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FIRE DETECTION USING DEEP LEARNING

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Abstract: In order to warn homeowners before a fire completely destroys their homes, fire detection devices are crucial. But nowadays, constructing a fire alarm system requires a significant amount of wiring. Users are deterred from putting them in their houses as a result. As a result, we suggest a simple-to install wireless fire alarm system that is Internet of Things-based. The suggested system is made up of an ad hoc network made up of multiple nodes placed throughout the house. Each of these nodes consists of a microprocessor coupled to sensors measuring temperature, humidity, flame, methane, smoke, and carbon monoxide (CO). These sensors continuously check the environment for signs of fire. A Wi-Fi network is independently created by the nodes. These nodes exchange data with a Raspberry Pi microcontroller-powered central node and a 4G module. A node that detects a fire sends a signal to a centralized node. After then, this node begins to act, which could involve alerting the house with a local alarm, phoning the user, or sending an SMS to the fire department. Sending an SMS to the system allows the user to receive information about the condition of his home. A bridge node connects the centre node to the mesh network of sensor nodes. Message protocol facilitates easier communication between the bridge and sensor nodes. The suggested system was prototyped, and it performed all required tasks.

Index Terms **– Fire detection, RESNET50 Algorithm**

I. INTRODUCTION

Installing a fire alarm system is crucial to preventing property damage and saving lives. Nevertheless, the majority of houses are not equipped with these fire alarms, which puts the occupants in jeopardy in the event that a fire starts while they are gone. Some houses have traditional fire alarm systems installed, but they have several drawbacks, chief among them being the ability to sound the alert when the residents are asleep or elsewhere. This paper suggests a fire alarm system that might use a remote communication interface to alert homeowners of a fire at their residences. To expedite the procedure, it could also communicate with the fire department. The systems we previously mentioned are designed to identify fires and notify the appropriate people. These technologies are comparable to the IOT-based fire alarm system that is being developed. A 4G module will be used to warn folks. When an external trigger, such a fire or a user request, happens, the system's numerous dispersed nodes connect with one another. A single, centralized node will serve as the system's interface. A home router is not necessary because all nodes in the network interact with one another via their Wi-Fi antennae. The sensed parameters as of right now are likewise visible to users. The system is also extendable, as the number of covered rooms may be increased by adding more sensing nodes.

II. LITERATURE SURVEY

A project report's literature survey or review, which takes into consideration the many project elements and the project's scope, highlights the various studies and research projects conducted in the area of interest as well as the results already published. The primary purpose of a literature review is to examine the project's past, which aids in identifying the system's flaws and provides
guidance on which outstanding problems should be remedied. As a result, the following topics not only outline the project's history but also draw attention to its flaws and problems, which served as inspiration for the creation of its solutions. A number of advanced fire alarm systems were suggested. For instance, the

intelligent fire alarm system "Nest Protect" has smoke and carbon monoxide detectors and is self-contained. As soon as Nest detects fire, it sounds an alarm and alerts users. If there were other "Nest Protect" smoke detectors nearby, it might be able to connect with them.

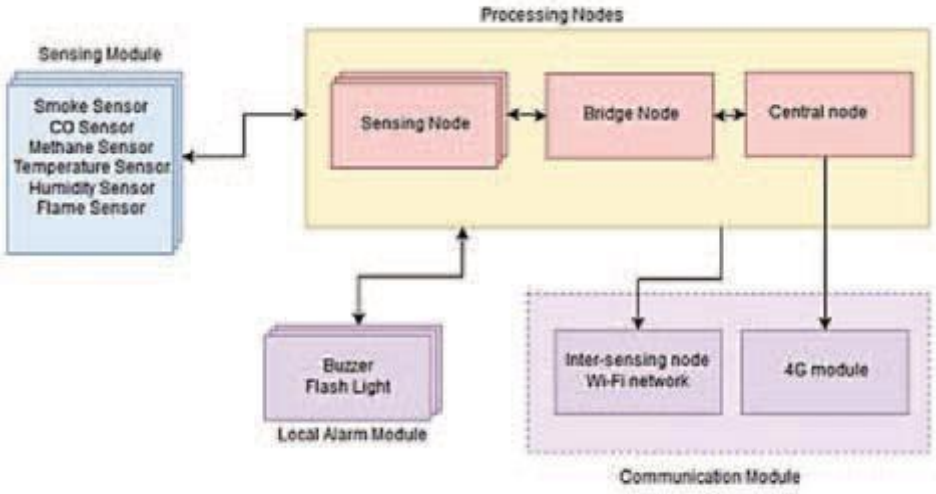
The Nest detector can be remotely operated by users of the "Nest Protect" programme [1]. From their device, users can also view recent safety steps. Nevertheless, "Nest Protect" has several limitations, such as requiring a Wi-Fi connection throughout the house and only working with Android or iOS-powered devices. [2].

