

Research on Mobile APP of Intelligent Manufacturing Operation and Maintenance System

Jiqing Cao

Department of Information Engineering

Suzhou Industrial Park Institute of Service Outsourcing, Suzhou, China

george.cao@siso.edu.cn

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Abstract: This paper discusses the new industrial Operation and Maintenance software solutions based on mobile APP, designs the function structure of the software, including Configuration Management, monitoring and alarm management, work order management, VR-based Knowledge Base and patrol management, and designs the cloud-based platform of interface between mobile APP and the original production system and Operation and Maintenance system. The application of mobile APP in industrial Operation and Maintenance can help Intelligent Manufacturing enterprises solve many difficulties in IT Operation and Maintenance, reduce the workload of maintenance personnel, and help enterprises improve the service efficiency and quality of IT maintenance.

1. Introduction

In Intelligent Manufacturing enterprises, equipment and systems are complex and diverse, distributed in different places, data throughput is huge, real-time and usability are demanded high, and work efficiency increasingly depends on stable and reliable system operation, which puts forward higher requirements for efficient IT Operation and Maintenance. At present, the update management of most domestic systems still depends on the field operation of IT engineers. The IT Operation and Maintenance of Intelligent Manufacturing enterprises need more efficient and intuitive management tools to monitor the operation of various parts of the IT system, and conduct comprehensive intelligent analysis, to find potential risks and adopt corresponding solutions as early as possible before the system problems occur, so as to realize the real-time monitoring and active management of IT Operation and Maintenance. In a word, IT Operation and Maintenance under Intelligent Manufacturing must realize automation, mobility, visualization and intelligence.[1]

2. Advantages of Mobile APP

At present, the speed and application of mobile Internet technology has become more and more mature. The penetration rate of mobile intelligent terminals is growing rapidly. Simple and convenient mobile terminals will become an important part of enterprise IT Operation and Maintenance management. Combining mobile interconnection technology with traditional IT Operation and Maintenance services can provide more timely, convenient and accurate services for Intelligent Manufacturing enterprises, and then improve the level and efficiency of Operation and Maintenance services.[2]

2.1. Integration

Mobile terminal APP can integrate all kinds of heterogeneous IT systems scattered in different areas to realize remote direct monitoring; the problems that need to be solved in the past can be operated in mobile APP. It does not interfere with existing processes or systems. All necessary information needs to be integrated and processed in industrial APP.

2.2. Real Time

Mobile interconnection technology can realize the maintenance of production system by operators at any time and in different places, including system status checking, network equipment maintenance, configuration file updating, system upgrade and network traffic monitoring, etc. Combined with cloud technology, fast migration or reset of faulty system or components can also be realized in mobile APP.

2.3. Visibility

Mobile APP combined with VR/AR technology can realize virtual and visual Operation and Maintenance scene guidance, simplify the training of Operation and Maintenance personnel and the operation of complex Operation and Maintenance activities on site, and improve the efficiency of Operation and Maintenance.

2.4. Predictive

Mobile APP combined with Big Data technology can realize intelligent Operation and Maintenance of the system. Operating and maintenance personnel can obtain real-time early warning of faults and spare parts on mobile terminals, and make first-time processing decisions.

2.5. Data Update

Combined with RFID and other technologies, mobile APP terminal can track and treat with the process data, maintain timely recording and uploading of information, and provide data support for continuous improvement and optimization of subsequent operation efficiency. The ultimate goal is to achieve maintenance efficiency and maintenance quality improvement.

3. Design of Mobile APP

3.1. Cloud-based Platform Architecture Design

Based on the requirements of the Intelligent Manufacturing, the architecture of the mobile App is based on the Cloud Platform (see Figure 1) and includes three layers, which are IaaS Layer (Infrastructure as a Service), PaaS Layer (Platform as a Service), as well as the SaaS Layer (Software as a Service). IaaS Layer is also known as resource management and data acquisition layer, covering the management of various of resources, infrastructure and basic services. PaaS layer, also known as platform management and data processing layer, it provides the core platform functions of Cloud Computing, Visualization, Big Data and Automation based on the corresponding technology platforms. SaaS Layer, also known as Operation and Maintenance APP layer, which achieves the core business of Operation and Maintenance, such as Monitoring and Alarms, Configuration, VR/AR Knowledge Base, Patrol management, and so on. [3]

3.2. APP Function Design

According to the requirement of Intelligent Manufacturing Operation and Maintenance, the content of mobile Operation and Maintenance APP mainly includes condition monitoring and fault analysis for the operation of production system, analysis and processing of various alarm information in business subsystem, supporting the management functions of job order creation, distribution and modification, managing the resource allocation information of each subsystem, and visualizing the process of failure maintenance. Prediction of barriers, data updates for various maintenance activities, etc. See the APP layer in Figure 1.

