

GSM Based Industrial Gas Leakage and Temperature Detector

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DECLARATION

We hereby, declare that the work presented in this project is the outcome of the investigation performed by us under the supervision of Md. Ashikur Rahman, Lecturer of the Electrical & Electronic Engineering Department, Sonargaon University. We also declare that no part of this project report and thereof has been or in being submitted elsewhere for the award of any degree.

We further undertake to identify the university against any loss or damage arising from breach of the forgoing obligation.



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CERTIFICATEION

This is to certify that the project report **"GSM Based Industrial Gas Leakage and Temperature Detector"**, is the confide record of the work done by-

for partial fulfillment of the requirement of their degree of B.Sc. in Electrical and Electronic Engineering at Sonargaon University.

The project report has been carried out under my guidance and is a confide record of the successful work. I wish them success in future.

Supervised By

…….

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ACKNOWLEDGEMENT

Firstly, we express our sincere thanks and gratitude to the almighty for his divine blessings which made it possible for us to complete this project successfully.

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We would like to express our gratitude to our Head of Department, as this project was completed under the Head of Department of Electrical and Electronics Engineering, Sonargaon University, Bangladesh.

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ABSTRACT

The Gas leakage is one of the big problems with industrial sector, residential milieu and gas functioning vehicles like CNG (Compressed Natural Gas) buses, cars etc. One of the contraceptive methods to stop accidents associated with the gas leakage is to install a gas leakage detection device at vulnerable places. The system detects the leakage of the LPG using a gas sensor and temperature detect by temperature dht11 and uses the GSM to alert the person about the gas leakage via SMS and call. When the concentration of LPG or temperature in air exceeds a certain level, the sensor senses the gas leakage and temperature and the output of the sensor goes LOW. The detection is done by the gas sensor and temperature sensor, through the microcontroller the LED and buzzer are turned ON simultaneously. An alert is provided to the user, sending an SMS and calling to the programmed mobile number. User can know updates anytime by sending SMS. When send to GSM by user then user get feedback from GSM.

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CHAPTER 1 :
INTRODUCTION

1.1 Introduction

Developing an efficient and reliable system for detecting gas (liquefied petroleum gas) leakage in domestic settings is crucial for ensuring safety and preventing potential hazards. The gas Leakage Detection System with an Auto Disconnecting Regulator stands at the forefront of innovation, aiming to address these critical concerns while prioritizing user safety and convenience. gas, widely used in households for cooking and heating purposes, presents a risk of leakage due to its highly flammable nature. This system emerges as a proactive solution to mitigate the risks associated with gas leaks, offering a comprehensive approach toward early detection and prevention. At its core, the system integrates cutting-edge sensors designed to promptly identify even minute traces of gas leakage. These sensors are strategically placed in key areas where gas pipelines or connections are present, ensuring comprehensive coverage throughout the household. Upon detecting any signs of leakage, the system triggers an immediate response, setting off alarms to alert occupants and activating an auto-disconnecting mechanism integrated into the regulator. The beauty of this innovation lies in its swift response mechanism, providing a real-time warning to occupants while simultaneously taking proactive steps to halt the gas flow. This automatic shut-off feature within the regulator prevents further gas leakage, effectively curbing the risk of fire or explosion. Moreover, the system incorporates intelligent technologies that offer remote monitoring capabilities. Users can access real-time status updates and notifications through a dedicated mobile application or a centralized control panel. This functionality enables users to remain informed about the system's performance and take necessary action even when away from home, enhancing peace of mind and ensuring continuous safety. Safety being paramount, the design and development of this system undergo rigorous testing and adherence to industry safety standards. The sensors are calibrated to detect various forms of gas, ensuring a high level of accuracy in identifying potential leaks. Furthermore, the auto-disconnecting regulator undergoes stringent quality checks to

guarantee its reliability and seamless functionality during emergencies. One of the key advantages of this system is its user-friendly interface and easy installation process. Designed to be intuitive, it can be seamlessly integrated into existing gas supply systems without the need for extensive modifications. This user-centric approach not only enhances accessibility but also encourages widespread adoption of the system among households. In addition to its primary function of preventing gas leakage, this system also contributes to environmental sustainability. By minimizing wastage through timely leak detection and prevention, it aligns with global efforts toward resource conservation and reducing carbon footprints. The implementation of the gas Leakage Detection System with an Auto Disconnecting Regulator represents a significant leap forward in ensuring domestic safety standards. Its comprehensive approach, combining advanced sensing technology with automatic shutoff features, reflects a commitment to innovation and the well-being of households. As we continue to prioritize safety and technological advancements, the continual refinement and enhancement of such systems promise a future where households can enjoy the benefits of gas with enhanced peace of mind, knowing that their safety is prioritized through proactive measures and reliable detection mechanisms.

1.2 Objectives

Developing an gas leakage detection system with an auto-disconnecting regulator involves a core focus on safety, efficiency, and user convenience, primarily aimed at reducing risks associated with domestic gas leaks. Swift identification of any scale of gas leaks is pivotal, aiming to prevent accidents and enhance household safety. Early detection capabilities are central, designed to spot even minor leaks promptly, preventing their escalation and subsequent risks. The auto-disconnecting regulator plays a critical role, swiftly cutting off the gas supply upon detecting any leakage, significantly mitigating fire or explosion risks. Real-time monitoring ensures continuous gas level surveillance and prompt leak detection, triggering timely alerts for homeowners or authorities to take preventive measures. The user interface is intuitively designed for swift homeowner responses in case of a detected leak. Seamless integration with existing gas setups is essential, ensuring easy implementation without extensive modifications. Key considerations encompass reliability, durability, and cost-effectiveness, aiming for a system resilient to various

conditions and accessible to diverse households. Adherence to safety standards and regulations governing domestic gas systems is fundamental for effectiveness and legal compliance. Equally crucial is educating users about system functionality, maintenance, and response protocols, fostering awareness and strengthening safety measures within households. These objectives collectively create a robust system prioritizing household safety and risk reduction.

1.3 The major features of this project are

- Provides Home or Industrial security.
- Highly sensitive
- Low cost
- Simple and Reliable
- User friendly

1.4 The project provides learning's on the following advancements

- Characteristics of the gas sensor.
- Construction of GSM modem interface.
- Conversion of AC supply to DC supply.
- Embedded C programming.
- PCB design.

1.5 Project Report Organization

This Industrial gas leakage detector and auto dialing controller system final project is arranged into following chapters:

Chapter 1: Gives brief introduction of the project, objective, feature and learning point of the project.

Chapter 2: This chapter covers the research regarding Literature Review.

Chapter 3: Focuses on the system Design of the project.

Chapter 4: Focuses on the hardware implementation.

Chapter 5: Focuses on the results and discussions.

Chapter 6: Concludes overall project and future recommendation.

CHAPTER 2 :
LITERATURE REVIEW

2.1 Introduction

Till now Bangladesh has experienced thousands of accidents/ disasters due to gas leakages. In 1984, around 20,000 people lost their lives in the Bhopal, India gas tragedy which is regarded as one of the world's worst industrial disasters. The main reason for such a huge number of deaths is because the people living nearby these areas were not informed to evacuate as soon as possible. Not only Industrial disasters but each year India also experiences hundreds of domestic gas cylinder explosions. According to reports, in 2017 around 309 domestic Gas Cylinder explosions took place which resulted in the death of around 300 people. These accidents could have been prevented easily if those people were informed sooner. So, we are working on a device to inform people about any gas leakage as soon as possible through messages and buzzers.

2.2 Literature Survey

In ref. [1], "A Wireless Home Safety Gas Leakage Detection System", Luay Fraiwan, Khaldon Lweesy, Aya Bani-Salma, Nour Mani, Jordan University of Science & Technology. Luay along with his research partners proposed a wireless safety device for gas leakage detection. Their system design consists of two main modules: detection-transmission module and receiving module. The main components of the detection and transmission module are MQ-5 Gas sensor, PIC-16F877A microcontroller, RF transmitter, and buzzer. The main function of this module is to detect changes in gas concentration. If the sensor detects any change in gas concentration, this module activates an audio-visual alarm and transmits a signal to the receiver module. The Receiver module consists of an RF receiver, PIC-16F877A microcontroller, LED, and Buzzer. This module acts as a mobile alarm device to allow mobility within the house premises. This system was tested using LPG and it successfully activated the alarm as a result of gas concentration.

In ref. [2],” A Novel Technique For LPG Gas Leakage Detection and Control For Safety”, Neha R. Shahapurkar, Shubham P. Deshpande, M. R. Rajput. This research paper successfully reports a novel technique to build an LPG leakage detector. In this project, the authors have used an 8051 microcontroller, MQ-6 Gas sensor, a dc motor, and a gsm module. This system detects gas concentration and performs the following operation successfully. The system they designed alarms the user with an audio-visual alarm and also sends an alert message on the owner’s mobile phone. It as well consists of a dc motor to turn off the regulator valve and start an exhaust fan.

