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IOT BASED FOREST FIRE DETECTOR AND ALERTING SYSTEM

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ABSTRACT:
Fire has been an issue of interest to researchers due to its significant damage to lives and property within a very short time.One of the recent solutions developed to detect fire is to use Internet of Things(IoT) devices equipped with GSM module.IoT- based forest fire detector, it typically consists of sensors,a communication module and a central monitoring system The sensors detect Flame and Smoke in the forest area. The communication module transmits this data wireless to the authorities,which analyzes the information and alerts authorities in case of a potential fire. It's a smart way to help detect and prevent forest fires. These sensors are designed to detect Flame and Smoke.
When a significant change is detected, the sensor sends a signal to the communication module.The communication module is responsible for transmitting the data collected by the sensors.This system acts as the brain of the operation. If a fire is detected, the system can trigger alerts to notify relevant authorities, such as fire fighters or forest management teams. These alerts can be sent through various means, including SMS.Overall, an IoT- based forest fire detector combines sensors, a communication module,and a central monitoring system to detect and respond to forest fires more efficiently.It's a proactive approach that can help minimize the damage caused by wildfires.

Keywords:
Arduino UNO, GSM module, Flame Sensor, Gas Sensor, Buzzer,LED.

INTRODUCTION:

Forest accidents are considered a sizable problem all over the world. Every year people in numerous amounts are injured due to fire accidents as there was no immediate rescue or controlling was done. Most of the fire accidents breakout into massive ones due to absence of automatic initial detection and immediate control systems. Fires accident can occur at house, industries, forest and shopping mall. Fire accident occur in house due to fault wire connection or unmindful use of electrical appliances, or gas leaks. Gas leakage leads to various accidents resulting in both material loss and human injuries. Home fires have been occurring frequently and threat to human lives and properties has been growing in recent years. The risks of explosion,fire,suffocation are based on their physical properties such toxicity, flammability. The number of deaths due to explosion of gas cylinders has been increasing in recent years. It is a well known fact that most fire incidents in any industry occur due to electrical short circuit. Such incidents can happen for various reasons, and one of the common causes is an earthing failure. Unfortunately, many people tend to invest less money in earthing solutions, considering them an extra expense.
However, poor earthing can result in high costs in terms of human lives, damaged machinery, and expensive equipment.Forest fire is uncontrolled fire that destroys large parts of the forest. Forest fire causes imbalances in nature and endangers biodiversity by destroying habitats and precious life. accidents of forest fires have increased in recent years. The main reason for this is climate change fueled by anthropogenic activity. Forest fires occur usually due to two reasons: natural reasons and manmade reasons. Natural causes like lightning can set fire on trees which may be spread by wind. Sometimes, High atmospheric temperatures and dryness offer favorable circumstances for a fire to start. Man made causes are usually the ones that become dangerous. Fire is caused when a source of fire like flame, cigarette, electric spark or any source of ignition comes into contact with inflammable material. In shopping mall fire accident are caused due to electrical malfunction and combustible

materials. when overheated electrical wire or a stray spark from a malfunctioning junction box, electricity is a common cause of fires in the shopping mall and storing flammable or combustible materials unsafely, which can pose a fire risk. Even the improper disposal of boxes and other packing materials from merchandise shipments can create a fire hazard in a retailer's room.

LITERATURE SURVEY

[1].G. Roque and V. S. Padilla, ''LPWAN based IoT surveillance system for outdoor fire detection,'' *IEEE Access*, vol. 8, pp. 114900–114909, 2020.

In this paper the system aims to provide early detection of fires in outdoor environment, reducing the response time. LPWAN have limitations in terms of data rate and quality of service compared. LPWAN provides long-range communication, the actual range may be affected by environmental factors.

[2]. K. Deve, G. Hancke, and B. Silva, ''Design of a smart fire detection system,'' in Proc. IECON-42nd Annu. Conf. IEEE Ind. Electron. Soc., Florence, Italy, Oct. 2016,pp. 6205–6210.

