Application Analysis of Artificial Intelligence in Port Shore Power

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Abstract. By studying the development status, application scenarios and development needs of port electricity application and operation at home and abroad, this paper analyzes the significance of building a port artificial intelligence power business support platform for shore power operation. In view of the diversified demand of electric equipment and the emerging demand of operation service under the condition of port power grid, this paper puts forward a scheme of electric business support platform system for port power and other artificial intelligence electric equipment, focusing on the platform system architecture, external interface of the system and future expansion function, and based on the development trend of China's ports, it will support the future port intelligent electric business. The application of the platform is prospected.

1. Introduction
The rapid development of AI business is becoming an indispensable basic resource to promote social development. All walks of life will implement "AI"; all walks of life have the application of artificial intelligence technology and business prospects. The rapid development of China's economy in recent years has led to the rapid development of international shipping business, and the density of the number of ships approaching the port has greatly increased. In order to protect the environment and save resources, it is urgent to develop ship shore power.

2. Overview of Artificial Intelligence
Artificial intelligence is an interdisciplinary subject involving philosophy, computer science, psychology, linguistics and other cutting-edge disciplines. Its essence is to study how to make man-made machines or systems to simulate human intelligent activities, so as to extend people's intelligent science. In 1955, Newell and Simon developed the first real intelligent program - "logic expert". This system has become an important milestone in the history of artificial intelligence. Then, the concept of "artificial intelligence" was first proposed at Dartmouth conference in 1956. After more than 60 years of development, artificial intelligence has made great progress, and now it has become an indispensable energy source to promote social development. The application of artificial intelligence can be divided into heuristic search, fuzzy theory, expert system and artificial neural network.

2.1. The Current Situation of Artificial Intelligence Technology in Port Shore Power System
It is a very heavy task to improve the port power system. In order to improve this work, it is not only necessary to be familiar with the circuit and shore based power supply equipment in the port shore power system, but also to use the experience in the design process to determine the possible problems and the optimal solutions in advance. At present, most of the port shore power systems usually use the
original manual way to work. This process not only does not produce the optimal design scheme, but also causes a lot of waste of human and material resources. At present, the intellectualization of port shore power system is still in the initial stage. The commonly used system in port mainly includes the use and monitoring of production equipment, and lacks the complete system including port shore power operation and port intelligent power business. In view of the port shore power system in different working environment, there is a lack of standardized and unified operation system to realize the virtuous cycle and long-term plan of port shore power service, that is, intelligent port, green port and port park. In recent years, with the rapid development of science and technology in China, artificial intelligence has been listed as a national strategy and a series of port shore power policies, which makes the port shore power system develop further.

2.2. Port Shore Power Operation Demand
Port electricity is divided into three parts: production electricity, domestic electricity and auxiliary production electricity. Production power mainly includes the power consumption of loading and unloading machinery, production site lighting, transportation machinery, storage equipment, etc.; domestic power mainly includes the power consumption of office and living facilities, etc.; production auxiliary power mainly includes the power consumption of maintenance, public lighting, auxiliary facilities, etc. With the low-carbon development of the port, the personalized and diversified power demand in the port increases sharply. As a new business of port production and power consumption, the large-scale application and operation of port shore power enriches the original service form of port power consumption and adds a new service field. The service demand varies greatly according to different types of terminals. According to the application scenarios, port shore power system operation can be divided into three types of wharfs: coastal large-scale wharfs, coastal and riverside medium-sized wharfs, inland river and lake small-scale wharfs. According to the operation and management methods of different wharfs, port shore power operation service needs are different. The shore power system of large coastal wharves and medium-sized coastal wharves is mainly used for the power consumption of large ocean going ships and large and medium-sized transport ships during the loading and unloading period. The intelligent power consumption business platform supporting the shore power operation needs to realize the basic functions of power consumption information query, cost settlement and so on between the ship agent company and the port side during the ship's berthing period; at the same time, through the information interaction with the port production scheduling system, it can realize the process management, equipment monitoring, power consumption statistics, billing management, statistical analysis and so on during the ship's berthing period Function: the shore power system of small inland river and lake wharfs is mainly used for the power consumption of small and medium-sized inland river ships during berthing and loading. As such ships are generally operated by individuals, the intelligent power consumption business platform supporting shore power operation needs to realize unmanned management of the overall business operation process; at the same time, it supports business processing and settlement through specific ways (swiping card, mobile app, network); it is oriented to emerging port power consumption forms and different types of operation service needs. In addition to effectively supporting the operation business of port shore power, the intelligent power business support platform also needs to consider the operation and management requirements of new types of port power services such as distributed energy access, electric vehicles, energy efficiency management equipment, power quality monitoring, etc. At the same time, facing the transformation of port from traditional energy consumers to energy service providers, the business support platform needs to have the ability and development space to expand new power operation business.