In ref. [3],” Implementation and design of Gas Leakage Detection system using ATMega8 microcontroller” , N Evalina and A Azis H. In many countries LPG is widely used for cooking for economic reasons. This paper show implementation and design of gas leakage detection system. The main aim of the project is to build a gas leakage detector using an LPG gas sensor and microcontroller. It develops a security system by providing an early Warning and to give a sign if there is a leakage of gas around there. If this system detects the existence of leakage, then the system will give a signal in form of alarm or buzzer. If there is leakage of gas, system will work and the early warning will be given. The presence of gas, is required on the sensors to work. The MQ2 is the gas Sensor used to detect diffused gas. The tool is designed to detect gas leaks that are then visible on the LCD screen and alarm. And in certain circumstances, the buzzer will ring. This MQ-6 sensor test is performed by measuring the sensor output with the Atmega8 microcontroller when the LPG gas is detected and then writes it on the LCD screen. This test was conducted to determine the contribution of the MQ-6 sensor. It becomes essential to protect gas leakage from damage and accident.

In ref. [4], “Gsm Based Gas Leakage Detection System”, Ashish Shrivastava, Ratnesh Prabhaker, Rajeev Kumar, Rahul Verma. This paper states that: - The aim of this paper is to present such a design that can automatically detect and stop gas leakage in vulnerable premises. In particular gas sensor has been used which has high sensitivity for propane (C3H8) and butane (C4H10). Gas leakage system consists of GSM module, which warns by sending SMS. However, the former gas leakage system cannot react in time. This paper provides the design approach on both software and hardware.

In ref. [5], “ IOT Based Industrial Plant Safety Gas Leakage Detection System”, Ravi Kishore Kodali, Greeshma R. N. V., Kusum, Yatish. Most of the fire- breakouts in

businesses are due to gas leaks. These cause terrible damage to the equipment, human life leading to injuries, deaths, and (surrounding conditions). Now available leakage detectors warn the people around using on- site alarms. So, this project proposes a leakage detector which sends the warning to the concerned people through SMS. This detector senses the presence of harmful gases especially, LPG, Methane and Benzene. LPG and Methane gases catch fire easily resulting in blasts. Benzene is (cancer-causing thing) producing/making happen the health of workers, if inhaled in higher concentrations. Because of this, detection of these gases is very important. This low-cost project includes MQ2, MQ4 and MQ2 gas sensors which detect LPG, Methane and Benzene gas leaks (match up each pair of items in order) and uses ESP-32 as a Wi-Fi module. The concentration levels of the above talked about/said gases are uploaded in the UBIDOTS cloud and the login details are included in the alert message so that the user can check, if needed. The early model of the proposed system creates a sound alert using buzzer on detection of a dangerous leakage and sends an SMS to the concerned person using IFTTT web service. Different color LEDS are used to specify the gas leaked for example, RED LED points to/shows the presence of LPG.

2.3 Methods

The gas leakage detection system has been meticulously designed to incorporate the following key operations:

1. The system utilizes an MQ2 sensor to effectively detect any potential gas leakage, promptly alerting the user to ensure safety.

2. A GSM Module is integrated into the system to facilitate the automatic calling to user end.

Gas primarily comprises propane, butane, and additional unsaturated components, namely propane and butane. By leveraging the capabilities of the MQ2 sensor, our system can identify and detect the presence of propane and butane, enabling effective gas leakage detection. Our design ensures continuous monitoring of gas levels using the MQ2 sensor. Amount of gas is known by measuring the weight of gas cylinder. To measure the weight, Load cell a weight sensor is used. It measures the weight of the cylinder and displays on LCD display and send an SMS through GSM module.

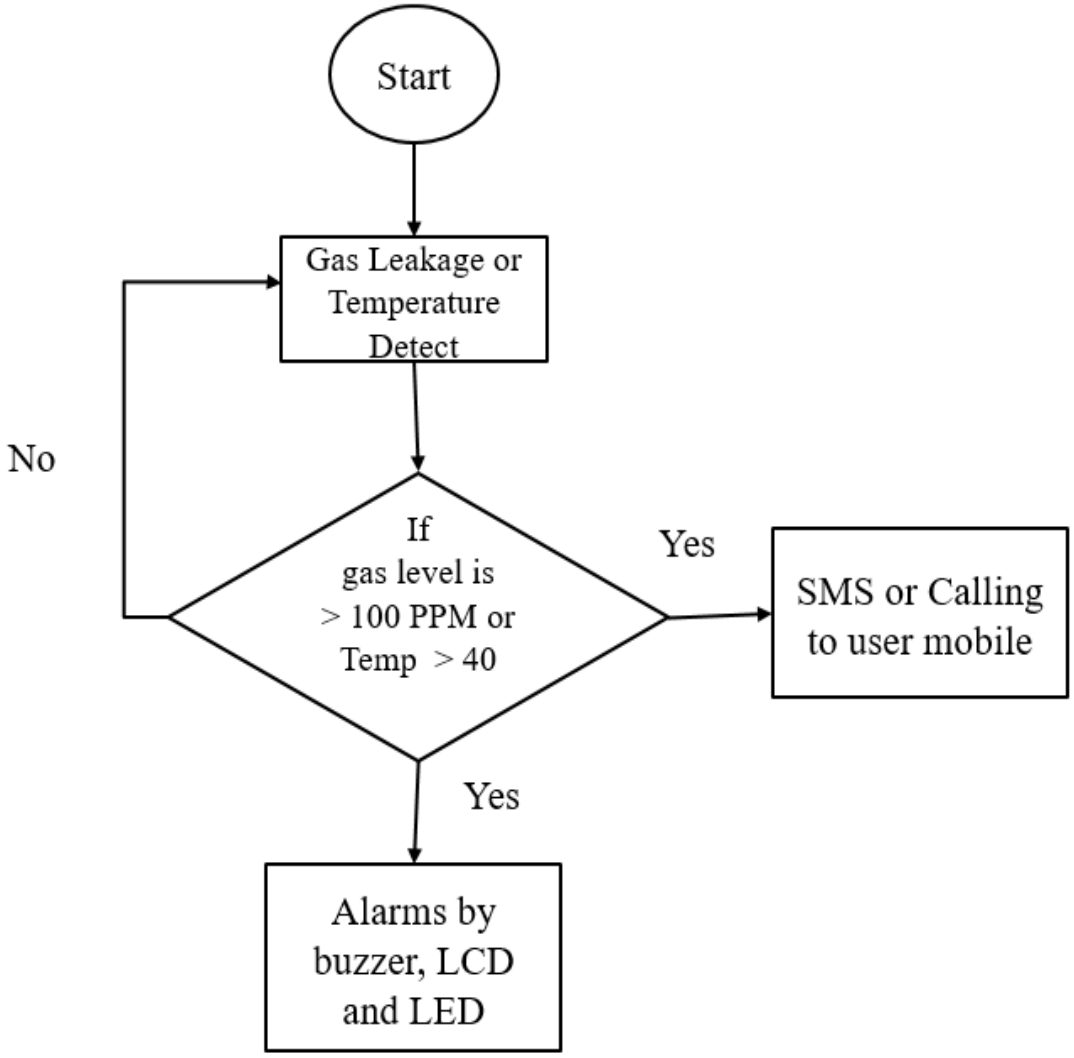


Figure 2.1: Data Flow Diagram

A threshold level is set before the gas is completely consumed. And if the weight of the gas cylinder is less than the threshold, it is indicated using an indicator and an email is also sent to the gas agency and the cylinder is booked automatically. MQ2 gas sensor is used to sense the gas leakage. MQ2 sensor module can detect gas, smoke, alcohol, hydrogen gas etc. In this project it continuously measures the concentration of gases and the concentration is displayed. whenever there is gas leakage, concentration increases and the increase is displayed and if the increase concentration is more than a specified level it is dangerous, so an indicator is used to indicate this and an alert message is sent to mobile in the event that the concentration exceeds 300ppm, an integrated notification system is triggered. The user is promptly notified through a combination of a buzzer, an LCD display, and LED lights, effectively alerting them to the potential danger. Simultaneously, the servo motor is

activated to assist in the immediate shut-off of the regulator's power supply, effectively preventing any further leakage of gas. By implementing these crucial features, our gas leakage detection system offers a robust solution to enhance safety measures and mitigate the risks associated with gas leaks.

2.4 GSM Basic Concept

GSM (Global System for Mobile communication) is a digital mobile network that is widely used by mobile phone users in Europe and other parts of the world. GSM uses a variation of time division multiple access (TDMA) and is the most widely used of the three digital wireless telephony technologies: TDMA, GSM and code-division multiple access (CDMA). GSM digitizes and compresses data, then sends it down a channel with two other streams of user data, each in its own time slot. It operates at either the 900 megahertz (MHz) or 1,800 MHz frequency band.

