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Design and Realization of a Low Power DC Electric Quantity Wireless Remote Monitoring Devices

Yiwang Wang[1,2], Rui Wang[1], Bo Zhang[1,2], Hai Chen[3], Shukai Fan [4]

[1]*School of Electronic Information Engineering, Suzhou Vocational University, Suzhou 215104, China*
[2]*Jiangsu Engineering Research Center for PV Generation, Suzhou Jiangsu 215104, China*
[3]*Suzhou Institute of Measurement and Testing Technology, Suzhou 215121, China*
[4]*China Mobile Communications Group Shandong Co., Ltd., Jinan 250001,China*

Abstract*:* A low power DC electric quantity wireless remote monitoring devices were described and designed in this paper, the devices can achieve a small remote power DC battery power or energy storage device parameter acquisition. The entire devices divide into electric quantity data acquisition module and wireless remote monitoring data receive module. The electric quantity data acquisition module is composed of electric quantity data monitor circuit, a control circuit and a wireless transmitter circuit, then send the data to receive module by wireless communication. The electric quantity data acquisition module is composed of wireless receiver circuit, a control circuit and display modules, which can display the received electric quantity data information. The devices' prototype was designed, and the test experimental results show that the devices can realize the low power DC electric quantity wireless remote monitoring, which can meet the application requirements of different projects occasions.

Keywords: Electric quantity; Wireless remote; Low power DC: Devices

INTRODUCTION

With the remote control electronic devices more and more applications, remote monitoring of the devices' electric quantity is even more important. In particular some small aircraft model ships and etc., which needs to electric quantity real-time monitoring, to determine whether reliable operation. In order to achieve these small devices wireless remote electric quantity monitoring, which can use digital control and wireless communication technology[Liao *et al.*, 2013] [Xiao *et al.*, 2015] [FENG *et al.*, 2014] [ZHANG *et al.*, 2012].

In this paper, according to the application requirements for some small power DC electric quantity wireless remote monitoring, a low power DC electric quantity wireless remote monitoring devices based on STC12LE5608AD and NRF24L01 was introduced and designed.

DEVICES' SYSTEM STRUCTURE

A low power DC electric quantity wireless remote monitoring devices composed of electric quantity acquisition module and receive and display module two parts. The system structure shown in Fig.1.

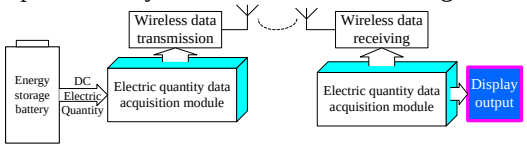

Figure 1. A block diagram of remote monitoring devices

The wireless remote monitoring devices collected electric quantity data then processed the data, transmitted by wireless transmission module. The data receive module received and processed the electric quantity data. The system uses NRF24L01wireless communication technology, which can meet the range of electric quantity wireless communication applications requirement.

SYSTEM DESIGN AND DEVELOPMENT

The whole system divided into the devices hardware design and system software development two parts.

The Devices Hardware Design

The devices hardware design includes a control circuit design hardware design, power supply circuit design, acquisition module hardware design, display circuit design and wireless data communication module hardware design.

The Control Circuit Module Hardware Design

The main control circuit of acquisition module uses STC12LE5608AD[YANG *et al.*,2011][STC Micro,2015] chip design, which collects the voltage and current data. The circuit schematics as shown in Fig.2.

Corresponding Author: Yiwang Wang, School of Electronic Information Engineering, Suzhou Vocational University, Suzhou 215104, China

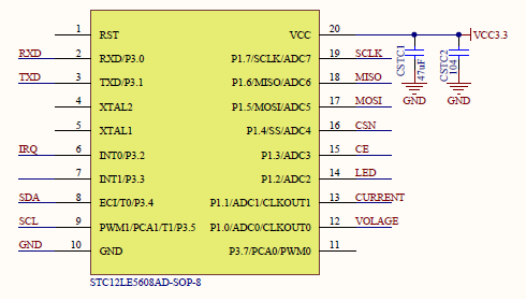

Figure 2. The control circuit schematics

The Power Supply Circuit Design

The power supply circuit uses RA7272A[RICHTEK,2015] synchronous buck DC / DC converter design, the measured system voltage to be converted DC3.3V output for monitoring devices as power source.The power supply circuit schematic is shown in Fig.3.

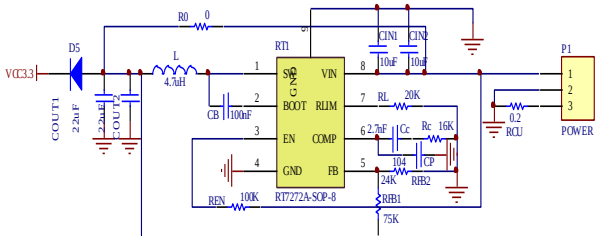

Figure 3.The power supply circuit schematic

Acquisition Circuit Design

The acquisition circuit mainly collects electric quantity data parameter that includes the voltage and current of power supply in the device. The voltage acquisition circuit uses resistor divider, then directly input to the control chip ADC. The voltage acquisition and processing circuit schematic is shown in Fig. 4.

