

Toxic gas detection-An experiment with the simulation process

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Abstract – Precaution from danger plays a major role in today's world and it is necessary that good secure systems are to be implemented in places of education and work. The main objective of the work is designing Arduino based toxic gas detecting and alerting system is to find the emission of toxic gases. The hazardous gases emitted by plastic should be sensed and displayed what type of gases is emitted by plastic 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.

Key Words: Arduino, alert, authorized, sensed, detection, hazardous, toxic

1. INTRODUCTION

Day to Day life the way of our life and the development of technology is increased, But it leads to the least consideration of the surroundings which we live in. Thus we polluted the environment and thereby reducing the quality of the place we live [1].The plastic emitted gases like propane or butane, carbon monoxide, Hydrogen etc., are detected in this process and the results are shown through the simulation process. Also there is a need to intimate the emission of hazardous gases as soon as possible to save the environment and human health issues.

2. SENSORS USED IN THE PROCESS

2.1 MQ-2 Sensor

Sensitive material of MQ-2 gas sensor is SnO₂, with lower conductivity in clean air. When the target combustible gases exist, the sensor's conductivity is higher along the gas concentration increasing. MQ-2 gas sensor is shown in fig 1, which has sensitivity to propane, butane and also to natural gas. The sensor could be used to detect different combustible gas, especially Methane and it is a low cost sensor and suitable for different applications.



Fig-1: MQ2 Sensor

2.2 MQ-3 Sensor

Characteristics of the sensor include

- * High sensitivity to alcohol and low sensitivity to Benzine
- * Immediate response and High sensitivity
- * Stable and long life
- * Compact drive circuit

They are suitable for alcohol checker, Breath analyser [2].

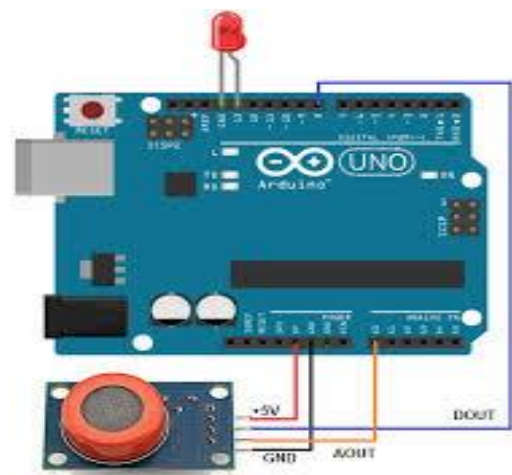


Fig-2: Alcohol Sensor with Arduino connection

2.3 MQ-8 Sensors

This is a simple-to-use hydrogen gas sensor, suitable for sensing concentrations of hydrogen in the air. The MQ-8 can detect hydrogen gas concentrations anywhere from 100-10000 ppm.

This sensor has a high sensitivity and quick response. The sensor's output is an analog resistance. The drive circuit is compact; all you need to do is power the heater coil with 5V, add a load resistance, and connect the output to an ADC (Analog to Digital Converter)[4].



Fig-3:Hydrogen Gas sensor

2.4 MQ-9 Sensor

Gas sensors are used for detecting the emission of toxic gases that are associated with the fire. Its advantage is that it has;

- Good sensitivity to CO/Combustible gas
- High sensitivity to Methane, Propane and CO
- Long life and low cost
- Simple drive circuit

The enveloped MQ-9 has 6 pins, 4 of which are used to fetch signals, and other 2 for providing heating current. The sensor works with voltages between 5V and 12V AC or DC. A 5V supply voltage was used for this design. Once powered, the output of the sensor is normally HIGH but goes LOW when gas is sensed [3].



Fig-4: carbon monoxide sensor

3. HARDWARE COMPONENTS

3.1 Arduino board

Arduino boards are equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (*shields*) and other circuits.

3.2 GSM

GSM stands for Global System for Mobile communication. GSM is an open, digital cellular technology used for transmitting mobile voice and data services with the transmission of SMS. GPRS is a wireless data service developed from the existing GSM system and can be associated with the INTERNET. GSM used in this process to send message to the concerned authoritative mobile as an alert about the toxic gases emission.

3.3 PC

Personal Computer is used to display at the place of base station which is for the administrator to notice the emission of gases.