GSM, together with other technologies, is part of the evolution of wireless mobile telecommunications that includes High-Speed Circuit-Switched Data (HSCSD), General Packet Radio Service (GPRS), Enhanced Data GSM Environment (EDGE) and Universal Mobile Telecommunications Service (UMTS).

2.4.1 History

Predecessors to GSM, including Advanced Mobile Phone Service (AMPS) in the U.S. and Total Access Communication System (TACS) in the U.K., were built with analog technology. However, these telecommunications systems were unable to scale with the adoption of more users. The shortcomings of these systems signaled the need for a more efficient cellular technology that could also be used internationally.

To achieve that goal, in 1983, the European Conference of Postal and Telecommunications Administrations (CEPT) set up a committee to develop a European standard for digital telecommunications. CEPT decided on several criteria that the new system must meet: international roaming support, high speech quality, support for hand-held devices, low service cost, support for new services and Integrated Services Digital Network (ISDN) capability.

In 1987, representatives from 13 European countries signed a contract to deploy a telecommunications standard. The European Union (EU) then passed laws to require

GSM as a standard in Europe. In 1989, the responsibility of the GSM project was transferred from CEPT to the European Telecommunications Standards Institute (ETSI).

Mobile services based on GSM were first launched in Finland in 1991. That same year, the GSM standard frequency band was expanded from 900 MHz to 1,800 MHz. In 2010, GSM represented 80% of the global mobile market. However, several telecommunications carriers have decommissioned their GSM networks, including Telstra in Australia. In 2017, Singapore retired its 2G GSM network.

2.4.2 Composition of the network

The GSM network has four separate parts that work together to function as a whole: the mobile device itself, the base station subsystem (BSS), the network switching subsystem (NSS) and the operation and support subsystem (OSS).

The mobile device connects to the network via hardware. The subscriber identity module (SIM) card provides the network with identifying information about the mobile user.

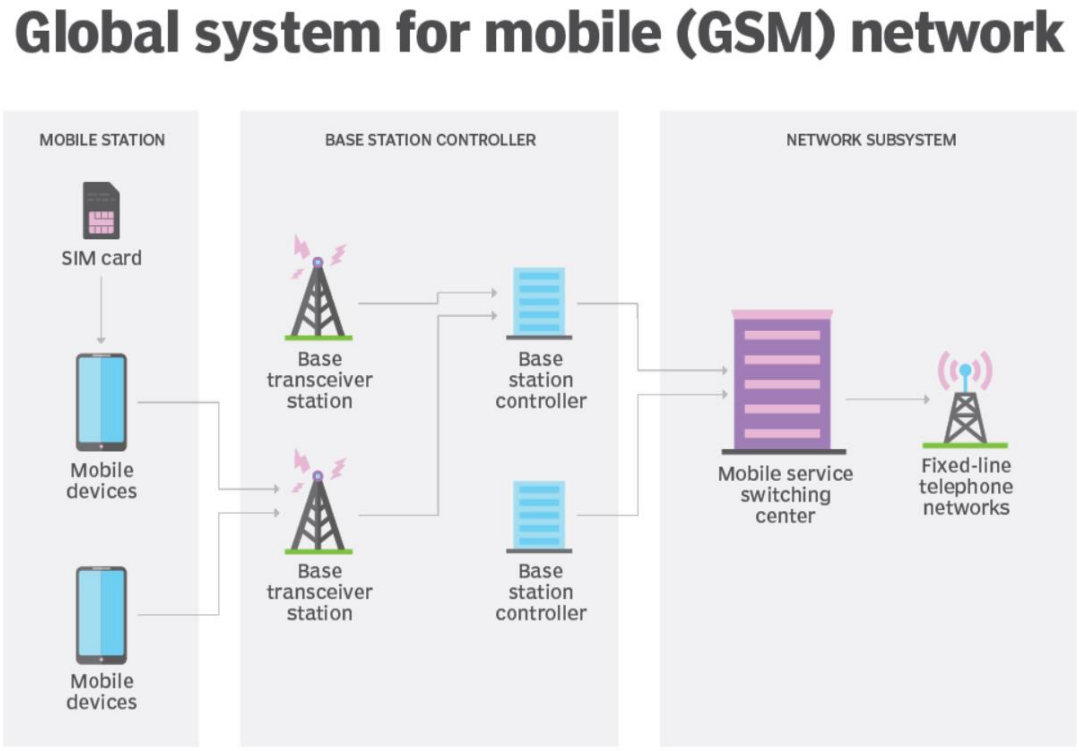


Figure 2.2: Diagram of the GSM network organization

The BSS handles traffic between the cellphone and the NSS. It consists of two main components: the base transceiver station (BTS) and the base station controller (BSC). The BTS contains the equipment that communicates with the mobile phones, largely the radio transmitter receivers and antennas, while the BSC is the intelligence behind it. The BSC communicates with and controls a group of base transceiver stations.
The NSS portion of the GSM network architecture, often called the core network, tracks the location of callers to enable the delivery of cellular services. Mobile carriers own the NSS. The NSS has a variety of parts, including mobile switching center (MSC) and home location register (HLR). These components perform different functions, such as routing calls and Short Message Service (SMS) and authenticating and storing caller account information via SIM cards.

Because many GSM network operators have roaming agreements with foreign operators, users can often continue to use their phones when they travel to other countries. SIM cards that hold home network access configurations may be switched to those with metered local access, significantly reducing roaming costs, while experiencing no reductions in service.

2.4.3 Security details

Although GSM was designed as a secure wireless system, it can still experience attacks. GSM uses authentication measures, such as challenge-response authentication, which prompts a user to provide a valid answer to a question, and a preshared key that is in the form of a password or passphrase.
There are a few cryptographic security algorithms that GMS employs, including stream ciphers that encrypt plaintext digits. A5/1, A5/2 and A5/3 are three stream ciphers that ensure a user's conversation is private. However, the algorithms for both A5/1 and A5/2 have been broken and published and are therefore susceptible to plaintext attacks.
GSM uses GPRS, a packet-based communication service, to transmit data, such as through web browsing. However, the ciphers that GPRS uses, GEA1 and GEA2, were broken and published as well in 2011. Researchers published open source software to sniff packets in the GPRS network.

CHAPTER 3 :

System Design

3.1 Block Diagram

The figure shows the block diagram of Industrial gas leakage detector and auto dialing controller. In this block diagram several types of sensors being used inside the abode like as smoke detector and gas detector, temperature, for diverse purpose and all these are connected directly to Arduino microcontroller.

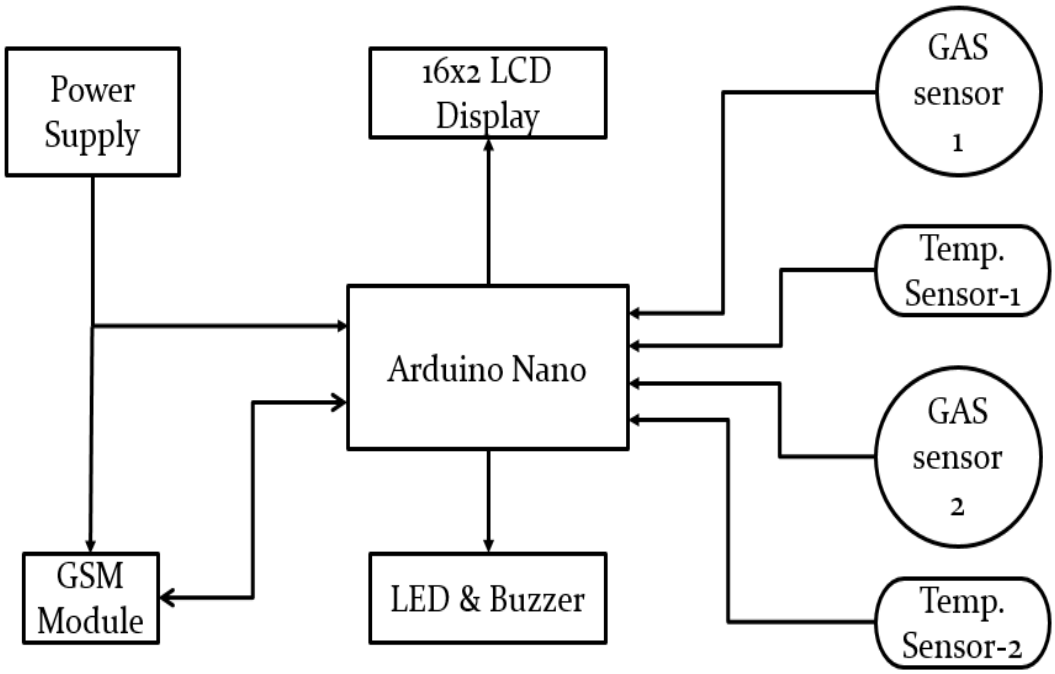


Figure 3.1: Block Diagram of Gas Leakage system

3.2 Prototype

The objective of this work is to develop an industrial gas leakage detector and auto dialing controller which signifies on the smart world. GSM provides the user to check the status of all the appliances by the SMS or calling. The figure 3.1 represents the prototype model of this project. This project work is done on Arduino Nano platform which communicate with the sensors by serial communication.

