Data Mining for State Evaluation and Analysis of Thermal Power Generators

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ABSTRACT

At this stage, with the progress of industrial science, my country's thermal power units are constantly supplementing the shortcomings, the total installed capacity has increased, and some power plants that have been eliminated by the times and are not conducive to environmentally friendly development have been shut down. The thermal power units currently in use are not only safe and reliable, but also attach great importance to intelligent power generation and refined tubes, especially the maintenance and management of thermal power generators. At present, a new data mining technology can be applied to the condition maintenance of thermal power units. This technology obtains potential information from data to help power plant personnel identify the operating status of the unit, so as to achieve better operation and maintenance of thermal power generating units. Based on this It can improve the economy and reliability of thermal power generators and promote the improvement of the intelligent level of power plants.

Keywords: *data mining technology; thermal power generator; state assessment*

1. INTRODUCTION

Generators are the source of power for my country's electric power industry, and problems with some parts of them will affect the normal operation of the equipment and may endanger the safety of the equipment. In order to better monitor the operation state of thermal power generators, this paper establishes a state evaluation system based on the application of data mining technology in the operation of thermal power generators. The evaluation system is mainly divided into two parts, one part is the evaluation parameters required for the operating state of thermal power generators, mainly including operating parameters and point inspection data; the other part is the state evaluation method, which is mainly divided into two parts, one is the evaluation of key parameters, and the second is the evaluation of the overall state of the generator.

2. APPLICATION STATUS OF DATA MINING TECHNOLOGY IN THERMAL POWER

At present, the popularity of computers has been greatly improved, storage media and other data technologies have developed rapidly, data has become an important factor of production, and the establishment of advanced database systems has been widely used in various industries. The huge amount of data and the extremely fast data growth rate bring difficulties to "digesting data" and "using data", and data mining technology can help people convert data into information.

Because data mining technology not only has ultra-high performance in data processing and information acquisition, but also has strong applicability and compatibility, it has been widely valued by many experts and scholars at home and abroad. In recent years, data mining technology is no longer limited to the commercial market, but has been further developed to apply it in the industrial field. The thermal power unit system is complex and requires regular monitoring, but there are many detection parameters, which brings difficulties to the detection, operation and maintenance work. At present, the plant-level monitoring information system of thermal power generators can collect a large amount of operating data in real time, and has data storage technology, which can store monitoring data for 3 to 5 years. This information system provides a good foundation for the application of data mining technology.

The research results of J. Smrekar, Ding Wei, Chen, Kai-Ying, Luo Chanchun and others show that data mining technology can be applied to the fault diagnosis of thermal power units and the state prediction of thermal power units [1]. Although these data involve fault monitoring and identification, they do not organically combine the monitoring results with equipment maintenance. It is difficult to effectively improve equipment operation and maintenance supervision and management, and it is still impossible to realize the intelligent operation of thermal power units. In view of this, starting from the research status of data mining technology, on the basis of condition monitoring and fault identification, this paper adopts a scientific and reasonable evaluation method to establish an evaluation system for the state of the generator and associate it with

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the equipment maintenance and management of thermal power units. Combine. At the same time, the evaluation system can also be developed and deployed in the condition maintenance platform and generator real-time condition assessment and early warning.

3. METHODS AND GENERATOR PARAMETERS FOR CONSTRUCTING AN EVALUATION SYSTEM

3.1 The key parameters of thermal power generator generator condition assessment

At present, the types of thermal power generators that are widely used in coal-fired power plants are mainly three-phase hidden pole water-hydrogen-hydrogen cooled synchronous generators. As shown in the figure below, the generator has an independent excitation winding. The overall structure mainly includes stators, rotors, end covers and bearings, hydrogen coolers, oil seals, brush holders and other components, using "water-hydrogen-hydrogen" cooling way to generate electricity. Therefore, the selection of key parameters is mainly based on the manifestations of equipment component failures and the equipment safety operation manual.

