

# On-line and Mobile Delivery Data Management for Enhancing Customer Services

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**Abstract.** With the growing trend toward the use of supply chain and e-commerce, logistic service providers for product warehousing, transportation and delivery are placing great emphasis on information technology (IT) to be competitive globally. Realizing the current service tracking system merely supports order status tracking within a service provider, applies mobile agent technology for customer satisfaction index through online delivery tracking across the logistic alliances. Therefore, in this paper, we propose a system that utilizes three-tier architecture for mobile agent technology and develops a prototype system for logistic delivery service tracking to satisfy customers who want to know the location of their things in detail. Also, we demonstrate the concept and technology proposed with mobile and internet. The online service tracking services enable customers to monitor the real-time status of their service requests through internet and therefore becomes key tool for modern enterprises to compete successfully in a global marketplace.

## 1 Introduction

In a context of growing market globalization, rapid diffusion of information and communication technologies and increasingly widespread de-localization of manufacturing activities, product mobility is preferred to their accumulation in warehouses, involving a continuous flow of materials through the supply chain [1]. Therefore, firms have to supply distant markets from their own warehouses and plants with always-greater frequency. This also involves relevant expenditures. [2] for instance states that transportation costs on average impact for about 50 percent of total logistic costs. This requirement will become even more critical with the progressive diffusion of e-commerce activities [4]. The technique for customer contentment enhances needs also from the perspective of e-commerce activation.

Such factors make the distribution logistics increasingly important and often critical for competitiveness of companies [7] justifying major efforts to reduce logistic

expenditures to the greatest extent possible in order to delivery goods at a reduced price and to enhance a customer contentment to customers. According to statistics from Council of Logistics Management, 20 to 30 percent of total production costs are directly attributed to distribution and logistics management [8]. Investment in efficient distribution and logistics management systems can considerably improve enterprise competitiveness. Further, logistics management can significantly affect the efficiency of production, distribution and the quality of total customer services.

Distribution and logistics management consist of a series of activities including warehousing, order manipulation, goods picking and dispatching, transportation and inventory control [9]. Since a vast amount of information is generated across the various logistic activities and participants, efficiency and quality of enterprise logistic services are hard to monitor, control and also provide with efficient and high-quality customer services. Moreover, since many participants such as freighters, distribution centers, manufacturers, and distributors are involved in the logistic service industry, in this paper we present them with a model to enhance customer services by providing a part containing real-time monitor function and show the prototype system to implement for service enhancement to customers.

The rest of this paper is organized as follows. In section 2, a short review of on-line service tracking and logistics management is discussed. We explain a logistic service system analysis and design in Section 3. In Section 4, we present our technical prototype system for enhancing customer services. Finally, we conclude with some comments in section 5.

## **2 Logistics Management of Customer Service Perspective**

This paper proposes an approach for customer service enhancement through online global logistic services using mobile agents. In this section, the literature covering online service tracking, agent-based techniques and logistics management is reviewed to formulate the research questions and basis for the approach.

### **2.1 Online Service Tracking**

Along with the tremendous development in industrial engineering and management applications, including supply chain management (SCM), customer relationship management (CRM), and global logistics, various computer-aided applications have been developed to assist implementation enterprises. The online logistic service tracking system is one of the more effective solutions that have been developed to support efficient customer service response. In the competitive global market, enterprises should efficiently respond to customer requests to gain market advantage. Service status tracking is the fundamental offer to provide customers a means to realize the status of their requests and to anticipate and plan actions. For a manufacturer down stream in the supply chain, this service provides real-time information that enhances the effectiveness of raw material planning and scheduling.

Since the service tracking system provides the order and delivery status of the products and services, users of the system can make decisions based on the actual status. Unlike the traditional approach, the Internet-based technique including wireless environment has the advantage that information exchange and transmission are not geographically restricted. Realizing the importance of efficient response to customers, traditional, non-Internet-based approaches for business transaction and communication have gradually been replaced by Internet means [10].

With the development of the Internet and wireless technique, numerous service tracking systems have gone online. Though users can easily access real-time status information via Web-based service tracking systems, most tracking systems cannot confirm an accurate place where his or her material is after departure. Therefore, this research aims at developing an Internet and Wireless-based logistic service tracking system for efficient feedback of service status.

## **2.2 Logistics Management**

The distribution center does not only take charge of a role as a hub for the storage, transportation to customers and logistic service providers, but also play a part as a control center of the distribution as well as the management of all of the logistics for the successful operations [13]. The well-known logistics companies such as UPS and FedEx have better organized distribution center than others.

Furthermore, because the efficient delivery from the supplier to the customer relies on the information management of transportation and warehousing and so on, the real time service system like a RSSOL must have a control algorithm of the data from the diversified logistic activities and show the accurate position of customer items to enhance customer services.