3.2.1 Temperature Monitoring

A gas leakage detector system needs to know the ambient temperature of its surroundings because of measuring the safety and precautions of an industrial. Temperature sensor informs to determine exact temperature and shows the details to the mobile phone by the SMS.

Initially Arduino can take the input from the temperature sensor from its surroundings and it shows details to the LCD Display. A temperature sensor gives us the information about ambient temperature of its adjacent area. We used ultra-low-cost digital temperature sensor. It is fairly simple to use but requires careful timing to grab the data. The only real drawback of this sensor is we can only get new data from it once in every 2sec. So, we can easily get to know the actual temperature near-by.

3.2.2 Gas and Smoke Detector Alarm

Method of detecting gas leakage becomes a problem after discovering the impacts of damaging gases on human welfare. Gas detector is such device which detects the presence of gases around its ambience atmosphere. Mainly this equipment's help to detect flammable gas leakage and give an alarm to be warn the user [14]. This device gives an alarm to the residents in the place where it’s occurring and gives scope to leave or to take action against it. Detection of gas leakage is the method by which sensors identify possibly potentially harmful gas leaks. Usually these sensors use an audible to warn individuals when a hazardous gas is identified.

A smoke detector is a smoke sensing tool, typically as a fire indicator. As part of a fire alarm system, security devices send a signal to a fire alarm, while household smoke detectors, also known as smoke alarms, usually send a local audible or visual alarm from the detector itself. Sensitive alarms can be used to detect smoking in fields and thereby prevent it. In households with working smoke alarms; the risk of dying in a home fire is reduced in half. In some households have no alarms for smoke but this tool helps to take careful measures.

3.3 Software

Software is a set of instructions, data or programs used to operate computers and execute specific tasks. It is the opposite of hardware, which describes the physical aspects of a computer. Software is a generic term used to refer to applications, scripts

and programs that run on a device. It can be thought of as the variable part of a computer, while hardware is the invariable part.

3.3.1 Arduino IDE for Controller and ESP Programming

The Arduino integrated development environment (IDE) is a cross-platform application (for Windows, macOS, Linux) that is written in the programming language Java. It originated from the IDE for the languages Processing and Wiring. It includes a code editor with features such as text cutting and pasting, searching and replacing text, automatic indenting, brace matching, and syntax highlighting, and provides simple one- click mechanisms to compile and upload programs to an Arduino board.

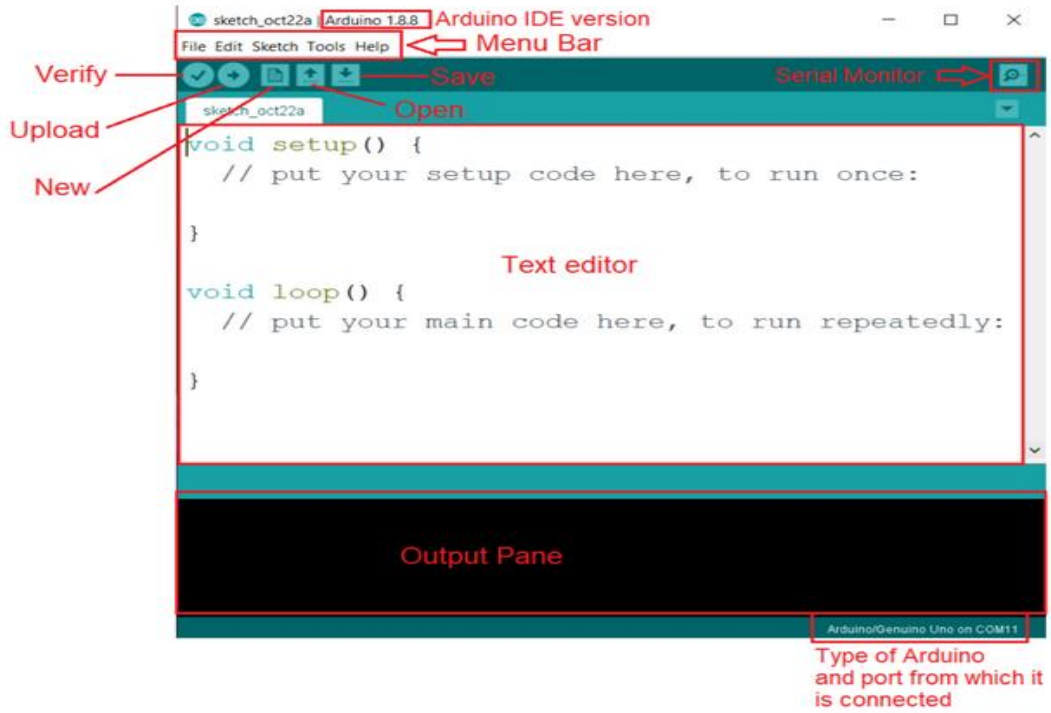


Figure 3.2: Arduino IDE software interface

It also contains a message area, a text console, a toolbar with buttons for common functions and a hierarchy of operation menus. The source code for the IDE is released under the GNU General Public License, version 2. The Arduino IDE supports the languages C and C++ using special rules of code structuring. The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures. User-written code only requires two basic functions, for starting the sketch and the main program loop, that are compiled and linked with a

program stub main() into an executable cyclic executive program with 25 the GNU tool chain, also included with the IDE distribution. The Arduino IDE employs the program AVR dude to convert the executable code into a text file in hexadecimal encoding that is loaded into the Arduino board by a loader program in the board's firmware

3.3.2 Proteus Simulation Software

Proteus is a fully functional, procedural programming language created in 1998 by Simone Zanella.

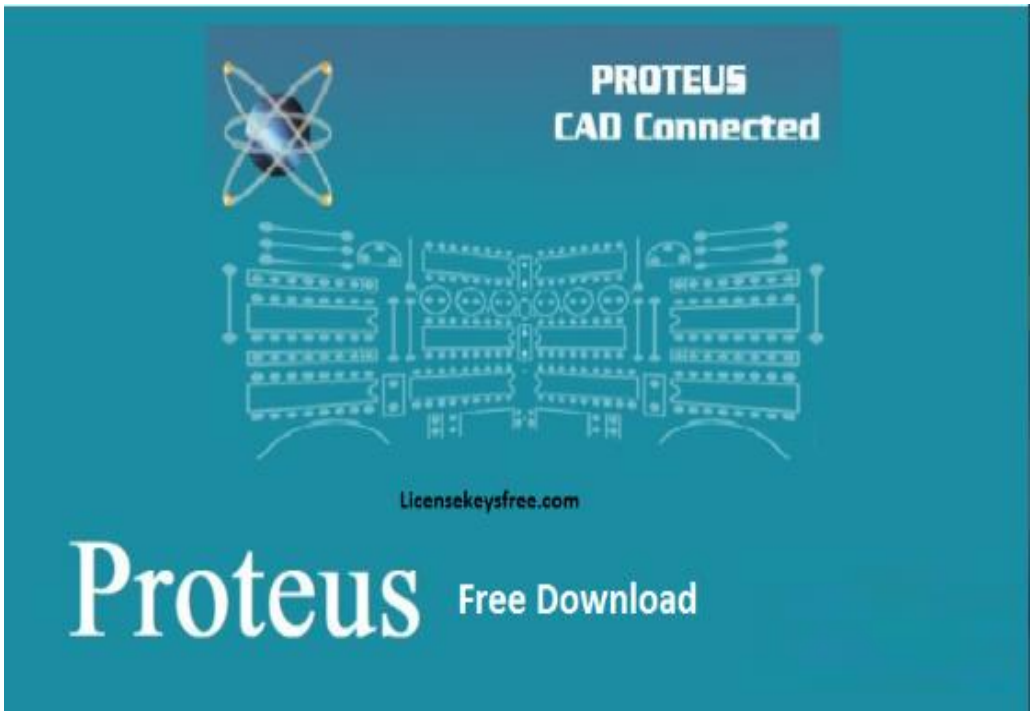


Figure 3.3: Proteus ISIS Professional v8.9 SP0 logo

Proteus incorporates many functions derived from several other languages: C, BASIC, Assembly, and Clipper/dBase; it is especially versatile in dealing with strings, having hundreds of dedicated functions; this makes it one of the richest languages for text manipulation [15]. In this project, we have used Proteus software version 8.9 to simulate the proposed protection system. It consists of two main parts, the ISIS, the circuit design environment that even the simulator VSM includes, and the ARES, the PCB -Designer. Developer and manufacturer of the software package is the company Lab Center Electronics.

