DESIGN AND IMPLEMENTATION OF MIDDLEWARE FOR RFID WAREHOUSE MANAGEMENT

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Abstract-In this paper, a suitable solution for the tobacco warehouse management based on RFID technology is proposed. We first summarize the middleware system to achieve the main function, then design its structure and composition of the modules. Through experimental analysis, the middleware is layered and reconfigurable and it can well meet the needs of enterprises. At the same time, the application of RFID technology can collect data more accurately, fast and reliably. So the efficiency of management is greatly improved.

Keywords-RFID (Radio Frequency Identification); Middleware; Warehouse Management; System Development

I. INTRODUCTION

Storage management can take full advantage of the resources and provide efficient storage and warehousing services provided by the plan, organize, control and coordination processes [1]. RFID technology, known as radio frequency identification technology, can greatly improve business efficiency and reduce operating costs. Development based on RFID technology, warehouse management system can effectively improve the production efficiency and increase the degree of automation [2].

Middleware is an important part of RFID system. RFID can speed up the development and implementation of critical applications. It has become an key technology in distributed heterogeneous information system construction and an important tool for data collection [3]. With the low-level operating system and middleware complexity, the developers can work in a simple and unified development environment, thereby greatly reducing the technical burden.

As can be seen from Figure 1, the main function of RFID middleware is to achieve reader management, to filter the data collected and storage and to provide the upper application program interface. Our RFID middleware can accomplish these three main functions.

II. RELATED RESEARCH

As well known in foreign countries, middleware vendors are IBM, Oracle, Microsoft, Sun, Sybase and other enterprises. IBM's RFID middleware is a Java-based J2EE enterprise architecture language and follows the development of open middleware products of Things [4].

Sun's RFID architecture defines a presentation layer, business process layer, service layer and the integration layer [5]. Oracle Middleware AII (Auto-ID Infrastructure) is a J2EE-based Java language and follows the enterprise architecture products to meet enterprise storage and analysis of massive RFID data processing requirements.

In China, research on middleware and public services has been carried out. 863 programs based on related topics are studied by Institute of Automation. Chinese Academy of Sciences has developed a RFID public service infrastructure system; Huazhong University of Science and Technology has developed a communication platform to support multi-middleware product of things Smarti; Shanghai Jiaotong University has developed the data for business logistics management and integration of middleware platforms.

The RFID solution has a distinctive classic features, but these solutions also have shortcomings. Such as the IBM RFID middleware design is mostly based on their current research and development of core product or technology, there is much depend and less scalability. In this paper, application-specific features of RFID in the warehouse management system is designed for its application.

III. SYSTEM ANALYSIS

The basic functions of RFID middleware and RFID front-end structure consists of hardware modules and software applications and back-end database and application software in the middle between the environment, it provides business process management, real-time data filtering and data collection, event management, security management, data routing and integration, and collaborative management of the reader a variety of functions and mechanisms [6]. RFID-based middleware architecture is shown in Figure 1.
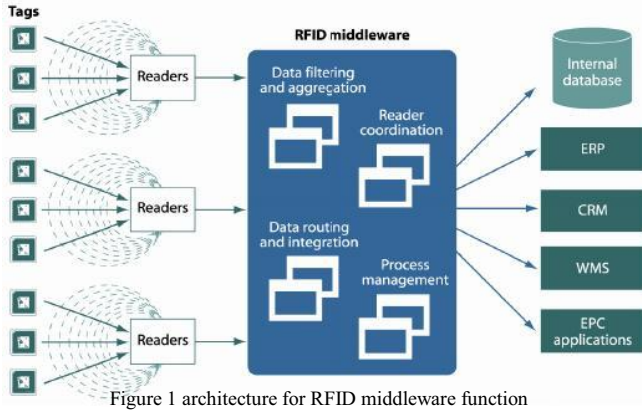
Figure 1 architecture for RFID middleware function

As can be seen from Figure 1, the main function of RFID middleware is to achieve reader management, filter the data collected and storage and to provide the upper application program interface. These three aspects are accomplished in our design of RFID middleware.

IV. SYSTEM DESIGN

RFID middleware applications can not only provide integrated functionality, but also provide data filtering to reduce the amount of data for the reader. And it also needs to guarantee the stability and time of system communication. We designed the middleware including three functional modules: communication management, data management and interface of application program.

