Design of patrol and control platform for power network based on UAV and VR

Yanjun Hao1, *, Weidong Shi2, TingLei2, Guoliang Yue3, Kun Zhang4 and Mingxia Chen1, a
1Xi'an Chuangyi Information Technology Co., Ltd., Xi'an, 710199 China
2China electric power research institute co. LTD, Beijing 100192 China
3State grid hebei electric power co. LTD, Shijazuan 50021 China
4Beijing state grid fidelity technology development co. LTD, Beijing 100067, China

*Corresponding author e-mail: cykj@chyitec.cn, a chenmx@chyitec.cn

Abstract. Since the beginning of the twenty-one th century, with the rapid development of China's economy and the continuous progress of China's power industry, it has contributed an indelible force to the development of China's socialist undertakings. The construction of power grid is very important to the development of society. The normal operation of the power grid can not be separated from regular inspection of power grid equipment and lines, so as to keep abreast of and understand the operation of power transmission lines and changes in the surrounding environment and Line Protection Areas. It is the power supply enterprise a heavy daily work. Manual inspection is a traditional inspection method, but also the main way of transmission line inspection. Due to the complex terrain of the transmission line corridor, there are almost no patrol roads in some sections along the route in some harsh conditions such as river-crossing or high mountains and steep mountains. This patrol method has great labor intensity and difficult working conditions. Transmission lines can not get timely feedback, and can not observe the real-time intuitive operation of lines and equipment. In this case, in response to the national "Internet + " strategic thinking, we initiated the "Internet + ", "UAV + " and "VR + " all-ecological power grid patrol mode. Realize the power network equipment long-distance inspection, all-round inspection, real-time simulation inspection, inspection in bad environment, so that the cause of power inspection can take off.

Keywords. UAV; Vr; Power Grid Patrol; patrol control; Mobile Inspection; Smart Grid.

1. Introduction

"Internet + ", "UAV + " and "VR + " are brand-new ecological patrol modes, as a brand-new patrol mode, the utility model has the advantages of rapidness, high working efficiency, no geographical influence, high patrol quality, high safety, labor saving, real scene, etc. According to statistics, the use of unmanned aerial vehicles for defect identification, tower and above the position of the bottle mouth, manual difficult to find the defects accounted for about 75%. The inspection efficiency and quality of the equipment are greatly improved, and the Labor intensity is greatly reduced, the inspection efficiency is improved, and the operation and maintenance capability of the power equipment is ensured. Therefore,
the application of "Internet +", "UAV + "and"VR + " is a more effective solution for the intelligent development of power grid patrol inspection.

Based on Unmanned Aerial Vehicle (UAV) and virtual reality (VR), a new mode of multi-level deployment and multi-level deployment is adopted, which is more flexible and convenient. At the same time, the platform is connected with the real-time data of patrol inspection, real scene data and airspace declaration data, which can display the whole process of patrol inspection in real time, and reappear the real-time warning information of manufacturers and airspace in real time It realizes the functions of round-the-clock monitoring, real scene reproduction, seamless connection between Operation Management and scene, intelligent analysis and Statistics of inspection data, intensive management and control of inspection resources and scientific deployment of inspection work.

At present, the State Grid Corporation of China has incorporated the Unmanned Aerial Vehicle (UAV) inspection into the transmission line lean inspection index, and various units in the company's system have widely used unmanned aerial vehicle (UAV) for Line Inspection It has played a prominent role in the G20 summit, the brics meeting, the National Games and the 19th National Congress of the Communist Party of China (CPC). "Internet +", "UAV + " and "VR + " , the new ecological inspection platform, combined with the development trend of new technologies, iteratively updates the inspection and repair operation mode to realize fully automatic and intelligent line operation management and control It can save the cost and ensure the safety of personnel, and has a broad application prospect. The development of this platform will put the wings of taking off for the development of our country's electric power industry.

