

Design and Realization of Animal feed production Management System based on MES

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Abstract: This article aims to develop a set of animal feed production management system based on MES. The article starts with the production process of the feed production enterprise, according to the requirements and construction goals of the feed enterprise for the production management system, as well as the analysis and combination of the main characteristics of the MES system, to achieve the basic realization of the purpose of data collection at the production site of feed products, and to ensure that the feed is processed and produced in the specific process. Digital and automatic control of the whole process when producing products. Ensure the production quality of enterprise feed products, and ensure the accuracy of feed production ingredients control. Effectively integrate management, design, purchase, inventory, process and production information, realize "one chain" management of information, and enhance corporate competitiveness.

Key words: animal feed production; MES; JAVA; production management system

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I. Introduction

In recent years, the output of my country's feed industry has achieved rapid growth. In 2020, the total output value of the national feed industry will be 946.33 billion yuan, a year-on-year increase of 17.0%. At the same time, there will be 749 feed factories with a scale of more than 100,000 tons in the country, an increase of 128 over the previous year.¹ Large-scale development at the same time also put forward higher requirements for feed production.

The feed production process is a dynamic process, which requires workshop production to be on-site and real-time. Only under the premise of establishing a scientific quality management system and standards, pay attention to strict quality and on-site management measures and advanced automated monitoring methods. In order to achieve the stability of the final feed quality.² How to realize real-time online automation, digital quality control, and change from post-event to pre-check is the future development trend.

After a detailed investigation and careful analysis of the feed production workshop, it is found that the main problems existing in the workshop production management are as follows:

(1) The production data of the entire production process cannot be collected comprehensively: the workshop staff cannot track the operating status, processing time, product quality, etc. of each equipment in the feed production process in real time. The data collection needs to be collected manually and then manually Input to the computer, the integrity and reliability of the data cannot be guaranteed, and the management efficiency is low.

(2) Difficulties in achieving quality analysis and traceability: production management is chaotic, lack of post-production feed quality traceability, unable to effectively provide information on the actual processing status of materials, unable to trace the specific production information and the entire production process of problem feeds, and it is difficult to make specific production situations Analysis; unable to track the production of the workshop to determine the completion progress of the production order, and therefore unable to provide an accurate delivery date.

(3) Data sharing is difficult to achieve: the collaborative operation of various production equipment and the data of various business departments cannot be shared in time, and it is impossible to ensure that the internal data of the enterprise is consistent and accurate in real time. Each production department forms "information islands" to a certain extent, and production data The management and delivery of the product need to be completed manually, resulting in a waste of human resources and low work efficiency.

(4) Backward material management: In order to truly ensure feed safety, the storage of raw materials and finished feed products needs to be strictly controlled. Enterprise material inventory management methods are backward, unable to provide accurate and timely material inventory information, and complete the update of relevant material in and out information in a timely manner, resulting in a backlog, sluggishness, and shortage of

raw materials or products, which not only consumes a lot of manpower and material resources, but sometimes also Affect normal production.

(5) It is difficult to control the entire production process: In the feed production process, whether the entire production process is reasonable and whether the production equipment is used is also the key to effectively ensuring the safe production of feed.³

The MES system realizes the optimal management of information transmission from the production order to the completion of the entire production process. When a real-time event occurs in the production workshop, MES can quickly and promptly respond and report on it, and use the accurate data obtained in real time to guide the optimization and processing of the production process. The above rapid response to changes in the production process enables MES to effectively guide the production operation process of the factory by the management personnel of the enterprise, so that it can not only improve the timely delivery ability of the factory, improve the circulation performance of materials, but also increase the rate of return on production. MES also provides key mission information about product behavior at the enterprise resource planning layer (ERP) and the entire production process control system (PCS) through two-way direct communication, and solves the problems of information islands and information gaps in enterprise production.

