Cold chain information collection system based on cc2530 pdf

The **cold chain information collection system** based on **CC2530** is a comprehensive system that integrates multiple fields such as sensor technology, single-chip **microcomputer** control, Internet of Things communication and cloud platform data processing.

The system is based on the CC2530 single-chip microcomputer, uses **sensors** to collect environmental parameters in the cold storage warehouse, transmits data to the cloud platform through the **Internet of Things communication** technology, and finally displays and analyzes it through the mobile phone or mobile terminal.

The following is a detailed introduction of the system by experts from the Internet of Things cloud platform.

System background and significance

With the continuous improvement of people's consumption needs, chain supermarkets, convenience stores, hypermarkets and other supermarkets not only provide a variety of fresh foods, but also adopt unified procurement and cold chain storage methods.

This method not only ensures the quality of goods, but also provides a good shopping environment, making supermarkets the main place for people to shop. However, the cold chain system faces many challenges in the operation process, such as product quality control, operating cost control and power consumption management.

Therefore, designing a data acquisition system for the cold chain system and realizing real-time monitoring of the cold chain system is of great significance for improving the safety and economy of operations and enhancing the economic benefits of enterprises.

System architecture and hardware selection

2.1 System architecture

The cold chain information acquisition system based on CC2530 mainly includes the following parts: sensor module, single-chip control module, Internet of Things communication module and cloud platform data processing module.

The system collects environmental parameters (such as temperature, humidity, etc.) in the cold storage warehouse through the sensor module, and then transmits these data to the single-chip control module for processing.

The single-chip computer transmits the data to the cloud platform through the Internet of Things communication module, and the cloud platform stores, analyzes and processes the data, and finally displays and analyzes it through the mobile phone or mobile terminal.

2.2 Hardware selection

1. CC2530 single-chip computer:

As the core device of the system, the CC2530 single-chip computer has a 51 core, which is similar to the programming of ordinary 51 single-chip computers. However, it has an integrated ZigBee module, which can realize ZigBee networking, thus facilitating wireless data transmission.

2. ESP8266-WIFI:

It is used to communicate with the host computer and realize data transmission. The ESP8266-WIFI module has the advantages of low power consumption and high stability, which can meet the system's needs for data transmission.

3. DHT11 temperature and humidity sensor:

A calibrated digital signal output temperature and humidity sensor. Its humidity measurement accuracy is ±5%RH, temperature measurement accuracy is ±2℃, and the measurement range is humidity 5%~95%RH, temperature -20~+60℃. The DHT11 sensor can accurately measure the temperature and humidity parameters in the cold storage compartment and transmit the data to the microcontroller for processing.

4. Buzzer:

When the set threshold exceeds the standard, the buzzer can sound an alarm to remind you, so as to find the problem in time and take measures.

System software design

3.1 MCU programming

MCU programming is the key part of the whole system. First, you need to build the IAR integrated development environment and install the relevant drivers and code burning tools. Then, program design is performed according to the functional requirements of the system. Program design includes serial port initialization, sensor data acquisition, data processing and transmission.

In the serial port initialization part, you need to configure the serial port parameters (such as baud rate, data bit, stop bit, etc.) to communicate with the host computer. In the sensor data acquisition part, you need to write the corresponding code to read the data of the DHT11 sensor.

The data processing part is responsible for processing and analyzing the collected data, such as calculating the average value, judging whether it exceeds the set threshold, etc. Finally, in the data transmission part, the processed data needs to be transmitted to the cloud platform through the ESP8266-WIFI module.

3.2 IoT cloud platform configuration and application

The IoT cloud platform is the data processing center of the whole system. In this system, Huawei Cloud's Device Access Service (IoTDA) is selected as the IoT platform. IoTDA provides capabilities such as connecting massive devices to the cloud, two-way message communication between devices and the cloud, batch device management, remote control and monitoring, OTA upgrades, device linkage rules, and can flexibly transfer device data to other Huawei Cloud services.

Using the IoT platform to build a complete IoT solution mainly includes three parts: IoT platform, business applications, and devices. As the middle layer connecting business applications and devices, the IoT platform shields various complex device interfaces and enables rapid access to devices. At the same time, the IoT platform also provides powerful open capabilities to support industry users to build various IoT solutions.

Devices can access the IoT platform through multiple networks such as fixed networks, 2G/3G/4G/5G, NB-IoT, Wifi, etc., and use LWM2M/CoAP, MQTT, and HTTPS protocols to report business data to the platform. The platform can also send control commands to devices. Business applications implement business scenarios such as device data collection, command issuance, and device management by calling the API interface provided by the IoT platform.

In this system, the following IoT cloud platform configuration tasks need to be completed:

1. Create a product: Create a new product on the Huawei Cloud IoTDA platform and configure the product's sensor properties.
2.
3. Create a device: Create a new device under the product and save the device information for subsequent use.
4.
5. Generate MQTT triple information: Use the tools provided by Huawei Cloud to quickly generate MQTT triple information (ClientId, Username, Password) so that the device can successfully log in to the IoT platform.
6.
7. MQTT topic subscription and publishing: Configure the MQTT topic subscription and publishing format of the device so that the device can correctly receive the messages sent by the platform and report data to the platform.
8.

