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Summary and Structure of Building Energy Monitoring Platform

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Abstract: Based on the discussion of energy consumption in buildings, this paper introduces a large-scale energy saving service platform for building energy conservation, which is oriented to vertical field-building energy saving field. According to the characteristics of energy use of large public buildings, this paper puts forward the software business function architecture of the platform and the overall technical framework of the system. And through the SOA architecture to achieve better reuse and loose coupling.
Keywords: energy management, public buildings, energy use, heterogeneous coupling.

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1. DISCUSSION BACKGROUND

All the time, the problem of energy consumption is concerned all over the world, and the energy consumption of buildings occupies a large proportion of the total energy consumption, and the high energy consumption of large public buildings and community buildings bear the brunt again. In building energy consumption, the problem of high energy consumption in large public buildings is increasingly prominent. With the development of urban construction, residential buildings, especially large public buildings, have been growing very fast in recent years. In 2009, the area of office buildings and large public buildings will double that of 2004. Office buildings and large public buildings have significantly higher energy use densities than residential or general public buildings. At present, the number of office buildings and large public buildings is only 4% of the total number of urban buildings, but its annual electricity consumption has reached 22% of the total electricity consumption of the towns, and the annual power consumption per square meter is 10-20 times that of ordinary residential buildings. Many countries have low energy efficiency and huge energy saving space. At present, the core challenge is that the mainstream energy saving service companies in the market have not grasped the energy use condition of large buildings, the energy management is extensive, and the energy employment scheduling is not closely combined with the energy saving service.

2. SECONDLY SUMMARY

This paper mainly focuses on the energy collection monitoring service platform in the vertical field-building energy saving field. Through the energy monitoring, energy information management and energy consumption sub-measurement construction, the energy consumption data is collected and sorted out. Based on the function of energy consumption data acquisition and analysis, the corresponding energy saving scheme is established, which takes energy efficiency as the core and energy saving and emission reduction as the goal. This paper mainly through the energy data acquisition instruments, sensors and other related hardware equipment, for the buildings of transformer and power distribution, lighting, air conditioning, elevators, water supply and drainage system of the practical situation of energy use analysis, The centralized real-time detection of each energy-using equipment is carried out in order to facilitate the energy manager to grasp the running state and the energy consumption status of the equipment, and to present energy consumption analysis to the energy-using manager in the form of a visual trend chart that is easy to understand. To facilitate the energy use management to effectively grasp the energy use status of the buildings it manages; at the same time, to develop a system to automatically analyze situations where the energy consumption exceeds the expected standard, and once the energy use management finds that the energy use equipment is abnormal, it can immediately carry out an investigation into the current situation. By combining the results of investigation with the results of systematic analysis, the management can formulate and implement the corresponding energy saving measures according to the unified basic principles of energy saving.

3. SOFTWARE ARCHITECTURE

3.1 Business function architecture

The result of functional requirements analysis is the basis of system development. Combining real-life and related energy management system examples, these business functions are derived:

(1) User registration, login, and personal information management functions.

(2) Check the actual location and energy use of the building via the map.

(3) Monitor energy consumption of the current building and make inquiries on real-time energy consumption charts, equipment operating status, and electricity usage, and use a line chart to express them.

(4) Conduct energy consumption analysis for the current building, and inquire about unit energy consumption, sub-item energy consumption, energy saving comparison before and after transformation, and use column charts and pie charts to express them.

(5) Inquire about the current conditions of the central air conditioning parameters of the building.

(6) The administrator reviews, makes up, corrects, and deletes inaccurate energy consumption data.

