



# DESIGN AND IMPLEMENTATION OF EMBEDDED BASED SAFTEY AND SECURITY SYSTEM FOR INDOOR ENVIRONMENT

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## ABSTRACT

The destruction can happen at any point of time, it may be due to negligence of people or due to any failure. The chance of saving peoples life increases when it comes to this application as applicable to many places easily. For example, LPG has additives like propane with butane, present has a high reason regarding people belonging to family and business sector, about there well being. This is a common destruction that causes due to negligence of people in their kitchen or in industry. Due to chance of leaking that may be the reason to trigger blastings in many places or fire hazards. Over the years the leakage of gases has led to heavy loss, it may be applicable to medium to large scale industries, or the gas associated with any of the regions. The combo of gas leakage and fire detection devices is mostly applicable in early detection of gas leakage and fire in near by premises to reduce the chance of occurrence at any point of time. To prevent several hazardous accidents, the system has been built in such a way that it is reliable in detecting fire and gas. Moreover, the system has ability to alert about the information through message to the respective authority using the communication module such as Global System for Mobile Communication (GSM).

**Keywords:** LPG, SIM900A GSM module, LM393, MQ5 sensor.

## 1. INTRODUCTION

Hydrocarbon gases are associated in the mixture of LPG, these gases act as fuel in many applications such as restaurants and industries and due its desirable properties it may releases highly inflammable gases and can cause fire accidents as it includes high calorific value. These highly inflammable gases can be burnt easily from the source of leakage [1-2]. Therefore, people should be alerted in case of any gas leakages. The Embedded design is developed by connecting GSM Module and Arduino, with all the other components like sensors, Lcd display, MCB together. This resultant device is an efficient model which is of affordable cost and consumes less power. It can be installed easily in any of the locations as its size is very compact and easy to handle.

### 1.1 Objective

The aim of the system is to provide solution by automatically alerting the people in case of any leakages. To be discussed clearly the ArduinoUno module is configured to interface with input and output modules such as sensors and GSM. This design operates automatically to track the leakage of gases and fire using MQ5 and LM393 sensors [3-4]. For further instance GSM module is used to alert people by sending message to the respective authorities.

## 2. SYSTEM DESIGN AND ITS FUNCTIONALITY

The operation of the system is classified into two main parts. They are, input and output devices such as MQ5, LM393, GSM, LCD display, Buzzer respectively, which have been interfaced to Arduino module.

**Input Devices:** Gas Leakage Detection using MQ5 and Fire detection using LM393.

The MQ5 sensor used is connected to arduino through an analog pin, as it reads analog values. Its analog

pin is used for data transfer between arduino and MQ5. Here the threshold value is set to 250 (in case of LPG gas detection it is set to 650) for testing purpose. Here MQ5 has a sensitive filament of SnO<sub>2</sub>, when combustible gas is recognized, the conductivity of filament starts increasing and the change in conductance can be used to indicate gas concentration. So, when the detected gas crosses threshold then the alarm starts buzzing.

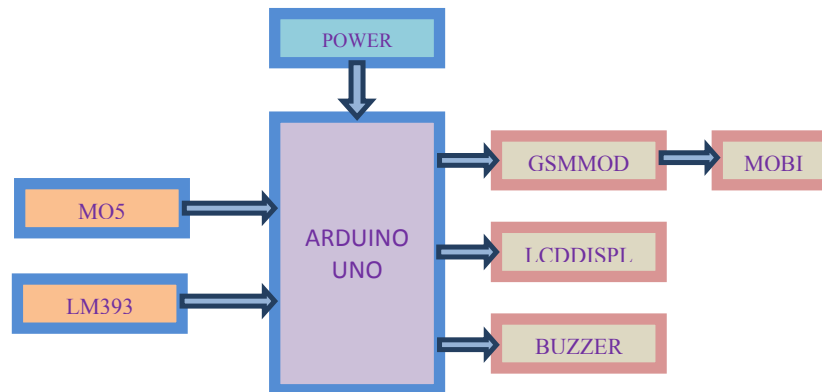
The LM393 flame sensor is primarily sensitive to flame, it can also respond to ordinary light. Can detect flames or light with wavelengths ranging from 760 nm to 1100 nm. Sensitivity of the module is adjustable via potentiometer [7]. Here it is connected to Arduino using digital pin. So, we are going to read digital values from the sensor. Based on those values, Arduino acts accordingly and sends message using GSM Module. It indicates fire when the value received from fire sensor is high.