A. Communication Management

Communication management module is responsible for the completion of data with the reader and the transfer of information between databases. The upper software does not need to consider specific issues of information exchange, as long as concerned about how you can implement your own functionality and this makes it easy to write program and to debug. Communication module structure is shown in Figure 2.
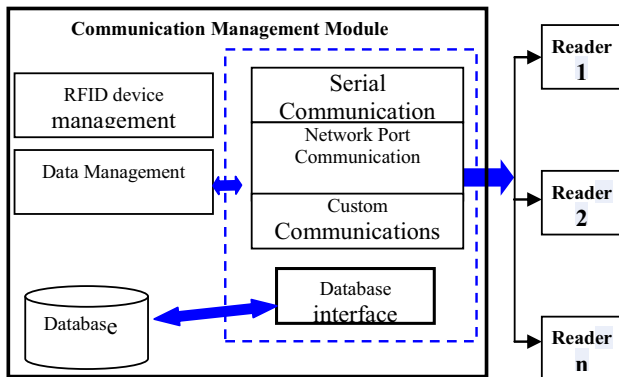

Figure 2 Module structure of communication management

B. Data management module t

This module from the reader device and the label information is collected to be treated as data, RFID middleware, information management module's main function is the hardware interface module from the RFID tag information is passed over for processing, including electronic tags information filtering, screening and storage. On the other hand the data management module is also responsible for the information RFID reader system maintenance, to ensure that each device is working properly. The communication management module by calling the relevant function module device status and related parameters for reading and writing. Data management module structure is shown in Figure 3.
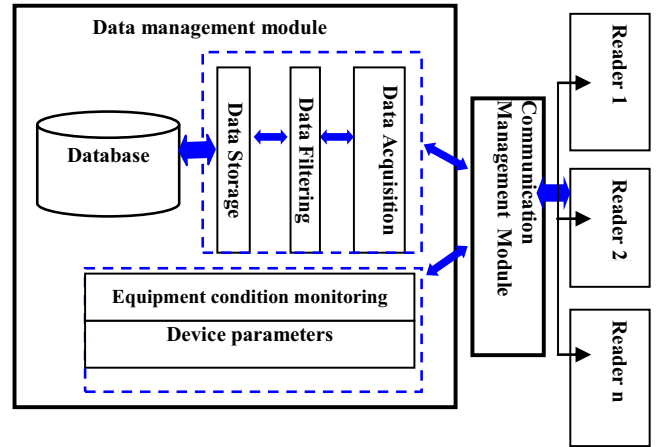

Figure 3 Module structure of data management

C. Application Program Interface

Middleware provides API defines a high-level application environment is relatively stable, regardless of the underlying computer hardware and system software how to replace old ones, as long as the middleware upgrade update, and maintain the same interface definition external middleware, application software is almost non- any changes required to protect the enterprise application software development and maintenance of major investment.

This paper designs a number of application program interface, through these interfaces, the ability to transfer data from the RFID middleware to other application systems, and ultimately achieve enterprise information integration.

V. SYSTEM TESTING

The middleware designed in this paper is used in a company's warehouse management system and then the test results are analyzed. The system is safe and data transmission is reliable and accurate, so the system design requirements is achieved. We further compare our RFID-based design to the traditional way of operation and the results are shown in Table 1.

Table 1 Unit cost of different mode

	100 / 4 tray			500 /17 tray		
	Traditional way	RFID	Decline	Traditional way	RFID	Decline
Library	0.0413	0.0133	67.80%	0.0389	0.0104	73.26%
Storage	0.0289	0.0102	64.71%	0.0256	0.0092	64.06%

After the above analysis it can be concluded that in the storage we use RFID by pallet transport means and greatly reduce the cost of single indicators, which effectively improve the production efficiency.

VI.   SUMMARY

We can use RFID technology to identify goods quickly and greatly improve the work efficiency ofoperation. So it is attractive for the storage and logistics management. RFID middleware in the warehouse management system has played an important role in connecting link and it can collect data directly on the reader information and communication platform to provide more data access interfaces. Through its application, we can quickly integrate with other applications, effectively improve the level of storage management.

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