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REVIEW

Exploration and Research on Fault Maintenance System of New Generation Weather Radar

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ABSTRACT

In order to improve the standardization, specialization, intelligence and timeliness of the new generation weather radar fault repair, the technical threshold of radar fault repair is greatly reduced, so that the general operators can carry out radar fault repair work. In order to achieve this goal, this paper designs a new generation weather radar fault repair system, which aims to solve two problems: one is to solve the causes and locations of the new generation weather radar faults which can be quickly and accurately detected and diagnosed[1]; the other is to solve the problem that the grass-roots radar operational staff are inexperienced in maintenance and will not be repaired, and to provide visual through the maintenance system. Maintenance methods and steps with expert intelligence level [2], so that general radar operators can operate radar fault repair according to video steps, and have the technical level of maintenance experts, to achieve breakthroughs in technical difficulties of radar fault repair, to achieve both disease detection and treatment effect, to improve the efficiency of the use of new generation weather radar and to achieve modern technical equipment support. Chemistry plays an important role and significance.

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1. Introduction

The sudden change of wind and cloud generally indicates that there will be rapid and intense weather changes. To effectively deal with the unexpected weather, advanced technology and equipment should be used as support. The advanced equipment for dealing with short-term severe convective weather in meteorology should belong to the new generation weather radar. It can monitor and detect the sudden short-term severe convective weather system and grasp its development and change trend in real time. The internal condition and intensity of the severe convective weather system are continuously tracked and detected to provide reliable basis for forecasting, early warning and disaster prevention. However, all of these are based on the function that the new generation weather radar can play in the absence of faults and normal operation. Long-term operation of machinery and equipment will always lead to faults. Finding the causes of faults, rapid positioning and timely repairing are very important safeguards. The existing fault self-checking system of the new generation weather radar has been

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running for more than ten years, and its technology and functions have been improved. At present, there are two difficulties in the rapid diagnosis and timely maintenance of the new generation weather radar faults. One is that the existing self-inspection system of the new generation weather radar faults urgently needs to be updated, perfected, supplemented and upgraded. The other is that the new generation weather radar fault repair technology requires a high threshold and lacks one to provide technical support for timely repair. Standardized and intellectualized maintenance system can greatly reduce the technical barrier of maintenance, so that when the new generation weather radar breaks down, it can not only quickly detect the location and determine the cause of the breakdown, but also have the ability to eliminate the breakdown in time and quickly restore the normal working state of the radar. This research is to develop a standardized and intellectualized maintenance step that can provide visual function. The maintenance system plays an important role in ensuring the normal operation of radar and realizing the modernization of radar.

2. The Reason Why the Troubleshooting of the New Generation Weather Radar has Become a Technical Difficulty

Fault detection and maintenance of new generation weather radar are two main reasons for technical difficulties.

2.1 Fault Detection and Diagnosis of New Generation Weather Radar

2.1.1 Fault Diagnosis Technology

Fault diagnosis is to use various inspection and testing methods to find out whether there is a fault in the system and equipment. The process of further determining the roughly location of the fault is fault location. Fault detection and fault location belong to the category of network survivability. The process of locating the fault to the replaceable product level (replaceable unit) when repairing is called fault isolation.

System fault diagnosis is to detect the system running state and abnormal situation, analyze and judge the type, location and cause of the system fault, and take the judgment results as the basis of system fault recovery, give solutions to achieve fault recovery.

2.1.2 Development of Fault Diagnosis Technology

From the end of the 19th century to the beginning of the 20th century, fault diagnosis is in its infancy. Experts in various fields depend on their senses to obtain the state information of equipment. They also need to make direct judgments based on their own experience. This is a simple and practical method for fault diagnosis of some simple equipment. Since 1960s, due to the development and application of reliability theory and the gradual development of sensor technology, it has become easier to measure various diagnostic systems and data, especially the development of artificial intelligence technology, which makes expert intelligent system widely used in the field of fault diagnosis. This concept will gradually replace the diagnostic process, which used to be based on numerical computation and signal processing, with knowledge processing and knowledge reasoning as its core. At present, intelligent diagnosis technology has become a new direction of the current development of diagnosis technology. The development of modern fault diagnosis technology has formed a new comprehensive subject of "fault diagnosis", and fault diagnosis has also produced a variety of classification methods, and each has its own characteristics.

