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The research and design of the RFID track and trace system based on web services

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Abstract. This paper analyzes the problems of the modern logistics: track and trace of products, and provides an effective solution that combines with RFID and web services to develop a B/S platform of track and trace of logistics . RFID middleware is adopted in the system implementation process. The paper has done a lot of research in some key technologies in the design ,the manufacturer, the third part of logistics and the retailers are the three key roles, they can both use this system to track and trace products in the Internet.

Introduction

The paper provides an effective solution combining with RFID and web services: it has constructed a information network using RFID and wireless communication technology on the basis of Internet. RFID tags contain standardized and interoperability coding information, dynamic information of the tags are gathered to public information system automatically through the cable/wireless communication network, to realize the automatic recognition of products and event handling, and then through the open Internet to realize information exchange and sharing.

Degisn of system framework

The track and trace demonstration system includes a complete business supply chain. The whole platform is divided into three modules: middleware and the underlying hardware modules, enterprise data center module, the enterprise application module .

Edge Server and the underlying hardware modules are including RFID tags system, readers and antenna network, as well as RFID middleware [1]. RFID middleware controls their RFID readers, when the products with RFID tags pass each readers , the first ,readers read information on the electronic product code (EPC) to verify , if condition is triggered, it can change or update information of electronic tags according to a certain rules .In addition, RFID middleware also plays role of the information filtering, logic EPC judgment, transmit, and communication between enterprise data center and business module ,etc[2].

Business module uses B/S structure designed, points three characters: suppliers ,the role of the third party logistics, retailers, these are the most basic three roles in the supply chain.

The three characters have their own special database and RFID middleware. Each role subscribe to their own RFID middleware ,after RFID middleware has read the tags, it will immediately send EC reports with EPC information to the each role of the DB. Retail enterprises place an order to manufacturers, manufacturers put information into products, when readers read products with RFID tags, if it has no error ,model and number of products contrast to DB, then system begin to write information into RFID tag . When the products are transported by the third party logistics ,the reader networks begin to real-time tracking products and send EPC information in real time. At last products go to the retail storage, readers scan products information in tags to verify information in tags and update EPC information ,process of the entire supply is

complete[3,4]. Each role (including the end user) can get information of the products from prime to finally ,including users real-time and historical information from enterprise data center in EPCIS calls, to realize track and trace of products.

Web Services

Web services is a bridge among the enterprise information system and retailers, manufacturers, the communication amid the third party logistics providers: send orders, delivery note, change the state of the goods, all is to use web services to achieve .Web services is a kind of interface , it can be able to communicate with the information and sharing information from each the isolated site. Web services is based on XML and HTTP, SOAP is used to realize cross-platform message, greatly enhance the interoperability between heterogeneous applications and platforms. SOAP is the simple object access protocol, it is used to disperse and communication protocol of distributed network information exchange based on XML, and widely used to a new generation of cross-platform and cross-language distribution calculation of an important part of web services. Normally, the SOAP = HTTP +RPC + XML. HTTP is the underlying communication protocol of SOAP, RPC is interactive manner, XML is the format of data transfer .The server create a WSDL file (an XML document) according to the requirements of itself by programming, a WSDL defines the format of client message, demands of the parameters, the ways of sending messages, etc., and then the server will publish this WSDL to the application server, make different development platform (Windows, Linux, mobile platform, etc.), the different languages (J2EE,.net) to access the WSDL file through the http protocol . The client create the client program according to the WSDL , call running environment to create a SOAP request message, sent to the server through HTTP. Server-side running environment will parse the contents of XML in SOAP after receiving request message of SOAP, then invoke the service interface to implement class, after getting the results, it will create a response message of SOAP to the client. As shown in figure 1:

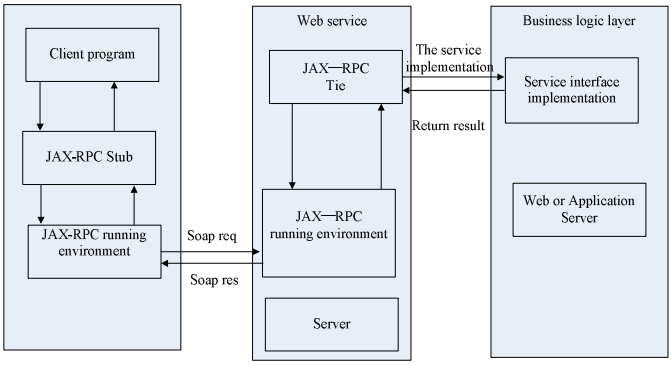

Fig.1, Principle of web services under J2EE platform

System flow module

Process design

As shown in figure 2 ,the business process as follows:

