Design of Real-time Wireless Communication System Based on Internet of Things

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Abstract: Traditional wireless real-time communication system has the shortcomings of low transmission efficiency and low system stability. To solve this problem, a new wireless real-time communication system based on Internet of Things environment is proposed. The hardware design of the system is given, including system structure, circuit design, modem unit design, baseband processing and interface unit design. At the same time, the software framework structure is described, which realizes the overall scheme of wireless real-time communication system. The experimental results show that the proposed real-time communication system can greatly improve the efficiency of communication data transmission and solve the problem of low system stability compared with ordinary systems.

1. Introduction

Traditional wireless real-time communication system usually connects the host and client through WLAN mode to realize resource sharing. This kind of wireless real-time communication system has the characteristics of high data throughput, low construction cost and strong system flexibility, and the highest transmission rate can reach 58Mbps/s when long-distance communication is carried out. To a certain extent, it can realize the efficient transmission of real-time communication data. With the continuous development of information technology, this wireless real-time communication system gradually shows the drawbacks of low data transmission efficiency and low system stability. On the premise of guaranteeing the advantages of the original system, in order to make up for its shortcomings, this paper introduces the framework of the Internet of Things to improve the traditional wireless real-time communication system. It includes the optimization design of circuit wiring, hardware and software structure, modem unit, baseband processing unit and interface unit to improve the transmission efficiency and stability of the system.

2. Hardware Design of Wireless Real-time Communication System Based on IOT

The hardware system of wireless real-time communication system in the environment of Internet of Things consists of two parts: hardware architecture and circuit wiring. The specific design process is as follows:

2.1 System Hardware Framework Design

The hardware framework of wireless real-time communication system in Internet of Things environment is composed of power module, Bluetooth subsystem, WLAN subsystem, real-time communication interface, network center and transmission module. As the core structure of hardware structure, network center is responsible for processing all wireless real-time communication data. Power module, responsible for the automatic operation of the system, to provide continuous energy support. Bluetooth subsystem is an important structure for collecting real-time wireless communication data. The setting of WLAN subsystem represents the wireless real-time communication system in the whole Internet of Things environment, and can connect the wireless network by itself. The transmission module is connected with the real-time communication

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interface and is responsible for the transmission of communication data in the system. Detailed system hardware framework structure, as shown in Figure 1.

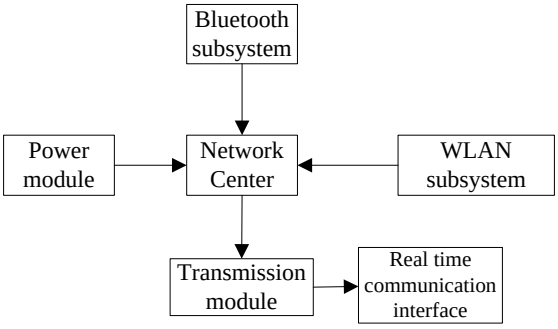

Fig. 1 system hardware structure diagram

2.2 Hardware Circuit Wiring Design

The hardware circuit wiring of wireless real-time communication system proposed in this paper includes a buck regulator, a power management unit and multiple low-drop linear regulators. All voltage regulators needed for system circuit wiring are programmed by PMU, which improves the input and output flexibility of the voltage regulator. BCM-4330 equipment is equipped inside each voltage regulator, which provides the possibility for the stability of voltage pins. Detailed hardware circuit wiring design principle is shown in Figure 2.

