Design of Multi-point Monitoring System Based on Internet of Things

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Abstract. In recent years, due to the rapid development of Internet of Things technology, the online monitoring technology of electrical equipment has a new research direction. This design gives typical temperature/humidity, sound and light alarm, flammable gas and other monitoring and control system solutions for typical buildings such as teaching buildings, laboratory buildings, office buildings, dormitory areas, canteens, etc. on campus, and puts monitoring points into the sensor network. Then, the data is transmitted to the base station by wireless transmission, and then transmitted to the center via the base station, and the real-time monitoring function and the linkage alarm function can be realized in the terminal through the temperature management software. This design reduces the labor intensity of employees and reduces troubleshooting time.

I. Introduction
In the wireless Internet of Things, location information plays an important role in real-time detection of the entire system. Because the nodes in the whole network are large in scale but limited in energy, and are randomly placed, which limits the wireless communication distance, high requirements are put forward in the positioning algorithm and technology. Generally, the following characteristics are required:
(1) Self-organization: Each node in the Internet of Things is arbitrarily arranged, and its positioning does not depend on the global infrastructure.
(2) Error correction: The nodes in the whole network are large in scale but limited in energy, and the hardware configuration is low, which will cause errors, so there is a good error correction capability in the algorithm.
(3) High energy efficiency: In order to reduce the energy consumed by wireless communication between nodes, this can increase the service life of network nodes.
(4) Distributed: Each node in each Internet of Things should calculate its own location. The entire network is mainly composed of a management center machine, a transmission base station, and a wireless temperature sensor. The whole system consists of several wireless temperature measurement network nodes, router nodes and network coordinators, data transmission terminals and alarm devices. The network terminal node is at the substation electrical equipment, and the router forwards the data to the network coordinator. The network coordinator is responsible for summarizing the data, compressing the data, and monitoring the host to receive the collected data.

2. the system’s physical structure
The distributed physical structure is divided into three layers as a whole: the acquisition layer, the collection layer, and the monitoring layer, providing flexibility and convenience for the Internet of
Things system. The system performs wireless communication between the acquisition layer and the collection layer, and the collection layer and the monitoring layer are connected by a communication network line. The sensor temperature measuring component detects the temperature information of the measured object and then wirelessly transmits it to the collecting layer through the collecting layer. The master station collects the transmitted temperature measurement data information and transmits it to the monitoring layer after processing. Data management is performed by the monitoring terminal, and by analyzing the real-time temperature value information, it is judged whether or not an alarm signal is issued. The temperature information sent by the substation is sent to the primary station, and then the data information is sent to the monitoring system and the dispatcher via the RS-485 bus. The monitoring layer receives the data information uploaded by the primary station through the monitoring management center machine. The monitoring management center machine is equipped with the application analysis software of the system, and calculates and analyzes the received data information and stores the temperature curve time and value. According to actual needs, the central machine database can also be operated, modified and expanded online.

3. the ZigBee protocol stack upgrade and multiple node control

The design and development of the IoT technology in the smart laboratory node mainly includes the following aspects.

(1) ZigBee intelligent power take-off node. The power supply module provides energy support for each node of the IoT sensor. Therefore, it is important to reduce the energy consumption of the terminal node. The working mode of the chip can be set as needed. When there is a command request, jump to the active mode. This greatly reduces the power consumption of the chip, thereby extending the working time of the node, and remotely authorizing the smart power take-off node to prevent human operation under unauthorized conditions and reduce damage. Effectively avoid electrical safety accidents on campus.

(2) ZigBee fire detection node. An ionized smoke sensor is used, which contains an ionization chamber. The activity of the radioactive element Am241 is about 2.96×10⁴ Bq. Under normal conditions, the electric field is in an equilibrium state. When the smoke enters the ionization chamber, the balance is destroyed. When the alarm circuit detects that the concentration exceeds the set threshold, an alarm will be issued. The data development kit supports VC++/C#/Java for C/S and B/S architectures.

(3) ZigBee combustible gas detection node. The combustible gas detector adopts high-quality sensor. The microprocessor combined with the precision temperature sensor can intelligently compensate the drift of the gas sensor. The environment has wide adaptability and stable operation. It can detect the concentration of natural gas, liquefied petroleum gas and gas, and supports C/S. VC++/C#/Java for B/S architecture.

(4) ZigBee temperature/humidity collection node. The temperature/humidity sensor SHT11 integrates the sensing element and signal processing, and the output digital signal is fully calibrated for high reliability and long-term stability. The temperature/humidity sensor used in the design combines a temperature measuring element made of a gap material and a humidity sensing element of a capacitive polymer on the same chip, with a 14-bit A/D converter and a serial interface circuit. The calibration coefficients are stored in the OTP memory as a program and used during the calibration process. The A/D converter must meet the following requirements when making selections: a. Conversion rate. The A/D converter takes some time to complete the boot-to-conversion process, which is the reciprocal, which is the conversion rate, which refers to the number of conversions completed per second. This is one of the important metrics to consider when choosing an A/D converter. In addition, when determining the conversion rate of the A/D converter, we can consider starting with the sampling rate first. b. Number of digits selected. When selecting the number of bits of the A/D converter, it should be considered from the data acquisition system and the three aspects of static accuracy and system resolution. Static accuracy is mainly caused by the error caused by amplified signal noise. The quantization error is also related to the number of bits in the A/D
converter.

(5) ZigBee sound and light alarm police node. The function of the ZigBee sound and light alarm node is: when a sensor or image recognition device detects an abnormal condition other than the system setting, the system will emit a high-decibel siren sound to remind the user and alert the intruder.

After collecting the data, each terminal node sends the data to the data collection coordinator through the ZigBee protocol. The coordinator sends the signal to the Web server through wired transmission, and finally realizes the two-way communication through the remote control system path through the Internet, GPRS and other networks.

4. the conclusion
The multi-point monitoring system based on smart Internet of Things technology has important significance in many aspects such as open service, resource sharing, convenient management and saving human resources, and the market has a broad prospect. This technology can be further extended to more applications in the IoT smart home, IoT smart agriculture, IoT smart store, IoT smart industry, etc., to cultivate more IoT technology development talents.

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