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The application of Internet of Things technology in intelligent fire protection

Peihan Guo

Hebei University of Technology, Tianjin, 300401, China

1085790349@qq.com

Abstract. The uncertainty of fire and the difficulty of accurate prevention greatly increase the difficulty of fire prevention and control. Therefore, it is necessary to actively introduce modern science and technology, adopt fire Internet of Things (IoT) technology, realize remote dynamic monitoring, and accurately obtain fire prevention and control data information. This paper carries out an in-depth analysis on fire prevention and control, focusing on the application of fire IoT in the field of fire prevention and control. In addition, it specifically introduces the key technologies of intelligent fire protection, Radio Frequency ID, and the construction of fire safety models. At the same time, it describes the problems faced by the IoT in intelligent fire protection, that is, the quality of transmitted information is not strong, the speed of message transmission needs to be improved, and the application platform that is more conducive to the transmission of information needs to be built. By overcoming these issues, the future intelligent fire control system will be more intelligent and bring more convenience to people.

Keywords: Internet of Things Technology, Intelligent Fire Protection, Data Mining, Artificial Intelligence.

1. Introduction

The Internet of Things (IoT) technology is a comprehensive new technology that enables intelligent perception, remote monitoring, and fast response. The large-scale application of this comprehensive new technology is of great significance in various fields, especially in the field of fire prevention and control, which can effectively prevent and control the occurrence and spread of fire. It can not only significantly improve the level of fire prevention and control but also ensure the safety of people's lives and property, and then the harmonious development of society can be promoted. Through the application of fire Internet of Things technology, fire prevention and control has become more intelligent, automated, and efficient, providing strong support and guarantee for fire prevention. This paper mainly studies from three aspects, first is a brief summary of the Internet of Things, then is the specific application of the Internet of Things in the fire, such as development prospects, key technologies, and problems faced, and finally the future of intelligent fire is prospected. This paper plays a revelatory role in the research of the Internet of Things in the field of intelligent fire protection.

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2. Physical network technology introduction

2.1. Overview

At present, the necessity of acquiring and collecting logistics information data shows explosive growth. Due to the complexity of information data, the past data management technology can not adapt to the new situation of the IoT industry for rapid processing and accurate analysis of data development requirements, so intelligent processing technology based on big data emerges as the times require. This technology makes use of advanced data mining, machine learning, and artificial intelligence algorithms, which can effectively sort, filter, and analyze a large number of logistics information data. Using this technology, people can easily and quickly identify, retrieve, track, monitor, and manage products [1]. Therefore, there is a need to know more about IoT so that various data can be properly handled, operational efficiency can be improved, the value of IoT systems can be maximized, and the development of society and economy can be promoted.

The Internet of Things is a technical form with great social value developed based on Internet technology, which is mainly composed of a perception layer, a network layer, and an application layer. The role of each layer is different [2]. Each layer plays a different role in the overall system. Firstly, the perception layer is the foundation of the IoT, which is responsible for collecting and sensing various data in the environment. The perception layer monitors the information of the physical world in real time through technical means such as sensors and smart devices, and it processes and transmits the collected data. The main goal of the perception layer is to connect the real world with the digital world in order to better understand and control the environment. Secondly, the network layer acts as a connecting link in the IoT. It is responsible for transferring the data collected by the perception layer to the application layer and processing it. The design of the network layer enables various devices and systems to communicate and cooperate smoothly, which provides the basis for the operation of the Internet of Things. Through wireless communication, the Internet, and other communication technologies, the network layer can realize the transmission, routing, and management of data. Finally, the application layer is the top layer of the Internet of Things, which is the realization carrier of the application of the Internet of Things technology. The application layer utilizes the data and connection services provided by the perception layer and network layer to provide various functions and services to users. Whether it is a smart home, smart city, or industrial automation, the application layer plays a key role. It can realize the interconnection between devices, provide real-time monitoring, remote control, and data analysis functions, and provide users with a more intelligent, convenient, and efficient experience.

