

# SMOKE DETECTOR SYSTEM WITH GSM MODULE

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**Abstract-** This paper explains how to build a home fire alarm using an Arduino-based system and a GSM Module. The goal of the mission is to defend the home, with the principal goal of preventing hearth accidents to the occupants and the houses within the residence. It makes use of an Arduino Uno board and a GSM module. The Arduino microcontroller is the main controller, and it is used to operate the house alarm system, which is controlled by smoke sensors. An MQ2 smoke sensor is used to locate smoke because of fire. Through the GSM module, a short message service (SMS) alarm message may be sent to the customer. The machine detects smoke which has the presence of dangerous gases which include CO<sub>2</sub>, Methene and etc. and straight away triggers an alarm that's the house alert machine and also sends message to the proprietor of the residence using the GSM module via this device, it is able to assist customers to enhance their protection standards by means of having instant reaction in stopping injuries. Customers may ultimately be able to defend their lives and their houses against disasters as a result of this.

**Keywords:** Arduino UNO, GSM module, MQ2 smoke sensor, fire alarm.

## 1. INTRODCTION

Alarm systems for fire and gas detection are crucial tools for protecting our homes, buildings, offices, markets, and other locations. A well-designed fire and gas system should be capable of automatically detecting and reducing fire, flammable gas, and poisonous gas hazards in specific conditions. To avoid escalation, adequate detector placement is critical in the design of a fire and gas system to ensure that enough coverage is provided to detect hazards in their early stages. The fire alarm algorithm detects the presence of a fire by calculating the rates of development of these three components [1].

The smoke sensor detects smoke and serves as an early fire warning system. The oldest form of automated fire detection equipment is the heat detector [2]. They react when the sensing element reaches a predefined fixed temperature or when the temperature changes at a specified pace. If a fire breaks out, mechanisms can be installed to put out the flames while also protecting adjacent places from the fire's effects. In most cases, the fire and gas detection systems are integrated into a single fire and gas detection system. One approach to distinguish research areas from utility or office / residential spaces is to use a single fire and gas system for processing areas and a separate fire and gas system for utility or office / residential areas [3, 4].

## 2. SYSTEM COMPONENTS

An Arduino UNO, a MQ2 smoke and gas detector, a GSM Module, and a Buzzer for a home alarm system comprise the system [5].

### 2.1 Arduino UNO

The Arduino Uno includes a microcontroller board that is based entirely on the ATmega328 microprocessor from Atmel. In Italian, "uno" means "one," therefore a contemporary uno board with USB sequence is called "uno" (wide serial Bus). A 16 MHz ceramic resonator, USB connection, power jack, ICSP header, reset button, 6 analogue inputs, and digital input/output pins 14 are all included on the Arduino Uno Board (6 which can be used as a PWM output). The board has 32 KB flash memory, of which 0.5 KB is used by the boot-loader, 2 KB SRAM, 1 KB EEPROM, and a clock speed of 16MHz [6].

The Arduino system has a set of analogue and digital pins that may be linked to a number of other boards and circuits to execute a variety of jobs in a design. The Arduino board features a USB serial connection connector for loading code from a computer. The integrated development environment (IDE) is Arduino's proprietary software that fully supports the C and C++ programming languages [7].

### 2.2 GSM Module

This is a quad-band GSM/GPRS phone that runs on the 850/900/1800/1900MHz frequency and may be used for not only Internet access, but also spoken conversation (when connected to a microphone and a small loud speaker) and SMS. Phone communication, data communication (through an integrated TCP/IP stack), and communication with the mobile phone circuit are all handled by an AMR926EJ-S CPU (via a UART and a TTL serial interface). The CPU is in

charge of a SIM card (3 or 1,8V) that must be connected to the module's exterior wall. The GSM modem (Sim900) device also includes an analogue interface, an A/D converter, an RTC, an SPI bus, an IC, and a PWM module [8].

### 2.3 MQ2 Gas and Smoke sensor

LPG, propane, methane, hydrogen, alcohol, smoke, and carbon monoxide are all detected by the MQ2 gas sensor. MQ2 gas sensor is also known as a chemoreceptor. As the sensor material comes into touch with the gas, its resistance changes. To detect the presence of gas, a change in resistance value is employed. MQ2 is a gas sensor made of metal oxide semiconductors. The sensor detects gas concentrations in the gas using a voltage divider network. This sensor is powered by a 5V DC power supply. It is possible to detect gases with concentrations ranging from 200 to 10,000 parts per million [9,10].

### 2.4 Buzzer

A buzzer is a mechanical, electromechanical, magnetic, electromagnetic, electro-acoustic, or piezoelectric aural signaling device. A piezo-electric buzzer can be powered by an oscillating electrical circuit or another source of audio signal. When a button is pressed, it can make a click, beep, or ring sound. It consists of a number of switches or sensors coupled to a control unit that determines whether a button has been pressed or whether a particular amount of time has passed. As a warning, it usually flashes a light on the appropriate button or control panel and produces a buzzing or beeping sound [11].

### 2.5 Smoke Detection and Alarm System

The design of this project is incredibly sleek and small. The given project has a very simple circuit and is extremely easy to construct. With the aid of connection wires or jumper cables, the sensor is linked to the Arduino's input. The circuit then continues to the output, where the buzzer is attached [12].

