Forestry Fire Prevention Detection and Emergency Command System Based on Internet of Things and Infrared Light Sensing Technology

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Abstract: *Forest fire is a sudden, destructive and difficult natural disaster, which not only burns a lot of forests, but also harms the animals in the forests, and also reduces the forest's reproductive capacity, causing the soil to be barren, destroying the forest's water conservation and even causing the ecological environment to lose balance. The forest is harmful and difficult to extinguish, so it is particularly important to extinguish the fire immediately when it is still in the bud. However, because the fire often originates in the deep mountains and forests, it is difficult to find it, so it is of great significance to find out the fire for early extinguishing. Compared with the construction of watchtower and video surveillance system, the establishment of new intelligent early warning system can realize the intellectualization and informatization of forest fire prevention, and can detect and extinguish the fire in the early stage of fire.*

Keywords: *Internet of Things, Infrared Light Sensing Technology, Forest Fire, Fire Alarm System*

1. The subject content

1.1 Present situation of Forestry

According to the data, the annual average number of forest fires in the world reaches more than 220,000 times, with a large number of damaged areas, accounting for 0.1% of the total forest area in the world. Coupled with the aggravation of global warming, the occurrence of forest fires is getting worse and worse, which has become a global problem. Therefore, effective measures must be taken to prevent and put out forest fires in different areas, so as to reduce the occurrence and loss of forest fires. People's awareness of forest fire prevention is progressing with the development of the times. In terms of forest fire prevention, every country has continuously invested manpower and financial resources, and constantly improved high-tech has begun to be applied to forest fire prevention. At present, some countries have begun to apply modern forest fire prevention management to forest fire prevention. For example, Germany, Switzerland, Finland and other countries not only vigorously publicize forest fire prevention knowledge to improve people's literacy, but also make full use of modern science and technology, and make good use of scientific and technological products to control and manage forest fire prevention. In recent years, many scholars and enterprises in China have also explored the establishment of remote video surveillance and early warning system, forming a relatively mature theoretical system and practical products. The most common one is the remote video monitoring and early warning system of forest fire prevention. Through the construction of the remote video monitoring and early warning system of forest fire prevention, it can provide more comprehensive information about forest fires, which is beneficial for professionals to study the corresponding fighting methods. The establishment of this method will be more conducive to mastering the actual situation of forest fires, and will play an important role in continuously improving the level of forest fire prevention, preventing forest fire prevention and taking auxiliary measures.

1.2 Source of the Subject

With the development of science and technology and people's emphasis on forestry, the traditional low-efficiency artificial forest fire prevention can no longer meet the needs of forestry fire prevention in reality. On the basis of using infrared sensing technology and target detection, combined with advanced Internet of Things and big data technology, this paper has created an intelligent detection,

early warning and emergency command system for forest fire prevention based on Internet of Things and infrared light sensing technology. The system integrates remote intelligent monitoring systems such as video monitoring, resource management and intelligent early warning, and integrates geographic information (GIS), intelligent image recognition technology and large-scale centralized monitoring technology. The online big data visualization platform is developed, which can provide accurate information query for forest fires in fire prevention planning, decision-making, management and other aspects, and can query the location and situation of forest fires in the first time, which is conducive to taking reasonable measures to deal with forest fires in time. Intelligent forest fire prevention early warning and emergency command system is the latest fire prevention monitoring platform designed by Internet of Things technology. This system is a high-tech product, which focuses on forest fire monitoring, and comprehensively applies GIS technology, far infrared thermal imaging technology, digital image processing technology and other high-tech technologies to forest resource management. The system is applied in the field of emergency management of urban public safety, which can really realize early detection and early solution, thus reducing the economic loss caused by fire and its occurrence to the greatest extent.

1.3 Significance

Forest fire is one of the most important forestry disasters in the world. With the continuous development of afforestation in China, fire prevention has become the primary task. The intelligent detection, early warning and emergency command system of forest fire prevention based on the Internet of Things and infrared light sensing technology can effectively implement the policy of "putting prevention first and actively putting out fires", and can truly realize early detection and early resolution of fires. Realizing the modernization and facilitation of forest management has greatly maintained the security of forest, and can effectively reduce casualties and property losses.

2. Establishment of Forest Fire Prevention Remote Video Monitoring and Warning System

2.1 Overview of Early Warning and Monitoring System

The forest fire warning and monitoring system requires that GIS and other technologies should be combined with computer technology to be applied to fire monitoring. Through GIS technology, all positions in the forest can be located, and through computer technology, all kinds of information such as location can be transmitted. Finally, when a forest fire happens, it can be perceived and dealt with in time, so as to reduce the harm caused by the fire.