Retail enterprise send orders to the manufacturer through web service; manufacturers make products based on orders, at the same time ,to generate and print EPC tag and attached to the product packaging for each product ;manufacturers send the goods to the of the third party logistics , when the products pass the readers in the exit of storage , the EPC information is sent to EPCIS to save ;manufacturers send shipment notification to the third party logistics through the network web service , at the same time send to retail enterprise, the third party logistics and retailers receive delivery notice; the third party logistics receive products, when products pass the readers of storage or retail shop , the EPC information is collected ,and then sent to EPCIS to save; the third party logistics deliver goods to retail enterprise; the third party logistics send shipment notification to the retailers enterprises through the network web service, at the same time send to manufacturers,

retailers enterprises and manufacturers receive delivery notice; retail enterprises receive products, when products go into storage, EPC information of products is collected by readers ,and then send to EPCIS to save[5,6].

It can clearly see web service which is a link between the communications from the above process, and EPCIS plays a role of data warehouse.

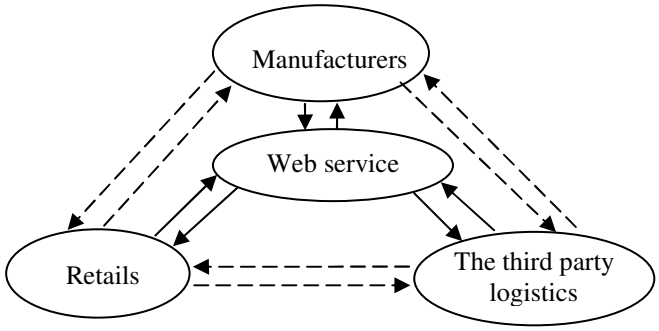

Fig. 2 ,Business process

RFID middleware event management module

In the RFID middleware , RFID Event manage module (EMM) is the most important component, its function is collecting tags and reading event, communicating with readers ,managing event flow of readers sending .

It allows different reader to adapter; collects EPC data from reader in a standard format; allows setting filters to smooth or remove EPC data; allows writing to all kinds of documents, such as writing EPC data to the database log, recording EPC data broadcast to remote server event HTTP/JMS/SOAP network log; buffering register, filter and adapter for events, so that they do not interfere with each other in operation. RFID EMM help RFID middleware to collect, buffer, smooth and organize information from readers[7]. Readers can upload hundreds of events per second. Every event can be buffered, filtered and recorded appropriately based on the disposing of the middleware request .RFID EMM is a high performance system. Different kinds of reader can work in different protocol, RFID EMM support various reader protocol , RFID EMM support EPC reader with different protocol . Events of RFID EMM can be filtered according to requirements of the middleware .

Events of acquisition will eventually be appropriately disposed , such as storing in the database as the permanent memory; it will store in storage data structures, such as real-time memory event database (RIED); it will send to a remote server through the HTTP, JMS or SOAP protocol broadcast ;RFID EMM support various of event recorder.

Adapter, filter, affair analyzer, the gateway, application server, they have function modules with collection, filtering and recording , the program work in separate thread. RFID EMM can start treatment unit in different thread, and be able to buffer event flow between unit[8] .

Conclusions

1. The paper introduced an standard business operation process of the track and trace system based on RFID logistics， the three roles of supply chain :retailers, manufacturers, suppliers are communicating with web services, the whole logistics process is sharing real-time information of exchange goods by using RFID technology.

2. In this system, each user data communications are using web services, but this only applies to the business of small companies. The data communication between the large or medium-sized enterprises, companies often are independent of ERP system and data exchange format, this kind of business data exchange problem involves the object naming service (ONS) and general electronic data format standard, now some organizations are studying the above problem, this is the main research direction of the future.

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