Ahmedabad University

ENR305: SENSORS,INSTRUMENTS AND EXPERIMENTATION

PROJECT TITLE: Gas Leakage Detector

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Abstract

The goal of the project we created is to provide a dependable solution to the problem of LPG gas leakage from gas cylinders by implementing a network-connected sensor that notifies the user of a gas leakage wherever he or she is and brings the leakage to his or her attention quickly.

Keywords : Microprocessors; GSM; Arduino; Sensors; MQ5

I. Introduction

In recent decades, India has experienced a massive increase in urbanization. Switching from kerosene to LPG cylinders is one of urbanization's trends. One of the cylinder's disadvantages is that the LPG can leak due to improper valve design or inferior connecting tubes. The highly combustible nature of this gas has resulted in the deaths of many people in this country, as well as serious disfigurement. The only way to detect the gas is by smelling the added chemical ethyl mercaptan, which requires the person to be there and alert.

The world around us is rapidly approaching a technological singularity, or a point in time when humans and machines merge into one. This project comprises an internet of things system that uses sensors to monitor its environment for surges in liquefied petroleum gas levels and notifies the user. It's a low-cost, high-effective solution that the user may set up and forget about until the need to address the leak occurs.

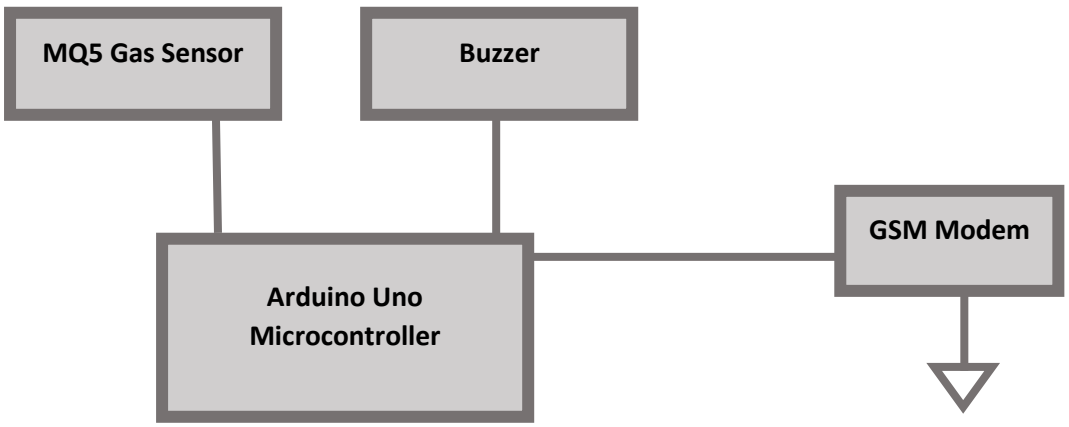
The objective of this project is to provide a real-time solution to detect gas leakage in household environments and restaurant environments so that countermeasures can be deployed quickly and prevent loss of property and life. The project uses a combination of microcontrollers, sensors and telecommunication networks to achieve this.

