iJRASET
International Journal For Research in Applied Science and Engineering Technology

# INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

**Volume:** 11 **Issue:** V **Month of publication:** May 2023

**DOI:** https://doi.org/10.22214/ijraset.2023.52591

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
*ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538*
*Volume 11 Issue V May 2023- Available at www.ijraset.com*

# GSM Based Fire Alert System

Rauf Jamadar[1], Harsh Uike[2], Piyush Kakade[3], Shital Pawar[4]
[1, 2, 3, 4]*Department of Electronics & Telecommunication Engineering, Vishwakarma Institute of Technology, Pune, India*

***Abstract:*** ***A fire alarm system is essential for maintaining and monitoring the safety of all types of environments and situations. However, the usability of many existing fire alarm systems is well known, but production could be expensive. As a result, it is out of reach for low-income users. The primary goal of this project is to create a low-cost fire control system. The detection system, the monitoring system, and the appliance system are the three main systems in the project. The detection system serves as a fire and smoke detector. This paper describes the design and implementation of a fire alarm system using the Arduino UNO as the system's controller. The detectors are arranged in parallel at various levels. A fire alarm system is critical for ensuring the safety of all types of environments and situations. The usability of many existing fire alarm systems is well known, but production may be costly. As a result, low-income users are unable to access it. This project's primary goal is to develop a low-cost fire control system. The three main systems in the project are the detection system, the monitoring system, and the appliance system. The detection system also functions as a smoke and fire detector. The design and implementation of a fire alarm system using the Arduino UNO as the system's controller is described in this paper. The detectors are parallel-arranged at various levels.***
***Keywords: GSM, Arduino UNO, Flame Sensor, Smoke Sensor***

## I. INTRODUCTION

A fire alarm system is essential for the safety of all environments and situations. Many existing fire alarm systems are well known for their usability, but production may be costly. As a result, low-income users cannot use it. The primary goal of this project is to create a low-cost fire control system. The detection system, monitoring system, and appliance system are the three main systems in the project. The detection system is also a smoke and fire detector. This paper describes the design and implementation of a fire alarm system using the Arduino UNO as the system's controller. At various levels, the detectors are parallel-arranged. All environments and situations require a fire alarm system to be safe. Many existing fire alarm systems are well known for their usability, but manufacturing can be expensive. As a result, low-income users are unable to use it. This project's primary goal is to develop a low-cost fire control system. The project's three main systems are the detection system, the monitoring system, and the appliance system. The detection system also functions as a smoke and fire detector. The design and implementation of a fire alarm system using the Arduino UNO as the system's controller is described in this paper. The detectors are parallel-arranged at various levels.

## II. LITERATURE REVIEW

This platform has hosted numerous research projects. The gas leak detection system was initially proposed with only an on-site alarm. Following that, wireless media is connected to the system to generate an alarm [2]. The paper proposed a gas leak detection system with radio frequency (RF) communication in 2011 [3]. It alerts about gas leaks using RF communication. The proposed system with ZigBee communication [4]. It has a wireless network that connects the sensors. worked with the FPGA system [5]. The process is controlled by an FPGA system in that system. In that system, a GSM module is also used. These systems are not less expensive. These systems are not less expensive. proposed a low-cost gas detection system [6]. It is built with a microcontroller. There are numerous research projects in the field of fire safety. Including a fire alarm system based on the CAN bus. It was a multi-sensor-based system, with the PIC16712 receiving sensor data and communicating with the CAN bus via CAN bus communication [7]. Haibing Hu and his team proposed another multi-sensor fire detection system based on ARM in 2009. The nrf2401 was used for short-range communication, GPRS for long-range communication, and ARM9 for the center console in that system [8]. The paper proposes a design for a fire alarm system that included a submachine to retransmit sensor signals [9]. created a GSM based fire security system in 2011. The fire was detected using a smoke detector and a temperature sensor in this system [10]. A fire security system using Raspberry Pi and Arduino UNO. In that system, there was a webcam that sent images of incidents to the owner via Raspberry Pi. After viewing the incident image, the owner can instruct the system to contact the fire department [11]. All of these systems merely notify the owner in various ways. There is nothing about security options in these. If an accident occurs, these systems are powerless to intervene.

