LED 조명장치의 네트워킹을 위한 원격다중통신시스템

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Remote Multi-Communication System for Networking of LED Lighting Devices

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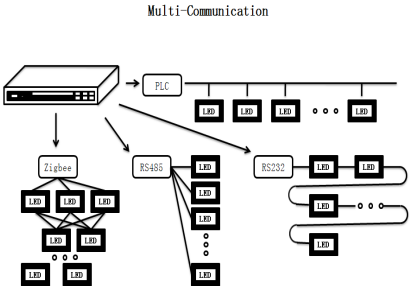
Abstract - The main contents of this paper is to design a system that can remote control the most of the LED lighting device in the market. In order to realize the device driver, we choose the communication mode Zigbee, PLC, RS232 and RS485. Using client-server system, LED lighting device can be controlled just through web browser.

1. Introduction

LEDs are growing in popularity because they are following the major trends in the lighting industry, in which there is strong demand for lighting equipment that is getting smaller, smarter and more colorful. LED lighting, in particular colored LEDs, offer a number of advantages over traditional light sources in a broad range of applications. According to a new report from Strategies Unlimited, the LED lighting market will grow at almost 37% over the next few years. By 2011, the total market for LEDs in lighting is forecast to grow at a CAGR of 36.9% to reach approximately $1 billion.
The largest lighting application for LEDs is architectural lighting, followed by channel letter/contour lighting and consumer portable.
There are a lot of LED products and controllers in LED lighting market, but all most of them are used in the stand-alone system, controllers just have single communication. So there is a problem for stand-alone system. that is each lighting device cannot be controlled totally. So multi-communication system for networking of LED lighting system is proposed in this paper.

2. Multi-Communication System

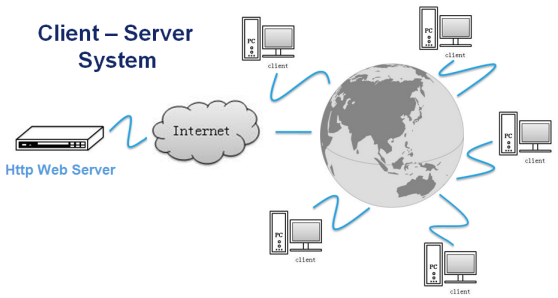
A communications system is a collection of individual communications networks, transmission systems, relay stations, tributary stations, and data terminal equipment (DTE) usually capable of interconnection and inter-operation to form an integrated whole. The components of a communications system serve a common purpose, are technically compatible, use common procedures, respond to controls, and operate in unison.
Many LED lighting devices have different communication such as Zigbee, PLC, RS485 etc. So a single communication system is not enough, multi-communication is necessary.



<Fig 1> Multi-Communication

3. Client-Server System

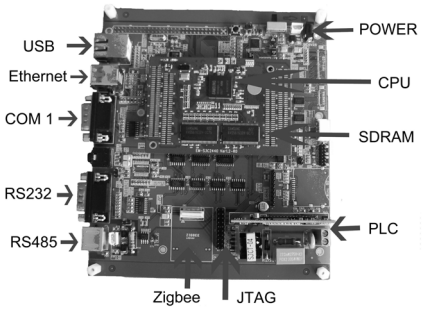
The client-server software architecture model distinguishes client systems from server systems, which communicate over a computer network. A client-server application is a distributed system comprising both client and server software. A client software process may initiate a communication session, while the server waits for requests from any client.
The client-server model has become one of the central ideas of network computing. Most business applications being written today use the client-server model. So do the Internet's main application protocols, such as HTTP, SMTP, Telnet, DNS, etc. In marketing, the term has been used to distinguish distributed computing by smaller dispersed computers from the "monolithic" centralized computing of mainframe computers. But this distinction has largely disappeared as mainframes and their applications have also turned to the client-server model and become part of network computing.



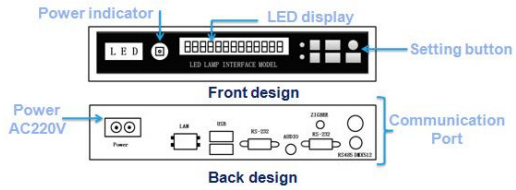
<Fig 2> Client-Server System

4. Hardware Design

Samsung S3C2440 be used for CPU in this system. This is a microprocessor-based ARM920T core 16/32 bit embedded RISC microprocessor, CPU running at up to 400MHz, with high performance, low power, low cost and small size, etc. So we designed PCB board for S3c2440 and designed box.



<Fig 3> PCB board



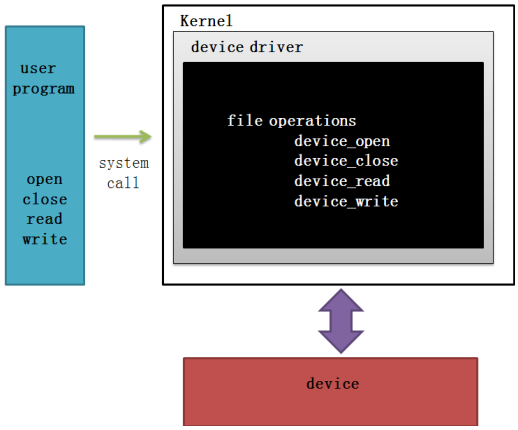
〈Fig 4〉 Box Design

5. Software Design

4.1 Device Driver

Linux Device Driver is actually the peace of code which very well knows the device it is controlling. It knows the behavior and has knowledge of device internals. Device Drivers in Linux can be a part of core kernel it self or it can even be developed as a separate module, which can be attached/detached from running kernel anytime, providing a flexibility in kernel to support multiple devices in dynamic environment.

