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**BUILDING THE FACTORY OF THE FUTURE THROUGH THE
INTEGRATION OF ADVANCED MES AND WMS SYSTEMS
(USING THE EXAMPLE OF MIDEA GROUP)**

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Annotation. The article describes a manufacturing execution solution system and a warehouse management system. The possibility of their integration and operation is analyzed using the example of a specific enterprise (Midea Group).

Key words: production system, warehouse management system, manufacturing execution solution.

As the product life cycle, control and compliance requirements for managing the execution process with correct instructions, real-time data and production information increase, a Manufacturing Execution System is needed. With the manufacturing execution system, production and process parameters are recorded and reported instantly by establishing direct connections from production lines and machines. Manufacturing is kept under control by providing real-time access to production values and performance via the Internet at any time.

What are the main benefits of a manufacturing execution system?

1. It enables companies to standardize production processes across multiple plants in a global organization as a central source of information.
2. It enables real-time data collection for continuous improvement.
3. It improves efficiency, quality control and decision making in manufacturing and warehouse.
4. It offers companies more transparent, optimized workshop processes, production processes and better resource management.
5. It can be integrated into ERP systems.

MES records work, waste, downtime and maintenance in real time. It eliminates the need for paper notes and spreadsheets. The Manufacturing MES system also collects valuable data to evaluate unprofitable business models and predict future prices. With this information you can increase productivity and efficiency in your business.

An MES system can be integrated with other enterprise resource planning (ERP) systems. This integration eliminates the need for independent systems and redundant data entry. At the same time, it enables more precise delivery date forecasts and improves decision-making through more accurate data collection.

An advantage of MES is its accuracy when examining production lines and end products. It can detect any irregularities on the factory floor and stop them immediately to minimize material waste and help companies reduce avoidable expenses.

An MES system creates accurate production plans and monitors inventory of raw materials and parts. This process reduces the time lost due to scheduling adjustments while parts are in transit. This employee scheduling method allows you to effectively utilize available staff.

Manufacturing execution system software provides real-time operational data that you can use to optimize product, time and labor management, resulting in optimized operations and greater efficiency. Ultimately, this leads to cost savings and freed up human resources.

The MES system updates inventory records with new product and material information. It provides the purchasing, shipping and planning departments with information about the availability of inventory and orders. Implementing an MES system can help maintain optimal inventory levels and reduce excess, which can be beneficial given the high costs of transporting, storing and monitoring goods.

Founded in 1968, today Midea is one of more than 10 home appliance brands owned by the leading international technology company Midea Group. In 2022, Midea Group was ranked 278th on the Global Fortune 500 list, improving its ranking by 43 points compared to the previous year. Midea Group's activities go beyond the production of household appliances and include such areas as Heating, Ventilation and Air Conditioning, Robotics and Automation, Smart Home, Internet of Things, as well as smart logistics and components. The main principle of all Midea Group enterprises is “humanization of technology”.

1. Midea MES system and WMS system

Manufacturing execution system (MES) is a set of production management software for the workshop level. It realizes real-time monitoring and management of production activities by integrating various information in the production process. MES systems can optimize production processes, improve production efficiency, reduce costs, and support production decisions through accurate data collection. It covers the entire production cycle from order placement, production scheduling, material management to product quality tracking, ensuring a smooth and efficient production process.

Warehouse management system (WMS) focuses on logistics and inventory management within the warehouse. It uses automation and intelligent technology to control and track the flow of materials in the warehouse. The WMS system helps companies realize real-time monitoring of inventory, optimize storage layout, improve picking and distribution efficiency, while reducing human errors and inventory backlog. It is tightly integrated with the MES system to ensure seamless connection between production and supply chain.

Midea's smart manufacturing MES and WMS planning is a comprehensive solution designed to enhance the intelligence level of the entire production and logistics through a highly integrated information system. In terms of MES, Midea Planning improves the transparency and response speed of the production process by implementing advanced production monitoring, automated scheduling, real-time data collection and analysis and other functions. In WMS planning, Midea Group is committed to optimizing warehouse operations through automated storage, intelligent picking, precise inventory control and efficient material distribution. The combination of the two not only improves production efficiency and product quality, but also enhances the flexibility and accuracy of the supply chain, providing strong support for Midea Group in global competition.

2. Midea MES and WMS overall planning plan

Midea Group's MES (Manufacturing Execution System) and WMS (Warehouse Management System) overall solution is an integrated intelligent manufacturing system designed to improve production efficiency, product quality, inventory management, and the transparency and response speed of overall operations through information technology. The following is a detailed introduction:

2.1 MES (Manufacturing Execution System) Solution:

Production planning and scheduling: The MES system can automatically generate detailed production plans and scheduling instructions based on market demand and resource conditions to ensure the orderly progress of production activities.