We obtain a difference in the buzzer sound if we change the delay value of the buzzer, and then we have the GSM module, which is used to alert the user by text message or phone call when gases are detected. This may be used to detect a variety of gases [13]. Arduino is utilized in this design since it is simple to use in the circuit and uploading programmes is also straightforward. It is for this reason that Arduino is utilized. It is supplied with 5v dc, which has the benefit of using less power and being simple to install [14].

### 2.6 Hardware Design

The Arduino board serves as the core or main controller in this system, and the entire system is built around it [15]. The MQ2 smoke and gas sensor detects smoke, and the Buzzer functions as a home alert system by sounding an alarm. The GSM module is used to communicate with the user about the detected fire. The hardware design is depicted in the block diagram below [16]. Fig. 2.1 shows the block diagram of hardware setup.

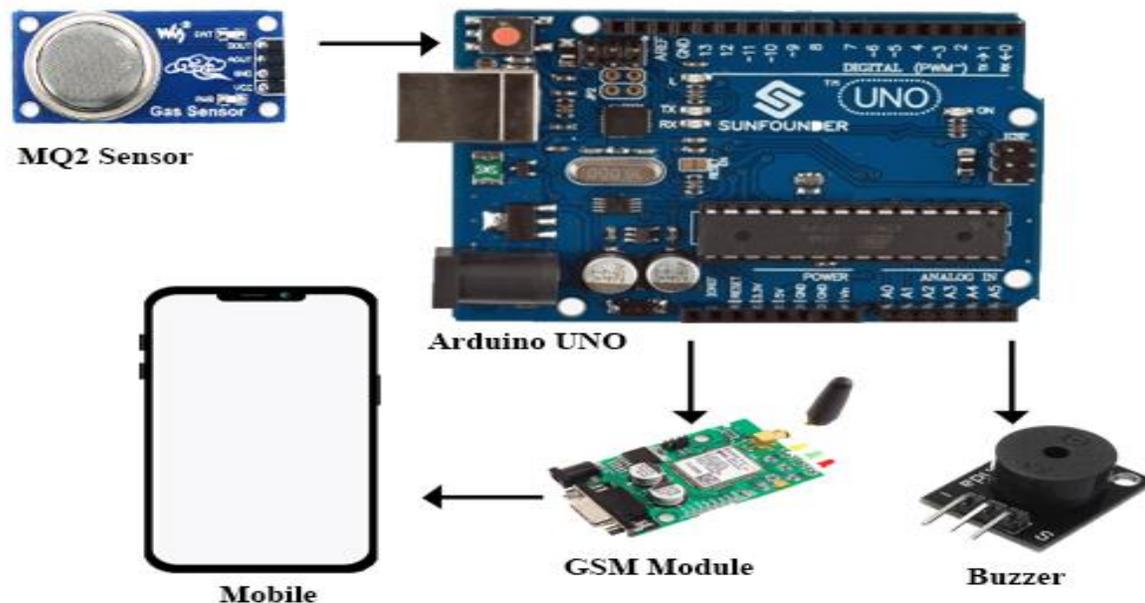


Fig. 2.1 Hardware Block Diagram

### 2.7 Software Design

The Arduino fire alarm system is a significant system for both industrial and domestic use. When it senses fire or smoke, it sends a GSM message to the user to notify them of the fire [17]. Fig. 2.2 shows the flow diagram of software design.

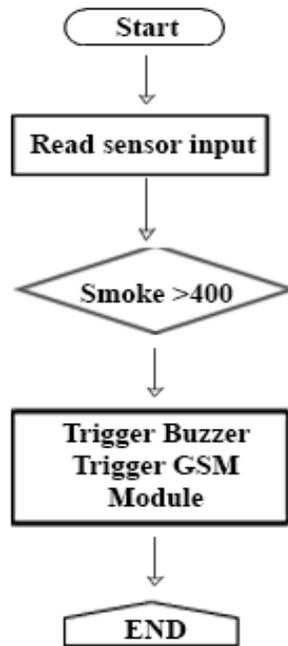


Fig. 2.2 Software Flow chart

### 2.8 Implementation

The hardware includes a gas sensor, an Arduino microcontroller, and a GSM SIM-900A that is controlled by an Arduino through a relay module. A fire alarm system is a collection of technology that works together to detect and notify people via visual and aural devices when there is smoke, fire, carbon monoxide, or other risks present. Various variables, such as the geometry, dimension, architecture, and use of the structure, might impact the spread of fire and smoke within it. Alarm sounders activate when a detector detects smoke or heat, or when someone activates a break glass unit, to alert people in the building that there may be a fire and to evacuate.

### CONCLUSION

This article describes the design and implementation of an automated GSM-based fire alarm system that is both cost-effective and trustworthy. A smoke sensor, as well as temperature and humidity sensors, are commonly used in fire detectors. The Arduino controller is linked to the sensor input data. For output, Arduino is also connected to an LCD display, a buzzer, and a GSM module. The fire alarm is signaled by a buzzer, and the condition of the fire detection is displayed on the LCD. The GSM module may alert a specific user to know or prohibit them from entering their house, workplace, or building. This system is suitable for use in homes, businesses, and hotels. With this method, you can rest confident that you are protected. For early detection of building fires, the system may undertake several parameter measurements. A minimum of two or three smoke detectors should be installed in your house. A smoke and carbon monoxide detector should be installed on each floor of a home. For your personal protection, install a smoke detector and a fire alarm system in your house. The system's advantages can aid in early response, perhaps saving lives and property. It can also keep us and our home safe.

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