In [3], a different intelligent fire alarm system is used. The core of this system was wireless communication between the sensing nodes, each of which consisted of an Arduino UNO R3 microprocessor and a Wi-Fi shield CC3000 linked to gas, flame, temperature, and humidity sensors (DHT11, MQ-6). Sensor nodes gather information from the environment and provide it to the cluster head, who transmits packets and aggregates data. Then, using code created in Android Studio, the data is wirelessly sent to the gateways for use in notifications. The other nodes in the system are battery-powered, which makes them susceptible to energy depletion, but the central node is designed to run continuously to prevent energy loss. A system for promptly reporting, observing, and managing fire events was created in [4].

When a fire is detected, the fire alarm's Intel Edison module connects to the cell phones of passing pedestrians. Real-time connection between the Edison module and mobile devices is made possible by Bluetooth Low Energy signals. The smoke and heat-detecting fire alarm that is currently installed in Japanese homes is the same one that this device employs. Smart phones may be used to send fire alerts to the Internet in addition to being utilized for fire location. People may utilize cell phones to locate the fire with the aid of the ibeacon initiative. More individuals will learn about the fire alert and spread the word as a consequence.

III. SYSTEM REVIEW

Fig. 1 displays the system's block diagram. There are two primary purposes for this mechanism. The first is used to detect fires. Where in the sensor nodes pick up on their surroundings before sending the sensor values to the microcontroller to which they are attached. The microcontroller looks over the parameters and compares them to a predetermined threshold. When the threshold is crossed, a local alarm is triggered and a notification is sent to the central node from the bridge node. When the central node receives a fire notification, it notifies the user and the fire department over the GSM cellular network. Additionally, the sensor data is regularly forwarded to the central node by the bridge node. The second component of the system allows the user to request real-time sensor measurements. The user sends in a request by SMS. The central node gets the user's request and the most recent sensor value via the GSM network. This value is given to the user. Furthermore, the central node is configured to monitor the detecting nodes and notify the user in case one of them malfunctions. If a node is not responding to the central node, the user receives an SMS.



IV. SYSTEM STUDY

A. Utilizing remote sensing data and resampling algorithms, machine learning models are utilized to predict the susceptibility of forest fires.

This study predicts Iran's Chaloos Rood watershed's vulnerability to forest fires using three machine learning (ML) models: boosted regression trees (BRT), support vector machines (SVM), and multivariate adaptive regression lines (MARS). Fourteen sets of fire predictors, based on topographical features, vegetation indices, climatic variables, and environmental factors, are used in the research. Utilizing the cross validation (CV), optimism bootstrap, and bootstrap procedures, the training dataset from the Natural Resources Directorate of Mazandaran province was resampled in order to evaluate the models' appropriateness and ascertain the variance and bias of the estimation. A weight was assigned to each contributing variable, which indicated how strongly the predictors were spatially associated.

Advantages:

This study shows that curvature, rainfall, height, distance from a river, and distance from a residential area all positively impacted the prediction of forest fires.

Disadvantages:

It's not appropriate for the image.

