individual wires are easily pulled apart by hand to create single jumper wires or to make smaller cables consisting of multiple wires which are handy for keeping wires together when connecting small buses or running multiple wires to a sensor.

Figure 6: Jumper Wires
[15]

1.3.1.6 Red / Green Led

The Bi-Colour LED is a small component that allows two colours (red and green) to be combined in a single LED while only requiring two pins (cathode and anode). The colour of the LED is determined by the polarity of the connection, which allows only one colour to be displayed at a time. LEDs with two or even three colours often have three or four pins, allowing for a wide spectrum of blended hues.

Two pins may appear to be a disadvantage; however, this is not the case. This LED may simply be used to visually identify polarity direction in a circuit. Alternatively, it may save me an extra i/o pin on a future Arduino project, as in my case.

Figures 7: Led

1.3.1.7 Exhaust fan

An exhaust fan's principal function is to evacuate gas from a given region in order to reduce the PPM value of combustible gas. They improve the safety of the home and its inhabitants by decreasing cleaning chemical emissions that might cause health problems.

Figure 8: Exhaust fan
[16]

1.3.1.8 Power Supply

At least one load must be supplied with electricity by a power source. There are a variety of methods for converting non-electrical sources of energy, such as solar, mechanical, or chemical, into electrical power.

A power supply provides components with electricity. Devices that are incorporated into the component being powered are often referred to as "integrated." AC current is converted to DC current in power supplies, which are located at the rear of a computer and normally include at least one fan.

Figure 9: Power Supply

1.3.1.9 GSM Module

To connect to the internet using GSM mobile phone technology, you need a modem, or GSM module. It is common for GSM modems to be used in mobile phones and other devices that connect with mobile networks. They identify their devices to the network with the help of a SIM card.

Figure 10: GSM Module

1.3.1.10 Neo-6M GPS

The NEO-6M GPS Module is based on the u-box NEO-6M Global positioning chip. In addition to its ability to track up to 22 satellites on 50 channels, it consumes only 45 milliamps of electricity from the power supply.

Figure 11: Neo-6M GPS

1.4 Software Specifications

Arduino Integrated Development Environment (IDE) 1.8.19-

The Arduino Software (IDE) is free and open-source, making it simple to create code and upload programs to Arduino compatible. Any Arduino board can be used with this software.

Programming Language- C

Chapter2: Literature Survey

2.1 Existing System:

- **"GAS LEAKAGE DETECTION AND SMART ALERTING SYSTEM":**

  Result-

  Here a buzzer and LED is used to alert the users about the gas leakage when the gas exceeds the normal level. An alert message is also sent to the authorized person.

  Finding-

  This system helped in providing safety against the leakage of harmful and toxic gases.

- **"IOT Based Smart Gas Monitoring System":**

  Result-

  Infrared sensor based gas wastage monitoring.

  Finding-

  People could easily use their time effectively.

- **"IoT Based LPG Gas Leakage Detector":**

  Result-

  Arduino with an integrated microcontroller system is used for detection.

  Finding-

  Mainly used to alert users about gas leakage to avoid fire accidents.

- **“Design and Development of Gas Leakage Monitoring System”:**

  Result-

  The system is designed in such a way that the sensor is deployed near to gas pipeline so as to receive immediate response.

  Finding-

  Used LabVIEW GUI and Zigbee transceiver with LCD display, buzzer alarm system to implement the autonomous exhaust system.

- **“Sensor-Based Gas Leakage Detector System”:**

  Result-

  Here MQ-6 sensor is used. The microcontroller senses the presence of a gas and gives an audiovisual alarm.

  Finding-

  Mainly helpful in reducing accidents caused by gas leakage.

- **“INTERNET OF THINGS (IOT) BASED GAS LEAKAGE MONITORING AND ALERTING SYSTEM WITH MQ-6 SENSOR”:**

  Result-

  It is more efficient OS because of it connected to the web page.

  Finding-

  This system reduces the accident occur by gas leakage

Literature Table:

S.N0.	TITLE	AUTHOR	OBJECTIVE	REQUIREMENTS	WORKING	RESULT	FINDINGS
1	Development of wireless sensor network system for LPG gas leakage detection system	Dr Tabbsum Mujawar	The system is configured in star type topology with devices and sensors in it and then controls all the devices through a gateway node with XBee network, and takes safety measures to protect against serious risk.	Arduino nano board, MQ-2/MQ-6 gas sensor, XBee and a GSM module	The sensor node will detect a minute concentration of the gas according to the voltage output of a sensor and also collects the gas leakage data thereby locating the specific area of the sensor node. XBee sends the data from gas sensor to the monitoring system that is displayed on LabVIEW GUI. A GSM module was as a communication tool between the microcontroller unit and mobile phone unit.	The gas leakage response can be obtained and send to the mobile users saved in Arduino GSM shield and also displayed on the monitoring system	The proposed system describes a new visual LabVIEW approach in the area of gas leakage detection at a low gas concentration.
2	LP GAS LEKAGE ALARM	M. G. D. D. Wickramasinghe, N. Abhayasinghe	This paper presents a low cost, power efficient centralized LP gas leakage alarm system. The system has two main devices: the gas detector and the centralized alarm unit.	Two alkaline batteries, buzzer alarm, NCP 1402, LP gas sensor (TGS 2610D00), DS1305 alarm real time clock, LEDs, MCP73831 controller, AC supply	Sensing module - LP gas sensor sense every 5 minutes and if the ppm level is above 1800 the sensor module sends address bit to alarm unit which make the buzzer on. Alarm module - If the risk level exceeds the alarm rings. Back up battery unit can continuously operate up to hours.	The paper presented the design, development and implementation of low power, accurate LP gas	Surface mount level PCB was designed as the final product without modules and kits, Two modules were designed and implemented in printed circuit board.
3	Design and Development of Gas Leakage Monitoring System	Huan Hui Yan, Yusnita Rahayu	This paper presents the design and development of a wireless gas leakage monitoring system by using Arduino and Zigbee.	gas sensor (MQ9),Arduino uno, Zigbee, LabVIEW Graphical User Interface (GUI)	the monitoring system is developed by using LabVIEW GUI. It is used to display the level of gas concentration in a place through another remote PC, and via internet server. Hence, it provides benefit to monitor the condition of a room in a safe distance.	the sensor is designed to place near to the gas pipeline in order to detect the leakage of gas. Thus, the response of the gas leakage detection can be obtained immediately and managed to obtain data from a scene of accident and display it in the monitoring system.	the monitoring system developed by using LabVIEW GUI, Zigbee transceiver used to monitor the gas concentration, gas detector with LCD display, alarm system built by using buzzer to alert the workers, and in the autonomous exhaust system
4	Internet of Things (IOT) Based Gas Leakage Monitoring and Alerting System with MQ-2 Sensor	Rohan Chandra Pandey, Manish Verma, Lumesh Kumar Sahu	Designing microcontroller based toxic gas detecting and alerting system	Arm Cortex M4, Gas Sensor (MQ-2), Raspberry Pi	Gas level through the sensor and it link with web page or i-cloud to tell us real time value by mq-2 gas sensor.	It is more efficient OS because of it connected to the web page.	This system reduces the accident occur by gas leakage.
5	IOT Based Smart Gas Monitoring System	Anandbakrishnan S, Deepesh Nair, Rakesh K, Sampath K,Gayathri S Nair	Design of an SMS based alert system	MQ-2 Sensor, Load cell, Infrared Sensor, Microcontroller, Wi-Fi Module, Arduino.	If any leakage sense by sensor then the output of this sensor goes high. This monitored by the microcontroller and it will identify the gas leakage. If there is a leakage, the user is informed through the sms and a signal is sent back to the microcontroller to turn off.	The issue of gas wastage is also monitored by the infrared sensor.	People could easily use their time effectively and it is mainly designed for the safety of people and property