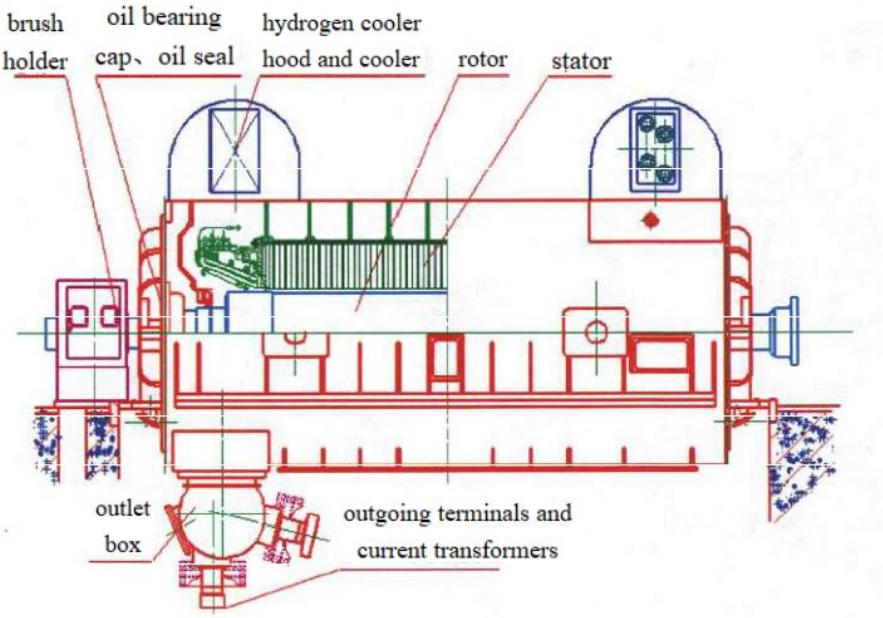

Figure 1 Schematic diagram of generator structure

The main components of the equipment include stator core, machine base and its vibration isolation structure, stator winding and its inlet and outlet water manifolds and other components. First of all, the role of the stator core is to cut the magnetic field lines in the magnetic field to generate an induced current, and it will be accompanied by a large amount of heat consumption. The hydrogen circulation can maintain the temperature of the stator core; when the hydrogen is cooled or the stator insulation is damaged, heat will be generated. The failure to shoot makes the temperature of the iron core rise, which in turn destroys the use of the iron core. Secondly, the role of the rotor is to generate a rapidly changing magnetic field through the connection between the winding embedded in the rotor core slot, the collector ring and the excitation system. Thirdly, when the transmission conduit of the cooling water circuit has both cooling and thermal conductivity, we should pay special attention to the conductivity of the cooling water and the stability of the PH value to copper. The formula for the absorption of heat by the cooling water is as follows:

Cooling water absorbs heat Qw=μw*Ho*Be*Le (μw=engine cooling loss, generally 0.25)

At the same time, the amount of hydrogen leakage and the inlet flow of stator cooling water will also affect the safe operation of the equipment. Finally, the hydrogen cooling system, which is mainly responsible for cooling the rotor and stator core, uses the fans installed at both ends of the generator shaft to circulate the hydrogen along the stator base - the surface of the core - the air channel inside the rotor for heat exchange [2].

In addition to the component parameters mentioned above, the electrical parameters of thermal power generators such as active power, line voltage, various currents and excitation voltage are also worthy of our attention, but this paper mainly selects several key parameters that need to be monitored as evaluation. basis of the system.

3.2 State assessment method of thermal power generator generator

3.2.1 Key parameter classification and state deterioration degree score

As shown in the table below, this method classifies the degree of influence of the key parameters of the generator on the operating state of the generator. The higher the degree, the greater the degree of importance; the degree of equipment state deterioration reflected by the key parameters The grades are classified, and the higher the deterioration degree value, the more serious the failure.

Table 1 Key parameters and deterioration level values

The importance level of key parameters				
	class I	class II	class III	class IV
importance value	1	2	3	4
	deterioration level			
	class I	class II	class III	class IV
deterioration value	2	4	8	10

3.2.2 Equipment status assessment

The level of the key parameters of the generator and the degree of state deterioration can reflect whether the equipment is in good condition. After multiplying the two to obtain the evaluation value of the key parameter, the equipment state is determined according to the maximum evaluation value, and the evaluation result is formed accordingly. Assuming that the equipment status evaluation value is max, $\leqslant 10$ is normal, < 20 is attention status, < 30 is abnormal status, $\geqq 30$ is serious status and needs to be maintained in time. The generator state evaluation matrix is shown in the following table:

Table 2 Generator status evaluation status table

importance value deterioration value	1	2	3	4
10	10	20	30	40
8	8	16	24	32
4	4	8	12	16
2	2	4	6	8

4. CONSTRUCTION OF THE CONDITION MAINTENANCE PLATFORM FOR THERMAL POWER GENERATORS

The construction of the generator condition maintenance platform should not only aim at the overall condition maintenance, but also meet the needs of users in each office area, so that the operation centralized control center, the logistics support warehouse and the office area can work together. On this basis, the remote maintenance and transmission requirements of the system should also be considered. In view of this, this paper adopts the Browser/Server system as the basis of the platform architecture. Users in the local area network can access the server normally [3]. At the same time, technicians can Distribute data from the network to reach various designated departments, which is convenient for remote maintenance and centralized data transfer. The platform not only makes overall planning for management and maintenance work, but also the various functional applications of the system do not interfere with each other, which increases the stability of the platform by reducing the workload of operation and maintenance.

The construction of the generator condition maintenance platform is shown in the figure below, which mainly includes the display layer, the business layer, and the data layer. The functions of the three regional modules are different. The display layer is the view display of various links; the business layer is mainly the model center, to reflect the status of the rule base and maintenance item base; the data layer includes the transmission and storage of various data.