2.1.3 Fault Diagnosis Method

At present, the mature and effective fault diagnosis methods are: fault tree analysis and diagnosis method, diagnosis method based on fuzzy theory, diagnosis method based on statistical theory, expert system fault diagnosis method, neural network fault diagnosis method, data fusion fault diagnosis method and integration technology fault diagnosis method, and each has its own advantages and disadvantages. The most suitable fault diagnosis method can be selected according to the characteristics of equipment. A combined fault diagnosis method.

Expert system diagnosis method is one of the most noticeable development directions in the field of fault diagnosis. It is also a kind of intelligent diagnosis technology with the most research and application. It has roughly gone through two stages of development: the fault diagnosis system based on expert experience knowledge in shallow knowledge field and the fault diagnosis system based on model knowledge of deep knowledge diagnosis object.

2.1.4 Current Fault Detection System of New Generation Weather Radar

The new generation weather radar fault self-detection system has been in use for more than ten years. It is developed and set up by professionals according to the common fault cases that appeared or may appear in the past, but it has not been fully supplemented, improved and upgraded. At present, fault detection technology and fault analysis and diagnosis technology have made great prog-

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ress, and the existing new generation weather radar equipment gradually shows aging fatigue, and the failure rate gradually increases. After that, although some high-level weather radar personnel and maintenance personnel have studied several new generation weather radar fault self-detection and diagnosis schemes, they have not been popularized and applied. Both technology and function need to be upgraded in order to provide more effective basis and guarantee for the new generation weather radar to maintain normal use and fault repair.

2.2 Weather Radar Fault Maintenance

The new generation weather radar is a fusion of multidisciplinary advanced technology products. The technical threshold of radar fault maintenance is very high. It is necessary to master a variety of technical knowledge and rich maintenance practice experience to be competent. Most of the existing radar operators only carry out single-disciplinary systematic learning and training. Daily duty and simple faults can be dealt with without docking knowledge. There are too many points, too many blind areas, many radar attendants are not familiar with the internal structure and components of the radar, and they have never seen what the components of any specifications look like. Even if the weather radar fault location and causes are found out by the self-inspection system, they will not repair it. Most radar operators do not even know the sequence and steps of the fault repair and installation, and improper disposal may cause greater damage, and stations are often damaged. Because of the absence of maintenance personnel when the radar fails, it will delay the rush repair time, affect the radar observation work, greatly limit the timeliness of the repair of radar failures, and also affect the efficiency of the new generation weather radar. At present, radar maintenance is basically divided into station level, provincial level and manufacturer level.

The existing fault self-detection system of new generation weather radar is no longer suitable for the needs of radar operation, and it also needs to be updated, perfected, supplemented and upgraded urgently. Especially the existing radar fault self-examination system is only responsible for seeing a doctor, regardless of the treatment, even the prescription is not opened, which allows the radar watchman who is not proficient in maintenance to watch the observation period slip past in front of his eyes, sweating on his head and anxious in his heart. At present, the grassroots radar station lacks an expert intelligent maintenance system which can automatically provide general radar operators with fault information and guide fault maintenance after fault location and causes are diagnosed by fault self-inspection system when weather radar fails.

3. Solutions of Difficulties in Fault Maintenance of New Generation Weather Radar

3.1 Solution of the Fault Detection Shortcomings and Diagnosis of New Generation Weather Radar

The existing new generation weather radar fault self-detection system has been used for more than ten years. In order to better integrate with the new generation weather radar fault self-detection system, the existing radar fault self-detection system can be optimized, upgraded, and its old appearance can be changed. In order to improve the ability of fault detection, analysis and diagnosis for the new generation weather radar, more advanced system and equipment self-inspection analysis and diagnosis methods are selected to be used in combination, so as to provide accurate location and cause for the maintenance of weather radar faults in time, and to improve the accuracy and timeliness of diagnosis.

To adapt to the requirements of new weather radar fault detection technology, the existing database of new generation weather radar fault cases is reformed, perfected, supplemented and upgraded.

3.2 Maintenance Method for Solving Fault of New Generation Weather Radar

Strengthen the relevant technical training of the new generation weather radar operators, accumulate experience, gradually improve their familiarity with each part of the new generation weather radar system and equipment, and improve the operational level and response ability of radar fault maintenance.

