AN INDUSTRY ORIENTED MINI PROJECT

on

HAZARDOUS GAS DETECTION AND ALERTING

Submitted to

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, HYDERABAD

In partial fulfilment of the requirement for the award of the degree of

BACHELOR OF TECHNOLOGY

in

ELECTRONICS AND COMMUNICATION ENGINEERING

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(AN AUTONOMOUS INSTITUTION)
(Approved by AICTE, New Delhi & Affiliated to JNTUH, Hyderabad)
NAAC Accredited Institution with 'A' Grade & Recognized Under Section2(f) & 12(B)of the UGC act,1956

August,2024

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Date:

CERTIFICATE

This is to certify that the project work entitled "**HAZARDOUS GAS DETECTION AND ALERTING**" work done by **NAZMEEN (217Y1A04F4), J. NIKHIL REDDY (217Y1A04F8), E. POOJITHA (217Y1A04F9), S. SANEETH REDDY (217Y1A04H0)** students of Department of Electronics and Communication Engineering, is a record of bonafide work carried out by the members during a period from August, 2023 to July, 2024 under the supervision of **R. KIRAN**. This project is done as a fulfilment of obtaining Bachelor of Technology Degree to be awarded by Jawaharlal Nehru Technological University Hyderabad, Hyderabad.

The matter embodied in this project report has not been submitted by us to any other university for the award of any other degree.

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This is to certify that the above statement made by the candidate(s) is correct to the best of my knowledge.

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ACKNOWLEDGEMENTS

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LIST OF ABBREVIATIONS

GSM	Global Systen for Mobile Communications
PIC	Peripheral Interface Controller
UART	Universal Asynchronous Receiver/Transmitter
CPU	Central Processing Unit
RISC	Reduced Instruction Set Computer
SMS	Short Message Service
LPG	Liquefied Petroleum Gas
ADC	Analog to Digital Converter
RTOS	Real Time Operating System
IDE	Integrated Development Environment
LCD	Liquid Crystal Display
ICSP	In-Circuit Serial Programming

ABSTRACT

Safety plays a major role in today's world and it is necessary that good safety systems are to be implemented in places of education and work. This work modifies the existing safety model installed in industries and this system also be used in homes and offices. The main objective of the work is designing microcontroller based toxic gas detecting and alerting system. The hazardous gases like LPG and propane were sensed and displayed each and every second in the LCD display. If these gases exceed the normal level then an alarm is generated immediately and also an alert message (SMS) is sent to the authorized person through the GSM.

The advantage of this automated detection and alerting system over the manual method is that it offers quick response time and accurate detection of an emergency and in turn leading faster diffusion of the critical situation.

Keywords- Air pollution Monitoring, gas sensors, GSM module, wireless networks

CHAPTER 1

INTRODUCTION

1.1 Introduction

The increase in the development of technology and the human race, we failed to take care about the surroundings in which we live in. thus we polluted the environment and thereby reducing the quality of the place we live. Even though there are several aspects of pollution such as soil, air and water pollution, out of these air pollution acts as the serious aspect as the other can detected visually and by taste, but the polluted air cannot be detected as it can be odourless, tasteless and colourless. Hence there is a growing demand for the environmental pollution monitoring and control systems. In the view of the ever-increasing pollution sources with toxic chemicals, these systems should have the facilities to detect and quantify the sources rapidly. Toxic gases are one that causes serious health impacts, but are also used in industries in large quantities. These gases have to be monitored; such that increase in the normal level of them could be known and proper precaution measures can be taken. But the current systems available are not so portable and are costly and difficult to implement. So an embedded system is designed using PIC 16F877 Microcontroller, for the purpose of detection of hazardous gas leakage, which in turn avoids the endangering of human lives. The hazardous gases like LPG and propane were considered here. If these hazardous gases level exceeds normal level that is LPG>1000ppm or Propane>10000ppm then an alarm is generated immediately, and a SMS is sent to the authorized user as an alert message, which leads to faster diffusion of emergency situation. The system is affordable and can be easily implement in the chemical industries and in residential area which is surrounded by the chemical industries or plants, to avoid endangering of human lives. The system also supports to provide real-time monitoring of concentration of the gases which presents in the air. As this method is automatic the information can be given in time such that the endangering of human lives can be avoided.

1.2 Hazardous Gas Detection and Alerting

Hazardous gas detection and alerting systems are critical tools used to monitor the risks associated with the presence of dangerous gases in various environments. These systems are deployed in a wide range of applications, including industrial facilities, laboratories, residential areas, and more.

In the view of the ever-increasing pollution sources with toxic chemicals, these systems should have the facilities to detect and quantify the sources rapidly. Toxic gases are one that causes serious health impacts, but are also used in industries in large quantities. These gases have to be monitored; such that increase in the normal level of them could be known and proper precaution measures can be taken. But the current systems available are not so portable and are costly and difficult to implement. So an embedded system is designed using PIC 16F877 Microcontroller, for the purpose of detection of hazardous gas leakage, which in turn avoids the endangering of human lives. The hazardous gases like LPG and propane were considered here. If these hazardous gases level exceeds normal level that is LPG>1000ppm or Propane>10000ppm then an alarm is generated immediately, and a SMS is sent to the authorized user as an alert message, which leads to faster diffusion of emergency situation. The system is affordable and can be easily implement in the chemical industries and in residential area which is surrounded by the chemical industries or plants, to avoid endangering of human lives. The system also supports to provide real-time monitoring of concentration of the gases which presents in the air. As this method is automatic the information can be given in time such that the endangering of human lives can be avoided.

