

Research on Smart Grid Model based on Internet of Things

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Abstract: Internet of things has the characteristics of radio frequency identification, wireless sensing, remote monitoring and the intelligent management. It is suitable to apply this technology in the power grid management. We can increase the grid security, reduce the labor intensity and realize the human-machine interaction based on the characteristic of the internet of things. The designed smart grid model that based on the internet of things uses the internet of things to build the four floor structure with information application, information management, information transmission and perception extension. Moreover, this article analyzed the detailed solution. Based on the internet of things, we build the model to transmit power, transform the power and distribute the power for the smart grid. This model can not only realize the grid equipment management of the enterprises, but also reach the information interaction and operation between users and grids.

1 INTRODUCTION

With the development of information technology and the pressure of power application, we can perfect grid application, grid stability, and increase the information interactivity between enterprise management and users, which has significant meaning to the smart grid development. The internet of things is the new type of communication network with the characteristics of radio frequency identification, wireless sensing, remote monitoring and the intelligent management. We can build the smart grid platform which combines internet of things with the power grid. The perception extension can build the interactive communication of human-material, material-material, human-human, and reduce the labor work. This solution will develop the grid intelligent and security as well as the communication between power supply enterprise and the users.

2 MODEL FRAMEWORK OF THE SMART GRID MODEL BASED ON THE INTERNET OF THINGS

2.1 Application Framework Design

Based on the internet of things, smart grid is the intelligent grid platform that combines with communication, perception, and remote control. It can realize the information collection and transmission of power supply, power transformation, power distribution, and power utilization. In addition, it can realize the remote interaction of both the users and grid companies to ensure the real-time monitoring and hyalinize the power utilization.

Based on the internet of things, the application module framework of the smart grid is based on the various requirement of the power utilization process. Build the module of smart power transmission, power transformation, power distribution and power utilization can help the power supply companies monitor the power information, and ensure the security.

In the information process, we can monitor the wire condition, tower condition and weather condition during the power supply processing that based on the internet of things. Moreover, we can

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collect and analyze the information in order to ensure the reliability and security of the equipment and power supply. During the smart power transformation, we can analyze the primary equipment condition and secondary equipment condition to ensure the accuracy. During the power distribution, we can realize the automatic power distribution, optimize and manage the power quality. During the user power utilization, we can manage user power consumption information and build both-way interaction between enterprises and users to ensure the power consumption transparency and accuracy.

Information transmission uses the special electrical communication network. It has the function of fast transmission, large data capacity, and anti-lose to ensure the communication accuracy, high-efficiency and energy conservation.

2.2 Layered Network Design

Based on the internet of things, the smart grid module can be divided into the application layer, network layer, perception extended layer based on the function requirement and technology differences. Figure 1 has the details.

2.3 Application Layer

Application layer builds management platform for the users and power management enterprises. Through the power data and power consumption data we can realize the management and control. It can ensure the power using security and management convenience. Application layer includes power operated equipment, middle supporting facility, and system business. Basic equipment and supporting facility provide reliable data to the platform and help with the calculation and analysis. The smart grid platform includes many parts: power supply, power transmission, power transformation, power distribution and power consumption. Through the mode identification, smart analysis and other technologies we can realize the comprehensive evaluation and management. Moreover, we can support intelligent decision, control, and service in order to promote the grid informatization, automation and smart level. With the cloud calculation technology, middleware technology, data digging technology and other key techniques, we can realize the analysis and processing of smart grid data. It is useful to change

the power supply and reach the convenient and high utilization of the power.

2.4 Network Layer

Network layer is the service layer that connects application layer and perception extended a layer. It can be divided into wide band network, user interaction terminal, and perception terminal. The wideband network can collect and transmit the data information. User interaction terminal and perception terminal can realize the information interaction and remote control through Ethernet/ADSL/3G/xPON etc. Based on the internet of things, network layer combines and extends the wide band, wireless public communication, wireless sensor network, optical transmission network. Then, we can realize the information transmission, route and control of the perception layer and application layer. It is possible to increase the reliable, secure, and large-scale data transmission, which includes access network and core network. Power access of the wide band takes special optical network as the principal thing. This network has high stability and fast transmission speed. It can provide high-speed communication platform for the power supply enterprise that combine with digital microwave, and power line wave carrier communication.