3.4 Schematic Simulation Diagram

In this part of this book we attached here full circuit diagram of this proposed system. Here we use Proteus simulation software to design this circuit diagram which version is Proteus 8.9.

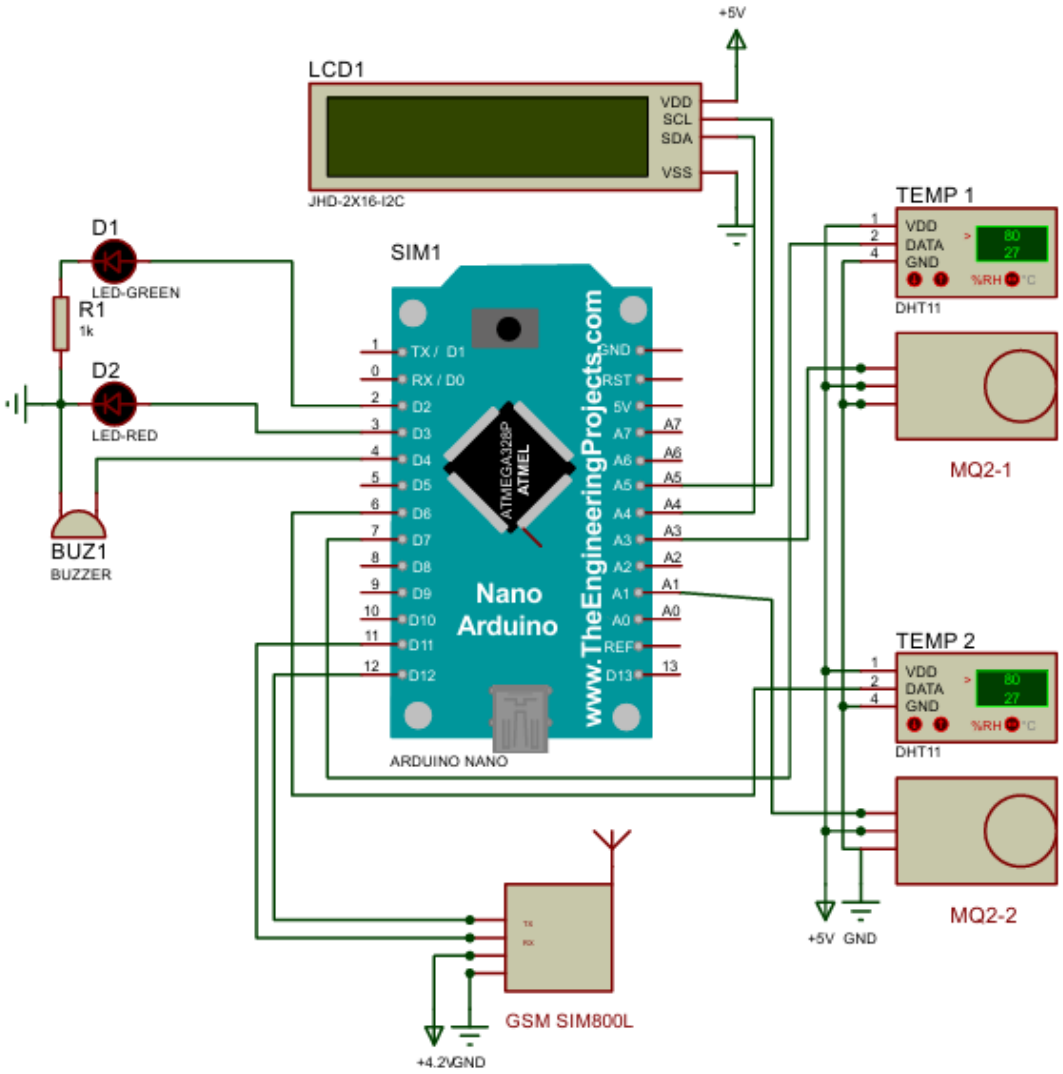


Figure 3.4: Schematic Simulation Circuit

CHAPTER 4 :
HARDWARE IMPLEMENTATION

4.1 Hardware

Abbreviated as HW, hardware is best described as any physical component of a computer system containing circuit board, ICs, or other electronics. A perfect example of hardware is the screen on which you are viewing this page. Whether it be a monitor, tablet, or smartphone, it is hardware.

Without any hardware, your computer would not exist, and software could not be used. The picture is a Logitech webcam, an example of an external hardware peripheral. This hardware device allows users to take videos or pictures, and transmit them over the Internet.

4.2 The major Components of this project

- Power Supply
- Voltage Regulator – LM7805
- Step Down Converter – 2595
- Micro Controller – Arduino Nano
- GSM modem – SIM800L
- Gas Sensor - MQ2
- Temperature Sensor – DHT11
- LCD display with driver – 16X2
- Buzzer – 5 volt
- LED indicators
- Connecting wire
- PCB
- PVC Board
- etc.

4.2.1 Power Supply

There 12V 2A & 0.5A Power Adapter is a high-quality power supply manufactured specifically for electronics. These are switch mode power supplies which means the output is regulated to 12V and the capable output current is much higher.



Figure 4.1: 12V Power Adapter

Specification:

- Voltage Input: AC 100-240V
- Frequency Response: 50/60Hz
- Voltage Output: DC 12V
- Electric Current: Max. 2A & 0.5A
- Power: 6W to 24W
- Length of the cable: approx. 93 cm (36.6 inch)

4.2.2 Voltage Regulator

In this project we used a regulator IC, model LM7805 and LM7812. It is a 3-terminal 1A positive voltage regulator. Its main features are thermal overload protection, short circuit protection and output transistor safe operating area protection. Its safe output current is up to 1A. Its maximum input voltage is 35 V. Its output voltage is between 4.75 V and 5.25V for LM7805. Its short circuit current is 230mA at 35V I/P and at +25˚C. It is shown in the following figure 3.6.

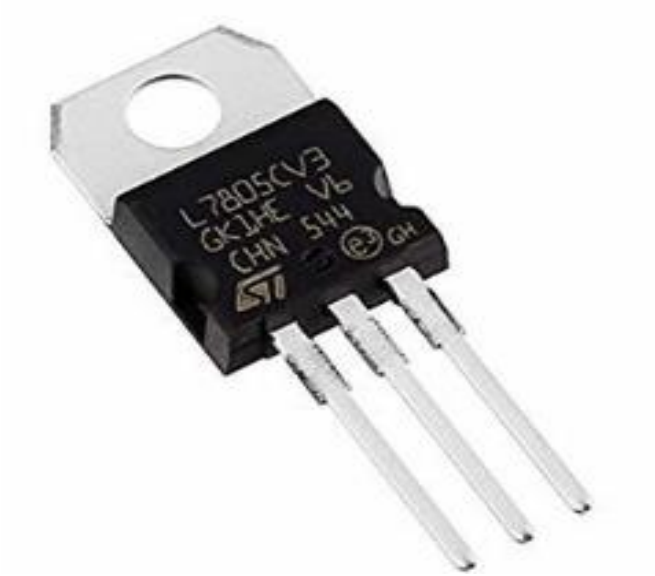


Figure 4.2: Typical LM 7805 regulator IC

4.2.3 Step Down Converter

LM2596 DC-DC Buck Converter Step Down Module Power Supply is a step-down buck converter switching regulator. LM2596 Buck is capable of driving a 3-A load with excellent line and load regulation and fixed output voltages of 3.3 V, 5 V, 12 V, and an adjustable output version.



Figure 4.3: LM2596 DC-DC Buck Converter

4.2.4 Arduino NANO

Arduino Nano is a small, compact version of the Arduino microcontroller board. It is designed for projects that require a small footprint and low power consumption. It is based on the ATmega328P microcontroller and has a similar set of features as the Arduino Uno, including digital inputs/outputs, analog inputs, and PWM outputs. It can be programmed using the Arduino software development environment and is commonly used in projects such as robotics, automation, and home automation.

Features:

- 1 pair of TTL level serial transceiver ports RX / TX
- Using Atmel Atmega328P-AU MCU
- Support for external 5V ~ 12V DC power supply
- Power OK blue LED on the bottom.
- ICSP header for direct program downloads.
- Manual reset switch.

