Research Article

Construction of intelligent home furnishing control system based on Internet of things and sensor

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ABSTRACT

Intelligent Home Furnishing is home as a platform, including building, automation, intelligent in an efficient, comfortable, safe, convenient Home Furnishing environment. The Internet of things is through the RFID, infrared sensors, GPS, laser scanners and other information sensing device, as agreed in the agreement, to any item connected to the internet. The paper presents construction of Intelligent Home Furnishing control system based on Internet of things and sensor. Simulation results show that the proposed method is effective.

Keywords: Intelligent Home Furnishing, Internet of things, sensor.
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INTRODUCTION

Intelligent Home Furnishing large control system usually consists of system server, the home controller (modules), various router, cable modem termination equipment CMTS, switches, communication device, controller, wireless transceiver, detectors, sensors, a variety of the main part for institutions, printer and so on.

Modern Home Furnishing life is a kind of high grade, high quality, and personalized, intelligent manner [1]. This system is the intelligent Home Furnishing system based on AT89S52 single chip control; home appliance control room can practice various, and can display the current working state through the LCD screen dynamic. Intelligent Home Furnishing system than the system with the traditional, functional diversification, cost low cost advantages, and in accordance with the concept of development in today's society, intelligent, energy-saving, environmental protection, and to raise people's awareness of conservation in the enjoyment of high grade, high quality, personalized, intelligent life at the same time.

With Internet expanding to ordinary family life, consumer electronics, computer, and communications integration trend has become increasingly evident, modern intelligent Home Furnishing because of its safety, convenient, efficient, fast, and intelligent and so on will become the new fashion of modern society and the family in twenty-first Century. When the family intelligent gateway to all kinds of family appliance through family bus technology together, constitute the modern intelligent Home Furnishing system is powerful, highly intelligent.

The Internet of things is a model system for virtual network real-time interaction with the real world, the ubiquitous data aware, in a wireless based information transmission, intelligent information processing, on one hand, is conducive to enhance the efficiency of the society, on the other hand, would cause public attention to information security and privacy issues. Technically the Internet of things has many hidden trouble of network security. Because of the Internet of things in many occasions that require wireless transmission, the exposure signal in public places, is easy to be stolen, but also more vulnerable to interference, which will directly affect the network system security.

Wireless sensor technology is a hot technology in the field of wireless communication, it integrates sensor

technology, embedded computing technology, modern network and wireless communication technology, distributed information processing technology, the micro sensor collaboration of the integrated real-time monitoring, sensing and collecting information of various environmental or monitoring objects, through embedded system is the processing of information, and through random self-organized wireless communication network with multi hop relay transmit information perception to the user terminal. In this design, using a variety of sensors to combine, intelligent automation control according to the numerical value of each sensor, such as automatic switch of fan, the intelligent control of frozen water, automatic adjustment of wind valve opening. And can realize the fault diagnosis, alarm, real-time data and history data query and Excel output.

2. The analysis of function Home Furnishing intelligent control system
Intelligent Home Furnishing control system can be defined as a process or a system. The use of computer technology, network technology, integrated wiring technology, will be associated with the Home Furnishing life of various subsystems advanced communications, together organically, through integrated management, let Home Furnishing life more comfortable, safe, and effective. Compared with the common Home Furnishing, intelligent Home Furnishing has not only the traditional living functions, provide comfort and safety, high quality and pleasant family life in space. Also the passive static structure to change the original as a wisdom tools, provide a full range of information exchange, to help families and external information exchange flow, optimize people's way of life, to help people manage time effectively, enhance the security of Home Furnishing life, even to save money for a variety of energy costs.

Various sensors to complete the scene information collection, using the input channel for single chip microcomputer for data processing, real-time control; Short Message sending part of the hardware circuit of mobile terminal level GSM module TC35 and TI conversion chip MAX232 component based, complete Short Message transceiver function.

The main control device (51) using matrix keyboard scanning, the key components according to the ranks of matrix, in the ranks of intersection corresponds to a key, so use less keys, to determine whether the key is pressed and the key position, this is called the key scanning method. Save the microcontroller using keyboard scanning matrix I/O, eliminates the pull-up resistor is welded conveniently; improve the appearance of the whole circuit board [2]. The first decision has no key is pressed, and then judging the key position.

Main function of the intelligent home control system including the family equipment automatic control, home security two aspects.

