On Unmanned Electric Power System and Its Development Strategy

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Abstract. With the development of artificial intelligence, unmanned system and equipment has become an essential part of electric power system and played a growing vital role in the intelligent power generation and storage, smart grid, unmanned circuit check, and automatic meter reading system. Speeding the development of unmanned electric power system of our country has become the most important way for our country to push the strong intelligence charged barbed wire net. Therefore, it is necessary for our country to increase the budget of the unmanned system devotion, strengthen the construction of soft and hardware, develop a true application training and talented person's developing, enhance the level of data secrecy, and insure the information safety.

1 Introduction

The development of artificial intelligence and robotic devices is speeding up our country 's smart grid technology and unmanned power system. The artificial intelligence and unmanned equipment are now being used in the power supply system, which has become a new trend in the development of the world power grid [1].

In this paper we will discuss the application of artificial intelligence and unmanned equipment in power system and its actual combat training and development strategy to provide reference for the development of the power system of our country.

2 The Unmanned Electricity Generation, Storage and Battery

The unmanned generation of electricity is based on information technology. The process of power generation, environmental protection, management and control, diagnosis, maintenance and marketing is unmanned and remote based on AI and application of unmanned equipment. The unmanned power has the characteristics of safety, self diagnosis, remote monitoring, optimization and efficient operation of the unattended.

To achieve the goal of unmanned operation, we first need to realize the on-line monitoring of the unmanned, digitalized information transmission and real-time connection with the AI system, and grasp the state of raw materials, combustion, equipment, operation, generation process, events and behaviors in real time. AI technology can make use of expert system to optimize the operation, diagnosis, maintenance, management, operation and decision of power generation, and realize remote control and management of power generation system, and realize unattended and automatic optimization operation [2] .

Hydropower, wind power and solar power have been unattended. However, the power generation and transmission power of new energy is influenced by weather and geographical conditions, which has great volatility and randomness, which affects the stability and power quality of the power grid. The premise of the implementation of the global energy Internet by the national Power Grid Corp is to store energy. Energy storage plays an important role in grid peak and frequency, standby, demand side response, black start and renewable energy consumption and the construction of smart grid, can effectively prevent the abandoned wind, abandoned light, abandoned water caused a waste of

electricity, is conducive to the prevention of haze governance, renewable energy waste. And pumped storage, compressed air energy storage, battery energy storage can also be unattended mode to run [3-8].

3 The Unmanned Smart Grid

The smart grid is based on high-speed communication networks, through advanced sensors, measuring equipment and technology, intelligent control and intelligent decision support system, real-time monitoring and control of power grid status of all equipment, makes the grid adaptive and self-healing, the power generation, transmission and distribution and automatic optimization balance between electricity, to achieve safe and reliable economic, efficient and environmentally friendly and efficient operation.

The integration of information technology, sensor technology, automatic control technology and power grid infrastructure will get real-time panoramic information of the power grid, and detect and predict possible failures in time. An expert of artificial intelligence technology to provide the system of self learning and self organization, self constructed fault diagnosis samples corresponding to the basis of constructing the complete sample set to determine the fault location and fault type, fault isolation and rapid recovery, self realization, so as to avoid the occurrence of blackouts.

Highly intelligent power grid dispatching is horizontal integration, vertical connection, online intelligent analysis, early warning and decision making, so as to achieve effective control of all kinds of new generation and transmission technology equipment and lean control of AC / DC hybrid power grid. Through the intellectualized power grid two-way interaction, users can real-time understand power supply capacity, power quality, electricity price situation and outage information, arrange electricity rationally, electric power enterprises can get users' electricity information and provide more value-added services.

Smart grid can achieve large scale hydropower, large coal power, large nuclear power and large-scale renewable energy trans-regional, long-distance, large capacity, low loss and high efficiency transportation. The power exchange capacity between regions is significantly improved, and the operation is stable and stable. The establishment of global energy Internet Co by the State Grid, the development of the global energy Internet strategic plan and the acceleration of the development of interconnected interconnection projects, therefore, the intellectualization of the power grid is more and more important for [9-16].

4 The Unattended Transformer Substation

The progress of automation and information technology makes the substation unattended. Unattended substation saves manpower and labor, has high work efficiency and low management cost. The unattended substation contains intelligent management system, data collector and data monitoring and monitoring centralized control station. It can transmit the monitoring data network to the server, and realize remote control of the unattended substation by operation information and remote control manager.

The system has functions of data query, monitoring and operation information management in power assisted system, and it can reduce manual errors, facilitate query and detection later, and improve efficiency.

The application software of the centralized control station mainly includes the microcomputer operation ticket system and the voltage reactive power analysis system. The system and the five anti locking system of the centralized control station have improved the accuracy and efficiency of unmanned operation, and can prevent misoperation. The voltage and reactive power analysis system monitors the distribution of voltage and reactive power in the area, controls capacitors, reactors, on load tap changers and other devices, or gives control strategies, suggesting manual intervention. The remote image monitoring system can monitor and record the substation equipment operation, monitoring of power equipment heating degree, discover and deal with the accident, is helpful to

improve the safety and reliability of the substation equipment, find the cause of the accident, but also has the fire prevention, anti-theft function [17-19].