2.2. Application characteristics

In the development of modern society, the Internet plays a significant role in promoting the integration and sharing of information. Through the combination of the Internet and "things", "things" can realize information sharing to a certain extent, thereby promoting people's application of "things" and providing convenience for people's life and work. The application scope of the Internet of Things is very wide, covering almost all fields, including industry, agriculture, transportation, medical care, home, etc. IoT can play a role either in automated production lines in smart factories or soil moisture monitoring in smart agriculture. It can also connect a large number of objects to build a huge network. Through sensors and wireless communication technology, all kinds of devices and items can be connected to the IoT to achieve data collection and sharing. This feature of large-scale connectivity enables IoT to have powerful data processing and analysis capabilities. At the same time, IoT applications can process and transmit large amounts of data in a timely manner and can respond quickly. Since IoT is automated and intelligent, it can also improve work efficiency and resource utilization efficiency. For example, IoT applications can enable intelligent management and automatic control of equipment, improve production efficiency, and reduce energy consumption.

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3. Application in fire protection

3.1. Application and development status

The application of Internet of Things technology in the field of fire protection is promising. Through the use of advanced sensor technology, various fire-related information data can be collected efficiently. These sensors can be installed on various fire fighting equipment such as smoke alarms, flame detectors, and temperature and humidity sensors, in order to monitor fire and other fire risks in real time. After sensors collect data, these data can be transmitted to a central server using novel transmission facilities, such as wireless networks or IoT communication technologies. This central server can be located in the command center of the fire department or related agency, and fire personnel can remotely access and analyze these fire data through this central server. It can achieve alarm information push and timely send the alarm information of each system to the relevant personnel. It is convenient to confirm and deal with the automatic fire alarm, low liquid level, undervoltage, and other alarm events, thus improving the alarm processing efficiency [3]. The collection and transmission of sensor data can not only provide real-time information about the fire but also provide more information about the fire, such as fire size, type of burning material, and indoor and outdoor temperature and humidity. These data can help firefighters better understand the situation of the fire, so as to develop more effective fire-fighting and rescue strategies. In addition, IoT technology can also be used in combination with other smart devices and systems, such as intelligent fire hydrants and automatic water sprinkler systems. Through the collaborative work of sensors and Internet of Things technology, automatic coordination and cooperation between devices can be realized, making the fire protection system more intelligent and efficient. At the same time, using the Internet of Things to take reasonable fire emergency measures can not only help people understand the risk of fire and possible losses but also provide scientific guidance for fire prevention and extinguishment. It can also provide the basis for the establishment of the relevant guarantee legal system [4]. At present, although the application of the Internet of Things in social fire safety management exists, the practice of the current urban Internet of Things technology in social fire safety management has not achieved comprehensive technical coverage.

3.2. Key technologies

The Internet of Things technology is based on network technology. The core of this technology is the identification and communication of objects using electronic tag technology (Radio Frequency ID, referred to as RFID) [5]. RFID technology is a kind of wireless communication technology that can achieve data transmission and identification through radio waves. It can combine objects with electronic tags to realize the perception and interaction between objects. RFID tags are integrated into the object with a unique identification code and storage function. These tags can wirelessly communicate with the reader to transmit information about the object to the underlying network system. Based on RFID technology, the Internet of Things technology realizes the intelligence of objects through electronic tags on objects. Through the application of RFID technology, the object can realize wireless automatic identification and positioning, as well as real-time monitoring and tracking. For example, using RFID technology, goods can be tracked and managed to improve the efficiency of logistics transportation. In the practical application process of this technology, only some electronic tags with bar codes need to be pasted on fire equipment, and the relevant product models and parameters can be accurately identified.

The numerical model of social fire safety management is constructed. The corresponding model is divided into three layers: the perception layer, the transport layer, and the application layer. The sensing layer mainly consists of a series of devices with sensing capabilities, such as cameras, GPS, M2M sensors and terminals, sensor networks, and sensor gateways [6]. The devices in the perception layer sense various information in the environment, such as fire, smoke, temperature rise, etc., and the information is converted into digital signals. The camera can capture the fire scene in real time, the GPS can locate the specific position of the fire, and sensors can monitor various parameters of the fire, such as temperature and humidity. Through these devices, the occurrence and development of the fire can be quickly understood. The transport layer is responsible for transferring the data acquired by the

