Research on consumption rule and prediction model of equipment maintenance equipment

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Abstract. This paper analyzes the factors affecting the consumption of equipment maintenance equipment, studies the data of equipment consumption, and builds a equipment consumption prediction model on the basis of the maintenance equipment consumption prediction. Through the design and realization of the basic module of equipment support and prediction module, the analysis and prediction of equipment maintenance equipment consumption are realized, which provides a new application means for equipment maintenance support.

Keywords: Equipment consumption; Consumption law; Prediction model

1   Introduction

Equipment maintenance equipment is the most important material basis for equipment maintenance support work, and its guarantee effect has a crucial impact on equipment maintenance support. On the one hand, the lack of maintenance equipment will seriously affect the quality of maintenance and the completion of maintenance tasks; On the other hand, if the maintenance equipment is overstocked, the limited maintenance equipment support funds will not be fully and reasonably utilized, and bring about a series of problems such as the storage and treatment of the maintenance equipment [1][2]. Maintenance equipment consumption is closely related to maintenance equipment support, as shown in Figure 1.
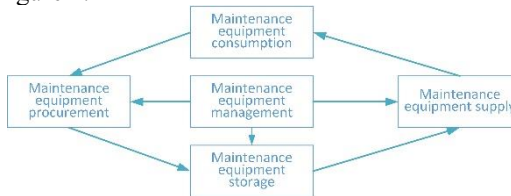

Fig. 1. Relationship between maintenance equipment consumption and maintenance equipment support

It can be seen that the impact of maintenance equipment consumption on maintenance equipment support is all-round, and it plays an important and obvious role in

maintenance equipment support. We must actively explore the consumption law of maintenance equipment, and scientifically and reasonably predict the consumption of maintenance equipment, so as to scientifically allocate and use maintenance equipment support costs, avoid blindness in maintenance equipment support work, reduce decision-making errors, and strive to achieve greater military economic benefits with less investment.

2   Analysis of Consumption Influencing Factors

There are many factors affecting the consumption of maintenance equipment, which can be divided into equipment factors, design factors, use factors, management factors and maintenance equipment itself [3].

2.1   Equipment Factor

Includes the number of equipment, installation maintenance tasks, and the service life of equipment.

2.2   Design Factors

This includes equipment failure rate, quantity consumed per unit, and consumption rate.

2.3   Use Factors

Including the use of equipment intensity and use environment.

2.4   Management Factors

Including equipment management level and maintenance equipment management level.

2.5   Maintenance Equipment Itself

Including the sensitivity of the equipment to damage and storage life.

3   Research on Maintenance Equipment Consumption Data

The consumption data of maintenance equipment is the direct reflection of the consumption of maintenance equipment, and it is the basis and basis for studying the consumption law of maintenance equipment [4].

3.1   Data Classification

The data related to the consumption of maintenance equipment collected in the actual process is often diverse and rich in content, which needs to be summarized and classified in order to facilitate analysis and find out the law, so that the obtained data reflects its due value. There are different classification methods from different angles, and the data can be divided according to the source mechanism, which runs through the whole life process of the design, test and use of the equipment. It can also be divided according to the type of data or according to the size of data.

3.2   Design Data

Design data refers to some failure rate or reliability analysis data about equipment units that can be obtained from the early development stage of equipment, and the consumption of corresponding maintenance equipment can be analyzed and studied by using the relevant information about equipment (unit) reliability that has been available at this stage.

3.3   Test Data

Test data refers to the consumption data of maintenance equipment in the test stage or the information about unit life obtained through the test way, which can be divided into test consumption data and life test data, mainly from the test site [5].

3.4   Consume Data

The so-called total consumption data refers to the sum of all maintenance activities consumed by a unit in a period of time. That is, within the specified time, no matter which maintenance is consumed by which equipment, but the statistics of all consumption of the same maintenance equipment [6].

4   Research on Maintenance Equipment Consumption Forecast

The research on the consumption law of maintenance equipment is to guide the guarantee work of maintenance equipment, which is mainly used for the consumption prediction of maintenance equipment, application of maintenance equipment and revision of maintenance equipment standards. With the consumption data and the consumption prediction model, the consumption of maintenance equipment can be predicted [7].