6	IoT Based LPG Gas Leakage Detector	Prof. Pranay Meshram, Nancy Shukla, Stuti Mendhekar, Renuka Gadge, Shivani Kanaskar	A IOT based system that can alert, detect, and automatically control gas leaks	Arduino Kit, Buzzer, Gas Sensor (Mq5), WI-FI Module.	When the gas level has exceeded this threshold value, the LED lights up and the system warns the environment by the buzzer. At the same time, the alert sound is sent via a WiFi module to the user's mobile phone.	Arduino kit is used in the system with an integrated microcontroller. This Arduino kit forms the core of the system.	It can be used to avoid fire accidents and provide safety.
7	Sensor-Based Gas Leakage Detector System	Mohammad Monirujjaman Khan	this paper propose and discuss a design of a gas leakage detection system that can automatically detect, alert and control gas leakage	Arduino Uno R3 MQ-6 LPG gas sensor 16*2 LCD Buzzer Male to male/female wire 9 V Battery Gas Lighter 10 K Variable Resistor Mini Breadboard	When the sensor detects gas it will give digital output 1 and if gas in not detected the sensor will give digital output 0. Arduino will receive the sensor output as digital input. If the sensor output is high, then the buzzer will start tuning along with the LCD that will show that "Gas detected: Yes". If the sensor output is low then buzzer will not be tuning, and the LCD will show that "Gas detected: No"	microcontroller senses the presence of a gas when the voltages signal from the MQ-6 sensor goes beyond a certain level and gives an audiovisual alarm.	This system can be helpful in reducing accidents caused by gas leakage
8	GAS LEAKAGE DETECTION AND SMART ALERTING SYSTEM	K.Manichandana, Simrah UmmeRuman, Harshavardhini Biderkota, Ms.Pr Anisha, Dr.B.V Ramana Murthy, and Mr.C Kishor Kumar	designing microcontroller based toxic gas detecting and alerting system	Arduino uno ESP8266 WIFI module MQ-5 sensor Buzzer LED jumper wires	Sensors will sense the value per time and the system will send the values to cloud server and the server will check if the sensor values have increased the threshold value. If sensor value crosses the limit the server will send the command to hardware for buzzing the alarm. Server also sends the notification message to user.	When the gas exceeds the normal level then the led glows and a buzzer is triggered immediately at the incident placeand also an alert message is sent to the authorized person.	this system bring a revolution in the field of safety against the leakage of harmful and toxic gases in environment andhence nullify any major or minor hazard being caused due to them.

Table 3: Literature Table

2.2 Proposed System

Easy-to-use LPG sensor that is ready to detect LP GAS (mainly butane and propane) in the air with the MQ-6 sensor module. In the range of 200 to 10,000 ppm, the MQ6 sensor can detect gas. A gas detection appliance's primary sensing component, it may be found here. In order to detect gases, the sensor uses a sensing substance that ionises the molecules it comes into contact with. As a consequence of this, the resistance in the circuit varies due to the ionisation of the gases. There is just one drawback to this sensor; it is less sensitive to alcohol and smoking.

Arduino Nano, a gas sensor (MQ-6), a photoelectric detector, a GSM module, and an exhaust fan are all essential components of this system. An advanced yield of zero will be given if no gas is detected by the sensor, and one will be given for a detected gas. The sensor's output will be sent into Arduino through computer.) if the sensor's output is high, then the gadget will start tuning adjacent to the LCD display, which will signal "Recognization of gas: "Yes." In conjunction with the GSM module, an alarm message will be sent to the user, and an exhaust system will be activated in close proximity to a gas station. The ringer will not tune if the sensor yield is low, and the LCD will display "Gas distinguished: No" if that occurs "Yes, of course. When a catch is pressed or the predetermined time has passed, the device will often flash the catch value bulb or control board and emit a steady or unnatural rumbling or screaming noise to signal completion of the discipline. All of the associated equipment is necessary for the sensory-based gas system spillage identification and warning framework. Flexible, lightweight and simple to use, the device has a wide range of features that may be used for several purposes.

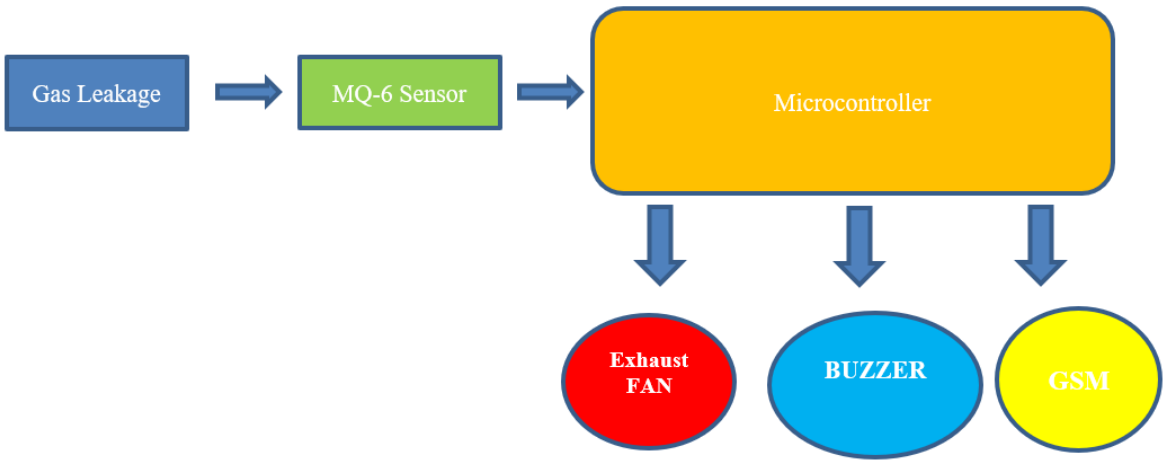


Figure 12: Diagram

2.2.1 Approach used

The project's development is separated into several parts, the first of which is to comprehend the challenge and all of its requirements. Then, in order to obtain the knowledge needed to build the project, a thorough literature review is required. The first module of the project's development will be to connect the components for the IoT-based system. Further code modules and other hardware requirements will be completed at a later date.

2.3 Feasibility Study

Any comprehension of the major specifications for the scheme is necessary for feasibility study.

Feasibility Dimensions for Computers would be as shown in:

Resources

Will the corporation have the capital necessary for success? Two major variables used in the study of viability are:

a) Technical Feasibility
b) Economic Feasibility

a) Technical Feasibility

The purpose of this analysis is to check the technological viability, that is to say, the system's technical requirements. Any built system does not have a strong need for the technological resources required.

- The ability to create output in a given amount of time due to the system's ability to accommodate numerous users.
- Ability to process and respond quickly in particular situations.

