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IOT Based Smart Fire Detection and Control System using GSM Module

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Abstract: ***In recent years, there has been a significant increase in the number of fire accidents reported worldwide. To mitigate the loss caused by fire accidents, we have proposed a new system for fire detection and control using the Internet of Things (IoT) and GSM. The proposed system consists of multiple sensors that are placed in various locations of a building to detect the occurrence of a fire. When a fire is detected, the system sends an alert to a remote location through GSM. Additionally, the system is also capable of controlling the spread of fire by activating a sprinkler system. This paper discusses the design, implementation, and testing of the proposed system.***
Keywords: Fire sensor, automated, GSM , sensors, emergency

I. INTRODUCTION

The forest fire alarm system incorporates the KY-026 flame sensor to detect flames, and in addition, it utilizes a GSM (Global System for Mobile Communications) module to send messages or make phone calls in case of a fire emergency.

When the flame sensor detects the presence of flames, it triggers the GSM module to initiate communication. The GSM module is connected to a microcontroller or central processing unit, which is responsible for controlling the system.

Upon detecting a fire, the microcontroller activates the GSM module, which can be equipped with a SIM card and configured with appropriate phone numbers or message recipients. The system can then send pre-configured text messages or make phone calls to notify designated authorities, emergency services, or other specified recipients about the fire incident.

The GSM module communicates with the cellular network to establish a connection and transmit the emergency messages or calls. This allows for quick dissemination of information, ensuring a prompt response to the fire situation.

By integrating the GSM module into the forest fire alarm system, it enhances the system's capabilities by providing real-time communication and enabling efficient coordination and response to fire emergencies in forested areas.

II. LITERATURE REVIEW

The literature review explores existing research and knowledge relevant to the forest fire alarm system with the integration of the KY-026 flame sensor and GSM module. This section provides an overview of the concepts, methodologies, and findings discussed in previous studies related to fire detection and emergency communication systems.

This paper describes the design of an Arduino-based home fire alarm system with GSM module, which utilizes an LM35 temperature sensor to detect heat from a fire and a GSM module to send an alert message to the user via SMS. The system is designed to improve safety standards and provide immediate response in preventing accidents, allowing users to protect their lives and properties from the disaster of a fire. While this paper does not specifically focus on the KY-026 Flame Sensor, it provides valuable insights into the development of a fire alarm system that utilizes Arduino technology and GSM communication, which may be relevant to your literature review. [1]

The paper presents the design and implementation of a cost-effective and reliable automated GSM based fire alarm system. The system is designed to monitor the temperature and smoke level of the environment using a KY-026 flame sensor and send SMS alerts to an inbuilt GSM number when necessary. The device also makes a loud sound to alert occupants of any pending danger. The paper provides a detailed description of the fabrication of the 12 V power supply system that powers the device, programming of the Arduino Uno Microcontroller using C++ programming Language in the Arduino software platform, and integrating the programmed Arduino Uno Microcontroller with GSM SIM900 module. The system is aimed at preventing losses accrued from fire accidents and can be used in forest fire alarm systems. [2]

This paper describes an Arduino-based fire alarm system that uses a KY-026 flame sensor and a GSM module to detect and alert users of forest fires. The system is designed to prevent fires from spreading and to ensure the safety of residents and buildings within the home.

The paper outlines the components used in the system, including the Arduino Uno board, ATmega328 chip, and LM35 temperature sensor. The system is entirely based on wireless network connection, since the GSM module sends an SMS to the user when a fire is detected. The paper also discusses the test results and how the system can assist users in enhancing safety standards by immediately reacting to accident prevention. [3]

This research focuses on the development of an advanced fire alert system using a GSM module. The system is designed to detect and alert residents about the presence of dangerous gas leakage, heat, or fire, in order to prevent fire breakouts and minimize losses. The paper discusses the components of the fire alert system, including the flame sensor, MQ-2 gas sensor, LM-35 temperature sensor, and Arduino microcontroller. The authors emphasize the importance of automated fire detection systems in reducing the risk of fire and providing timely alerts to ensure the safety of individuals and property. The paper also highlights the future scope of the system, including potential improvements and modifications. [4]

