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Earlier Detection of Forest Fire Using IoT

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Abstract - According to a report, 80% of losses in woodlands are accumulated as a result of fires being discovered too late. In the pre-suppression phase, forest fire detection has become a crucial concern, necessitating the urgent requirement to detect forest fires as quickly as possible. He has made a strong case in his writing for the skilled use of wireless sensor networks as a possible explanation for the cause of forest fires. To solve this, we put up a fresh approach to early fire prediction. The hardware kit with a temperature sensor and a flame sensor is linked to an Arduino Nano in our suggested approach, and the data that is obtained is then communicated to a cloud server via a GSM module.

Key Words: **Detection, Sensors**

1. INTRODUCTION

An uncontrolled fire that starts in a forest region is known as a forest fire, wildfire, or wildland fire. A significant number of tracts of timberland are regularly burned to the ground. It is obviously challenging for vegetation to grow over time on burned soil where there were once woods. The reason for this is because as soil goes towards being water-repellent and stops absorbing water, the level of ground water decreases. One of the real causes of the increase in global temperature, according to the 2008 Global Warming Report, is fires that spread quickly. Wildfires are frequently started by lightning, by extremely hot and dry conditions, or by reckless people. One of the techniques for early detection is provided by the use of wireless sensors in this research.

With the dawn of the Internet, human have become increasingly interrelated interconnection between devices. Due to the escalation and the omnipresence of devices, some of the lacking-order net terminate Bluetooth and wireless sensor network (WSNs).

Devices are anticipated to typically be jointly connected in order to create, converge, and disseminate data. These previously indicated procedures will include a sequence of device-to-device communications that might or might not require human intervention. These gadgets are a variety of objects or things that have communication and intelligence built in. Among them are sensors, automobiles, smartphones, medical equipment, home appliances, and RFID tags. As a result, connectivity is spreading beyond just people to include devices.

The pattern chemise enumerate has led to the origin of IoTs (Internet of Things). With the use of Internet standards and protocols, these gadgets communicate with the human world while gathering environmental data. The IoT will transform information that has been detected or collected into intelligent data, fusing intelligence into the environment. The IoT will also comprise billions of gadgets that can wirelessly report their identity, location, and past activities. The IoT technology, in which everything is connected to the Internet, allows the devices to communicate with one another. These gadgets communicate with their surroundings. The dynamic way of cloud computing in accumulation and storing of data can be used for the IoT conceptualization. As the usage of IoT, for communication between the devices is automated, the time and human effort are reduced. These devices can dispatch the essential information among the devices which supports the completion of work with perfection and without human interference.

1.1 OVERVIEW WITH PROBLEM STATEMENT

It is now imperative to detect forest fires as quickly as possible since they have grown to be a crucial concern in the pre-suppression phase. We built a fire detector using an Arduino Nano that is connected to a temperature sensor and a flame sensor. When the temperature rises above the threshold value and the flame sensor detects a fire, the temperature sensor highlights the warmth and ambient room temperature. When a fire is detected, the Arduino Nano's buzzer sends us a warning signal.

2. LITERATURE SURVEY

[1] Title: forest fire detection system using wireless sensor networks and machine learning

Authors: Udaya Dampage, Ridma Wanasingh, Lumini Bandaranayake

Publication year: 2021

Summary: In this application it detects forest fire using a wireless sensor networks and machine learning where it uses linear regression technique to detect the fire, in which the dataset will be stored in the system and matches it with the provided data and then the result is analyzed.

[2] Title: Forest fire detection and monitoring

Authors: Sunil Thapa, Vishwas sudhir Chitale

Publication year: 2021

Summary: In this application they have used fire risk mapping using natural and anthropogenic parameters for the forest fire detection and monitoring in which it captures the image of the fire detected area and then sends it to the system and then they monitor and take the precaution which is time efficient.

[3] Title: Forest fire detection using LoRa technology

Authors: Nicoleta, cristina Gaitan, Paula Hojbota

Publication year: 2020

Summary: In this application they have used LoRa WAN and sigFox protocols for the detection of forest fire, they use LoRa technology for detecting forest fire in which sensors are used and the sensed data is sent to the system, and it is time saving

[4] Title: Image processing for forest fire detection

Authors: Priyadarshini M, Hanamasaddi

Publication year: 2019

Summary: In this application they have used YCbCr color model for the detection of forest fire in which it captures the images of the area where the fire is caught and matches with the dataset stored and then the result is displayed, here the image processing steps are carried out for the accurate result.

3. EXISTING SYSTEM

The existing system people had to manually visit the forest areas where the fire is caught and they had to monitor every now and then by visiting the place which will be time consuming. Even though the systems are designed, it detects after the fire is caught. As systems use the remote sensing technology, the information obtained may be inaccurate during cloudy weather.

4. PROPOSED SYSTEM

Forest fire Reconnaissance Framework which comprises of WSN was likewise proposed for identification of forest fire. The information gained by sensors is transmitted utilizing SIM800L module. In the proposed system it highlights the influential feature of wireless sensor networks (WSN) for earlier detection of forest fire. It utilizes various sensors attached and data transmission through wireless medium WSN comprising of temperature sensor setup, flame sensor and GPS module was likewise proposed for recognition of fire. In this temperature is fixed to certain threshold value.

