Implementation of Forest Fire Detection System using IoT and Neural Network

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Abstract -_Natural disasters have always been mankind's constant companion since time immemorial. Forest fire is one such disaster which when occurs at large scale not only destroys the flora, fauna, and vegetation of the forest but also puts the life of human being and animals at a very high risk. In the recent past years, managing this type of crisis, viz., a large scale fire has become a very difficult and challenging task. Things that are common in most of the forest fire that occur at large scale are loss of life (human or animal), loss of vegetation, loss of flora and fauna, and communication failure. Therefore, a comprehensive survey on the existing forest fire detection and monitoring mechanisms is highly desired. This article is aimed at providing a bird's eye view of these existing detection and monitoring mechanisms for forest fires._

Keywords: **Forest Fire detection, Monitoring, Wireless sensor networks, Sensors.**

1. INTRODUCTION

Forests are the protectors of earth's ecological balance. Unfortunately, the forest fire is usually only observed when it has already spread over a large area, making its control and stoppage arduous and even impossible at times. The result is devastating loss and irreparable damage to the atmosphere (30% of carbon dioxide(CO2) in the atmosphere comes from forest fires), in addition to irreparable damage to the ecology (huge amounts of smoke and carbon dioxide(CO2)in the atmosphere).Among other terrible consequences of forest fires are long-term disastrous effects such as impacts on local weather patterns, global warming, and extinction of are species of the flora and fauna.

Monitoring of the potential risk areas and a nearly detection of fire can significantly shorten the reaction time and also reduce the potential damage as well as the cost of fire fighting

2. LITERATURE SURVEY

[1]Sarwar, Barera et al. "An Intelligent Fire Warning Application Using IoT and an Adaptive Neuro-Fuzzy Inference System." Sensors *(Basel, Switzerland)* vol. 19,14 3150. 17Jul. 2019, doi:10.3390/s19143150In the recent past, a few fire warning and alarm systems have been presented based on a combination of a smoke sensor and an alarm device to design a life-safety system. However, such fire alarm systems are sometimes error-prone and can react to non-actual indicators of fire presence classified as false warnings. There is a need for high-quality and intelligent fire alarm systems that use multiple sensor values (such as a signal from a flame detector, humidity, heat, and smoke sensors, etc.) to detect true of fire.

[2]Saeed F., Paul A., Rehman A., Hong W.H.,SeoH. IoT-Based Intelligent Modeling of Smart Home Environment for Fire prevention and Safety. J. Sens. ActuatorNetwork. 2018;7:11.doi: 10.3390/jsan7010011[5]

Fires usually occur in homes because of carelessness and changes in environmental conditions. They cause threats to the residential community and may result in human death and property damage. Consequently, house fires must be detected early to prevent these types of threats. The immediate notification of a fire is the most critical issue in domestic fire detection systems. Fire detection systems using wireless sensor networks sometimes do not detect a fire as a consequence of sensor failure. Wireless sensor networks (WSN) consist of tiny, cheap, and low-power sensor devices that have the ability to sense the environment and can provide real-time fire detection with high accuracy.

[3]Manolakos E., Logaras E., Paschos F. Wireless Sensor Network Application or Fire Hazard Detection and Monitoring. Lecture Notesof the Institute for Computer Sciences. Soc. Inform. Telecommunication. Eng. 2012;29:1–15.[6]

Hazard detection systems are sophisticated tools that can help us detect and prevent environmental disasters. The role of a well designed environmental hazard detection system based on a Wireless Sensor Network (WSN) is to continuously monitor and report the environment's status by sampling relevant physical parameters (e.g. adapteddynamically to the criticality of the current situation, so that precious energy is conserved as much as possible and communication bandwidth is not wasted, both preconditions that need to be met for a scalable WSN application.

[4]Soliman H., Sudan K., Mishra A. A Smart Forest Fire Early Detection Sensory System, Another Approach of Utilizing Wireless Sensor and Neural Networks;

Proceedings of the IEEE SENSORS 2010 Conference; Kona, HI, USA. 1–4 November 2010[7]

In this paper, we analyze the potential of combining wireless sensor networks with artificial neural networks (ANNs) to build a "smart forest-fire early detection sensory system" (SFFEDSS). We outline our new SFFEDS system in which temperature, light and smoke data from low-cost sensor nodes spread out on the forest bed is aggregated into information.