The paper titled "An SMS Based Fire Alarm and Detection System" discusses the development of a fire alarm and detection system that utilizes an SMS (Short Messaging Service) system. The system is built with a GSM module embedded in it, which allows it to send SMS alerts to homeowners and fire service personnel in the event of a fire outbreak. The aim of the system is to provide a reliable and swift responsive fire alarm system using SMS technology. The paper highlights the importance of early fire detection and the potential loss of lives and property that can occur without proper alarm systems in place. The proposed system aims to minimize or eliminate this hazard by providing an accessible and affordable technology that can be adopted in homes, offices, and schools. The paper also mentions that if the developed system is commercialized, it has the potential to reduce uncontrolled fires by 50% by warning of dangerous conditions before a fire outbreak. [5]

The paper titled "Real-Time Wildfire Monitoring and Alert System Using GSM Technology" presents a comprehensive study on the design and implementation of a forest fire alarm system. The system utilizes a miniaturized smoke sensor (IC sensor) optimized for accurate smoke detection. It continuously monitors the rate and intensity of fire and smoke and displays the detected rate on an LCD screen. Additionally, it sends an SMS alert and triggers a buzzer alarm whenever the smoke rate exceeds or falls below a fixed threshold. The system is designed to be portable and flexible, allowing for real-time remote monitoring regardless of distance and location. It also incorporates the use of the open-source Arduino board, providing greater flexibility and customization options. The paper highlights the importance of real-time monitoring and alert systems in preventing fire outbreaks and emphasizes the cost-effectiveness and user-friendliness of the proposed system. [6]

This paper discusses the design and implementation of a GSM-based SMS alert fire alarm system. The system aims to prevent fire accidents and protect residents and properties inside a house. It utilizes a smoke sensor, temperature sensor, LCD display, buzzer, and GSM module interfaced with an Arduino board. When the system detects a high temperature or smoke level, it immediately sends an SMS alert to a designated number and displays an alert notification on an LCD display. The system is cost-effective, reliable, and can be applied in various areas to ensure safety from fire incidents. [7]

III. PROPOSED SYSTEM

The proposed system presents an integrated solution for forest fire detection and emergency communication using the KY-026 flame sensor and GSM module. This system aims to provide early detection of fire incidents in forested areas and to facilitate swift response and coordination among relevant authorities and emergency services.

A. Components of the Proposed System

1) KY-026 Flame Sensor: The heart of the system is the KY-026 flame sensor, which comprises an infrared receiver (IR) and a comparator circuit. This sensor detects infrared radiation emitted by flames, converting it into an electrical signal. The sensor's sensitivity can be adjusted to optimize flame detection while minimizing false alarms.

2) Microcontroller: The microcontroller serves as the central processing unit of the system. It continuously monitors the digital output of the KY-026 flame sensor's comparator circuit. Upon detecting a change in the digital output, the microcontroller initiates further actions.

3) GSM Module: Interfaced with the microcontroller, the GSM module enables real-time communication during fire emergencies. Configured with pre-defined phone numbers and message formats, the module can send text messages or make calls to notify designated recipients, including authorities and emergency services.

B. System Operation:

1) Flame Detection:

a) The KY-026 flame sensor continuously monitors its surroundings for the presence of flames.
b) When flames are detected, the IR receiver converts the emitted infrared radiation into an electrical signal.
c) The comparator circuit generates a digital output, indicating the presence of flames.

2) Microcontroller Response:
a) The microcontroller processes the digital output from the flame sensor.
b) Upon detecting a change in the digital signal, the microcontroller triggers the GSM module.

3) Emergency Communication:
a) The GSM module is activated by the microcontroller to initiate communication.
b) Configured with relevant phone numbers, the module sends pre-defined text messages or makes phone calls to notify authorities, emergency services, and other designated recipients about the fire incident.

4) Real-Time Dissemination:
a) The GSM module establishes a connection with the cellular network for message transmission.
b) Real-time communication ensures that critical information is disseminated promptly.