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perception layer to the application layer for processing and analysis. The transport layer can make use of wireless communication technologies, such as WiFi, Bluetooth, and LoRa, to transmit data to a designated receiving device or cloud platform. The main task of the transport layer is to ensure the stable and reliable transmission of data so that the application layer can obtain the data in time and make corresponding decisions. The application layer is responsible for making analyses and decisions based on the data provided by the perception layer and the transport layer. The application layer can use data mining, machine learning, and other technologies to process and analyze the data transmitted from the transport layer, extract key information from it, and make corresponding decisions based on this information. For example, when a fire occurs, the application layer can quickly determine the severity of the fire and take corresponding measures, such as automatic alarm and evacuation guidance. By building such a three-layer numerical model, the fire safety situation in society can be sensed in real time, and the efficiency and accuracy of fire management can be improved through data analysis and decision-making, so as to protect people's life and property safety.

3.3. Problems and matters that should be paid attention to

The development of the Internet of Things provides a broad space for fire supervision and management. Through the establishment of the fire management system, the government and fire department personnel can know the situation of each fire facility in real time and quickly respond to fire incidents. Although the fire control room is set up, in the actual management process, the management work is relatively one-sided, and it is difficult to achieve message exchange, which affects the quality of message transmission. Under the background of modern development, it is a great challenge for the government and fire department personnel to make full use of the Internet to build a complete fire supervision and management system [7].

In the application of Internet of Things technology in fire safety management, it is necessary to grasp the application points of Internet of Things technology and build the corresponding technical application platform. First of all, it is necessary to build high-speed and stable network communication equipment to ensure that the data transmission between devices is unimpeded. The installation and use of sensors, the construction of monitoring equipment, and intelligent terminals are all crucial for fire safety management. In addition, the improvement of the fusion infrastructure is also a crucial part. Through the fusion of all kinds of equipment, systems, and data, the integration and sharing of information can be realized, and fire safety management can be more efficient. Finally, the construction of innovative application infrastructure is a key link in the fire safety management of IoT. In short, focusing on the three directions of information infrastructure, integration infrastructure, and innovation infrastructure, laying out new infrastructure construction, and improving the construction of 5G base stations are the key aspects that should be paid attention to at present [8].

4. The prospect of smart fire protection

Intelligent fire protection contains diversified technologies such as communication and information of the Internet of Things, which can realize accurate positioning, monitoring, identification, and other functions. The use of fire Internet of Things technology can efficiently collect, process, and fuse fire information. With the use of fire Internet of Things technology, the fire warning system has the characteristics of network, information, and intelligence. Once the fire is found, it can automatically alarm and ensure the accuracy of fire data to solve the problems of missed reports and false positives in traditional systems [9]. The use of the intelligent fire control system can improve the efficiency of fire extinguishing: the intelligent fire control system can monitor and warn the fire in real time through the sensing device, analyze the spread of the fire and the characteristics of the fire source through the intelligent algorithm, and quickly and accurately determine the fire extinguishing strategy. At the same time, the intelligent fire system can also strengthen the fire fighting ability. It can provide the optimal evacuation path and rescue plan based on the real-time situation of the fire and the structure of the building through artificial intelligence technology. At the same time, it can deploy personnel and equipment resources, carry out fire rescue scheduling arrangements, and ultimately ensure that fire

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safety management is efficient and convenient, saving manpower, material, and financial resources. In summary, intelligent fire control has great development potential and broad prospects, which will make an important contribution to the improvement in fire prevention and control ability and ensure the safety of personnel life and property [10].

5. Conclusion

This paper reviews the application and development of Internet of Things technology in the field of intelligent fire control, points out the key technologies of Internet of Things technology in intelligent fire control, and focuses on the digital model of the social fire management system. At the same time, it points out the limitations of the current application platform in information transmission, and people should improve the construction of 5G base stations. Finally, it looks forward to its future development prospects, that is, it can provide more efficient and convenient fire service management for people. With the continuous innovation of Internet of Things technology and the increasing demand for intelligent fire protection, it is believed that the application prospect of the Internet of Things in intelligent fire protection will be broader. It is believed that driven by the Internet of Things technology, the intelligent fire system will make greater breakthroughs and progress in the future.

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