5 The Unmanned Meter Reading

Manual meter reading has a large workload, low efficiency, high cost and many hidden dangers. With the development of information technology, meter reading has realized the automatic remote transmission of power data, and the function is varied, such as automatic power cut, automatic payment by mobile phone and so on. Many users of smart meter can realize remote automatic meter reading, with two-way metering, two-way communication and remote control management function, and between the remote intelligent substation through the power line carrier communication, wireless network communication, network communication and communication with other online communication network. The multi-user intelligent meter and concentrator form a local communication network. Each data exchange center node concentrator converge the automatic meter reading data to the remote control center, and finally realizes the remote automatic meter reading. The development of the combination of three networks brings greater convenience to the communication of the smart meter.

6 The Unmanned Inspection

A operation and maintenance station should be responsible for the maintenance work of several or more substations. It has a large amount of work, which has a negative impact on the safe operation of the substation. Substation inspection robot with intelligent inspection robot as the carrier, the application of artificial intelligence, machine vision technology, wireless communication technology, the infrared thermal imaging technology, intelligent video analysis technology and real-time database technology and other advanced technology, combined with the visible light video and infrared thermal imaging, effective identification of transformer, high voltage circuit breaker, transformer, capacitor equipment such as current and voltage caused by thermal fault, the temperature real-time detection equipment in substation, discover overheating equipment, to ensure the stable operation of equipment.

China Netcom Aviation Co., Ltd. uses the six rotor UAV's good mobility, maneuverability and image recognition technology to assist the inspection of transmission lines, which improves the safety of the inspection of the transmission line, saves the cost of manpower and improves the efficiency of inspection. UAV auxiliary patrol system can effectively compensate for the lack of manual inspection. Image recognition technology provides intelligent decision-making basis for defect detection. Compared with traditional manual inspection, it improves the recognition accuracy. This is a useful exploration of the application of unmanned equipment in the smart grid.

7 The Development Strategy of Unmanned Power System

China is a big country of power equipment manufacturing and export. Influenced by the oversupply, the power equipment industry is surplus in lower products, shortage in higher end. Therefore, we should seize the opportunity of rapid development of artificial intelligence, adhere to innovation, develop unmanned systems and equipment, and promote the unmanned development of the power system.

7.1 Strengthening the hardware construction and software development to improve cost-effectiveness

With the arrival of industrial 4.0, the unmanned power system is a must for the future development. Although the initial investment of unmanned equipment is large, compared with the increase of human resources cost, it will effectively reduce labor intensity, reduce operation and maintenance costs, improve operational efficiency and management level, and provide a nationwide safety guarantee for power grid safety. The autonomous system promotes autonomous capability through the extensive use of independent technology, and realizes the integration of perception,

understanding, analysis, communication, planning, decision-making and execution to improve the overall efficiency. China's power system unmanned equipment needs to improve the autonomic capacity of the autonomous system and adapt to various environmental requirements in the near future. In the middle stage, the technology level is mainly promoted, and the long-term role is to achieve the man-machine synergy role of the power unmanned system. At present, there are three major technical challenges: first, improve autonomous intelligence technology; second, improve reliability, availability and maintainability; third, improve durability, reduce maintenance costs and support adaptive fault state operation.

With the increase of the number of applications using unmanned systems, and security costs accounted for continuous improvement, it is necessary to improve the investment efficiency of unmanned systems, in order to enhance its use and guarantee the cost-effectiveness.

7.2 Establishing a standardized training model for the unmanned system

Nowadays, technology cannot achieve seamless links between the virtual world and the real world. In the future, more training is needed to save training funds and speed up the authentication of unmanned system qualification. With the progress of simulation technology, the complexity and authenticity of the virtual environment and scene will also be improved. For example, the control station personnel simulation training system can make the operator familiar with the equipment as soon as possible, perform an accident preview, and improve the level of duty. The relevant vocational schools and pre job training should take unmanned training as a part of its basic training. The training strategy of these systems is developed according to the life cycle management, and the development and documentation of operation and maintenance training are completed. The project manager establishes the general design standard and establishes the standardized training model of the unmanned system. Therefore, it is necessary to maintain close cooperation and synchronization between the trainers and the project managers responsible for the application of the system.

7.3 Improving data secrecy to ensure the security of technology and information

Providing reliable security measures to prevent unauthorized invasion, control, data and technology leaks, unmanned systems must focus on data encryption, data destruction and cloud computing security. In terms of data encryption, a more robust static data encryption method is developed, the data encryption speed delay reduced, adaptive data encryption technology developed, and the multi-level data encryption protection system formed. In terms of data destruction, the physical and non-physical destruction of data remains a challenge, so self-destruct and anti-self destructing means are required. In cloud computing security, the cloud computing security audit mechanism needs to be established to improve the data confidentiality, integrity and availability [20-21].

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