Hazardous gas detection and alerting systems play a vital role in safeguarding lives and assets by detecting the presence of dangerous gases and issuing timely warnings or alarms. These systems are designed to meet specific environmental and industrial safety needs and are subject to stringent regulations and standards. Advances in sensor technology and data analytics continue to improve the accuracy and efficiency of these systems.

Purpose:

Safety: The primary purpose of these systems is to ensure the safety of people and the environment by detecting the presence of hazardous gases and issuing timely alerts or alarms.

CHAPTER 2
LITERATURE SURVEY

2.1 Introduction

Dangerous gas leakage as well as fires have caused wide damage to industries and economies in the past. These agents spread wildly and instant action needs to be taken as soon as such an event occurs. It is very important to detect a gas leak or fire as soon as it breaks out so that it can be prevented from spreading instantly. We here propose a system that detects gas leakage as well as fires as soon as they start and alerts the authorities automatically so that it can be stopped from spreading. Our system consists of gas sensor to detect any gas leakage as soon as it is encountered. The gas sensor sends a signal to the microcontroller as soon as gas leak is detected so that microcontroller can process it further. We use a temperature sensor in order to detect fire. The temperature sensor instantly sends a signal to the microcontroller on fire detection. Once the microcontroller receives signal from the sensors, it processes the input and then sends a signal to the gsm modem to send an SMS to the intended authorities so that they may take appropriate action.

2.2 History

In the year of 2008, LIU zhen-ya, WANG Zhen-dong and CHEN Rong, "Intelligent Residential Security. Alarm and Remote Control System Based on Single Chip Computer", the paper focuses on, Intelligent residential burglar alarm, emergency alarm, fire alarm, toxic gas leakage remote automatic sound alarm and remote control system, which is based on 89c51 single chip computer. The system can perform an automatic alarm, which calls the police hotline number automatically. It can also be a voice alarm and shows alarm occurred address. This intelligent security system can be used control the electrical power remotely through telephone.

In the year of 2008, Chen Peijiang and Jiang Xuehhua, "Design and implementation of Remote Monitoring System Based on GSM", this paper focuses on the wireless monitoring system, because the wireless remote monitoring system has more and more application, a remote monitoring system based on SMS through GSM. Based on the overall architecture of the system, the hardware and software architecture of the system is designed. In this system, the remote signal is transmitted through GSM network.

The system includes two parts which are the monitoring centre and the remote monitoring station. The monitoring centre consists of a computer and a TC35 communication module for GSM. The computer and the TC35 are connected by RS232. The remote monitoring station consist of a TC35 communication module for GSM, a MSP430F149 MCU, a display unit, sensors and a data gathering and processing unit. The software for the monitoring centre and the remote monitoring station were designed using VB. In the year of 2006, Ioan Lita, Ion Bogdan Cioc and Daniel Alexandru Visan, "A New Approach of Automatic Localization System Using GPS and GSM/GPRS Transmission", this paper focuses on, a low-cost automotive localization system using GPS and GSM-SMS services, which provides the position of the vehicle on the driver's or owner's mobile phone as a short message (SMS) on his request. The system can be interconnected with the car alarm system which alerts the owner, on his mobile phone, about the events that occurs with his car when it is parked. The system is composed by a GPS receiver, a microcontroller and a GSM phone. In additional the system can be settled for acquiring and transmitting the information, whenever requested about automobile status and alerts the user about the vehicle started engine. The system can be used as a low-cost solution for automobile position localizing as well as in car tracking system Application. In the year of 2002, K. Galatsis, W. Wlodarsla, K. Kalantar-Zadeh and A. Trinchi, "Investigation of gas sensors for vehicle cabin air quality monitoring", this paper focuses on, car cabin air quality monitoring can be effectively analyzed using metal oxide semiconducting (MOS) gas sensors. In this paper, commercially available gas sensors are compared with fabricated Moo3 based sensors possessed comparable gas sensing properties. The sensor has response 74% higher relative to the hest commercial sensor tested In the year 2000, K. Galatsis, W. Woldarsla, Y.X. Li and K. Kalantarzadeh, "A Vehicle air quality monitor using gas sensors for improved safety", this paper focuses on A vehicle cabin air quality monitor using carbon monoxide (CO) and oxygen (o2) gas sensors has been designed, developed and on-road tested. The continuous monitoring of oxygen and carbon monoxide provides added vehicle safety as alarms could be set off when dangerous gas concentrations are reached, preventing driver fatigue, drowsiness, and exhaust gas suicides. CO concentrations of 30ppm and oxygen levels lower than 19.5% were experienced whilst driving.

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CHAPTER 3

HARDWARE DESCRIPTION

3.1. HARDWARE SYSTEM DESIGN

3.1.1 Block Diagram of The Proposed System
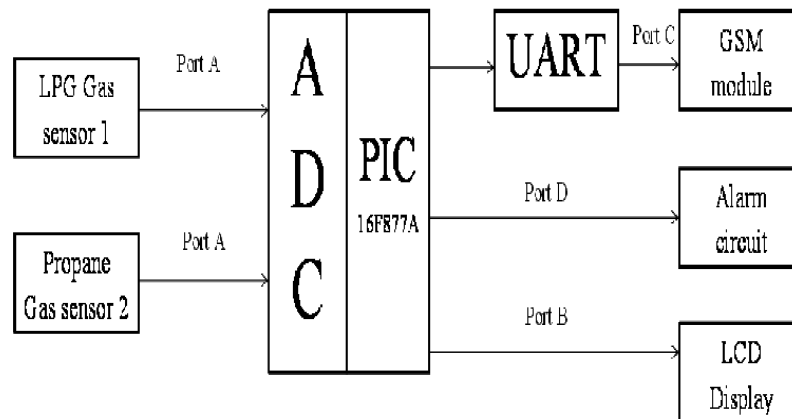
Figure: 3.1 Block Diagram of the Proposed System

The gas levels are sensed through the respective gas sensors (here MQ-2 and MQ-7 are used for sensing LPG and propane respectively for demonstration purpose) and sent to the PIC micro controller. The sensed analog signals are converted to digital through ADC (inbuilt in case of PIC). The sensed gas levels are displayed in the LCD; if any one gas level exceeds the set point then an alarm is generated immediately. At the same time an alert message is sent as SMS to the authorized user through the GSM modem. The block diagram of the proposed system is shown in figure3.

