

Application of Internet of Things Management in Electric Power Industry

Yong Qian¹, a, Xinyu Wang¹, Hua Guo¹, Xuanchen Long¹, Xiaoguang Chi¹

¹State Grid Tieling Electric Power Supply Company, Tieling, Liaoning Province, China

Abstract: In recent years, with the continued growth of energy demand, intelligent grid has become the common choice for the global power industry to meet the challenges of the future. In order to achieve a high degree of integration of the intelligent grid and the Internet of things, based on a brief introduction of related theories and techniques, through the research on the functional characteristics of the Internet of things and its application status in power grid, the framework of the whole life cycle management of power equipment based on Internet of things was constructed, and its management advantages were analyzed in detail. Experimental results show that this system can provide a high degree of integration of intelligent grid and Internet of things.

Keywords: Electric power; Internet of things; intelligent; management

1 Introduction

With the development of the world economy and the continued growth of energy demand, the world energy development pattern is undergoing major and profound changes. In this context, intelligent grid becomes the common choice for the global power industry to meet the challenges of the future. The power grid relay protection and fault information management system based on Internet/Intranet was proposed by Yuan Yubo in 2001, this system improved the level of power network fault analysis and the management level of equipment such as relay protection and fault recorder [1]. The urban and rural power grid management system based on GIS was put forward by Wang Hongyuan in 2005, which completed the distribution automation equipment management and user information system, and had high generalization [2]. A smart grid information platform based on cloud computing was designed by Wang Dewen in 2010, which realized the reliable storage and fast parallel processing of massive information in the smart grid [3]. Besides, data splicing, data migration and graphics integration and other key technologies were used to construct the integration of the whole set of computing data management system by Chen Chaohui in 2012, this system realized the whole set calculation topology graph and the distribution maintenance and centralized sharing of the data [4]. A smart home energy management system based on wireless network technology was designed by Dai Jiaqiang in 2013, which had positive significance for the construction of intelligent power system [5]. However, the realization of intelligent grid depends on the on-line monitoring and real-time information control of the important operation parameters of the power network. Based on this, as an inseparable support technology for intelligent grid, the Internet of things technology has become the focus of research in the power industry

In order to achieve a high degree of integration of intelligent grid and Internet of things technology, this paper presents the whole life cycle management system of power equipment based on Internet of things. The remainder of this paper is organized as follows. Section 2 describes the relevant theories and techniques. Section 3 gives the study on a whole life cycle management system of power equipment based on Internet of things. Section 4 presents a real experiment to evaluate the system. Conclusion is summarized in Section 5

2. State of the Art

2.1 Internet of things

Internet of things is the combination of wireless radio frequency identification technology and wireless sensor network, so as to provide users with the monitoring, command scheduling, remote data collection and measurement, remote diagnosis and other personal services of the production and life [6]. In order to make it easier to understand the concept of the Internet of things, in simple terms, the Internet of things is that all of the world's objects are connected to a network, so as to form the Internet of things, then the Internet of things is combined with the existing Internet to realize the integration of the human society and the physical system, and achieve a more precise and dynamic way to manage production and life [7]. As a sense terminals of intelligent information, the Internet of things will gradually penetrate into the power grid production and operation, so as to form the power network [8].

2.2 Power network

Power grid and intelligent grid are complementary to each other, the purpose of which is to further optimize the system operation and improve the safety and stability of the system [9]. However, there are many problems in the Internet of things, in order to promote the development of intelligent grid, it is necessary to analyze and discuss the issue of power network, and provide a powerful guarantee for the safe and stable operation of power grid [10]. Power network is a kind of intelligent network, which is formed by a variety of sensing devices between various electrical equipment and personnel, which has the following features:

Saving energy and reducing consumption: Power network achieves the real time monitoring of the power grid and the power supply situation, and carries out the reasonable adjustment

Improving equipment operation safety and stability: Power network can monitor equipment operating conditions in real time, so as to facilitate the risk assessment and early warning

Protecting the personal safety of employees: Power network implements the positioning tracking and management for the maintenance and switching operators, so as to avoid the mistakes caused by personal injury

3. Methodology

3.1 Whole life Cycle Management of Power Equipment Status

Grid enterprises uses Internet of things technology, through the RFID, GPS and other sensors to monitor and collect all aspects of the power equipment information (Including the environment, conditions, accounting, test, defects, reasonable selection of statistical methods),

analyzes the life present situation of equipment, future development law and the key influencing factors, so as to form equipment risk assessment method based on Internet of things technology, this system can dynamically update the added, allocation, maintenance, idle, waste and other historical information in the life of power equipment, and establish complete equipment management files. In this system, equipment status information and asset management information are effectively integrated, supervision management is unified. Whole life cycle management system of power equipment based on Internet of things is shown in Fig. 1.