B. Decision Tree-based Chip-based Forest Fire Prediction System.

We propose the decision tree-based intellectual property (IP) core development for forest fire prediction in this study. We describe its integration into the Micro Blaze-based SoC architecture, which serves as the sensor node's processing section. The objective is to accelerate the prediction process by making the choice locally at the level of the sensor node. Before the decision tree-based prediction model's hardware is developed using the high-level synthesis approach, it is simulated and trained using a MATLAB tool for tree creation. About 75% and 0.88, respectively, are the decision tree classifier's accuracy and recall scores. The findings of the hardware implementation of the decision tree based forest fires forecast system on chip show that the developed IP core requires minimal resources.

Advantages:

It can identify flames with a 75% accuracy rate.

Disadvantages:

It works only with the collected sensor data; it is inappropriate for photos. Moreover, accuracy is lower.

C. A deep neural network-based wildfire prediction system utilizing IoT's sensors.

The forest is one of the most important and precious resources on the planet since it provides an animal's natural home. Additionally, forest products have a significant direct and indirect impact on human life. But wildfires have the extraordinary potential to cause serious harm not only to land but also to people, houses, animals, and other objects. Wildfires may burn acres of land and destroy everything in their path in a matter of minutes. Wildfires destroy everything: houses, animals, trees, plants, wildlife, and vegetation. Wildfires have numerous, varied, and far-reaching effects. It significantly harms the social structure, customs, economy, and environment of rural communities. Many factors, such as soil moisture, temperature, humidity and pressure.

Advantage:

To predict the occurrence of wildfire using machine learning with the help of historic data and recording the environmental changes using various sensors which will feed the real-time data.

Disadvantages:

It works only with the collected sensor data is not suitable for image.

D. Arduino-Based Smart Home Automation System

The design and prototype implementation of the automation system, which may be utilized with two Arduino Nanos and sensors, are described in this article. To demonstrate the automation system's effectiveness, it has been integrated with a number of devices, such as temperature, motion, smoke, and light detection sensors. Furthermore, security systems also incorporate RFID and GSM modules. The sensors' roles include keeping an eye on and managing the light, temperature, and alarms in the room. The main feature of the security system is GSM, which enables the owner to get SMS alerts. Two Arduino Nanos are used to control sensors and relays that monitor a specific region and react to preset parameters, such light or temperature.

Advantages:

It demonstrates that it is feasible to construct an inexpensive, easily programmable automation system (based on an Arduino) and link it to an intuitive application for monitoring and control.

Disadvantages:

It isn't appropriate for smart city fire detection.

E. Wireless sensor network cluster-based for monitoring forest conditions.

People have always relied on monitoring the weather in the forest. However, there is currently a lack of information regarding the temporal and spatial environmental variables of the forest that affect its health in real time. This endeavor focuses on monitoring humidity and temperature as weather data from the forest. Wireless sensor networks (WSNs) provide real-time data gathering from any position inside the forest, in contrast to conventional approaches. However, the WSN faces certain challenges, such as limited bandwidth, low power consumption, and short battery life.

Advantages:

The Firefly algorithm takes into account indicators like load, packet delivery ratio, and predicted delay.

Disadvantages:

It works only with the collected sensor data it is not suitable for image.

V. CONCLUSION

- There are serious worries regarding forest fires and the fire around smart cities in many different countries. Global experts and researchers agree that the most crucial first step in averting these disasters is to invest in efficient technologies.
- Using the Thing Speak cloud application, several temperature, humidity, light intensity, and smoke charts have been created. Through real-time data processing, the system can detect a variety of environmental characteristics and is successful in recognizing events in this study. The design is effective and provides a fair, cost-effective method of collecting and monitoring real-time data globally. The suggested system incorporates the image processing method for identifying fire occurrences. Several rules are also intended to detect the fire incidence more precisely.
- This project uses an Internet of Things enabled network with intelligent sensors to construct and develop a wireless communication model. It can monitor forest region data in real-time and offers options for global area coverage. This degree of responsiveness is attained by attaching weather monitoring sensors like DHT11 and MQ2 to a concurrently elevated data recording module with strong internet connectivity.
- This shows that the technology is able to detect flames before they get out of hand. This lessens the extent of the fire's damage and makes it possible for the appropriate authorities to put it out fast. Technology also makes it possible to monitor an occurrence at any time and provides a useful means of reducing the possibility of a fire.

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