IBM NAALAIYATHIRAN PROJECT

DOMAIN: ARTFICIAL INTELLIGENCE

TITLE: EARLY DETECTION OF FOREST FIRE

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ABSTRACT:

Forest fires are one of the major environmental concerns, each year millions of hectares are destroyed over the world, causing economic and ecological damage as well as human lives. Thus, predicting such an environmental issue becomes a critical concern to mitigate this threat. Several technologies and new methods have been proposed to predict and detect forest fires. The trend is toward the integration of artificial intelligence to automate the prediction and detection of fire occurrence. This paper presents a comprehensive survey of the machine learning algorithms based forest fires prediction and detection systems. First, a brief introduction to the forest fire concern is given. Then, various methods and systems in forest fires prediction and detection systems are reviewed. Besides works that reported fire prediction and detection systems, studies that assessed the factors influencing the fire occurrence and risk are discussed. The main issues and outcomes within each study are presented and discussed.

INTRODUCTION:

There are many concerns in automatic fire detection, of which the most important ones are about different sensor combinations and appropriate techniques for quick and noise-tolerant fire detection. Researchers have been studying fires taking place in various places such as residential area (Milke and McAvoy 1995), forest (Yu, Wang et al. 2005; Bagheri 2007) and mines (Tan, Wang et al. 2007) to find some solutions for fire monitoring. An important issue in automatic fire detection is separation of fire sources from noise sources. For the residential fires, being flaming or non-flaming (smouldering smoke fires), the general trend is to focus either on the sensor and sensor combinations or detection techniques. In another word, researchers have ocused either on identifying the best set of sensors which collaboratively can detect fire using simple techniques (Milke and McAvoy 1995; Milke 1999; Cestari, Worrell et al. 2005) or on designing complex detection techniques that use single or at best very small set of simple sensors (Okayama 1991; Thuillard 2000). Several decades of forestry research have resulted in many advances in field of forest fire monitoring. The Fire Weather Index (FWI) system being developed by the Canadian Forest Service (CFS; Bagheri 2007) and the National Fire Danger Rating System (NFDRS) introduced by the National Oceanic and Atmospheric Administration (NOAA; Yu, Wang et al. 2005) are two examples of such advances. Studying the state-of-the-art techniques reveals two main trends in fire detection, i.e., existing

techniques have either considered fire detection as an application of a certain field (e.g., event detection for wireless sensor networks) or the main concern for which techniques have been specifically designed (e.g., fire detection using remote sensing techniques). The rest of this paper is organised as follows. Section 2 presents related work on residential fire detection. Section 3 introduces some indices for forest monitoring. Section 4 reviews contribution of wireless sensor networks (WSN) for fire detection that may occur in any places. In Section 5 some conclusions are drawn.

LITERATURE REVIEW

The idea of this research is to fabricate a system through IoT sensors, which is arbitrarily spread in the forest and to make a self-sorted out powerful system between the sensors to cover all the enormous territories in the forest that will used to maintain a strategic distance from the fire harm whenever. The capacity of the sensor is to identify fire in the inclusion region between the time intermission of each 5-10 minutes. At the point when the fire is recognized the entirety of the sensor in the region will be dynamic and order to stop the normal assignment. The concept is to build early fire detector using Arduino which is connected with different IoT sensors. Putting all efforts to develop a smarter system by connecting it to a webpage and monitoring the developed system statistics controlled by the Arduino programming. The use of latest technology can help to prevent the catastrophic accidents in forests. The aim is to early detect the fireplace in forest by considering the several factor like smoke, temperature, humidity, flame and based on the data we get from this programming, the forest department will be able to take an appropriate decision and the rescue team will be able to arrive on time at exact location. Consider, if it is a large region and it produces more carbon monoxide than the ordinary vehicle traffic. Surveillance of the danger areas and an early detection of fireplace can appreciably shorten the response time and additionally decrease the practicable injury as nicely as the fee of firefighting. Known rule applies here: 1 minute – 1 cup of water, 2 minutes - 100 liters of water, 10 minutes - 1000 liters of water. The goal is to notice the fireplace as quicker as possible, its actual localization and early notification to the fire devices. When fire starts then the flammable texture may likewise issues fuel to the hearth focal spot. The spot at that point will expand and more extensive. The first phase of start is alluded as "surface fire‟ stage. This may feed on abutting bushes and the fire will turn into higher and transforming into "crown fire‟. Generally, at this stage the hearth transforms into wild and injury which end up being extreme that could stay for quite long time while depending on atmosphere

conditions and the territory. Forest fire detection using optimized solar–powered ZigBee wireless sensor networks- In this paper, they have developed system for Forest Fire Detection which overcomes the demerits of the Existing technologies of Forest Fire Detection. It can be ensured that the system developed can be implemented on a large scale with its promising results. The system is provided with low-power elements, higher versions of Zigbee, Maximum power point tracking Algorithm is used in order to make the system run for longer periods efficiently. Forest fires are a very serious problem in many countries, and global warming may contribute to make this problem worse. Experts agree that, in order to prevent these tragedies from happening, it is necessary to invest in new technologies and equipment that enable a multifaceted approach. This paper describes a WSN for early detection of forest fires. This network can be easily deployed at areas of special interest or risk. There are two types of nodes from the physical structure point of view: SNs, to collect data from the environment, and CNs, to gather data from the SNs and transmit the information to a Control Centre. The nodes also can be in different functioning modes. This enables a proper and seamless configuration of the network, provides redundancy, and ensures there will be full temporal and geographical coverage in the deployment zone. The information gathered is related not only to early detection purposes but also to environment monitoring to maximize the WSN usage. This environmental data can also be employed to firefighting preventive tasks such as vegetation modelling, microclimate studies, and propagation model parametrization.In this paper, a forest fire detection algorithm is proposed. The algorithm uses YCbCr color space since it effectively separates luminance from chrominance and is able to separate high temperature fire center pixels because the fire at the high temperature center region is white. The final results show that the proposed system has good detection rates and fewer false alarms, which are the main crucial problems of the most existing algorithms.The presences of fire in video streams are indicated by semantic events. Most of the existing systems can only be used for the videos obtained from stationary cameras and videos obtained from the controlled lightening conditions. These existing automatic fire detection systems cannot be used for video streams obtained from mobile phones or any hand held devices.

CONCLUSION

In this paper previous work in fire detection domain were surveyed from different perspectives. Our interest for this literature survey is to identify which sensor combinations and algorithms can detect fires accurately and quickly. The

general conclusions that can be drawn are as follows:

- In residential areas ION detectors are advantageous for flaming fire detection, while photo detectors are beneficial for nonflaming fire detection. However, to achieve more reliable and fault-tolerant results and higher detection rates more than one sensor should be used. This assures that flaming and nonflaming fires can be discriminated.

- Although temperature sensors are probably the simplest and the most obvious sensors for fire detection, studying various sources in this field reveals that all researchers agree on the fact that it alone cannot accurately indicate fire and gas (e.g., CO, CO2) concentrations are main features for fire detection.

- Fire Weather Index (FWI) and other indices resulted from several decades of forestry research can be used as strong indications for forest fire detection.

- The WSN community needs to use the general knowledge about fire patterns, best combination of sensors and appropriate detection techniques from the fire-related disciplines. It is apparent that selection of sensors was often carried out randomly or assumption-basely.