When people are not at home, they require an explosion alert. An explosion alert system is typically used in ground and underground structures such as mines and industries to detect the explosion of a toxic gas chamber, which is hazardous to workers [12]. The LPG cylinder occasionally explodes as well. As a result, explosion detection is required for home security. When there is a gas leak, there is a high risk of fire. The conventional smoke sensor base fire security system is too slow to detect cylinder blasts. PIR and infrared flame sensors are faster [13]. This IR flame sensor detects radiation ranging from ultraviolet to infrared. The implemented gas detector system met certain favorable conditions such as low cost, broad application, design economy, availability of components (locally sourced) and research materials, efficiency, compatibility, portability, and durability. The project's performance after testing met design specifications [14]. With a gas leakage alert system, all three security measures are required. The system should also be inexpensive. The system proposed in this paper meets all three security requirements. This system takes protective measures in the event of a gas leak, fire, or explosion. The system also takes protective measures quickly [15]. This paper describes a house fire alarm system based on a microcontroller and a GSM module. The primary goal of the project is to protect residents and their belongings from fires, which are common hazards in residential areas. It is powered by an Arduino Uno and an ATmega328 microcontroller. In the average home, the temperature triggered fire alarm is controlled by the ATmega328[16]. The project's objective is to increase home safety by preventing home fires as well as in the event of an emergency or unplanned situation. The user will receive an alert message via short message service (SMS) via the GSM module if this occurs in a resident's neighborhood without the homeowner's knowledge. The message will describe the excessive temperature rise in the home [17]. This project was created to assist the "Solar Inverter Room" responsible party in solving the issue that arose when a fire spread or a temperature increase occurred when the accountable party was not nearby. The fire alert system is feasible and useful for residents and factories to protect their assets, according to the results [18]. A temperature and smoke detector, a microcontroller, an alert response system, and a fire-retardant system are all included in the proposed IOT-based fire alarm prototype system. An LM35 temperature sensor is used to detect the temperature or heat from the fire. The ATmega328 chip and Arduino Uno board serve as the microcontroller. After detecting a trigger response from the temperature sensor, the ATmega328 controls the home fire alert. The alert message is sent to the user via a short message service and uses the GSM module. (SMS). The system sends an SMS alert to the users and displays an alert notification on the LCD display when the temperature in the house reaches the threshold value, in this case 104°F or higher [19]. The development of web-based intruder alarm monitoring and control hardware and software is involved in the intruder alarm systems and detectors, with a special focus on the various technologies used for wireless transmission and reception of alarm messages and commands via GSM/GPRS, TCP/IP, and other methods [20]. A GSM modem and three fundamental modules make up this project. In an emergency, a message is sent to the appropriate authorities using a GSM modem. The lock keypad in the first module can be used to lock the doors. Three attempts are required before an emergency signal is activated. The second module consists of intruder checkers, which use a network of PIR sensors to identify people inside the home. The third and final module is the fire detection module, which includes temperature and LPG gas sensors [21]. The presenting system aims to be user-friendly while overcoming the shortcomings of earlier works. First, the transmitting unit's fire detection sensors are installed in the building's fire-prone areas, and three switches on the receiver side of the system are used to establish the building's latitude and longitude. Second, the RF transmitter transmits the various values that represent the sensors' responses. The transmitted data is then received by the RF receiver and sent to the microcontroller. As a result, it determines the area affected by the fire and the number of extinguishers needed to put it out [22]. This system uses a microcontroller in conjunction with a sensing circuit to detect gas leaks and fires. With the aid of an alarm system, the system will alert the user if there is a fire or gas leak, and SMS notifications can be sent to the user if there is a fire or gas leak. If a fire occurs, a water sprinkler will spray water on the affected area to lessen the impact of the fire. The state of the system is shown on a liquid crystal display (LCD) [23]. The "GSM-based control unit" project, as its name suggests, aims to create a control tool that permits total device access. The project's main objectives are to use Short Message Service (SMS) to organize gadgets and other appliances so that they can efficiently receive and transfer data through SMS and to do away with the need for a physical presence in either position for tasks requiring the operation of appliances in a home or workplace [24]. The nodes of the processing module form a mesh network in this network-based system. Each sensing node has the ability to function both as a soft access point (AP) for multiple nodes and as a station node (STA) for a single node. With this configuration, the central node should receive the packet and all other nodes should be able to communicate with one another [25].

