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Build intelligent home furnishing control system by microcontroller GSM and optical fiber sensor

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ABSTRACT

The overall goal of intelligent home furnishing control system is through the use of computer, network, control and integration technology to build the domain family and even the whole city integrated information service and management system, in order to improve residential high-tech living environment. Optical fiber is mainly composed of three parts: the core, the cladding and the buffer coaTIng. Optical fiber sensor can change its reflection according to the environmental temperature and strain change wavelength. The paper proposes build intelligent home furnishing control system by Microcontroller GSM and Optical fiber sensor. This paper construct intelligent network by using GSM short information system for wireless communication, and using GSM as wireless data transmission network.

Keywords: Intelligent home furnishing, Global System for Mobile Communication (GSM), Optical Fiber Sensor.

INTRODUCTION

Intelligent home furnishing is also emerging as the times require in this situation. The main function of the intelligent home furnishing control system is including communication, automatic control equipment, security three aspects [1]. With the development of new technology and automation, using a number of sensors is more and more big, the function is also more and more strong, providing great convenience to design various sensor have been standardized, modular to the intelligent home furnishing control system.

Intelligent home furnishing control system the hardware part is composed of five parts, namely the switched telephone network program-controlled exchange signaling part, control unit, sensor data acquisition system, GSM module and TC35 modem interface and power supply. Telephone exchange network, program-controlled exchange signaling part is mainly composed of MT8870 and a voltage detecting element, it is part of the key components in control system, and control unit control function; sensor data acquisition system, GSM module and TC35 modem control unit to complete the processing and sending alarm signal; power supply part for each part provide power source.

When people leave their own living environment, how to obtain a home environment information, has become a reality demand, Internet and GSM become the development direction can be selected based on the. The use of the Internet to transmit information with a large amount of information, visual and other advantages, but the cost is relatively high, impeding their access to the ordinary family. In recent years, short message service (SMS) as a value-added service of GSM, along with the GSM network coverage continues to expand, has been developing rapidly, it has high transmission speed, low cost, does not occupy the communication channel and other advantages, research on this system based on SMS short message service, a convenient, economic, the utility, expandable intelligent home furnishing control system is good.

Optical fiber sensor is the solution to the application of these challenges excellent, instead of using beam current, and the use of standard fiber to replace copper wire as transmission medium. In the past twenty years, the development of Optoelectronics and optical fiber communication industry in a large number of reform has greatly reduces optical device costs, improve the quality of. By adjusting the optics industry economies of scale, optical fiber sensor and optical instruments have been from the stage of laboratory to practical applications, such as structural health monitoring applications.

Short message service (SMS) and GSM (Global System for Mobile) a GSM terminal system provides the (mobile phone), the service center (Service Center) was applied to text messaging service, the service center for information storage and forwarding function. Short message service as a basic business of GSM network has been the system operators and developers more and more attention, the application of this service is developed based on it. The paper proposes build intelligent home furnishing control system by Microcontroller GSM and Optical fiber sensor.

2. Using Optical Fiber Sensor to Design Intelligent Home Furnishing Control

The use of white LED light source instead of a laser light source, so it takes no time to warm up to the laser diode and constant temperature control, reduces the light source stability requirements, and white LED life is much longer than LD laser diode, optical sensor and the reader with a wedge-shaped thin film structure within the same interferometer TFFI, such can measurement error caused by manufacturing error compensation of TFFI, maximum linear error is usually get in without any compensation for the case of full scale 0.15%; manufacturing process of the TFFI complex, at present can only provide a range of displacement sensor 20mm.

Monitor all kinds of display screen is aimed at changing light conditions, such that the screen provides the best display brightness and reduce power consumption; also can be used for street light control, security lighting and so on numerous occasions. The following main characteristics of the chip can be programmed license: light intensity on the threshold, when the actual light intensity exceeds the threshold value is given when the interrupt signal; digital output conforms to the standard of SMBus (TSL2560) and I2C (TSL2561) bus protocol.