3.2 HARDWARE COMPONENTS

3.2.1. GAS SENSORS

MQ135 Gas Sensor module for Air Quality having Digital as well as Analog output. Sensitive material of MQ135 gas sensor is SnO2, which with lower conductivity in clean air. When the target combustible gas exist, The sensors conductivity is more higher along with the gas concentration rising. MQ135 gas sensor has high sensitivity to Ammonia, Sulphide and Benze steam, also sensitive to smoke and other harmful gases. It is with low cost and suitable for different application. Used for family, surrounding

environment noxious gas detection device, apply to ammonia, aromatics, sulphur, benzene vapor, and other harmful gases/smoke, gas detection, tested concentration range: 10 to 1000 ppm.

Specifications of MQ135 Gas Sensor Module:-

Working voltage: DC 5V

Working Current: 150mA

DOUT: TTL output

AOUT: Analog output

Preheat time: Over 20s

Dimension: 32mm x 22m x 27mm (HIGH 27mm)

Figure: 3.2 LPG gas sensors

3.2.2.GSM

GSM stands for Global System for Mobiles. GSM provides recommendations and not requirements. The GSM module as shown in figure6 has specifications that define the functions and interface requirements in detail but not address the hardware. The reason for this is to limit the designers as little as possible but still to make it possible for the operators to buy equipment from different suppliers. The GSM network is divided into three major systems,

Important facts about the GSM are given below –

- The Switching system (SS)

- The Base station system (BSS)

- The Operation and support system (OSS)
- The concept of GSM emerged from a cell-based mobile radio system at Bell Laboratories in the early 1970s.

- GSM is the name of a standardization group established in 1982 to create a common European mobile telephone standard.

- GSM is the most widely accepted standard in telecommunications and it is implemented globally.

- GSM is a circuit-switched system that divides each 200 kHz channel into eight 25 kHz time-slots. GSM operates on the mobile communication bands 900 MHz and 1800 MHz in most parts of the world. In the US, GSM operates in the bands 850 MHz and 1900 MHz.

- GSM owns a market share of more than 70 percent of the world's digital cellular subscribers.

- GSM makes use of narrowband Time Division Multiple Access (TDMA) technique for transmitting signals.

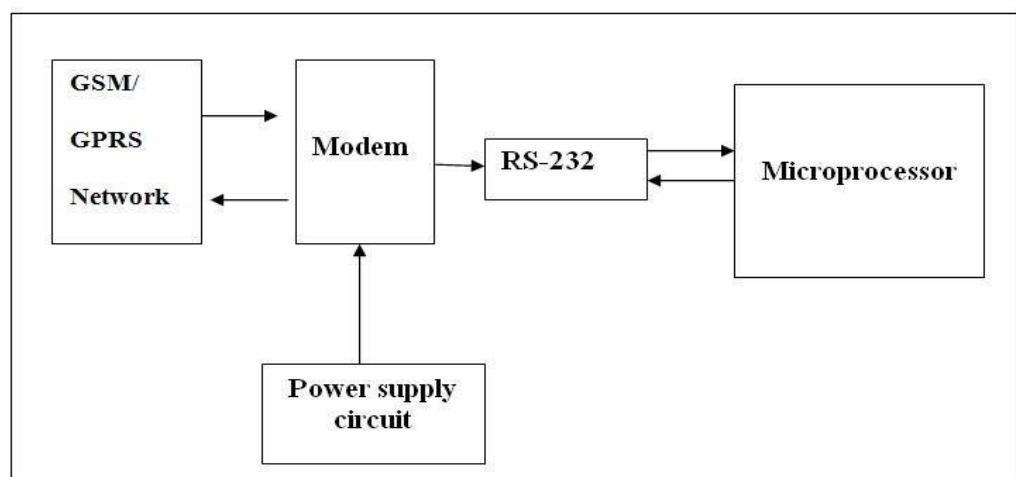- GSM was developed using digital technology. It has an ability to carry 64 kbps to 120 Mbps of data rates.

Figure: 3.3 Block diagram of GSM module

3.2.3. PIC Microcontroller

The Microcontroller used here is the PIC16F877. It has attractive features and they are suitable for a wide range of application. It consists of I/O ports, 3 timers, ROM, RAM, Flash memory and inbuilt ADC. PIC channel 10 bit inbuilt ADC which convert the analog value into 10 bit digital data. PIC is programmed to convert 10 bit data into an 8 bit data and to transmit the data into a transistor driver. Microcontroller 16F877A has 40 pins, 32 pins for parallel port. One port includes 8 pins, so 32 pins formed 4 parallel ports; each of them is recognized as port 0, port 1, port 2 and port 3. Number of each pin of parallel port starts from 0 through 7, first pin of port 0 is named P0.0 and the last pin of port 3 is named P3.7.