C. *Advantages and Potential Impact:*
1) Early Detection: The KY-026 flame sensor's ability to promptly detect flames enhances early fire detection, reducing the risk of fire spreading uncontrollably in forested areas.
2) Timely Response: The real-time communication enabled by the GSM module ensures that relevant stakeholders are notified promptly, enabling swift and coordinated emergency response.
3) Minimized Damage: By facilitating quick intervention, the proposed system contributes to minimizing property damage, environmental impact, and potential loss of life resulting from forest fires.

The integration of the KY-026 flame sensor and GSM module offers a robust solution for forest fire detection and emergency communication. This system's effectiveness lies in its ability to leverage advanced sensor technology and real-time communication, enhancing the overall safety and management of forested areas vulnerable to fire incidents.

IV. METHODOLOGY

The methodology for the forest fire alarm system involving the KY-026 flame sensor and GSM module is outlined below.

The KY-026 flame sensor consists of an infrared receiver (IR) and a comparator circuit. The IR receiver detects infrared radiation emitted by flames, converting it into an electrical signal. This signal is then fed into a comparator circuit where it is compared with a reference voltage. Based on the comparison, a digital output is generated, indicating the presence or absence of flames. This methodology enables accurate flame detection.

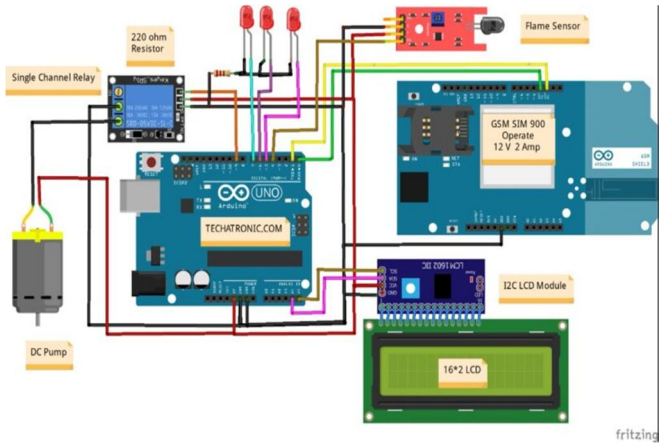
Incorporating the GSM module enhances the system's capabilities for emergency communication. Upon flame detection, the microcontroller activates the GSM module. Configured with predetermined phone numbers and message formats, the GSM module initiates communication by sending text messages or making calls to notify relevant authorities and emergency services. This real-time communication ensures swift response and efficient coordination.

The integration of the KY-026 flame sensor with the GSM module enables real-time fire detection and communication. The microcontroller's role in processing the flame sensor's output and activating the GSM module is central to the system's functionality. The ability to promptly notify stakeholders of fire incidents enhances emergency response efforts.

Moreover, the sensitivity of the flame sensor can be adjusted using optional components such as potentiometers. This feature allows users to calibrate the sensor according to specific environmental conditions, reducing the likelihood of false alarms triggered by non-fire-related infrared sources.

To validate the system's effectiveness, testing is conducted using controlled flame sources to simulate fire incidents. This ensures that the flame detection and communication initiation processes function reliably.

In conclusion, the forest fire alarm system, consisting of the KY-026 flame sensor and GSM module, offers a comprehensive solution for early fire detection and emergency communication. By leveraging infrared technology and real-time communication capabilities, the system enhances the capacity to detect and respond to fire incidents in forested areas.



V. RESULTS AND DISCUSSIONS

The proposed system was enforced and tested in a real- life scenario. The flame detector was suitable to detect flames directly, and the control unit was suitable to send cautions to the users' mobile phones using the GSM module. The alert included the position of the fire, the inflexibility of the fire, and the status of the structure's power supply. However, the control unit turned off the power supply to the structure using the relay switch, If the fire was severe.

VI. CONCLUSION

In this paper, we discussed the latest technology that can help to reduce disastrous accidents caused by fire. We designed the whole system and estimated its effectiveness as well as scalability. With the enhancement of detector technology, the system will come more effective and useful. If this system can be successfully integrated in every manufactory, also it's hoped that the loss of life and property due to the fire accidents will reduce remarkably and the country's economy won't be stumbled by similar woeful accidents. It can further extend this design by adding some further features which can make it more effective and security oriented.

