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Fire Alert System for House GSM Based, Arduino UNO

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Abstract
A fire alert system is an important safety mechanism designed to reduce property damage and loss of life caused by accidental fires in residential environments. This research proposes a GSM-based fire alert system using Arduino UNO capable of detecting fire-related hazards such as smoke, abnormal temperature, gas leakage, and flames. The system integrates MQ-2 smoke sensors, flame sensors, temperature sensors, GSM modules, buzzers, and relay modules to provide real-time monitoring and emergency notification.
When hazardous conditions exceed predefined thresholds, the Arduino UNO processes the sensor data and activates alarm systems, sends SMS notifications through the GSM module, and optionally triggers automatic suppression mechanisms such as water pumps or exhaust fans. The proposed system aims to provide low-cost, energy-efficient, reliable, and fast fire detection suitable for domestic applications. Experimental evaluation demonstrates reduced response time, improved detection reliability, and effective remote communication during emergency conditions.

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I. Introduction

Fire accidents are among the major causes of property destruction and human casualties worldwide. Traditional fire alarm systems mainly provide local alerts through sirens and buzzers but fail to notify homeowners remotely when they are away from home. Modern communication technologies such as GSM enable remote alert transmission through SMS and phone calls.

Arduino UNO provides an affordable and flexible microcontroller platform capable of integrating multiple sensors for intelligent fire monitoring. The proposed fire alert system combines smoke detection, flame sensing, temperature monitoring, and GSM communication to create a smart emergency response system for residential safety.

II. Problem statement

Traditional household fire alarm systems have several limitations:

- No remote notification capability
- High false alarm rates
- Limited sensing capability
- Lack of automatic emergency response
- High installation cost
- Poor adaptability to environmental conditions

This research addresses these issues by developing an intelligent GSM-based fire alert system using Arduino UNO.

III. Objective

Main Objective

To design and implement a GSM-based fire alert system for houses using Arduino UNO.

Specific Objectives

- Detect smoke, fire, and abnormal temperature conditions.
- Send emergency SMS alerts to homeowners.
- Trigger audible alarms during emergencies.
- Reduce false alarms using multiple sensors.

1. Provide low-cost fire safety solutions.
2. Improve emergency response time.

IV. Literature Review

- Several researchers have proposed GSM-based fire detection systems.
- Mahzan et al. developed an Arduino-based fire alarm system using GSM communication and temperature sensors.
- Jamadar et al. designed a low-cost GSM fire alert system integrating MQ2 smoke sensors and flame sensors.
- Baba et al. proposed a multisensory fire detection system using GSM and RF communication with Android monitoring.
- Hussin et al. introduced dual-sensor validation techniques to reduce false alarms in GSM fire alert systems.
- Most existing systems focus only on basic smoke detection and SMS transmission. Advanced intelligent decision-making and predictive analysis remain limited.

V. Proposed System

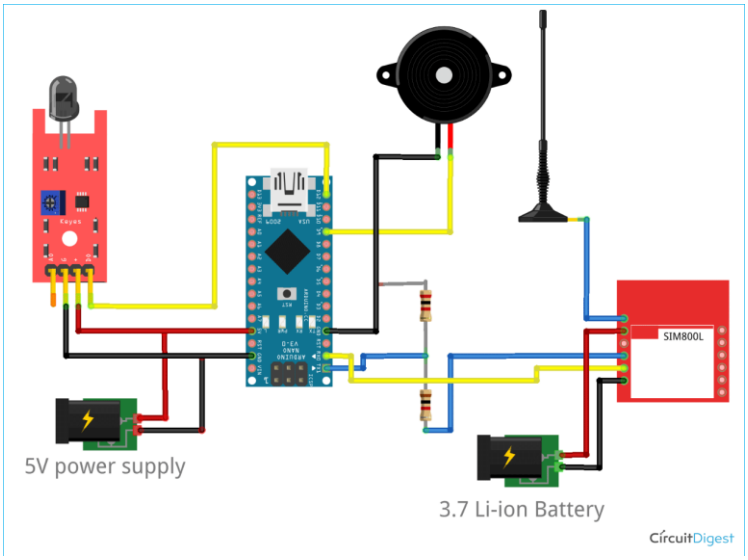
- The proposed system consists of:
- Arduino UNO microcontroller
- MQ-2 smoke sensor
- Flame sensor
- Temperature sensor (LM35/DHT11)
- GSM module (SIM800L/SIM900A)
- Relay module
- Buzzer alarm
- LCD display
- Water pump (optional)