## III. METHODOLOGY

### A. *Components*

*1)* Arduino Uno

*2)* IR Flame sensor

3) MQ2 135 Smoke sensor
4) GSM 800
5) Buzzer
6) I2C LCD Display
7) MAX 232
8) DC Motor Pump
9) Relay-Coil

### B. *Bock Diagram*

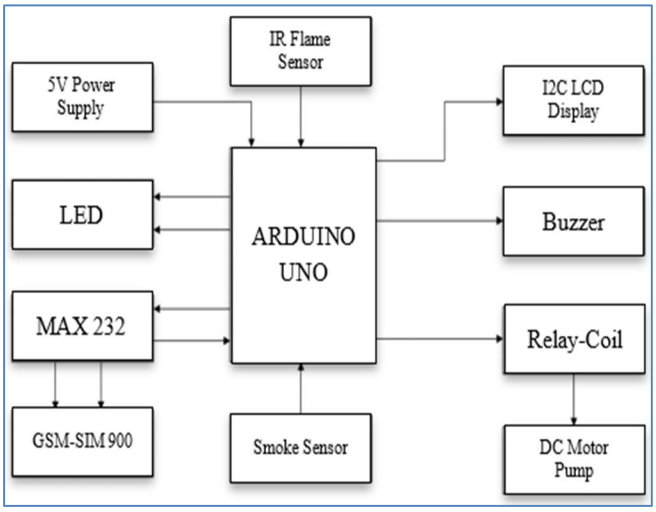



Fig.1. System Block Diagram

### C. *Working*

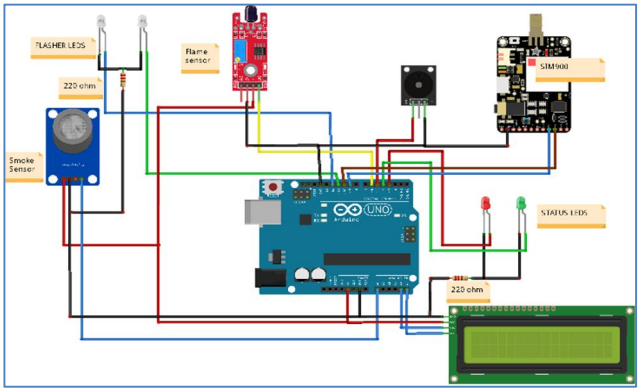



Fig.2. Reference Circuitry

Three phone numbers can be entered into the program code. It is required to receive fire alert SMS and phone calls. The system also consists of a relay module, in this fire system control, the relay module's function is to allow a high-voltage device to be controlled by a low-voltage signal. This is accomplished by closing a switch that activates the device when a small current is applied to it by the fire alarm. If you want to send fire alerts to more than one phone number, enter the second and third numbers here. If not, leave these variables blank. We defined the flame sensor and buzzer pins connected to Arduino and created a software serial object for GSM Module. We initiated serial communication with the SIM800L Module during the setup function. The flame sensor pin was then set as an Input for reading the sensor value. Similarly, we have set the buzzer pin to Output, and the buzzer's default state is LOW. We read the flame sensor value and store it in the flame-detected variable inside LOOP. If the value of the flame sensor is low. The fire is then detected, and we will activate the buzzer and send the fire alert to the phone number we entered. At the same time, the relay connected to the fire alert signal detected by the module is sent to the relay coil and activates the alarm device.

DC motor pump is connected to the main water supply and is activated through a GSM module connected via a relay coil. This is done in such a way that, when a fire is detected, the GSM module sends a signal to the DC motor pump to turn on and start pumping water. This ensures that water is immediately available to help extinguish the fire before it causes any major damage. The buzzer is activated, and the send multi-SMS function is invoked. It will send SMS messages to several phone numbers. To make multiple phone calls, it is using the make multi-call function. It sends the fire alert SMS to all phone numbers when you use the send multi-SMS function. It will call all of the phone numbers that we have entered in the multi-call function Finally, in the make call function, it will dial a phone number, then wait 20 seconds before terminating the call with the ATH command.

