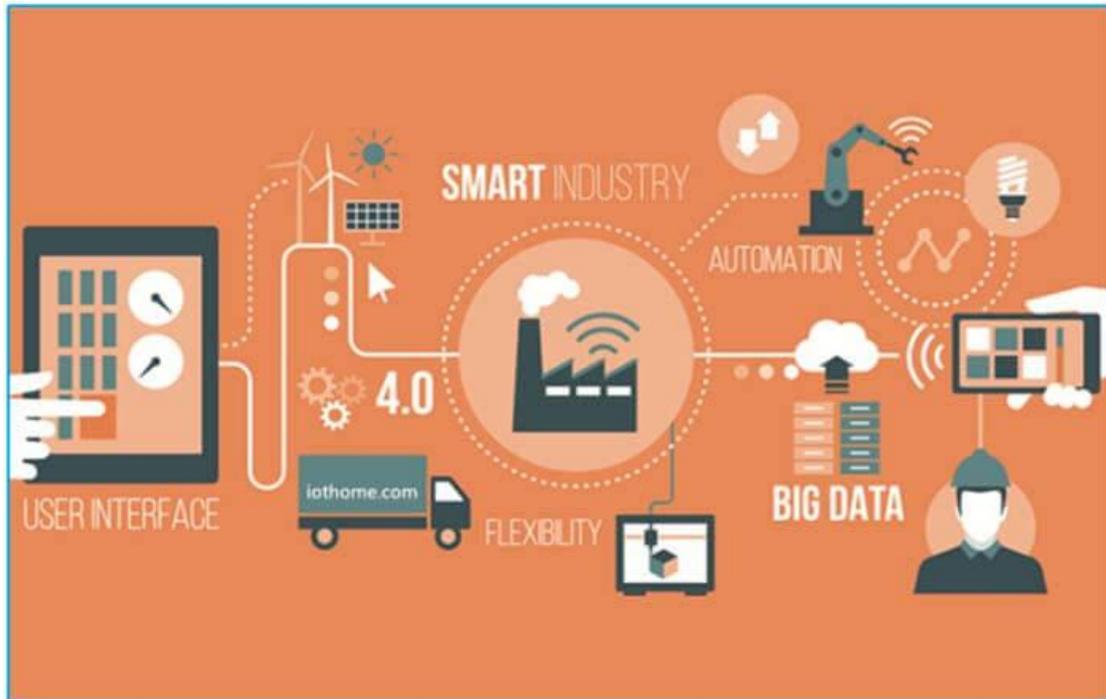# 3 Common Wireless Communication Technologies in the IoT

There are many types of wireless communication technologies in the IoT, such as Wifi, Lora, NB-IoT, Bluetooth, ZigBee, Sigfox, etc.

What is wireless communication technology?

Wireless communication technology transmits information over the air using electromagnetic waves like IR (Infrared), RF (Radio Frequency), satellite, etc. For example, GPS, Wi-Fi, satellite television, wireless computer parts, wireless phones that include 3G and 4G networks, and Bluetooth.

In the current social and economic development situation, information transmission has an important impact on social and economic development. In recent years, the level of communication technology has been significantly improved and rapidly promoted, and it has been deeply penetrated into the industrial and civil fields.

Wireless communication technology has significant advantages in its transmission speed and cost, including low price, flexibility, and rapid transmission. The combination of many elements such as software, network, microprocessor, cloud computing, and Internet of Things, makes it possible to realize digital and intelligent transformation.

In large production scenarios, production application systems, equipment, products, personnel, and other factors are involved, making stable, high-speed, and easy-to-manage wireless networks an essential requirement.

Different wireless communication methods differ in terms of networking, power consumption, communication distance, security, stability, etc.

Therefore, different networking methods have different application scenarios. At present, the most common wireless communication technologies in industrial IoT are Wi-Fi, Bluetooth, NB-IoT, and LoRa.

3 types of wireless communication technologies

Wi-Fi technology of the types of wireless communication technologies

Wi-Fi technology in the types of wireless communication technologies in the IoT is a technology that allows devices with WIFI capabilities to connect to a wireless local area network (WLAN), Wi-Fi full name Wireless Fidelity, also known as 802.11 standards. Widely used in IoT use cases, it is designed mainly for mobile devices to access LAN (Local Area Network), WAN (Wide Area Network), and the Internet, with the mobile device playing the role of the client and the server being the network-centric device (e.g., server, etc.).