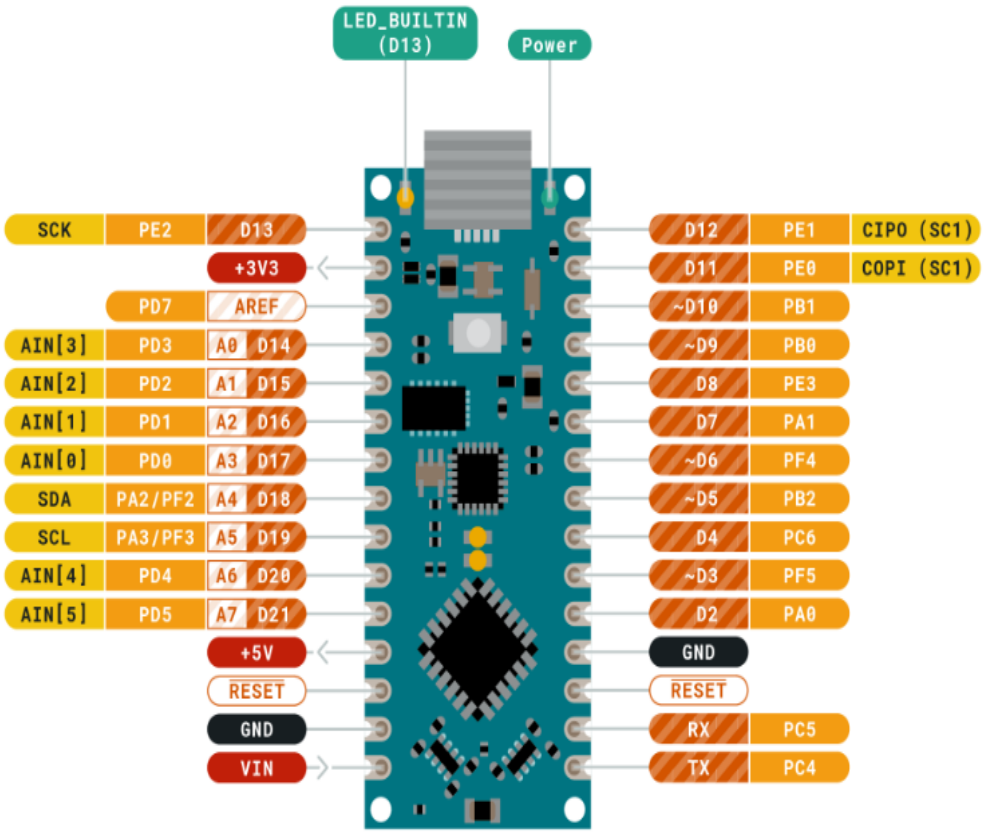


Figure 4.4: Arduino NANO Pinout

4.2.5 GSM Module

SIM800L Mini Module is built with Dual Band GSM/GPRS based SIM800L modem from SIMCOM. It works on frequencies 900/ 1800 MHz. SIM800L can search these two bands automatically. The frequency bands can also be set by AT Commands. The baud rate is configurable from 1200-115200 through AT command. The GSM/GPRS Modem is having internal TCP/IP stack to enable you to connect with internet via GPRS. SIM800L is an ultra-compact and reliable wireless module. This is a complete GSM/GPRS module in a SMT type and designed with a very powerful single-chip processor integrating AMR926EJ-S core, allowing you to benefit from small dimensions and cost-effective solutions.

Power supply you cannot power the module from the Arduino, as it is incapable of supplying the necessary peak currents. The SIM800L draws about 1A every so often. It's not necessary to build a 1A supply, as a large storage capacitor on the power supply output will supply the current. I am using a small switch mode buck power supply to step down from an external 3.8V DC source to 3.3V, with a 0.1F 5V super capacitor on its output and that works a treat. I believe that a 1000uF low esr cap will also work, but I've not tried it. The photo shows the power supply with a 0.1F cap underneath.



Figure 4.5: GSM Module SIM800L

4.2.6 MQ2 Gas Sensor

For the gas leakage identification, this MQ2 gas sensor is used in home and industrial sides. Due to its high sensitivity and fast response, measurement can be done as soon as possible. Its sensitivity can be adjusted by potentiometer. Gases like Hydrogen, Carbon Mono-oxide, Hydro carbon, Fuel gases and smoke can be easily detected by this sensor. The wide detecting scope, higher sensitivity and long life time stability features make this sensor widely used in different professional and home sectors.



Figure 4.6: MQ2 Gas Sensor

In this project, this gas sensor is used to identify the gas leakage in a room at home so that it can send alert via wireless connection to the user. A buzzer is connected to notify the alert to the user or home living people. The gas sensor here is operated by Nodemcu.

Specification

- Working voltage from 4.9-5.1 V
- Heating consumption 0.5-800mW
- Sensing resistance 3-30 kΩ

4.2.7 DHT11 Temperature Sensor

The DHT11 is a commonly used Temperature and humidity sensor that comes with a dedicated NTC to measure temperature and an 8-bit microcontroller to output the values of temperature and humidity as serial data.

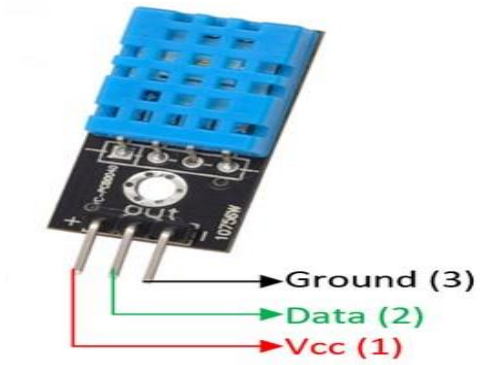


Figure 4.7: DHT11 Temperature Sensor

DHT11 Specifications

- Operating Voltage: 3.5V to 5.5V
- Operating current: 0.3mA (measuring) 60uA (standby)
- Output: Serial data
- Temperature Range: 0°C to 50°C
- Humidity Range: 20% to 90%
- Resolution: Temperature and Humidity both are 16-bit
- Accuracy: ±1°C and ±1%

4.2.8 LCD Display

The term LCD stands for liquid crystal display. It is one kind of electronic display module used in an extensive range of applications like various circuits & devices like mobile phones, calculators, computers, TV sets, etc. These displays are mainly preferred for multi-segment light-emitting diodes and seven segments. The main benefits of using this module are inexpensive; simply programmable, animations, and there are no limitations for displaying custom characters, special and even animations, etc.



Figure 4.8: 16X2 LCD Display

4.2.9 Buzzer

An audio signaling device like a beeper or buzzer may be electromechanical or piezoelectric or mechanical type. The main function of this is to convert the signal from audio to sound. Generally, it is powered through DC voltage and used in timers, alarm devices, printers, alarms, computers, etc. Based on the various designs, it can generate different sounds like alarm, music, bell & siren.



Figure 4.9: Buzzer

This simple digital buzzer module, model: MOD-00055 is used here to alert user and others when this buzzer gets command from gas detector sensor MQ2. This buzzer has 3 pins with ground and VCC which operates at 5V. Another pin is switching pin for the connection with sensor.

CHAPTER 5 :
RESULT AND DISCUSSION

5.1 Introduction

Leakage of gas is a major issue in the industrial sector, residential buildings, and gas-powered vehicles, one of the preventive methods to stop accidents associated with gas leakage is to install gas leakage detection devices. The focus of this work is to propose a device that can detect gas leakage and alert the owners to avert problems due to gas leakages. The system is based on a microcontroller that employs a gas sensor as well as a GSM module, an LCD display, LED and a buzzer. The system was designed for gas leakage monitoring and alerts with calling and SMS via an Arduino microcontroller with a buzzer and an MQ2 gas sensor. The circuit contains a Microcontroller MQ2 gas sensor, buzzer, LCD display, and GSM module, when the sensor detects gas leakage it transmits the information to the Microcontroller while the microcontroller makes a decision and then forwarded a warning message to the user as SMS to a mobile phone for decision to be taken accordingly. The output of this research will be significant in averting problems associated with gas leakages now and in future.

5.2 Project Prototype

Certainly! Below is a project prototype outline for a GSM-based gas leakage and temperature detection system. This project utilizes GSM technology to send alerts and notifications in case of gas leakage or abnormal temperature levels. To design a prototype system that can detect gas leakage and abnormal temperature conditions and send alerts via GSM (Global System for Mobile Communications) to a mobile phone. This project hardware showing below.