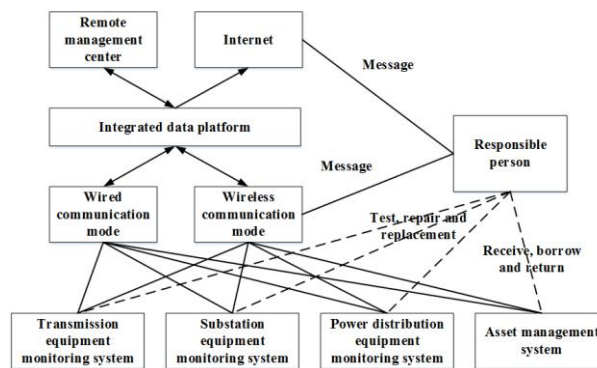


Fig.1. Whole life cycle management system of power equipment based on Internet of things

3.2 Management advantages

The following benefits are realized in the management of power grid enterprise by the use of the whole life cycle management system of power equipment based on Internet of things:

Combination of production operation and enterprise management: The intelligent dynamic real time tracking and centralized monitoring of add, allocate, repair, idle, scrap and other process of the whole life cycle of assets are realized by using power network technology, which provides an accurate reference data for the enterprise investment decision-making and asset allocation, effectively increases the marginal efficiency of investment and improves asset utilization, then reduces unnecessary equipment investment and idle waste, so as to achieve high efficiency and low cost of assets in the life cycle. At the same time, the effective integration of equipment status information and asset management achieves the sharing of resources and information across departments, so as to improve the efficiency of enterprise operation and economic benefits

Information and integration of asset management: In this system, the daily management of the assets is embedded into the asset management system, which realizes the record of the information of the task, the place, the material object, the time in the daily operation process of the asset, and introduces the alarm function. Whole life cycle management system of power equipment based on Internet of things achieves the effective regulation of daily work, reduces the pressure on the daily management of the assets, then saves a lot of manpower and financial resources asset inventory and unnecessary allocation cost, and avoids the loss of assets that caused by a variety of factors, so as to improve the management efficiency of the enterprise

Non - access mode of asset management: The system uses the public network IP access address, users can access the system anytime and anywhere through the Internet to achieve the asset management work of the remote office

4. Result Analysis and Discussion

In order to verify the effectiveness of the system, the simulation test was carried out on the running state of the power equipment. In the process of the test, the operation data of equipment was collected by off-line and on-line monitoring system, and the running state of the equipment was displayed, then whether the current equipment operation is normal or not by means of the equipment operation state was judged. The equipment running status was recorded in the following table.

Table.1 Record of operation status of power equipment

Node Type	Temperature	Humidity	Test Time
ROU	28.86	41.92	2016-4-1 10:30:01
RFD	28.97	40.75	2016-4-1 10:30:40
ROU	29.29	40.29	2016-4-1 10:31:11
RFD	29.66	38.61	2016-4-25 10:31:53
ROU	29.78	38.18	2016-4-25 10:32:24
ROU	29.25	40.29	2016-4-25 10:32:57
RFD	29.26	38.71	2016-4-25 10:33:19

As can be seen from the above table, the system can detect the running state of the power equipment in real time, so as to improve the management efficiency, and realize the intelligent and digital management of the power industry

5. Conclusion

As inseparable support technology for intelligent grid, Internet of things technology has become the focus of research in the power industry. In order to achieve a high degree of integration of the intelligent grid and the Internet of things, this paper proposes a whole life cycle management system of power equipment based on Internet of things. Through the research on the functional characteristics of the Internet of things and its application status in power grid, the framework of the whole life cycle management of power equipment based on Internet of things is constructed. This system provides research basis for improving the application of the Internet of things technology in power systems and achieving a high degree of integration of smart grid and networking technology. Intelligent grid further optimizes the grid control of all levels, achieves the acquisition of power grid panoramic information through the combination of centralization and decentralization, and integrates a variety of production and operation of information, so as to provide a comprehensive and complete decision-making reference for the operation and management.

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