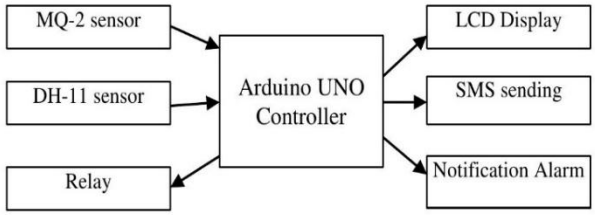
VI. Software design

The system software is developed using Arduino IDE with Embedded programming.
Main functions:

- sensor reading
- threshold comparison
- GSM communication
- alarm control
- LCD display management.

VII. Block Diagrams





'igure4. Block Diagram

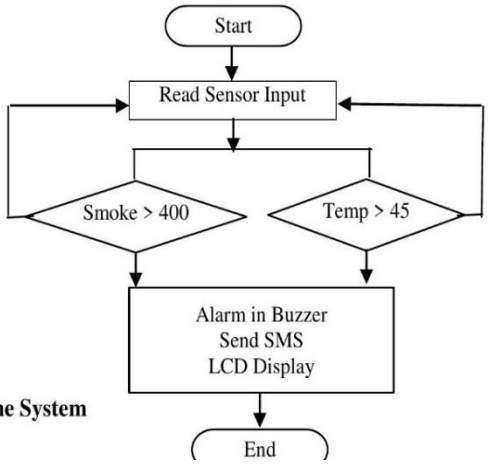


Figure5. Flow chat of the System

8. Hardware Components

Component	Function
Arduino UNO	Main controller
MQ-2 Sensor	Detects smoke and gas
Flame Sensor	Detects fire flames
DHT11/LM35	Temperature sensing
SIM800L GSM	SMS communication
Relay Module	Controls high-power devices
Buzzer	Local alarm
LCD Display	Shows system status
Water Pump	Fire suppression

9.Circuit Diagram Explanation

Sensor Connections

Sensor	Arduino Pin
MQ2 Analog	A0
Flame Sensor	D2
DHT11	D3
Buzzer	D8
Relay	D9
GSM TX	D10

Sensor	Arduino Pin
GSMRX	D11

10. Mathematical Model

Fire risk can be modeled as:

$$R = S + T + F$$

Where:

- R= Fire risk
- S= Smoke intensity
- T= Temperature value
- F= Flame intensity

$$R = S + T + F$$

Advanced weighted model:

$$R = w_1 S + w_2 T + w_3 F$$

$$R = w_1 S + w_2 T + w_3 F$$

11.Expected Results

The proposed system should:

- detect fire rapidly
- send SMS within seconds
- reduce false alarms
- provide reliable operation
- improve residential safety

Studies show multisensor systems improve fire detection reliability significantly.

12.Future Enhancements

Future work can include:

- IoT cloud integration
- Mobile applications
- AI-based prediction
- Camera-based fire recognition
- Smart sprinkler systems
- Voice evacuation guidance

Advanced intelligent systems are emerging in recent research.

13.Conclusion

The GSM-based fire alert system using Arduino UNO provides an efficient and low-cost solution for residential fire safety. The integration of smoke, flame, and temperature sensors with GSM communication enables rapid emergency notification and early fire detection. The proposed system improves response time, minimizes property damage, and enhances public safety.

Multi-sensor integration significantly improves detection accuracy compared with single-sensor systems.