O& M APP Layer (SaaS)	Conf. Mgt, Monitoring and Alarm Mgt, Work Order Mgt, VR Knowledge Base, Patrol Mgt
Platform Mgt. Layer (PaaS)	Big Data, Cloud Platform, ESB, CMDB, VR/AR
Data Acquisition Layer (IaaS)	MES, ERP, PLC RFID

Fig.1. Cloud-based Operation and Maintenance APP

The APP layer achieves the access interface function for the users to operate on the various applications and Operation and Maintenance services on the platform. The APP layer presents a variety of professional reports, visualization models and alarm signals for the Operation and Maintenance engineer to make scientific decisions upon these rich reports.

3.2.1. Configuration Management

By associating software, hardware and services with application projects, the level of system monitoring is defined according to the importance of the system, and the classification and classification of faults are quickly obtained from the association tree of the Configuration Management database according to the definition of type, degree, level, scope of influence and degree of influence. From the IT infrastructure information, application project association, rule definition and other aspects, the monitoring objects are bound to each other, and the latter object is used as a point in the application configuration. Configuration Management is the basis of other functions. [4]

3.2.2. VR Knowledge Base

The key point of Knowledge Base management is to accumulate the knowledge of maintenance and management of application systems, record the measures taken to deal with different events and abnormal performance indicators in detail, search the classification and fast location of related fault maintenance in Knowledge Base, provide meaningful data and find the matching place in the process of fault automatic processing and manual processing. Reasoning cases, speeding up the speed of troubleshooting and problem solving, so that performance monitoring truly integrated into the overall Operation and Maintenance work. Intelligent management of alarm and report forms can also be realized by using Big Data technology.[5]

3.2.3. Monitoring and Alarming Management

This module achieves the intelligent control, including monitoring of automation systems, IT systems and the video surveillance of production environments, which dynamically shows the operational status of equipment and resources, trends of power consumption and status of sensors. Through real-time and historical data analysis, this module achieves the pro-warning of the system failures and smart positioning, so that the service quality and the resource consumption of hotspots business services are visible and measurable. [6]

3.2.4. Maintenance Work Order Management

When the maintenance order is created, all relevant information has been fully collected, including the location of maintenance, the number of fault location and the special tools needed for maintenance. When the maintenance personnel create the maintenance list in the industrial APP, the system can automatically fill in the equipment-related data, and get the specific situation of the failure and make the right decision immediately. When maintenance personnel carry out

progressive maintenance according to the specific items on the maintenance list, the industrial APP can provide a timestamp for each repair step, and display the real-time data and annotation information for executing the step. After the maintenance measures are implemented, the relevant data and analysis are recorded in the system.[7]

If Big Data technology is associated, industrial APP can achieve more functions in the maintenance process, such as on-site access to real-time data of equipment, access to historical data and error analysis. In this way, maintenance personnel can directly check and confirm whether the failure has been successfully repaired on site.

3.2.5. Patrol Management

In daily maintenance, maintenance personnel read RFID tags through mobile terminals to obtain equipment information and add and update the latest maintenance information. For the equipment that achieves scrap disposal, the system will automatically remind the staff to dispose of the scrap, so as to complete the management of the whole life cycle of the equipment.

Mobile terminal can also realize the management of spare parts, including the automatic collection of spare parts information, the realization of spare parts inventory, location and special operation information. When the inventory of spare parts is insufficient, it can carry out early warning, automatically generate purchase orders, and timely replenish the shortage. This module reduces the work intensity of managers and enhances the automation of spare parts management. And the level of visualization improves its management efficiency and efficiency. [9]

The mobile application system is developed based on HTML5, using HBuilder with built-in HTML5 + APP development environment as development tool, Mui as front-end framework, and Ajax technology and background for data interaction.

4. Summary

The application of mobile APP can improve the work efficiency of IT Operation and Maintenance personnel, and ensure that all levels of plant managers and maintenance personnel can keep interconnection with enterprises wherever they are. The APP has built-in indicators and tools, which can solve problems directly at the mobile end, and help improve efficiency and security. To enable the relevant responsible person to receive alarms remotely and monitor the operation situation, help factory personnel to cope with various situations more quickly, improve the operation status of business systems, improve the overall management efficiency of the company, while improving the competitiveness of enterprises and customer satisfaction.

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