All kinds of electrical appliances more and more in the home, all kinds of function is very complex, electrical control function of intelligent home furnishing control system, can control all function of the household appliances or remote control [2]. The curtain control, according to the light, and it is time, indoor lighting difference automatic control curtain to open, close or remote manual control. Remote query and control through the mobile phone to the electrical appliances work. Security alarm, can on the lamp, electrical system network in working state and the indoor temperature, humidity, fire, gas and other indoor environment detection and warning, and can automatically react to the emergency program set in advance.

Intelligent home furnishing mounted behind the QS18 photoelectric sensor and efficient, opposite the two holes are respectively provided with the reflecting plate, when the luggage placed on the machine on the track, QS18 photoelectric sensor to detect the luggage, and then sends a signal, the background starting transmission, luggage began to be transported into machine safety detection. Using the QS18 photoelectric sensor reached the semi automatic energy-saving handling, save energy; improve work efficiency, as is shown by equation1.

$$x(t-\tau)=\sum_{i=1}^{n} c_i(t-\tau)+r_n(t-\tau) \tag{1}$$

X is one or several properties of optical fiber sensor will change the wave propagation parameters according to changes in the external environment of the tested, t put it such as intensity, phase, polarization and frequency. Non intrinsic type (mixed type) optical fiber sensor will only fiber as transmission medium of light between the device and the sensing element, and the natural fiber sensor the fiber as sensing element.

ISD2560 chips use multilevel direct analog storage technology, each sampling value stored in on-chip single E2PROM units, no need for additional A/D or D/A transform to storage and playback, can very natural, true to the music, voice, tone and sound effects, avoiding a general solid recording circuit due to quantization and the compression caused by quantization noise and "metal sound", therefore, as a voice chip at home and abroad and the ideal, in many areas has been widely used in. Quality, functional voice chip quality determines the strength of station announcer voice and performance.

The major obstacles for fiber Bragg grating sensor is the application of wavelength demodulation. Wavelength demodulation method mainly has the spectrometer, edge filter, tunable filter, and the interference scanning, grating matching method. However, in these methods, the high cost of spectrometer, bevel edge filtering method resolution interferometer no less, good repeatability, and can scan cycle longer tuned filter [3]. Therefore, in recent years,

grating matching method is becoming more and more popular.

Because residential design is various, the design cover to take the overall signal, local design implementation, due to the closed nature of each room, may cause the attenuation of the signal, the signal coverage area connection, signal of each region can be transmitted signal communication, wireless signal frequency transmission system using 2.4GHz, wireless sensor networks in the frequency of global unity, without the need to apply for a ISM band, and allows for the wireless signal encryption, to ensure the security of the wireless transmission of data. The figure of using Optical Fiber Sensor to Design Intelligent Home Furnishing Control, as is shown by figure1.

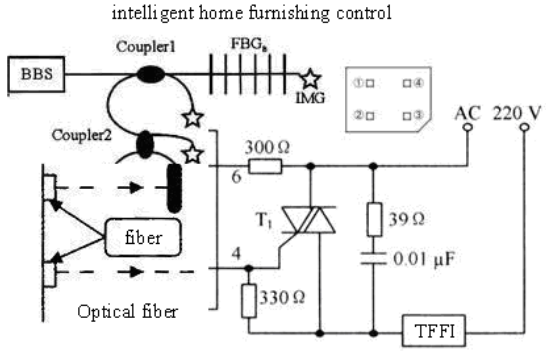

Fig. 1. Using Optical Fiber Sensor to Design Intelligent Home Furnishing Control

Optical fiber sensor is an important direction of development, the system shown in figure 1. The light emitted by the light source of LD modulated by AOM pulse signal after EDFA amplification, pulse signal after amplification by fiber Bragg grating filter coupled known sensing optical fiber, optical fiber backward Rayleigh scattering and Brillouin scattering through the coupler output to the interferometer, the Brillouin scattering signal is extracted by PD monitoring by amplifier with digital oscilloscope waveform display the collected signals, finally, through the analysis of the waveforms obtained parameters monitoring.