The specific steps of the prediction process are as follows:

Step 1:Determine the maintenance equipment to be predicted, collect and sort out the relevant consumption data.

Step 2:Determine whether there are multiple types of data. If yes, select the data to consume, and then proceed to step 3; If there is only one type of data, proceed directly to step 3.

Step 3:The prediction model is selected and calculated according to the consumption data.

Step 4:Rationality analysis of the forecast results. If reasonable, the forecast ends and the forecast result is output; If it is not reasonable, return to step 2, first analyze the reasons for the unreasonable prediction, and re-select the consumption data and prediction model for prediction until a satisfactory prediction result is obtained.

When analyzing the rationality of forecast results, it is difficult to use a unified standard to measure because there are many prediction models and some models are complicated. Therefore, you can give a confidence level (such as 90%, 95%) according to the specific situation, and then calculate the corresponding confidence interval, if the forecast results fall within this interval, it is considered reasonable, otherwise it is not reasonable.

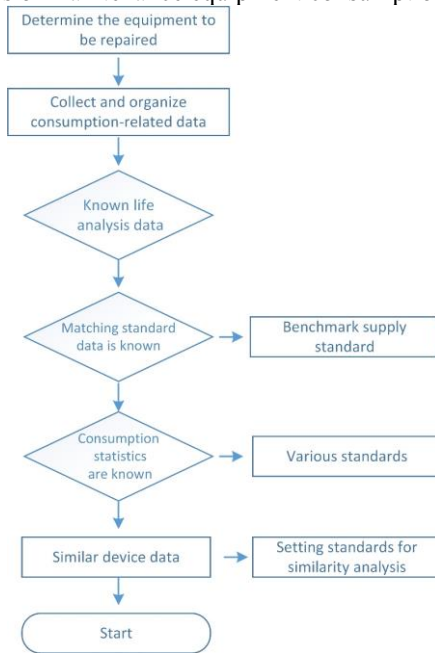The forecast process of maintenance equipment consumption is shown in Figure 2.

Fig. 2. Repair equipment consumption forecast flow chart

5 Design and Realization of Equipment Prediction Module

5.1 Equipment Support Basic Module

Equipment prediction is realized according to equipment support module, which can realize data visualization, data orchestration, container engine, twin neural network

algorithm and fault tolerance algorithm and other cutting-edge technologies to realize the whole process management and accurate support of equipment and equipment. Specifically, it includes the whole process from equipment and equipment warehousing to tasks, planning, warehousing, maintenance management, equipment forecasting, visual query and maintenance support, and accurate visual restoration. The integrated management system of general equipment maintenance equipment accurate support system includes equipment consumption law prediction model, algorithm optimization, equipment visual query and equipment information management database design, software interface design includes data layer, support layer, display layer and so on. The system architecture diagram is shown in Figure 3.
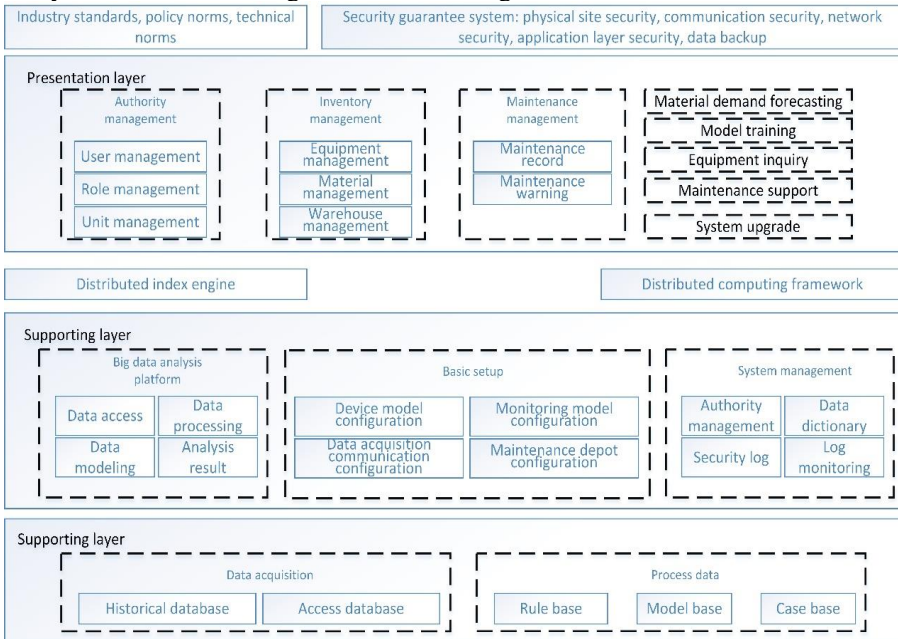
Fig. 3. Equipment support basic module system architecture