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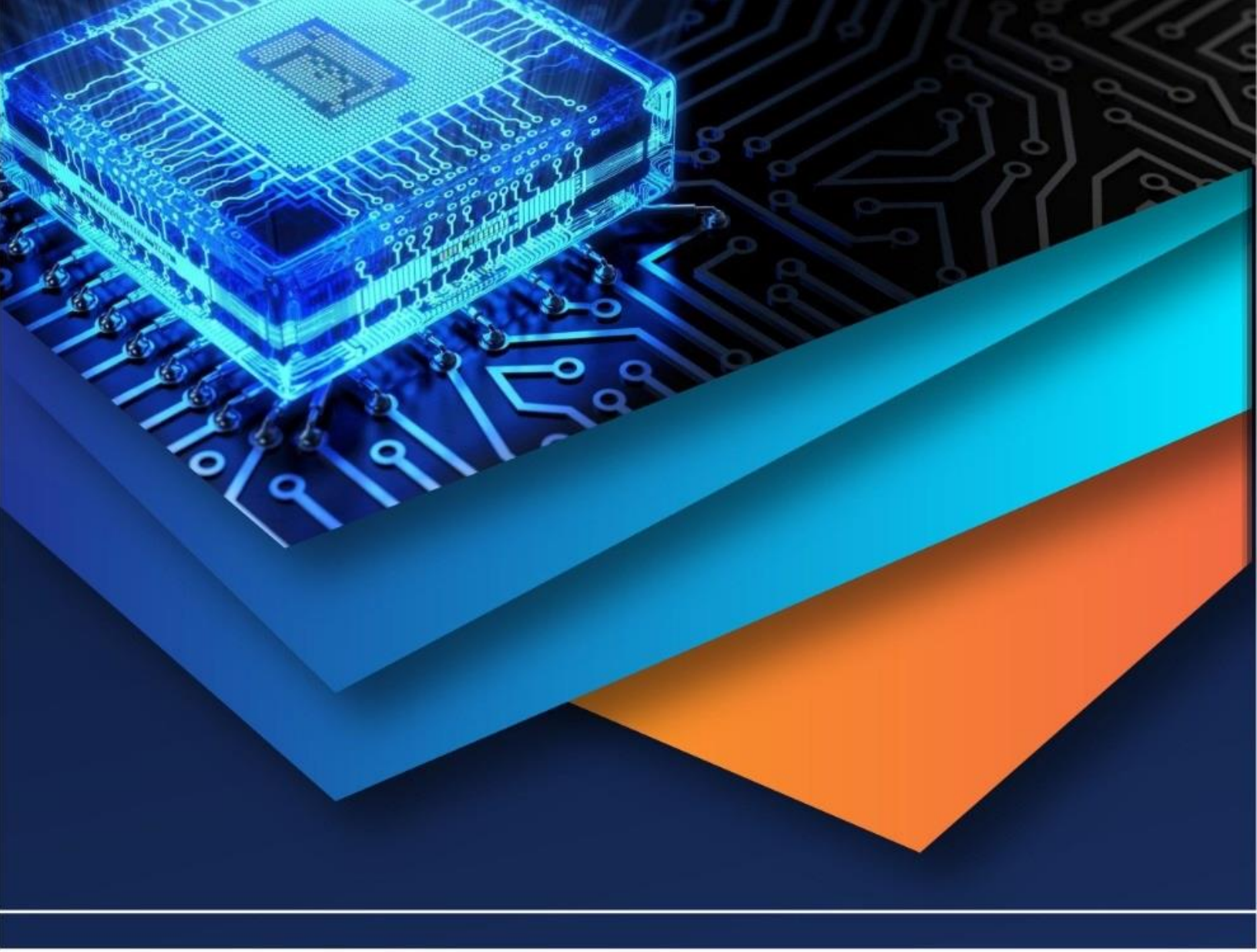

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