The Intelligent Management System of Electricity Purchasing Based on Internet Applications

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Keywords: internet applications; power control; IC card; power purchase buffet

Abstract. For the current problems that electrical energy consumption is huge and complicated and electricity management raising a method of the intelligent management system of electricity purchasing based on internet applications. The intelligent management system consisted of the client terminals, power switch control cabinets and remote control center servers with the function that power purchase buffet, querying the electricity information, outage notifications, inquiring and losing personal IC cards, IC card information management, real-time deductions and payment recharge. The experimental results show that the system can effectively real-time monitoring for user electricity usage, eliminating the need for manual meter reading and avoiding errors caused by manual meter reading, also benefited for power purchase buffet and querying electricity usage, improved the efficiency of energy management.

Introduction

In the situation where Internet applications moving toward diversify and energy crisis, the use of Internet technology is a new trend to achieve management automation and humanity [1]. With the diversification of electricity demand and proposed "people-oriented" management philosophy, only adopt modern management tools, introduced scientific management methods to resolve the power management problem. The improvement of people's living standards, the use of electrical energy is increasing, processing electricity charges and data management workload is growing electricity consumption. Changing the traditional manual meter reading mode, reducing on-site meter reading meter reading staff human error, to achieve paperless meter reading, energy metering automation, data transmission network, it will become a trend. By using Internet technology applied to the purchase of electricity management system, it will replace the traditional manual power switch control and manual meter reading and the burden caused by artificial fee. The system can updates the user data with timing automatic meter reading, and the functions that power switch automatic control, user fees reminders, and the use of history electricity, checking purchase electricity records and user non-contact IC card intelligent management. The diversified electricity purchasing way will further enhance the efficiency of power consumption in the user terminal and power management, reduce administrator workload and benefit to use for user.

The Overall Structure of the Intelligent Purchasing Power Management System

The intelligent management system of electricity purchasing based on internet applications using C# and SQL (Structured Query Language) as programming language, to build the master server administrator user interface and the client user interface via Visual 2008. Control center server uses SQLServer2008 as database, client terminals using ARM9 embedded platform equipped WINCE6.0 operating system and the client user interface, meanwhile based on the embedded platform extended the non-contact IC card reader module and realized power purchase buffet and power usage query

function [1]. Power switch control cabinet using 51 microcontrollers as the main chip to link the control center server via Transmission Control Protocol / Internet Protocol (TCP / IP) transfer RS485 module, the server sends a command in the control center off and energized for users. The overall structure of the system is shown in Fig. 1:

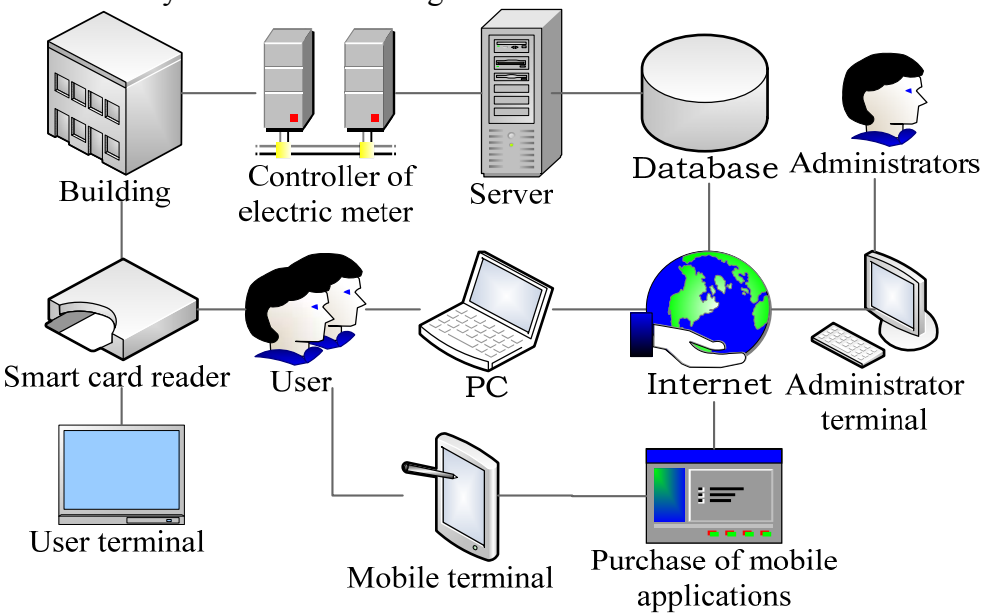

Fig. 1. Structure diagram of system

The Diversified Method of Purchasing Electricity

The system from the user point of view allowing users to easily purchase and clearly display electricity consumption and providing a wide power purchase and consumption situation inquiry via [2].