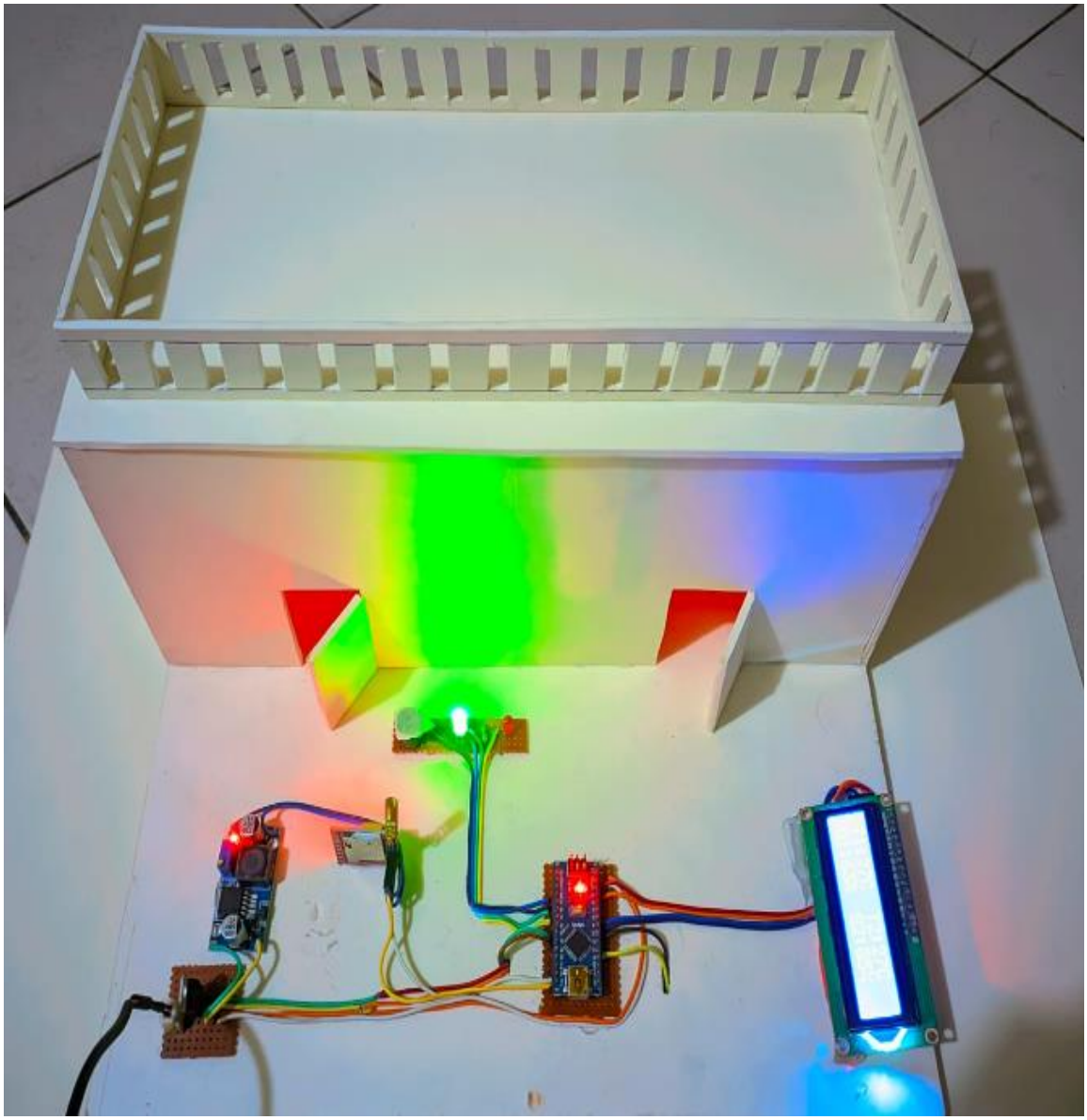


Figure 5.1: Prototype of the Project

5.3 Output Result



Figure 5.2: High Gas of Room-1 and Room-2



Figure 5.3: High Temperature of Room-1 and Room-2

5.4 Notify to user Mobile

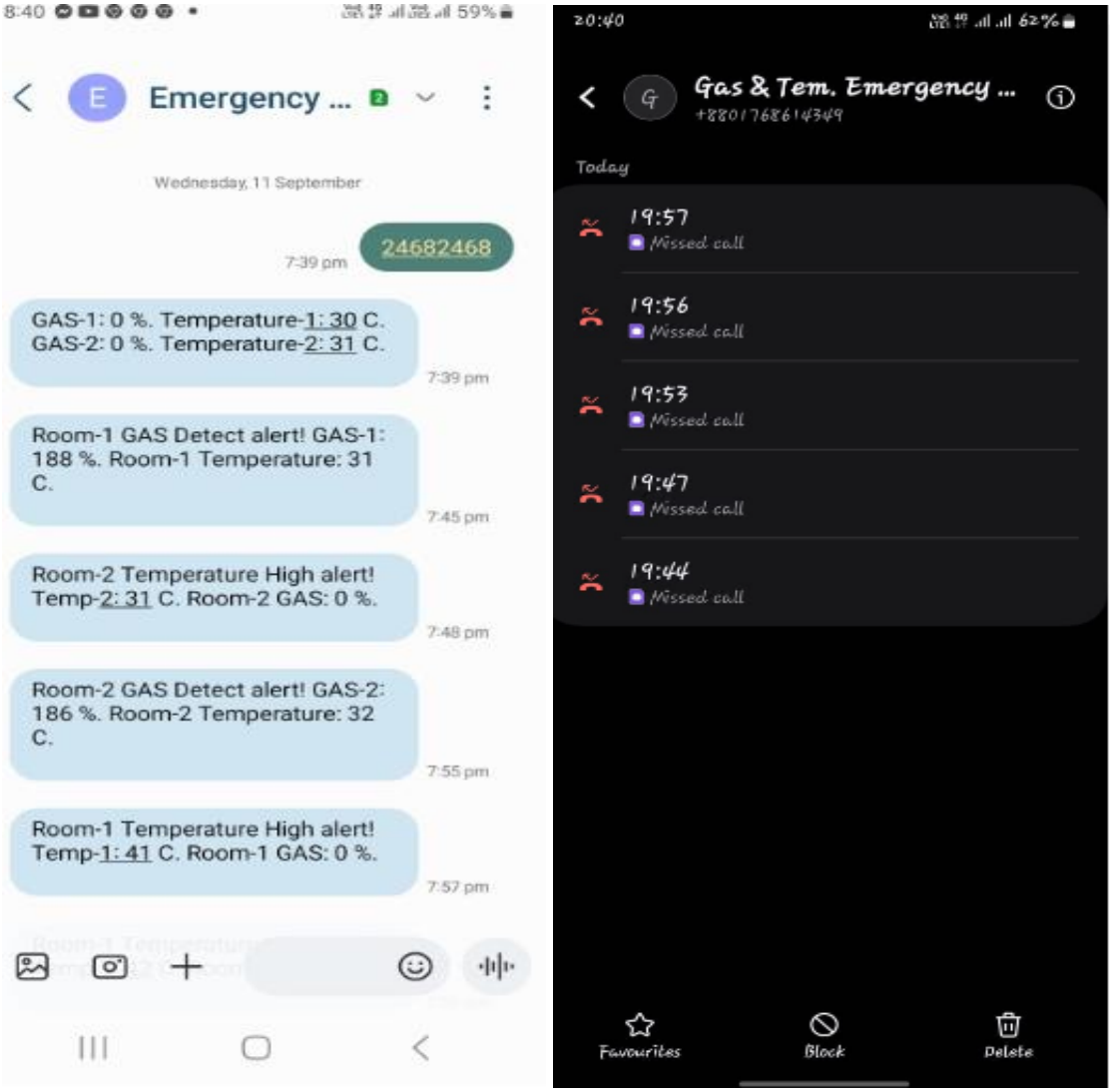


Figure 5.4: Notify to user Mobile

CHAPTER 6 :
CONCLUSION

6.1 Conclusion

This work presents the design and implementation of gas leakage detection system. Various works on gas leakages detection system was reviewed and presented. I was discovered that some of the existent research don't takes in to considerations the cost effectiveness for the purpose of implementation of gas leakages detection at individual/domestic uses, and not easy to be further modified. This research work had advanced in knowledge as it included an embedded system to alert users via multiple mobile phones for further action to be taken when leakage is detected. The device detects gas leakage using a highly sensitive MQ-2 gas sensor or Temperature sensor to activate a buzzer that alert people of leakages, and also sent an SMS with the information "Gas Leakage Detected" from the SIM800 GSM Module as a backup to alert the appropriate authority or facility owner of a gas leakage. This design could be adopted, funded, and implemented as it has a great potential of mitigating against accidents associated with LPG leakage.

6.2 Advantage

- Provides Home or Industrial security.
- Highly sensitive.
- Low cost.
- Simple and Reliable.
- User friendly.
- Notify to Mobile phone by calling or SMS

6.3 Application

- Hone Security – Can be used in homes (especially kitchen area) to prevent accidents due to gas leak.
- Industrial Security – Cen be used a sensitive area to prevent any accidents.

- Enhancement – Can be enhanced to measure specific gas levels to use in industrial application.

6.4 Limitations

This system only Send SMS & calling to User mobile. But not prevent accidents in industries. It can't do anything if by chance the leaked LPG catches the fire. This system can't extinguish the fire occurred.

