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Research Article

Food Safety Monitoring System Design Based on WIA-PA

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Abstract: The study designed a food safety monitoring network system which is composed of the wireless sensor network and MCU based on the emerging wireless communication technology. Tests indicate that the system runs well with small consumption and good mobility and the data can be uploaded to host computer for real-time display and record.

Keywords: Food safety monitoring network system, real-time, wireless sensor

INTRODUCTION

Due to the traditional food safety monitoring system of monitoring has problem ranging in monitoring scope is small, artificial dependence is strong; there is a lot of restrictions in practice. Most systems use cable network communication technology, although the monitoring and control system has high reliability, wiring is difficult, scalability is not high (Sun, 2008). WIA-PA technology is wireless network criterion in our country with independent intellectual property rights of the standard, a wireless network system which is based on the IEEE 802.15.4 standard for measuring and monitoring. For existing problems in monitoring system applications, this study designed the safety monitoring system sensor detection technology, combined with the calculator technique and WIA-PA wireless network technology, realizing the function of parameters can be automatically collected, data can realize wireless transmission, can monitor in real-time etc. This study introduces the design of food safe monitoring system and then the fall detection and integrated food safety monitoring system are combined to be analyzed (Kruger and Eloff, 1997).

In the process of production, we must pay enough attention to the security problem. In order to effectively prevent accidents, the food safety monitoring system must be used for the safety production (Li and Liu, 2008). In the system have a large number of sensor networks, which can be to detect the information and then analyze the detected data to obtain the abnormal situation in time so that we can formulate the corresponding countermeasures fleetly and maximize to prevent accidents. Integrated food security monitoring system includes a network of gas sensors, wind speed sensor network, a pressure sensor and a temperature sensor networks and other networks, in the wireless sensor network information management system not only to the inherent properties of the production management with data and the individual data hierarchical distribution relationship clear.

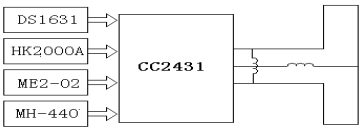

Fig. 1: The system structure block diagram

MATERIALS AND METHODS

Parameter acquisition module circuit design: The system structure block diagram is shown in Fig. 1, ME2-O_2 is an oxygen concentration sensor, for acquiring down-hole oxygen concentration data and which outputs a current signal proportional to the concentration of oxygen, MH-440V/D is the methane concentration sensor for detecting underground gas concentrations, DS1631 is a digital temperature sensor for miner temperature acquisition, HK2000A pulse sensor is used to capture the heart of miners. CC2431 is a ZigBee wireless location chips, during 2.4G ISM band wireless achieving data transmission function, which integrates a 51-core chip microcontroller with a 14 bit A/D. The framework structure of the data terminal, CC2431 as to the core components, is shown in Fig. 1.

This design uses MG811 sensors to collect Carbon dioxide content, the sensor adopts the principle of solid electrolyte battery to test Carbon dioxide content (Xu and Hu, 2009). Carbon dioxide Sensor circuit connection diagram as shown in Fig. 2, sampling circuit is made up of three parts: the temperature compensation part, amplification and voltage comparison part. Part temperature compensation circuit mainly composed of temperature sense resistor, enlarged part mainly adopts CA4140 circuit chip. Compare and the output part adopts the comparator LM393 implementation.