PXA270 chip microprocessor based ARM10 system is developed by Intel as the core of the highly integrated chip, this processor was added to the Wireless MXX technology, greatly improved the ability of multimedia processing, also joined the Intel SpeedStep dynamic power management technology, in ensuring the CPU of energy, reduce device power consumption. The specific model using NHPXA270CS, the highest frequency can reach 624MHz, bear the program running, resource allocation, and memory management, interrupt processing tasks, and control the whole system operation, as is shown by equation2.

$$p = \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} f\dfrac{X}{Z} \\ f\dfrac{Y}{Z} \end{pmatrix} \tag{2}$$

The light sensor is realized by using photoelectric transistor, *p* is photosensitive resistance or photodiode, but for the application of x and y the total light requirements, monolithic photodiode based on IC is one of the best choices [4]. The photodiode is used for semiconductor probe light and generate current, it is constructed based on a silicon chip, and used for crystal silicon production integrated circuit similar. A typical sensor application framework map consists of a photodiode, a current amplifier and a passive low-pass filter, to detect and processing optical input and output voltage signal caused by it.

Intelligent home furnishing control system based on HFC, Ethernet, field bus, public telephone network, the wireless network transmission network is the physical platform of network technology, computer technology, field bus as the application platform, form a complete set family communication, family equipment automatic control, home security and other functions control system. The overall goal of intelligent home furnishing control system is through the use of computer technology, network technology, control technology and integration technology to build a family to the area and even the whole city integrated information service and management system, in order to improve the content and residential high-tech living environment.

EL7900 integrated PIN photodiode and a current mirror stage gain function, a light sensor for a linear operation up to 10000Lux. Dynamic range and sensitivity can be achieved through a load impedance on the output (ground)

easily adjusted. Choose a lower value of the resistor will provide a wider dynamic range, but need to weak light sensitivity at the expense of. On the other hand, choose a more high value resistor will provide enhanced low light sensitivity, but at the expense of the cost of dynamic range.

Intelligent home furnishing lighting system using 8 LED lamp (F3 round white light, white 3mm LED dip) is simulated, which connected with the MCU control circuit of electric light photosensitive resistor will change the intensity of light conversion resistance value, the circuit can be changed to conversion circuit voltage. Through the AD conversion chip ADC0804 (DIP package) will simulate the circuit voltage changes into digital quantity input interface changes. SCM through the program setting two thresholds, when light intensity is too strong or weak, intelligent control 8 LED lights light out number, as is shown by equation3.

$$X_k = A \times X_{k-1} + B \times u_{k-1} + w_{k-1} \tag{3}$$

X_K is making the system debugging that is divided into hardware debugging, *A* with *B* are software debugging and the on-line debugging of three parts. After a preliminary analysis and design, in the design of hardware circuit and debugging of application, interspersed, system hardware and software debugging is not divided, many hardware fault is found in the debugging software.

Light sensor ISL29004 illumination acquisition and control program of light control circuit, the 4 system, the timer 0 interrupt service routines, should be sequentially through the I2C bus to read 4 ISL29004 collection value and light controlled by 4 PWM channels for automatic adjustment of the corresponding, *u* with x_1 and x_2 as is shown by equation4.

$$\nabla^2 u = \frac{\partial^2 u}{\partial x_1^{\,2}} + \frac{\partial^2 u}{\partial x_2^{\,2}} \tag{4}$$

Home appliances small amount of information but higher demand for real-time, must carry on the real-time adjustment in light of the family environment. Home appliance runtime environment has the very big difference, the higher requirement to the anti disturbance and stability of system. Home users for the price are relatively high, must reduce the cost of building the network to a certain extent, can be widely recognized and accepted [5]. Household appliances complete function is different, need to achieve intelligent level is also very different, according to different functional requirements, design of intelligent level of different home appliances, if let the lamp also shared Internet resources, it is not necessary, but of smoke in the home equipment requires a higher intelligent level.