At present there have been the mainstream of the central Home Furnishing processing platform is divided into two categories, one category is the gateway to central platform Home Furnishing processing platform. The home gateway integrated intelligent Home Furnishing system introduced in this way, the gateway and the central Home Furnishing processing platform can be combined, and the family security system, home automation system this platform, as well as the Internet into a whole, the realization of intelligent home control, entertainment, communication and information sharing etc.. The second is directly using a home computer to control all kinds of appliances.

Serial communication TC35i default is 8 digits according to bit, 1 stop bit, no parity, baud rate in 1.2KBit/s to 115Kbit/s can be automatically adjusted. Note the TC35i pin definition is for external connection, for example TC35i, TXD signal input pin, connecting one of the microcontroller TXD; RXD is a signal output pin, connecting one of the microcontroller RXD ,as is shown by equation1.

$$p' = W(p,d) = p + D = \begin{pmatrix} x \\ y \end{pmatrix} + \begin{pmatrix} d_1 \\ d_2 \end{pmatrix} \tag{1}$$

Acquisition of the temperature information of the current through the temperature sensor, sent to the acquisition module conversion, were analyzed by MCGS software, compared with the preset value, determines the water valve water chiller opening, the room temperature maintained at a constant. At the same time, in order to facilitate the control, MCGS configuration software will be collected by the temperature value is sent to the LCD1602 liquid crystal display screen.

The design of MCU is application system. To determine the overall scheme of SCM control system is a system design is the most important, the most critical step. The overall plan is good or bad, directly affect the performance of the control system and the detailed rules for the implementation of. The overall program design is mainly based

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on the task and process requirements of controlled objects and determine the. Design methods are as follows: according to the requirement of the system, first determine the system uses the open-loop system and closed-loop system, or data processing system. Select the detecting element, to determine the overall plan, you must first select the measuring element good parameters to be measured, it is one of the important factors affecting the precision of control system.

The STC89C52 is a low-power, high-performance CMOS8 bit microcontroller, with 8K in system programmable Flash memory. In a single chip, with 8 bit CPU deft with in system programmable Flash, the STC89C52 offers solutions for high flexible, super efficient for many embedded control applications.

This module is composed of a light control, motor drive, infrared receiver to realize the control of the curtain. The reverse input end point constitutes two equivalent resistance of the crimping operation amplifier LM358, so that the output voltage of the amplifier is 1/2U. Day light, light photosensitive resistor sensor to external environment, the resistance is small, the reverse voltage is higher than the positive side, the LM358 operational amplifier output end to output the high level, so that part of the drive motor control curtain, as is shown by equation (2).

$$MI_{FA}(f,a) = \sum_{f,a} P_{FA}(f,a) \ln \frac{P_{FA}(f,a)}{P_F(f)P_A(a)} \tag{2}$$

Smoke gas sensor is the main component of this module; U1BLM323 operational amplifier is the collection of signal amplification, transmitted to the ZigBee wireless module, the operational amplifier is a function of time delay, the relay is the role of a switch, here as long as the signal output, relay is closed, the rest of the time are disconnected, horn alarm the role of PT2262 wireless module, chip, is to send a signal to the central controller.

Short Message is a standard ETSI developed by the European Telecommunications Standards Committee, in order to control the GSM MODEM Short Message service, GSM protocol provides 3 kinds of interface protocol, which are BLOCK model, TEXT model and PDU model.

Mode control, is the concentrated electric together control, such as temperature, chilled water or hot water, this is if one by one switch manually becomes more complex, if the summer pattern, chiller with frozen water set as a model, when there is the need to start this pattern, so before fussy control will become a step, and this kind of control mode for urban system is relatively easy.

$$\frac{\partial^2 u}{\partial x_1^2} = u(x_1, x_2 + 1) + u(x_1, x_2 - 1) - 2u(x_1, x_2) \tag{3}$$

The DTMF signal, the system controller by MT8870 receiving the distal sent and carries on the decoding, signal decoded by the central processing unit, data acquisition and processing. For the convenience of users, the system voice prompts interface design [3]. Telephone remote control system of general work in unattended environment, and it is the automatic reset function, online, offline. In order to meet the requirement of intelligence, the system adopts SM8952AC25P as central processor.

The system uses a MQ-2 combustible gas sensor. With its excellent stability, wide measurement range, high sensitivity and is widely used in the family, the plant's gas leakage monitoring device. By setting the MQ-2 combustible gas sensor to monitor the kitchen, gas pipeline, with no leakage of gas stove. As the gas leakage family controller sends an alarm signal, electromagnetic valve and close the gas pipeline on the linkage.

From the current market intelligence Home Furnishing existing control system, high cost, has not been widely applied. Through the data comparison, mainly is the intelligent Home Furnishing lighting, electrical control system to function as the core. But this system on the base of the lighting, electrical control can control the water flow monitoring, power supply system, security system, the approach in system integration.