## **3 Design and Analysis for Real-Time Delivery Service**

In this section, the business analysis, architecture and functions of the proposed logistic service tracking system are discussed. The objectives of the proposed approach are to provide customers with an intelligent mechanism to track the service. The system is designed for the following two participants to meet their operational requirements and to enhance their business competitiveness:

(1) Customers. Expect their requests for products or services from distributors and manufacturers to be fulfilled on time.

(2) Logistic service providers. Provide logistic services with a range of information support provided to buyers in order to enhance the business efficiency of the customers.

### **3.1 Coordination Model Analysis**

A general procurement processes within a supply chain are described as shown in figure 1[13].

At first, a consumer places an order on the retailer and then the retailer may request the logistic service provider to deliver the goods, and vice versa in the delivery process from the logistic service provider to retailer, finally to the consumer.

As shown in figure 1, the transportation plays an essential role in distributing and delivering the merchandise to the consumers, the retailers, the manufacturers and the raw material suppliers. However, in case of the international commerce including e-commerce, the delivery must take advantage of intermediary distribution centers and overseas service providers of the logistics between suppliers and foreign customers in addition to the domestic logistic services.

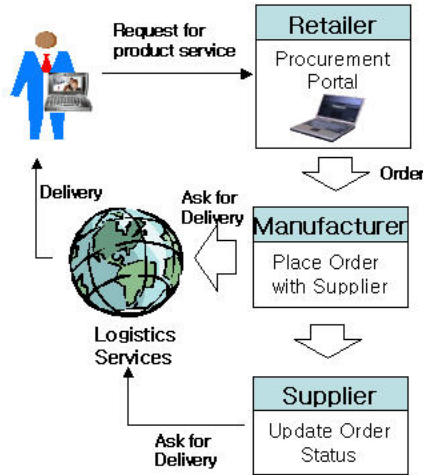


Fig. 1. Configuration of the Supply Chain

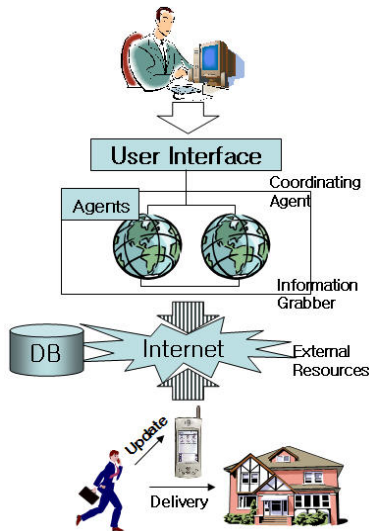


Fig. 2. Three-tire architecture for supply chain

In the delivery process from an order to the customer, the real time localization of customer's deliver items are critical for the satisfied services and more efficient Logistic Services than before. Therefore, in this paper, we propose a RSSOL prototype system using the facility of logistics.

### 3.2 System Design

The configuration of the RSSOL in figure 2 shows three-tire architecture of three parts: the agent center as a service-tracking kernel, the user interactive and real time logistic service and the delivery operation center as a carrier.

The RSSOL consists of three parts proposed in figure 2 and we explain two points of view to enhance customer services as follows:

At the customer side:

1. Ordering phase: the customer can order through the internet after logging on.
2. Delivery status tracking phase:
  - Log on internet, and then
  - Lists of the serviced items with delivers charging of the items are displayed on the web page.
  - A customer can search for the location of a deliverer by pushing the last specific hyperlink text.
  - The delivered status of the items is displayed at the bottom side of the screen.
  - The customers can estimate the arrival time by confirming the location of the deliverer on the internet, which is one of the enhanced services, and finding algorithm of the short cut path.

At the Internet service provider (ISP) side:

1. A deliverer decides which item to deliver the next based on the displayed data.
2. The deliverer logs on the server using mobile device and update the items data after delivering, also one of the services which make customer take services.
3. The deliverer location and item is updated simultaneously by sending mobile information with signature of the customer to the server after step 2.
4. If any items to be delivered are remained, then continue from 2 to 3, or finish LSP side activity.

## 4 Implementation and Evaluation of RSSOL

In this section, we verify the superiority of the proposed method by implementation and evaluation.

### 4.1 Environment for Delivering

To implement the RSSOL to enhance customer services, we first look into the environment of delivering system through postal operations. The addressing system of

Korea is composed of rather complex than that of other countries. The addressing system of Korea is configured as shown in figure 3(a). We can also mention that the addressing system is similar to other countries. For example, 4 or at most 5 items (nation, state, city, street, address) among items in figure 3(a) are enough information to deliver in the addressing system of America.

