Forest Fire Detection Using GSM Module

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Abstract

Forest Fire Detection System focuses on developing a system that ensures the safety of the forest by sending an SMS alert to the forest officials for rescue as soon as a fire is detected. It aims to develop a system for early detection of forest fires using GSM technology and the ThingSpeak cloud platform. The system will consist of a network of sensors deployed in forested areas to monitor temperature, humidity, and smoke levels. When abnormal readings are detected, the sensors will send real-time alerts to a central server via GSM communication. The server will analyze the data and trigger appropriate responses, such as notifying authorities or activating firefighting equipment. By leveraging the power of cloud computing and wireless communication, this system offers a cost-effective and efficient solution for mitigating the devastating effects of forest fires.

Overall, the "Forest Fire Detection Using GSM and ThingSpeak Cloud" project offers an innovative solution that harnesses modern technologies to address the critical issue of forest fires and enhance forest fire management practices.

I. Introduction

Forest fires pose a significant threat to ecosystems, wildlife, and human lives worldwide. Early detection of forest fires is crucial for timely intervention and effective containment of these disasters[4]. Traditional methods of monitoring forest fires rely on manual observation or satellite imagery, which can be costly and time-consuming. To address this challenge, this project proposes a system for early detection of forest fires using GSM technology and the ThingSpeak cloud platform. [1] In response to this challenge, this study presents a novel approach to forest fire detection utilizing the Arduino Nano microcontroller platform in conjunction with various components including a power supply, buzzer, relay, pump motor, fire sensor, NodeMCU, GSM900A module, flame sensor, and LCD display. This integrated system aims to provide an autonomous and efficient means of detecting forest fires in real-time, enabling prompt response and intervention to mitigate the spread of fire and minimize damage.

The Arduino Nano serves as the central control unit, facilitating the communication and interaction between different components of the system. [3]The fire sensor continuously monitors

the environmental conditions for any signs of fire, while the flame sensor detects the presence of flames, providing an additional layer of detection and accuracy. Upon detection, the system Triggers an alarm through the er to alert nearby individuals and activates the relay to control the pump motor for fire suppression.

Furthermore, the integration of NodeMCU and GSM900A module enables the system to transmit data to a centralized server or cloud platform in real-time, facilitating remote monitoring and control. This connectivity enhances the system's effectiveness by providing authorities with timely information for decision-making and intervention strategies. Additionally, the inclusion of an LCD display provides local feedback on the system's status and detected threats, allowing for easy monitoring and maintenance.

II. Literature Survey

M. Trinath basu, Ragipati Karthik, J.Mahitha, V.Lokesh Reddy [1], It has been found in a survey that 80% losses caused due to fire would have been kept away from the fire was identified promptly Node Mcu based IoT empowered fire indicator and observing framework is the answer for this issue.

N. Junguo Zhang, Wenbin Li, Zhongxing Yin, Shengbo Liu, [2], A cluster-based wireless sensor network paradigmfor forest fire real-time detection w as put forward in this paper. Some key question were discussed emphatically, such as the adhoc network related technology, node hardware designing, the forest-fire forecasting model and the propagation characteristic of UHF wireless signal and so on.

T.Sasikumar, P.Ramya [3], in their research they developed an Arduino platform based IOT fire detector and monitoring system is the solution to this problem. In this project we have built fire detector using Arduino UNO which is interface with a temperature sensor, a smoke sensor and a buzzer.

Ranjith E, Padmabalaji D, Sibisubramanian S, Ms.S Radhika [4], their reasearch uncontrolled blaze occurred by weather, wind, and dry underbrush, can burn acres of land and consume everything in their paths which cause significant damage to natural and human resource. The objective of this work is to design IoT based system that can detect the fire as early as possible before the fire spread over the large area and to prevent poaching.

III. Existing System

Forest fire detection systems currently employ various technologies such as satellite imagery, ground-based sensors, cameras, and IoT devices to monitor forested areas. These systems use a combination of sensors to detect changes in temperature, humidity, smoke, and vegetation health, with data typically transmitted to a central monitoring station for analysis.Alerts are then issued to relevant authorities for response and mitigation.

IV. Proposed System

Forest fire detection systems incorporating GSM (Global System for Mobile Communications) modules leverage cellular networks to transmit data from remote areas to a central monitoring station. These systems typically integrate temperature, humidity, and smoke sensors along with a GSM module for data transmission.