## IV. RESULTS

The project's goal was to implement and design automatic fire alarms and monitoring for factories, as well as a smart hand-one system for aviation industries. The microcontroller unit responds to instructions sent by the mobile phone based on the application's requirements and raises an alarm in the event of a critical situation. The application's goal of remotely managing chronic devices was also met. In our first approach, we had to individually test each of the components in the order in which they functioned. So we began with detection, then moved on to SMS exchange, motor configuration, and finally combining all of the components into a single set of operational tools.

Also, such systems have been shown to be highly effective in providing reliable fire alerts and improving response times in emergency situations.

Some of the key benefits of this system includes:

1) *Rapid response:* With GSM-based systems, alerts can be transmitted quickly and reliably, enabling emergency responders to arrive on the scene faster and potentially save lives.
2) *Easy installation:* GSM-based fire alarm systems are often easier to install than traditional systems, as they do not require extensive wiring or infrastructure.
3) *Customizable:* These systems can be customized to meet the specific needs of different buildings, ensuring optimal performance and ease of use.
4) *Comprehensive:* GSM-based fire alarm systems can be integrated with other building systems, such as security cameras and access control systems, to provide a comprehensive fire safety solution.
5) *Cost-effective:* In many cases, GSM-based fire alarm systems can be more cost-effective than traditional systems, especially in buildings where extensive wiring is not feasible.

Overall, the use of GSM-based fire alarm systems has been shown to improve fire safety outcomes in a range of settings, including residential, commercial, and industrial buildings. By providing reliable and rapid alerts in emergency situations, these systems can help prevent serious damage and loss of life.