[5]Sowah R., Ampadu K.O., Ofoli A., Koumadi K., Mills G.A., Nortey J. Design and Implementation of a Fire Detection and Control System for Automobiles using Fuzzy logic; Proceedings of the IEEE IndustryApplications Society Annual Meeting; Portland, OR, USA. 2–6 October 2016.[8]

Typical fire monitoring and warning systems use a single smoke detector that is connected to a fire management system to give early warnings before the fire spreads out up to a damaging level. However, it is found that only smoke detector-based fire monitoring systems are not efficient and intelligent since they generate false warnings in case of a person is smoking, etc. There is need of a multi-sensor based intelligent and smart fire monitoring system that employs various parameters, such as presence of flame, temperature of the room, smoke, etc. To achieve such a smart solution, a multi-sensor solution is required that can intelligently use the data of sensors and generate true warnings for further fire control and management.

3. EXISTING SYSTEM.

Authorities Fire Suppression and Detection Techniques

The most frequently used fire detection and suppression techniques employed by authorities can be summarized as follows: (i) controlled burning

(ii) Fire weather forecasts and estimates of fuel and moisture

(iii) watchtowers

(iv) optical smokedetection

 (v)lightning detectors which detect the coordinates of thestrike

Optical Sensor and Digital Camera:Two different types of sensor networks are available for fire detection, camera surveillance and wireless sensor network. The development of sensors, digital camera, image processing, and industrial computers resulted in the development of a system for optical, automated early recognition and warning of forest fires.

4. PROPOSED SYSTEM

Forest fire detection using IoT and neural network. we designed sensor nodes for fire monitoring employing multi-sensors such as temperature, humidity, smoke, and flame.An Arduino UNO atmega328p micro-controller is used to embed the sensors. For gathering heat and humidity measurements, DHT22 is used which gives us two important measurements required for a smart fire monitoring system. The LED light shows the presence of fire.

Fig-1 Smoke sensor used in the proposed system.

The MQ-7 Gas Sensor is used for the proposed system which is sensitive to carbon monoxide. Carbon monoxide results in a burning process. Its output boots with the concentration of CO level. It Can detect CO anywhere from 20 to 2000 ppm.
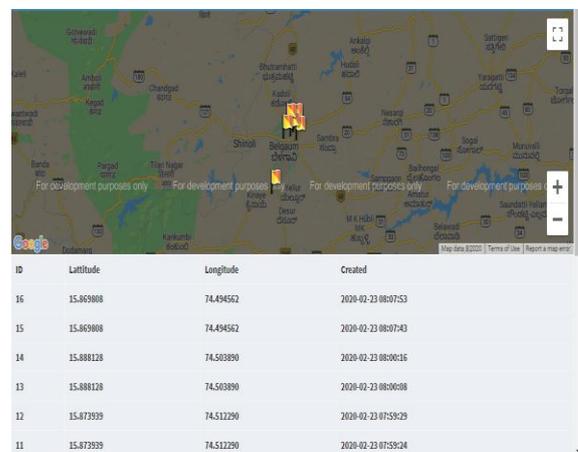

Fig-2 Main pageof the website

The above image shows the picture of our website's mainpage.we have shown the icon to indicate the places where the fire occur.we have also shown the longitude and latitude of the places ,by entering the latitude and longitude we can supervise the areas.
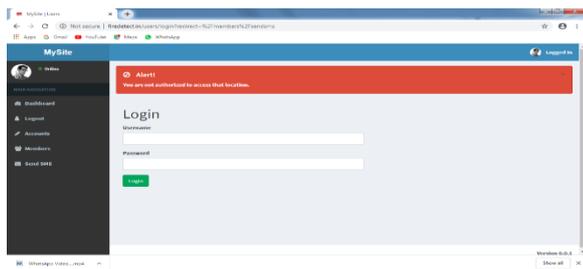
Fig-3 Login page of website

This is the login page of our project the dashboard contains the admin login and the user login. The admin can add number of users and only authorized users can access the website and the messages are sent only to the authorized persons. Authentication is done for the user.

5. CONCLUSION

This paper proposed an intelligent and smart fire warning system for forest. This system not only analyses the fire presence, but also notifies the concerned people for severe fire chances in case of an emergency or critical situation. ANFIS architecture model makes the proposed system more efficient, robust and reliable; and reduces false alarms; the proposed system used easily available, lightweight and cost-effective sensors and is more reliable than conventional fire detection systems.

REFERENCES

[1]Sarwar, Barera et al. "An Intelligent Fire Warning Application Using IoT and an Adaptive Neuro-Fuzzy Inference System." Sensors (Basel, Switzerland) vol. 19,14 3150. 17 Jul. 2019, doi:10.3390/s19143150

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