When sensors detect abnormal conditions indicative of a fire, the GSM module sends alerts via SMS or data packets to designated recipients, enabling timely response and mitigation efforts.
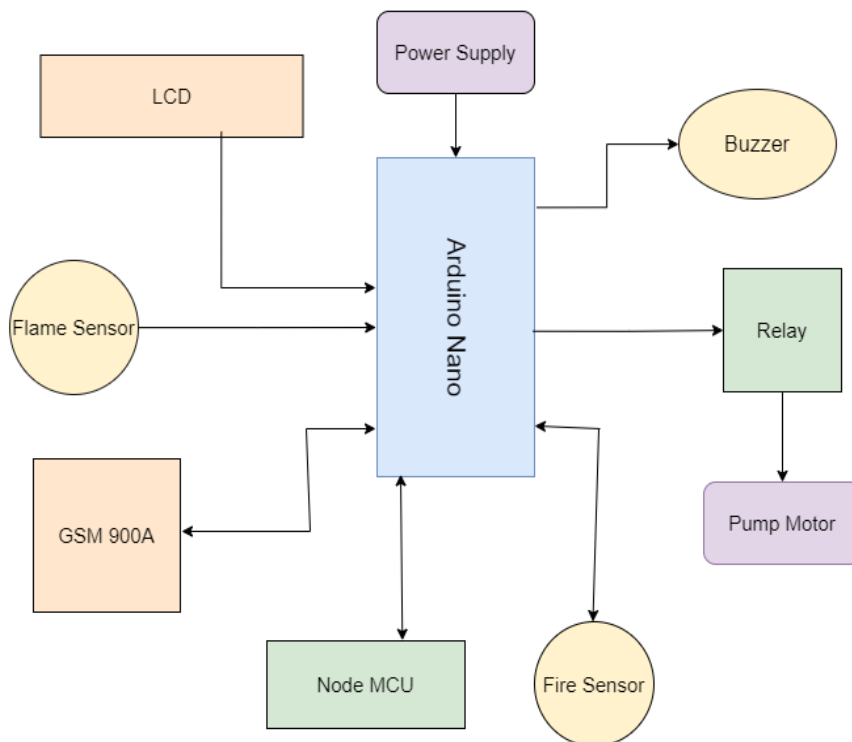

Figure 1: Block Diagram of the Proposed System

V. Hardware Used

Arduino Nano is used as the microcontroller to handle data processing and control functions for the forest fire detection system.

An **LCD** is employed for local display, providing real-time feedback and status updates on the detection process.

The **NodeMCU ESP8266** serves as a communication bridge, facilitating data transmission between the Arduino Nano and the internet.

GSM 900A module is integrated for remote monitoring and alerting capabilities, enabling the system to send notifications via SMS in case of fire detection

A **Buzzer** is incorporated to provide audible alerts in addition to SMS notifications, enhancing the effectiveness of the warning system.

Fire and Flame sSensors are employed for detecting the presence of fire or flames in the forest environment.

A **DC Pump Motor** is utilized for initiating firefighting measures, such as spraying water to suppress the fire upon detection.

A **5V Relay** is used to control the operation of the DC pump motor, enabling the Arduino Nano to activate and deactivate the pump as needed.

VI. Software Used

Arduino IDE: The Integrated Development Environment (IDE) used for programming Arduino boards. It provides a user-friendly interface for writing, compiling, and uploading code to the Arduino platform.

ThinkSpeak: An Internet of Things (IoT) platform that allows users to collect, analyze, and visualize data from sensors or other devices. It provides APIs for connecting IoT devices to the cloud, enabling real-time data monitoring and analysis.
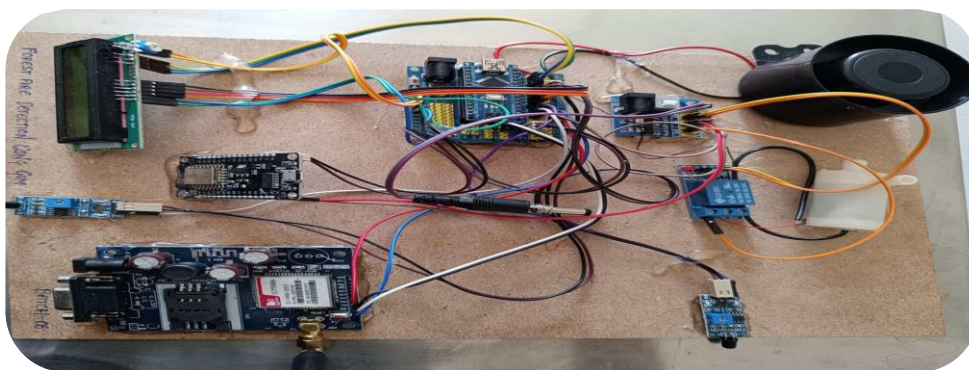
VII. Results and Discussions