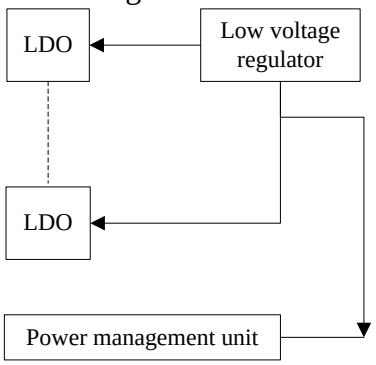

Fig. 2 Schematic diagram of wiring design for hardware circuits

3. Software Design of Wireless Real-time Communication System in IOT

In the Internet of Things environment, in order to ensure the smooth operation of the system, it is necessary to complete the construction of software modules. The software framework of the wireless real-time communication system consists of four parts: interface unit, baseband unit, transceiver unit and electro-modulation duplexer. The interface unit is composed of RS-422 interface and coding interface. Baseband unit is responsible for real-time wireless communication data, spread spectrum modulation, dispread modulation and other processing. Transceiver unit, which is directly connected with the hardware power structure of the system, is responsible for providing the power resources needed for the operation of the entire software structure. Electrical duplexer is responsible for receiving the real-time wireless communication data from the central system, sorting out the data and transmitting them to the two filters for further transmission preparation.

3.1 Modulation and Demodulation Unit Design

The software modulation/demodulation unit of wireless real-time communication system mainly completes the quadrature modulation of two wireless real-time communication data. The main structure of modulation/demodulation unit includes D/A changer, LPF modulation module and signal receiving module of FPGA. When the wireless real-time communication data is transmitted to the modem unit, the signal receiving module of the FPGA classifies the signals according to the

different contents of the received signals, and transmits the classified data to the D/A changer [3]. D/A aviator, low-pass filtering data processing, in the use of modulation baseband principle, increase the real-time transmission of data. LPF modulation module, the received wireless real-time communication data, radio frequency modulation, and ultimately generate a complete baseband signal. The detailed design principle is shown in Figure 3.

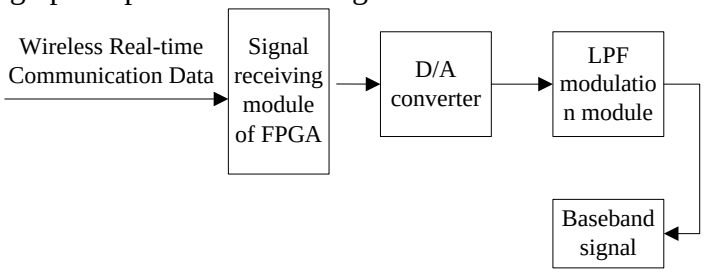

Fig. 3 Schematic diagram of modulation and demodulation unit design

3.2 Baseband Processing and Interface Unit Design

The baseband processing and interface unit of wireless real-time communication system software has the functions of road frame synchronization, scheduling data error correction, communication data interface conversion, burst power control and so on. Firstly, the received real-time wireless communication data are buffered, then the results are corrected and coded, and then the data are multiplexed by a fixed structure to generate the real-time wireless communication data frame [4]. After synchronization processing, the data frame of wireless real-time communication is processed again, including data splitting, error correction coding and data buffer processing. After processing the data, one part is connected with RS422 interface, the other part is connected with coding interface. Detailed baseband processing and interface unit design principles, as shown in Figure 4.

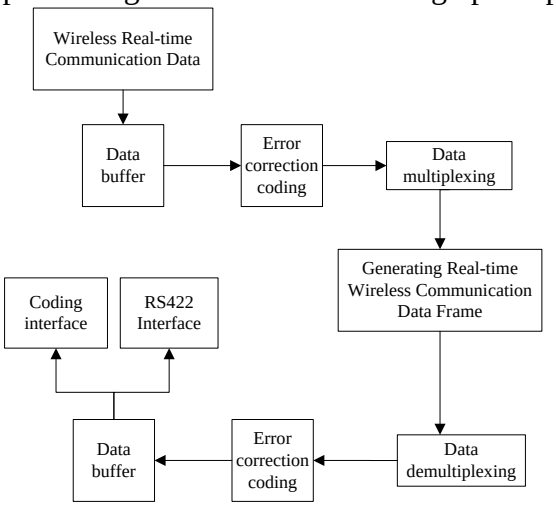

Fig. 4 Schematic diagram of baseband processing and interface unit design

4. Experimental results and analysis

In order to verify the practicability of the proposed system, compared with the traditional wireless communication system. In this paper, NS2 simulation software is used to compare the performance of two communication systems. Two computers with the same configuration were used as experimental objects. One of them used the system proposed in this paper as the experimental group and the other carried the traditional ordinary system as the control group. The two groups of computers started to work at the same time and maintained the same working time. The efficiency and stability of communication and data transmission of the two groups of systems were recorded respectively.

