Design of Smart Home System Based on Power Line Communication Technology and Wireless Sensor Networks

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Based on power line communication technology, research of smart home system-wide power line developed. Combined with high speed power line data communication system based on low-voltage distribution network, set Internet access and intelligent home control is one of the intelligent digital cell. Smart application of the home network system and power line communication technology put forward new ideas. Based on power line communication technology, research developed intelligent home automation system based on the power line. Power line combined with high-speed data communication system constructed set of Internet-based low voltage distribution network of the Internet. Intelligent home control in one of the intelligent digital cell for application of intelligent home systems and power line communication technology has opened up new areas. A comprehensive summary of the research results intelligent home automation systems and power line carrier communication technology, innovation put forward intelligent home automation based on an all-electric line of thought, the whole structure was constructed based on power line communication technology, intelligent home systems.

1. Introduction

In recent years, with the rapid development of network technology and communication technology, people not only pay attention on the degree of automation and home of the increasingly high demand, but also the flexibility and convenience of home appliances control of external information obtained higher requirements (Jeet, 2015; Yu, 2015).

Therefore, research and development of smart home system has become a hot issue in the information industry. At the same time, power line communication technology has been vigorously developed (Sarathi, 2013). After several years of research and hinder its development has been successfully break through some technical bottlenecks, making the low-voltage power line high-speed data transmission is possible (Tong and Zhou, 2014). Therefore, this article in the current understanding of the development of smart home system, the full use of the power line to act as a smart home system data signal transmission media, presented the overall program smart home system based on power line communication technology (Vasan and Long, 2014). Electricity networks have the advantage everywhere, using the power grid can reduce the huge investment in network construction, and this is the important factor restricting broadband applications (Wang, 2015). PLC network networking is very simple, just connect the power socket and the necessary network communications equipment, digital devices can communicate with each other between. And any power outlet in the room where the Internet can be connected and permanently online. Therefore, power line communication technology has broad application prospects (Subramanian, 2015). Once the technology commercialization phase, will facilitate change the telecommunications market, and to the popularity of the Internet has brought great development space (Ding, 2013; Yi, 2015).

Based on the design of smart home system, flexible use of the power line communication technology, put forward innovative overall solution the whole power line smart home automation systems and digital community management system, to achieve a high speed power line data communication technology and smart home system integrated applications, a good power line carrier communication technology and intelligent home control combine to make the whole system has unique advantages, complete functions, to

form a more perfect intelligent control system, and more broadly to expand the application of smart home system and power line communication technology.

2. Smart home system home gateway (ICDT)

2.1 ICDT control system block diagram

Intelligent network control data terminal (ICDT) act as special role, its contact within the family all the smart home installations (Long, 2012), smart home network system is the hub to connect an external network, CDT is the core unit of work is clearly the smart home system, often referred to as " home gateway ", as shown in Figure 1.
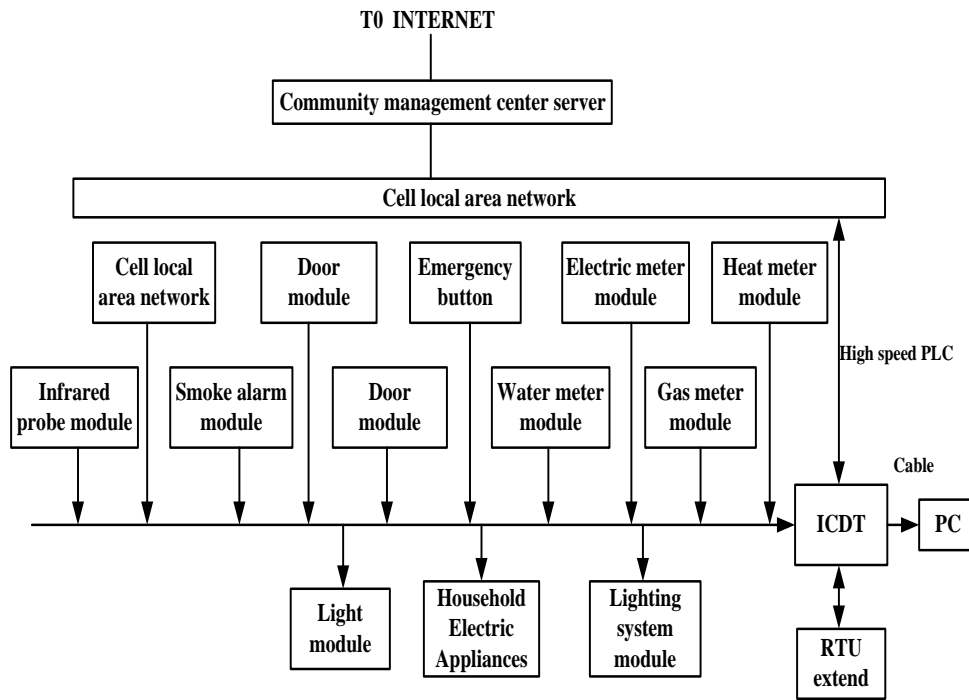