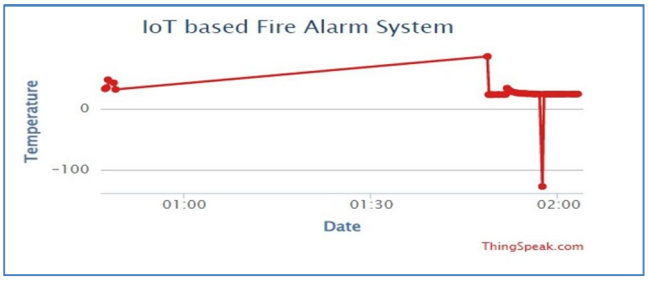



Fig. 3. Temperature in Celsius

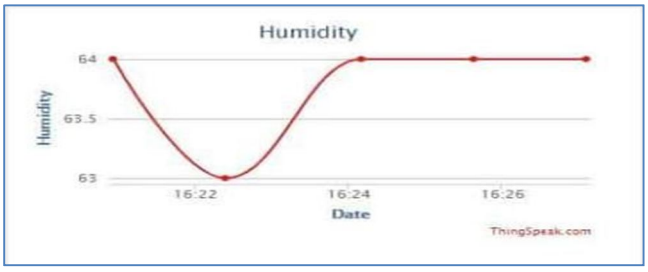



Fig. 4. Humidity

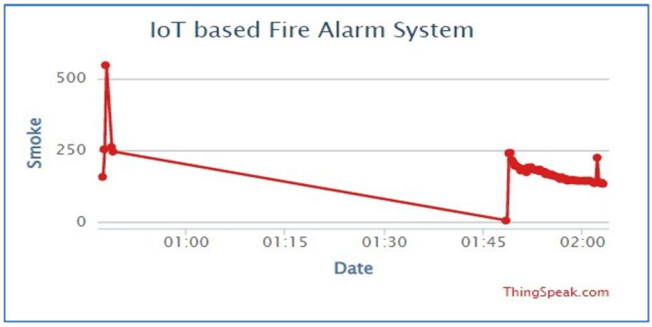



Fig. 5. Smoke Level

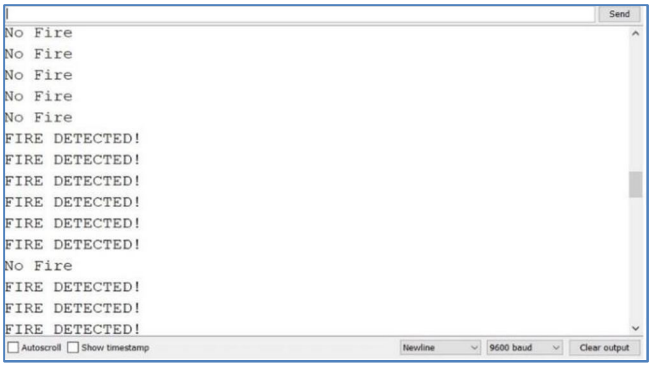



Fig. 6. Alert messages of fire & smoke on serial monitor

## V. CONCLUSION

GSM-based fire alert systems are a critical component of fire safety for residential and commercial buildings. These systems use GSM technology to transmit alerts in the event of a fire, allowing for quick and effective response times that can help prevent serious damage or loss of life. Overall, GSM-based fire alert systems provide numerous benefits over traditional fire alarm systems. First, they are highly reliable, thanks to the use of GSM technology, which ensures that alerts are transmitted quickly and efficiently. Additionally, these systems can be customized to meet the specific needs of different buildings, allowing for optimal performance and ease of use. Another advantage of GSMbased fire alert systems is that they can be integrated with other building systems, such as security cameras and access control systems, to provide a comprehensive fire safety solution. This means that building owners and managers can monitor and control fire alerts and response efforts in realtime, ensuring that any potential risks are quickly identified and addressed. In conclusion, GSM-based fire alert systems are a crucial component of modern fire safety protocols. By leveraging the power of GSM technology, these systems provide reliable, customizable, and integrated fire alert solutions that can help prevent serious damage and loss of life in the event of a fire.

This was a simple application project that demonstrated a fire alarm and control system. The project can be expanded by increasing the number of sensors used as well as the number of installation locations. The use of various real electronic devices can also be used to extend the remote management of electronic devices. The Arduino Uno Board is used to implement the system on the Arduino platform. The entire system is written in the Code language for the Arduino platform. Using the Arduino IDE software, the software written on the platform can be uploaded to the microcontroller i.e., Arduino UNO board.

## REFERENCES

[1] E. Jebamalar Leaving, D. Asir Antony Gnana Singh, B. Abinaya and H. Deepika, “LPG Gas Leakage Detection and Alert System” International Journal of Electronics Engineering Research, vol. 9, no. 7, pp. 1095-1097, 2017.

