Department of Information Science and Engineering

6th Semester Team 2

Synopsis

IOT based Forest Fire Detection System

Members	USN ID	Email
Pankaj Garg	1DS19IS066	1ds19is066@dsce.edu.in
Neha S Shetty	1DS19IS064	nehashetty1009@gmail.com
Saquib Ameer Khan	1DS19IS089	saquibameer2019@gmail.com
Nandini Poddar	1DS19IS063	1ds19is063@dsce.edu.in
Ananya M	1DS19IS015	1ds19is015@dsce.edu.in
Bhoomika RS	1DS19IS031	1ds19is031@dsce.edu.in
Mentor In charge		
Rajat Duggal	Nokia University connect, Bangalore	rajat.duggal@nokia.com

Contents:

SECTION-I

SECTION-II

SECTION-I

Abstract:

A wildfire, forest fire, bushfire, wildland fire or rural fire is an unplanned, uncontrolled fire in an area of combustible vegetation starting in rural and urban areas. Forest fires not only cause loss of biodiversity, loss of valuable timber, degradation of natural forests and water catchment areas but also result in depletion of carbon sinks, reduction in water table level, global warming, ozone layer depletion and also loss of agricultural production. So, in order to try and overcome these problems we have proposed an IOT based Forest Fire Detection System.

The Forest fire detection system uses advanced technology which will help in tracing out the forest fire in its initial stage. The poaching activities and illegal trade of forest goods can be stopped by the application of these sensors. Hence, with the complete information of the incident and its nature, the administration can take the appropriate decisions to combat illicit trading of trees and prevent forest fires.

Internet of Things (IoT) technology has brought revolution to each and every field of common man's life by making everything smart and intelligent. IoT refers to a network of things which make a self-configuring network. The development of IOT based Forest Fire Detection System will be helpful in mapping emergency plans and making them more effective during the occurrence of any disaster. In this project, the intention is to build a Forest fire detection system using IoT which would detect the fire and send an emergency alert to the Authority through IoT. Here a GSM/GPRS module is used to communicate with IoT servers as usually in forest areas network bandwidth is very low or not available. Hence a 2G network is preferable to communicate with the server.

Problem Statement:

Forest fires are common hazards in forests that cause a lot of harm to wildlife as well as the environment. It could be avoided if a robust system could be deployed in forest areas to detect the fire and alert the fire extinguishing authority to take immediate action. In this project, the intention is to build a Forest fire detection system using IoT which would detect the fire and send an emergency alert to the Authority through IoT. Here a GSM/GPRS module is used to communicate with IoT servers as usually in forest areas network bandwidth is very low or not available. Hence a 2G network is preferable to communicate with the server.

Brief Solution:

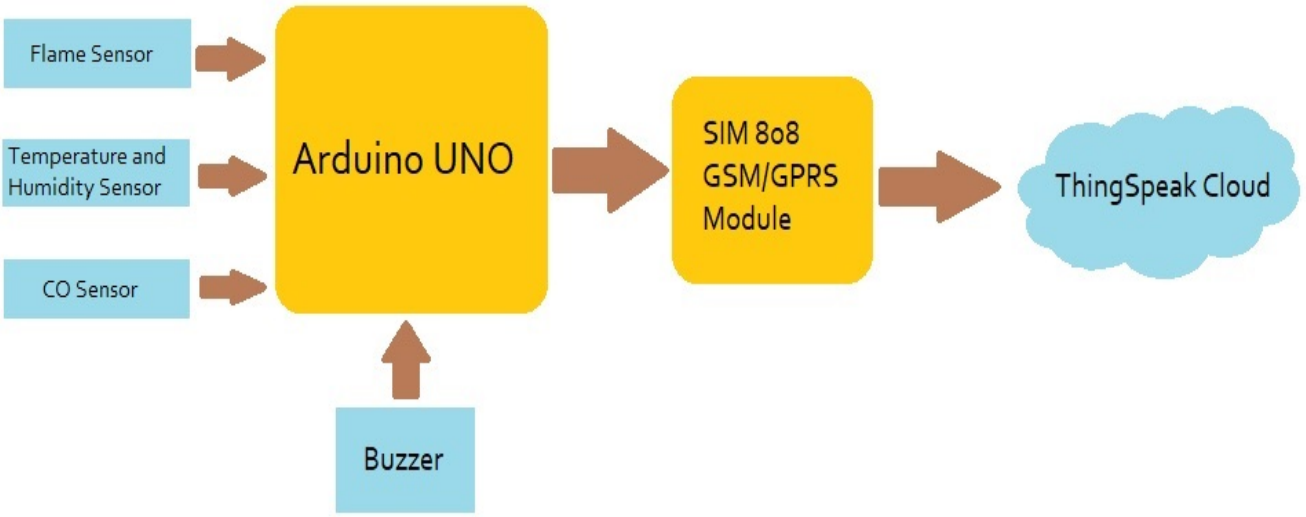
In this project, we will design an IOT based forest fire detection system. The working of the project is pretty simple: detect the fire and send an emergency alert to Authority through IoT.