5.2   Design and Realization of Equipment Support Prediction Module

The equipment forecasting module includes the import of historical data and manual addition, and realizes the equipment consumption forecasting function of the system through the underlying model algorithm. The equipment prediction interface can select task mode, input environmental parameters, determine operation proficiency and use intensity, and invoke prediction algorithm and prediction model to predict equipment consumption according to input parameters, thus achieving personalized and accurate protection. The equipment prediction module supports the expert correction of the forecast results, and generates the warehouse delivery plan inside the system to realize the information management of the equipment. The task management process is shown in Figure 4.
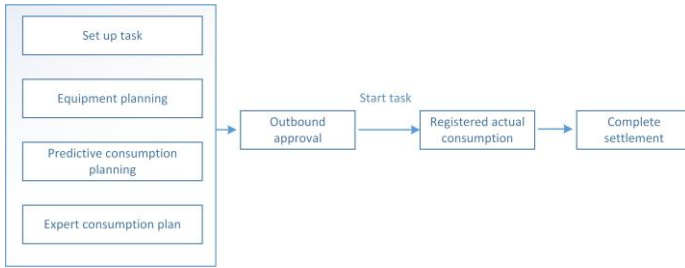
Fig. 4. Equipment support task management process

The consumption prediction module contains the input key information prediction, and the predicted data can be used for visual chart analysis and display. The prediction model runs in the open source engine tensorflow environment, and the server communicates with it through sock, and the data results are fed back to the system task module. The display interface of consumption prediction module is shown in Figure 5.
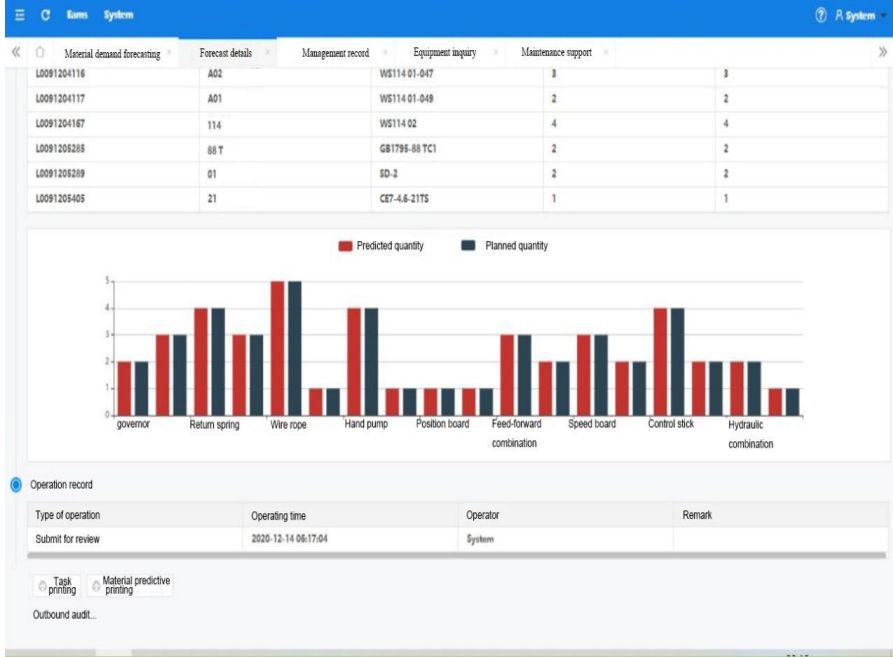

Fig. 5. Equipment consumption forecast display

6   Conclusion

The analysis and research of equipment consumption law is of great significance to equipment maintenance and support. Through the forecast of equipment consumption, the pre-management of equipment supply can be effectively realized, so as to reduce the cost of equipment production reserve and improve the overall economic benefit.

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