(1) Advantages of Wi-Fi technology

Wide coverage:

The radius of Wi-Fi can reach about 300 feet or about 100 meters, and additional antennas or hotspots can be set up to expand the coverage area.

Fast speed and high reliability:

The maximum bandwidth is 1Mbps during communication, and the bandwidth can be adjusted to 5.5Mbps, 2Mbps, and 1Mbps in case of weak signal or interference, and the automatic adjustment of bandwidth effectively guarantees the stability and reliability of the network.

Network structure:

Support star topology structure networking.

(2) Disadvantages of Wi-Fi technology

Large signal attenuation:

Compared to wired networks, wireless networks in its coverage area, its signal will weaken with the increase of distance from the node, resulting in weaker transmission speed, and wireless signals are easily obstructed by obscurants, electromagnetic environment, and lightning weather, and wireless signals are easily interfered by the same frequency radio waves.

Poor security:

Wi-Fi provides an encryption algorithm called WEP though, which encrypts the data transmitted wirelessly between the network access point and the host device to prevent illegal users from eavesdropping, attacking, and invading the network.

Since Wi-Fi does not have the protection of the physical structure of the wired network, and also unlike to access the wired network before you must first connect to the network, if the network is not protected, as long as it is in the signal coverage range, just through the wireless network card others can access your network, occupy your bandwidth and cause your information leakage.

(3) The application of Wi-Fi technology

With the development and update of Wi-Fi technology, Wi-Fi is one of the most important wireless communication technologies in IoT, from the first phase driven by consumer-grade electronic terminals such as cell phones, tablets, laptops, etc.

The second phase driven by IoT applications such as smart homes, smart cities, smart manufacturing, Industry 4.0, and the third phase driven by a new generation of high-speed rate

applications such as virtual reality, ultra-high-definition video applications driven, is focusing on penetrating IoT application scenarios as the most widely used means of wireless networking.

Bluetooth technology of the types of wireless communication technologies

Bluetooth technology in the types of wireless communication technologies in the IoT is a wireless transmission technology in close proximity, first created by Ericsson in 1994, then as an alternative to RS232 data line connection, can realize the data exchange between fixed devices, mobile devices in a short distance, from the release of Bluetooth 1.0 in 1998 to now, has developed to Bluetooth 5.0, in the data transmission speed, stability, security, exchange protocol, power consumption performance and other aspects have been greatly improved.

(1) The advantages of Bluetooth technology

Transmission mode:

Using circuit switching and packet switching technology, support asynchronous data channel, three-way voice channel and asynchronous data and simultaneous voice transmission channel, can transmit voice and data at the same time.

Peer-to-peer connection:

The temporary peer-to-peer connections can be established, according to the role of Bluetooth devices in the network, can be divided into master and slave.

Small size: Bluetooth modules are small and easy to integrate, and are usually embedded directly into mobile devices.

Low power consumption:

Bluetooth devices in the communication connection state, there are four working modes, active mode, breathing mode, hold mode, and hibernation mode, according to the actual use of the four modes automatically switch.

(2) The disadvantages of Bluetooth technology

Transmission distance is short:

Bluetooth 5.0 theoretically can be in the distance range of about 100 meters between the devices for short-distance connection, but the actual use of only about 10 meters.

Poor anti-interference:

Because the Bluetooth transmission protocol and other 2.4G Bluetooth devices are sharing this band of signals, it will lead to signal interference with each other's situation.

(3) The application of BlueTooth technology

Bluetooth technology in the types of wireless communication technologies in the IoT is a relatively large feature is to let the portable mobile communication equipment fast networking, data transmission, and exchange, currently commonly used in mobile terminals, wearable devices, smart homes, vehicle networks, and other industries.

NB-IoT technology of the types of wireless communication technologies

NB-IoT (Narrow Band Internet of Things) technology in the types of wireless communication technologies in the IoT is a narrow band IoT based on the cellular network, which can be directly deployed in GSM network, UMTS network, or LTE network to reduce deployment cost and achieve a smooth upgrade.

It is an emerging technology in the field of IoT and the main standard for future IoT construction,

China is already in the scale commercialization stage.

It is also called Low Power Wide Area Network LPWA because it supports cellular data connection of low-power devices in wide area networks.

(1) Advantages of NB-IoT technology

Strong connectivity:

NB-IoT can provide 50-100 times more access than existing wireless technologies. Supports low latency sensitivity, low device power consumption, and optimized network architecture.

Wide coverage:

NB-IoT can cover indoors and basements, which can not only meet the network coverage demand in remote places, but also long-distance communication up to 10KM or more, and is also applicable to application scenarios such as factory, garage, and manhole cover which have requirements for deep coverage.