2.5 Perception Extended Layer

Perception extended layer means collect, classify and preprocess the information of the object, environment, condition during the process of power supply, power transformation, power distribution, power utilization. It can operate the interaction among various terminal facilities and realize the remote control. In the power internet of things, perception extended layer combines with the various perception nodes of the different perception objects. Through the self-organization to build the perception network, then collect and transmit the data of power supply, power transformation, power distribution, and power utilization. Moreover, use the internet of things and it is possible to set different types of sensors on the grid lines. Temperature sensor, humidity sensor, vibrating sensor, velocity sensor, and air velocity transducer is the example. Video technology, identification technology, transmission technology, GIS technology and network technology can feed back the sensor information to the platform of the internet of things in order to monitor the various conditions such as icing, dirt, temperature, wave, microclimate and other information. Then,

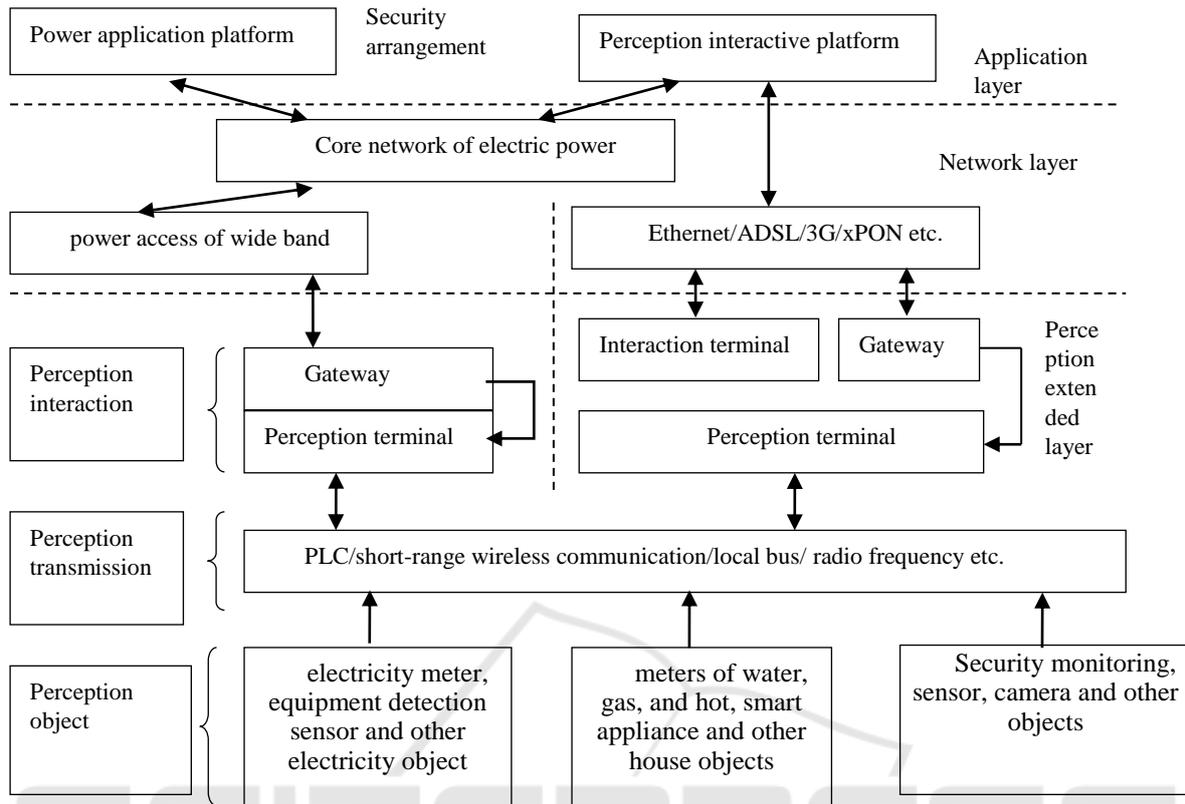


Figure 1: Hierarchical structure of internet of things.

based on the condition to publish error alert and ensure the circuit security.

3 SMART GRID APPLICATION BASED ON THE INTERNET OF THINGS

3.1 Network Application of Wireless Sensor

Wireless sensor network is the terminal service network of smart grid informatization and automatic application.

Wireless sensor network has sensor, RFID and smart terminal that can collect the various involved information in the smart grid. Then, it can classify the information and gather the data into the gateway node. Finally, the smart grid analysis and management system will analyze and manage the data and realize smart grid monitoring, error alert, and problem processing.

