

RFID-based Tracking and Tracing Information Platform of Logistics

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Abstract—Combining with the radio frequency identification (RFID) technology and Internet technology, for tracking and trace technology provides an effective solution: in computer to the Internet, and on the basis of using RFID, wireless communication technology, constructing a cover everything in the world of information network. RFID tag contains standardized and interoperability coding information, through the cable/wireless communication network, tag of the dynamic information automatic acquisition to public information system, the realization of articles) automatic identification and event handling, and then through the open Internet to realize information exchange and sharing of items, "transparent" management. The paper also use the J2EE developed a set of logistics tracking based on RFID and traceability platform. The three core role: the manufacturer, the third part of logistic and the retailer, who both use this platform base B/S to online track and cast back of the cargo with RFID label, meanwhile the ultimately user also can use this platform to query the history of the cargo with RFID label.

Keywords—Traceability Information Platform, Radio Frequency Identification (RFID) , J2EE , logistics

I. INTRODUCTION

Tracking and tracing system does not currently have global uniform definition, the so-called can track sex can be understood as determined through understanding the current position identity goal, such as the ability of the state information, the so-called traceability to understand through the record of trace the history of a target identification, the use, or the ability of the position. As for the product, tracking and traces of technology including the label of the product, as well as information, information transmission and information management, etc. Through the tracking and tracing system can determine the source of the raw material or component, products processing and history, in the process of circulation and delivery location; As for the user, in time and space with the qualitative and quantitative within the scope of the way to track the product. There are many valuable researches on it. Lee C.K.M. [1] studied the design and development of logistics workflow systems for demand management with RFID. Guo Zhanglin and Zhang, Xiaocue [2] discussed the application of RFID technology in the logistics supply chain. Chen James C. [3] published paper on Logistics efficiency improvement with lean management and RFID application. Tibus Cheryl A. and Brennan Linda L. [4]

studied RFID and labor management systems selection in the logistics industry. Trappey Amy J.C. [5] researched Genetic algorithm dynamic performance evaluation for RFID reverse logistic management. Some scholars have also studied the design of vehicle management system based on RFID [6], RFID data processing in supply chain management [7]. Aqiang Shen [8] published paper on RFID spectrum management in China.

How to efficiently achieve the food, drug, dangerous goods, track and trace? How to effectively address the logistics supply chain information sharing? How effective way to make monitoring of goods and counterfeit products of gray can not enter normal channels of supply chain? Combination of radio frequency identification (RFID) technology and Internet technology to track and trace technology provides an effective solution: the Internet in the computer based on the use of RFID, wireless communications and other technologies, to construct a covered everything in the world, the "information network." RFID tags store a specification and interoperability with the coded information through the wired / wireless communication network to label the dynamic information collected automatically to the public information system to realize the goods (commodities) and automatic identification and event handling, and then through the open Internet to achieve information exchange and sharing of goods, "transparent" administration.

II. PLATFORM TASK

The platform has following tasks:

1. An RFID-based tracking and tracing of the demonstration system is established, which includes complete supply chain business scenarios (including manufacturers, third party logistics, and retailers). The system's hardware (including electronic tags, readers, antennas, servers, etc.), software (middleware, applications, databases), solutions (network security, security of goods) and will be assessed through the system.

2. Platform is to simulate the "Internet of Things" and "electronic pedigree" requirement to construct a matching of the actual business scenarios (from manufacturers to end-user supply chain collaboration), to demonstrate how RFID technology to help companies and enterprises collaboration between business and information between users and business interaction.

3. The back-end interface to WMS or ERP system to meet the diverse integration requirements is reserved, to achieve RFID information with the regional public service platform for other applications of the interface. And its software works as low-coupling RFID information systems as a whole to join the regional public service platform for enterprise application layer.

III. EASE OVERALL DESIGN OF THE SYSTEM

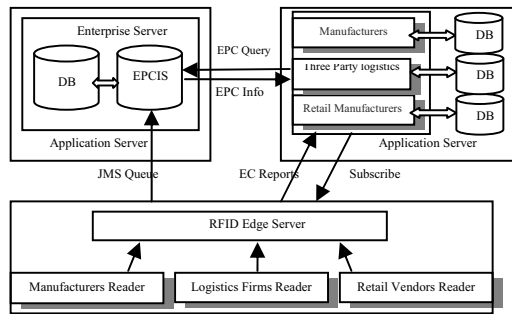


Fig. 1. System Summary Design

As Figure 1 shown, the whole platform can be broadly divided into three modules: Edge Server and the underlying hardware module, Enterprise Server data center module and the Enterprise application module.