2.2 System Architecture

The design of forestry remote video monitoring and early warning system applies advanced fire prevention technology to detect forest fires, mainly combining advanced science and technology such as GIS technology, digital image processing technology, nanometer wave filter technology, etc. There is a corresponding address code in the front-end collection station. When there is a suspected fire, the positioning pan/tilt will transmit the collected data to the GIS system, and then the location of the fire will be clear. At the same time, the system will start the corresponding background SMS publishing platform, and the fire situation will be notified to the specific leaders and work assignments. The disaster relief personnel can set up the isolation belt accurately according to the provided status, and the leaders can make timely command and dispatch for the fire fighting work according to the situation in the surveillance video. In addition, the system can also transmit the collected data to the fire control command center in the form of digital monitoring, and use GIS technology to locate the fire area, so as to make an accurate judgment and analysis, which plays an important role in better formulating fire fighting methods and controlling the fire. We should also pay attention to the storage of data and materials, so as to facilitate the better processing of data, which can provide an effective reference for the next construction of fire warning system.

2.3 System Composition

Forest fire early warning monitoring system is mainly composed of meteorological satellite remote sensing monitoring service station and Yuntai base station. The function of the meteorological remote sensing monitoring service station is to collect remote sensing information, monitor the weather at the

same time, and transmit the above two kinds of information to the relevant personnel through the corresponding interfaces, so as to provide reference for the fire grade forecast and the location of the fire. The function of the base station is to realize the video monitoring of the forest. Through the video positioning interface, the monitoring information can be converted into geographic data and transmitted to relevant personnel, so as to provide a reference for making the geographic model of the fire place. The forest fire prevention monitoring and early warning system consists of forest system transmission, front-end monitoring and terminal management platform. Among them, forest system transmission mainly includes wired transmission, control cable and coaxial cable transmission. Short-term monitoring includes acquisition and positioning system, power supply system, transmission system, equipment placing system and lightning protection grounding system of base tower; Terminal management platform mainly includes geographic information system, automatic identification of forest fireworks, digital video management system, alarm system, UPS power supply, etc.

2.4 Design of Front-End Acquisition and Positioning

Because the occurrence of forest fire is sudden, it is necessary to select an appropriate camera when designing a remote video monitoring and early warning system for forest fire prevention, which can carry out 24-hour and 360 comprehensive monitoring. Choose the equipment that meets the needs of forestry fire prevention. Usually, infrared thermal imager and CCD camera are used. The specific choice should be based on the actual situation, and the most suitable camera should be used. The short collection before the forest fire monitoring is generally set up in high mountains, and the environment is rather harsh. The selection requirements of the outdoor variable-speed positioning revolving tripod head are higher, and the functions of lightning protection, wind resistance, positioning, waterproofing and corrosion protection should be taken into account. Pay attention to the construction of lightning protection grounding, for direct lightning strike, lightning wave intrusion and lightning electromagnetic pulse interference.

(1) Base station positioning

A base station is a station that can exchange signals. Cell phones can receive signals, and making phone calls is through cell phone base stations. These base stations are built by national mobile communication operators, such as China Mobile, China Unicom and China Telecom. The principle is as follows: the distance between the two is judged by the signal strength of different base stations received by the mobile phone. Of course, the location information of the base station is already known, so the location of the mobile phone is known. The premise is that the mobile phone must be registered with the SIM card. Because the mobile phone signal will be interfered, the positioning accuracy of the base station is low. Moreover, the accuracy is also affected by the density of the base station. The greater the density, the more accurate it is.

(2) WiFi positioning

WiFi is a technology of wireless internet access. Usually, the mobile phone can be located without the WiFi function. The general principle is that the WiFi signal is detected by the device, and the database records the corresponding location of the WiFi signal and the device. When it is detected by more and more devices, its location can be obtained by some algorithm using these data. As the signal decreases with the increase of distance, the distance between the two can be calculated according to the WiFi signal strength acquired by the device. Knowing the surrounding points and the distance between them, it is not difficult to calculate the location of the equipment to be located. WiFi positioning was put forward by Google, which mainly solved the problem of indoor positioning. The disadvantage is that when a WiFi moves, the database is not updated in time, and the positioning is inaccurate.