Figure 1: ICDT control system block diagram

As a home gateway, ICDT have good adaptability to provide for the smart home system friendly interface, user-friendly operation. The intelligent device management control ICDT divided into two: the input / output devices. Figure 1, above the indoor power line trunk road marked input equipment, the CDT acquisition read their input data and transmitting signals; label output devices below, ICDT to send control commands to them to achieve the appropriate action (2014).

Workers CDT in the structure mainly composed of two parts: a communication interface unit and intelligent control unit, between two units interconnected via asynchronous communication interface, the communication interface unit is provided from the power line communication network between the intelligent control unit interface. The communication interface unit integrates 10M Ethernet card and four of HUB chip, its main role is to deal with network transport protocol. Input from the network packets are processed out all the protocol header, and re-assembled into a complete application layer data in a buffer, through asynchronous communication port to send to the intelligent control unit.

2.2 ICDT hardware design

Workers CDT principle hardware structure was shown in Figure 2. Workers selects high-performance 16-bit microcontroller 80C196KC on the basis of the minimum system was extended 32KB data memory and program memory. X25045 set watchdog timer, voltage monitoring and EZPROM (sIZxsbit) in one, some of the basic parameters used to store memory systems, such as the number of nodes, each node of the characteristic parameters, and some of the node identifier associated with the node contacts. Serial Real Time Clock using DSI302, provides seconds, minutes, hours, days, months, years real-time information, and can automatically adjust the month and end dates for the month and leap year situation. 8255 extends the parallel chip 4X5 keyboard interface for users to set and query interfaces to provide input.
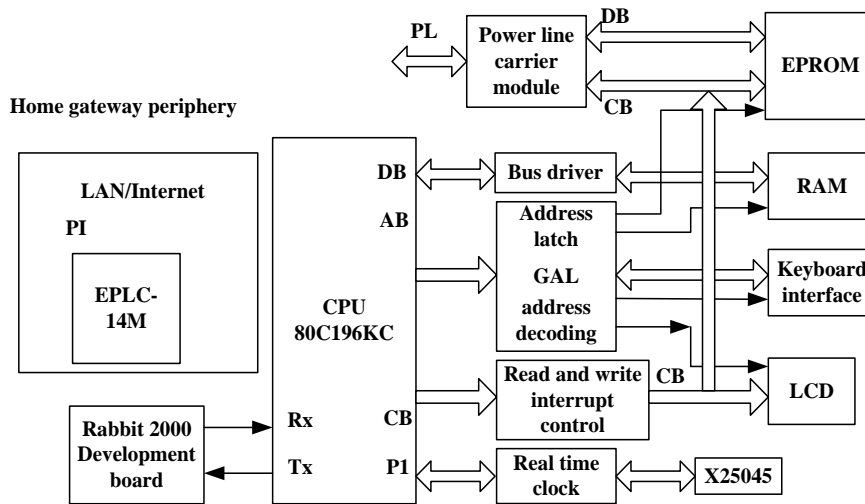
Figure 2: ICDT hardware design structure diagram