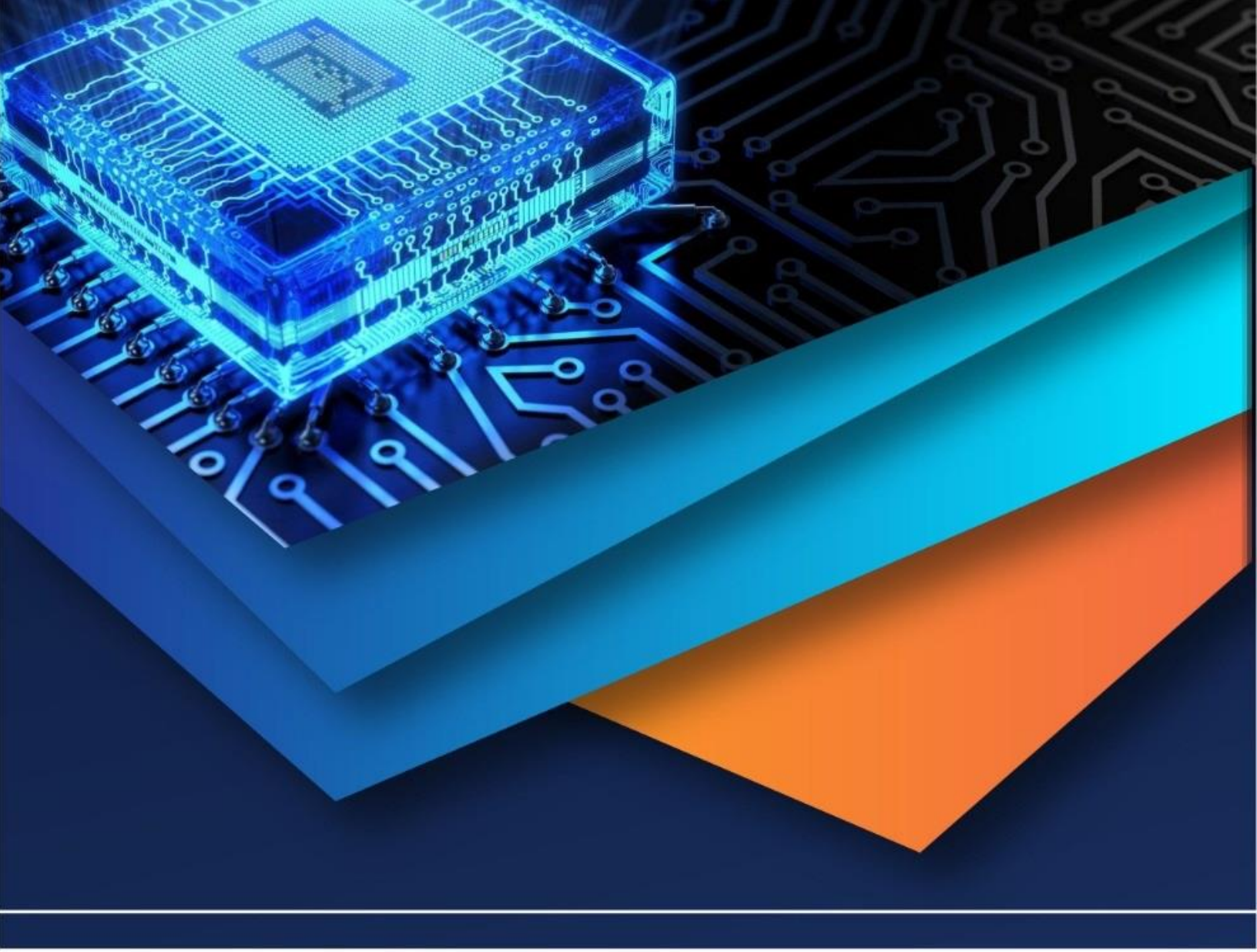
[2] Fabien Chraim, Yusuf Bugra Erol, Kris Pister, “Wireless Gas Leak Detection and Localization” IEEE Transactions on Industrial Informatics, vol. 12, pp. 768-779, April 2016.

[3] Luay Fraiwan, Khaldon Lweesy, Aya Bani-Salma, Nour Mani, “A wireless home safety gas leakage detection system”, 1st Middle East Conference on Biomedical Engineering, pp. 11-14, 2011.

[4] Ganesh D, Anilet Bala.A, “Improvement on Gas Leakage Detection and Location System Based On Wireless Sensor Network”, International Journal of Engineering Development and Research, vol. 3, pp. 407-411, 2015.

[5] T. Arpitha, Divya Kiran, V. S. N. Sitaram Gupta, Punithavathi Duraiswamy, "FPGA-GSM based gas leakage detection system", 2016 IEEE Annual India Conference (INDICON), pp. 1-4, 2016.