3. Technological Innovation

3.1 Foreign Technology

Innovation This system introduces the international advanced fire prevention technology, and provides the international quality and stable forest fire prevention monitoring system at the domestic price level. The system is a high-tech product, which focuses on forest fire monitoring and comprehensively applies GIS technology, far infrared thermal imaging technology, digital image processing technology and other high-tech technologies to forest resource management. At present, the international advanced long-distance fog-penetrating camera system and far-infrared thermal imaging

system are used to realize long-distance day and night monitoring. The imaging technology of the system has stable performance and is not affected by weather and environmental factors. Adopting the mode of object temperature difference analysis and detection and automatic warning of critical temperature value of combustion, applying the built-in CPU calculation system with independent calculation function and the infrared temperature automatic induction temperature measurement module, using the difference between the temperature emitted by the object itself and the ambient temperature to automatically analyze, calculate and alarm; It can not only accurately judge the burning open fire, but also detect, identify and warn the dark fire in smoking state and the spontaneous combustion in high temperature state.

3.2 Remote Sensing Positioning

Forest fire warning and monitoring system has the function of remote sensing and positioning. This function of the system can be triggered by "Remote Sensing Location Interface", which can transmit information about the geographical coordinates of the fire place to realize the location of the fire place. The specific location process is as follows: the projection parameters of the fire place are obtained: the coordinates of the fire place, usually composed of longitude and latitude, are not displayed in height. The system can reflect the coordinates of the fire place by projection, and can immediately know the geographical location of the fire place by obtaining the projection parameters. Fire addition: the geographical coordinates of the fire place can be sorted out, numbered and stored in the system as a reference for future fire prevention work; Through the application of remote sensing positioning interface, the information around the fire site can be found, so that the fire situation can be more comprehensively understood.

3.3 Video Positioning

The forest early warning and monitoring system has the function of video positioning. The realization of this function needs to be supported by the function of Yuntai base station. The specific video positioning methods are as follows: In the fire early warning and monitoring system, Yuntai is usually embodied in three-dimensional form, that is, it can reflect the geographic coordinates composed of longitude and dimension, and at the same time, it can also reflect the value of height. The system can place the camera on the platform to realize the video monitoring of the fire site. On the basis of adhering to the Technical Specification for Forest Fire Prevention Video Monitoring System, the protection level of lens and camera protection warehouse should be controlled above IP67, so as to improve the video positioning effect in an all-round way; If there are multiple key fire prevention areas, Yuntai can integrate the parameters obtained from multiple areas with each other, and finally simulate the scene where multiple lines of sight meet, thus reducing the difficulty for workers to locate the fire through video; According to the requirements of Technical Specification for Forest Fire Prevention Video Monitoring System, the positioning error should be no more than 100m, and the early warning monitoring system should take this regulation as a benchmark to control the positioning error.

3.4 Fire Risk Rating

Through the detection of meteorological information, the forest fire risk grade can be judged. The specific methods are as follows: get meteorological information and store it in the system through the meteorological data interface; The fire risk rating calculation model is adopted, and the corresponding meteorological information is integrated to calculate and evaluate the fire risk rating.

3.5 Spread Analysis

Through the application of early warning and monitoring system, the spread trend of fire can be analyzed: parameter information can be obtained. Through the application of fire spread deduction model, integrating the weather information, wind force and humidity of the day, the fire spread trend is preliminarily evaluated. Through the use of the above information, the fire spreading trend is simulated, and then the fire extinguishing scheme is considered.

4. Summary

In a word, forestry carbon sequestration is a new concept put forward internationally in order to

reduce greenhouse gas emissions and improve the natural environment. At the same time, it is also a new development opportunity for forestry development, so we should pay attention to the concept of forestry carbon sequestration. China is a big developing country, and the international community also hopes that China will play a leading role in the process of emission reduction. Therefore, China has established the world's first forestry carbon sequestration project, and from the perspective of future economic development, China will also attach importance to the application of forestry carbon sequestration forest concept. Therefore, forestry practitioners should actively seize the opportunity of forestry development to promote the development of forestry. At present, the effect of forest resources protection in China is not ideal, the main reason is that in actual work, there will be problems of inadequate management. Among them, the biggest problem is that the effect of fire prevention management is not good, causing serious damage to the forest. In order to better solve the corresponding problems, it is necessary to start with forest fire prevention and improve the effect of forest resources protection by controlling fires. This paper expounds the related contents of forest resource protection and forest fire prevention management, in order to enhance the actual effect of forest resource protection and promote the healthy and orderly development of forests. People-oriented and ecologically livable forest fire is one of the most important forestry disasters in the world. With the continuous development of afforestation in China, fire prevention has become the primary task. The intelligent forest fire prevention early warning and emergency command system implements the principle of "prevention first, actively putting out fires", which can really achieve early detection and early resolution of fires. Realize the modernization and convenience of forest management, and greatly safeguard the public safety of the city.

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