In the following ways, practical evaluation of feasibility can be carried out.

b) Economic Feasibility

An Economic Feasibility study examines the project's costs and benefits. For this feasibility study to be complete, a thorough assessment of the project's development expenses, including all necessary costs for the final development, such as hardware and software resources, cost of creation and cost of maintenance must be conducted.

c) Social Feasibility

A proposed project's "social feasibility" relates to whether or not it would be accepted by the general public, hence this proposal is both social and feasibly acceptable.

d) Operational Feasibility

It focuses largely on human issues, including organisational and social aspects. These features should be taken into consideration: the system interface is standard, user-friendly, and provides extensive support. As a consequence, there is no need for further training.

2.4 Risk Management: -

2.4.1 Risk Identification

2.4.1.1 Product Size Related

R1 Our product is small in size which is very easy to carry or to place anywhere.

2.4.1.2 Customer Related

R2 Since its consumer isn’t a professional individual and it poses a challenge in interpreting the customer's additional specifications.

R3 If the consumer offers unnecessary details; it can result in an undisclosed danger.

2.4.1.3 Technical Risk

R4 There is no technical risk as of now in our system.

2.4.2 Strategies used to manage Risks

S1 By reducing size, we can prevent Chance R1.

S2 Meeting with the customer regularly reduces the risk to some extent.

S3 R3 properly develops the system to incorporate modifications at a later stage and retains all necessary paperwork to minimize the risk, as previously stated.

S4 As consumer demand changes, we will continue to increase the software's functionality.

Chapter 3: System Analysis and Design

3.1 Software Requirement Specification

Easy-to-use LPG sensor that is ready to detect LP GAS (mainly butane and propane) in the air with the MQ-6 sensor module. In the range of 200 to 10,000 ppm, the MQ6 sensor can detect gas. A gas detection appliance's primary sensing component, it may be found here. In order to detect gases, the sensor uses a sensing substance that ionises the molecules it comes into contact with. As a consequence of this, the resistance in the circuit varies due to the ionisation of the gases. There is just one drawback to this sensor; it is less sensitive to alcohol and smoking.

The Arduino Nano, Gas Sensor (MQ-6), Photoelectric Detector, GSM Module, and an Exhaust Fan are all integral parts of this system's construction. An advanced yield of zero will be given if no gas is detected by the sensor, and one will be given for a detected gas. The sensor's output will be sent into Arduino through computer.) It will begin tuning next to the LCD and display "Gas recognition: Yes" if the sensor output is high. In conjunction with the GSM module, an alarm message will be sent to the user, and an exhaust system will be activated in close proximity to a gas station. if the sensor yield is low, then the ringer won't tune, and the LCD will display "Gas distinguished: No.". When a catch is pressed or the predetermined time has passed, the device will often flash the catch value bulb or control board and emit a steady or unnatural rumbling or screaming noise to signal completion of the discipline. All of the associated equipment is necessary for the sensory-based gas system spillage identification and warning framework. Flexible, lightweight and simple to use, the device has a wide range of features that may be used for several purposes.

3.1.1 Product Perspective

In view of its composition, the MQ-6 sensor senses the gases and accordingly the system works.

3.1.2 Product Functions

Its major function is to measure gas leakage and GSM module to send to the user.

3.1.3 User Characteristics

3.1.3.1 Large Organizations

When fully developed, the system can be used as part of the kitchen, chemistry Lab and Industry.

3.1.4 Design and Implementation Constraints

Determine the imperatives that can be enforced by various models, confines of equipment, etc.

- Standards Compliance

3.1.5 Assumptions and Dependencies

- There should be Internet service.
- The device's operating system should be up to date.
- There should be proper power supply.
- Sensor should be maintained properly and replaced is not working.

3.2 Flowcharts/DFDs/ERDs

3.2.1 Case Diagram

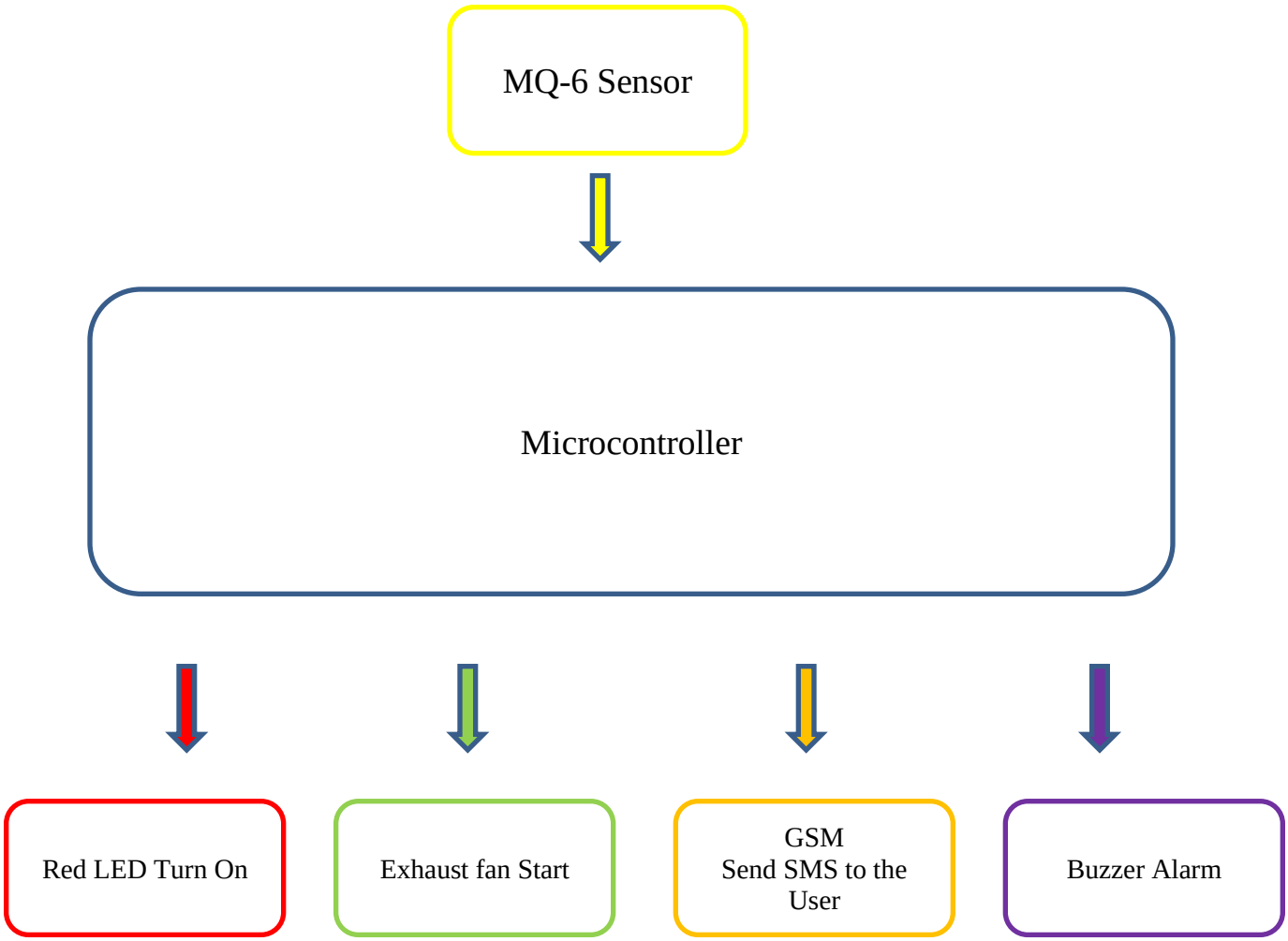


Figure 13: Case Diagram

3.2.2 DFDs

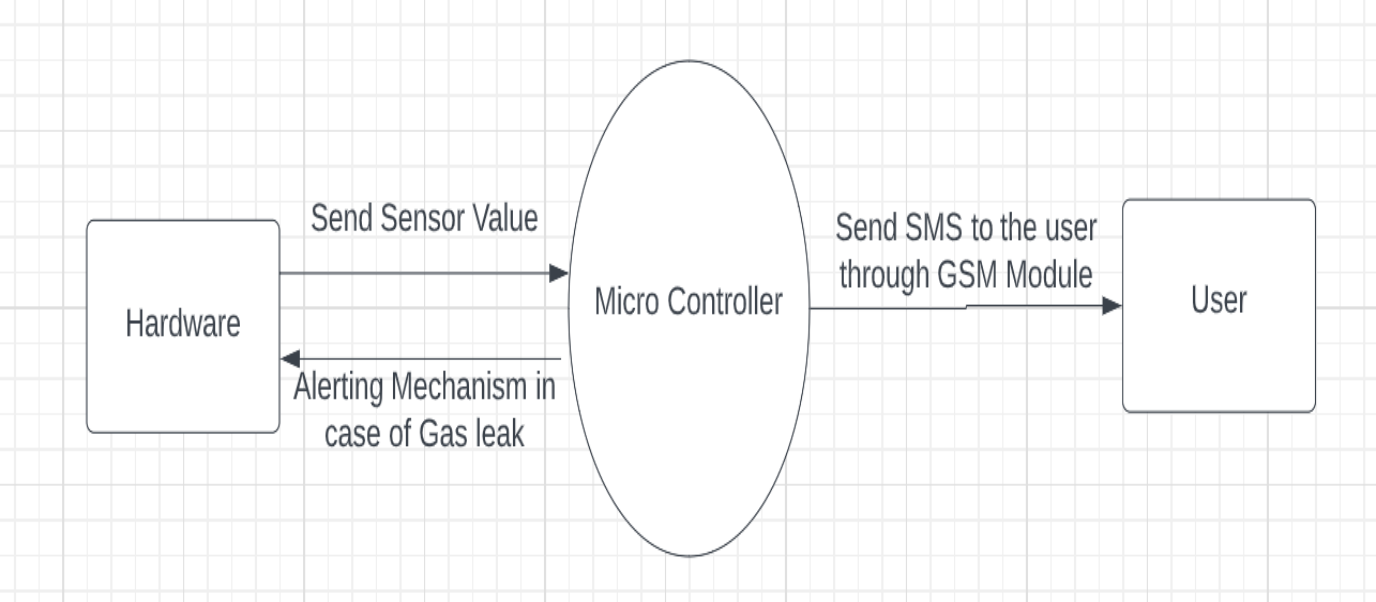


Figure 14: DFDs

3.2.3 Flowchart

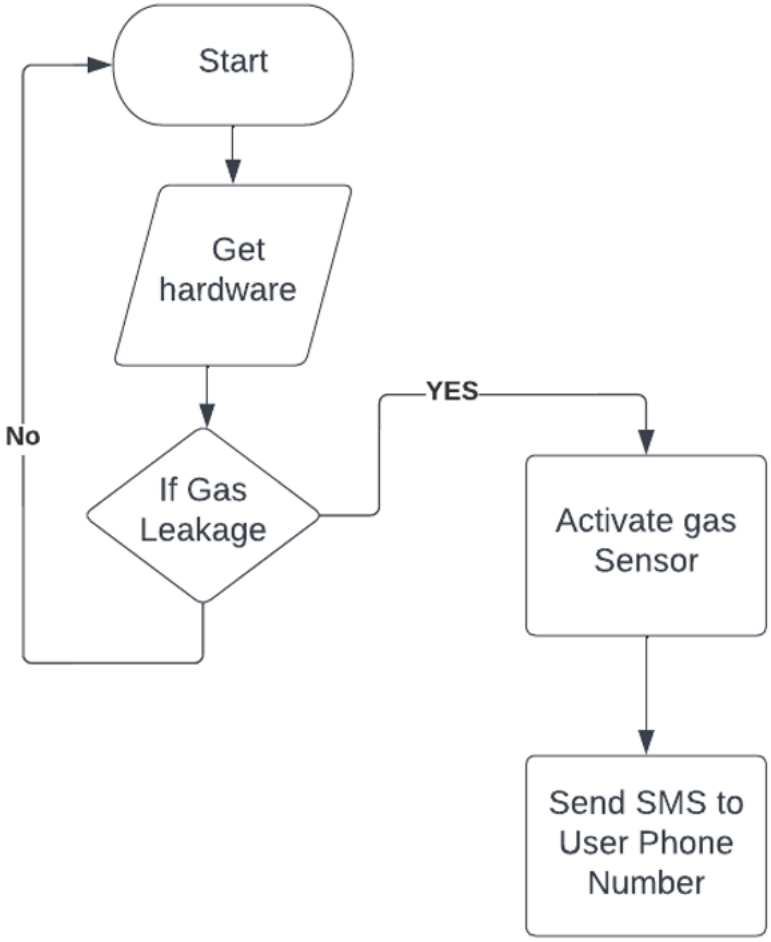


Figure 15: Flowchart

3.3 Design and Test Steps/Criteria

The components utilized in this project are listed below, along with a brief explanation, as stated in the preceding sections. The effective completion of the project is dependent on the implementation of the supplied components. MQ-6 Sensor, Arduino Nano, LED, Jumper wires, Buzzer , and GSM Module are among the components utilized. Figure 6 depicts the integrated project with hardware/components.

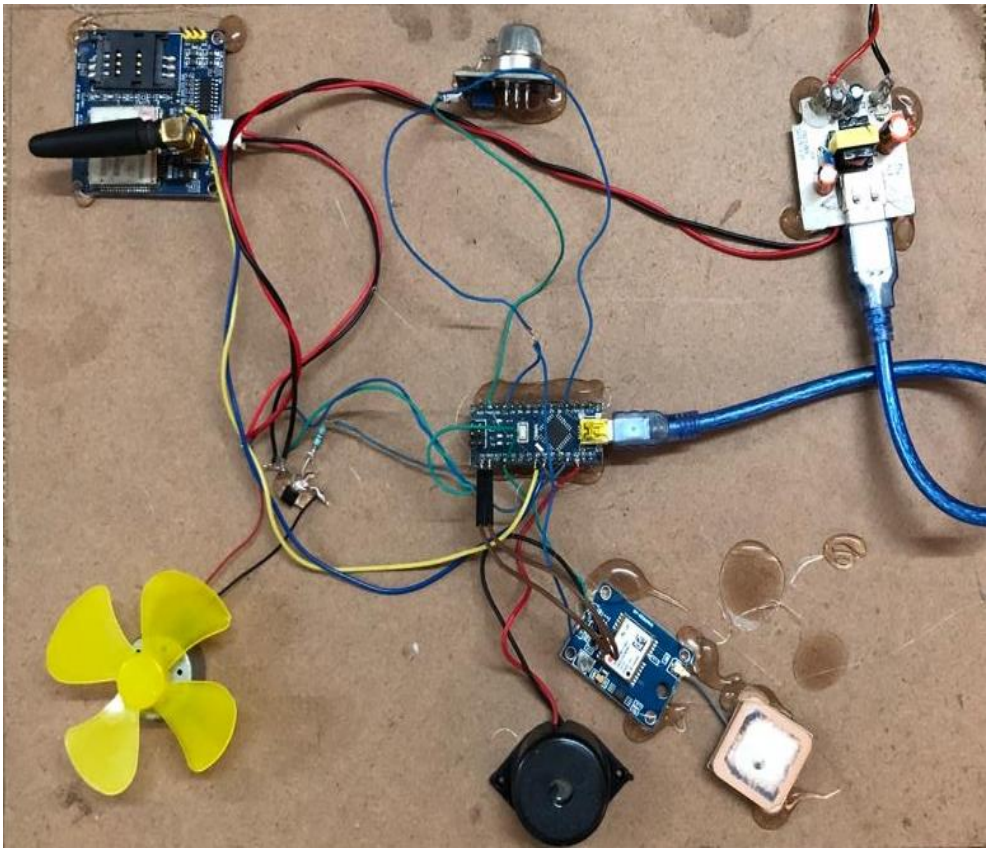


Figure 16: Circuit

3.3.1 Incremental Model

The loop model in our method is seen as an incremental solution. (Pictured) On the basis of the design and implementation of the project is chosen the S/w engineering process model. We have chosen an IncrementalModel for our project.

A small collection of specifications is enforced easily and distributed to the authority/customer using the Incremental model.

- Changed & extended demands can be added step by step.
- It combines elements with the iterative prototyping theory of the linear sequential paradigm.
- A deliverable increment of the S/w is generated by each linear sequence.
- The Linear Sequence is divided into four sections: -

1. **Analysis:** Device & software specifications are reported and reviewed.
2. **Design:** Includes four software attributes: Data structure, S/w Architecture, representation of theinterface & procedural information.
3. **Coding:** This step is used to convert the design into machine code.
4. **Testing:** Works with S/w logical internals and guarantees that all declarations are right to detect allsecret errors.

Advantages of Incremental Model:

- Generates S/w function rapidly & early during the life cycle.
- More versatile & less expensive for changing specifications.
- Easier for checking & debugging
- Customers will react to each designed product.

Why is the Incremental Approach used?

In order to boost the project's performance and usability, the key aim of using the model is to add additionalfeatures to the current modules. Using this model, we will adapt to changing consumer needs, which helps toexpand the project in a very short period. The next increment in the previous raise incorporates input from consumers and several extra requirements. The process is replicated before the project is completed.

Characteristics of Incremental Model:

1. These models allow the rapid implementation and delivery of a new set of industry requirements toclients and then updating and expanding functionality step by step.
2. Each increment generates the commodity sent to the consumer and proposes certain adjustments andincrements that differ with certain extra criteria compared to previous ones.
3. The radical model prevents the initiative from being completed all at once. This is useful for designingand checking components, enabling the project to be modularized for easier management.

Ultimately, the growth of the project in increments is easier. We will create a working prototype form 1 withonly core tasks and then in subsequent increments, expand on this layout. By splitting the entire system into separate priority groups, this will serve to reduce system complexity.

3.3.2 Breakdown Structure (Modules Analysis)

- **Communication:**

The phase of product creation begins with user and developer interactions and the requirements of the world. We also gathered the project-related specifications according to work requirements.

- **System Design:**

A process model that is used in the implementation of the system. This activity also determines the Breakdown Structure (Modules). In the Breakdown Structure, various components used in the frameworkare shown.

- **Project Planning:**

Full calculation and timing of the entire time line diagram for project development and for monitoring are included. Tasks are often expected to identify tools, time line, and other details relevant to the project.

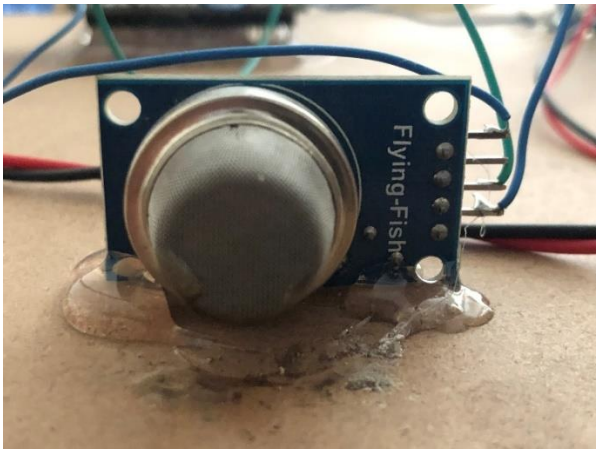
- **Modeling (Analysis & Design):**

It entails thorough review of specifications and project planning. In the analysis of demands, system analysis is done in accordance with customer requirements and what the start of the system will be in which direction it moves and what the destination will be is provided by the analysis process. In architecture, device design takes place according to research.

3.3.3 Requirements for the system

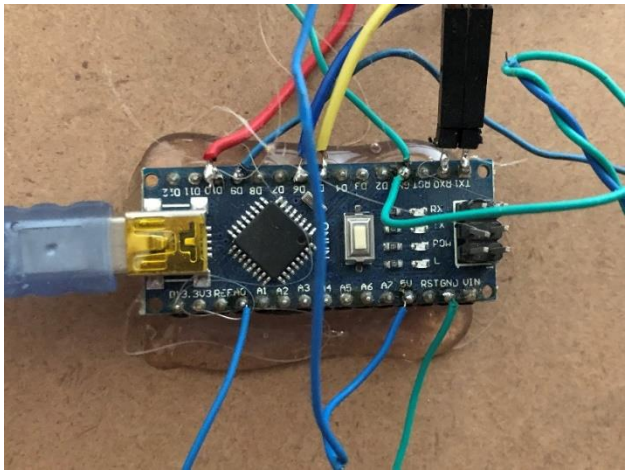
3.3.3.1 MQ-6 Sensor

This is a basic and easy petroleum gas (liquefied petroleum) sensor that can detect lpg in the air (particularly propane and butane). Mq-6 can monitor gas loading at levels ranging from 200 to 10,000 parts per million. The sensitivity of this sensor is excellent, and the reaction time is quick. Figure depicts the Mq-6 Sensor.



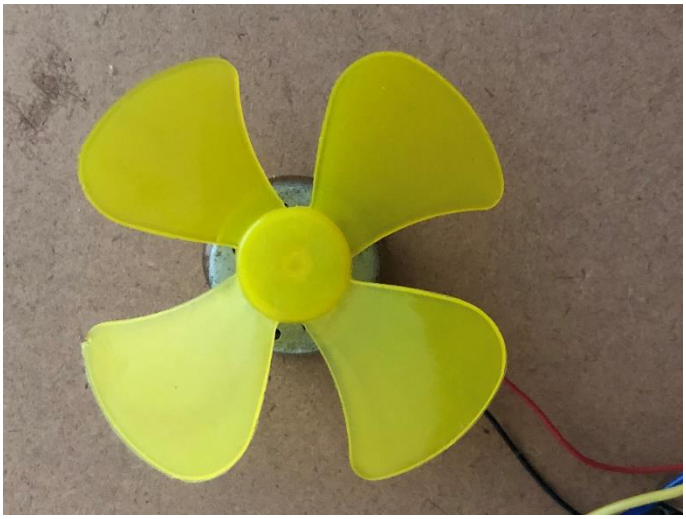
3.3.3.2 Arduino Nano

One of the Arduino Nano's advantages is its small size and breadboard friendliness (Arduino Nano 3.x). Duemilanove has roughly equal functionality, however it is packaged differently from the Arduino Duemilanove model. MiniB USB cables are used instead of standard USB cables since it only includes a DC power plug. The Arduino Nano may be seen in the illustration..



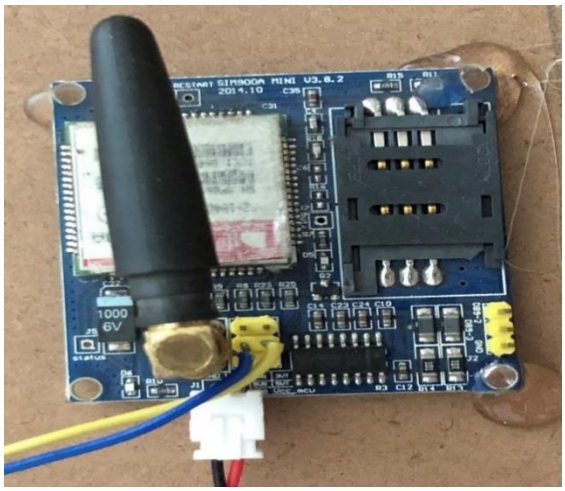
3.3.3.3 Exhaust Fan

The fan uses the engine to adjust its blades, which work to drain air into space. High, damp, or dirty air is driven through the exhaust vent, out of the home. Exhaust Fan is shown in Figure.



3.3.3.4 GSM Module

The GSM module is a wireless data connection to a network that employs GSM mobile technology. Cellphones and other cellular network-connected devices utilize GSM modems. They connect their device in the network via SIM cards. Figure shows the GSM module.

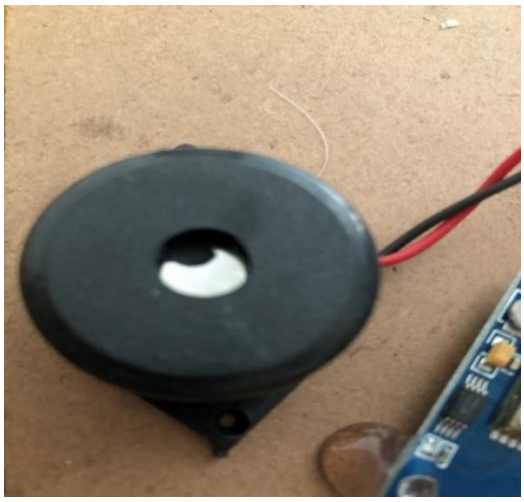


3.3.3.5 Neo-6M GPS Module

With a 25 x 25 x 4mm ceramic antenna, the NEO6M GPS module has a powerful satellite search capability. The module's status may be monitored using the module's power and signal indicators. See Figure for a view of the NEO6M GPS module.

3.3.3.6 Buzzer

Whether mechanical, electromechanical, or piezoelectric, an audible signalling device such as a buzzer or beeper may be used. The buzzer is undoubtedly in order. An audio model is converted into a sound signal by a buzzer, a speaking device. As a warning or a prod, it is most often used. Depending on the design and intended application, it may produce a variety of sounds, including music, buzzer, alarm, electric bell, and more. wn shown in the figure below.



3.3.4 Algorithms and Pseudo Code

The following is an overview of the different development measures that have been taken to achieve the ultimate aim of our project.

Input: Gas Leakage Detect
Output: Send SMS to the user

Phase 1: Starting the power supply

Phase 2: Sensor senses the Gas Leakage

Phase 4: This data is sent to the microcontroller

Phase 5: Microcontroller sends this data further to the GSM Module

Phase 6: GSM Module then sends sms to the user

Phase 7: Red LED Turn On

Phase 8: Buzzer Alarm Start

Phase 9: Buzzer Alarm Start.

Phase 10: Turn off the system

Implementation: -

Code:

```
#include "MQ135.h"
const int ANALOGPIN=A0;
MQ135 gasSensor = MQ135(ANALOGPIN);
//////////////////////////////////////////////
#include <TinyGPS.h>
#include <SoftwareSerial.h>
SoftwareSerial Gsm(5,6);
char phone_no[] = "##########"; //replace with phone no. to get sms
TinyGPS gps;
int Buzzer = 10;
int FAN = 9;
void setup()
{
 Serial.begin(9600);
 pinMode(ANALOGPIN,INPUT);
 pinMode(Buzzer,OUTPUT);
 pinMode(FAN,OUTPUT);
digitalWrite(Buzzer,LOW);
digitalWrite(FAN,LOW);
 Gsm.begin(9600);
 //Serial.println("welcome");
 delay(3000);
 }
void loop()
{
 float ppm = gasSensor.getPPM();
 //Serial.print("MQ135 ");
 //Serial.println(ppm);
 //Serial.println("ppm");
 if(ppm>=1)
 {
 //Serial.println("AIR QUALITY BAD");
digitalWrite(Buzzer,HIGH);
digitalWrite(FAN,HIGH);
send_message();
delay(1000);
send_message_normal();
 delay(1000);
```

```
  }
  else
  {
  //Serial.println("AIR QUALITY GOOD");
  digitalWrite(Buzzer,LOW);
  digitalWrite(FAN,LOW);
  delay(500);
  }
}
void send_message()
{
  int count=0;
  bool newData = false;
  unsigned long chars;
  unsigned short sentences, failed;
  // For one second we parse GPS data and report some key values
  for (unsigned long start = millis(); millis() - start < 1000;)
  {
    while (Serial.available())
    {
      char c = Serial.read();
      Serial.print(c);
      count++;
      if (gps.encode(c))
        newData = true;
      if(count >= 10000)
        break;
    }
  }
  if (newData)      //If newData is true
  {
    float flat, flon;
    unsigned long age;
    gps.f_get_position(&flat, &flon, &age);
    Gsm.print("AT+CMGF=1\r");
    delay(400);
    Gsm.print("AT+CMGS=\"");
    Gsm.print(phone_no);
    Gsm.println("\"");
    delay(300);
```

```
Gsm.print("http://maps.google.com/maps?q=loc:");
   Gsm.print(flat == TinyGPS::GPS_INVALID_F_ANGLE ? 0.0 : flat, 6);
   Gsm.print(",");
   Gsm.print(flon == TinyGPS::GPS_INVALID_F_ANGLE ? 0.0 : flon, 6);
   delay(200);
   Gsm.println((char)26); // End AT command with a ^Z, ASCII code 26
   delay(200);
   Gsm.println("\"");
   delay(300);
   Gsm.println();
   delay(20000);
  }
  else
  {
   Gsm.print("AT+CMGF=1\r");
   delay(400);
   Gsm.print("AT+CMGS=\"");
   Gsm.print(phone_no);
   Gsm.println("\"");
   delay(300);
   Gsm.print("AIR QUALITY BAD");
   delay(200);
   Gsm.println((char)26); // End AT command with a ^Z, ASCII code 26
   delay(200);
   Gsm.println();
    //Serial.println("SNDING OKKKKK");
   delay(20000);
  }
}
void send_message_normal()
{
 //Serial.println("sending....");
 Gsm.print("AT+CMGF=1\r");
 delay(400);
 Gsm.print("AT+CMGS=\"");
 Gsm.print(phone_no);
 Gsm.println("\"");
 delay(300);
 Gsm.print("AIR QUALITY BAD");
 delay(200);
```

```
  Gsm.println((char)26); // End AT command with a ^Z, ASCII code 26
  delay(200);
  Gsm.println();
  delay(20000);
 // Serial.println("sending....ok");
}
```

3.4 Testing Process

3.4.1 Software Testing

3.4.1.1 Introduction: -

The role of software testing is to ensure that programs are efficient and accurate. Software testing is an observational science investigation conducted to provide consumers with informationregarding a product's quality in the environment in which it is intended to function. This can include but is not limited to running a program or application to detect errors.

3.4.2 Unit Testing: -

In this case, each module is evaluated independently. The standards for defining unit test modules wereselected to identify modules that have key functionality. A module may be either an individual or a method.

The unit testing functions that will be tested are as follows:

Choose the handwritten document's scanned input image.

- Preprocessing can be used.
- Make use of segmentation.
- We are using Feature Extraction to extract features.
- Take out a digital character.

3.4.3 Integration Testing: -

Relevant components are integrated and analysed as a group during integration planning. Integration testing takes unit-tested elements like data, groups them into larger aggregates, appliesintegration test plan tests to those aggregates, and produces the integrated testing framework.

3.4.4 Validation Testing: -

At the start or end of the production process, this approach is used to determine if the software satisfies the specified specifications.

Test Cases: -

Use Case ID	1
Test Case Name	Check Gas Leakage
Test Case Description	Gas Leakage is measured and accordingly SMS Send to the user.
Steps	1. Turn on system 2. Detect Gas Leakage
Expected Results	SMS send to the user
Results obtained in practise	In line with expectations

Table 4: Case 1

Use Case ID	2
Test Case Name	Red LED Turn on
Test Case Description	The Red LED should turn on when gas leakage detected.
Steps	1. Turn on system 2. Detect Gas Leakage
Expected Results	Red LED Turn On.
Results obtained in practise	In line with expectations

Table 5: Case 2

Use Case ID	3
Test Case Name	Exhaust Fan Turn on
Test Case Description	The Exhaust Fan should turn on when gas leakage detected.
Steps	1. Turn on system 2. Detect Gas Leakage
Expected Results	Exhaust Fan Turn On.
Results obtained in practise	In line with expectations

Table 5: Case 3

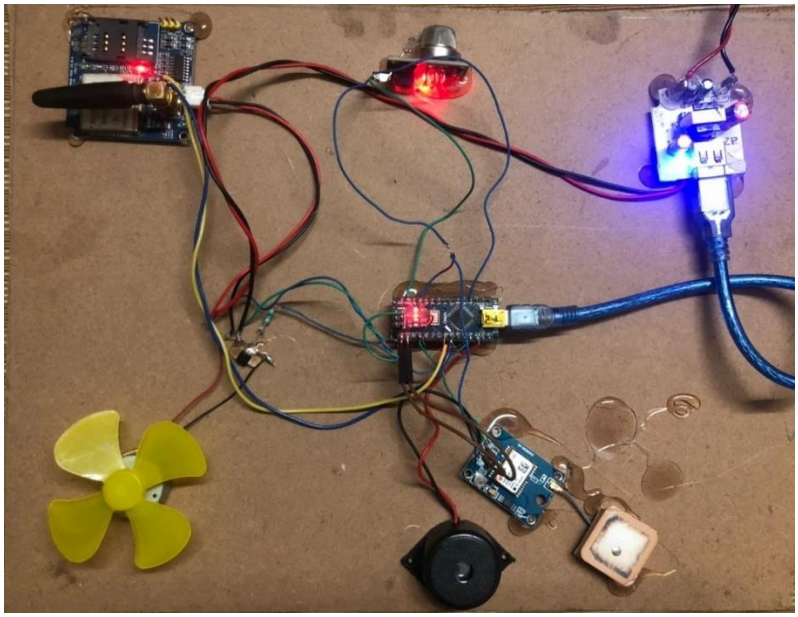
Use Case ID	4
Test Case Name	Buzzer Alarm Turn on
Test Case Description	The Buzzer Alarm should turn on when gas leakage detected.
Steps	1. Turn on system 2. Detect Gas Leakage
Expected Results	Buzzer Alarm Turn On.
Results obtained in practise	In line with expectations

Table 5: Case 4

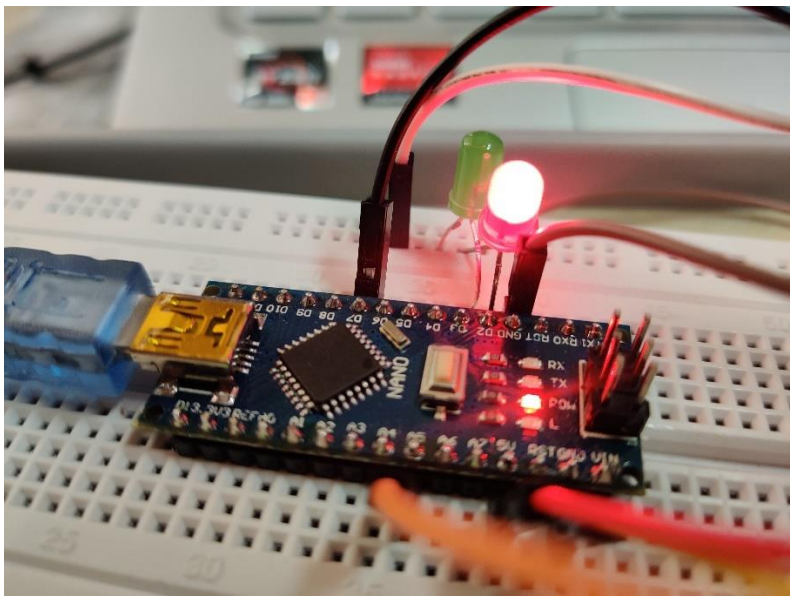
Chapter 4: RESULTS / OUTPUTS

There are several goals that have been met by effectively applying the system in the planned task. The following are the aims:

Figures provide a peek of what the planned system would look like.

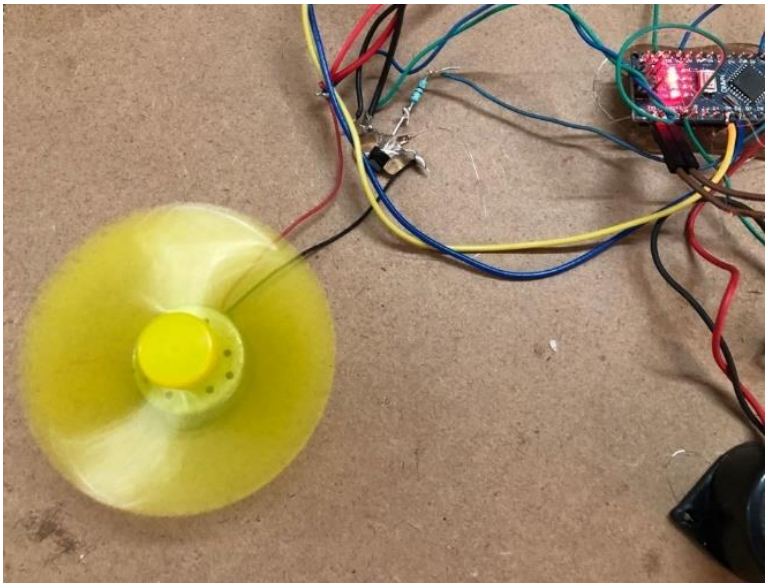


- At a low cost and with optimum advantages, to develop and build a GSM-based automated alarm system for disaster management.
- Detect LPG leaks with an Arduino and LPG gas sensor.