Figure 2:   Forest Fire Detection Using GSM Module Kit
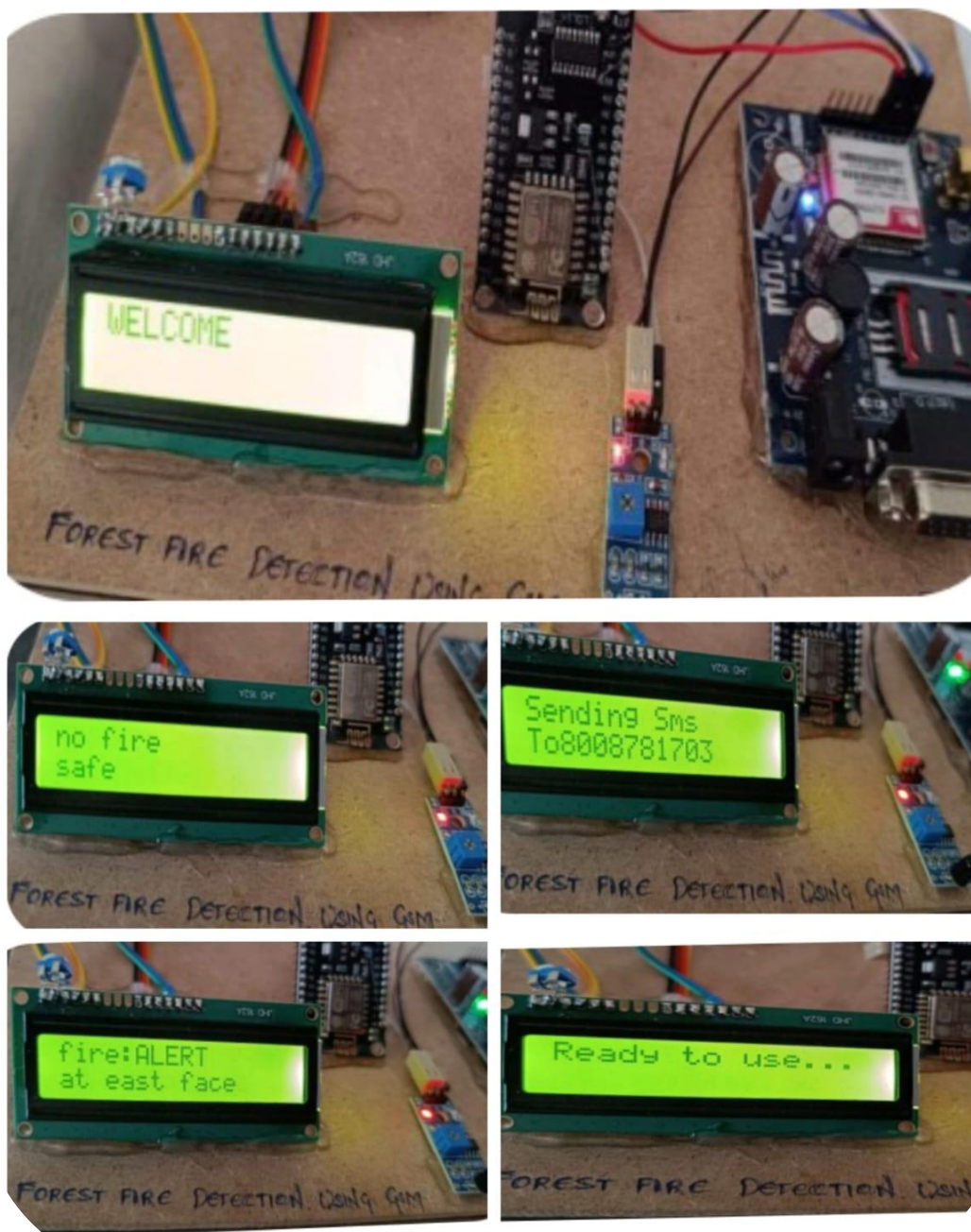
Figure 3: Working mechanism of the Module

(i)   when we switch ON the kit it shows the "welcome" message.