Fig. 5 is a comparison of communication data transmission efficiency between the experimental group and the contrast group.

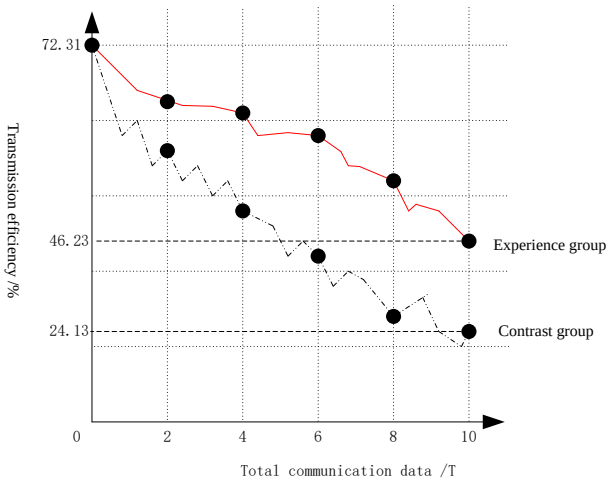

Fig. 5 communication data transmission efficiency

Analysis of Fig. 5 shows that the initial communication and data transmission efficiency of the experimental group and the contrast group are 72.31%. With the increase of the total amount of communication data, the efficiency of communication data transmission in the experimental group decreases significantly less than that in the contrast group. When the total amount of data reaches 10T, the data transmission efficiency of both groups reaches the minimum value, 46.23% in the experimental group is higher than 24.13% in the contrast group. Therefore, the application of wireless real-time communication system in the Internet of Things environment can greatly improve the efficiency of communication data transmission.

The stability of the system is always proportional to the VKS index. When the VKS index increases, the stability of the system increases, and vice versa, decreases. The following picture shows the changes of VKS indicators in the experimental group and the control group. Analysis of Figure 6 shows that when the transfer time is 30 seconds, the VKS index of the experimental group reaches the maximum of 71.22%. When the transmission time was 25 seconds, the VKS index of the control group reached the maximum of 37.36%, less than 71.22%. Therefore, it is proved that the proposed wireless real-time communication system can solve the problem of low system stability.

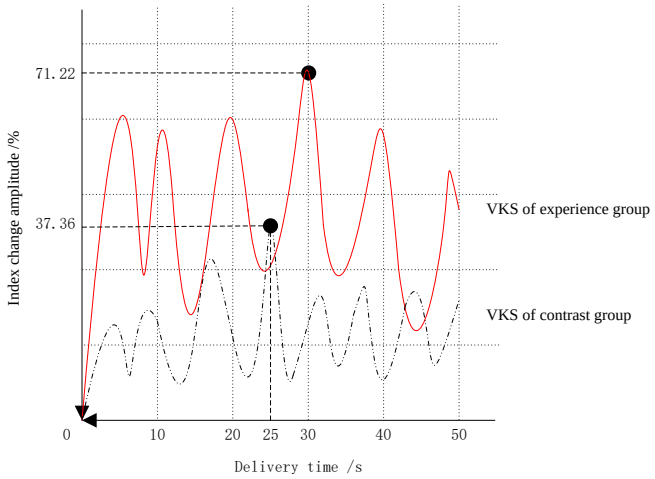

Fig. 6 System stability contrast

5. Conclusions

In view of the low performance of the traditional wireless real-time communication system, this paper a wireless real-time communication system based on the Internet of Things is proposed in this paper, and gives the overall design idea of the system, expounds the principle composition of the

system software and hardware. the experimental results show that the proposed system can be effective while retaining the advantages of the original system, and can solve the problem of low efficiency of communication data transmission and system stability.

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