Design and Implementation of Self-Service Terminal for Electric Power Marketing Service

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Abstract At present, the existing electric power marketing service channel lacks a comprehensive and effective service mode. Realize a power marketing business self-service terminal comprehensive design of hardware and software. The terminal integrated high-definition video communications, human-computer interaction and cooperation, remote intelligent routing, biometrics and electronic collection and other high technology. With self-service, remote assistance and counter employee processing three business models, highly integrated the existing variety of business management method.

Introduction

Self-service terminals¹ have been widely applied to telecom, power, medicine, aerospace, retailing and other industries² since the first debut in the bank sector. Market demands for self-service terminals are boosted by rapid growth of bank and telecom industries, fast increase of bank and business branches, as well as improvement of industrial service and information construction.

With deepening reform of electric power companies and fast development of urban grid construction, power users come up with higher requirements for quality of electric power as well as service and operation efficiency of electric power companies³. By analyzing challenges for technologies⁴ of current service channels on basis of user demands, this paper defines design principles and ideas for hardware and software of self-service terminals which are used to support power marketing business. Except business scope of hardware and software of self-service terminals, this paper also introduces service modes and network topological structures⁵. At last, this paper presents current and future application of self-service terminals.

Current Situations and Demands of Power Marketing Service

At present, marketing service of power electric companies relies on electronic and traditional service channels. Although convenient, effective and labor-efficient, the electronic channel can only support part of marketing services. Power users can’t apply for power capacity increase and new power utilization in electronic channel. As a contrast, traditional business hall can provide comprehensive marketing service. However, the traditional channel suffers low efficiency and poor user experience due to lack of effective service mode. To narrow the gap caused by last kilometer between electric power companies and end users, this paper invents a self-service terminal for power business, which could solve users’ demands, improve user experience and cut down investment in construction of business branches. The self-service terminal serves as an upgraded electronic service channel beyond the portfolio of existing electronic service channel and human service channel. Clients can communicate with tellers through online remote video and handle their businesses.
Design of Hardware and Software

Hardware Design

The self-service terminal gets upgraded on basis of original self-service payment terminal for power fees. In addition, all functional modules are designed according to actual demands.

1) Master control module: this module consists of IPC, sound module, alarm module, various control circuits, and other supporting accessories. All these parts are installed inside the case. This module supports information collection, remote connection, information conversion, information communication, system monitoring and other functions [6].

2) Display module: the self-service terminal has two screens, one for user operation and one for interaction. Both of these two screens are connected to graphic card of the host. Web pages are displayed on basis of an embedded web browsing program. This program can launch two embedded windows for web pages, one of which is on the operation screen and the other of which is on the interaction screen. While using the operation screen, users can get hints on the interaction screen. In addition, users can control information displayed on the interaction screen by controlling operation screen.

3) Printing module: the module consists A4 printing module, slip printing module and invoice printing module

4) Fingerprint identification module: this module adopts the 3rd-generation biological radio frequency identification technology. The sensor can emit radio signals to penetrate epidermis of fingers and thus identify and record the clearest fingerprints.

5) Card reading and writing module: this module consists of power card reading and writing module as well as debit card reading and writing module.

6) ID reading module: this module uses RFID technology to read information on ID cards.

7) Password keyboard module: It uses 16 hardware-encryption small keys, which support DES and 3DES algorithms based on ECB and CBS as well as the SAM encryption of Union pay. Once opened by force, the password keyboard module will destroy secret keys automatically. This module is used by users to type in password

8) High-resolution scanning module: this module can scan ID cards, passports and relevant documents.

9) Monitoring module: With high-resolution auto-focus (AF) lenses, this module is mainly used for monitoring, taking photos, and video interaction.

Software Design

Business Scope. Businesses of the system mainly cover business processing, payment of power charges/power purchase, inquiry of power consumption information, auxiliary service, and public service etc. [8]

1) Processing of Businesses

The businesses mainly refer to processing of the application for new power utilization, processing of the application for power capacity increase, and processing of the application for power utilization change. Application for new power utilization (power capacity increase and power utilization change): power users can choose to submit business applications on the self-service terminal according to application requirements of electric power companies. They can also fill out application forms for new power utilization (power capacity increase and power utilization change) with remote assistance of service seats, submit relevant materials, and deliver application forms.

2) Payment of Charges/Power Purchase

This service mainly refers to power purchase, payment of charges, and printing of invoices.

3) Inquiry of Power Consumption Information

Uses can inquire client information, payment information, business progress, arrearage statement, power consumption, power fees and power purchase information.
4) Auxiliary service

Auxiliary service covers phone number registration of contacts, registration of ID information, record of fingerprints, change of service passwords, and information subscription.

5) Public Service

Public service involves information announcement, service evaluation and suggestions, business consultation, business guide, and common problems

**Service Modes.** The self-service terminal operates in three service modes: self-service mode, assistant mode, and teller service mode [9].

Self-service mode: when operating the self-service terminal, users can process businesses and inquire information according to hints on different business types.

Assistant mode: Users can process businesses by video interaction or remote guidance of service seats. The service seats can communicate with users and guide them by high-resolution video and remote desktop sharing during the process.

Teller service mode: service seats can process businesses for users in remote control. In this mode, users only need to start video conservation with service seats and ask them to process relevant businesses, but they should provide necessary documents to service seats. These service seats process businesses through video interaction, remote projection, remote desktop sharing, and remote document inspection.