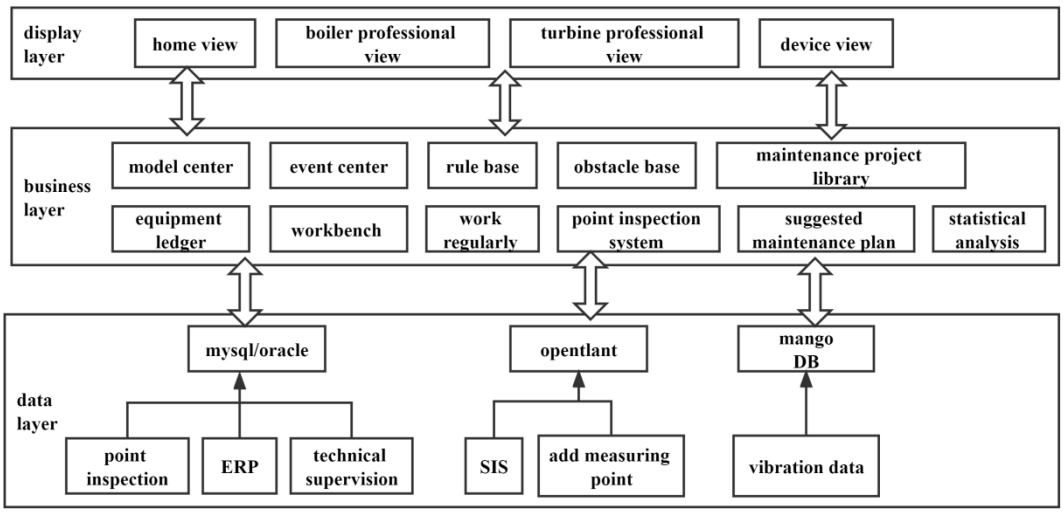

Figure 2 Generator condition maintenance platform

The evaluation method configuration of the platform is mainly based on the data base, mainly the key parameters of the state evaluation (as shown in Table 1), as well as other electrical data, such as offline data, stator coil temperature, intermediate results generated by model calculations, etc. On this basis, professionals can judge the status of the equipment and predict the operation of the equipment through the existing evaluation methods and data resource allocation [4]. The system improves the work efficiency of maintenance personnel to a certain extent. At the same time, the system has powerful functions. Users can set the trigger conditions and states of events in the configuration module, and the system will automatically make decisions and generate defect orders or maintenance plan suggestions.

5. FUNCTIONS OF THERMAL POWER GENERATOR CONDITION MAINTENANCE PLATFORM

5.1 Condition monitoring

Based on data mining technology, the platform has the function of real-time monitoring of generator status. The monitoring interface can display key parameters concerned by various professions, including equipment status and pending event information. For key parameters, major index parameters, statistics of event status and other information, the monitoring interface can send reminders to managers. For example, the construction of an electrical professional maintenance platform includes the main parameters such as the active power of the generator set, stator voltage, etc., and is equipped with a status statistics table and a generator equipment event reminder mechanism.

5.2 Event Handling

The motor unit operation and maintenance event information is a relatively complete and mature mechanism, including event number, status, trigger time, event data, equipment ownership, measurement point name, operator and other information. These information can not only be shared, but also each step is It is traceable [5] and strongly reminds users in the form of to-do items. The event processing process also tends to be intelligent and automated. After the equipment defect work order is formed, it will be automatically submitted to the maintenance plan library, and then the relevant system of the platform will formulate maintenance plan suggestions. During the monitoring process, if it is found that the equipment status is abnormal or changes from the attention state to the serious state, the maintenance platform can automatically trigger an alarm to remind the inspection personnel to carry out equipment inspection and maintenance. Before maintenance, the inspection personnel also need to verify the monitoring information. If it is a false alarm caused by abnormal measurement points and other factors, the inspection personnel can manually cancel it and confirm that there is no abnormality in the link and the event ends.

5.3 Maintenance decision

If the specific implementation of equipment condition maintenance is limited to the equipment level, it is difficult to truly exert the value and benefit of the platform maintenance decision-making function, and more is to go deep into the specific maintenance items and maintenance content of the equipment. The current power plant consumes a lot of electricity, and the equipment is numerous and complex, leaving many overhaul projects. We have to make the final decision on the maintenance projects in stages. The differentiation of the stages is mainly based on the data of different aspects such as equipment aging, wear and failure. In general, it can be divided into three types of maintenance strategies:

durable parts, wearing parts and performance-deteriorating parts.

6. CONCLUSION

To sum up, with the rapid development of the current electric power industry, the state monitoring and operation and maintenance management methods of corresponding equipment should also be upgraded. Data mining technology can well integrate the two to realize the monitoring and operation of thermal power generators. Maintenance integration and intelligence, reduce the workload of electrical inspection personnel, and promote the development of intelligence and automation in the electric power industry.

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