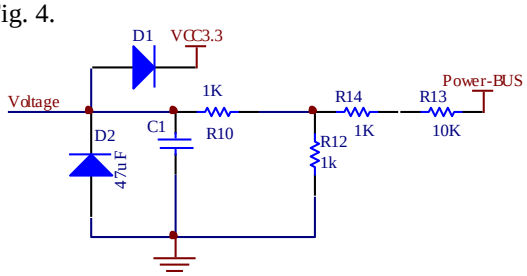

Figure 4. The voltage signal acquisition circuit schematic

The current signal after the collecting by the sampling resistor voltage is amplified circuit processes, sent to the control circuit of the AD collection terminal. The current acquisition and processing circuit schematic is shown in Fig. 5.

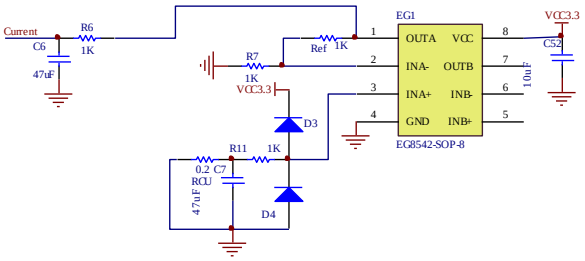

Figure 5. The current signal acquisition circuit schematic

Wireless Data Communication

The designed wireless data communication circuit uses NRF24L01[XIAO *et al.*,2015] wireless communication module, through the SPI interface controller for data exchange connection. The Wireless data communication circuit schematic is shown in Fig. 6.

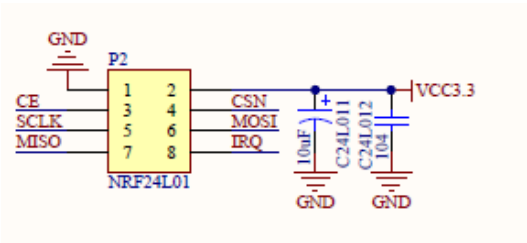

Figure 6. The Wireless data communication circuit schematic

Display Circuit

The display circuit uses OLED display electricity data information, which includes power, voltage and current, real-time data. Display circuit through IIC interface connects to control circuit. The display circuit schematic is shown in Fig. 7.

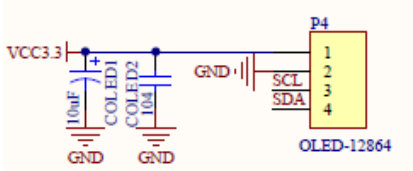

Figure 7. The display circuit schematic

The Device Software Design

Based on the C language development the entire software, the software includes data acquisition and transmission, data reception and display processing section. The entire software components are shown in Fig.8.

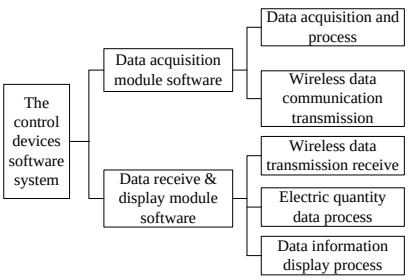

Figure 8 .Control software diagram

EXPERIMENTAL VERIFICATION TEST

Designed and develop a remote monitoring device prototype, the prototype shown in Fig.9.

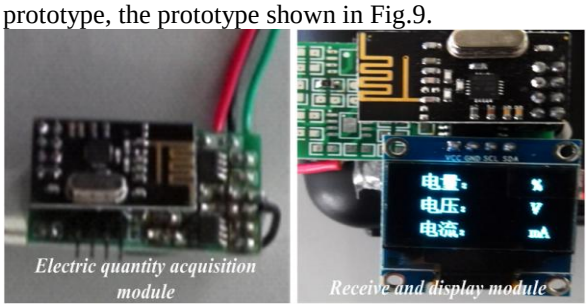

Figure 9.The system prototype

Prototype tested according to different applications.

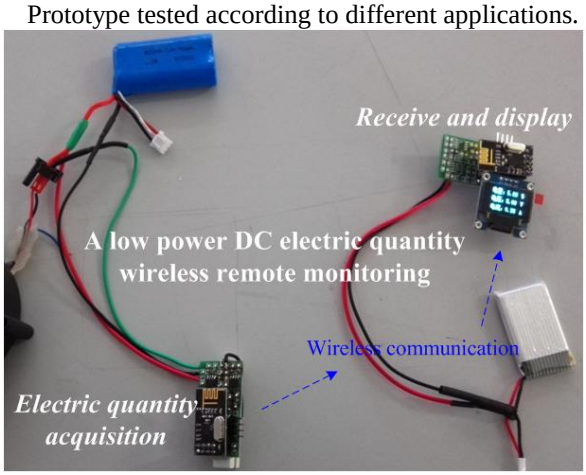

Figure 10. Experimental test results

The experimental test results show that the design of the device can be remotely collecting and monitor electricity required, to achieve the desired monitoring requirements, to meet the application needs of low power DC electric quantity wireless remote monitoring.

CONCLUSION

According to the application requirements of low power DC electric quantity monitoring, a novel wireless remote monitoring devices based on STC12LE5608AD and NRF24L01 were described and designed in this paper, the devices can achieve a small remote power DC battery power or energy storage device parameter acquisition. The system composition, operating principle, hardware design and software development were introduced. Final the prototype devices were designed and developed, and the experimental test on prototype was carried out, the experimental test results show that the designed devices to achieve the desired design indexes, can achieve a better low power DC electric quantity monitoring. The designed devices can meet engineering applications of different occasions, and provides a new implementation methods and approaches for the low power DC electric quantity wireless remote monitoring.

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