II. Overview

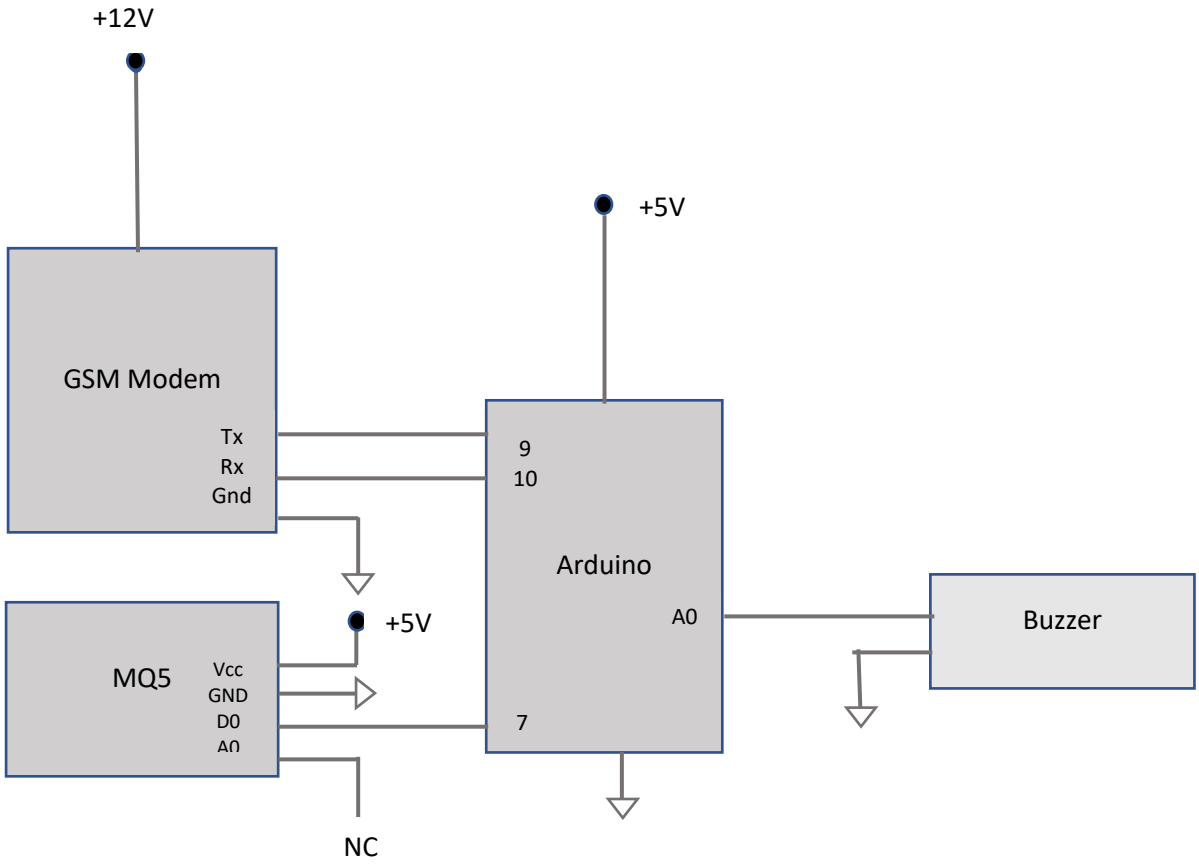
The system we've put in place is as follows: a microcontroller to oversee the entire system's operation To do the sensing, use a commonly available gas detection sensor. A modem that sends leak status alerts to the user.

An MQ5 gas sensor is attached to an Arduino Uno microcontroller. A tin dioxide filament is used in the gas sensor, and its resistance lowers as the concentration of LPG rises. We have a SIM900A GSM Modem linked to the Arduino's serial connection ports. It's a UART modem, or Universal Asynchronous Receiver/Transmitter. A laptop was used to programme the microcontroller, and the executable was written onto the microcontroller's ROM. The system is meant to operate in a stand-alone mode and can self-reset.

a) System Model:



b) Circuit Diagram:



c) System Design

In this section, we will see how the system has been designed. The price of the components, the requirements, the performance and its usability.

a. Functional Requirement

i. Assumptions & Dependencies:

We assume that the user has knowledge of operating a phone and nothing else. The project is dependent on the availability of a SIM card and a good mobile signal strength to send messages in a timely manner.

ii. Domain Requirements:

Microcontrollers, sensors, cellular technology, and automation are all topics covered in this project. The workings of this project, on the other hand, may be explained to anyone with a basic understanding of the topic.

iii. User Requirements :

The user must be able to utilise a phone. He or she will need a spare SIM card to deliver messages from, as well as adequate cellular signal coverage at the deployment location. It's also preferable to have a reliable power supply.