3. Advantages of Artificial Intelligence in Port Shore Power Construction

3.1. Optimization and Design of Port Electrical Equipment
As the port shore power system is in its infancy, it needs a large number of new electrical equipment. The research and development of a product from R & D to production needs a lot of scientific experiments. With the continuous development of science and technology, it is possible to shift from
artificial design to artificial intelligence technology in the design of electrical equipment. AI aided design not only greatly reduces the design cycle, but also makes the new design products more scientific, practical and compatible.

3.2. Effectively Prevent and Solve the Faults and Accidents in the Port Shore Power System

Artificial intelligence plays an important role in the fault diagnosis of port shore power system, especially in the fault treatment of Port Transformer and distribution box. In the operation process of port shore power system, the probability of failure is very high. If the failure is not found and solved in time, it will bring huge economic losses. Take the transformer failure in the system as an example. The early processing method is to judge the cause of the failure through the step-by-step analysis and research of mobile phone samples. This process is not only tedious but also requires a lot of time, and also cannot get accurate results. If the analysis result is wrong, it will bring more serious economic loss. Using intelligent technology can not only solve the problem quickly and effectively, but also improve the accuracy of fault diagnosis, so as to ensure the stability and reliability of the whole shore power system.

3.3. Further Optimize the Construction of Customer Terminal in Port Shore Power System

With the continuous progress of science and technology, the popularity of smart phones provides conditions for optimizing the realization of customer terminals, and then provides higher power services for shipowners. The implementation of port shore power customer terminal, on the one hand, realizes the monitoring of shipowner's power demand, on the other hand, realizes the sharing of power information. The implementation of customer terminal can make the owner have a clear understanding of the power consumption and account balance, so as to better arrange the working time and improve the production efficiency. The inquiry of account balance and the early warning of insufficient balance can avoid the power failure caused by insufficient account balance, and cause unnecessary economic losses.

4. Platform Design Scheme

4.1. System Architecture

The logical structure of the port intelligent power use business support platform system is divided into three layers, namely terminal equipment layer, network communication layer and business application layer. The terminal equipment layer includes the shore power connection equipment at the front of the port, the main production power use equipment at the port and its acquisition and monitoring device, which mainly realizes the shore based power supply function of the port to the ship, as well as the information acquisition and status monitoring of the power use. The business application layer is mainly based on the port intelligent power business support platform, and realizes the port by integrating the existing production scheduling system, port power distribution automation system, port lighting control system and other business functions. Operation and
4.2. System Deployment Mode

According to the scale of the port and the application scenario of the shore power system, the deployment of the port intelligent power business support platform system can be divided into centralized deployment and distributed deployment. Centralized deployment is mainly aimed at the inland river service area, channel channelization section and other unattended shore power operation equipment. The business support platform can be deployed to shore power operation companies at provincial or prefecture level. Individual users can access the platform by landing on the client system, and use and consume shore power equipment by prepaid card or personal mobile terminal payment. Centralized deployment can facilitate the centralized management of systems and equipment within a certain area, and facilitate the user to use all shore power equipment within the area. The overall construction cycle of the system is short and easy to maintain. The distributed deployment is mainly aimed at the requirements of large-scale port and terminal hierarchical management, and a set of business support platform system is deployed in port group and each terminal company respectively. The system of the group company is mainly responsible for the summary management and statistical analysis of various subordinate wharf shore power operation and other intelligent power use businesses. The system of each wharf company mainly realizes the business application and management of its own shore power and other intelligent power use businesses. Distributed implementation is conducive to the fine management of each terminal itself. Secondly, each terminal system is relatively independent, and the system security is greatly improved. Single subsystem failure will not affect the shore power operation and intelligent power consumption business of the whole port group. However, for large port group users, the initial investment of the distributed system is relatively large, and the system integration requirements are high.