The wireless communication facility enables real-time data transmission,which improves the system's responsiveness. However, the initial setup costs are high due to the need for multiple sensors, microcontrollers, GSM modems, and other components in each mode. An IoT-based forest fire detection system must address the challenges of early detection of forest fires, especially in remote areas where traditional monitoring may not be feasible. The system should accurately detect fires, differentiate them from false alarms, and alert authorities promptly to minimize the spread of the fire and potential damage.

[3].P. Dasari, G. K. J. Reddy, and A. Gudipalli, ''Forest fire detection using wireless sensor networks,'' *Int. J. Smart Sens. Intell. Syst.*, vol. 13, no. 1, pp. 1–8, 2020.

The system utilizes a combination of smoke and fire sensors (such as the MQ-2 smoke sensor) to enhance the accuracy of fire detection. This multisensor approach increases the reliability of the system in identifying potential fire incidents. The coverage area of the system may be limited by the range of the wireless communication technology used (e.g., RF transmitter and receiver). In large and expansive forested regions, deploying an adequate number of nodes for comprehensive coverage may be challenging.

EXISTING METHOD

In existing fire detection and alerting systems using IoT, various sensors are deployed in buildings or homes to monitor for signs of fire. These sensors can include smoke detectors, heat detectors, and even gas detectors. These sensors are connected to a LED and buzzers for alerting people about the fire and take required measures.

When a sensor detects smoke, high temperature, or the presence of hazardous gases, it sends a signal to the central control unit.. The control unit then triggers an alarms to vacate a particular place, and may even activate sprinkler systems or fire suppression mechanisms if available. This enables quick response and helps in minimising damage and ensuring the safety of occupants.

These IoT-based fire detection systems also often come with additional features, such as remote monitoring and control via smartphone applications, real-time data analysis for predictive maintenance, and integration with other smart home or building automation systems.

Overall, these existing IoT-based fire detection and alerting systems provide enhanced safety like traditional fire detection systems.

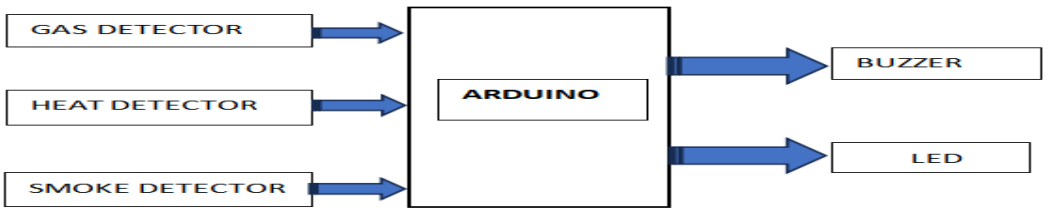

Fig-1: Existing method of alerting and detecting

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PROPOSED METHOD

The system continuously monitors the environment for flames and smoke. If a fire hazard is detected, the Arduino triggers the alarm, activates the visual indicator LED and sound indicator buzzer, and sends alerts via the GSM module to ensure prompt response and evacuation if necessary. It's an effective way to detect fires early and alert people, helping to prevent potential disasters.

- **Flame Sensor:**

The flame sensor is a component that can detect the presence of flames. It usually works by sensing the infrared light emitted by flames.

- **Microcontroller:**

The microcontroller is the brain of the system. It receives the signals from the flame sensor and processes them. It also interacts with other components like the gas sensor, LED, buzzer, and GSM module.

- **Gas Sensor:**

The gas sensor is responsible for detecting any harmful gases that may be released during a fire. It can detect gases like carbon monoxide and smoke.

- **LED:**

The LED is a visual indicator. When a fire is detected, the microcontroller can activate the LED to light up, providing a visual alert.

- **Buzzer:**

The buzzer is an audio indicator. It can produce a loud sound when activated by the microcontroller, providing an audible alert.