b. Non-Functional Requirement :

i. Efficiency:

In terms of both time and space, the product is effective. It uses a microcontroller to run rapid machine-level code and is capable of detecting and informing the user about leakage in real-time. It's also lightweight and simple to set up.

ii. Reliability:

After a leakage event, the product is able to reset itself and continue monitoring the surroundings. It's built in such a way that it won't need to be maintained once it's up and running.

iii. Portability:

The system is compact and can be set up very easily. It has good portability.

iv. Usability:

The system has been designed keeping the layman in mind. It does not need any domain knowledge to operate and can be easily used by most adults.

c. Figures and Tables:

i. Hardware Requirements

The components required and their costs are listed below

Name	Component SerialNumber
Arduino	Arduino Uno
Gas Sensor	MQ5
GSM Module	SIM900A
Buzzer	-

ii. Software Requirements

There is no special software required to run the project except the availability of a phone that can receive messages. To code the program for running the microcontroller logic we require any computer withWindows/ GNU-Linux/ MacOS, Arduino IDE

III. Arduino Code:

```
#include <SoftwareSerial.h>
SoftwareSerial mySerial(9, 10);
int buzzer = 13;
int GASA0 = A0;
int gasvalue;
void setup() {
 mySerial.begin(9600);
 Serial.begin(9600);
 pinMode(buzzer, OUTPUT);
 delay(5000);
}
void loop() {
  int analogSensor = analogRead(GASA0);
  int gasvalue=(analogSensor-50)/10;
  if (gasvalue >= 50)
  {
    SendTextMessageSafeZone();
    tone(buzzer, 1000, 200);
  }
  else if (gasvalue >= 200)
  {
    SendTextMessageDangerZone();
    tone(buzzer, 1000, 500);
  }
  else
  {
    noTone(buzzer);
```

```
  }
  delay(500);
}
void SendTextMessageSafeZone()
{
  mySerial.println("AT+CMGF=1");    //To send SMS in Text Mode
  delay(1000);
  mySerial.println("AT+CMGS=\"+918160006933\"\r");  // change to the phone number you using
  delay(1000);
  mySerial.println("Gas Leaking has started!!!! Address:Unit-2 SP Hostel,Gulbai Tekra, Navrangpura , 380006.");       //the content of the message
  delay(200);
  mySerial.println((char)26);//the stopping character
  delay(1000);
}
void SendTextMessageDangerZone()
{
  mySerial.println("AT+CMGF=1");    //To send SMS in Text Mode
  delay(1000);
  mySerial.println("AT+CMGS=\"+91XXXXXXXX\"\r");  // change to the phone number you using
  delay(1000);
  mySerial.println("DANGER DANGER DANGER !!! Gas Leaking!!!! Address:Unit-2 SP Hostel,Gulbai Tekra, Navrangpura , 380006.");//the content of the message
  delay(200);
  mySerial.println((char)26);//the stopping character
  delay(1000);
}
```

IV. Working Video Link:

https://drive.google.com/drive/folders/1hUVQ2O5eDWPitIkdKnFxFZU8-wtb9LOi?usp=sharing

V. Summery Of Result:

From the above test cases, we deduce the working of the hardware prototype of the system we have presented. When there is a spike in the LPG levels in the environment the gas sensor sends a digital output to the Arduino board. The Arduino board interprets this signal and accordingly changes and asks the GSM modem to send an SMS to a pre-registered mobile number. After this, the system resets itself having done its job, and waits for user intervention to get rid of the gas leak.

VI. Conclusion:

The system has demonstrated that it has the properties that is required of it, namely- cost-effectiveness, reliability, feature completeness and modularity. However, no system is without its limitations. Ours is no exception. For one, the current system lacks customization. The SMS can be sent only to a single pre-determined number. Also, if the system gets damaged, it cannot be repaired by the user but someone with domain knowledge. We seek to rectify these two major pitfalls in the future.

VII. References:

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