The Terminal Design of Archives Temperature and Humidity Based On WIA Wireless Networks

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Abstract. In order to improve the real-time and accuracy in the archives collects the data of temperature and humidity. Reducing fire hazards which caused by wiring. We design an intelligent temperature and humidity data collection terminal which based on WIA wireless network. This paper mainly describes the terminal equipment hardware design and software workflow and so on.

Introduction

The archival paper mildew and handwriting faded and paper embrittlement and other more serious problem are caused because of the temperature and humidity control improper. This phenomenon exists in the archives of country. The regulations of National Archives provides the archives warehouse temperature range 14 ℃ ~ 24 ℃ and relative humidity of 45% to 60% in the "Archives Interim of temperature and humidity " [1]. The fluctuation of every day and night temperature does not exceed ± 2 ℃ in the limits prescribed. The fluctuation of humidity is no more than ± 5%. Otherwise it will cause file mildew and paper hydrolysis and accelerate aging and so on. Therefore, we control the temperature and humidity of archives warehouse to meet the standards. It is an important way to extend the life of the file. It is an important task to solve our archives coffers in the current [2,3].

Many places still use temperature and humidity recorder to read data in the archives monitoring of temperature and humidity. It needs to send specialized personnel to inspection and maintenance. It is periodic manual transcription and record daily temperature and humidity data. Though this method is simple, it is waste of labor resources. The recorder of temperature and humidity is not accuracy. The recorded data is not correct enough. It cannot reaction the actual environmental conditions actually and real-time. The data of temperature and humidity will be collected through the cable. And then transmit it to the background computer [4]. The method has the advantage of flexible and convenient of collection information. There is great security risk due to using wiring in the field. The intelligent data collection terminal node of temperature and humidity is designed in this paper which based on WIA wireless network. It is not wiring and the node layout flexibility. The data acquisition has real-time. It collects the data of temperature and humidity is very accuracy. Therefore it has good potential applications in the National Archives and the related application areas [5].

The system is consisting of server and terminal device. The serve is mainly to storage and display data of the temperature and humidity. The terminal equipment is mainly used for collecting temperature and humidity data. The terminal device nodes support Mesh network. It supports ad hoc network. The node can join network in any time. It cannot cause serious impact in the entire network. It is shown in Fig.1 WIA Wireless Network System Block Diagram.
Hardware Design

The temperature and humidity monitoring system of archives consists of a background server and terminal node. This article focuses on the hardware design of terminal. The hardware design of collection terminal comprises a radio frequency circuit module and a power supply circuit and the sensor circuit and the indicator circuit. It is shown in Fig. 2 Terminal Block Diagram of Temperature and Humidity.

The sensor of temperature and humidity is the core component of collection terminal. The temperature sensors and the humidity sensors are in one device. The name of device is SHT71. It is designed very simply and compactly. It is easy to install and disassemble. The sensor is connecting with 4-core plug. The plug can be installed on the device directly. We can put the sensor in the place which is not easy to reach by connecting cable. The sensor is a digital signal output. The internal structure of industrial CMOS determines the accuracy and stability of sensor output which work long time. It has 14 bits AD. The sensor precision can reach to ± 0.4 °C and the humidity accuracy can reach to ± 3.0% At the operating temperature is 25 °C. It is shown in Fig. 3 Temperature and humidity sensor circuit schematics. The pin-four of u1 is data line. To avoid signal contention the microcontroller should only drive DATA low. An external pull-up resistor (e.g. 10 kΩ ) is required to pull the signal high.

The indicator of terminal node begins work when the system power-on. The pin of indicator is controlled by pin PB1. The indicator flashes three times when the system power-on at the intervals of 200ms. The node of temperature and humidity happens to accident If the indicator keeps flashing. The indicator flashes once and sends one packet of temperature and humidity data when the node works normally.

It is shown in Fig. 4 Power Circuit. The power circuit uses AMS1117-3.3V to convert voltage. It can also be supplied voltage directly by two South Corfu batteries. The two 3.6V lithium battery are
connected and placed into battery box when R2 is not welded. The R2 is welded when placing two 1.5V South Corfu batteries in battery box. The system will automatically identify the power supply voltage is 3.0V or 3.3V and then provide a reference voltage to the sensor.

**Software Design**

It is shown in fig. 6 Node Software Design Process. The node uses two power supply ways. And each power supply way will influence the reference voltage of node. So the node will detect reference voltage at first. The indicator flashes three times after selecting reference voltage. The nodes begin to work. We set the node waiting for 3 hours according to the actual needs. The node collects data of archives ambient temperature and humidity every three hours. And transfer it to the backend server. If sent data to the backend server successfully, the indicator flashes once. It finishes data collection work.

**Conclusion**

We apply WIA wireless sensor network technology into the archives data of temperature and humidity acquisition. Changing the traditional temperature measurement methods. It is a leap from wiring data acquisition to wireless data transmission. These changes will greatly enhance the management of archives and improve the timeliness of its management. It is not only saves costs and expenses, but also save personnel costs.

The system uses a technology of network information to achieve the archives intelligent environmental monitoring and automation detecting and information technology. The system run stably and measure precision high through the actual experiment. It can meet the practical needs.

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