Nonetheless, ISPs only use the information of city or station level to deliver any product or things to customers. This means that customers through internet can get the information of their products delivered till the city or station level of that city although street information exist. Therefore, in this paper, we emphasize and use that information to enhance customer services. It is also one of main contributions of the paper. For instance, a customer who does not receive his or her product yet can not estimate time to receive the product, whereas the customer using this proposed system, RSSOL, can estimate the time to receive products because the customer can know roughly the distance between the customer location and the last delivered location of deliverer through internet.

Nation	State	City	district	street	address
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a) Components of addressing system

100-101 Sangrok apartment, Ilwon-dong, Gangnam-gu, Seoul, Korea

b) Example for postal system to deliver in Korea

**Fig. 3.** Korean record for addressing system

For RSSOL, we design and show the implementation result. First, we implemented RSSOL by dividing it into two parts: one is customer side and the other is service provider one as discussed in section 3. For these directions, we can first consider the following service provider side.

**4.2 Service Provider Side to Deliver**

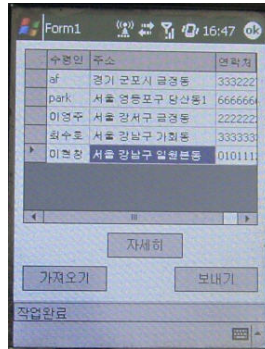
ISPs take the responsibility of delivering customer’s products safely and get handwrite information of customers after delivering by deliverer using PDA in real-time. However, because of the sophisticated contents of the address record until to the address, they can give an exact localization as well as an estimation of the arrival time for their items through internet accesses of customers.

Figure 4 shows a delivering example of a deliverer using PDA that accesses to RSSOL. As for first step, deliverer like figure 4(a) can login to connect the server, RSSOL. Then in the figure 4(b), the receiver’s names and addresses to be delivered for a day are displayed in the PDA screen after clicking the left lower button, “Bring”

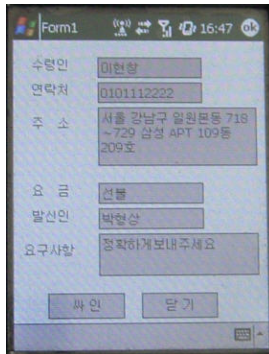
(data from server, “가져오기” in Korean), in 4(b). If the deliverer wants to know more information of a customer chosen, then by clicking the center button “Detail”(“자세히” in Korean), the deliverer could get the result like figure 4(c). At step 2, e.g. after delivering the customer’s product, deliverer clicks the right lower button, “send” (“보내기”) to the RSSOL as a last step for confirming and storing the delivering information. So we can see the PDA screenshot to be deleted the last customer information in figure 4(d).



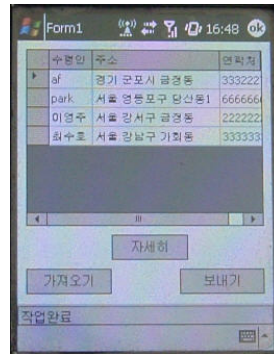
(a) deliverer login



(b) item list to be delivered



(c) customer information



(d) update after delivering

Fig. 4. A series of operations at a deliverer side using mobile device

### 4.3 Customer Side

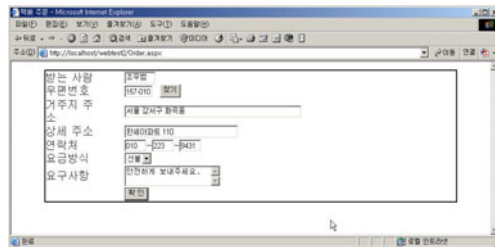
Any customers who want to localize their items or know to distribution status can take advantage of this RSSOL, confirm the deliverer’s location and estimate the time to get their items through internet easily. Figure 5 shows the processes of customer

side: figure 5(a) for ordering phase of a customer and 5(b) for the neighboring delivery list of deliverer within ordering information of customers that is including facts whether customer items are delivered or not.

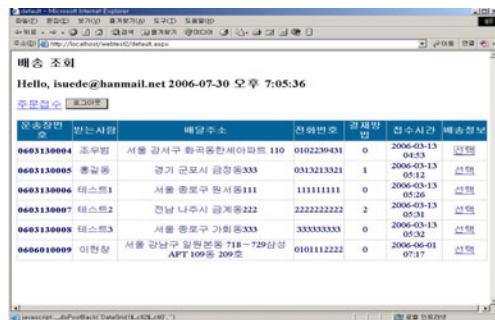
If a customer connects to RSSOL through web browser, the customer could see the deliverer position by confirming whether the previous customers (first to be delivered) of the customer get their items or not. If the previous other customers have not got their items, the customer could estimate the time to get his or her item like figure 6(a) to 6(c) only by clicking the last field and by confirming the status at the bottom side as well. The status of delivering items is displayed on the bottom side as shown in figure 6(a) for the first delivery. Next order is shown in a figure 6(b) for the second delivery and so on.