Low power consumption:

NB-IoT focuses on small data volume and small rate applications, so the power consumption of NB-IoT devices can be very small, and the equipment endurance working time can be significantly increased from a few months in the past to several years.

Low cost:

NB-IoT does not need to re-build the network, and RF and antennas are basically reused. Low rate, low power consumption, and low bandwidth also bring low-cost advantages to NB-IoT chips and modules.

(2) Disadvantages of NB-IoT technology

Small communication data:

Weak computing power; small transmission data volume; more difficult to upgrade.

Complex deployment environment:

Many NB-IoT terminals are deployed in unsafe places such as outdoors, which are easy to be stolen and controlled. When the terminal is out of control, it is easy to cause leakage of user privacy and other information.

Difficult to upgrade:

NB-IoT terminals are widely deployed in large numbers and network communication resources are not abundant, which makes it difficult to upgrade NB-IoT terminals in time. The terminals that are not upgraded in time are a security risk for the system.

The network and core network of NB-IoT access are open to a large number of terminals, and the network layer is vulnerable to attacks from terminals and wireless space, bringing the risk of invasion to the system.

(3) Application of NB-IoT technology

NB-IoT is an extension and expansion of the Internet, specifically, it combines various information sensing devices with the Internet to realize the interconnection of people, machines, and things at any time and any place.

Currently, NB-IoT has been widely used in smart homes, smart meters, smart devices, smart cities, artificial intelligence, and other fields.

LoRa technology of the types of wireless communication technologies

LoRa (Long Range) wireless transmission technology in the types of wireless communication technologies in the IoT is a low-power narrowband long-distance communication technology based on spread spectrum technology introduced by Semtech Corporation in the U.S.

LoRa uses linear FM spread spectrum modulation technology, which increases communication distance and network efficiency while maintaining low power consumption, and eliminates interference, i.e., using the same frequency to send data at the same time without generating.

It can receive and process data from multiple nodes in parallel. In the same power consumption conditions as other wireless communication methods to spread farther distance, to achieve the unification of low power consumption and long-distance, it is the same power consumption than the traditional wireless radio frequency communication distance expanded 3-5 times.

(1) Advantages of LoRa technology

Long communication distance:

The communication distance in urban areas is 1KM-2KM, and the communication distance in a suburban area is up to 15KM.

More connected nodes:

The number of 10,000 nodes can be added, and the network deployment topology layout can be designed and deployed according to specific applications and scenarios to form networks by themselves at low cost.

Low power consumption:

In the case of applications with low communication frequency and small data volume, the battery can be used for 1~5 years.

(2) Disadvantages of LoRa technology

Low security:

The data transmission method is to send the field data to the base station first and then back to the enterprise server, not to upload directly, and there is data leakage in this process.

Poor latency:

The interference and blocking factors in the transmission path of WAN are not controllable, and the link transmission has a delay, which easily leads to unstable data reception.

(3) LoRa technology application

LoRa technology in the types of wireless communication technologies in the IoT is being deployed worldwide, because its low power consumption, deep coverage, easy deployment, and other advantages make it very suitable for IoT applications requiring low power consumption, long-distance, a large number of connections and location tracking, etc.

Currently, smart meter reading, smart parking, vehicle tracking, smart factory, smart agriculture, smart industry, smart city, smart community, and other fields are applied.

The development of wireless communication technologies in the future

Wireless communication technologies itself is a diversified market, and there is no one technology that can solve all problems. Facing different wireless communication technologies, enterprises should combine their own scenarios to choose, and meet the needs to solve the pain points in order to play its maximum value and bring real benefits to enterprises.

With the rise of new wireless communication technologies such as big data, cloud services,

intelligent manufacturing, high-end equipment, in order to comply with the development trend of information technology, digitalization, intelligence, wireless communication technologies in commercial, civil, and industrial fields will be more widely used, and the future will also be more reliable, flexible, stable and lower construction costs.

Besides the 3 Common Wireless Communication Technologies in the IoT article, you may also be interested in the below articles.

About Wi-Fi, You Did Not Know

What is the difference between WIFI and WLAN?

Summary of 41 Basic Knowledge of LTE

What Spectrum Is Used In 5G?

What Is Wi-Fi 7?

How To Choose 2.4G And 5G?

What Are The Advantages And Characteristics Of NB-IoT And LoRa?

What Is The 5G Network Slicing?

Wifi Antenna Design