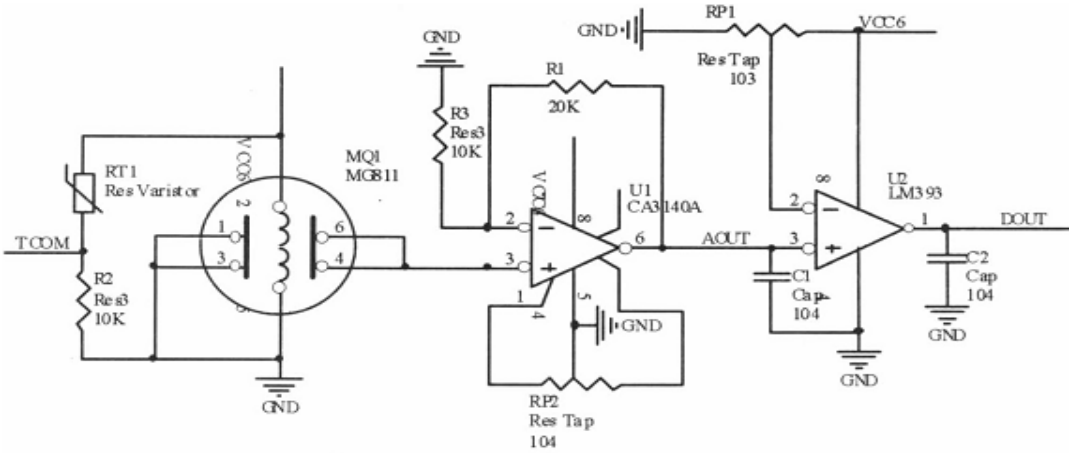

Fig. 2: Carbon dioxide sensor circuit design

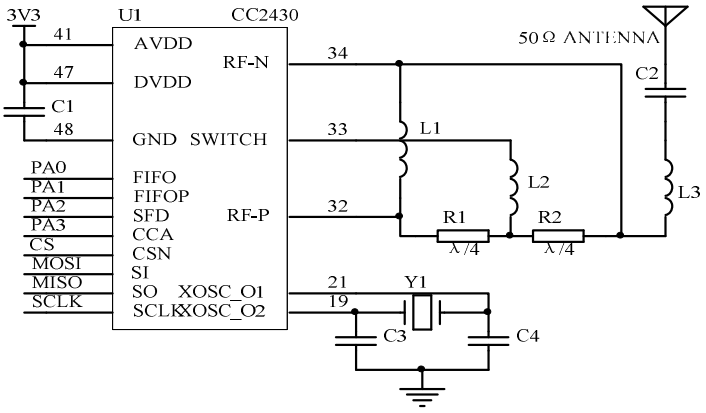

Fig. 3: RF module circuit

RF module circuit design: TI produces location engine CC2431 with hardware, based on RSSI (Received Signal Strength Indicator) technology, the location of the own node can be accurately calculated based on the received signal strength and the known reference point and its location information is transmitted to the receiving end, achieving 3~5 m positioning accuracy and resolution of 0.25 m. It operates in the 2.4 GHz ISM band, on-chip integration of ZigBee Frequency (RF) front-end, memory and 8051 controllers (Fig. 3).

System software design: The development environment for the system software is IAR Embedded Workbench for MSP430 and the programming language is C. The system software can be divided into two modules: the main processor program, which is responsible for processing the water environment parameters collected by the sensors and the ZigBee wireless communication program, which is designed for receiving and sending the water environment parameters. The integration of the two modules enables the nodes to sense, collect, process and transfer the water parameters. The power module is illustrated in Fig. 4.

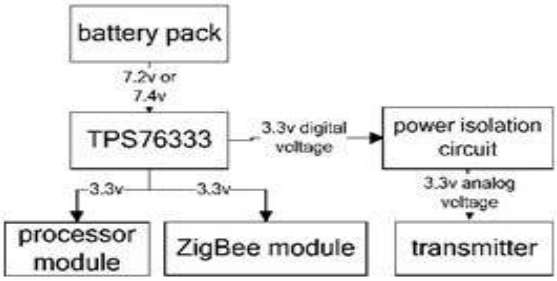

Fig. 4: Software module

Design and implementation of food remote monitoring system: Food remote monitoring system is based on J2EE B/S architecture, the application framework integrates the Struts framework and Hibernate application frameworks technology, can guarantee the system effectively under the condition of the large load and working long time (Scheer, 1994). The system architecture is divided into four modules, it is risk control management module, PLCU statistics and analysis module, Warning operation risk module, Life events management module.

Table 1: Nodes sending data statistics

Distance/m	Time/msec	Success (%)	Distance/m	Time/msec	Success (%)
200	28.3	100	1100	125.9	95.8
400	32.8	100	1200	239.2	94.4
600	37.2	100	1300	342.8	91.8
800	55.7	100	1400	671.3	82.2
1000	82.3	98.2	1500	967.1	63.3

Risk control management module: Risk control is the project and the normal development of the various events for real-time monitoring, to prevent any risk of the mechanism. If it can detect the normal event in our life and remind, it can reduce the occurrence of risk probability accordingly. In order to achieve the life events reported in the design of peripheral circuit function, is adopted in the system, LED display circuit and the numerical and characters music remind modules, LED digital display can display the time of life event, Chinese character display shows the specific content of life events and the music is real-time remind reminding function. In order to reduce the occurrence of risk, it needs to be updated every day of life events, their content input into the single chip center control unit, achieve the function of life events regularly reported.

PLCU statistics and analysis module: Real-time PLCU statistics and analysis, through PLCU unit connected to the center control unit, makes it the rest of the world gathered the information and input information of normal corresponding comparison and analysis, realize the real-time detection of the risk, when the risk surpass than the default one of the biggest standard dynamic warning module which is about to start, until the risk is to reduce or get rid of, just close the dynamic display warning, but need to keep the real-time information in the process of statistics and analysis.

Warning operation risk module: In the operation process, some risk factors will enter the normal work all the time, these factors have strong uncertainty and randomness and the dynamic operation risk warning is when these uncertainties are added to the normal system operation when reminding function, better use the interrupt program, reduce the application steps and save the storage space. In circuit design application buzzer alarm, when the risk information value reaches preset began to appear LED lights flashing and buzzer, until the user buzzer will risk rule out and need to manually preset.

Life events management module: A file management separation of life events will required and in the system control center in the allocation of reasonable storage unit and space and realize its classification processing, more logical consecution and time. Handled separately, at the same time, make the music remind function of more targeted. The process of life events presets and then controls the display on the LCD screen, the LCD display is chosen on STC, achieved 320*240 pixels.

RESULTS AND DISCUSSION

The system was tested in the food supermarket, set in the supermarket eight environmental parameter acquisition nodes and gateway nodes, parameter sampling interval time is set to 30 min, sampling data transferred from WIA-PA network transmission to the gateway node, transmitted to remote Web hosting through the gateway node. Each node send 48 packets, by querying the information stored within the Web host to calculate packet delivery successful rate. Nodes sending success rate statistics are as shown in Table 1. We learn from that the success rate decreases with the increase of communication distance and the sending time increases with the increase of communication distance.

CONCLUSION

This system adopts the way of WIA-PA wireless data transmission which can reduce the cost, the system reliability is high, the node layout is real-time and there will be a very good application prospect.

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