Research on Zigbee Wireless Communication Technology and Its Application

Jiahe Peng

Yunnan College of Business Management, Yunnan, Kunming, 650304, China

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Abstract: Today, with the rapid development of technology, emerging technologies in the field of IT technology are emerging one after another, and wireless communication is also seen everywhere in our lives. From small headphones, watch wireless communication, to satellite and other military wireless technology applications, it can be said that since its emergence, unlimited communication technology has never left our production and life. At present, the wireless communication technologies applied in various fields are changing with each passing day. This paper introduces ZigBee's wireless communication technology and its application in medical communication transmission and home intelligent network wireless control, hoping to get recognition and sharing from all colleagues.

1. Introduction

The development of network and communication technologies has made people's demand for wireless communication more and more high. Short-range, low-speed and low-cost wireless communication technologies are becoming the focus of attention. At present, a new type of wireless communication technology has attracted people's attention. This is the so-called "ZigBee" technology. The name ZigBee is derived from the communication methods used by the bee colony. The bees share the position, distance and direction of the newly discovered food source by dancing in the ZigZag shape. With ZigBee's low-rate communication technology, the applications it supports will be closer to people's daily lives, meeting the low-power and low-cost requirements of industrial, home, medical and other purposes. This article discusses the IEEE 802. 15. 4 standard and its reliability and low power consumption characteristics, ZigBee technology and its hardware and software support, and application development.

2. Introduction to Zigbee Wireless Communication Technology

ZigBee wireless communication technology is a wireless communication technology based on Internet applications. It is similar to the original GPRS wireless data transmission technology, but ZigBee technology has its own technical characteristics. First of all, what we need to know is Zigbee, a kind of information exchange that bees tell the companions when they dance in the form of ZigZag when they discover pollen. Inspired by this, a low-power, low-cost, low-rate, and less complex short-range wireless network communication technology was invented. At present, more than 150 companies joining the IT field and other industries have joined the worldwide wireless technology ZigBee alliance.

ZigBee wireless communication technology has won the praise of many wireless communication technology enthusiasts for its unique low cost and low power consumption. Since the technology does not have too many complicated structures and protocols, it is very easy to master this technology. ZigBee takes all the advantages of IEEE 802.15.4's powerful wireless physical layer: power-saving, simple, and low-cost specifications; ZigBee adds logical networking, network security, and application layers.

The topology of ZigBee technology can be three types: star, tree and network topology. This topology is commonly used in wireless communication networks. Wireless communication technicians can determine the application type according to the actual situation.

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3. Principle of ZigBee Technology

ZigBee technology is a short-range, low-complexity, low-power, low-data-rate, low-cost two-way wireless communication technology or wireless network technology. It is a group of related networks developed based on the IEEE 802. 15. 4 wireless standard. , security and application software technologies.

It is suiTable for carrying services with small data traffic, can be embedded in various devices, and supports geolocation. ZigBee-compatible devices have a mesh topology that greatly extends the transmission range of a single node, targeting targeted wireless, low-power, low-cost wireless communications applications such as industrial, home, and medical. Figure 1 shows the structure and division of the ZigBee wireless communication protocol.

The IEEE 802. 15. 4 standard addresses the low-cost and higher-level integration requirements in the physical (PHY) layer design, using operating frequencies divided into 2. 4 GHz, 915 M Hz, and 868 M Hz. There are three kinds of channels, and each channel can use 16, 10, and 1, respectively, each providing a transmission rate of 250 Kbps, 40 Kbps, and 20 Kbps, and the transmission range is between 10 and 100 m.

The IEEE 802. 15. 4 standard mainly uses the CSM A/CA method of the IEEE 802.11 series of standards in the Wireless Local Area Network (W LAN) for the Medium Access Control (M AC) layer. To improve system compatibility. This MAC layer design not only makes the application of multiple topologies network simple, but also achieves very efficient power management. Of course, the IEEE 802. 15. 4 standard only deals with the M AC layer and the physical layer protocol; the ZigBee standard, which is dominated by the ZigBee Alliance, defines the data layer or profile of the network layer, the security layer, the application layer, and various application products, and Standardize its network layer protocols and application programming interfaces (APIs).

Network function is an important feature of ZigBee, and it is also different from other wireless LAN standards. In terms of the network layer, its main task is to be responsible for the establishment and management of the network mechanism, and has self-configuration and self-repair functions. In the network layer, Zig-Bee defines three roles: the first is the network coordinator, responsible for the establishment of the network, and the allocation of network locations; the second is the router, which is responsible for finding, establishing, and repairing the routing of packets. The path is responsible for forwarding the packet; the third is the end device, which can only choose to join the network that has already been formed by others, can send and receive information, but cannot forward information, and does not have routing function. Typically, network coordinators and routers are implemented by Full Function Devices (FFDs), while end devices are implemented by Reduced Function Devices (RFDs). In the networking mode, ZigBee mainly adopts three networking modes: one is a star-shaped network with a master-slave structure, which requires a network coordinator capable of managing and maintaining the network and no more than 65 535 slave devices; A cluster-shaped network, which can be an extended single star network or interconnect multiple star networks; the third is a mesh network. Each FFD in the network can also act as a router, according to the AD hoc network routing. Protocol to optimize the shortest and most reliable path.

For the application layer, there are three main parts: Application Support (APS) connected to the network layer, ZigBee Device Object (ZDO), and device application profile. ZigBee's application layer architecture, and most importantly, has embraced the notion of services.