14.Suggested Research Novelty

To make your paper stronger and more publishable, add:

- AI-based false alarm reduction
- adaptive thresholding
- IoT cloud dashboard
- GSM + WiFi hybrid communication
- predictive fire analytics
- encrypted emergency alerts

Refernces

1. Mahzan et al. (2018)

Design of an Arduino-based Home Fire Alarm System with GSM Module

Citation (IEEE style):

Mahzan, N. N., Enzai, N. I. M., Zin, N. M., and Noh, K. S. S. K. M., "Design of an Arduino-based home fire alarm system with GSM module," *Journal of Physics: Conference Series*, vol. 1019, no. 1, 2018.

This is one of the most cited Arduino-GSM fire alarm papers.

2. Jamadar et al. (2023)
GSM Based Fire Alert System
Citation:
Jamadar, R., Uike, H., Kakade, P., and Pawar, S., "GSM Based Fire Alert System," *International Journal for Research in Applied Science and Engineering Technology (IJRASET)*, vol. 11, no. 5, pp. 1–5, 2023.
Discusses low-cost GSM fire alert implementation using Arduino UNO.

3. Baba et al. (2022)
A Multisensory Arduino-Based Fire Detection and Alarm System Using GSM Communications and RF Module with Android Application
Citation:
Baba, M. C., Grado, J. B., Solis, D. J., Roma, I. M., and Dellosa, J. T., "A Multisensory Arduino-Based Fire Detection and Alarm System Using GSM Communications and RF Module with an Android Application for Fire Monitoring," *International Journal of Innovative Science and Research Technology*, vol. 7, no. 3, 2022.
Very useful for multisensor methodology and Android integration.

4. Hussin et al. (2025)
Fire Alarm System Alert Via Short Message Service (SMS)
Citation:
Hussin, M. Z., Jalani, J., Sukor, J. A., Rahimi, M. I., Awang, R., and Nasir, N. M., "Fire Alarm System Alert Via Short Message Service (SMS)," *International Journal of Integrated Engineering*, 2025.
Important reference for:

- smoke sensor placement
- false alarm reduction
- dual-sensor validation
- GSM SMS alerts.

5. Singh (2022)
Arduino-Based Fire Alarm System with GSM Module
Citation:
Singh, R. P., "Arduino-Based Fire Alarm System with GSM Module," *International Journal of Innovative Research in Computer Science and Technology*, vol. 10, no. 2, pp. 241–244, 2022.
Useful for hardware architecture and GSM communication techniques.

6. Munagala et al. (2019)
GSM Based Fire Alarm System
Citation:
Munagala, D., Reddy, P., Maseehuddin, S., Kumar, P., and Swarnalatha, P., "GSM Based Fire Alarm System," *International Journal of Advance Research, Ideas and Innovations in Technology*, vol. 5, no. 6, 2019.
Contains sensor interfacing and GSM notification algorithms.

7. Bahrudin et al. (2013)
Citation:
Bahrudin, M. S. B., Kassim, R. A., and Buniyamin, N., "Development of Fire Alarm System using Raspberry Pi and Arduino Uno," in *2013 International Conference on Electrical, Electronics and System Engineering (ICEESE)*, 2013, pp. 43–48.
Very important IEEE conference reference for:

- Arduino fire systems
- embedded fire monitoring
- hybrid controller systems.

8. Lian (2011)
Citation:
Lian, C. Y., "Design of Intelligent Fire Alarm System Based on GSM Network," in *Proceedings of the International Conference on Electronics and Optoelectronics*, vol. 1, pp. V1-393–V1-396, 2011.
Good foundational GSM-based intelligent alarm reference.

9. Hu et al. (2009)
Citation:
Hu, H., Wang, G., Zhang, Q., Wang, J., Fang, J., and Zhang, Y., "Design Wireless Multi-Sensor Fire Detection and Alarm System Based on ARM," in *2009 International Conference on Electronic Measurement & Instruments*, pp. 3-285–3-288, 2009.
Important for multisensor fusion methodology.

10. Liu et al. (2010)
Citation:
Liu, H., Li, S., Gao, L., and Wu, T., "About Automatic Fire Alarm Systems Research," in *2010 IEEE International Conference on Information Management and Engineering*, pp. 419–421, 2010.
Useful for theoretical background and fire alarm research trends.