FOREST FIRE DETECTION SYSTEM

[Document subtitle]

ABSTRACT

Forest fires are one of the problems that threaten sustainability of the forest. Early prevention system for indications of forest fires is necessary. The extent of the forest to be one of the problems encountered in the forest condition monitoring. To overcome the problems of forest extent, designed a system of forest fire detection system by adopting the Wireless Sensor Network (WSN) using multiple sensor nodes. Each sensor node has a microcontroller, transmitter/receiver and three sensors. Measurement method is performed by measuring the temperature, and humidity of each region in forest area and analyze them to predict the fire.

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Introduction

Nowadays, wireless sensor networks (WSNs) have been used in enormous applications for data collection in an unfriendly environment. Forest fire makes vast hazard to the consuming plant of the world. To preserve the forest from fire, sensor nodes monitor the environment temperature. If the temperature is increased and it exceeds the threshold, the sensor sends the notification message to the fire monitoring system.

Project Idea

In this project, a forest fire detection system is implemented using temperature and humidity sensors (DHT11), taking the readings of these sensors using node MCU module(esp-8266) then passes the inputs to ThingSpeak to visualize and store the readings then apply the algorithm to detect the fire. Thingspeak is IOT analytics platform. In future work, we plan to replace the algorithm we use with an artificial intelligence algorithm.

Project Architecture:

Suppose the figure shown represents a forest

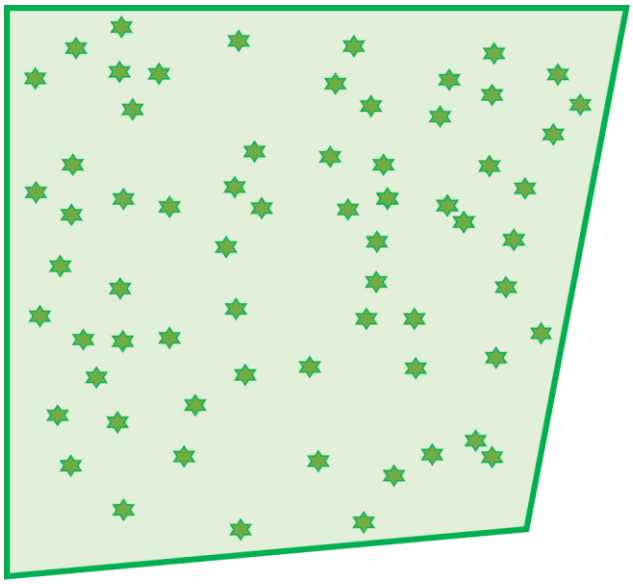

Figure 1 Forest Example

According to researches, the effective region of the temperature sensor DHT11 is 60 cm as shown in table (1). Thus, in the proposed methodology, we will place the sensor at the center of a circle of radius 60cm as shown in fig(2).

Table 1. Forehead temperature T(C) of subject C.

Distance (cm)	T(A) ℃	T(O) ℃	T(C) ℃
0	33.3	33.37	33.43
10	33.3	33.11	33.33
20	33.3	32.87	33.40
30	33.3	32.70	33.24
40	33.3	32.32	33.34
50	33.3	31.82	33.44
60	33.3	31.32	33.32

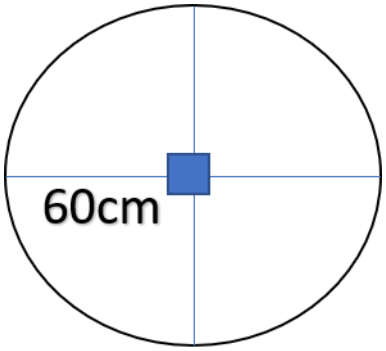

Figure 2 Sensor placement relative to the region

Consequently we will divide the forest shown in fig(1) into circular regions of radius 60cm. Moreover, we will make each two neighboring regions intersect each other at half the effective distance (ie.30cm). In this way, if one sensor stopped working, it doesn't affect the detection system. In other words, if one sensor stopped working, the neighboring sensors will still sense the fire in the neighboring region as shown in fig(3).

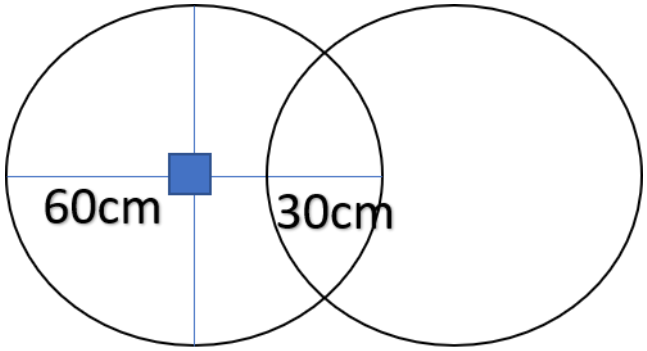

Figure 3 Regions' intersection

By applying the above mentioned, the forest in fig(1) will be as shown below.