Many researchers came up with the solution by using various types of control and detection systems. It is a detection system equipped with a GPS navigation system, a temperature and humidity sensor,a flame sensor and a CO sensor .

As shown in the schematic block diagram below, the project consists of a temperature and humidity sensor,a flame sensor and a CO sensor, a buzzer, Arduino Uno & SIM808L GSM/GPRS module as its primary components. The fire can be detected by the flame sensor which gives a digital output that corresponds to the fire status and is received by the Arduino Uno.

Arduino compares the signal and triggers the SIM808L in case of fire incidents. SIM808L is a compact module that allows GPRS transmission, send/receive SMS, and making voice calls. The SIM808L module has two antennas included on it. The first is for a ring antenna which can be soldered

directly on the board and the other is meant for an external antenna.Through AT commands, SIM808L communicates with thingspeak server.

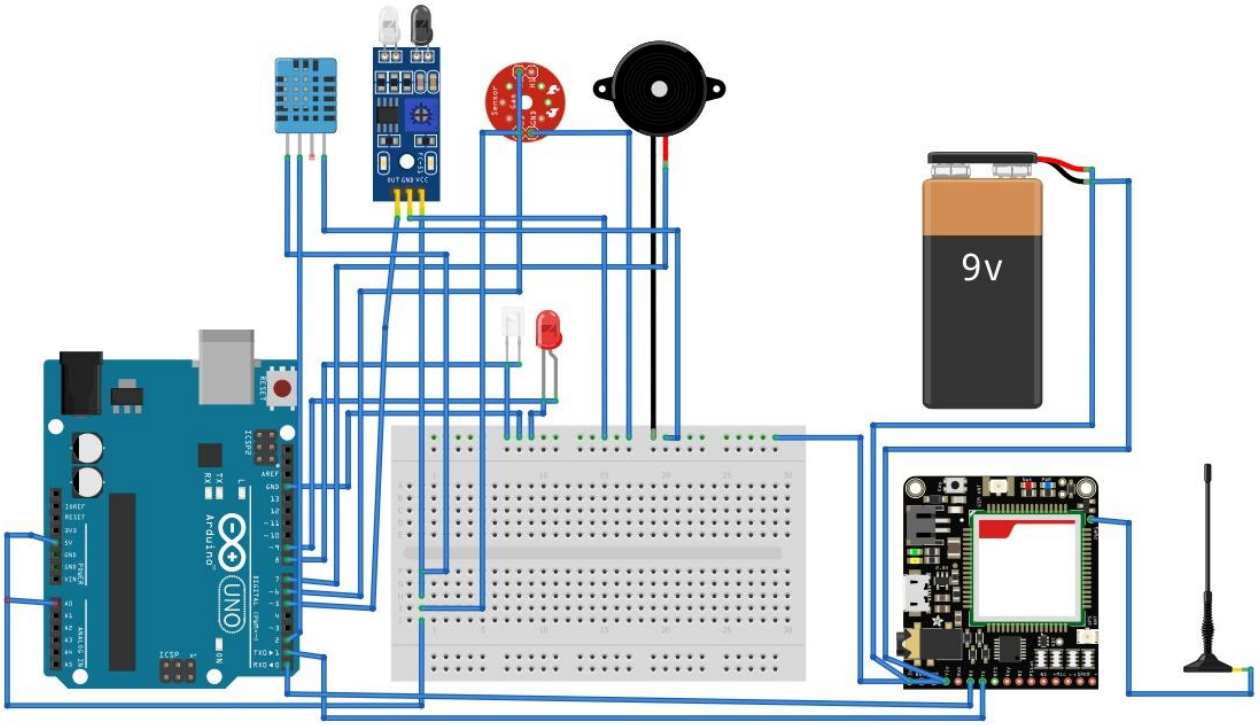


Components Used:

- Arduino Uno
- SIM808L GPS/GPRS Module
- 9 V Li-ion Battery
- Flame sensor
- Bread Board
- LEDs
- MQ135 sensor
- Jumper wires
- DHT
- Alarm Speakers
- Temperature and Humidity Sensor

<<Amazon links>>

Construction Steps:



1. Connect the sensors,LEDs and buzzer to the Digital Input pin of Arduino Uno.
2. Connect the SIM808L to the Arduino Uno.
3. Supply separate power to SIM808L module as it works in 3.4-4.2V DC.
4. 5V DC external supply is given to Arduino Uno.

After successful completion of hardware as shown in the above circuit diagram, the IoT platform needs to be set up, where the real-time data will be received. Here Thingspeak is used to store the parameters and show them in GUI. For creating an account in Thingspeak follow the steps below:

Step 1: Sign up for Thingspeak

First, go to https://thingspeak.com/ and create a new free Mathworks account if you don't have a Mathworks account before.

Step 2: Sign in to Thingspeak

Sign in to Thingspeak using your credentials and click on “New Channel”. Now fill up the details of the project like Name, Field names, etc. Then click on “Save channel”.

Step 3: Record the Credentials

Select the created channel and record the following credentials.

- Channel ID, which is at the top of the channel view.
- Write API key, which can be found on the API Keys tab of your channel view.