ICDT control platform operating system is the digital home network. Since the object of control and monitoring it very clear that all the family microcontroller and electrical equipment, so workers CDT operating system must be a dedicated system, so not only can improve the control and monitoring functions to complete efficiency, but also save hardware resources, which will help reduce costs. Therefore, the operating system is not suitable for work CDT supplement made from an existing operating system such as Linux or Windows CE cut, we should proceed from the need to complete the function of the target, in a targeted manner designed.

3. Experiments and results

3.1 Overall system architecture

Smart home system is a computer network-based intelligent residential management control system. In view of our multi-family residential units of cells, the paper design of smart home system is mainly composed of digital home networking, residential access network control center and community management platform structure, shown in Figure 3.

Digital home network is based on a home control system centralized control terminal, through which the family complete variety of sensors, controllers and water, electricity, gas, heat meter data acquisition and control, data transmission within the family network using low-voltage power line carrier communication. Residential access network is a local area network to extend residential district home network, it can work well on a variety of broadband access networks, the design of high-speed PLC devices. Community management center is Ethernet-based information platform, system architecture C / S and B / S combined, mainly by the central management server, workstation and Internet access control network routers, complete the entire residential district intelligent control and management.

Power line carrier communication module, the master, the slave module, this is one of the key design and development, they bear the analog system acquisition and pulse capture and digital acquisition tasks. Temperature controller and flooding controllers and other intelligent devices, the installation of a slave module for the collection and processing of analog signals, the analog slave controller input (current value 4 ~ 20 mA) is converted to level signals to digital by 0,1 microcontroller writing digital frame, and then converted to a modem chip carrier signal transmitted through the power line to the main station, the main station use a similar principle, the carrier signal received demodulated digital frame, Interpretation reduced to digital distributed HCT. Four table (water, electricity, gas, heat meter) CC genus pulse volume collection, after collection by the pulses from the station converted into a carrier signal is sent to the master, the master pulse volume reduction.
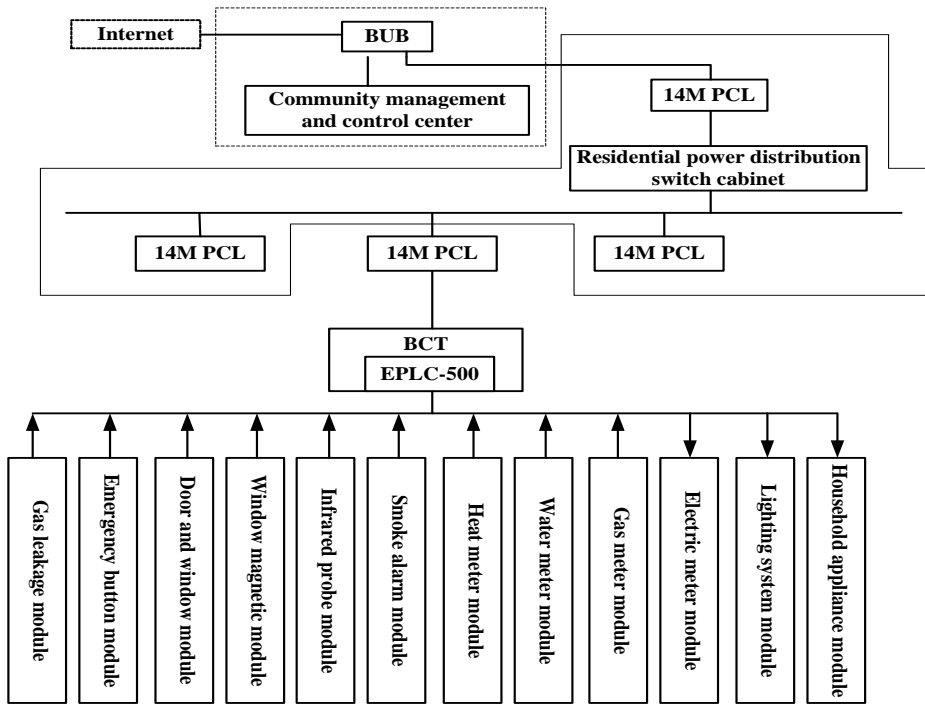
Figure 3: Smart home network mapping system