The core of optical fiber sensing technology is optical fiber - a fine glass line, light can propagate in the center. Optical fiber is mainly composed of three parts: the core (core), the cladding (cladding) and the protective layer (buffer). The blanket will stray light reflection core sent back to the core, to ensure that the light has the lowest transmission loss in the fiber core. The function of the realization of the principle is the core of the optical refractive index higher than the index of the cladding, so that light from the core communication to the cladding layer undergoes total internal reflection. The protective layer out to provide protection from external environment or external force, the fiber damage.

3. Development of Intelligent Home Furnishing Control System by Microcontroller GSM

With the rapid popularization of GSM network, the GSM network covers almost the whole country, the competition between the GSM mobile communication operators is becoming increasingly fierce, and the mobile phone short message sending and receiving in the fee will be lower. Moreover, mobile phone with Chinese characters display and input function, make the system operation more intuitive. So using short message function of GSM mobile phone remote control is detection function more obvious advantages. Intelligent home furnishing has become represent the general trend of modern home decoration [6]. Colleagues can be expected in the future for a long period of time is still the mainstream mobile phone equipment people exchange information.

This thesis is the Internet of things and intelligent home furnishing design based on the combination of the background, the temperature of the environment light, home furnishing, real-time monitoring of smoke and other factors, and make the corresponding control through the GPRS communication module and management system, to enhance the home furnishing environment safety, comfort, convenience.

Intelligent home furnishing not only provides a full range of information exchange, but also optimize the people's way of life and living environment, help people to effectively arrange the time, saving energy, realize the appliance

control, lighting control, remote control, automatic control, interior and exterior curtain anti-theft alarm, computer control, timing control and telephone remote control and other functions. Embedded systems generally refers to non PC system, it includes two parts: hardware and software. The hardware includes a processor / microprocessor, memory and peripheral devices and I/O port. The software includes operating system software (OS) (the requirements of real-time and multi task operation) and application programming. Application controls the operation of the system and behavior; and operational interaction system controls the resource scheduling and hardware.

Telephone remote control of this system is the international dual audio communication telephone switching network based on standard DTMF communication, program-controlled exchange signaling as the system control commands, double MT8870 audio codec circuit, SCM from the telephone exchange machine identification through the MT8870 network control signal, the user only need to dial the home phone according to the system voice prompts button to select the recognition, in order to achieve the identity of the user remote control and security operation; detection of various sensor is a measured value is converted into a digital data acquisition system is used, after the single chip microcomputer for data processing, real-time control, as is shown by figure2.

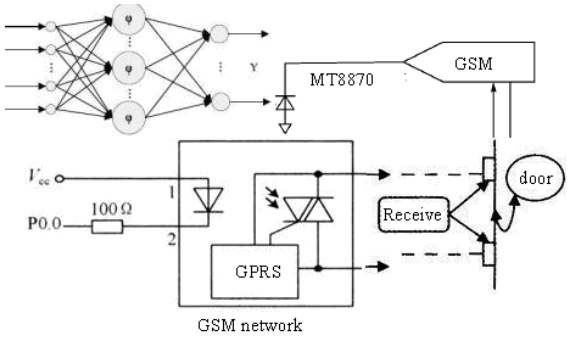

Fig. 2. Development of Intelligent Home Furnishing Control System by Microcontroller GSM

Short message service as a basic business of GSM network has been the system operators and developers more and more attention, the application of this service is developed based on Development of Intelligent Home Furnishing Control System by Microcontroller GSM, as is shown by figure2. Because the network of GSM roaming across the country, has the characteristics of network capability, users without the addition of networking, and coverage in greatly increase network for customers to save the expensive construction costs and maintenance costs. At the same time, he is the number of users are not limited, to overcome the traditional investment network communication system cost, high maintenance costs, and coverage of network monitoring and user a limited number of defects. Receive

Regulation and control of air conditioner, surveillance, according to the program, according to the time, temperature, humidity and other parameters to monitor, air conditioner regulation and control. Regulation and control according to the preset time program lighting equipment monitoring, respectively, and it is to each room lighting equipments, control, and can automatically adjust each room illumination. Curtain control, it is according to the preset time program, the curtains open / close control.