3.4. PIC Features

3.4.1. High performance RISC CPU

- Only 35 single word instructions to learn.
- All single cycle instructions except for program Branches which are two cycle.
- Operating speed: 20MHz clock input, 200 ns instruction cycle.
- Up to 8k x 14 words of FLASH program memory, up to 368 x 8 bytes of Data memory (RAM). Wide operating voltage range:2.0V to 5.5V

3.4.2 Peripheral Features

- Timer0: 8-bit timer/counter with 8-bit prescaler.
- Timer1: 16-bit timer/counter with prescaler, can be incremented during SLEEP mode.
- Timer2: 8-bit period register, prescaler and postscaler

3.4.3. Analog Features

- 10-bit, up to 8-channel Analog-to- Digital Convertor (A/D)
- Brownout Reset (BOR)
- Analog Comparator module with :Two analog comparators.
- Programmable on-chip voltage reference (VREF0 module.

- Programmable input multiplexing from device inputs and internal voltage reference.

- Comparator outputs are externally accessible.

3.4.4. Special Micro Features

- 100,000-erase/write cycle Enhanced Flash program memory typical.

- 1,000,000-erase/write cycle Data EEPROM memory typical.

- Data EEPROM retention > 40 years

- Self-re-Programming under software control

- In-circuit Serial Programming (ICP) via two pins

- Watchdog Timer (WDT0 with its own on-chip RC oscillator for reliable operation.

- Programmable code protection

- Selectable saving sleep mode

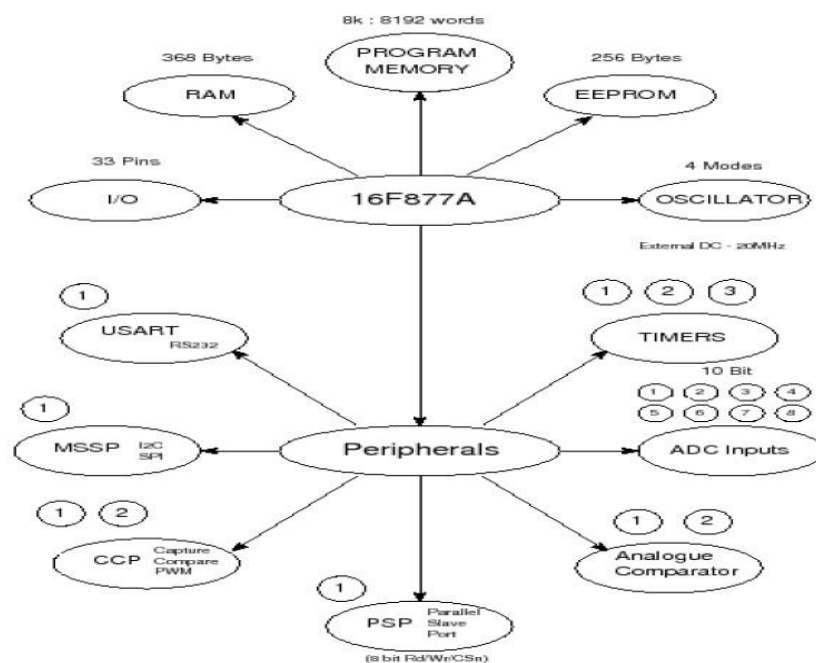- Selected oscillator options

- In-circuit Debug (ICD) via two pins

Figure: 7 PIC functional diagram
Figure 3.4: PIC Functional Diagram

Arduino UNO

The Arduino UNO is a standard board of Arduino. Here UNO means 'one' in Italian. It was named as UNO to label the first release of Arduino Software. It was also the first USB board released by Arduino. It is considered as the powerful board used in various projects. Arduino.cc developed the Arduino UNO board.Arduino UNO is based on an ATmega328P microcontroller. It is easy to use compared to other boards, such as the Arduino Mega board, etc. The board consists of digital and analog Input/Output pins (I/O), shields, and other circuits.

The Arduino UNO includes 6 analog pin inputs, 14 digital pins, a USB connector, a power jack, and an ICSP (In-Circuit Serial Programming) header. It is programmed based on IDE, which stands for Integrated Development Environment. It can run on both online and offline platforms.

The components of Arduino UNO board are shown below in figure 3.5:
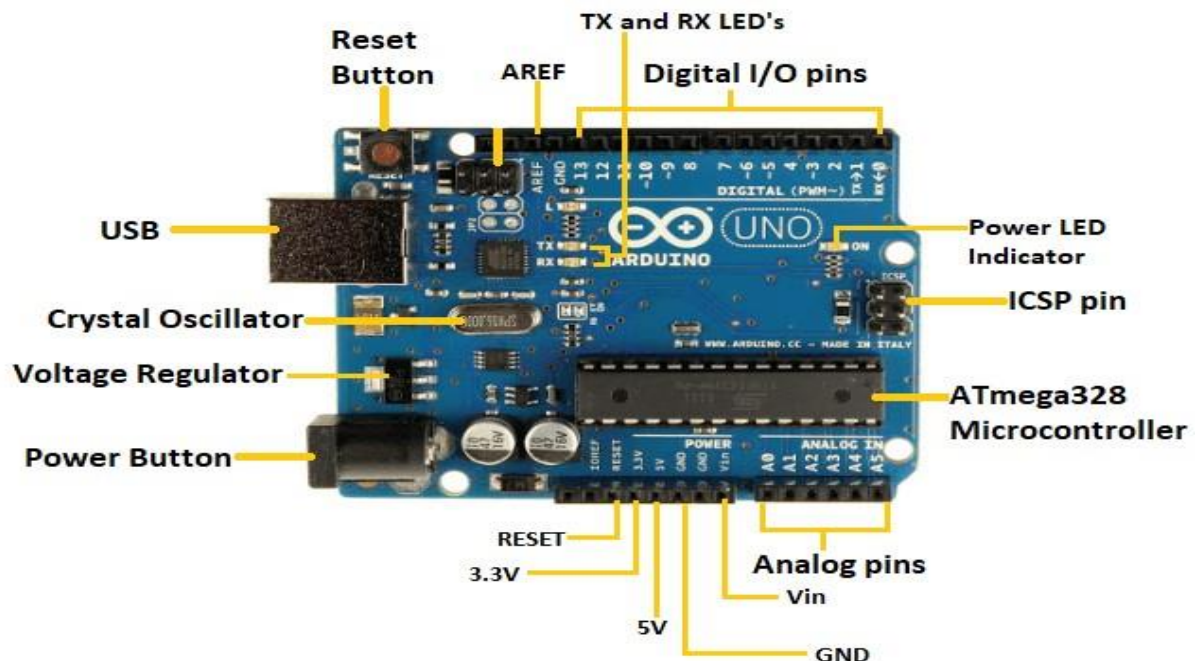
- o **ATmega328 Microcontroller**- It is a single chip Microcontroller of the ATmel family. The processor code inside it is of 8-bit. It combines **Memory (SRAM, EEPROM, and Flash), Analog to Digital Converter, SPI serial ports, I/O lines, registers, timer, external and internal interrupts, and oscillator.**

