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Research on Transmission Line Information Routing based on Directional Antenna

Demeng Bai[1], Ying Lin[1], Jiafeng Qin[1], Guocheng Wang[2]
[1]State Grid Shandong Electric Power Research Institute, Jinan, China.
[2]Shandong ZhongShi YiTong Group, Jinan, China.

Abstract. Transmission line is a high-speed channel to ensure long-distance transmission of power and the lifeblood of power system. Currently, the status of transmission lines is obtained mainly through on-line monitoring devices, which transmit the information to the monitoring system through the network after monitoring the information. However, the working time of on-line monitoring devices is limited by the battery, thus improving the utilization rate of power of transmission line monitoring devices can significantly prolong the working time of the devices. Ensure the reliability of monitoring.

Keywords: transmission line routing, directional antenna, on-line monitoring.

1. Introduction

Transmission line is a high-speed channel to ensure long-distance transmission of power and the lifeblood of power system. Due to long-term outdoor, the line will encounter a variety of adverse environmental weather, such as thunderstorm, ice, and external damage, bad environment and external information will seriously affect the transmission line power transmission capacity, lightly cause line insulator flashing, and seriously cause long-term power supply interruption.

In recent years, the development of wireless communication technology, embedded technology and sensor technology has promoted the wide application of wireless sensor in industrial production. Transmission lines use sensors to monitor the connectivity and galloping of lines. But the sensor is not easy to install conventional power supply circuit because it is installed on the tower, and the sensor is usually powered by battery because of its simple structure.

2. Transmission Method of Transmission Line Information

Previously, transmission line inspection mainly relied on periodic inspection by operation and maintenance personnel. Although hidden troubles of equipment could be found, due to its own limitations, lack of special environment and climate detection, in the vacuum period of inspection cycle cannot timely grasp the change of external force of the line corridor, it is very easy to be due to lack of monitoring before the next inspection. Measure line accident. Now with the development of technology, the data acquisition methods of transmission line monitoring mainly include on-line monitoring, UAV patrol, personnel on-site patrol and so on.

On-site staff use their eyes or telescopes and other tools and instruments to observe, inspect and measure the various components of the transmission line. The purpose is to grasp the operation status of the line, find the equipment defects and threaten the safety of the lines in time. Because overhead lines are widely distributed and run under the open air for a long time, they are greatly affected by the changes of the surrounding environment and nature.

Unmanned aerial vehicle (UAV) patrol system adopts fixed-wing UAV patrol system, which monitors transmission lines, ground wires, metal fittings, insulators and towers through remote control image system, and carries out rapid and wide-range patrol and screening of transmission lines. However, UAV usually needs personnel to be near and remote controlled, and the patrol situation needs personnel to check again.

On-line monitoring of transmission lines uses sensors with specific functions to real-time monitor the environmental channel environment, temperature, humidity, wind speed, wind direction, leakage current, icing, conductor temperature, wind deviation, sag, galloping, insulator pollution, surrounding construction, tower tilt and other parameters of transmission lines to provide abnormal conditions of

the line. Early warning, through the monitoring of the effective parameters of transmission lines, can improve the management level of safe and economic operation of transmission lines, and provide a necessary reference for the condition-based maintenance of transmission lines.

At present, each transmission line monitoring device needs to install SIM card, but this will increase the operation cost and management difficulty; at the same time, the monitoring device is far away from the base station, and the transmission of information consumes energy faster; moreover, the monitoring device needs frequent battery replacement, which increases the work content and difficulty;

Currently, installing SIM cards for each transmission line monitoring device requires continuous payment of SIM cards, which increases operating costs. Due to the distance from the base station, each transmission will consume more energy and frequent battery replacement will bring more additional workload.

3. Transmission Line Information Routing based on Directional Antenna

Transmission lines are usually directional, that is, the connection between the poles and towers is usually linear, the distal poles and towers are connected in a linear relationship, and the wireless signal is spread to all directions, not directional. If the directional antenna is used to transmit the wireless signal, the energy consumption can be effectively reduced under the condition of the same distance.

In order to solve the problems of high energy consumption and poor signal transmission quality of sensors, the application of directional antenna devices in transmission line monitoring nodes can significantly reduce the energy consumption of nodes, balance the energy consumption of nodes, prolong the overall working time of the network, reduce the use of SIM cards, reduce operating expenses and workload.

Transmission line information routing based on directional antenna mainly includes physical layer, data link layer and network layer.

The node routing method needs to know the location and direction of the other node in the physical layer, and the directional antenna adjustment method can also use GPS or other positioning technology to obtain the position information of other neighboring communication nodes, so as to calculate the relative position between nodes and correct the antenna receiving and receiving direction.

Node routing method realizes error-free transmission of protocol data unit between two adjacent nodes in data link layer, and solves the communication problem between two adjacent nodes.

Node routing method implements routing selection, loop avoidance and routing reconfiguration in network layer, and solves routing table maintenance problems. The node network layer determines the next hop node, which reduces the link error probability, improves the link stability, and improves the end-to-end delay performance of the network.

Fig. 1 is a schematic diagram of transmission line information routing based on directional antenna. From the diagram, it can be seen that the tower connection of transmission line is linear, which provides a good basis for the application of directional antenna.