6.5 Future Work

This monitoring system can be further enhanced by using IOT and GSM to send the alert messages to user, which supports another real-time application. For industrial sector, the data collected by the mobile application is beneficiary and used for data analytics. The integration of other sensors like Fire, pressure sensors etc. makes the system as a home automation project.

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Appendices

A. Programming Codes for Proposed Project

```
#include <Wire.h>
#include <LiquidCrystal_I2C.h>
#include <DHT.h>
#define DHTPIN1 7
#define DHTPIN2 6
#define DHTTYPE DHT11
DHT dht1(DHTPIN1, DHTTYPE);
DHT dht2(DHTPIN2, DHTTYPE);
#define MQ135PIN1 A3
#define MQ135PIN2 A1
#define BUZZER_PIN 2
#define RED_LED_PIN 4
#define GREEN_LED_PIN 3
LiquidCrystal_I2C lcd(0x27, 16, 2);  // Adjust address and dimensions as needed
#include <SoftwareSerial.h>
SoftwareSerial sim800l(11, 12);  // RX, TX for SIM800L
void setup() {
  Serial.begin(9600);
  lcd.init();
  lcd.backlight();
  dht1.begin();
  dht2.begin();
  lcd.setCursor(3, 0);
  lcd.print("WELCOME TO");
  lcd.setCursor(3, 1);
  lcd.print("OUR PROJECT");
  Serial.print("Welcome to Our project");
  pinMode(BUZZER_PIN, OUTPUT);
  pinMode(RED_LED_PIN, OUTPUT);
  pinMode(GREEN_LED_PIN, OUTPUT);
  sim800l.begin(9600);
  delay(3000);
  RecieveMessage();
  delay(5000);
}
void loop() {
  // Read data from DHT11 sensors
  int h1 = dht1.readHumidity();
  int t1 = (dht1.readTemperature() - 3);
  int h2 = dht2.readHumidity();
  int t2 = (dht2.readTemperature() - 3);
  // Read data from MQ135 sensors
  int mq135Value1 = (analogRead(MQ135PIN1) - 130);
```

```
  int mq135Value2 = (analogRead(MQ135PIN2) - 230);
  if (mq135Value1 < 30) mq135Value1 = 0;
  if (mq135Value2 < 30) mq135Value2 = 0;
  // Check for errors
  if (isnan(h1) || isnan(t1) || isnan(h2) || isnan(t2)) {
    lcd.clear();
    lcd.print("DHT11 Error");
    delay(500);
    return;
  }
  // Display sensor data
  lcd.clear();
  lcd.setCursor(0, 0);
  lcd.print("T1:");
  lcd.print(t1);
  lcd.print("C");
  lcd.setCursor(8, 0);
  lcd.print("T2:");
  lcd.print(t2);
  lcd.print("C");
  lcd.setCursor(0, 1);
  lcd.print("G1:");
  lcd.print(mq135Value1);
  lcd.print("%");
  lcd.setCursor(8, 1);
  lcd.print("G2:");
  lcd.print(mq135Value2);
  lcd.print("%");
  // Check for incoming SMS
  if (sim800l.available()) {
    String incomingSMS = sim800l.readString();
    Serial.println("Received SMS: " + incomingSMS);
    // Check if the received SMS contains the specific code
    if (incomingSMS.indexOf("24682468") >= 0) {
      // Send a response SMS with sensor data
      String responseMessage = "GAS-1: " + String(mq135Value1) + " %.
Temperature-1: " + String(t1) + " C. "
                          + "GAS-2: " + String(mq135Value2) + " %. Temperature-2: " +
String(t2) + " C.";
      sendSMS("+8801782035259", responseMessage);
      delay(3000);  // Ensure the SMS is sent before continuing
      sendSMS("+8801795159599", responseMessage);
      delay(1000);
    }
  }

  if (mq135Value1 > 100) {
    digitalWrite(RED_LED_PIN, HIGH);
```

```
    digitalWrite(GREEN_LED_PIN, LOW);
    digitalWrite(BUZZER_PIN, HIGH);  // Sound buzzer
    delay(500);
    makeCall1();
    delay(1000);
    makeCall2();
    delay(1000);
    sendSMS("+8801782035259", "Room-1 GAS Detect alert! GAS-1: "
                          + String(mq135Value1) + " %. Room-1 Temperature: " +
String(t1) + " C.");
    delay(3000);  // Wait for a minute to avoid repeated calls and messages
    sendSMS("+8801795159599", "Room-1 GAS Detect alert! GAS-1: "
                          + String(mq135Value1) + " %. Room-1 Temperature: " +
String(t1) + " C.");
    delay(500);  // Wait for a minute to avoid repeated calls and messages
  } else if (mq135Value2 > 100) {
    digitalWrite(RED_LED_PIN, HIGH);
    digitalWrite(GREEN_LED_PIN, LOW);
    digitalWrite(BUZZER_PIN, HIGH);  // Sound buzzer
    delay(500);
    makeCall1();
    delay(1000);
    makeCall2();
    delay(1000);
    sendSMS("+8801782035259", "Room-2 GAS Detect alert! GAS-2: "
                          + String(mq135Value2) + " %. Room-2 Temperature: " +
String(t2) + " C.");
    delay(3000);  // Wait for a minute to avoid repeated calls and messages
    sendSMS("+8801795159599", "Room-2 GAS Detect alert! GAS-2: "
                          + String(mq135Value2) + " %. Room-2 Temperature: " +
String(t2) + " C.");
    delay(500);  // Wait for a minute to avoid repeated calls and messages
  } else if (t1 > 40) {
    digitalWrite(RED_LED_PIN, HIGH);
    digitalWrite(GREEN_LED_PIN, LOW);
    digitalWrite(BUZZER_PIN, HIGH);  // Sound buzzer
    delay(500);
    makeCall1();
    delay(1000);
    makeCall2();
    delay(1000);
    sendSMS("+8801782035259", "Room-1 Temperature High alert! Temp-1: "
                          + String(t1) + " C. Room-1 GAS: " + String(mq135Value1) + "
%.");
    delay(3000);  // Wait for a minute to avoid repeated calls and messages
    sendSMS("+8801795159599", "Room-1 Temperature High alert! Temp-1: "
                          + String(t1) + " C. Room-1 GAS: " + String(mq135Value1) + "
%.");
```

```
    delay(1500);  // Wait for a minute to avoid repeated calls and messages
  } else if (t2 > 40) {
    digitalWrite(RED_LED_PIN, HIGH);
    digitalWrite(GREEN_LED_PIN, LOW);
    digitalWrite(BUZZER_PIN, HIGH);  // Sound buzzer
    delay(500);
    makeCall1();
    delay(1000);
    makeCall2();
    delay(1000);
    sendSMS("+8801782035259", "Room-2 Temperature High alert! Temp-2: "
                          + String(t2) + " C. Room-2 GAS: " + String(mq135Value2) + "
%.");
    delay(3000);  // Wait for a minute to avoid repeated calls and messages
    sendSMS("+8801795159599", "Room-2 Temperature High alert! Temp-2: "
                          + String(t2) + " C. Room-2 GAS: " + String(mq135Value2) + "
%.");
    delay(1500);  // Wait for a minute to avoid repeated calls and messages
  } else {
    digitalWrite(RED_LED_PIN, LOW);
    digitalWrite(GREEN_LED_PIN, HIGH);
    digitalWrite(BUZZER_PIN, LOW);  // Turn off buzzer
  }
  delay(1000);  // Delay between readings
}
void makeCall1() {
  sim800l.println("ATD+8801782035259;");  // Replace with the actual phone number
  delay(30000);                       // Wait for the call to connect and disconnect
  sim800l.println("ATH");               // Hang up
  delay(1000);
}
void makeCall2() {
  sim800l.println("ATD+8801795159599;");  // Replace with the actual phone number
  delay(30000);                       // Wait for the call to connect and disconnect
  sim800l.println("ATH");               // Hang up
  delay(1000);
}
void sendSMS(String phoneNumber, String message) {
  Serial.println("Sending Message please wait….");
  sim800l.println("AT+CMGF=1");  //Text Mode initialisation
  delay(500);
  Serial.println("Set SMS Number");
  sim800l.println("AT+CMGS=\"" + phoneNumber + "\"");  // Receiver’s Mobile
Number
  delay(1000);
  Serial.println("Set SMS Content");
  sim800l.println(message);  // Messsage content
  delay(2000);
```

```
  Serial.println("Done");
  sim800l.println((char)26);  // delay(1000);
  Serial.println("Message sent succesfully");
  delay(1000);
}
void RecieveMessage() {
  Serial.println("Receiving Messeges");
  delay(100);
  sim800l.println("AT+CNMI=2,2,0,0,0");  // Eeceiving Mode Enabled
  delay(1000);
  Serial.write("Messege Received Sucessfully");
}
```

--The End--