2. overview

Based on the power network patrol and control platform which is connected with UAV and Vr, the platform can overcome the shortcomings mentioned in the background service and technology, and users can interact with Uav on-site patrol through Vr, and the equipment information of on-site patrol and control can be reproduced in real time The environment around the scene; the UAV will interact with the image transmission CNC center, which will receive the information of the on-site inspection; after finding the faults or hidden dangers of the on-site inspection through Vr, the figure transmission numerical control center carries on the diagnosis and analysis, gives the processing suggestion, the staff according to the past experience carries on the processing through the drone or the arrangement nearby staff, after processing, carries on the confirmation, the confirmation completes the patrol inspection immediately; The center records the whole inspection process and generates the inspection report, and then the end; The graphic numerical control center records the whole inspection process and generates the inspection report Information; after VRF finds out the trouble or hidden trouble in the field inspection, the graphic transmission numerical control center carries on the diagnosis and analysis, gives the treatment suggestion, the staff according to the past experience carries on the treatment through the UAV or the arrangement nearby staff, after the completion of processing, confirmation, confirmation of the completion of inspection and then the end; The graphic numerical control center extracts the inspection experience and report into the knowledge base of the think tank, which can be used as reference for the following inspection, power grid construction and development.
3. Business flow chart of patrol and control platform based on UAV and VR

Based on the patrol and control platform of UAV and VR, the real scene is reproduced by VR, the data is collected and filtered by UAV terminal, the information is received and sent by CNC center, and the defect / hidden trouble of patrol and control equipment is discovered and dealt with. The report of inspection tour, the method and report of dealing with the hidden defect are collected into the statistical analysis of the knowledge base of the think tank to complete the inspection task.

4. Patrol UAV, patrol VR, patrol diagram transmission data center equipment

The Power Network Patrol Management Platform based on UAV and VR is composed of patrol UAV, patrol remote controller, patrol VR, patrol digital control center and other equipment and software:

- **PATROL UAV**: It is used to receive the command of patrol remote controller and carry out on-site patrol inspection, remote patrol inspection, and transmit the real scene and the information of on-site patrol inspection back to the patrol VR and the patrol map transmission CNC CENTER. Real-time interactive response with patrol inspection VR and patrol Inspection Drawing Transmission CNC center;

- **Patrol remote controller**: It is used to command and control the patrol UAV, and realize on-site patrol and information feedback;

- **Patrol VR**: The real scene equipment and the surrounding environment can be reproduced, and the patrol information can be interacted with the UAV; Digital Control Center for patrol drawing transmission: Data Acquisition, data transmission, data analysis and data display are realized with patrol VR and patrol UAV.
5. Summary and Outlook

Based on Unmanned Aerial Vehicle (UAV) and virtual reality (VR), combining “internet +”, "UAV + “ and "VR +”, a new ecological patrol mode. The platform is developed on the basis of micro-service architecture, combined with patrol UAV, patrol remote controller, patrol VR, patrol digital control center and other equipment and software, to realize real-time, efficient and convenient patrol inspection of power network. The real scene is reproduced by VR, the data is collected and filtered by the uavs terminal, the information is sent and received by the graphic CNC center, and the defect / hidden trouble of the inspection equipment is discovered and dealt with, and the inspection report is generated. The methods and reports of dealing with the hidden defects are collected into the statistical analysis of the knowledge base of the think tank to complete the inspection task. The invention, as a brand-new patrol mode, has the advantages of quick and fast, high working efficiency, no local influence, high patrol quality, high safety, labor saving, real scene and the like. When the UAV is used to identify the defects, about 75% of the defects can not be found manually at the bottle mouth of the tower or above. The inspection efficiency and quality of the equipment are greatly improved, and the labor intensity is greatly reduced, the inspection efficiency is improved, and the operation and maintenance capability of the power equipment is ensured. Therefore, the application of "Internet +", "UAV + " and "VR + " is a more effective solution for the intelligent development of power grid patrol inspection.

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