- o **ICSP pin** - The In-Circuit Serial Programming pin allows the user to program using the firmware of the Arduino board.

o   **Power LED Indicator**- The ON status of LED shows the power is activated. When the power is OFF, the LED will not light up.

o   **Digital I/O pins**- The digital pins have the value HIGH or LOW. The pins numbered from D0 to D13 are digital pins.

o   **TX and RX LED's**- The successful flow of data is represented by the lighting of these LED's.

o   **AREF-** The Analog Reference (AREF) pin is used to feed a reference voltage to the Arduino UNO board from the external power supply.

o   **Reset button**- It is used to add a Reset button to the connection.

o   **USB**- It allows the board to connect to the computer. It is essential for the programming of the Arduino UNO board.

o   **Crystal Oscillator**- The Crystal oscillator has a frequency of 16MHz, which makes the Arduino UNO a powerful board.

o   **Voltage Regulator**- The voltage regulator converts the input voltage to 5V.

o   **GND**- Ground pins. The ground pin acts as a pin with zero voltage.

o   **Vin**- It is the input voltage.

o   **Analog Pins**- The pins numbered from A0 to A5 are analog pins. The function of Analog pins is to read the analog sensor used in the connection. It can also act as GPIO (General Purpose Input Output) pins.

CHAPTER 4
SOFTWARE DESCRIPTION

4.1. SOFTWARE USED: Arduino IDE

Arduino integrated development environment (IDE) is a cross-platform application written in java, and derives from the IDE for the processing programming language and the wiring projects. it is designed to introduce programming to artists and other newcomers unfamiliar with software development. it includes a code editor with features such as syntax highlighting, brace matching, and automatic indentation, and is also capable of compiling and uploading programs to the board with a single click. a program or code written for arduino is called a "sketch".Arduino programs are written in c or c++. The arduino IDE comes with a software library called "wiring" from the original wiring project, which makes many common input/output operations much easier. Most arduino boards contain a led and a load resistor connected between the pin 13 and ground, which is a convenient feature for many simple tests. the previous code would not be seen by a standard c++ compiler as a valid program, so when the user clicks the "upload to i/o board" button in the IDE, a copy of the code is written to a temporary file with an extra include header at the top and a very simple main() function at the bottom, to make it a valid c++ program. Arduino is open-source hardware: the Arduino hardware reference designs are distributed under a Creative Commons Attribution Share-Alike 2.5 license and are available on the arduino Web site. Layout and production files for some versions of the arduino hardware are also available. The source code for the IDE is available and released under the GNU General Public License, version 2. Although the hardware and software designs are freely available under copy left licenses, the developers have requested that the name "arduino" be exclusive to the official product and not be used for derivative works without permission. The official policy document on the use of the arduino name emphasizes that the project is open to incorporating work by others into the official product. Several Arduino-compatible products commercially released have avoided the "Arduino" name by using "-duino" name variants.

Embedded C

One of the few constants across all these systems is the use of the C programming language. .More than any other, C has become the language of embedded programmers. The C language has become so popular, because successful development is so frequently about selecting the best language for a given project; it is the one language that has proven itself appropriate for both 8-bit and 64-bit processors. In addition, C has the benefit of processor independence ,which allows programmers to concentrate on algorithms and applications, rather than on the details of a particular architecture. C gives embedded programmers an extraordinary degree of direct hardware control without sacrificing the benefits of high-level languages. Embedded C is a set of language extensions for the c programming language by the C standards committee. It introduces a number of features not available in normal C and basic I/O hardware addressing. It is having the declaration of microcontroller registers and special function as header files, we can include these files to make easy implementation. Embedded C has same flow and programming methodology as C. It has unlimited number of source files, mixed C and assembler programming. It's Compatibility integrates into the MPLAB IDE, MPLAB ICD and most third party development tools and runs on multiple platforms: Windows, Linux, UNIX, Mac OS X, Solaris EX:- Kiel C.

4.3. Real Time Operating System

• The RTOS (Real Time Operating System) requires only the basic functionalities of the OS which are needed for the specific application.

• The RTOS differ from other desktop OS by taking the control of application first.

• The main characteristic RTOS is its defined response time to the external stimuli.

4.4. Software Development

Application development on desktop computers is called native development as development and execution are done on the same hardware platform. Embedded software cannot be developed directly on the embedded system. Embedded software development is done in two stages. Initially, the software is developed on a desktop computer or a workstation. This is called the host system. Subsequently, the software is transferred to the actual embedded hardware called the target system. The host and the target system can be connected through a serial interface such as RS232 or through

Ethernet. The processors of the host and the target system are generally different. Hence, this development is known as cross-platform development. The embedded software can be transferred to the target system by programming an EEPROM or Flash memory using a programmer, or downloading through a communication interface or JTAG port. There are several different ways of writing code for embedded systems depending on the complexity of the system and the amount of time and the money that can be spent. Many ready built designs provide libraries and additional software support which dramatically cut the development time. Fig 8 shows the software cross-platform development.