3.3 Mobile or mobile application development

In order to facilitate users to view and analyze cold chain environment information at any time, a mobile or mobile application needs to be developed. The application needs to be connected to the IoT cloud platform so that it can obtain and display the data uploaded by the device in real time. At the same time, the application also needs to provide functions such as data analysis and alarm reminders so that users can find and deal with problems in time.

During the development process, you can use the application-side development API interface provided by Huawei Cloud IOT. This interface provides management interfaces such as product creation, device creation, device attribute acquisition, device deletion, and device query. You can actively obtain the attributes of a device under the product through the API and require the device to report the latest data. The entire development process is based on the HTTP protocol API interface for interaction, which does not rely on the

development environment or development language. Whether it is desktop software, mobile APP, WeChat applet or web page, the core code is basically the same, all of which are HTTP protocol interactions.

System testing and optimization

After the system development is completed, system testing is required to ensure its stability and reliability. The test content includes functional testing, performance testing and stability testing. Through testing, problems in the system can be discovered and solved, thereby optimizing system performance.

4.1 Functional testing

Functional testing mainly checks whether the system can meet the functional requirements of the design requirements. In this system, it is necessary to test whether the functions such as sensor data acquisition, data processing and transmission, cloud platform data reception and processing, and mobile phone or mobile terminal data display are normal.

4.2 Performance testing

Performance testing mainly evaluates the performance indicators of the system, such as data transmission speed, data accuracy, system response time, etc. Through performance testing, the performance bottleneck of the system can be understood, so as to optimize and improve it.

4.3 Stability testing

Stability testing mainly checks whether the system can run stably for a long time. In this system, a long-term running test is required to observe whether the system has abnormal conditions or crashes. Through stability testing, it can be ensured that the system can run stably and reliably in actual applications.

System Application and Outlook

The cold chain information collection system based on CC2530 has broad application prospects. The system can be applied to supermarkets, cold chain logistics centers, food processing companies and other places to achieve real-time monitoring and management of environmental parameters in cold storage warehouses. Through this system, enterprises

can promptly discover and deal with problems in the cold chain system, thereby improving product quality and operational efficiency, and reducing operating costs and power consumption.

In the future, with the continuous development of Internet of Things technology and the continuous expansion of application fields, the cold chain information collection system based on CC2530 will also be continuously upgraded and improved.

For example, more sensor types can be introduced to monitor more environmental parameters (such as gas concentration, light intensity, etc.), or more advanced communication technologies can be used to improve the reliability and stability of data transmission.

In addition, data can be analyzed and processed in combination with big data and artificial intelligence technologies to provide more intelligent decision support and services.

Summary

The cold chain information collection system based on CC2530 is a comprehensive system that integrates technologies from multiple fields. Through this system, real-time monitoring and management of environmental parameters in cold storage warehouses can be achieved, product quality and operational efficiency can be improved, and operating costs and power consumption can be reduced. This system has broad application prospects and important practical significance.

In the future, with the continuous advancement of technology and the continuous expansion of application fields, the system will continue to upgrade and improve, providing more powerful support for the development of the cold chain logistics industry.

About IoT Cloud Platform

IOT Cloud Platform (**blog.iotcloudplatform.com**) focuses on IoT design, IoT programming, security IoT, industrial IoT, military IoT, best IoT projects, IoT creativity, IoT companies, Chinese IoT companies, American IoT companies, top IoT companies, IoT modules, embedded development, IoT circuit boards, IoT solutions, Raspberry Pi development and design, Arduino programming, programming languages, RFID, lora devices, IoT systems, sensors, **temperature and humidity sensors**, liquid level sensors, sensor devices, artificial intelligence, blockchain, robotic arms, smart homes, smart cities, smart agricultural factories, edge computing, big data, cloud computing, brain-computer interfaces, machine learning, robots, VR/AR, new energy, photovoltaic solar energy, lithium batteries, AGI, chips, semiconductors, smart hardware and other scientific and technological knowledge.

FAQs

The following are frequently asked questions and answers about the cold chain information collection system based on CC2530:

What is CC2530?
CC2530 is a true system-on-chip (SoC) of IEEE 802.15.4 standard, supporting standards such as ZigBee, ZigBee PRO and ZigBee RF4CE. It is suitable for low-power wireless communication and has excellent RF performance and selectivity.

What is the application of CC2530 in cold chain information collection system?
CC2530 can be used as a sensor node or relay node in the cold chain information collection system. Through wireless communication protocols such as ZigBee, it can transmit cold chain information such as temperature and humidity to the central management system in real time to achieve remote monitoring and management.