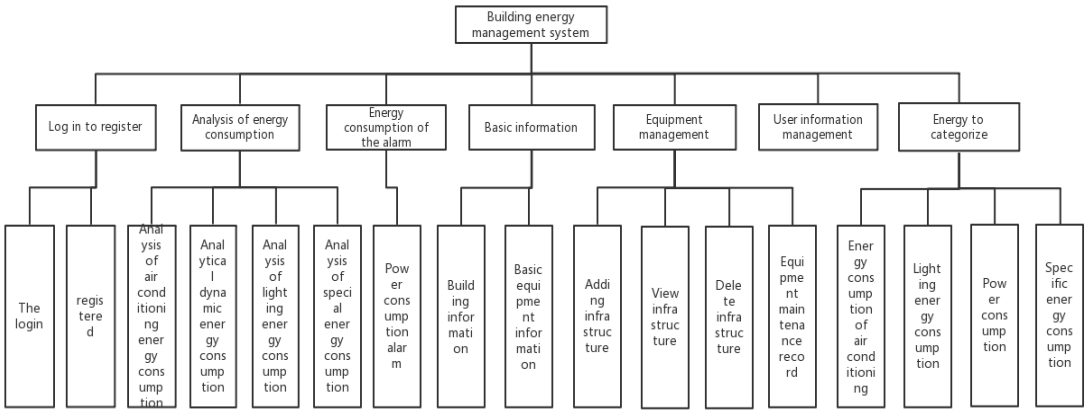

Figure 1. Functional architecture diagram

4. TECHNOLOGY ARCHITECTURE

The system adopts the SOA robust architecture model. The system uses the server as the core. The energy consumption data collection system based on the 97 Statutes and State Grid 376.1 Statute and the device status information collection system based on the DTU serve are as the core hardware support and data source of the APP. Based on the analysis of the overall hardware architecture, the hardware system architecture topology is as follows:

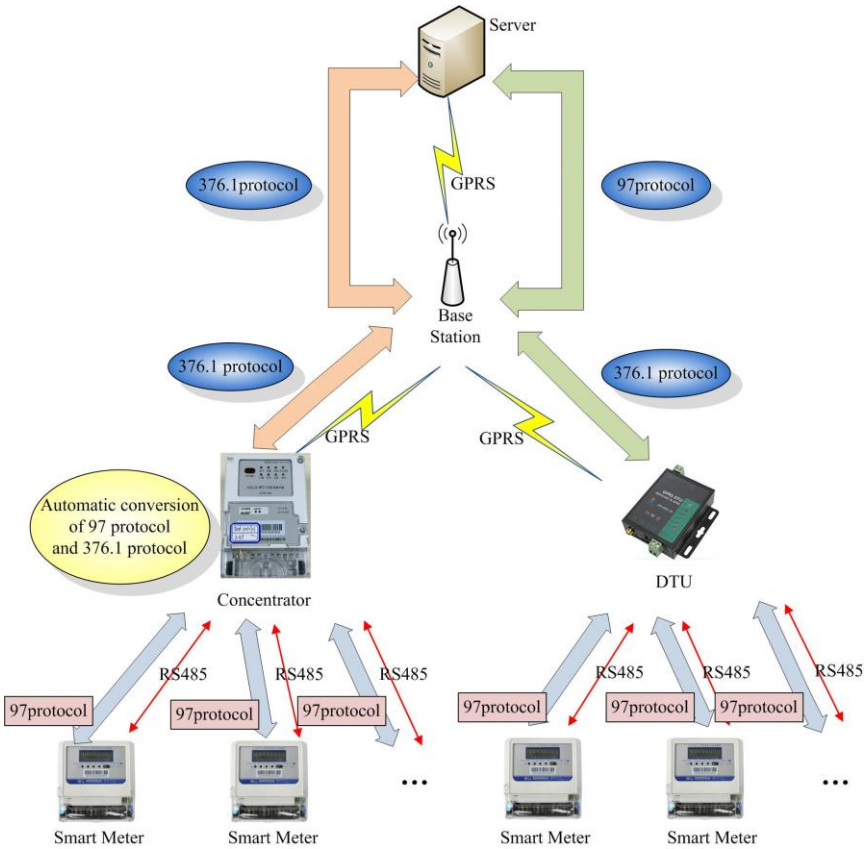

Figure 2. Hardware system architecture topology

Based on the data transmission structure analysis, the energy consumption meter collects the electricity according to the set time interval and uses the RS-485 standard serial Electric

interface to transmit the data to the concentrator or the data transmission unit (DTU), and the concentrator receives the packet and sends the base station by GPRS according to the Q/GDW 376.1 Communication Protocol. The base station forwards packets to the server, and the data transmission unit of the Data Transmission Unit (DTU) is similar to the concentrator, except that the dl/t645-1997 Communication Protocol is used in the whole process. The data transmission network architecture diagram is shown below:

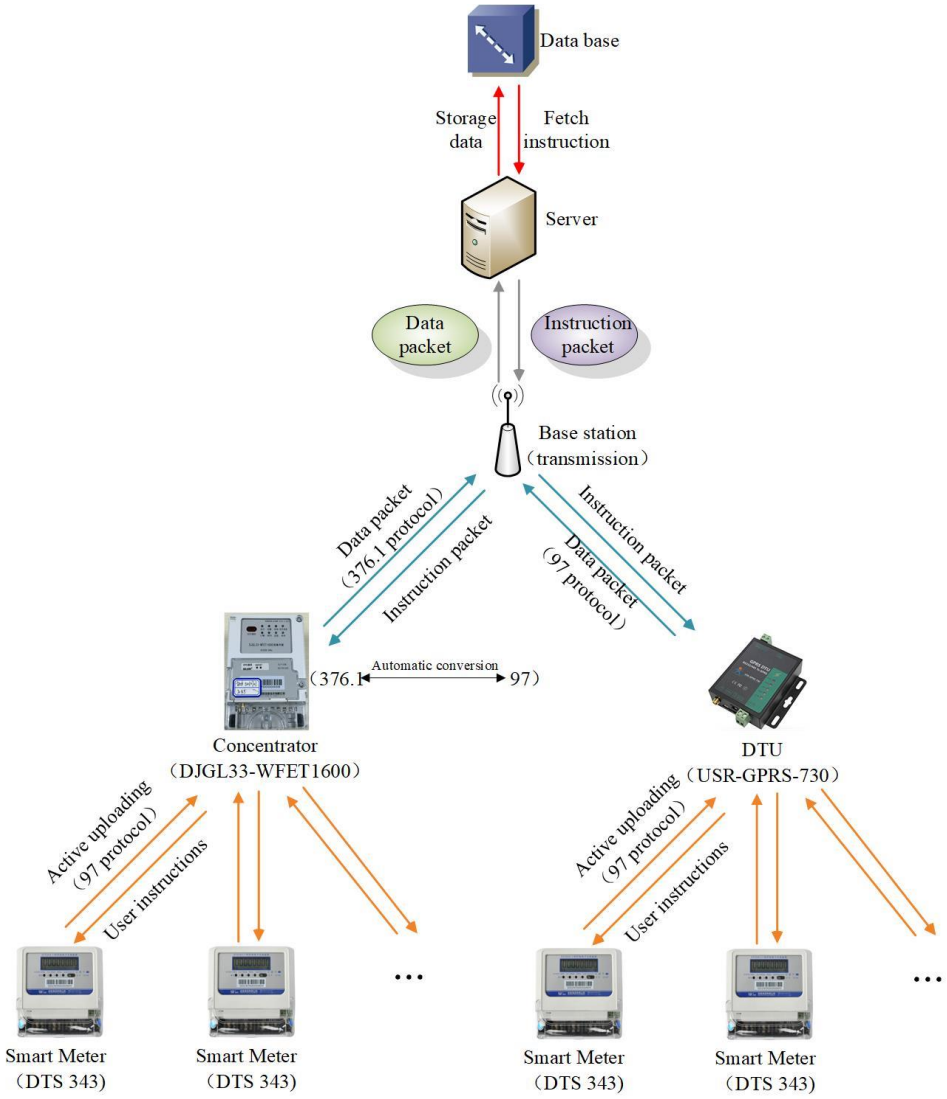

Figure 3. Data transmission network architecture diagram

In terms of hardware related features of the device, the meter collection system and DTU-based data upload system involved in the technology are all typical embedded systems. It is a software and hardware complex that involves many autonomous and heterogeneous hardware and bus systems, such as multi-function meters, concentrators, servers, PLCs, development boards, 485 buses, etc. The software needs to be based on the hardware platform. The work of the hardware part mainly includes the selection of the embedded microprocessor and the selection of the peripheral hardware circuit, the construction of the environment and the interconnection of numerous hardware devices. The work of the software part mainly includes selecting a suitable

operating system for porting and designing and developing highly stable embedded communication software.

In terms of communication protocols, there are many communication protocols involved in this architecture, and the analysis methods are relatively diversified. There are 97 Statutes, State Grid 376.1 Statute, MODBUS Communication Protocol, and TCP Protocol. The system will use appropriate communication protocols to complete the communication and interconnection between numerous hardware devices according to the specific hardware devices. There are different resolution methods used for different communication protocols.

The data acquisition system mainly includes the establishment of an embedded software operating platform and the development of related applications. The main task is to complete the development of the application program running on the required embedded software operating platform to support the Wince operating system. Based on Wince development, export the SDK with Platform Builder, select the corresponding SDK on the VS2008 to compile the acquisition software, and use network programming to upload data.

5. SUMMARY

This paper mainly focuses on the mobile building energy related field, which integrates building energy monitoring, energy information management, and energy user scheduling. As the same time, this paper comprehensively summarizes energy consumption in large-scale public buildings, analyzes the methods about decreasing the energy consumption of buildings and related technologies, describes the software business functions and introduces the technical architecture-related content and difficulties.