4.4.1. Programming the PIC

Step 1: Click the Start Menu and select the MPLAB IDE from the program Menu and a   window will be opened.

Step 2: Click Project-> new project (a window will be opened)

Step 3: Enter the PROJECT NAME, PROJECT DIRECTORY where the program to be stored   in the corresponding fields and clicks ok.

Step 4: Click Configure ->Select device (a window will be opened)

Step 5: Select the device name as PIC16f877 and click ok

Step 6: Click project-> set language tool locations Figure: 8 Software Develop *Step 7*: Expend CCS C compiler for PIC12/114/16/18 in line displayed window. Further expand the executable and select the CCS C compiler (CCSC.exe) and click ok.

Step 8: Click Project->set language suits

Step 9: Select CCS C compiler for PIC12/14/16/18 in the active tool suite and click ok

Step 10: Click file-> new file. Now type the corresponding program and save it as in the corresponding location where the project name is denoted.

Step 11: Click project-> add file to the project (Select the saved file and click open)

Step 12: Click project-> build option-> project (a window will be opened)

Step 13: Select CCS C compiler in the window, click none in the debug option, tick the use alternate settings and enter +p in the space provided and click ok.

Step 14: Click Project-> build all the CCS compiler will denote the result if any errors indicated, go to step 10 else continue.

Step 15: Click Start menu and select the PIC ISP from the program menu and a window will   be opened.

4.5. Code

```
#include <SoftwareSerial.h> // Define pin connections
const int gasSensorPin = A0;     // Analog pin for gas sensor
const int buzzerPin = 9;        // Digital pin for buzzer const
int ledPin = 13;          // Digital pin for LED


// GSM module connections const int rxPin = 2;        // RX pin of GSM module
(connect to Arduino TX pin) const int txPin = 3;         // TX pin of GSM module
(connect to Arduino RX pin)
SoftwareSerial gsmSerial(rxPin, txPin);
// Threshold value for gas concentration (adjust as needed)
    const int gasThreshold = 200;
    void setup() {
    Serial.begin(9600);
    gsmSerial.begin(9600);
    pinMode(buzzerPin,
    OUTPUT);
    pinMode(ledPin,
    OUTPUT);
    }  void
    loop()
    {
 // Read analog value from gas sensor    int
gasValue = analogRead(gasSensorPin);
 // Print the analog value for reference
 Serial.print("Gas Value: ");
 Serial.println(gasValue);
// Check if gas concentration exceeds the threshold   if (gasValue > gasThreshold) {
    // Activate the alarm and send SMS
    activateAlarm();
```

```
    sendSMS("Hazardous gas detected!");
  } else {

    //        Deactivate       the       alarm
deactivateAlarm();

  }
  // Delay for stability (adjust as
needed)   delay(1000); }
void activateAlarm() {
  Serial.println("Hazardous Gas Detected!");
digitalWrite(buzzerPin, HIGH);  // Turn on the buzzer
digitalWrite(ledPin, HIGH);     // Turn on the LED
}
void deactivateAlarm() {
  Serial.println("Gas concentration within safe levels.");
digitalWrite(buzzerPin, LOW);   // Turn off the buzzer
digitalWrite(ledPin, LOW);       // Turn off the LED
}
void sendSMS(String message) {
  // Replace with your SIM card's phone number
   String phoneNumber = "+1234567890";  // AT commands to
configure and send SMS   gsmSerial.println("AT+CMGF=1");
// Set SMS mode to text   delay(1000);
gsmSerial.print("AT+CMGS=\"");
gsmSerial.print(phoneNumber);   gsmSerial.println("\"");
delay(1000);  gsmSerial.println(message);   delay(1000);
gsmSerial.write(26); delay(1000);
```
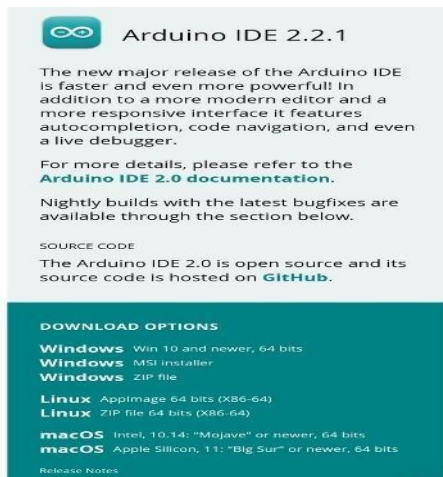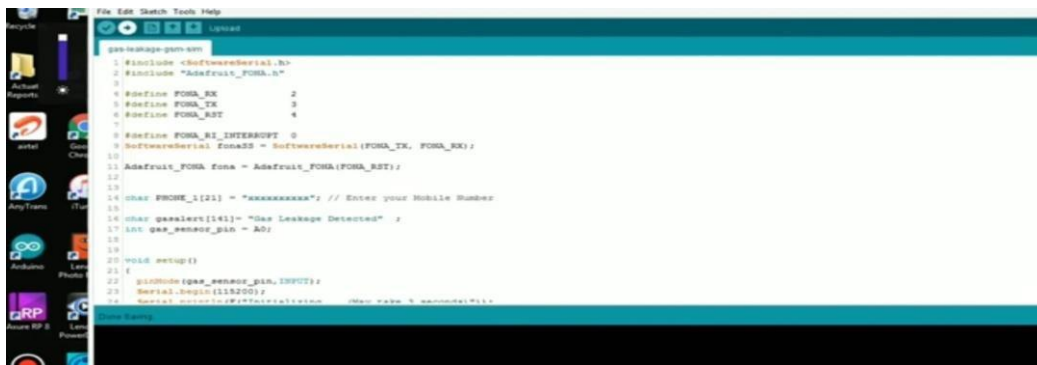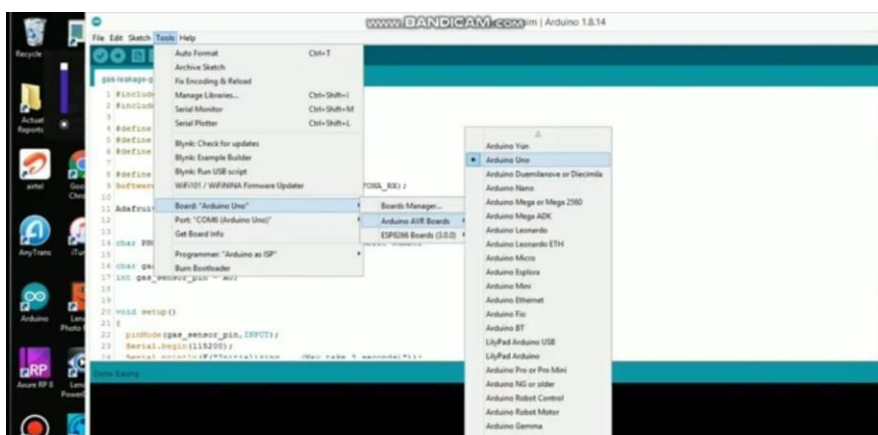
4.6. Implementation