**Output Devices:** LCD Display, GSM, Buzzer.

If there is any fire detected or gas leakage and if the value exceeds than the threshold limits, then the output across the LCD will change and alerting the GSM to send a message to the respective higher authorities and it triggers the buzzer to alert the people in the nearby premises [5-6]. Otherwise, the buzzer will be in off state. LCD display shows the sending and receiving status of the messages, which are being sent from GSM module along with the status of gas and fire.



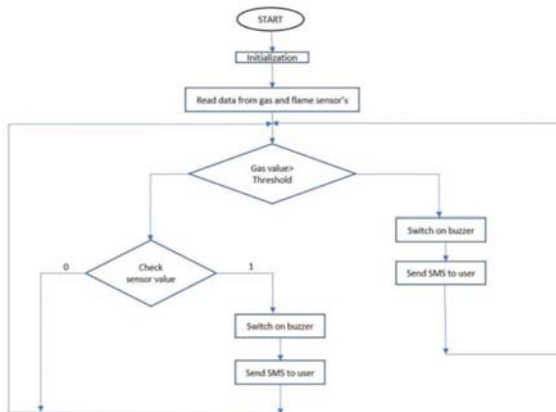
## 2.1 Block Diagram



**Figure-1.** Block diagram of designed system.

The Block diagram shows the overall components like flame sensor, Gas sensor, GSM Module, Buzzer. Here GSM module sends message to the mobile phone if any gas leakage or fire accident occurs, and the buzzer starts ringing to alert near by people to escape the fire or gas leakage accidents.

## 2.2 Flow Chart



**Figure-2.** Flow chart of designed system.

Here first it reads data from gas and flame sensor's and if the detected gas value is more than the threshold value, then microcontroller switches on the buzzer and sends SMS to user. If the detected gas value is not more than threshold value then it again reads sensor values, and the process continues in a loop.

## 3. COMPONENTS USED FOR DESIGNING SYSTEM

The Main and Primary components used in proposed model are

### 3.1 Arduino Uno:

It is 8-bit microcontroller device that's based on the ATmega328. It has a variety of digital input/output pins, and it has a built-in clock oscillator and a USB connection. The board has 14 digital pins, and it has 6 analog inputs. The USB provides a flexibility to connect and to dump the program into the Arduino microcontroller. Power can be given from the AC to DC adapter or from a battery. It has a 32KB flash and used to store number of instructions.



**Figure-3.** Arduino uno.

The programming is stored in the ATmega328, which is the brain of the board. The board has several ground pins-The board has 14 digital pins that can be used to connect external electronic components to Arduino. The board has six analogue pins built in. These pins can read analog values and converting them to digital signals. USB cable is used to connect to system and to upload sketch into the Arduino.



### 3.2 SIM900A



Figure-4. SIM900A.

The SIM900A is a GSM/GPRS module that is readily available. It is a dual-band GSM/GPRS engine that works on the EGSM 900MHz and DCS 1800MHz frequencies. It uses these frequency bands and allows users to make and receive phone calls as well as send and receive messages. The UART or RS232 interface is used to communicate with this module. Through the UART interface, data is delivered to or received from the module. The controller delivers data to the module through UART Interface. The module uses the cellular network to deliver this information to another GSM user. It receives information from Arduino using AT commands, these commands make the GSM to send SMS or call a user from the inserted SIM in the GSM module.

### 3.3 MQ5 Sensor

The MQ5 module can be used to detect gas leaks. It can be used to detect hydrogen, methane, carbon monoxide, as well as LPG. It is an analog output sensor and can be easily connected to the Arduino analog input pin. A sensitive filament composed of SnO<sub>2</sub> is used in the sensor. This filament has a decreased electrical conductivity in the presence of pure air.