Real-time monitoring and data collection: By directly connecting to equipment on the production line, MES monitors production status in real time, automatically collects production data, and provides real-time information support for production decision-making.

Quality management: The MES system has a built-in quality management module, which can realize the whole process quality control from raw material inspection to finished product delivery, and timely discover and deal with quality problems.

Equipment management: Integrating equipment status monitoring and maintenance management, MES can predict equipment failures, reduce unexpected downtime, and improve equipment utilization.

Process management: The MES system supports flexible process route design and changes to adapt to changing production needs, while recording and analyzing process execution to provide a basis for continuous improvement.

Material management: MES accurately controls the use and flow of materials to reduce waste, and through integration with WMS, it enables timely replenishment of materials and inventory optimization.

2.2 WMS (warehouse management system) solution:

Inventory control: WMS provides precise inventory management functions, including real-time updates of inventory levels, inventory warnings, and implementation of inventory optimization strategies.

Material flow management: The system tracks the entire flow process of materials from entry to exit to ensure correct placement and timely distribution of materials.

Warehouse layout optimization: WMS helps companies optimize warehouse layout, improve space utilization, and reduce material handling time.

Picking and distribution: Through the intelligent picking system, WMS improves picking efficiency and accuracy, and supports multiple picking strategies to adapt to different order needs.

Returns and defective product management: WMS can handle the return process, isolate and analyze defective products, and ensure inventory quality.

Integration and scalability: WMS and MES systems are tightly integrated to achieve seamless connection between production and logistics, while supporting connections with other enterprise information systems, such as ERP, SCM, etc.

2.3 Features of Midea's smart manufacturing MES and WMS planning:

Integration: Tight integration between MES and WMS ensures the consistency and real-time nature of production information and logistics information.

Intelligence: Apply artificial intelligence and machine learning technology to analyze production and inventory data, predict trends, and automatically adjust production and inventory strategies.

Flexibility: The system design takes into account changing market and production needs and can quickly adapt to changes in production plans.

User customization: Provide customized MES and WMS configurations according to the characteristics of different factories and production lines.

Sustainable development: Support Midea Group's green manufacturing and sustainable development strategies by optimizing resource utilization and reducing waste.

How the MES system integrated with the WMS system works in Midea Group is shown in Figure 1.

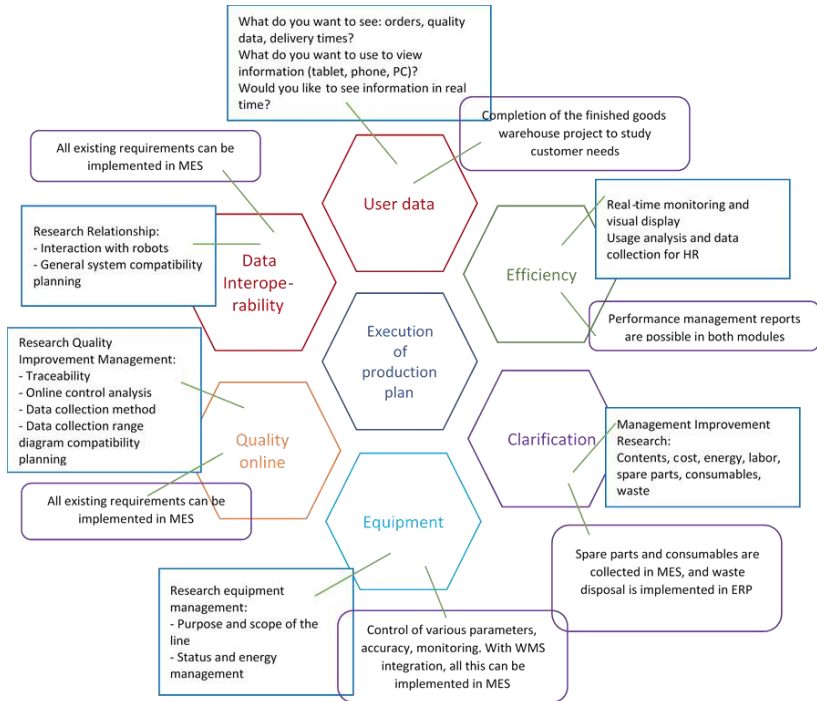


Figure 1 – Relationship between MES and WMS systems in Midea Group

Midea's MES and WMS overall solutions not only improve production efficiency and product quality by improving the intelligent level of production, but also strengthen the control of the supply chain, bringing higher competitiveness and market response speed to enterprises.

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