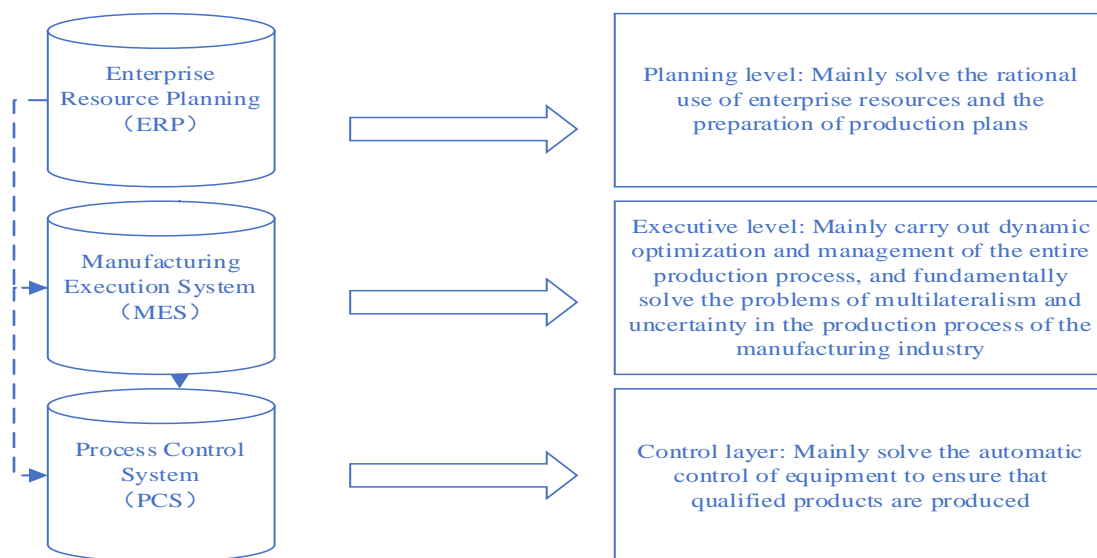


Fig. 1 Three-tier structure of production information system

Moreover, the application of the MES system can provide companies with production data management, production order planning management, production process management, raw material and finished product inventory management, quality analysis and traceability management, human resource management, production equipment management, procurement management, cost management, and production process control. And other management modules to create a solid, reliable, comprehensive and feasible manufacturing collaborative management platform for the enterprise. Combining with the MES system, aiming at the above problems in the survival of feed manufacturers, MES-based feed production management is designed. This system can feed back the order status, quality data, production process, real-time materials and other data to the management personnel in a timely manner. Provide relevant basis for decision-making.

II. System design

2.1 System architecture design

Through the analysis of the feed production process, combined with the basic design of the MES system, the architecture design of the feed production management system is completed, as shown in Figure 2. The production management system is mainly divided into system framework layer, production management layer, system equipment interface layer and production data collection layer. The system framework layer is mainly responsible for the safety, configuration, and basic service management of the production management system; ⁴the production management layer is responsible for the entire production process, material entry and exit, and plan execution; the system equipment interface layer is responsible for completing the production information interaction with the ERP system, including raw materials, Production work orders, workshop users, feed suppliers and other information, forming a unified information foundation; the production data collection layer is responsible for collecting real-time data of equipment operation during production, and completing

automatic collection of test information through integrated development of known equipment related protocols , So as to support the business logic of each business module of workshop production management.

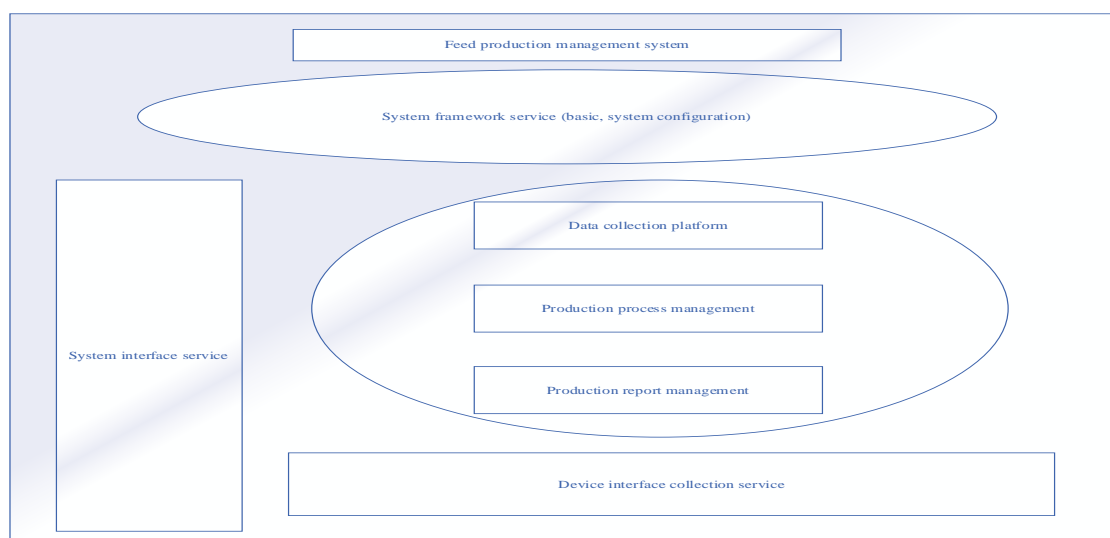


Fig. 2 System architecture diagram

2.2 Function module design

According to the demand analysis of feed manufacturers and the problems in the production process, the functional modules of the production management system are designed. It is mainly composed of six modules: system management, production process management, production plan management, equipment management, quality management, and inventory management .⁵Each main function module is composed of several sub-function modules, which together form The entire feed production management system.The specific functional modules are described as follows:

2.2.1 System management module

This functional module is mainly for system management of the production management system, including operations such as user management and database backup. In user management, the system adopts a role-based management mode. The feed production management system is mainly oriented to system administrators and feed production company employees. Different system permissions are assigned according to different roles. The highest management authority of the system belongs to the system administrator. The feed production company employees only have basic office Module operation authority. The backup of the database will ensure the data security of the system. This function can back up the entire database, including all database objects such as user tables, system tables, and stored procedures, but the complete backup of the data takes more time and system space. , So on the basis of ensuring system performance and data integrity, the system will complete a full backup once a week.

2.2.2 Production process management

The production process management module records the detailed information of the work orders generated in each production process. Including feed formula management, production process management, and material configuration.The production process management of feed products is an important guarantee for the quality of feed products. The management of feed formula is mainly based on the control of the ingredients and the weighing process according to the different formulas, avoiding errors caused by manual weighing of ingredients.⁶ Material configuration can realize fine control in the process of receiving and placing feed ingredients.The management of the production process is mainly the identification of the type and batch of raw materials by the workers through the code scanning gun. When the information of the raw materials is consistent with the produced feed formula, the feeding operation can be carried out, and at the same time, the information will be obtained. The raw material information is uploaded to the data server for storage and display; when the above information does not match, the system will give an equipment alarm, and then abandon the feed for a second correction.

2.2.3 Production plan management

This functional module mainly includes two parts: production order management and team management. The production plan management of feed production is based on the specific process flow in the feed production process, combined with feed order sequencing, raw material and finished product inventory,

workshop capacity, and equipment conditions to determine the main plan of feed production, and then according to the specific production plan, Come to arrange the workshop team. At the same time, appropriate adjustments can be made according to the completion of the planned order, temporary order insertion, order cancellation, etc., so that the tracking of each process plan is accurate and orderly, and the execution of the plan is guaranteed.

2.2.4 Device management

The equipment management module realizes the equipment status monitoring and the collection and analysis of production data, and finally forms a summary analysis of the daily output of the equipment.⁷A summary chart of the daily volume of equipment as shown in Figure 3 can be generated.

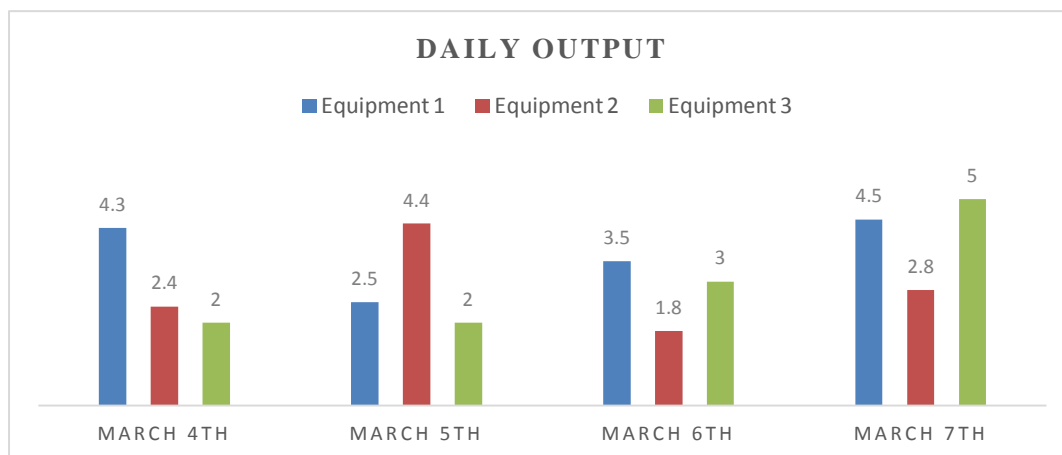


Fig. 3 Summary of equipment daily output

2.2.5 Quality management

The quality management module is mainly divided into two parts: product quality management and raw material quality management. Product quality management mainly records, tracks and analyzes the quality data of finished feed products and the production process to control product quality and determine issues that need attention in production. According to the completion of the job, the quality inspection time and quality inspection standards are formulated to inspect the product quality, and a quality inspection report is generated. Quality inspectors set quality inspection standards for different products in different sections, conduct quality inspections on products according to quality inspection standards, and record quality inspection information. According to the quality inspection report and quality inspection information, standardize the production operation process.