Intelligent disaster prevention, wireless sensor applications in the Internet of things on the family of light control, and electrical appliances network provides a good solution. And the use of GPRS communication module, the emergency family informed householders, and intelligent alarm. This significantly reduces the family unexpected disaster loss, as is shown by equation5.

$$S_x(\omega) = \lim_{T\to\infty}\left\{E\left[\frac{X_r(\omega)^2}{2T}\right]\right\} \tag{5}$$

The design of MCU is Sx application system by 2T. To determine the overall scheme of SCM control system is a system design is the most important, the most critical step with Xr. The overall plan is good or bad, directly affect the performance of control system and the detailed rules for the implementation of. The overall program design is mainly based 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, in determining the overall scheme, 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. Has the standard features: 8K bytes of Flash, 512 bytes of RAM, 32 I/O lines, the watchdog timer, built-in 4KB EEPROM, MAX810 reset circuit, three 16 bit timer / counter, a 6 vector level 2 interrupt structure, a full duplex serial port. In addition STC89X52 can be reduced to Ws 0Hz static logic operation, K+1 can supports 2 software selectable power saving mode.

GPRS by using the TDMA channels are not used in the GSM network provides moderate speed data transfer. Ds and k+1 by GPRS broke the GSM network can only provide the circuit switching mode of thinking, only by increasing the functional entity corresponding and part of the transformation of the current base station system to realize packet switching, the transformation of the investment is relatively small, but the user data rate but have considerable. But, because you no longer need to need the current wireless application intermediary converter, so the connection and transmission will be more convenient and easy.

Data acquisition is to collect the signal of the sensor, analysis of the control part is based on the information collected by the time-sharing operation is beneficial to improve the efficiency of the system. Other software including the Windows CE customization, design of serial communication protocol, write home appliances control panel program.

TC35 module mainly consists of a GSM base band processor, GSM RF module, power supply module (ASIC), flash memory, ZIF connector, an antenna interface is composed of six parts. TC35 as the core, the baseboard processor mainly deals with speech, data signal of the GSM terminal, and covers the cellular radio frequency equipment in all of the analog and digital functions. On the premise of no additional hardware circuit, which can support FR, HR and EFR voice channel coding.

4. Build Intelligent Home Furnishing Control System by Microcontroller GSM and Optical Fiber Sensor

Intelligent home furnishing is a use of communication and Internet and integrated wiring technology, according to human body engineering, agricultural personalized demand, through the family of unified management platform, will work with family life of various subsystems are closely related with system together. So from the point of view of market demand, intelligent home furnishing is necessarily a broad prospect.

The communication mode of GPRS packet switching communication in packet switching, data is divided into a certain length of the packet (packet), there is a packet in front of each package (the symbol indicates the address where the packet). Does not need to pre distribute channel data before transmission, to establish the connection? But in each data packet arrives, according to the data in the header information (such as the destination address), temporary find an available channel resources will be the datagram sent. In this mode, do not occupy a fixed relationship between the data sending and receiving the same channel, channel resources can be regarded as by all users.

Fiber Prague grating sensor is a kind of optical fiber sensor used in the highest frequency, the widest range, the sensor based on optical environment temperature and / or strain changes its reflected wavelength. Fiber Prague grating by holographic interferometry and phase mask method to a short photoperiod sensitive fiber exposed to a light intensity distribution of the light cycle. Such optical fiber refractive index will be according to the light intensity of irradiation was to change forever.