Figure 4.1: Arduino Ide

Figure 4.2: Installing code on Laptop

CHAPTER 5

METHODOLOGY

5.1. IMPLEMENTATION

The hazardous gases like LPG and combustible gas were sensed by the MQ-2 and MQ6 sensors respectively and are monitored by the PIC microcontroller and displayed in the LCD. In critical situation, that is when the LPG exceeds from normal level above 1000ppm and in the same way when the Propane exceeds the normal level of 10000ppm then an alarm is generated and a SMS is sent to the authorized user as an alerting system, which helps in faster diffusion of the critical situation. The prototype of the proposed is shown in the Fig 10.

5.2 procedure

i. Connect the GSM to the Arduino module.

ii. Insert the sim in sim card holder.

iii. Then connect the gas sensor in the GSM.

iv. Now connect the 12v adapter for the power supply.

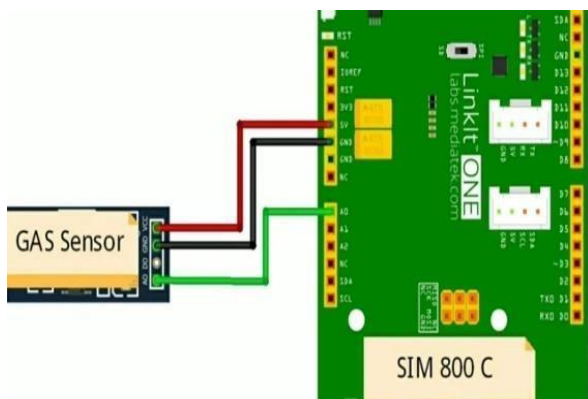v. Now connect the Arduino board to the laptop and upload the code

Figure 5.1: Circuit diagram   Figure 5.2: Showing All Components

CHAPTER 6
RESULT ANALYSIS

In this project we successfully completed the design of the toxic gas detection .The gas sensor was sensed the gas .when detecting the gas by the sensor and its value was exceeded from the threshold value the alarm was indicated and it alerted successfully. When the threshold value is reached the warning message was sent successfully to the base station. The value of the sensor was displayed successfully in the LCD display. The arduino board was interfaced with the sensors and LCD display successfully. In the arduino the microcontrollers was successfully programmed for alarm indication, getting input from sensors and print the values. Hence the system was successfully designed and implemented and results were checked.

Figure 6 1: Overall Setup
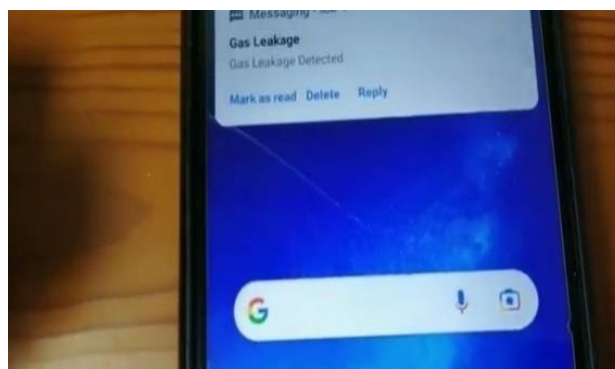

Figure 6.2: Showing Call

Figure 6.3: Showing SMS

CHAPTER 7

CONCLUSION AND FUTURE SCOPE

7.1 Why Gas Sensors and Detection?

As per research, the human body has 400 different scent receptors to sense 1 trillion diverse Odors. Still, the human body does not perceive toxic gases hence Gas detection companies in India brought numerous sensors to measure different gases accurately in the atmosphere. Multi-Gas detector Manufactures and suppliers in India Use it to develop an IoT-powered system that identifies the variety of toxic gases around the facility. The pre-detection of toxic gases helps companies by keeping them safe against any unexpected threats like explosions.