- **GSM Module:**

The GSM module enables communication via the cellular network. In the case of a fire detection, it can be used to send notifications or alerts to a designated phone number, informing them about the fire.

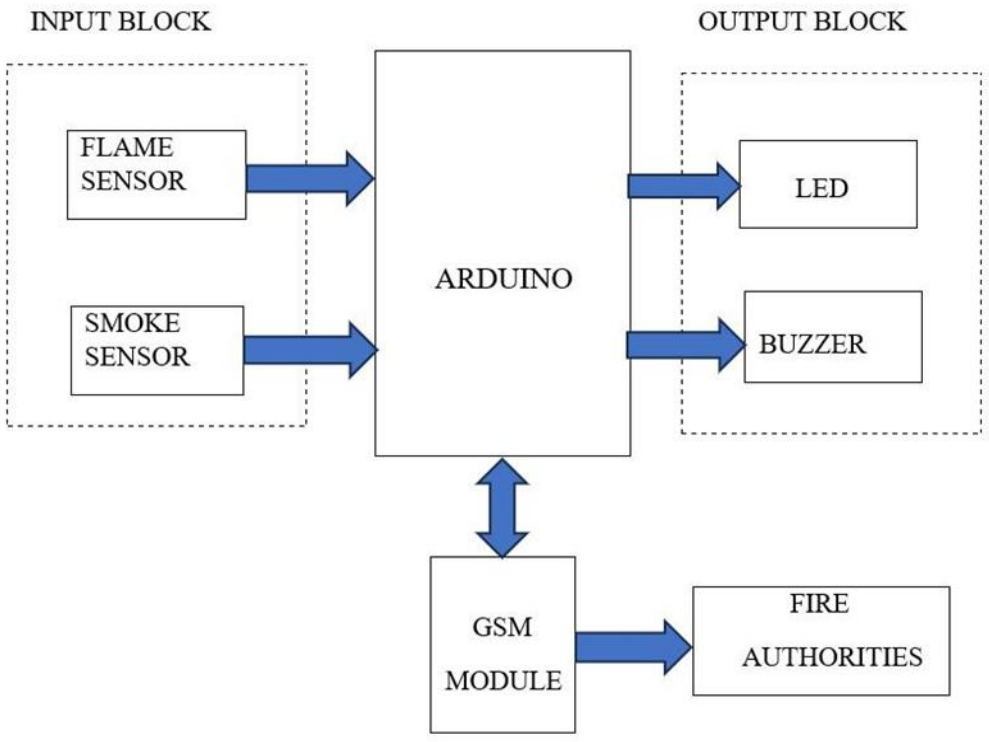

Fig-2: Block Diagram of Proposed System

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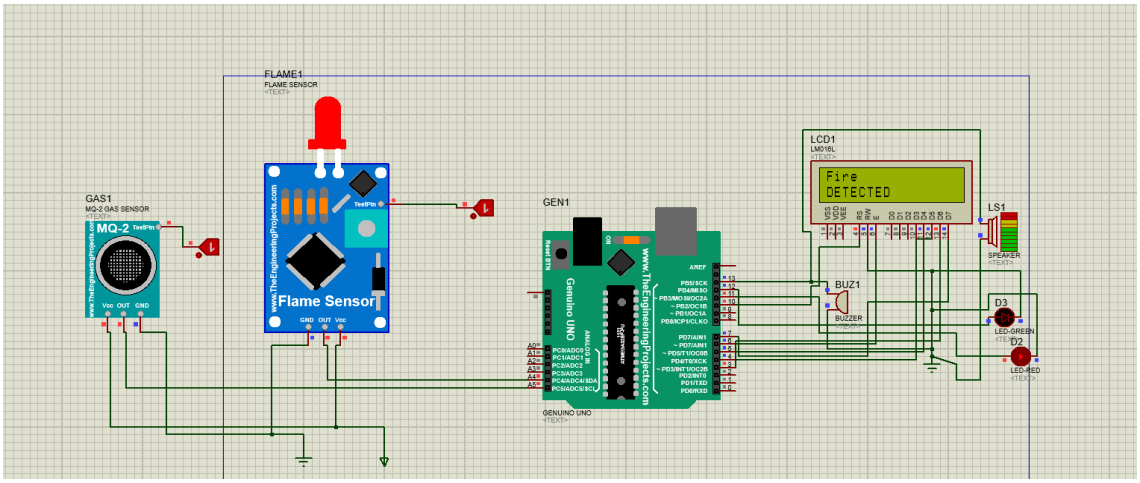