For the ZigBee device, when added to a personal wireless local area network (WPAN), the ZDO of the application layer initiates a series of initialization actions, first performing device search and service search through the APS, and then according to the predefined description information, The related device or service is recorded in the binding Table in the APS; after that, all the services are used to query the device data or profile through the binding Table. The device application rule is to design different description information according to different products, and parameter settings of ZigBee layer protocols.

The security layer is not a separate protocol. Zig-Bee provides a set of security classes and software based on the 128-bit AES algorithm, and integrates the security elements of the IEEE 802.

15. 4 standard. To ensure the confidentiality, consistency and authenticity of the MAC layer frame.

In addition, the ZigBee Alliance is also responsible for the interoperability testing and certification specifications of ZigBee products, allowing manufacturers of ZigBee products to have a public occasion to test interoperability. In the authentication part, the ZigBee Alliance has defined three levels of certification, the first level of authentication PHY and MAC, and the chip factory has the most direct relationship; the second level of certification ZigBee protocol stack (Z-Stack); level 3 certification Zig-Bee products. Only products that pass the Level 3 certification are allowed to be labeled with ZigBee, so they are also known as ZigBee registration certification.

According to the technical nature of ZigBee, its features include: low power consumption, short delay, simple implementation; high reliability; high scalability; low cost of installation, installation and maintenance; simple protocol, internationally versatile;

From IEEE 802. 15. 4 to ZigBee, it is not difficult to find that the purpose of these standards is to cut into industrial automation control, energy monitoring, electromechanical control, lighting system control, home security and radio frequency (RF) remote control at low cost. The data transmitted in the ZigBee network is divided into three categories: periodic data, such as data transmitted in the sensor, the data rate can be defined according to different applications; intermittent data, such as data transmitted when controlling the light switch, the data rate is applied by the application. Or external stimulus definition; there are repeated low-reaction time data, such as data transmitted by a wireless mouse, and the data rate is defined according to the assigned time slot. Therefore, any transfer of a small amount of information (such as control or event information) is a battlefield that ZigBee can easily play.

For the formation of a ZigBee network, the FFD must be the first to act as a network coordinator. The coordinator scans and finds an unused best channel to establish the network; then allows other FFDs or RFDs to join the network. In fact, people can pre-program their devices based on their role and function in the network. For example, the function of the coordinator is to find an unused channel to build a network by scanning and searching; the function of the router is to scan and search, find an active channel and connect it, and then allow other devices to connect; and the function of the terminal device Always try to connect to an existing network.

4. The Application of Zigbee Wireless Communication Technology

Because ZigBee wireless communication technology transmits a small amount of data, low cost, and no strong power support, the application of ZigBee technology requires a network device with a large communication coverage area, and is only suiTable for wireless detection or monitor. Let me introduce you to the application of ZigBee technology.

First, there is a data management center in the network. This data management center is usually set up at the nurse's duty station so that the nurse monitor can see any information sent by the doctor and the patient. In the data management center, there is a central node of the ZigBee wireless network, which is a signal connection point connecting the wireless network and the management center in each ward, and the wireless network data is transmitted through the node. Generally this node device is a wireless ZigBee router. There will also be a central ZigBee router in each ward that is responsible for connecting the central node to the communication between patients.

There is a ward monitoring instrument or pager with ZigBee at each patient's bed. When the patient needs it, it will press the pager and transmit it over the wireless network. The data management center's medical staff will know that the patient needs the help of the doctor, so that the medical staff can feel the patient's side to the patient at the first time. Treatment and care. Some patients have a patient mobile monitor because of their medical condition. When the patient walks out of the ward, the patient's condition monitor monitors his or her health at any time, and in the event of a health problem, an alarm is issued. Whenever there is a corridor or a toilet, there will be a ZigBee wireless network route through which the information is transmitted to the management center, and the medical staff will know where the patient is and what the body is in the first place. So as soon as possible, rush to the location of the incident to treat the patient. The network advantage of ZigBee wireless communication is that the transmission speed is fast and the power

consumption is small. The wireless signal radiation emitted by him is not harmful to human health. Therefore, hospitals generally use this wireless communication network for information exchange.

Usually, the wireless communication technology applied to a smart home wireless control network is ZigBee technology. The establishment of this network first uses the Internet network technology. Because the building area of the house has a certain range, it is suiTable. Application of ZigBee wireless network technology. To build a ZigBee wireless control network at home, you first need to set up an ARM home gateway to control all your home appliances. After that, a ZigBee router needs to be placed within a certain range for data transmission between each home appliance and the central gateway. In this network, the terminal of each branch unit (that is, the terminal equipment such as TV, refrigerator, water meter, etc.) is required to install the ZigBee wireless module, otherwise the network will not be able to exchange information. The control system of each terminal can be established in the central control device, or some remote sensing control can be set, such as using sound to control the opening or closing of the TV, such as temperature control air conditioning to adjust the most suiTable temperature, or remote control terminal to control the microwave oven or Refrigerator cooling, etc., and these conventional remote sensing control networks require that each signal port is connected to obtain corresponding control. With the ZigBee wireless communication network, these appliances can be controlled at any corner of the home. . Such intelligent home control network application ZigBee wireless communication technology has lower cost, and ZigBee wireless communication technology has better anti-interference ability, and is a practical wireless communication technology for home network.

5. Conclusion

In summary, through the introduction of ZigBee wireless communication technology and its corresponding applications, the author believes that the application of ZigBee wireless communication network will be more widely used in various fields in the future, its unique low cost, low power consumption. The strong anti-interference ability will be the leader in the field of wireless communication technology in the future. It is believed that under the development of the times, the intelligent ZigBee wireless communication network will get more applications.

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