The highest frequency of SM8952C25 is 25MHz, with 8KB MCU flash memory, the SM8951/8952 series products are 8 bit monolithic 4/8K embedded flash microcontroller as many as 32 I/O port of the 4K/8K flash memory has not only can be used as a program storage space can also be used as data storage space or program data mixed space these hardware features and its powerful instruction system and its own Programmable Watchdog so that it can be used in different occasions, so it is a universal and high performance price ratio controller, SM8951/8952 allows users can also through 0 set the SCONF register (ALE1) to reduce EMI, the watchdog timer (WDT) is 1 to 16 since running counter in the counter overflow will generate a reset signal.

The system uses TMS320VC5402 as the main control chip. The fixed-point DSP chip can realize the optical fiber grating sensing signal processing, stepper motor control and display. The chip has a data operation and powerful processing function, using the RPT and MAC instructions can be implemented in a single cycle multiply accumulate operations. The flexible loop buffer and efficient C language can make TMS320VC5402 easily realize the circular addressing and convolution operation data, so as to realize high speed demodulation.

The program uses the C language programming. The single chip microcomputer and GSM module and fingerprint recognition module is based on the instruction set of the form of communication. This design uses the sequential execution of the cycle of each software module in the main program, as is shown by figure3. The figure is about of Comparison design of Intelligent Home Furnishing Control System by GSM with Optical Fiber Sensor. When an external trigger can enter the corresponding subroutine executes the corresponding function.

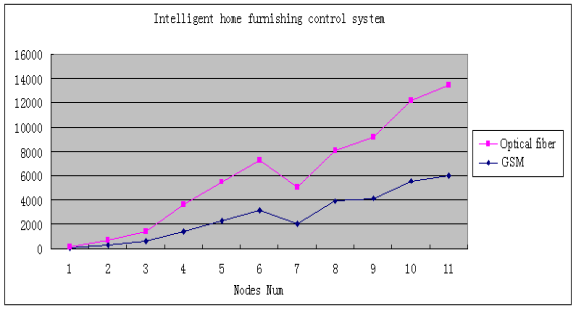

Fig. 3. Comparison design of Intelligent Home Furnishing Control System by GSM with Optical Fiber Sensor

The system uses the ARM11S3C6410 control chip as the core controller, to complete the processing of all the family internal data, including a data acquisition and control commands, is the core of intelligent home furnishing control, using Linux embedded system for monitoring system home furnishing center, can run automatically, data processing, through the serial port management, wireless network to control the control terminal, communication and the central controller through the GPRS module to realize the family system with mobile phone, users can realize the remote control of home system through SMS.

The conveyor belt at the beginning and the end of Q45 photoelectric sensor without with counting function, and the effect of saving energy, when no home furnishing the conveyor belt, the photoelectric sensor to the PCL system of this kind of state feedback to the backstage, controlled by the PCL system with the operation of transport, to achieve energy-saving effect.

By using light instead of current and the use of standard fiber to replace copper wire as transmission medium, FBG optical sensor solves many use electrical sensing to the challenges and difficulties. FBG and fiber optical sensor are insulators, with passive electrical properties, and is not affected by electromagnetic induction noise. With the interrogator high optical power tunable laser source can be a very low packet loss rate is even zero loss to complete the growing distance measurement.

CONCLUSION

Short message service of GSM short message platform this system fully with the help of GSM network realization of the short message remote alarm, has the advantages of less investment, low cost, high reliability, but also has good also has good expansibility and practicability, the intelligent, networked direction of the future development of home appliances. Short message sent by mobile terminal hardware circuit level SIEMENS TC35 GSM module of TC35 modem and TI conversion chip MAX3238 component based on short message send and receive functions can be completed. The paper proposes build intelligent home furnishing control system by Microcontroller GSM and Optical fiber sensor.

In the design of the system, in the face of various object detection and control unit, need to be connected with various interface standards and MCU, through the MCU for data processing, real-time control. While the use of single-chip microcomputer to realize the intelligent home furnishing control system not only has the advantages of simple, convenient collection control, flexible, and can greatly improve the recovery of each module and the chip's coordination, thus greatly improving the system can be used.

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