5. SYSTEM DESIGN

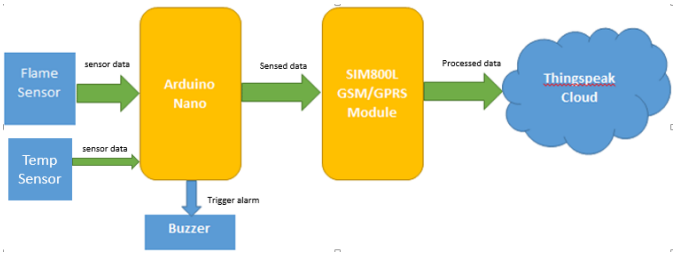

Fig -1: System Design

The system design explains the architecture that would be used for developing a project. The system design provides an overview of an entire system, identifying the main components that would be developed for the interfaces.

6. MODULE DESCRIPTION

A. Arduino Nano: The ATmega328-based Arduino Nano is a microcontroller board. It includes 6 analogue inputs, 14 digital input/output pins, of which six can be utilised as PWM outputs. a reset button, an ICSP header, a USB connection, and a ceramic resonator operating at 16 MHz

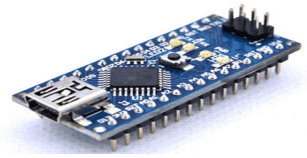

Fig -2: Arduino Nano

B. Temperature sensor: LM35 is used as temperature sensor which is integrated circuit rated to operate over -50 degree to +155 degree Celsius. The temperature and humidity reading value are sent to user through IoT so that user is able to know the field conditions from anywhere. Temperature sensor is a device which is used to measure the hotness or coldness of an atmosphere. Here we use LM35 which is an integrated circuit sensor used to measure temperature with an electrical output proportional to the temperature around the atmosphere.

Fig -3: temperature sensor

C. Flame sensor: A flame detector is a sensor created to find and react to a fire or flame. Flames are discovered using the flame sensor. The module uses a comparator and fire sensor to detect fire up to a distance of one metre.

Fig -4: Flame sensor

D. SIM800L Module: This module helps in automatically sending an notification when the temperature is above the threshold value. The operating voltage of this module is from 3.5 Volts to 4.4 Volts. This module comes with a helical antenna and SIM socket on the back and any activated 2G micro SIM would work perfectly to notify the server connected monitor.

Fig -5: SIM800L Module

E. Buzzer: A buzzer or beeper is a mechanical or electromechanical aural signalling device. The buzzer alarm will immediately turn on when a fire is discovered.

Fig-6: Buzzer

7. SEQUENCE DIAGRAM

An outline of a process is Unified Modelling Language (UML) is a type of interaction diagram that demonstrates how and in what order processes interact with one another. It is an implementation of a message sequence diagram. Event scenarios are another name for sequence diagrams.

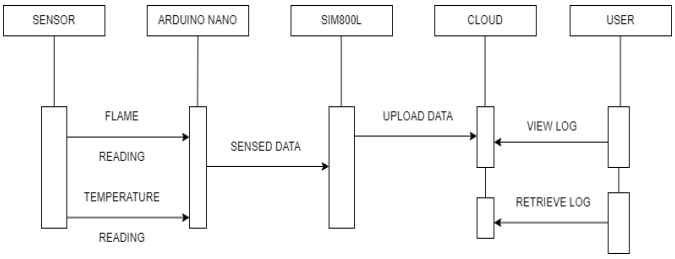

Fig -7: Sequence Diagram

8. DATA ANALYSIS AND RESULTS

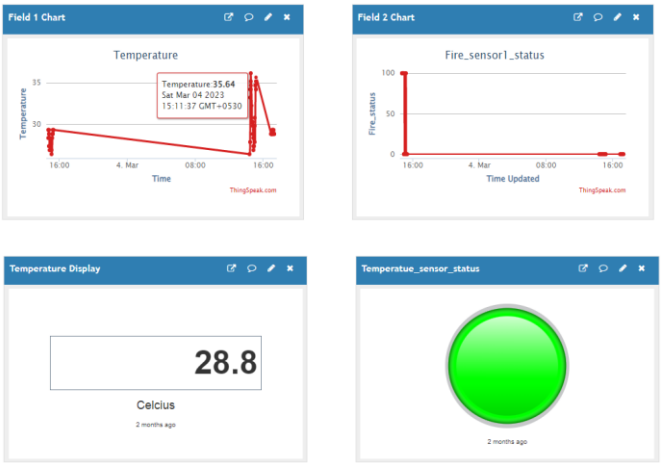

Fig -8: Thingspeak Graphical Analysis

Field 1: It contains the data of the temperature sensor which is collected with the help of GSM module. It contains the time and date when the temperature has reached above the threshold value.

Field 2: It contains the data of the flame sensor. This channel stores the value in 0 and 1, where 0 represents no fire and 1 represents present of fire

Temperature display: It constantly senses and displays the temperature of the surrounding environment. Once it reaches above threshold value the status chart glows with the color given, otherwise the color does not glow.

9. CONCLUSION

Forest fires cause damage to the environment only when they are not detected immediately. When this problem is analyzed and immediate alert will be sent to the forest officials, this will help in avoiding huge environmental losses and cultural heritage damages. Therefore, the key goals in this type of a system are that the whole process is very quick, the detection is reliable to trace the location of the fire. It is easier to distinguish a fire when the starting location of the fire is known, and while it has just begun to spread. Designed this system which can detect and reduce catastrophic events that occur because of the forest fire calamity.

The forest fire detection system's most important feature is its speed that will help the forest officials to get notified about the fires as early as possible to prevent the fire from spreading over a large area.

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