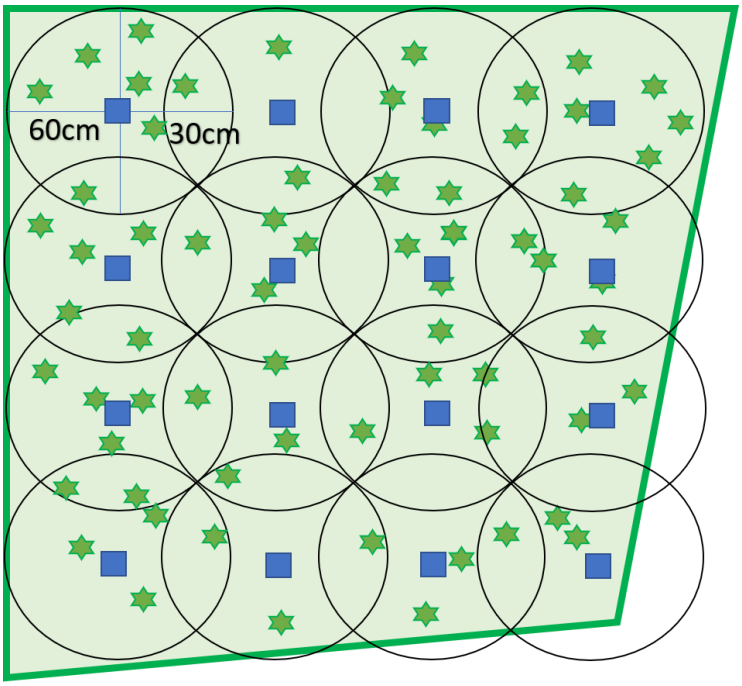

Figure 4 Final project architecture

Fire Detection Algorithm:

The detection algorithm periodically calculates the average temperature of each 5 consecutive readings, then compare each group of readings with its previous one. The difference between each two consecutive groups is the deviation amount. If the deviation amount is more than normal, the system predicts a fire and sends the deviation amount which represents the intensity of the fire.

Implementation:

Fig(5) and fig(6) shows the prototype of the aforementioned architecture illustrating a sample of the circular regions and sensors placement and distribution.

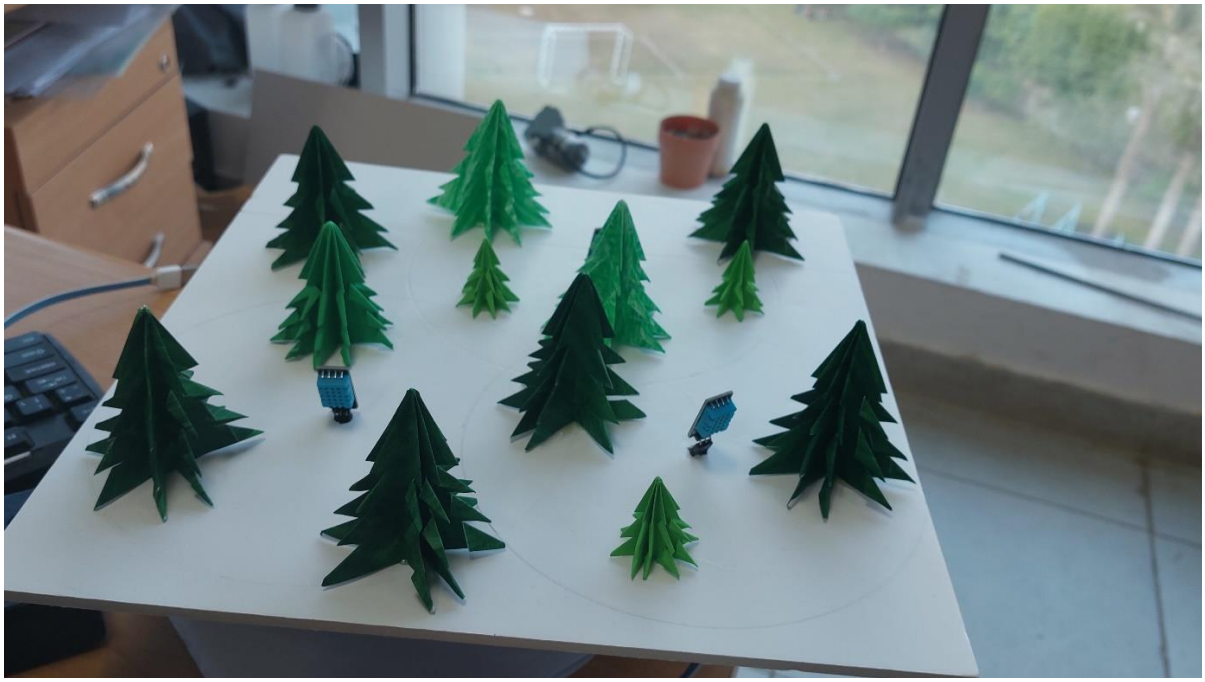

Figure 5 Project Implementation

Figure 6 Project Implementation (top view)