For example, in case of “hclee” (in Korean “이현창”) which will be delivered from now on, any sign is not displayed at the bottom side and only he is able to estimate the time to get his items by the previously explained procedure.

Figure 7 shows a comparison result of RSSOL with conventional logistics methodology for the delay in logistic service. We see that the more there are customers, the better we get the result of delay unit.



a) ordering phase



b) delivery list of deliverer

Fig. 5. Steps through the internet at a customer side



배송 조회  
Hello, isuede@hanmail.net 2006-07-30 오후 7:05:52

운송장번호	받는사람	배달주소	전화번호	상세방법	접수시간	배송정보
0603130004	조우범	서울 강서구 화곡동한세아파트 110	0102239431	0	2006-03-13 04:53	신뢰
0603130005	홍길동	경기 군포시 금정동333	0313213321	1	2006-03-13 05:12	신뢰
0603130006	테스트1	서울 중로구 명서동111	1111111111	0	2006-03-13 05:26	신뢰
0603130007	테스트2	전남 나주시 금계동222	2222222222	2	2006-03-13 05:31	신뢰
0603130008	테스트3	서울 중로구 가회동333	3333333333	0	2006-03-13 05:32	신뢰
0606010009	이현창	서울 강남구 일원동 718-729 삼성 APT 109동 209호	0101112222	0	2006-06-01 07:17	신뢰

a) 1<sup>st</sup> delivery state

배송 조회  
Hello, isuede@hanmail.net 2006-07-30 오후 7:08:28

운송장번호	받는사람	배달주소	전화번호	상세방법	접수시간	배송정보
0603130004	조우범	서울 강서구 화곡동한세아파트 110	0102239431	0	2006-03-13 04:53	신뢰
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0603130006	테스트1	서울 중로구 명서동111	1111111111	0	2006-03-13 05:26	신뢰
0603130007	테스트2	전남 나주시 금계동222	2222222222	2	2006-03-13 05:31	신뢰
0603130008	테스트3	서울 중로구 가회동333	3333333333	0	2006-03-13 05:32	신뢰
0606010009	이현창	서울 강남구 일원동 718-729 삼성 APT 109동 209호	0101112222	0	2006-06-01 07:17	신뢰

b) 3<sup>rd</sup> delivery state

배송 조회  
Hello, isuede@hanmail.net 2006-07-30 오후 7:08:20

운송장번호	받는사람	배달주소	전화번호	상세방법	접수시간	배송정보
0603130004	조우범	서울 강서구 화곡동한세아파트 110	0102239431	0	2006-03-13 04:53	신뢰
0603130005	홍길동	경기 군포시 금정동333	0313213321	1	2006-03-13 05:12	신뢰
0603130006	테스트1	서울 중로구 명서동111	1111111111	0	2006-03-13 05:26	신뢰
0603130007	테스트2	전남 나주시 금계동222	2222222222	2	2006-03-13 05:31	신뢰
0603130008	테스트3	서울 중로구 가회동333	3333333333	0	2006-03-13 05:32	신뢰
0606010009	이현창	서울 강남구 일원동 718-729 삼성 APT 109동 209호	0101112222	0	2006-06-01 07:17	신뢰

c) state for a specific customer “hlece”

Fig. 6. Monitoring states of being delivered

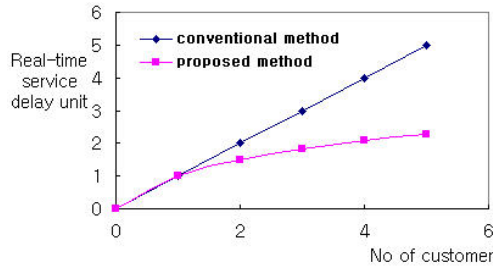


Fig. 7. Real-time service delay according to the number of customers

## 5 Conclusion

According to the popularities of supply chain and e-commerce, the ISPs recognize importance of the information technology (IT) in their business as real time monitoring tools. The customer's satisfaction must be more important than before and critical in leading competitiveness of companies through the IT. Hence, in this paper we propose the RSSOL in the logistics and implemented it by the PDA combined with web pages, and show the usefulness of the RSSOL in real time localization. Especially, the ISPs can cut down the Logistic expenditures because of monitoring the materials flows in real time and scheduling their products, and also the clients can get a chanced services through the real time localization and estimation to get their items.

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