3. Application of combination of Internet of things and sensor
This paper used strengthen ZigBee wireless technology type, with a wireless data communication equipment industry standard applications, can realize multi equipment of data transmission; network communication through wireless ZigBee, wireless and powerful, with the relay route and terminal equipment.

Sensor is a device of signal conversion of external information into electrical signals, which comprises a digital

signal and analog signal, digital signal, can be directly sent to MCU by electrical isolation or micro computer processing, analog signal data acquisition system combines multiple measured values are converted into digital quantity, after MCU or micro computer data processing, real-time control.

Signals from sensors are of the successive type, change analog signal acquisition to faster [4]. The analog input A/D converter in the conversion process requires constant. So after the signal amplification processing after the first sample and hold, and then sent to the A/D conversion circuit finally completes the signal processing.

The WSN network module and embedded server terminal module through a wireless network based on ZigBee communication, the transmission of a data packet consists of the following parts: initial encoding bite(0)(1), bite(2) address code, data type code bite(4), function code bite(5), efficacy encoding. End code each code 1 bytes, sending the data range in 0~255, different initial code within the family are the only, prevent the mutual interference signal, each receiving terminal after receiving data, as is shown by figure1.
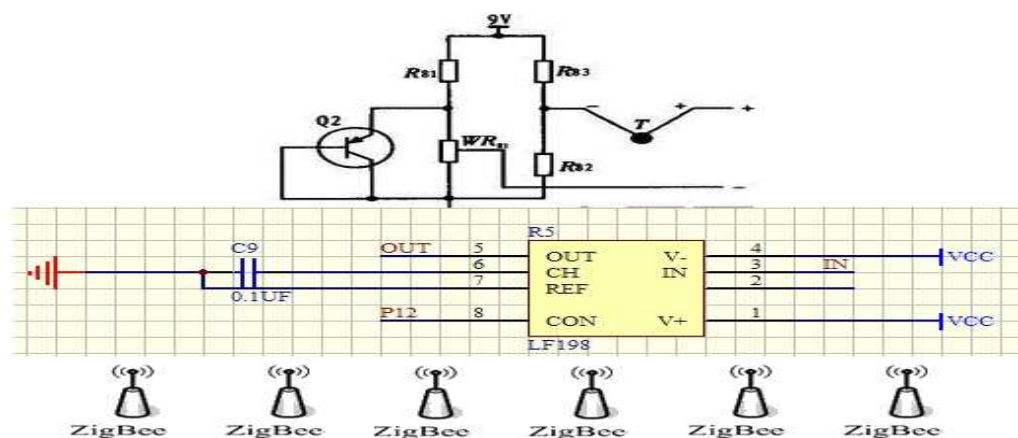

Fig. 1. The combination of Internet of things and sensor diagram

GSM base band processor is the core of the GSM module, which integrates the C166MCU processor and the DSP kernel, MCU and DSP program and data memory, the PLL system time generator programmable timer, MCU and DSP, the output pulse carrier modulation, RF serial control interface, compatible with ISO-7816SIM card interface, digital and analog voice filter and AD-DA converter, the battery voltage measuring circuit, battery temperature detection circuit, C51 and C52 password unit, GMSK regulator, static, dynamic power management module.

Because the RS-232 serial communication distance is only 15M, far can not meet the requirements of network wiring, intelligent Home Furnishing, taking into account the cost and technical problems, this design has selected a RS232 serial to Ethernet module, the SCM in the data sent through the network to Webpage daemon.

The main control unit to multi task, due in part to the requirements of reliability, the design of main control software of this system is a time-sharing operating system control, using the RTX51 version of the tiny operating system. As the main control unit MCU embedded system, the software is typically a microscopic real-time operating system, which is especially designed for a certain application. System program has real-time process control or real-time information processing ability, able to timely response to random external events and make rapid processing of the event. Time-sharing operating system is the CPU time division of short growth substantially the same time interval, i.e. "time slice" through the operating system, the management, the time sheets alternately allocated to each user.

4. The experimental simulation of Intelligent Home Furnishing control system based on Internet of things and sensor

Intelligent control system based on the analysis of Home Furnishing can make people through the mobile phone at any location at any time, the home of any electrical appliance (for example: air conditioning, water heater, electric cooker, lighting, etc.) for remote control; you can be on the way to work, will advance to the home air conditioning open, let the water heater burning well in advance water heater, electric rice cooker cook delicious Steamed Rice, whereas the realization of all only is completed by a message.