3.2 Running processes controlling application

Master program designed with loop combination of various modules (Figure 4). The first part of the process flow of the system is first run, the only run once; the second part of the process is the process run every time the system is powered; the third part of the normal operation of the process is a process. This loop execution time is very short, typically a few milliseconds or tens of milliseconds.
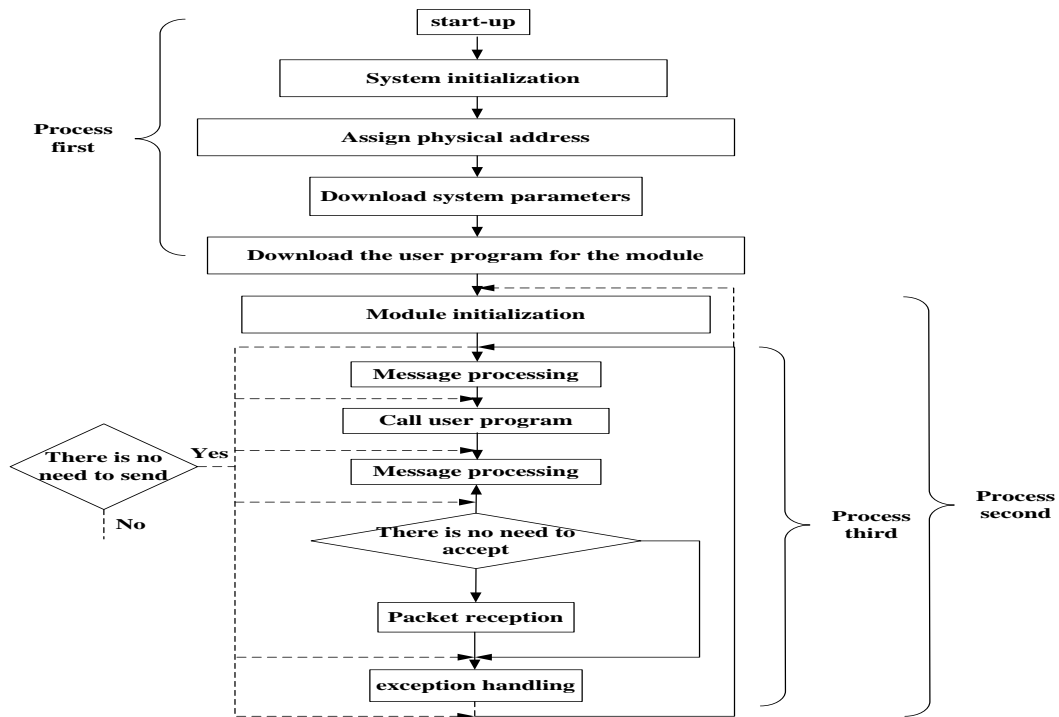