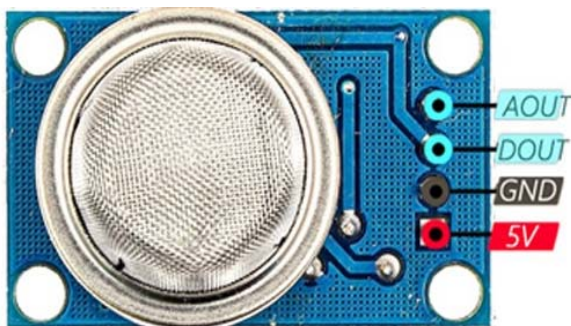


Figure-5. MQ5 sensor.

When a gas, such as LPG, is supplied, the conductivity of the filament increases, and the degree of change in conductance/resistance may be utilized to

determine the corresponding gas concentration. When concentration of gas rises, the sensor's output voltage and the analog value rises as well. The potentiometer can be changed to change the sensitivity.

### 3.4 LM393 Fire Sensor



Figure-6. LM393 sensor.

The LM393 flame sensor is primarily sensitive to flame, it can also respond to ordinary light. The IO port on the microcontroller can be directly connected to it. Operating voltage range is 3.3V-5V with a digital output. Can detect flames or light with wavelengths ranging from 760 nm to 1100 nm. Sensitivity of the module is adjustable via potentiometer

### 3.5 Basic Components Used

PCB (Printed circuit board) has been used to connect all the ground and vcc pins separately. Here ground pins are soldered together and all vcc pins are solder together. The traces on PCB are major reason for connecting all pins together. So, PCB played a major role in giving connections.

Jumper wires and Buzzer are also part of minor components used. Where jumper wires provide flexibility to connect any component to Arduino and Buzzer helps in alerting people in case of fire and gas arrivals.

LCD provides the status of the system, whether it is sending SMS or reading the values and other. It is a 16x 2 LCD, which can display 32 characters.

## 4. SOFTWARE IMPLEMENTATION

ArduinoIDE (Integrated Development Environment) is the software used. It is an open-source IDE, can be used to write and upload code to the board.

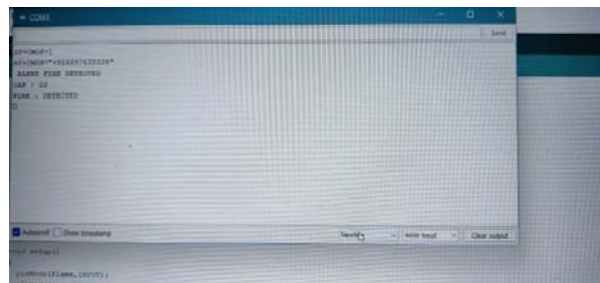


Figure-7. Software implementation result.



C and C++ are the supporting languages. It is applicable to many operating systems such as windows, MAC OS X and Linux. The code written is called sketching. The board is connected using a probe to system to upload the sketch. The sketch is saved with extension '.ino'.

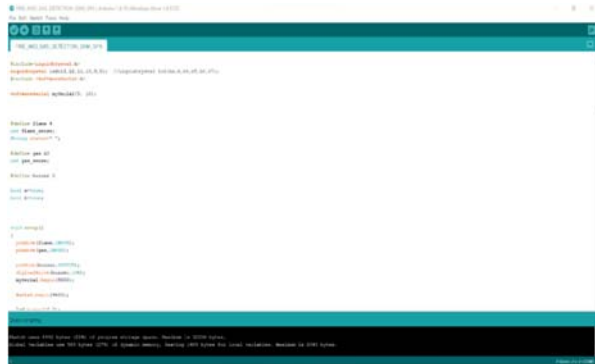


Figure-8. Compilation results.

#### 4.1 Practical Implementation



Figure-9. Practical results.

#### 5. CONCLUSIONS

It is a promising model made for the safety of people from fire accidents due to gas leakage and alerting people in case of fire. This model may be useful in future, which can be improvised using more efficient sensors and can be made available to every household or industry, where there is possibility of explosions. The device developed is easy to handle and can be accessed easily. There is no need of high maintenance as it consumes less power. This approach is an attempt to save people. The Arduino Uno used here is a low-cost board which provides all the necessary applications.

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