7.2. Applications of Gas sensors and Detection:

There are numerous applications of the Gas detector system: -

1.Harmful Gas Detection: Portable gas detector Manufacturers in India provide a Gas sensor that senses toxic gases like H2S, Methane, and CO. The detection avoids leakage and consequences like poisoning or explosions.

2.Fire Hazard Prevention: A Gas detector supplier in India provides an imperative solution to the industry, which keeps plant workers and equipment safe from fire hazards. These systems find hazardous gases like propane and methane, which prevent the company from the ignition.

3.Oxygen Level Measurement: Oxygen level measurement mostly takes place in mines. Mining exploration decreases oxygen levels, resulting in dizziness, brain damage, or even death.

4.A gas detector system maintains the oxygen level and increases the worker's productivity. The real-time alert provides enough time to take necessary measures and remove the worker from the facility.

7.3. Benefits Of Gas Monitoring Solution: -

1.Provide real-time alerts about the gas in the atmosphere.

2.Restrict fire hazards and explosions.

3.Supervisor of Gas concentration levels.

4. Ensure the health of workers.
5.Provide a real-time update on leakage.

6.Cost-efficient installation.

7.Measure oxygen level accurately.

8.Prompt notification about the Gas alert

Numerous Gas detector system have low energy consumption and low power transmission. It works for a longer duration and provides accurate data information. The Gas sensor measures temperature and humidity in the atmosphere improves plant facility and ensures employee health.

7.3 Conclusion

An embedded system for hazardous gas detection has been implemented; here only two gases (LPG and Propane) have been detected for demo purpose. The gas sensors and the critical level of the respective gas should be known, and then this system can be implemented for detecting various gases either in domestic area such as places of educational institutions, residential and industrial areas which avoids endangering of human lives. This system provides quick response rate and the diffusion of the critical situation can be made faster than the manual methods.

7.4 Future Scope

Interjecting the unfortunate and adverse impacts of gas leakage, authors have proposed this method for real time gas leakage detection system that categorizes the content of the feedback as gas leakage and helps to sense the gas leakage from gas pipe on time. Many of the hotels and restaurants do not keep any security measures to detect gas leakage due to lack of enforcement of standards and pre-assumption that installing such precautionary systems will be more costly but it can be easily available and extensively be used to detect fire breakouts in buildings, hotels, hospitals and industries or other public places. In this paper, the proposed gas detection system based on Arduino UNO, is used to detect the site from where the gas is leaking and accordingly disseminate messages to the coupled customers or its analogous users. Hence certainly, can be utilized to aqueduct the safety, nursing and proper maintenance of the end users. In future it will be used in every Building, hospitals, and hotels for precaution.

REFERENCES: -

[1]. R. Al-Ali, *Member*, *IEEE*, Imran Zualkernan, and FadiAloul, *Senior Member, IEEE,* "A Mobile GPRS-sensors array for Air Pollution Monitoring" *vol.6, pp.410-422, Oct.2010.*

[2]. NihalKularatnar, *Senior Member, IEEE,* and B. H. Sudantha, *Member, IEEE* "An Environment Air Pollution Monitoring System Based on the IEEE1451 Standard for Low Cost Requirements" *IEEE Sensors J., Vol. 8, pp.415-422, Apr. 2008.*

[3]. M. Abu Jayyab, S. Al Ahdab, M. Taji, Z. Al Hamdani, F. Aloul, "Pollumap: Air Pollution mapper for cities", *in Proc. IEEE Innovations in Information Technology Conf., Dubai, UAE, Nov.2006, pp.1-5.*

[4]. Y. J. Jung, Y. K. Lee, D. G. Lee, K. H. Ryu, and S. Nittel, "Air pollution monitoring system based on geosensor network", *in Proc. IEEE Int. Geoscience Remote Sensing Symp., 2008, vol. 3, pp.1370-1373.*

[5]. M. Gao, F. Zhang, and J. Tian, "Environmental monitoring system with wireless mesh network based on Embedded System", *in proc. 5th IEEE Int. Symp. Embedded Computing, 2008, pp. 174-179.*

[6]. J. W. Kwon, Y. M. Park, S. J. Koo, and H. Kim, "Design of Air Pollution Monitoring system Using ZigBee Networks for ubiquitous-city ", *in proceedings of In. Conf. Convergence Information Technology, 2007, pp.1024-1031.*

[7]. Geng Juntato, Zhou Xiaotao, Zhang Bingjie, "An Atmosphere Environment Monitor System Based on Wireless Sensor Network", Journal of Xihua University, Natural Science, Vol. 26, no.4, pp. 44-46 ,2007.

[8] F. Tsow, E. Forzani, A. Rai, R. Wang, R. Tsui, S. Mastroianni, C. Knobbe, A. J. Gandolf, and N. j.Tao, "A wearable and wireless sensor system for real-time monitoring of toxic environmental volatile organic compounds", *IEEE sensors, J., vol. 9, pp. 1734-1740, Dec.2009.*

[9] W. Chung and C. H. Yang, "Remote Monitoring System with Wireless Sensor Module for Room Environment", *Sens. Actuators B, vol. 113, no.1, pp. 35-42, 2009.*

[10] Raj Kamal, "Embedded System Architecture Programming and Design" TATA Mc-Graw Hill.

[11] N. Kularantna and B. H. Sudantha, "An environmental air pollution monitoring system based on the IEEE 1451 standard for low cost re-quirements,"*IEEE, sensors J., Vol, 8, pp. 415422,* Apr, 2008.

[12] Y. J. Jung, Y. K. Lee, D. G. Lee, k. H. Ryu, and S. Nittel, "Air Pollution monitoring system based ongeo sensor network " in *proc. IEEE Int. Geoscience Remote Sensing Symp., 2008,* vol, 3, 1370-1373.