Users can selectively apply individual IC cards and mobile phones registered Internet purchase system account that is through the IC card, a mobile phone application software or PC computer log the purchase of electricity purchase payment systems operate and transact business with the charge information query. Diversification purchase way solved issues that the unknown electricity usage and user purchase contributory complex.

Diversification purchase way is shown in Fig. 2:

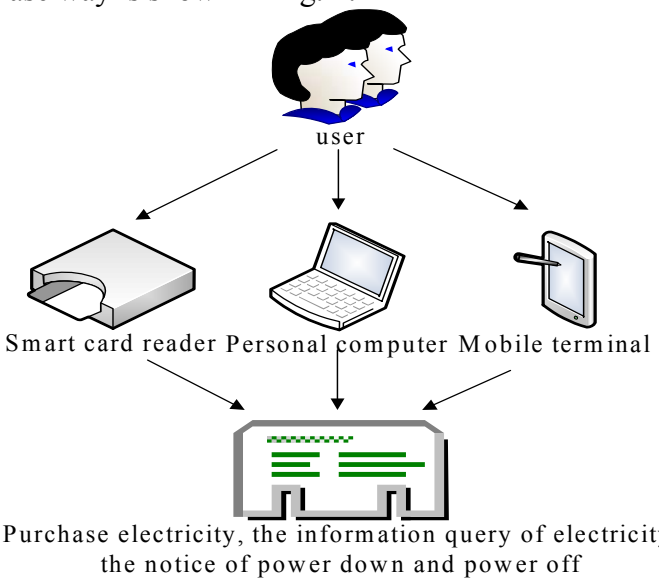

Fig.2. Configuration diagram of diversified power purchase mode

The Communication of Client Terminal

Internet network is the bond transferring instruction and information among master server and client self-purchase of electricity and control cabinet. In the Client / Server communication mode, communication between the client and the server using Socket programming interface, in the OSI network7 layer protocol, Socket shielded data link layer and physical layer, it is responsible for transport and network layers, program is simple. In the remote control of the system, it requires reliable link transmission and real-time control, and a small packet loss rate, so use the connection-oriented (TCP) of Socket programming. The remote control process chart of Socket programming is shown in Fig. 3.

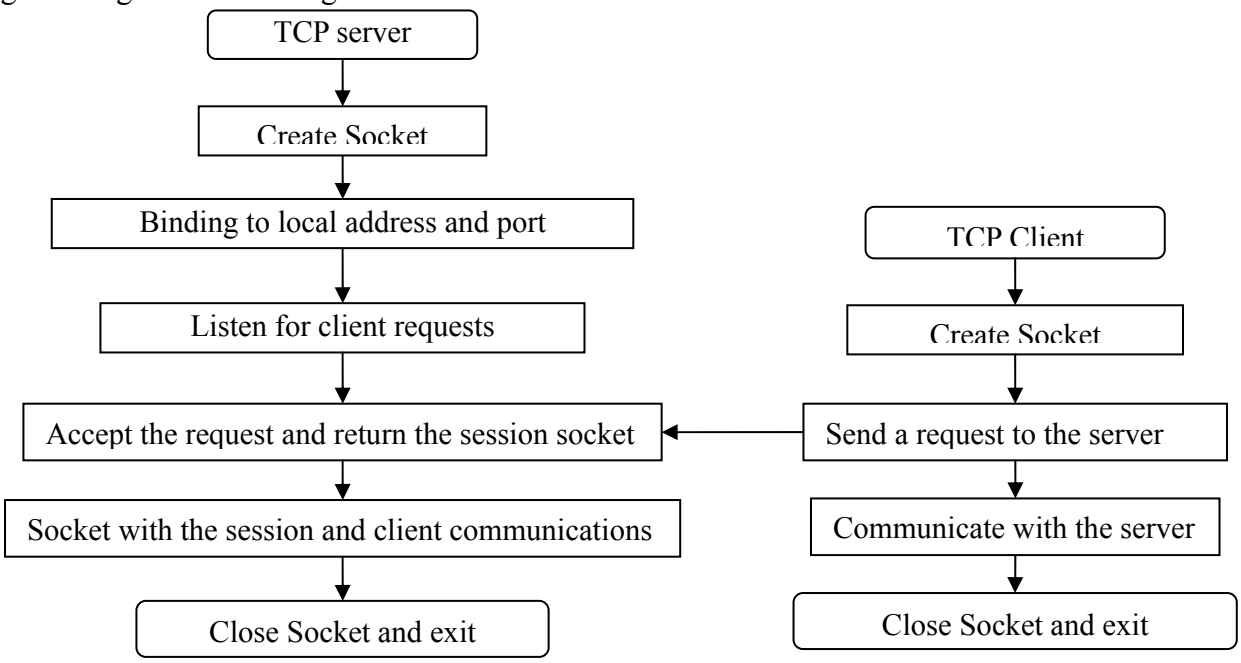

Fig.3. The flowchart of remote control which based on TC

The Design of Database

The system uses SQL Server 2008 as the database [3], in the database establish building information table, IC card information table, user information table, payment information table, meter information table, operation information table.

