Application of Beidou Positioning and Navigation Technology in Power Transmission and Transformation Enterprises

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Abstract. In Beidou positioning and navigation terminal, the position information of power equipment is preset to realize the positioning and navigation of power equipment via Beidou satellite, which is convenient for daily maintenance and inspection, especially to arrive at the scene quickly and accurately when an emergency occurs. At the same time, it can realize remote control management and command through the cooperation with Beidou monitoring and management system. Using the advanced wireless communication system, the video of the accident scene will be transmitted to experts in real time to realize remote joint consultation, improve the automation level of the whole power system and greatly improve the operation efficiency.

1. Introduction
After years of development, Beidou positioning and navigation system has gradually changed from being primarily military to civilian. Now Beidou positioning and navigation equipment, including vehicle-mounted Beidou positioning and navigation, Beidou positioning and navigation mobile phone, has entered everyone's life. Beidou navigation-related industry applications are also rising, and many industries have unique Beidou navigation applications. Nowadays, many technologies of power enterprises have reached advanced levels, but inspection still rely on manpower and remain at a relatively low level without substantial development. However, power equipment has many factors such as wide distribution, multiple categories and complex regions, and there are objectively situations where daily inspection and emergency repair personnel are not familiar with equipment maintenance roads and equipment positions are not accurately grasped. If we can't change the traditional method of "old employees" leading the way for a long time, it will not only waste manpower, but especially can't ensure that maintenance technicians can arrive at the scene at the first time in the event of an accident or failure. Beidou system will replace the current reliance on people and replace it with scientific and accurate satellite navigation to accurately solve the existing problems.

2. The Significance of Beidou System

2.1 Improve the efficiency of daily power grid operation and maintenance.
Our country has a vast territory, and the distribution of power operation equipment is wide and numerous. A lot of equipment is located in remote places, which brings a lot of inconvenience to
inspection and examination. How to find the equipment has become a difficult problem. It can only rely on experienced old employees to lead new employees and pass them on from generation to generation. This method is neither scientific nor efficient, especially not suitable for cross-regional cooperation in large-scale events such as the Olympics. Beidou positioning and navigation system inputs various positions of power equipment into map data, and any person can easily locate the equipment by Beidou navigation system and find the destination according to navigation instructions, which greatly saves labor cost and improves efficiency.

2.2 Enhance the ability to deal with accident failures.
At a time when we cannot completely avoid accidents, besides active prevention, it is particularly important to solve the problem quickly. At this time, arriving at the scene of the accident accurately and quickly via an accurate navigation device will save huge losses to the country and society. At the same time, with the help of the advanced wireless network at present, the video of specific situation of the accident scene can be transmitted to different experts around the country while consultation can be conducted in time, problems can be solved, and real-time first-hand information can be provided for decision-making levels so that emergency repair instructions can be issued quickly and accurately, thus greatly improving the emergency response handling capacity.

3. Benefit from Beidou System

3.1 Considerable economic benefits.
The faults of power system is a disaster for the national economy. The economic loss caused by one failure is from several million Yuan to several hundred million Yuan. When an emergency occurs, it can be said that every second is worth a lot of money. Beidou positioning and navigation system can help us reach the scene quickly by technology, locate problems quickly, solve problems quickly and recover economic losses as soon as possible. At the same time, there is no need to keep and arrange special guides in daily maintenance, thus greatly saving labor costs.

3.2 Huge social benefits.
In a civilized society, electricity affects our life. At all places, losing electricity is an unimaginable accident. The blackouts caused by several large-scale power accidents in history have brought untold shadows to the local people and even the whole nation. Therefore, Beidou positioning and navigation system has improved the power transmission and transformation enterprises' ability to solve faults quickly and has a tremendous influence on the national economy, our life and social stability.

4. Main Applications of Beidou System

4.1 Realize the navigation of towers, substations, office locations.
Through the presetting of Beidou coordinate information of transmission and transformation towers, substations, offices and other locations in Beidou navigation equipment and the combination with the electronic map in the navigation equipment, as shown in Figure 1, it can automatically calculate the route after clicking on the destination, realize the route planning from the departure to the target equipment, and track and navigate after positioning by Beidou satellite, as shown in Figure 2.
4.2 Dynamically increase or decrease the position information as required

The system adopts an open data structure and can easily add or delete location information. For newly added or abandoned equipment, users can easily modify them to meet the changing production needs of enterprises. The system cognizes the shared address and navigation information among different terminals, so that one person can collect location information and many people can benefit from it. There is no need to add new equipment in cross-regional cooperation, as long as the location information of different regions is effectively integrated.

4.3 Realize real-time monitoring, dispatching and command, and improve management level. After receiving the Beidou satellite signal for automatic positioning,

the Beidou navigation terminal sends the location information to the control center in data (4G) form through the wireless module, as Figure 3. After receiving the information, the general control center notes the location and shows the latitude, longitude, speed of the vehicle on the map in real time
so as to realize real-time monitoring and scheduling of work vehicles, as shown in Figure 4. By integrating the monitored data, the most suitable operation mode for enterprises can be found to reduce waste and save costs. Deep excavation and analysis of data will provide the company's management with the most authentic and reliable data and benefit from management.

Figure 3 Beidou Position and Navigation monitoring system

Figure 4 Beidou Position and Navigation system monitoring interface sketch
4.4 Improve the capacities for emergency management combining with advanced network technology.

As handling emergency events, the platform could grasp the allocation of emergency personnel and vehicles, and conduct arrangement and command. Meanwhile, Beidou system not only can quickly navigate workers to destination, but also has wireless communication function and can communicate with relevant personnel and superior leaders in time to obtain correct instructions. In case of complex problems, the camera of the terminal and the advanced wireless network (4G) can also be used to transmit the live video to the local authorities so that experts in different areas could take part in consultation, thus solving the problems quickly and saving huge losses.

5. Conclusions

Electric power is related as closely as the life of modern people. Electric power enterprises are shouldering much social responsibilities. How to ensure the stability and normal work of the power grid is the goal that electric power enterprises must pursue persistently. Beidou positioning and navigation system with advanced technical means and integration of advanced network applications can change the current inspection and maintenance mode of power transmission and transformation equipment in power transmission and transformation enterprises to a considerable extent and improve work efficiency. It also takes an immeasurable role in emergency control. It's believed that the wide application of Beidou positioning and navigation system in power transmission and transformation enterprises will certainly improve the modernization and technological level of the entire power system, improve work efficiency, promote the development of the entire power enterprise, and contribute more to the national economy, people's livelihood and harmonious society.

References

[1] WU Hai-ling, GAO Li-feng, WANG Tao-sheng, LI Zuo-hu; Development and Application of BeiDou Navigation Satellite System [J]; Journal of Navigation and Position, Jun, 2015

[2] Chunmei Pei. Application of GPS on Power System Operation [J], IFIP Advances in information and Communication Technology, 2011

[3] Guangshang Li, Qiankun Liu, Shuangge Yang. Explore BeiDou Satellite Navigation System in Application of Electric Tools [J], 2017 International Conference on Computer Systems, Electronic and Control (ICCSEC), 2017

[4] SHEN Xiang, WU Pei-ren, Maritime Emergency SAR System Based on BeiDou Navigation Satellite System [J], Command Control & Simulation, 2018