**Network Topology.** Based on B/S structure, the network topology of the self-service terminal is composed of the platform system, self-service terminal, marketing business system of electric power companies, multimedia service system, signal channels, and other business systems, among which the platform provides background support to applications of the self-service terminal, the marketing system and other relevant systems offer support to business processing, multimedia servers prop up video interaction service, and the self-service terminal serves as an end device for operation interface. These self-service terminals are installed in business branches of electric power companies around the city on basis of their internal network which is separated from Internet by the firewall. The network topology is shown in Figure 1:

![Figure 1. Network Topology.](image)

**Key Technologies.**

1) High-Resolution Remote Video Interaction and Remote Assistant Interaction Mode

Technically supported by two screens, the self-service terminal should enable 1080P high-resolution video chat with an all-round actual-scale view, so as to simulation the natural and real experience as face-to-face service. The platform can allocate service seats to users according to their business types and help users with their businesses. In order to visualize the operation process, this terminal is equipped with devices for card reading, card writing, and slip printing, which could simulate delivery of documents and improve user experience without changing their habits.

2) User Identity Recognition Technology

The 2nd generation ID recognition technology can be used to identify authenticity of ID cards and read ID numbers. This terminal uses the 3rd generation biological radio frequency recognition
technology to identify fingerprints. The sensor can emit radio signals to penetrate epidermis of fingers and thus identify and record the clearest fingerprints. In addition, the terminal can identify veins which are 3mm under the palm skin by near-infrared ray.

3) Electronic Signature

The self-service terminal uses electronic signature to guarantee business security. Clients can sign their electronic names on the screen while processing businesses. The terminal is equipped with an electronic signature panel which is could encrypt electronic signatures and integrates such signatures to signed documents for prevention of illegal copy.

Realization of Hardware and Software

Achievements of Hardware Design

The terminal is manufactured according to above hardware and software design. The sample of the terminal is shown in Figure 2:

![Figure 2. Sample of the Terminal.](image)

The self-service terminal includes four modules: advertisement video module, host control module, printing and collection module, and IPC module. The advertisement video module consists of LED, monitoring device, and lightbox. The host control module includes operation screen, anti-explosion telephone, ID reader, encryption keyboard, and fingerprint recognizer. The printing and collection module is composed of A4 paper recycler, power card reader, debit card reader, overlooking camera, invoice printer, and slip printer. IPC module consists of IPC device, sound module, alarm module, various control circuits, and other auxiliary devices. They are installed at the bottom of the case.

Business Process of the System

Businesses of the self-service terminal mainly cover business processing, payment of charges, power purchase, inquiry of power consumption information, auxiliary service, and public service. The business process is shown below.

1. Processing of Businesses

The businesses mainly refer to processing of application for new power utilization, processing of application for power capacity increase, and processing of application for power utilization change. These services are collectively called as application for new power utilization and power capacity increase.

Major steps of the business process:

(1) Identity Recognition

While selecting the business, which needs to be processed on the home page of the self-service terminal, power users will see a page for identity recognition. They must put ID cards on recognition module for confirmation of their identities.

(2) Registration of Power Consumption Information

Power users need to fill out electronic application forms on the touch screen for various business types. While filling out the forms, the self-service terminal will display demonstration pictures and help service seats solve problems of users by high-resolution remote video service. The demonstration pictures and service seats will help users fill out application forms and registration information. All information filled out by users will be stored in the system in an encryption way.
(3) Scanning and Submission of Documents

Power users need to scan materials used for applications at the scanning area according to their business types. The system will store the scanned information. In order to make it more convenient for users to process businesses, the self-service terminal enables users to scan such materials inconsecutively in consideration of the occasion in which users forgot necessary materials and fetched it later on.

(4) Confirmation and Printing of Application Form for Power Utilization

After the system generates the power application form, power users need to confirm the form and print the paper slip which bears a unique 2D code.

(5) Confirmation in Form of Signature

The confirmation can be made by handwriting signature and electronic signature. Confirmation in form of signature on paper documents refers to scanning and storing paper documents on the terminal after stamping seals and signing signatures. Confirmation in form of electronic signature refers to signing signatures on the screen of the self-service terminal with an electronic pen while processing businesses.

2. Inquiry of Power Consumption Information

Power users can inquire user information, payment information, information of business bills in progress, arrearage statement, power consumption information, power fees, and power purchase information on the self-service terminal.

Major steps are shown below:

(1) Log-In
Before inquiring power consumption information, power users need to log in the system.

(2) Inquiry of Power Consumption Information
After opening the power consumption inquiry page, power users can see available inquiry items on the page. They need to select corresponding item for power consumption inquiry.

(3) RFI for Marketing System
After receiving request for information, the self-service platform will send requested information to the marketing business system according to interface protocol of the marketing system.

(4) Decoding of Returning data
The platform will decode returning data of the marketing system and send the decoded data to the self-service terminal.

(5) Display of the Terminal Interface
The self-service terminal will display the interface after receiving the decoded data.

Conclusion

This paper introduces current situations and demands of power marketing services. The paper summarizes advantages and disadvantages of current electronic and traditional service channels by reviewing both the electronic service channel and traditional service channel of the power industry. This paper designs, develops and realizes software and hardware of the self-service terminal by combining advantages of both service channels.

The self-service terminal is characterized by inborn advantages, such as short construction cycle and convenient deployment etc. It is predicted that self-service terminals will be installed in office buildings, communities, rural areas or remote areas for business branches to narrow the gap caused by the last kilometer between electric power companies and end users. To testify advantages of self-service terminals over other service channels, the authors launch pilot projects in State Grid Anshan Power Supply Company and State Grid Beijing Power Supply Company. Users consider the self-service terminal reasonable, reliable, convenient, efficient, and easy to be used during actual use, because the terminal can meet users’ demands for business processing and information inquiry.
References