4. PROGRAM CODING

```
#include <SoftwareSerial.h>
SoftwareSerial mySerial(11, 12);
int sen1 = A0;
int sen2 = A1;
int sen3 = A2;
int sen4 = A3;
int lb = 5;
int las = 13;
int a;
int b;
int c;
int d;
int l;
int fan = 7;
int i = 1;
int j = 1;
int k = 1;
int m = 1;

void setup()
{
  pinMode(sen1, INPUT);
  pinMode(sen2, INPUT);
  pinMode(sen3, INPUT);
  pinMode(sen4, INPUT);
  pinMode(lb, INPUT);
  pinMode(fan, OUTPUT);
  pinMode(las, OUTPUT);
  mySerial.begin(9600);
```

```
Serial.begin(9600);
Serial.println("    TOXIC GAS DETECTOR AND PLASTIC
SEPRATOR ");
}

void loop() {
  a = digitalRead(sen1);
  b = digitalRead(sen2);
  c = digitalRead(sen3);
  d = digitalRead(sen4);
  l = digitalRead(lb);
  //delay(500);
  if (l == 1)
  {
    digitalWrite(las, 1);
  }
  if (l == 0)
  {
    digitalWrite(las, 0);
  }
  if (a == 1)
  {
    if (i == 1)
    {
      digitalWrite(fan, 1);
      Serial.println("PROPANE / METHANE DETECTED");
      // mySerial.println("AT+CMGF=1"); //Sets the GSM
Module in Text Mode
      // delay(1000); // Delay of 1000 milli seconds or 1
second
      mySerial.println("SEND MSG=\"+918610086368\"\\r");
// Replace x with mobile number
      // delay(1000);
      mySerial.println("PROPANE / METHANE DETECTED");//
The SMS text you want to send
      delay(1000);
    }
    i = 2;
  }
  else
  {
    digitalWrite(fan, LOW);
    i = 1;
  }
  if (b == 1)
  {
    if (j == 1)
    {
      digitalWrite(fan, 1);
      Serial.println("ALCOHOL DETECTED");
      // mySerial.println("AT+CMGF=1"); //Sets the GSM
Module in Text Mode
      // delay(1000); // Delay of 1000 milli seconds or 1
second
      mySerial.println("SEND MSG=\"+918700693232\"\\r");
// Replace x with mobile number
      // delay(1000);
      mySerial.println("ALCOHOL DETECTED");// The SMS
text you want to send
      delay(1000);
    }
    j = 2;
  }
  else
  {
    digitalWrite(fan, LOW);
    j = 1;
  }
  if (c == 1)
  {
    if (k == 1)
    {
      digitalWrite(fan, 1);
      Serial.println("HYDROGEN DETECTED");
      // mySerial.println("AT+CMGF=1"); //Sets the GSM
Module in Text Mode
      // delay(1000); // Delay of 1000 milli seconds or 1
second
      mySerial.println("SEND MSG=\"+918700693232\"\\r");
// Replace x with mobile number
      // delay(1000);
      mySerial.println("HYDROGEN DETECTED");// The SMS
text you want to send
      delay(1000);
    }
    k = 2;
  }
  else
  {
    digitalWrite(fan, LOW);
    k = 1;
  }
  if (d == 1)
  {
    if (m == 1)
    {
      digitalWrite(fan, 1);
      Serial.println("CARBON-MONOXIDE DETECTED");
      // mySerial.println("AT+CMGF=1"); //Sets the GSM
Module in Text Mode
      // delay(1000); // Delay of 1000 milli seconds or 1
second
      mySerial.println("SEND MSG=\"+918610086368\"\\r");
// Replace x with mobile number
      // delay(1000);
      mySerial.println("CARBON-MONOXIDE DETECTED");//
The SMS text you want to send
      delay(1000);
    }
    m = 2;
  }
  else
  {
    digitalWrite(fan, LOW);
```



```
m = 1;
}
}
```

5. DESIGN ANALYSIS

The architecture of the simulation process is shown in the following figure. It includes the sensors, Arduino board, GSM and pc connection.

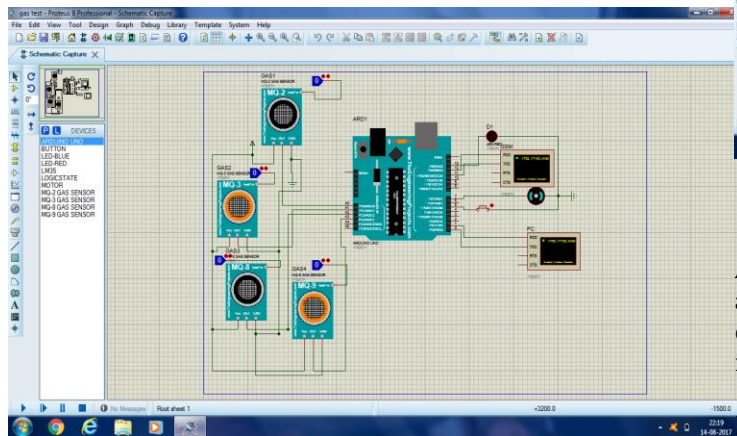


Fig-5: Initial Process of simulation

4.1 Input/output Process Explanation

The sensors are act as a input in this process. It senses the emission of toxic gas by the plastics and sends an alert message to the concern person.