3.2 Application of Smart Power Utilization

Smart power utilization means supply and distributes the power based on user requirement. The smart grid can set different user integration and smart meter. Table 1 has the details.

A smart meter can be integrated based on the user power consumption. It can collect user power consumption through the collecting equipment and upload it to the communication terminal to monitor the power using condition.

3.3 Grid Interaction Application

The perception is one of the important characters of the internet of things. Smart grid uses this character to build the relation of human-equipment, equipment-equipment, and realize the power network automation and interaction. Figure2 is the grid interaction framework based on the internet of things.

Table 1: User power utilization of smart meter monitoring.

Meter type	User detection	Detection content	Facility request
Ordinary smart meter	Ordinary user	Time-share power measurement	Low cost, high reliability
		Stealing electricity detection	
		Load management	
Smart meter of major client	Major client	Time-share power measurement	Easy operation, extendable
		Power quality detection	
		Stealing electricity detection	

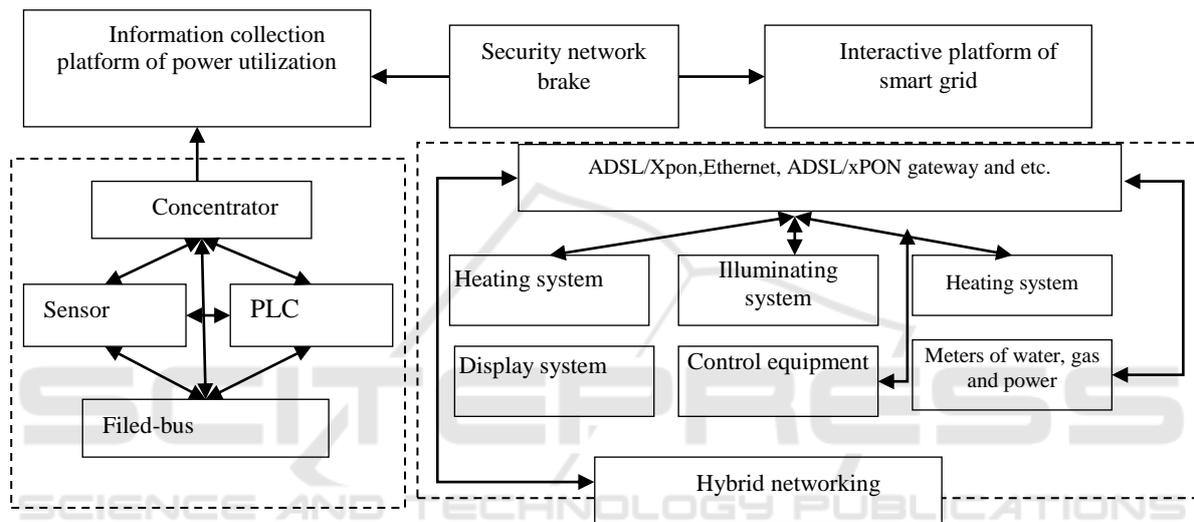


Figure 2: Grid interaction framework based on internet of things.

Uses internet of things to build power information collection platform and smart grid interactive platform and establish the perception interaction among enterprises, departments and users. The enterprise can manage the power equipment and user power utilization. Moreover, the users can inquiry the power utilization and price through the terminal equipment. The safety net brake is the electromagnetic switch that ensures the security of grid equipment and user power utilization. It can confirm the security of smart grid application. Smart grid application is not only decreasing the power supply pressure, increase the user satisfaction, but also promotes the application transparency and security.

4 CONCLUSION

Smart grid is highly integration of modern

technology and strong net rack. It can adopt clean energy in high limit and realize low carbon living, improve the grid security as the new-type modernized power grid. The integration of the internet of things and the power grid can transmit the operation information about different hardware setting to the management platform on time. This is helpful to realize the high-efficiency of grid monitoring and management. Based on the internet of things, smart grid uses communication technology, information technology, network technology and computer technology to realize the grid smart management. Based on the internet of things about smart grid module, this article starts from the characteristics of the power grid, takes the advantages of the internet of things, collects grid information, networking combination, data screening, high-efficiency analysis, and the reasonable classification. Moreover, it solves the power distribution, power transmission security, and

power network interaction, and then pushes the smart grid to the new development platform.

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