What are the common problems of cold chain information collection system based on CC2530?
Common problems include poor network stability, node disconnection, data transmission errors, etc. These problems may be caused by a variety of factors, such as outdated protocol stack version, channel interference, unstable power supply, etc.

How to solve the network stability problem of cold chain information collection system based on CC2530?
Network stability can be improved by updating the protocol stack version, optimizing channel selection, and strengthening power management. In addition, redundant nodes and additional relay nodes can be used to enhance the reliability and coverage of the network.

How to avoid node disconnection in the cold chain information collection system based on CC2530?
Node disconnection may be caused by insufficient power, signal interference or hardware failure. Node disconnection can be avoided by ensuring that the node has sufficient power supply, selecting appropriate communication channels, and strengthening hardware fault detection.

How to ensure the accuracy of data transmission in the cold chain information collection system based on CC2530?
The accuracy of data transmission can be ensured by adopting checksums, retransmission mechanisms, data encryption, etc. In addition, sensors can be calibrated and maintained regularly to reduce errors and drift.

How to achieve remote monitoring of the cold chain information collection system based on CC2530?
The collected cold chain information can be transmitted to the central management system in real time by wirelessly communicating the CC2530 node with the central management system. The central management system can store, analyze and display this information to achieve remote monitoring and management.

What are the advantages of the cold chain information collection system based on CC2530?

The cold chain information collection system based on CC2530 has the advantages of low power consumption, low cost, easy deployment and maintenance. In addition, it has high reliability and scalability, and can adapt to cold chain information management needs of various sizes.

What is the cold chain information collection system based on CC2530 Zigbee?

This is a system that uses the CC2530 microcontroller as the core device and uses Zigbee wireless communication technology and sensor technology to collect and transmit cold chain environmental information. It is mainly used to monitor environmental parameters such as temperature and humidity in the cold storage warehouse, and transmit the data to the host computer or IoT cloud platform for display and analysis.

What role does CC2530 play in the cold chain information collection system?

The CC2530 microcontroller is the core control device in the cold chain information collection system, responsible for data processing and wireless communication. Its built-in Zigbee module can realize wireless communication with sensors and other Zigbee devices, and transmit the collected cold chain environmental information to the host computer or IoT cloud platform.

What sensors are commonly used in cold chain information collection systems?

Cold chain information collection systems usually use temperature and humidity sensors, such as DHT11. These sensors can monitor the temperature and humidity information in the cold storage warehouse in real time, and transmit the data to the CC2530 microcontroller for processing.

How does the cold chain information collection system based on CC2530 Zigbee realize data transmission?

The system realizes data transmission through the Zigbee wireless communication protocol. CC2530 microcontroller, as a Zigbee node, transmits the collected cold chain environment information to other Zigbee nodes or host computers wirelessly. At the same time, the system can also communicate with the IoT cloud platform to realize remote monitoring and data management.

How to store and analyze the data of the cold chain information collection system?

The collected cold chain environment information can be stored in the internal memory of the CC2530 microcontroller, or it can be transmitted to the host computer or IoT cloud platform wirelessly for storage and analysis. On the host computer or IoT cloud platform, the data can be displayed in real time, historical data can be queried, data can be analyzed, and alarms can be performed.

What are the advantages of the cold chain information collection system based on CC2530 Zigbee?

The system has the advantages of low power consumption, low cost, easy deployment and maintenance. At the same time, the Zigbee wireless communication protocol has the characteristics of long transmission distance and strong anti-interference ability, which makes the system have a wide range of application prospects in cold chain environment monitoring.

How does the cold chain information collection system ensure the accuracy and reliability of data?

In order to ensure the accuracy and reliability of data, the cold chain information collection system usually adopts a variety of technical means. For example, use high-precision sensors for data collection; use redundant nodes and retransmission mechanisms to improve the reliability of data transmission; regularly maintain and calibrate the system, etc.

How to choose suitable Zigbee modules and sensors?

When selecting Zigbee modules and sensors, you need to choose according to the specific needs and application scenarios of the system. For example, you need to consider the communication distance, power consumption, cost and other factors of the Zigbee module; at the same time, you also need to consider the accuracy, stability, measurement range and other factors of the sensor. In addition, you need to ensure the compatibility between the Zigbee module and the sensor.

How can the cold chain information collection system be integrated with other systems?

The cold chain information collection system can be integrated with other systems through API interfaces, MQTT protocols, etc. For example, the collected cold chain environment information can be transmitted to the company's ERP system, WMS system, etc. to achieve data sharing and collaborative management.

How to maintain and upgrade the cold chain information collection system based on CC2530 Zigbee?

When maintaining and upgrading the system, it is necessary to regularly check and calibrate the sensors, Zigbee modules, and host computers. At the same time, it is also necessary to pay attention to the update and development of Zigbee wireless communication protocols and related technologies so as to upgrade and optimize the system in a timely manner. In addition, it is also necessary to establish a complete troubleshooting and emergency response mechanism to ensure the stable operation of the system.