Edge Server and the underlying hardware module include RFID tags system, reading and writing sensor and antenna network, and Edge Server middleware. RFID Edge Server management their RFID, speaking, reading and writing, when the with RFID tag product after each reading and writing device, the first read the EPC verify information products, if is to meet the triggering conditions, can according to certain rules on electronic tags on the information of the state make changes or updates. In addition Edge Server middleware also plays a filter, sentenced to heavy, automatic and Enterprise Server and business module communication, and other important role.

Enterprise Server is equivalent to data collection and exchange center, in the supply chain of all registered Edge Server will be active USES JMS Queue will read the reading and writing the EPC information can be active to Enterprise Server. For any products in the supply chain in the Enterprise Server will be stored in their own DB all status changes, namely "the historical records of the electronic pedigrees". The essence of Enterprise Server is a data warehouse and an EPCIS, data warehouse storage EPC information, but responsible for the storage, storage one-way after can't modify, can't be deleted, only by EPCIS to check.

Business module, the B/S structure in three roles: manufacturer, third party logistics, retail manufacturers, this also is the most basic logistics supply chain of three roles. The three parties have their own special DB and RFID Edge Server. Each role in their own RFID Edge in the Server

subscription, Edge Server read electronic tag immediately after with the EC real-time information EPC-sent to a role in the DB. Retail enterprise to manufacturers, production manufacturers an order after the completion of the outbound, with RFID tag products through the reading and writing, the system than the information such as the number of database model and began to write, RFID tag information. When the product by the third party logistics transport in the process of reading and writing, the network began to real-time tracking products and send EPC information in real time. When the last products go to the Treasury, reading and writing retail enterprise scanning label product information to verify information and the entire supply update EPC process is complete. Each role (including the end user) from Enterprise Server can call EPCIS inquires from manufacturing of products have started to finally get to users of all the real-time and historical information, i.e., the logistics tracking and traceability.

SOA architecture, the system adopts public module are using component model makes module to large reuse; Each module between the loose coupling mechanism; Using web service between modules for communications; All service all use standard WSDL description. Using such framework, makes this system almost not making any changes to the platform area can join the RFID information public service platform enterprise application layer, even for the different need to reconstruct the business logic, then for the reconstruction of the workload is small.

IV. MODULE DETAILED DESIGN

A. Detailed business process

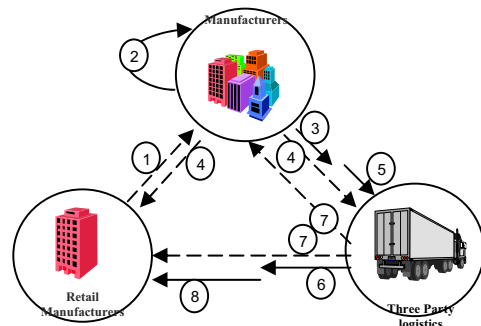


Fig. 2. Business process

Step 1, retail enterprises through the WEB SERVICE send an order to the manufacturers;

Step 2, manufacturers based on electronic product manufacturing, and order print EPC labels to every products;

Step 3, send product manufacturer to the third party logistics, when the product after the warehouse of the export, the EPC information literacy was sent to EPCIS save for;

Step 4, manufacturers through the WEB SERVICE to send electronic delivery notice to the third party logistics,

and copy to retail enterprise, the third party logistics and retailers receive electronic delivery notice;

Step 5, the third party logistics products, when product after the receipt of the entrance to the warehouse, reading and writing the EPC information was sent to EPCIS save for;

Step 6, the third party logistics send product to retail enterprises;

Step 7, the third party logistics through the WEB SERVICE to send electronic delivery notice to retail enterprises, and copy to the manufacturers, retailers and manufacturers to receive electronic delivery notice;

Step 8, retail enterprise received products, product after the entry of the warehouse when reading and writing implement, the EPC information was sent to EPCIS for preservation.

B. Development process

The detailed design of the system using MVC design patterns in J2EE platform uses the SSH (Struts + Spring + Hibernate) framework for building the platform. Hibernate is responsible for mapping objects to database work (ORM, that M's work), Struts (Web work) is responsible for trying and showing the work (i.e. V work), Spring is responsible for operational control of the work (that is, C's work.) Using this framework, the system of data control, views, business logic all the peeling, the full reduced system coupling between modules, making the system maintainability greatly enhanced.