Step 4: Add widgets to your GUI

Click on “Add Widgets” and add four appropriate widgets like gauges, numeric displays, and indicators. In my case, I have taken the Indicator for Fire Alert. Select appropriate field names for each widget.

Conclusion:

The major strategies to prevent extraordinary calamities, natural disasters, and harm to the social and natural environment are early warning and prompt response to a fire outbreak. Therefore, quick and accurate detection and fire restriction are the most important goals in flame observation. When the starting location is known and the fire is still in its early stages, it is significantly easier to put it out.Information regarding the spread of fire is also extremely beneficial for putting out the fire at all stages. Using the necessary firefighting equipment and vehicles, the firefighting staff can be directed to focus on preventing the fire from reaching social legacy destinations and quickly putting it out.

Planning:

S.No.	Date to complete	Items	Status	Remarks
1	14/04/2022	Problem Statement final	Done	
2	15/04/2022	Abstract readiness	Done	
3	15/04/2022	Hardware List submission	Done	
4	20/05/2022	Project Report updates	Done	
5	04/06/2022	Code submission	Done	
6	28/06/2022	Updated Abstract Submission	Done	
7	28/06/2022	ppt submission	Done	
8	28/06/2022	PoC clip submission	Ongoing	

SECTION-II

Innovation:

The already existing system or the system that has been used currently in detecting forest fire is not efficient enough to detect the fire in the initial stage. It can detect only when the fire is widely affecting the forest. This caused many damages. But the cost of these devices are very high. These are not making use of the IOT that is the main disadvantage of these systems. If it makes use of the IOT it can detect and warn the fire in the early stages.

In this project,we are going to determine the fire intensity using Byram's formula and categorize the extent of forest fire based on which a pre-recorded video link of the fire-level is sent to the authorities.

The extent of a forest fire is classified into 3 stages:

1.Ignition(Low)

2.Growth(Medium)

3.Fully developed(High)

Bayram's formula:

$I = H\,w\,R$ ***Equation 1***

where:

I = fireline intensity (kW m^{-1})

H = heat yield of the fuel consumed (kJ kg^{-1})

w = amount of fuel consumed (kg m^{-2})

R = forward rate of spread of the fire (m s^{-1})

We know that,

- Intensity is directly proportional to Temperature.
- Intensity is directly proportional to Concentration of CO2 present in the air.

- Intensity is inversely proportional to Relative Humidity of the atmosphere.

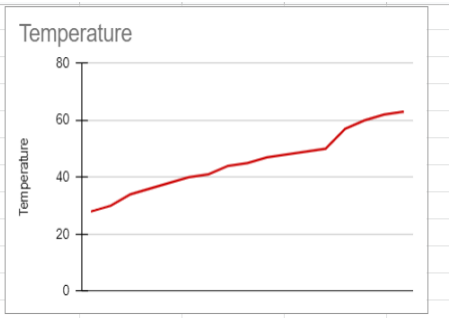
Thus using the concept of Byram's Formula, we have extended the formula as follows:

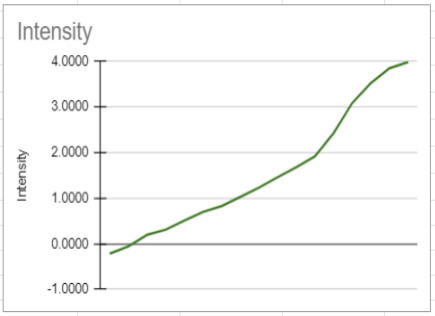
I = [(T * C * k) / H] - 1.2

where,

T= Temperature (in degrees celsius)
C= Concentration of CO2 present in the air(in ppm)
H= Relative humidity of the atmosphere (in RH)
k= proportionality constant
= 5.397 x 10^{-3} (RH per ppm per degree celsius)

Data sheet for the Intensity of Forest Fire						
S.No	Humidity	Temperature	CO2 concentration	Intensity	Stage of forest fire	Level
1	69	28	450	-0.2145	0	No Fire
2	68	30	480	-0.0571	0	No Fire
3	67	34	510	0.1968	1	Ignition
4	67	36	520	0.3079	1	Ignition
5	66	38	550	0.5091	1	Ignition
6	66	40	580	0.6971	1	Ignition
7	65	41	595	0.8255	1	Ignition
8	64	44	600	1.0263	2	Growth
9	64	45	640	1.2287	2	Growth
10	63	47	660	1.4574	2	Growth
11	63	48	700	1.6784	2	Growth
12	62	49	730	1.9137	2	Growth
13	61	50	820	2.4275	3	Fully Developed
14	61	57	850	3.0866	3	Fully Developed
15	60	60	875	3.5224	3	Fully Developed
16	59	62	890	3.8476	3	Fully Developed
17	59	63	900	3.9866	3	Fully Developed





Future Enhancements:

In the future, we can use this model to reduce the energy consumption of all sensors, as well as create a machine learning model to predict forest fires. Industrial sensors can also be used to improve ranging and accuracy. We can also add a wind sensor to the system, which will help us determine the direction of the fire and its rate of spread. In addition, we can install an automatic fire extinguisher system. The extinguisher is activated as soon as a sensor detects fire.