The specific design of the main data table structure as follows.

Table 1. The information about buildings

Column Name	Data Type	Description
apartment_id	Int	Automatic numbering
apartment_num	nvarchar(50)	Building number
meter_num	nvarchar(50)	Electric meter number
meter_amount	decimal(18, 2)	Residual electric quantity
ele_debt	nvarchar(50)	Whether the arrears
apart_remark	nvarchar(MAX)	Remarks

Table 2. The customer information

Column Name	Data Type	Description
user_num	varchar(20)	User number

user_name	varchar(20)	User name
user_password	varchar(20)	User password
user_ power	char(10)	user permission

Table 3. Integrated circuit card

Column Name	Data Type	Description
card_num	nvarchar(50)	IC card number
stu_num	nvarchar(50)	User number
stu_name	nvarchar(50)	Name
card_pwd	nvarchar(50)	Password
money	Money	Current balance
card_remoney	Money	The amount of recharge last time
recharge_time	Datetime	Last time to retarge
card_time	datetime	Card issuing time
card_sxdate	datetime	Expiry date
card_Gs	nvarchar(50)	The loss of marks
card_remark	nvarchar(MAX)	Remarks

Table 4.The information sheet of payment

Column Name	Data Type	Description
pay_num	nvarchar(50)	Bill of payment number
pay_money	money	Payment amount
pay_amount	nvarchar(50)	Purchasing power
apartment_numm	nvarchar(50)	Building number
meter_amount	nvarchar(50)	Surplus electricity
card_num	nvarchar(50)	IC card number
stu_num	nvarchar(50)	Valid ID number
stu_name	nvarchar(50)	Name
ele_debt	nvarchar(50)	Whether the arrears
meter_value	float	Current meter reading
pay_time	datetime	Payment time

Because in the management software system all data are stored in the database, for safety and to avoid unexpected data losing data, so the operation of backup, restore and export for the database in the software is necessary [4].

Database backup and database recovery flowchart is shown in Fig. 4.

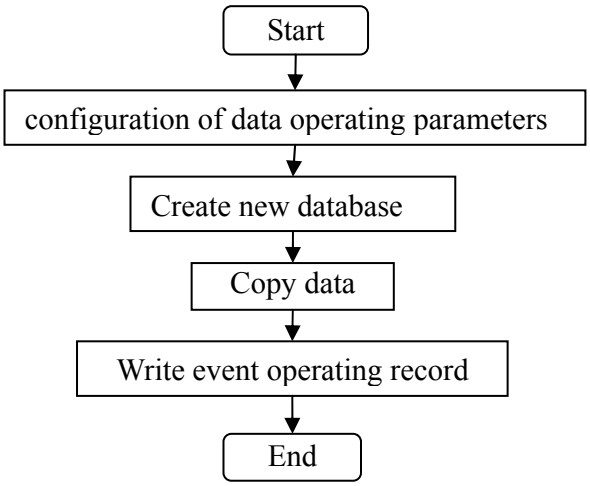

Fig.4. Database backup and recovery flowchart

Operating Results and Analysis of the System

In accordance with the needs analysis the system design is divided into: server-side management software system [5-6] (mainly including user information management, building information management, IC card information management, payment system, query system, user management, outage notification, remote meter reading management, reporting systems, system maintenance, database backup and restore module and help, etc.), the client self-purchase system (mainly including IC card management module, Web site modules, mobile application software modules, self-purchase modules, water query module, outage notification module), according to the module content complete the basic operations tasks such as log on, inquiry, payment, recharge, add, modify, delete and print.

The practice test, the system based on ARM and Internet application platforms effectively real-time monitoring management for the use of electricity, economical and practical, good reliability, to avoid the error of manual meter reading power, and to allow users to query information and purchase electricity using the Internet anytime and anywhere.

Conclusion

The design is a the intelligent management system of electricity purchasing applied to Internet applications, not only can achieve real-time monitoring the electricity for users, but also can accurately record and compute, according to the requirements of the control center transmitting data, and to control, the user can check the power of information and pay for electricity on the terminal or Internet device. Human-computer interaction interface can breezily and simply operate [7]. Payment of electricity bills and electricity inquiring work is convenient, fast, simple and effective; IC card approach allows users to purchase electricity like the ATM machine withdrawals as simple and practical.

Acknowledgement

This work is supported by teaching innovation project of Bohai University (No. BDJG-14-YB-A-002), Education Science Planning Foundation project of Liaoning province (No. JG15CB166).

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