If we want to achieve the timely and rapid repair of the new generation weather radar faults, we should try to reduce the technical threshold of radar fault maintenance. We can research and develop an advanced expert intelligent system for fault maintenance of the new generation weather radar. This system can automatically select the optimal maintenance scheme according to the fault information of the radar fault self-examination system. Provides, realizes the self-inspection system to find out the fault has the corresponding repair plan, and provides the radar fault repair plan to enable the general business personnel to understand, according to this plan everybody can carry on the fault repair, it should be the visual version of the maintenance plan with maintenance steps and maintenance tools and the required accessories physical image, this plan must have the maintenance expert level, and according to According to the fault repair plan, everyone can repair, which will change the current state of only responsible for seeing a doctor, regardless of treatment, so

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that the new generation of weather radar fault repair problems can be solved.

4. Design Scheme of Fault Maintenance System for New Generation Weather Radar

The new generation weather radar fault maintenance system consists of two subsystems: radar fault detection subsystem and radar fault maintenance subsystem.

4.1 Fault Detection Subsystem of New Generation Weather Radar

New generation weather radar fault detection subsystem [3], including radar monitor and radar fault detection device, radar monitor is connected with fault signal input interface circuit and operation state input interface. Radar monitor will acquire weather radar fault signal from fault signal input interface circuit and weather radar operation state signal from operation state input interface circuit. The signal is transmitted to the radar fault detection device.

Radar fault detection device, including the first processor, the first memory and the first remote communication device, the first processor is connected with the first memory [4], the first remote communication device; the first processor is used to query the fault location and fault of weather radar according to the weather radar fault signal transmitted by the radar monitor and the weather radar operation status signal in the first memory. The technical parameters of the cause are diagnosed by expert intelligent system[5], and the weather radar fault information is transmitted to the first memory to store and send out alarm signals. The weather radar fault information includes weather radar fault signal, weather radar operational status signal, fault location and fault cause diagnosis results of weather radar; the radar fault detection device will process the first one. The weather radar fault information inquired by the device is transmitted to the radar fault maintenance subsystem through the first remote communication device.

4.2 Fault Maintenance Subsystem of New Generation Weather Radar

The new generation weather radar fault maintenance subsystem includes the second processor, the second memory, the second remote communication device and the display. The second processor is connected with the second memory, the second remote communication device and the display. The second processor receives the weather radar fault information transmitted by the first remote communication device through the second remote communication device. The second processor also receives the weather radar fault information transmitted by the first remote communication device according to the second processor. The weather radar fault information received by the second remote communication device is searched in the second memory according to the radar fault information for the corresponding radar maintenance scheme, from which intelligent optimal screening is carried out, and the selected radar maintenance scheme and steps are pushed to the staff through the display to display and store, thus realizing the function of automatic analysis, search and screening the corresponding maintenance scheme, and also realizing the radar. Maintenance system is standardized, intelligent and professional.

4.3 Working Principle of Fault Maintenance System for New Generation Weather Radar

Working Principle of New Generation Weather Radar Fault Maintenance System (see Figure 1): When weather radar fails or runs abnormally, the radar monitor of Weather Radar Fault Detection Subsystem starts. It will acquire the weather radar fault signal from the fault signal input interface circuit and the weather radar running status signal from the runtime input interface circuit to the radar. The first processor of the radar fault detection device inquires the technical parameters of the weather radar fault location in the first memory according to the weather radar fault signal transmitted by the radar monitor and the weather radar operation status signal, and compares them. The expert intelligent system is used to diagnose the fault location and the fault reason diagnosis results are stored and sent out. The alarm signal can automatically supplement and update the weather radar fault information system in the first memory. At the same time, the radar fault detection device transmits the above results to the radar fault maintenance subsystem through the first remote communication device. After the second processor of the weather radar fault maintenance subsystem receives the weather radar fault information transmitted by the first remote communication device through the second remote communication device, it inquires the fault maintenance scheme according to the radar fault information in the second memory, and intelligently optimizes the best scheme from the fault maintenance subsystem, and visualizes the fault maintenance scheme and steps to the staff through the display. Push display and storage. Radar operators carry out fault repair according to the maintenance scheme of the radar fault maintenance system. After repair, the fault detection system is retested. If other faults are not repaired, the maintenance system provides a new scheme again, and then repairs until the weather radar resumes normal work.