Fig 3 Schematic Diagram

RESULT ANALYSIS

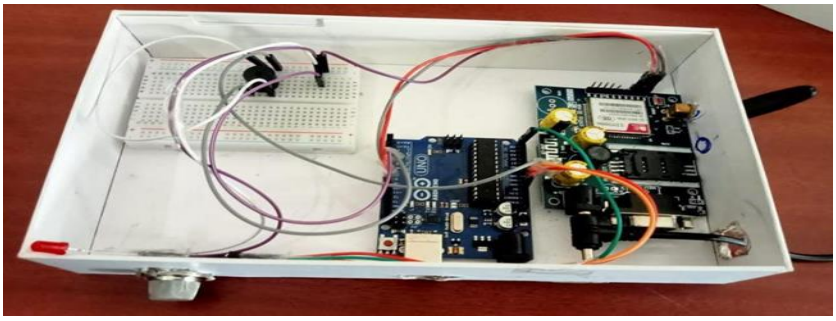

Fig-4:Hardware setup

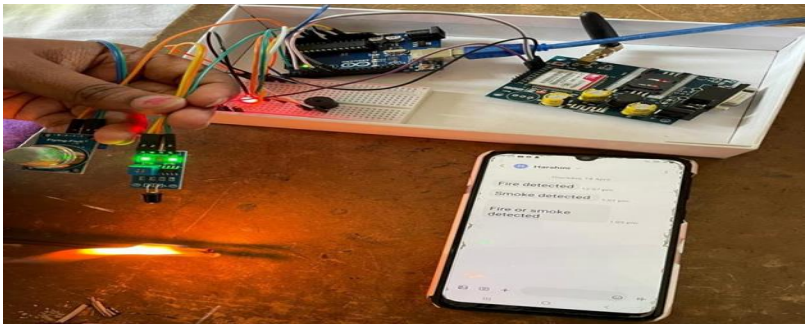

Fig-5: Detection of Flame and Smoke

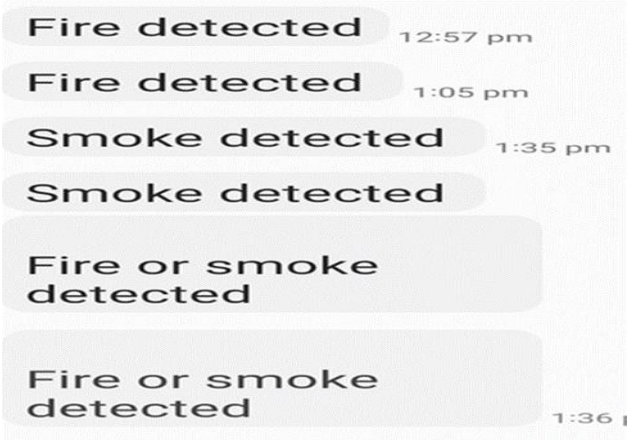

Fig-6: Fire Accident Alert Message Received by Fire Station

CONCLUSION

A prototype of a fire and smoke alert system based on GSM has been designed using Arduino UNO. The primary objective of this system is to minimize the loss of property and livelihood in fire accidents, as safety is of utmost importance in today's world. It is capable of detecting fire accidents using an IR flame sensor and a smoke sensor that uses MQ5 sensor. The system is also equipped to send alert messages to the fire station and make phone calls using GSM when a fire or smoke is detected. The authorities can take immediate action upon receiving an alert.

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