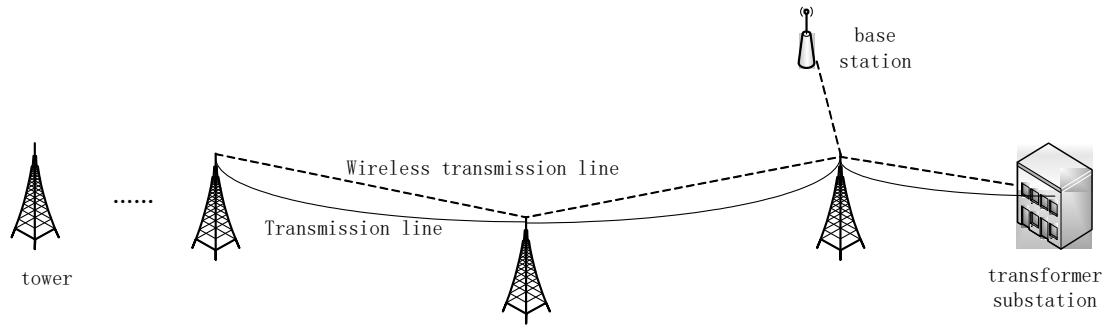

Fig. 1 Schematic diagram of transmission line information routing based on directional antenna

Fig. 2 is directional antenna forwarding routing graph. As can be seen from the graph, monitoring node A encapsulates the monitoring information after obtaining the monitoring information and forwards the encapsulated information to the next hop monitoring node in the routing table by querying the routing table. Similarly, the next hop node receives the information and fuses it with the information of the node again. Encapsulation, then the next hop route forwarding is finally transmitted to the monitoring system.

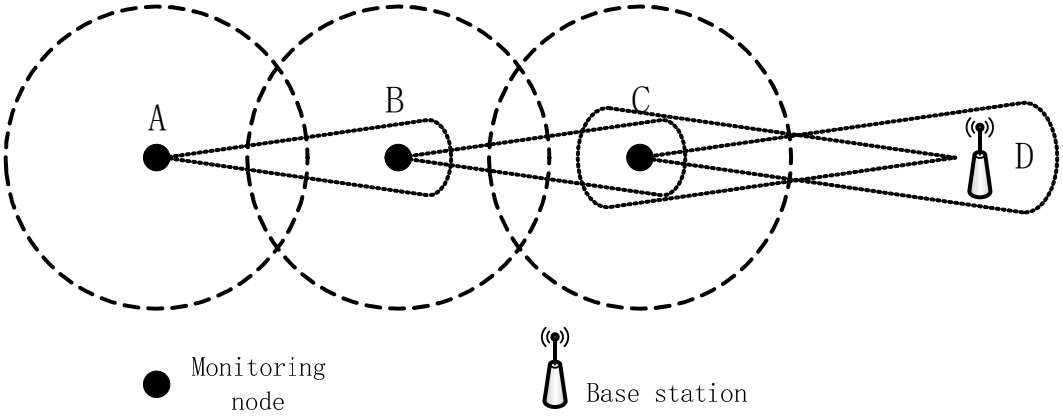

Fig. 2 forwarding routing for directional antennas

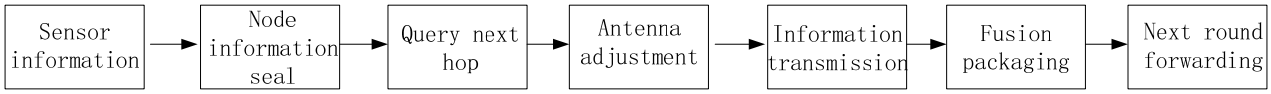

Fig. 3 routing information for transmission lines based on directional antennas

Fig. 3 shows the flow chart of routing information for transmission lines based on directional antennas.

4. Summary

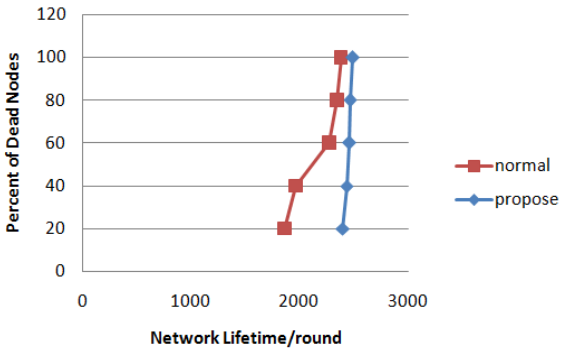

Fig. 4 Number of dead nodes with rounds

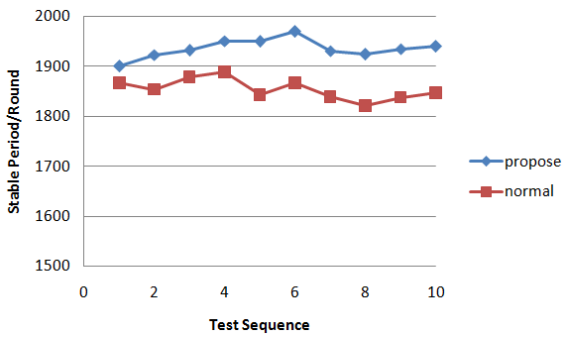

Fig. 5 Network stable period

We evaluate the improved protocol by comparing network lifetime with normal approaches H. Fig 4 shows percent of dead nodes with rounds, as can be seen dead node appears 380 rounds later than normal approaches, which is 21% of normal approaches stable period. The end of network using normal approaches ends when the first dead node appears in the improved network. So, energy efficiency is improved in the network that uses improved protocol. With more nodes alive in the network, the sensing area can be monitored accurately and QoS of network will be improved relatively.

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