4.3. System Communication Mode

The communication between the intelligent power service support platform and the terminal shore power equipment is mainly in the form of Ethernet access. The terminal shore power equipment adopts CAN/RS-485, optical fiber communication module and other methods to access the centralized controller or port shore power monitoring system to realize the management and monitoring of the equipment, and complete the collection and communication of equipment information. In addition, the terminal equipment can also use the way of wireless communication to directly interact with the business support platform.

4.4. System Interface

The effective operation of business platform needs data interaction and mutual support with existing business systems. All data interaction and business application functions need to be completed through the interface between the platform and other business systems; therefore, the platform needs to define the data model, business process and interface mode of the interface with other systems. The following introduces several system interfaces related to the port intelligent power business support platform: port production scheduling system interface. The production scheduling system of the port is mainly responsible for providing the stop record information, ship information and the use information of the main production equipment (shore bridge, field bridge, transport belt) and other data of the ships approaching the port. These data are mainly used for operation, management and settlement of shore power and ship berthing related services of business support platform; port power grid automation system interface. The power grid automation system of the port is mainly responsible for providing the main index data and business information of the power supply system (clean energy power generation, substation, etc.), power distribution system (power distribution network, distribution station area) and power consumption system of the port. These data are mainly used for business management and operation of business support platform related to shore power use, clean energy access and power consumption of main production equipment in port area; and interface with other non production systems in port. In addition to the production system, the port also includes many non production
management systems, such as lighting management, office building management, electric commuter vehicle management, etc. These systems can provide data information related to power consumption services through their own external interfaces. These data are mainly used for business management and operation of port intelligent power related value-added services based on business support platform.

5. Strategic Thinking on the Intelligent Development of Port Artificial Electricity

Countries all over the world are constantly promoting air pollution prevention and control, energy conservation and emission reduction and other related work. In 2013, China published the air pollution prevention and control plan, which clearly pointed out that it is necessary to control the pollution of ships when they approach the port. Ship port shore power technology is one of the effective means to achieve energy conservation and emission reduction and control port city. After five years of hard work, port shore power has developed rapidly. The combination of artificial intelligence and port shore power has become the current development goal. Port shore power has made great contribution to environmental protection and resource conservation. In the operation of port shore power, there are many new problems that need to be solved by artificial intelligence. The combination of artificial intelligence and port shore power has become an irreversible trend. The following suggestions are put forward for the future development and application of China's port shore power system intelligence. Under the guidance of national policies, keep up with the pace of the times, combine the current situation of port electricity, and use artificial intelligence to promote the upgrading of shore power system under the existing resources. To realize our country's overtaking at the corners of the world in terms of port shore power intellectualization. This paper analyzes the application of shore power system of port ships and the problems existing in shore power technology. Based on the internal model controller of BF neural network, according to the characteristics and technological requirements of shore power consumption of port ships, an intelligent ship shore power output control system with advanced technology, reliable operation and significant benefits is designed by combining the advanced computer algorithms such as fuzzy logic, neural network and evolutionary calculation. Actively develop and research new shore power system equipment. Develop corresponding software, especially intelligent software, purposefully and organizationally develop intelligent shore power equipment software and application platform with independent property rights of China, develop the latest port intelligent shore power system, and on this basis, make China's intelligent shore power system take the lead in the world. For foreign advanced intelligent shore power system, absorb and digest foreign advanced equipment in order to improve the level of localization. On the basis of realizing port shore power intellectualization, we will export China's advanced shore power system and talents to the world, and realize the internationalization of shore power system. The leadership and management of the port is an important prerequisite to promote the development of the port power system. Only by adopting more advanced technologies and systems can managers effectively promote the optimization and upgrading of shore power system.

6. Conclusions

Port intelligent power business support platform is the information foundation for port shore power operation and application promotion, and is the key link for port to build an intelligent port. Through the port intelligent power use business support platform, the existing power use services of the port can be effectively improved and expanded, and the new intelligent power use services represented by shore power can be carried out; at the same time, it can provide effective support for the subsequent third party to carry out the port intelligent power use value-added services.

7. References

[1] Xin Tian, Liu Yang, Zhiyuan Cai. A Summary Of The Development Of Shore Power Technology At Home And Abroad [J]. Smart Grid, In Chinese, 2014, 2 (11): 9-14.
[2] Shenghua Cao, Dake, Xu, Wengiang, Wang. Implementation Of The Overall Solution Of Intelligent Shore Power System [J]. Huadian Technology, In Chinese, 2014, 2 (11): 57-60.