Figure 4: ICDT master control program flow

Smart home control software management system in accordance with the main high-low coupling polymerization, top-down stepwise refinement of the design principles, the system function modules: "DHCP server" module (responsible for the underlying communication function), "Information Query Monitor "module" control system "module" alarm monitor "module" telephone remote control "modules," Internet control "module and" database server "module. This article focuses on "control system" module design, main structure is given in Figure 5 specific "control system" module, which includes system management, data management terminal, send messages, community services, queries, database management, interface settings , window and help directory entries.
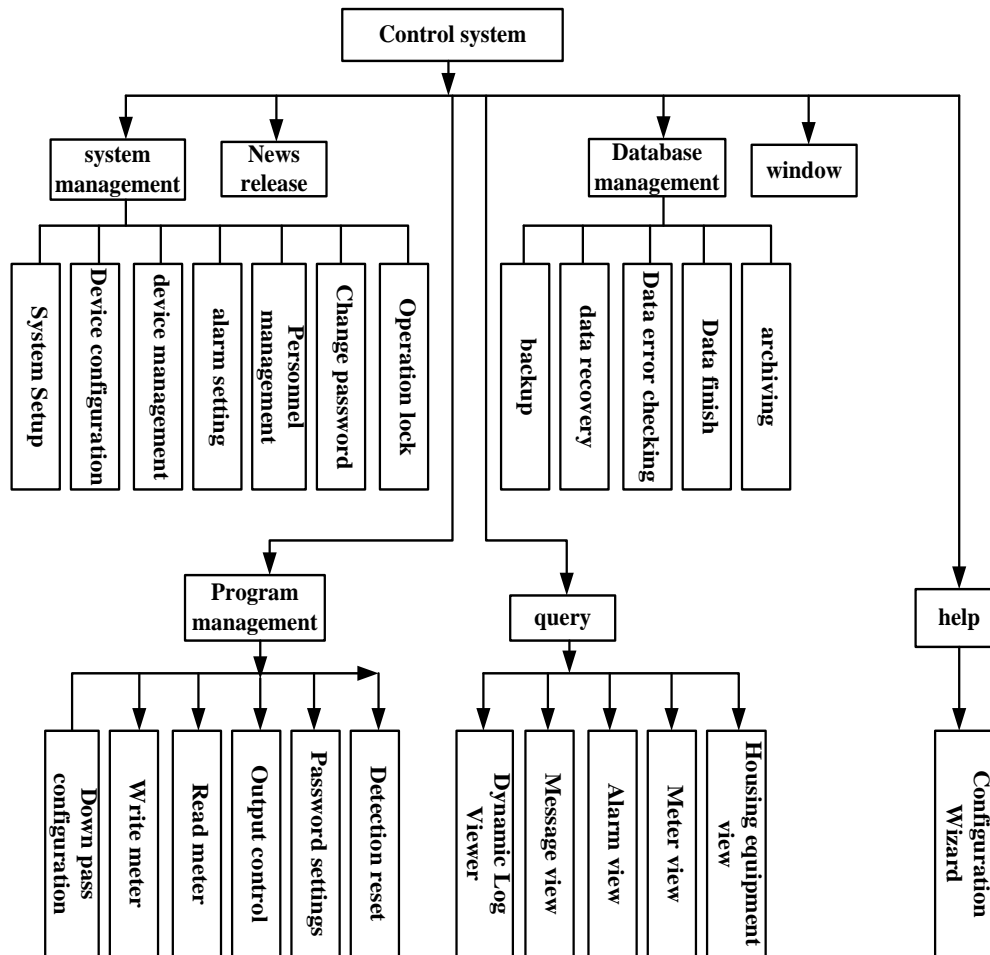

Figure 5: Control system module main structure design

4. Conclusions

With the development of power line carrier communication technology, especially the development of high-speed power line communication technology and mature, the power line carrier communication technology into the field of intelligent home will be on the development and popularization of intelligent home play a positive role in promoting. Based on the power line communication technology, research and development of intelligent home automation system based on the power line, and power line combined with high-speed data communication system constructed based on low-voltage distribution network set INTERNET access, intelligent home control in one of the intelligent digital cell for power line communication technology and smart home applications has opened up new areas. Based on the power line communication technology, research and development of intelligent home automation system based on the power line, and power line combined with high-speed data communication system constructed set of Internet-based low voltage distribution network of the Internet, intelligent home control in one of the intelligent digital cell for power line communication technology and smart home applications put forward new ideas.

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