The quality of raw materials is the most important thing in the production of feed products. While ensuring the quality of raw materials purchased, when the quality of feed products does not meet the standards, you can retrospectively query according to the product barcode to check whether there are any problems with the raw materials. If found in time Save it in the system data file to prevent the same quality problem from recurring .

2.2.6 Inventory management

Inventory management mainly includes information such as the storage time of finished feed products and raw materials, the inventory quantity, and the storage person. The detailed record of the source of the raw material can be inquired through the raw material number, raw material batch or basic information of the supplier.⁸ When the material is put into storage, scan the QR code of the material by hand-held PAD to obtain material-related information .

2.3 System development

In order to facilitate the use of the system on multiple platforms, the system is developed with a browser-based B/S structure.⁹ The system structure is shown in Figure 4.

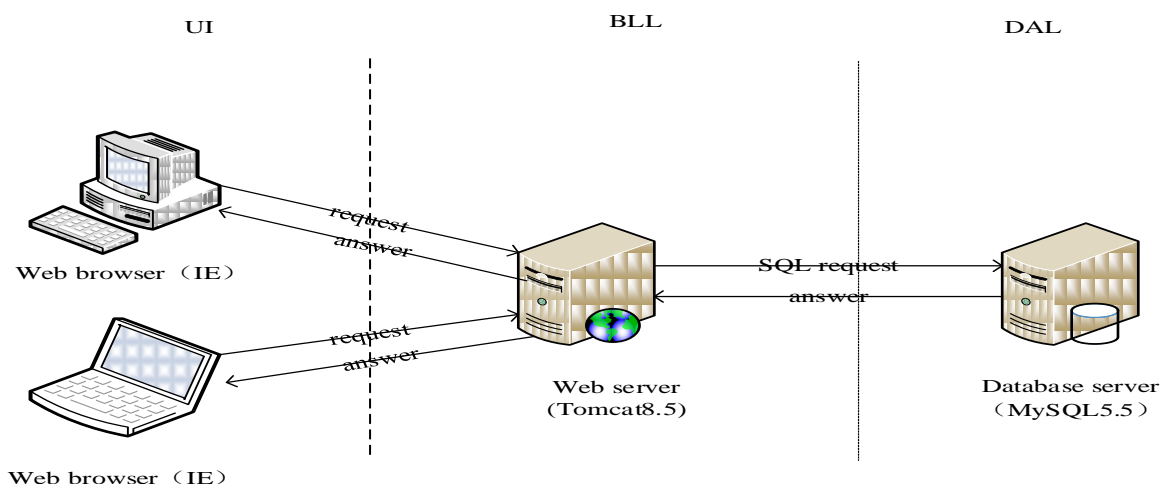


Fig. 4 B/S structure diagram

2.4 Database design

The conceptual structure design of the system database is realized by using E-R diagram (entity relationship). The E-R method can easily carry out conceptual model design. E-R diagram provides a way to represent entity types, attributes and connections, describes the relationship between data and data in the real world, and is easy to convert data models into data structures, which facilitates the needs of the database logic design stage. Among them, the relationship of the E-R diagram includes three types of contact, namely one-to-one contact (1:1), one-to-many contact (1:N) and many-to-many contact (M:N). This article designs the corresponding E-R diagram according to the business process of the feed production enterprise.

III. Framework development

The web project framework is developed using the SSM framework, which is integrated by Spring, SpringMVC, and MyBatis.(1) Spring is a lightweight inversion of control (IOC) and aspect-oriented (AOP) container framework. The dependency of each module is described through a simple configuration file, so that it can more clearly gather external information.¹¹(2) SpringMVC is a mainstream framework for user development. It separates the three roles of view, model, and controller, separates business processing from interface interaction, and encapsulates it into model and control In the design of the device, it can be decoupled from each other and can be expanded independently.(3) MyBatis is a persistence layer framework that supports custom SQL statements, stored procedures, and advanced mapping. MyBatis avoids almost all JDBC code and manual setting of parameters and obtaining result sets. It only uses simple XML or annotations to configure and map original information, and maps interfaces and Java POJO classes to records in the database.

IV. Conclusion

Combining the basic characteristics of the feed production workshop and the basic MES system, successfully designed a feed production management system based on the MES system, standardized the entire production process, and realized the real-time sharing of operating data, inventory data, production data, and quality inspection data. Further improve the management level and achieve the expected results. In the future, through the optimization of system shipping management, cost statistics and other functions, various resources of feed production enterprises will be coordinated and unified through the system, and the core competitiveness of the enterprise will be further improved.

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