In the specific development, we use a platform independent development: CLTC platform, developers need only write when the XML Schema and then use it to generate code. Below is the structure of the platform: the platform using J2EE Spring bonding business from a database side until the end of the Completed. The technical line of view from the platform of the total full power of Spring IOC and AOP capabilities to achieve both ends of the business layer (the presentation layer and persistence layer) is completely decoupled and seamless integration. This integration is not in the traditional sense to provide a simple configuration file, but a combination of business are provided for each frame of a more business-friendly abstraction layer calls, in addition to packaging, integration offers a set of customers outside the Configuration, expansion of the good general API. As for the function of particle size larger items, we released in the form of common components among platforms, such as the tree display, the object of the tree structure and so on. Performance on the platform in addition to the page can be customized tag library extension; it also provides a suite of Ajax technology as the core of rich-client, allowing users to feel better, more like a web2.0 technology. In addition, the platform provides a number closer to common business applications, including rights management, organizational structure, task management, etc., we can see is an open platform for continued expansion of integrated development tools. Finally, the generator runs through all levels, can

generate the persistence layer from the page until all the files (including configuration files), java code and SQL scripts.

Our development focus more on understanding the business logic, about 70% of the code can use it to generate, because the platform provides a common API and a lot of tools, including some general and their own complete, highly scalable business components.

V. CONCLUSION

Currently, the main development of the system has been basically completed, tested per each antenna of about 50 electronic tag reading and writing, (concurrent read and write, regardless of location of accumulation of shelter, etc.) read range of 100 square meters, (a reading and writing 8 devices can connect the antenna.) SMEs generally 2 to 3 sets to be completed by the reader all the basic business. However, after forming in the project, also found some problems. While many companies eager to use RFID platform, but the business itself will be the economic and management conditions are not adequate. Solution to this problem depends on the RFID information environment of public service platform companies have joined the establishment to reduce the threshold.

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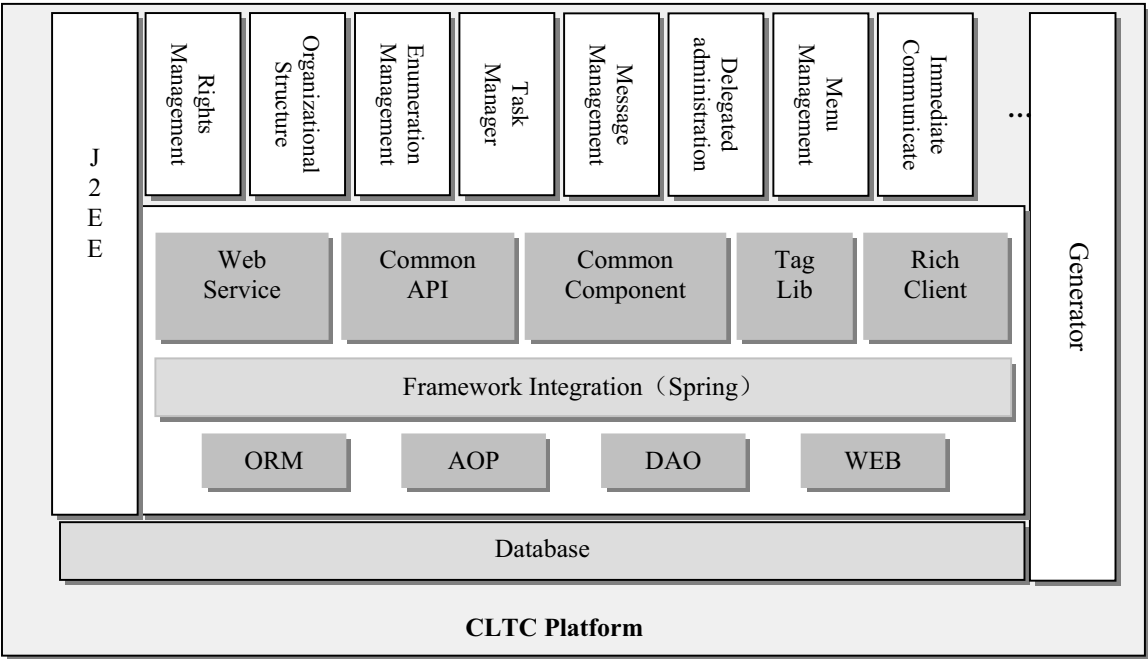


Fig. 3. CLTC Platform Overview Chart