[6] Arijit Banik, Bodhayan Aich, Suman Ghosh, "Microcontroller based low-cost gas leakage detector with SMS alert", 2018 Emerging Trends in Electronic Devices and Computational Techniques (EDCT), pp. 1-3, 2018.
[7] Chen Yueping, Gan Fangcheng, Zhang Yongxian, "Design and Realization of Fire Alarm System Based on CAN Bus", 2007 8th International Conference on Electronic Measurement and Instruments, pp. 1-832 - 1-836, 2007.
[8] Haibing Hu, Gang Wang, Qixing Zhang, Jinjun Wang, Jun Fang, Yongming Zhang, "Design wireless multi-sensor fire detection and alarm system based on ARM", 2009 9th International Conference on Electronic Measurement & Instruments, pp. 3-285 - 3-288, 2009.
[9] Huide Liu, Suwei Li, Lili Gao, Tao Wu, "About automatic fire alarm systems research", 2010 2nd IEEE International Conference on Information Management and Engineering, pp. 419 – 421, 2010.
[10] Chun-yuan Lian, "Design of intelligent fire alarm system based on GSM network", Proceedings of 2011 International Conference on Electronics and Optoelectronics, vol. 1, pp. V1-393 - V1-396, 2011.
[11] Md Saifudaullah Bin Bahrudin, Rosni Abu Kassim, Norlida Buniyamin, "Development of Fire alarm system using Raspberry Pi and Arduino Uno", 2013 International Conference on Electrical, Electronics and System Engineering (ICEESE), pp. 43-48, 2013.
[12] M. Chikhradze, E. Mataradze, K. Tavlalashvili, N. Bochorishvili, Shalva Marjanishvili, "Development of device for identification explosions and fires", 2015 Signal Processing Symposium (SPSympo), pp. 1-4, 2015.
[13] B. Uğ ur Töreyin, E. Birey Soyer, Onay Urfalıoğlu, A. Enis Çetin, "Flame detection system based onwavelet analysis of PIR sensor signals with an HMM decision mechanism", 2008 16th European Signal Processing Conference, pp. 1-5, 2008.
[14] Falohun A.S., Oke A.O., Abolaji B.M., Oladejo O.E., "Dangerous Gas Detection using an Integrated Circuit and MQ-9", International Journal of Computer Applications (0975 – 8887), vol. 135, no. 7, pp. 30-34, February 2016.
[15] D. Starikov, C. Boney, R. Pillai, A. Bensaoula, "Dual-band UV/IR optical sensors for fire and flame detection and target recognition", IEEE Sensors for Industry Conference 2004. Proceedings, pp. 36-40, 2014.
[16] Hossain, Md Turab. (2022). A review on GSM Based fire alarm system module. 10.6084/m9.figshare.21076954.
[17] Boganotan, Sheilame & Perin, Max Angelo. (2022). GSM based Fire Alarm System using Arduino.
[18] Koggalage, R. & Welihinda, Manjula & Nuwan, Hasitha. (2021). GSM based smart fire and high-temperature detection system. ITEGAM- Journal of Engineering and Technology for Industrial Applications (ITEGAM-JETIA). 7. 10.5935/jetia.v7i28.738.
[19] Yadav, Rishika and Rani, Poonam, Sensor Based Smart Fire Detection and Fire Alarm System (November 3, 2020). Proceedings of the International Conference on Advances in Chemical Engineering (AdChE) 2020.
[20] Eseosa, Omorogiuwa, and Elechi Promise. "GSM based intelligent home security system for intrusion detection." International Journal of Engineering and Technology 4, no. 10 (2014): 595-605.
[21] Chaudhuri, Diptanil. "GSM based home security system." International Journal of Engineering and Technical Research (IJETR) 3, no. 2 (2015): 38-40.
[22] S. Gupta, A. Mudgil, P. Bhardwaj and M. Gupta, "Design and Development of Automatic Fire Alert System," 2016 8th International Conference on Computational Intelligence and Communication Networks (CICN), Tehri, India, 2016, pp. 632-636, doi: 10.1109/CICN.2016.130.
[23] Okeke, R., and M. Ehikhamenle. "Design and simulation of gas and fire detector and alarm system with water sprinkle." International Journal of Engineering Research and General Science 5, no. 1 (2017): 216-225.
[24] Rakib, Md. Abdullah Al, Md. Moklesur Rahman, Md. Sohel Rana, Md. Sanjib Islam, and Fysol Ibna Abbas. 2021. "GSM Based Home Safety and Security System". European Journal of Engineering and Technology Research 6 (6):69-73.
[25] Mahgoub, Asma, Nourhan Tarrad, Rana Elsherif, Loay Ismail, and Abdulla Al-Ali. "Fire alarm system for smart cities using edge computing." In 2020 IEEE International Conference on Informatics, IoT, and Enabling Technologies (ICIoT), pp. 597-602. IEEE, 2020.



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

# INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY