

Analysis of Internet of Things Technology and Its Applications

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Abstract—The rapid development of Internet of Things technology has an increasing impact on human life and work. With the rapid development of artificial intelligence and other technologies, the application of Internet of Things technology is more extensive and deep. This paper provides an overview of the meaning of IoT technology, introduces the application of IoT technology in intelligent environment, and expounds the far-reaching significance of IoT technology application.

Index Terms—Internet of Things; intelligent environment; artificial intelligence

I. INTRODUCTION

With the acceleration of globalization and the rapid development of information technology, the emergence of Internet of Things technology has had an important impact on the development of many industries. As an innovative information and communication technology, Internet of Things technology provides new opportunities and solutions for the construction and application of urban information systems, which effectively integrates physical and digital by connecting various devices, sensors and terminal devices, and brings great potential and opportunities for the construction and operation of urban information systems.

II. THE MEANING OF THE IOT

Internet of Things (IoT) is through a variety of information sensors, radio frequency identification technology, global positioning system, infrared sensors, laser scanners and other devices and technologies, real-time collection of any object or process that needs to be monitored, connected, interacted with, collect its sound, light, heat, electricity, mechanics, chemistry, biology, location and other information, through all kinds of possible network access, to achieve ubiquitous connection between things and things, things and people, to achieve intelligent perception of goods and processes. Identify and manage. Its process is to upload the data obtained by the "sensor" to the "cloud (network)", then the "artificial intelligence" makes judgments based on the learning content, and finally the object makes "actions", that is, feedback to "humans". Internet of Things technology is currently widely used in agricultural production, transportation, unmanned driving, social governance and other aspects, and people are generally exposed to smart life and smart home. Through the distributed voice and terminal application interaction of home appliance terminals, a smart housekeeping system centered

on user experience to serve smart life at home can be created, and 25 scenarios covering food management, living room socialization, and sleep management in 7 living areas such as kitchen, living room, and bedroom can be realized. Users can realize the functional application of typical application scenarios through APP on mobile phones, tablets, TVs and other terminals, such as scene control, food push, remote maintenance, etc.

III. IOTS TECHNOLOGY

(1) Sensor network

A sensor network is a wireless network based on sensing nodes and composed of self-organizing methods. Where it is necessary to monitor and manage everything, sensor networks collect data of "things" from the external material world, and then cooperate to complete large-scale and complex monitoring work, and transmit the collected object (object) information to the "application processing center" to realize the monitoring and management of "things". It is often used in environmental and ecological monitoring, health monitoring, home automation and traffic control.

(2) M2M

M2M (Machine to Machine) for "machine-to-machine", refers to the transmission of data from one terminal to another, that is, the dialogue between machines, is a machine-based wide-area communication technology, which focuses on the connection of terminal equipment, centralized control management, integration of industrialization and industrialization, etc. M2M involves five important technology parts: machines, M2M hardware, communication networks, middleware, and applications. Wireless carriers are reluctant to extend it beyond just communication channels to a wider range known as M2M services.

(3) RFID

RFID (Radio Frequency Identification), or radio frequency identification, is a communication technology that can identify a specific target through radio signals and read and write relevant data without establishing mechanical or optical contact between the identification system and a specific target. For example, applications in automotive chip immobilizers, parking lot control, production line automation, access control, material management, etc. A complete set of RFID hardware consists of Reader and Transponder two parts, the principle of which is that the Reader transmits a specific frequency of radio wave energy to Transponder, which is used to drive the Transponder circuit to send the internal ID Code, and the Reader receives this ID Code; Transponder's special feature is that it is



battery-free, contactless, card-free, so it is not afraid of dirt, and the chip password is the only one in the world that cannot be copied, with high security and long life.

(4) Ubiquitous network

Ubiquitous network can achieve communication and exchange between anyone and any item at any time and any place, it is the goal of high integration of communication network, Internet and Internet of Things, it will realize the integration and collaboration of multi-network, multi-industry, multi-application, heterogeneous multi-technology, and is a generalization of comprehensive informatization for economy, society, enterprises and families. As a general consensus on the development of the information and communication industry, ubiquitous network is an important part of emerging global strategic industries.

4. Application of IoT technology

The development of the Internet of Things has brought a new development direction to people's lives, such as transportation, agriculture, industry, home, etc. The Internet of Things connects instruments and equipment through RFID, positioning, laser, remote sensing and other technologies, and then couples, communicates and exchanges information, so as to manage and monitor the environment in all aspects. At present, the application of Internet of Things technology involves the following aspects.

(1) Security protection

With the continuous improvement of awareness of potential safety hazards, various sensors have been installed in work, home, environment and other scenarios to prevent the occurrence of dangers and disasters, such as smoke sensors, temperature sensors, combustible gas sensors, PC-side video surveillance equipment and intelligent access control systems have been widely used. The excellent characteristics of microprocessors and the development of embedded technology have made various security alarm equipment popularized.

The core of IoT security is real-time perception, early warning, in-event intervention, and post-event analysis and management. The intelligent security system based on the Internet of Things technology is to build information interconnection between people and things with the help of various technologies or devices such as RFID, sensors, Global Positioning System (GPS) and laser scanners, so as to realize the intelligence of security. The intelligence of the security system is mainly reflected in the full use of Internet of Things technology to achieve the linkage between different functions and behaviors, and then build a networked and collaborative intelligent security system. Specifically, the linkage in the intelligent security system mainly includes the linkage between video surveillance and alarm behavior, the linkage between video surveillance and access control management system, the linkage between video surveillance and AB door, and the linkage between video surveillance and intelligent monitoring. As the most critical access control system, while linking network technology, it can also display indoor and outdoor conditions in real time 24 hours, if there are special circumstances, it can also carry out intrusion alarm function, can effectively patrol the living space, avoid fire,

flood and other situations, and also has an earthquake alarm function, users can only see their family through a mobile phone, but also through continuous optimization of the network system, the security system of the building becomes more stable and sensitive. This ensures the safety of the home when the owner goes out, and if there are elderly people and children in the house, it can effectively protect the family.

(2) Temperature and humidity monitoring

Indoor temperature and humidity are the main factors that determine the health and growth of the human body, organisms, etc., especially crops, the elderly, children, etc., which need an environment with suitable temperature and humidity. In traditional environments, most of the time is based on weather to regulate indoor temperature and humidity, or through humidifiers and air conditioners. In the Internet of Things monitoring application, the temperature and humidity sensor can monitor the indoor environment temperature and humidity in real time, and the main control system can intelligently control according to the data of the temperature and humidity sensor and link other intelligent products. For example, when the indoor temperature is too high or too low, the air conditioner switch can be intelligently controlled to adjust the temperature; when the room is dry or the humidity is very heavy, the humidifier switch can be intelligently controlled to adjust the indoor humidity. Temperature and humidity monitoring system, using a variety of Internet of Things temperature and humidity monitoring hardware and cloud platform, while detecting environmental temperature and humidity data, you can also remotely manually or automatically control the start, stop or adjust the operating power of air conditioning, dehumidification and other equipment.

In this mechanization, information age, not only people need a suitable temperature and humidity environment, all kinds of machinery, instruments, crops, etc., but also need to be in a suitable temperature and humidity environment to operate and grow well, some experiments and productive work have a very special demand for the environment, temperature and humidity and other indicators to supervise and control, in order to ensure the good order of production and life. Therefore, the application of IoT technology to indoor temperature and humidity monitoring and control is of great benefit.

(3) Light control

The primary purpose of lighting is to provide better visibility and comfortable space environment. With the continuous improvement of human requirements for living atmosphere, the lighting industry has gradually changed from how to obtain more light to how to create better and more energy-efficient light, and now to how to arrange more intelligent light. Thanks to the rapid development of the Internet of Things and other technologies, "Internet of Things" has become more and more popular, basically meeting some of the needs in intelligent control, simple operation, and energy saving and emission reduction, and the intelligent system will provide a friendly human-computer interaction interface. With the development of WiFi, Bluetooth, semiconductor light source technology, as well as

the wide application of intelligent remote control, intelligent sensing and other technologies, indoor and outdoor intelligent lighting technology has developed rapidly. Now people can remotely control indoor and outdoor intelligent instruments and equipment on intelligent software, and more advanced, there is the use of wireless smart speakers as a medium for voice interaction, turning voice into relevant instructions and accurately controlling lighting. And with the development of LED light source, control of light color and illuminance distribution has become easier, relying on the advantages of LED lighting, according to the different needs of human physiology and psychology, can adjust the color, temperature, intensity, etc. of light, and obtain lighting and art in one of the different effects of environmental scene mode lighting. [7] presented an innovative visual aid framework for completely blind people, which takes the form of a pair of glasses. The following are some of the most essential characteristics of the proposed device. The complicated algorithm processing is carried out on the Raspberry Pi 3 Model B+, which has low-end computing power. Using a combination of camera and ultrasound sensors and GPSbased location tracking for use in a navigation system, this Internet of things-based device offers advanced dual detection and distance measurement capabilities. This device makes it possible to have better access, solace, and navigational ease to blind people

(4) Entertainment

In the intelligent space, people can understand weather forecast information, exercise information, browsing preferences, etc. through various smart devices. For example, in the fields of film and television, music, games, communications, etc., IoT technology will intelligently recommend movies and TV that viewers may be interested in according to users' browsing records, historical viewing records, etc., and will also recommend music that users may like to listen to according to people's listening records, so as to truly realize the integration between services and devices. The application of Internet of Things technology is used to combine indoor lighting, viewing equipment, audio, etc., so that users can set different scenes according to their preferences. For example, in the "viewing mode", the indoor light will become dim with the change of the screen, and the curtains will automatically close, creating the best indoor light atmosphere for presenting the picture, so that the indoor temperature and humidity are kept at the appropriate level; Or in the "exercise state", you can automatically turn on the fitness exercise video, or you can automatically turn on the viewing equipment, audio, fitness equipment, etc. within a certain period of time.

(5) Intelligent transportation

Intelligent transportation refers to the use of advanced technologies such as information technology and the Internet of Things to improve the level of urban traffic management and services, and improve the efficiency, safety and comfort of public transportation through the application of advanced technologies and innovative solutions. Smart cities drive the development of electronic and mobile payments, and smart transit systems can be combined with these methods to enable

cashless payment and e-ticketing, providing passengers with a more convenient riding experience. Smart cities and smart transit are closely related. As an important part of smart cities, intelligent public transport systems apply advanced technologies and innovative solutions to improve the efficiency, safety and comfort of public transportation, and provide residents with more convenient and sustainable travel methods. At the same time, the intelligent public transport system also provides support for traffic optimization, data sharing and environmental protection in smart cities.

(6) Smart hospital

Smart hospitals realize online appointment and online payment through the application of professional software. Doctors can retrieve and query the electronic medical records in smart hospitals in a timely manner, understand the patient's medical treatment and recovery, and formulate effective treatment plans. Moreover, the application of electronic medical records can also reduce the printing of paper and effectively save resources. The construction of smart hospitals can simplify the medical treatment process of patients, shorten the time of patients to seek medical treatment, and improve the treatment efficiency, thereby improving the overall service level and treatment efficiency of the medical industry.

(7) Intelligent warehousing and logistics

The integration of Internet of Things technology in the warehousing and logistics industry not only improves the operation efficiency of warehousing and logistics, but also keeps items and logistics information confidential and processed more efficiently, and further realizes intelligent service management. Whether it is the integration, processing or extraction of information, it has shown a more intelligent and automated development state, and has become the core link of the logistics industry.

IV. THE SIGNIFICANCE OF THE APPLICATION OF IOT TECHNOLOGY

(1) Realize an intelligent environment

At this stage, the intelligent environment emphasizes the integration and application of supporting technologies such as cloud computing, edge computing and artificial intelligence in intelligent environment products on the basis of the home Internet of Things, with the aim of integrating various technologies such as home Internet of Things and artificial intelligence, strengthening the autonomous decision-making ability of intelligent systems, and better providing active services for human beings. The application of the Internet of Things and artificial intelligence can allow more devices to be combined with each other to achieve the effect of voice interaction. In the era of big data, technologies such as cloud computing are technologies that must be introduced in the intelligent environment, and the information between various devices can be well transmitted and processed through the Internet of Things technology, so as to achieve efficient information conversion. With the popularization of Internet of Things technology, the development content of intelligent environments will also



change, in addition to achieving wireless interconnection between devices, it is also necessary to combine various technologies. In the future, the intelligent environment will gradually use its voice interaction function, gradually reduce manual investment, and truly realize the intelligent environment. [8] discussed that Smart wearables are redefining the way people move and behave in real-time. Workers will be alerted to the presence of toxic gases as well as be tracked in the event of an accident if this system is implemented. Additionally, the instrument has sensors for methane and carbon monoxide gases included in its design. The prototype can detect gas in the air, the rate of the miner's breathing, the change in temperature and humidity, and the miner's location at all times. Wi-Fi will be used to transmit all of these parameters to a dynamic internet protocol. Every one of them will be able to make it through the shield. This way, all mineworkers can be monitored, and if something goes wrong, the miner can be rescued as quickly as possible. Using a pulse sensor on the miner's body, the base camp can track the miner's GPS location. It may be necessary to dig a coal mine as soon as possible to save the most people in a disaster. With the help of IoT, we can build a database and, if necessary, communicate with a nearby hospital. Our final consideration will look at market trends and challenges for WHDs to keep in mind.

(2) Realize smart home

With the development of society, people pay more and more attention to life enjoyment, so smart home products came into being. The smart home system can realize automatic operation, remote operation and timing operation, bringing users a comfortable and convenient living experience. Among the core technologies of many smart homes, Internet of Things technology is undoubtedly the most critical link. In recent years, the update and iteration of smart home products have accelerated, and the functions have become more and more abundant, especially in lighting, security, smart home appliances and other categories. For example, smart lighting provides not only switches, but also the adjustment of light color, color temperature, and the control of timing or automatic sensor switches, which can meet the needs of multi-scene use; Or through the remote mobile phone one-key control, through the system to set the timing trigger scene function, greatly reduce the operation cost, meet the people's pursuit of a better life experience.

(3) Realize intelligent transportation

By using IoT technology to realize intelligent transportation systems, functions such as vehicle monitoring, passenger information management, intelligent scheduling and payment systems can be realized, so as to provide real-time ride information, optimize route planning, and improve the operation efficiency of public transport vehicles, thereby improving passenger travel experience. In the future, the command transportation system has broader prospects and potential, and by making full use of the advantages of Internet of Things technology, the intelligent public transport system

can achieve more efficient and intelligent public transportation services and management, and provide better travel choices and experiences for urban residents.

(4) Realize intelligent medical care

Intelligent medical care through the advantages of Internet of Things technology to make the medical service system more perfect, can optimize the effect of hospital services, promote the comprehensive integration and comprehensive development of the medical industry, enable effective sharing between various organizations, share clinical experience among medical staff, improve medical level and medical effect, ensure the effectiveness and scientificity of diagnosis, and effectively make up for the shortcomings in the medical industry.

(5) Realize intelligent warehousing and logistics

Intelligent warehousing logistics effectively improves the efficiency of logistics management. In the application of Internet of Things technology in warehousing and logistics, more and more value has been mined, the most obvious of which is that IoT technology has effectively improved the efficiency of warehousing and logistics management. For example, logistics information, item information, transportation positioning and other aspects are inseparable from the help of Internet of Things technology, which can not only ensure the real-time update of information, but also speculate the future management direction of warehousing logistics. To a large extent, the amount of tasks of the staff is reduced, which provides a longer efficiency for the subsequent distribution of goods, and further improves the core competitiveness of China's warehousing and logistics market.

V. CONCLUSION

Using the network remote control intelligent system, through GPS, remote sensing and other technologies, you can remotely control the controlled equipment, instruments, devices, etc., effectively save time, improve work efficiency, achieve fast and effective monitoring and management, and provide high-quality and intelligent work, life, education, scientific research, etc. In the era of big data, intelligent environment has become an important demand for human life and work, and with the application of Internet of Things technology, the functions of intelligent environment are becoming more and more extensive, its use is convenient and fast, and the use of energy efficiency is gradually increasing, directly realizing the intelligent management of people's life and work. The application of Internet of Things technology not only meets the needs of people's life and work, but also is an inevitable trend of modern development. In the future development, the Internet of Things technology will be with the development of other science and technology to achieve a more intelligent human living and working environment.

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