(ii) when there is no fire detects it shows the "no fire" message on the LCD Screen

(iii) when the fire detects through the GSM it sends alert notification to the forest officials for the rescue as the fire detects it will aslo shows in which direction the fire detects .
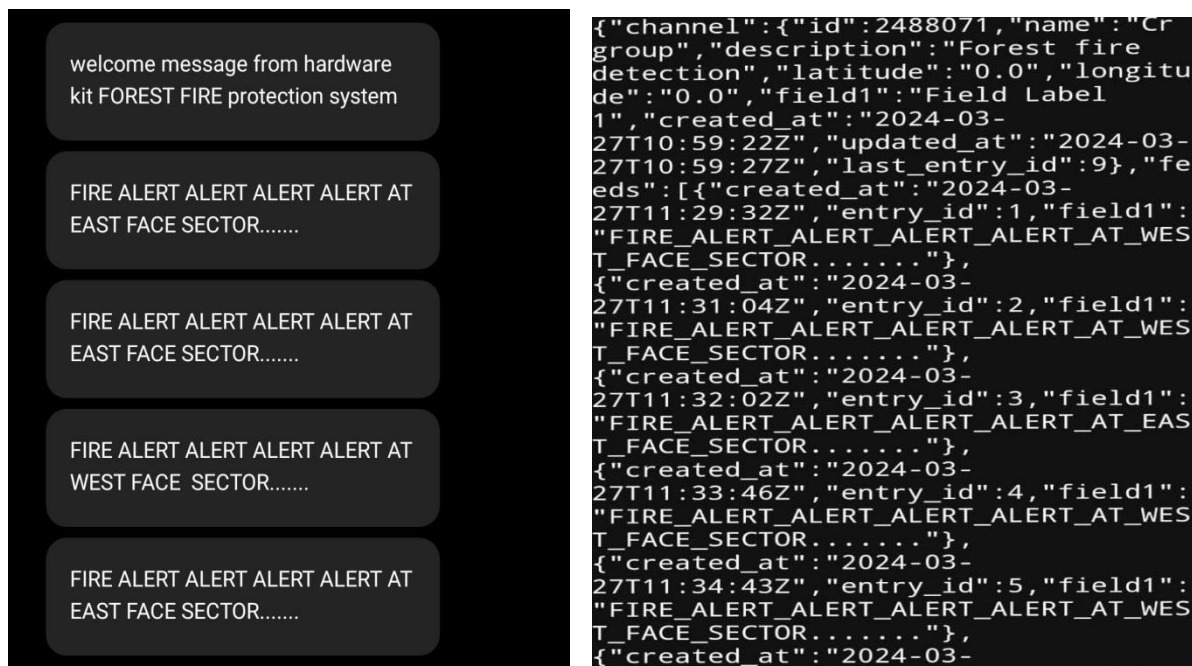
{"channel":{"id":2488071,"name":"Cr group","description":"Forest fire detection","latitude":"0.0","longitude":"0.0","field1":"Field Label 1","created_at":"2024-03-27T10:59:22Z","updated_at":"2024-03-27T10:59:27Z","last_entry_id":9},"feeds":[{"created_at":"2024-03-27T11:29:32Z","entry_id":1,"field1":"FIRE_ALERT_ALERT_ALERT_ALERT_AT_WEST_FACE_SECTOR......."},
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{"created_at":"2024-03-

Figure 4 : Final Output in Inbox and Thinkspeak Cloud Platform

VIII. Conclusion

In summary, forest fire detection systems integrating GSM modules offer real-time alerts, remote monitoring, and scalable solutions for early detection and rapid response. Their adaptability to climate change, regulatory compliance, and economic benefits underscore their critical role in mitigating wildfire risks and enhancing community resilience. As wildfires continue to pose significant challenges, the continuous improvement and deployment of GSM-based systems are vital for effective wildfire management and environmental conservation.

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