LED bulb and Fan acts an output. Fan used here to separate the different types of plastics.

LED light is turn on to red colour as an indication of alerting the concern authority person.

4.2 Software

Proteus design suite 8.5 and Arduino 1.6.12 are the two software used in this process.

4.3 Power supply

Power supply used here is +5 volt.

4.4 Process Explanation

The process performed by using the simulation software by installing it. The initial stage of the process is shown in the above diagram (Fig-5)

Once the process is run the simulation it activates the two windows virtual terminal (PC and GSM).

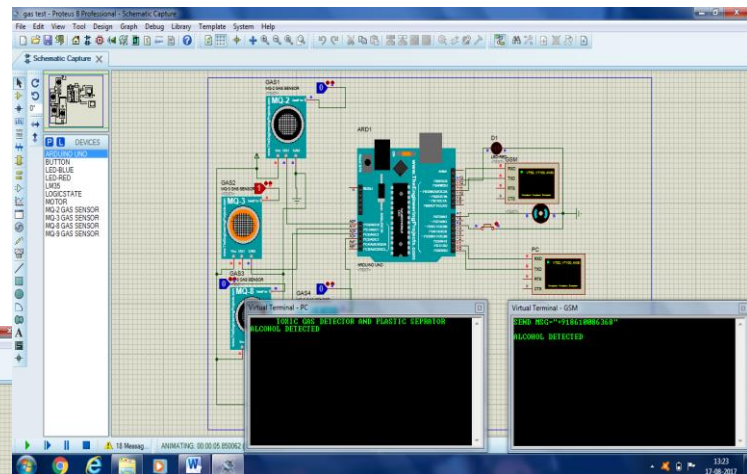


Fig-6: Showing the activation of MQ-3 Sensor

As early said, the sensor connected with the Arduino is analog it is displayed initially as 0 and once if it is found the emission of hazardous gases it turns into 1 (which is turn into red in the above figure).

Now, in the PC it just displayed the type of gas detected .In the above diagram it is displayed as “ALCOHOL DETECTED”. Another window which is for GSM displays the concern authority person number to send an alert message and display the type of gas detected.

In this only four type of sensors are used. If we want more then we have to use more sensors in the input. For each activation of the gases it displays the messages in the window.

In the following figure(Fig-7) all the four sensors are activated one by one and the window is show the type of gas it detected and in another window it display the concern authority number to send an alert message with the type of gas.

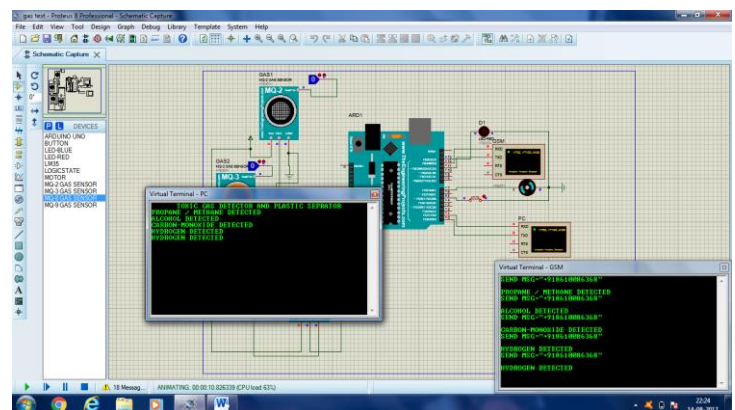


Fig-7: PC and GSM window display

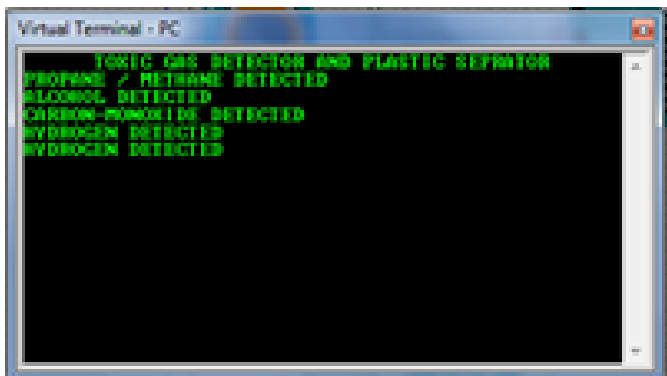


Fig-8: PC window

6 . CONCLUSIONS

The problem of toxic or hazardous gas emission is solved by implementing this process. By this program one can easily identify what type of gas is produced. If we want to set the threshold level of the gas, it is also possible by predefined it in the program. Once it crossed the threshold level it will send an alert message to the concern authority person who is an in-charge for that process. Here by receiving the alert message through the GSM mode one can take an immediate action to solve the problem.

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