A device driver has three sides: one side talks to the rest of the kernel, one talk to the hardware, and one talk to the user.



〈Fig 5〉 Device Driver

```
[root@falinux nfs]$ insmod dev_gpio.ko

 register device S3C2440 GPIO B Port driver 13.11   OK (major=194)

[root@falinux nfs]$ lsmod
Module                  Size  Used by    Not tainted
dev_gpio                2728  0
```

〈Fig 6〉 Install Driver

4.2 CGI Program

A CGI program handles information requests and returns the appropriate document or generates a document dynamically as needed. A CGI program processes browser requests and returns the appropriate information in a form usable by the browser.

A CGI program, or gateway, is an executable program or command procedure run on a Web server. The program is triggered by input from a browser and is a link between the server and some other program running on the system.

Depending on what your Web server supports, CGI programs can be command procedure or compiled programs.

4.3 Command Packet Design

There are so many LED device in the market, and all most of them have different command packet. According to the characteristics of most of them we have designed command packet. Command packet is divided into four kinds: White LED Lamp, Text LED, DMX-512 LED, 3 Color LED.

WHITE LED LAMP(조명용) 제어 Packet

①START HEADER	②TO ID	③FROM ID	④DATA LEN	⑤CMD	⑥DATA1-DATAn	⑦CHECKSUM	⑧ENDHEADER
1 byte	2 byte	2 byte	1 byte	1 byte	10 byte	2 byte	1 byte

TEXT LED 전광판 제어 Packet

①START HEADER	②TEXT	③END CHARS	④EFFECT	⑤LOOP	⑥SPEED	⑦END TEXT	⑧STO
1 byte	2-24 byte	1 byte	2 byte	2 byte	2 byte	4 byte	2 byte

반복구간

DMX-512 LED 전광판 제어 Packet

①COMMOND	②RED	③GREEN	④BLUE	⑤예약	⑥예약
1 byte	1 byte	1 byte	1 byte	1 byte	1 byte

DMX-512 LED 전광판 제어 Packet

①COMMOND	②SCENE NO	③EFFECT NO	④예약	⑤예약	⑥예약
1 byte	1 byte	1 byte	1 byte	1 byte	1 byte

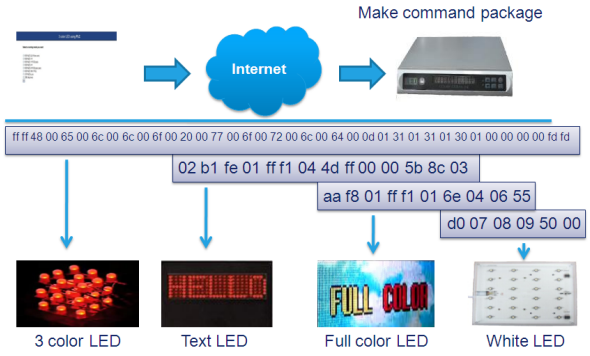
3COLOR LED LAMP(경관조명용) 제어 Packet

①START HEADER	②LEN	③FLAGS	④TO ID	⑤FROM ID	⑥CMD	⑦DATA1-DATAn	⑧CRC16	⑨STO
1 byte	1 byte	1 byte	2 byte	2 byte	1 byte	10 byte	2 byte	1 byte

〈Fig 7〉 Command Packet

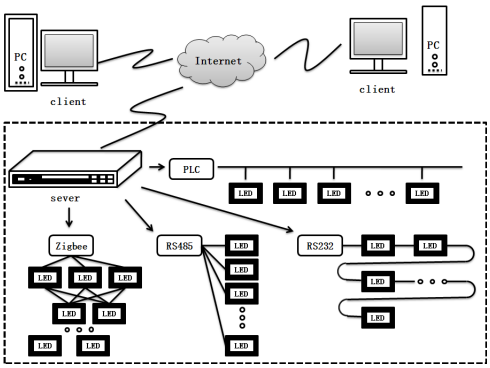
6. Experiment Result

We have done to control the Led through the Internet. Wherever and whenever we can real-time control LED lighting system. This is my controller is not only the restrictions led to the specified controller, or PC, mobile phones , PDA any tool what can connect to the Internet.



〈Fig 8〉 Experiment Result

7. Conclusion



〈Fig 9〉 multi-communication system for LED lighting system based on embedded system

System architecture has been designed. Multi-Communication System and Client-Server System has been realized. Hardware also has been realized and software has been programed.

There is a remote multi-communication system for LED lighting system based on embedded system. Although this system has been completed, but is not very sound. There are many security issues that need to be resolved. If using web

camera, we can know romet LED device status by homepage. In that case, this system performance and stability is even more powerful.

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