The new generation weather radar fault overhaul sys-

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tem realizes the functions of automatic detection, fault diagnosis, automatic case storage, alarm and automatic pushing visual radar fault repair schemes and procedures to the staff. It also realizes the automatic supplement and improvement of radar fault overhaul system, which makes the system standardized, intelligent and professional, and guarantees the realization of the system. Modernization plays an important role in promoting development.

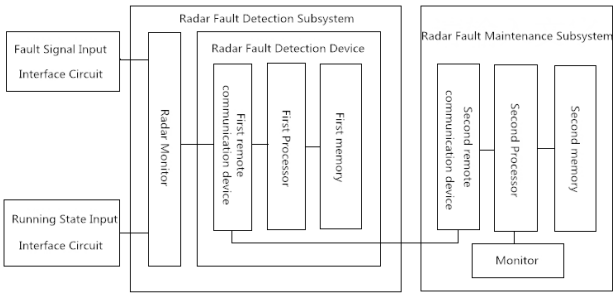

Figure 1. Icon Schematic diagram of fault maintenance system for new generation weather radar

5. Conclusion

The most prominent feature of the new generation weather radar fault overhaul system is that the system automatically provides the visual step maintenance plan according to the fault detection and diagnosis results. In the maintenance plan, the required tools, spare parts parameters and physical images are provided with visual images, and the scheme provided has the level of experts, which can greatly reduce the requirements of maintenance work for professional maintenance technology and experience. Threshold improves the timeliness of the new generation weather radar fault repair, and correspondingly improves the normal operation efficiency of the new generation weather radar.

The existing fault self-detection system of the new generation weather radar is no longer suitable for the needs of radar operation, and it also needs to be updated, perfected, supplemented and upgraded urgently. Especially the existing radar fault self-detection system has the characteristics of "only responsible for seeing a doctor, regardless of treatment", and cannot provide the corresponding repair methods. When the radar malfunction is also diagnosed the location and cause, which makes the radar watchman who is not proficient in maintenance, watching the observation period slip by in front of his eyes, sweating on his head and anxious in his heart. The establishment and application of the new generation weather radar fault repair system is conducive to strengthening the standardization, intellectualism and specialization of the new generation weather radar fault repair, and can achieve the effect of both seeing a doctor and treating a disease.

The new generation weather radar fault overhaul system has the function of expert intelligence system and self-supplementing, perfecting and upgrading case plan database, which improves the reliability, security and advancement of the system itself.

For the first complex new faults, new causes and solutions, the new generation weather radar fault overhaul system will carry out intelligent fitting analysis selection and expert scheme comparison and optimization input. The system will also automatically supplement and upgrade, Self-Summarize and accumulate experience, in order to achieve intelligent self-improvement mechanism, so as to maintain the new generation weather radar fault overhaul system has always been specialized. Home level.

The new generation weather radar fault overhaul system has an innovative design scheme which can automatically provide visual function. It also needs to select enough pilot units to carry out operational inspection and constantly improve the system in order to provide a good technical support function for the new generation weather radar.

Reference

[1] Xiong Guohua, Lai Weiguo. Brief Introduction of Fault Diagnosis Technology for New Generation Weather Radar [J]. Jiangxi Meteorological Science and Technology, 2001, (02): 41-44.

[2] Liu Xiaodong, Chai Xiumei, Zhang Weiquan, et al. Technology and method of new generation weather thunder overhaul [J]. Meteorological Science and Technology, 2006, 34 (S1): 111-114.

[3] He Jianxin. Research on testing and fault detection technology of new generation weather radar [J]. Chinese scientific and technological achievements, 2016, 17(01): 20-20.

[4] Wang Zhiwu, Lu Xinglai, Chen Hao. Design and application of weather radar test and maintenance database [J].Meteorological Science and Technology, 2016, 44(06): 896-901.

[5] Bian Zhi, Jia Hankui, Kang Guihong, et al. Several fault analysis and troubleshooting methods for the new generation weather radar (CINRAD/CD) [J]. Meteorological and Environmental Science, 2010, 33 (1): 85-88.

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