Wireless remote control module, the module consists of a transmitting end and the receiving end, the wireless transmitting device is connected to the PC (host) serial communication and wireless receiving device is connected with the main controller (51) of the serial port to the wireless communication [5]. The corresponding control button

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intelligent Home Furnishing system user interface in PC, the wireless transmitting device emits a signal to the wireless receiving device, wireless receiving device through the serial port to the main controller (51), composed of a main controller (51) is responsible for processing from the serial port information [6].

$$\overline{x} = \frac{1}{M} \sum_{i=1}^{M} x_i \qquad\qquad (4)$$

This part is the module of receiving and transmitting the user mobile phone short message MC703. Single chip computer carries on the explanation to the received information at the same time, the results will be through the ZigBee wireless network to the corresponding node to achieve the control objective, external network of interior control, an integrated SIM interface in the base band processor MC703, he directly connecting to the host interface (end to end connector) used to connect to the SIM deck outside.

The development of Internet of things to a certain stage, the home appliances can be connected and the network, through the sensors communicates electrical signals. Manufacturers in the factory can know use electrical appliances in your home, perhaps before we know the fault home appliances.

The whole hardware circuit block diagram of intelligent Home Furnishing system, the STC89C52 minimum system circuit, control circuit, the window curtain, the light adjusting circuit, smoke sensor circuit, household appliances, fingerprint identification circuit analog circuit design, can realize the intelligent home control functions Home Furnishing system, Home Furnishing security functions, Home Furnishing monitoring function.

This paper used VB to develop communication program, there are two main methods, one is to use VB itself provides the control, the other one is to use Windows API application program interface, Windows API provides three dynamic link library KERNEL.EXE, USER.EXE, GDI.EXE for developers to call KERNEL.EXE, which mainly includes some of the underlying operating functions, such as communication, menu, news and most non display function, GDI.EXE graphics device interface library, the main content is related to output function and equipment, is as shown in figure 2.
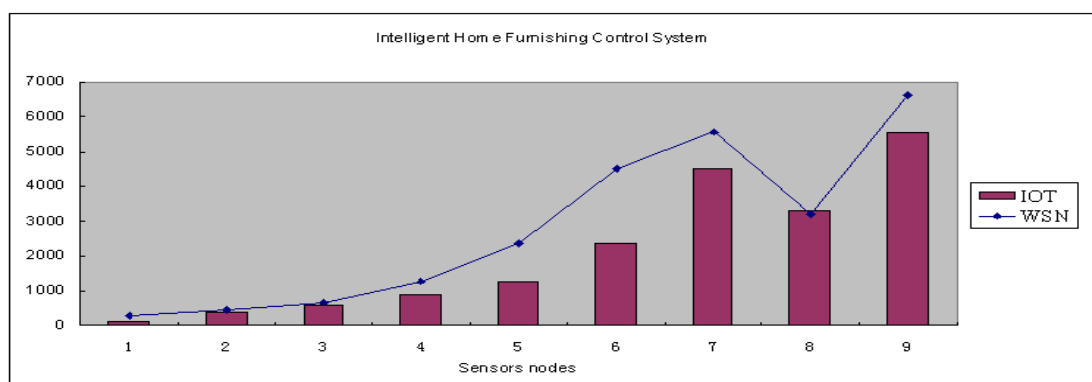

Fig. 2. Construction of Intelligent Home Furnishing control system based on Internet of things and sensor

System design of cable module, so all connections should be used in wire, so in practical application, this system is applicable to the pre arranged and do not need to move often replacement of electrical equipment, in order to facilitate control, relay module will be independent, as a control terminal. It also shortens the length of power line wiring of electrical appliances, increasing the safety coefficient system. The control core and the connection are to the server with the serial port, so the control core and the server host together.

Telephone remote control in this system, the key lies in the use of standard SPC exchange signaling with software programming, the realization of the speech interface and security authentication mechanism, Short Message business where GSM Short Message platform based on GSM network realizes Short Message remote alarm, has the advantages of less investment, low cost, high reliability, but also has good scalability and practicability, the intelligent, networked direction of the future development of home appliances.

CONCLUSION

This paper mainly introduces the technology and development tools, intelligent Home Furnishing control system

used to, architecture of ZigBee technology used in the module, wireless sensor network (WSN), GPRS communication module. Analysis of intelligent Home Furnishing system demand put forward the basic functions to achieve the design, and to determine the overall design scheme Home Furnishing system, and put forward the overall behind the circuit diagram of intelligent Home Furnishing system, and the design of each module of the circuit system.

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