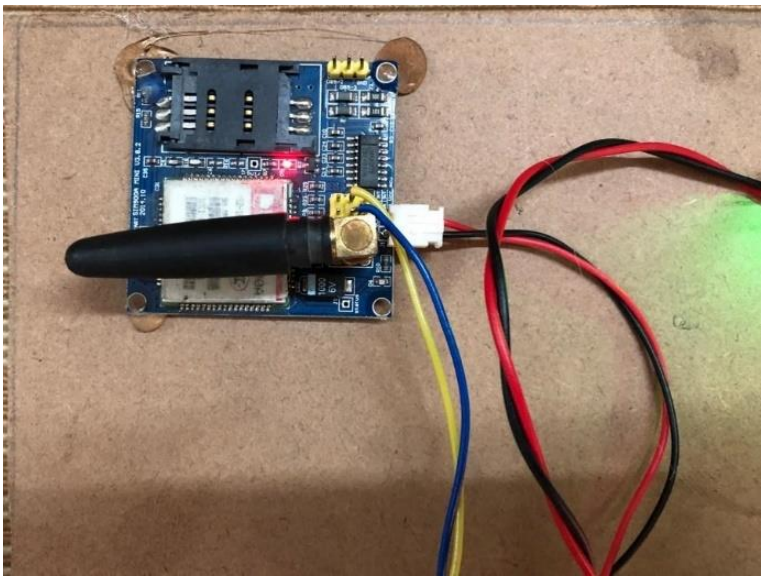


[44]

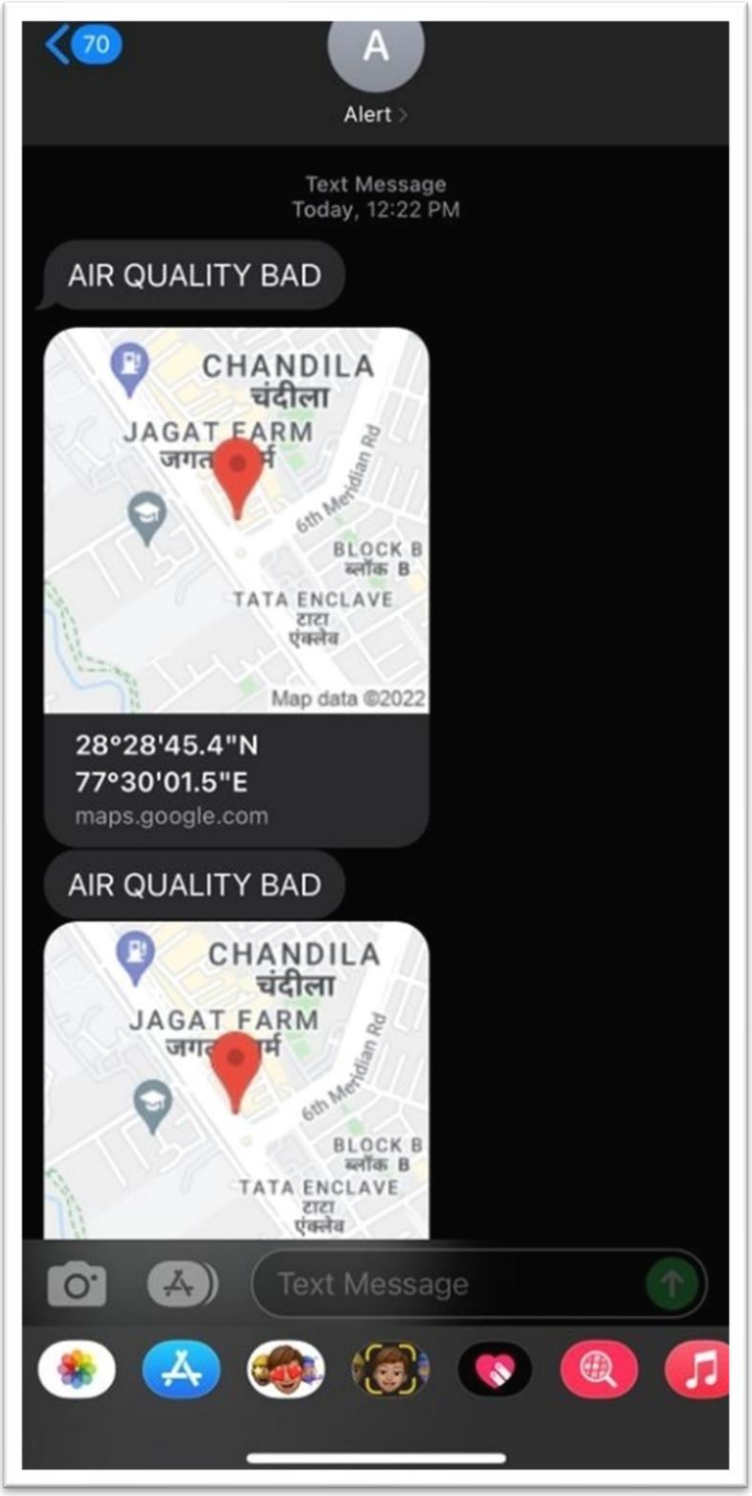
- Gas leaks may be detected by the sound of a beep or buzzer.
- When the system detects a gas leak, a red LED will illuminate..



- The GSM module is used to convey a message to the user.
- When a gas leak is detected, the exhaust fan is instantly activated.



- A call from the fire extinguishing department to the owner will be made as soon as feasible to take further preventative measures.



Chapter 5: Conclusion

Everywhere now uses LPG, from homes to cars to hospitals and hotels. Gas leaking has been blamed for several fatalities and serious injuries in recent years. Because of the "Buzzer" and "ALERT notification" that can be seen from a distance through Bluetooth, its utility will be enormous. Using our technology, we might avoid any and all mishaps caused by LPG leaks.

5.1 Future Scope

An Indian city's Smart Home programme has a gas-monitoring component. Drones may now be used as gas detectors thanks to the Internet of Things. In the future, it's possible that an Auto-Shutdown feature may be included. It immediately cuts off the gas supply if it detects a gas leak. Hotels and other places where LPG cylinders are common may find this strategy useful in the industrial sector. This technology has the potential to help a broad number of industries. In the steel and metallurgical sectors, this technique is used extensively. Pharmacies and aerosol makers may all use the suggested fix in their operations. The food processing industry can also use it. Hospitals may benefit from using this method to guarantee patient safety to the maximum degree possible. Using this technology, the cylinders used in it may be traced. Oxygen cylinders, for example, are often used. Pupils may not realise how likely it is that they may be involved in a car accident. In schools and institutions, our technology is available for use.. Some of the best schools in the country may be found in laboratories where gas burners are often used, such as chemistry labs and pharmaceutical labs. Medical equipment makes extensive use of gas cylinders.

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