



## REICO SPEDITION FOCUSES RFID ON THE BACKTRACKING OF FOOD

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**ABSTRACT.** The German logistics company ReiCo Spedition in Nunsdorf (Zossen, Brandenburg) has successfully implemented and tested a system to backtrack goods dispatched through the transport chains of two large food suppliers - Nordmilch and Frischdienst, together with the Technische Fachhochschule Wildau (University of Applied Sciences Wildau). The pilot project called RÜFILOG - "Backtracking through the application of RFID-Technology in Transport Logistics for small and medium-sized enterprises for cool and fresh goods" is promoted by the support of the Stiftung Industrieforschung (Foundation for Industrial Development). The European Union regulation No. 178/2002, which came into force on the 1st January 2005, created the need for an efficient procedure for the backtracking of goods to, and from ReiCo.

**Key words:** RFID, transport logistics, traceability, information system, identification.

### SELECTED TRANSPORT CHAINS

In the first transport chain which begins from Nordmilch, through ReiCo, to the end customer, complete pallets, loaded with the articles UHT-milk or UHT-cocoa, are the primarily transported goods. In the second transport chain, which is operated in co-operation with Frischdienst, fresh fish, with so-called "Düsseldorfer" pallets (half pallets), is transported. The UHT-milk and UHT-cocoa, articles were selected as the test articles as they are, on the one-hand, unproblematic to handle and on the other hand represent a challenge for the use of the RFID technology, as liquids and metals can impair the collection of information via RFID. Additionally the transport chain represents a large part of the incoming and outgoing transport flows of ReiCo. The reason for the inclusion of fresh fish into the project is due to the temperature sensitivity of the product and its very short use-by period.

### WHY RFID IS SUITABLE TO SOLVE THIS PROBLEM

The problem of backtracking goods through a transport chain is one that can be solved in many different ways, for example through manually documenting flow of goods, or through the use of barcodes. For the RÜFILOG Project, it was decided to utilise the relatively new RFID technology as the solution to the problem. The reasons for this are numerous. RFID allows the development of partly automated or fully automated systems, with little need for human interaction. RFID can potentially hold a large amount of data, which can make tracking of goods easier, and, when fully developed as

part of the RÜFILOG project, can also be utilised as a medium to help with warehouse management, stock control and inventory taking, to name but a few possible applications of this technology. Although barcodes can be used to perform many of the above tasks, it has some fundamental differences to RFID technology, which ultimately rules it out as a possible solution for the problem this project is attempting to solve:

Table 1. SWOT Analysis of RFID vs. Barcode technology  
 Tabela 1. Analiza SWOT technologii RFID w porównaniu z systemem kodów kreskowych

	<b>RFID</b>	<b>Barcode</b>
<b>Strengths</b>	Increased efficiency. Higher information storage. Automated stock control. Very durable. Does not need to be "line of sight". RFID Tags can be reusable.	Mature, widely used technology. Highly standardised (EAN/UCC). Cost effective, relatively cheap.
<b>Weaknesses</b>	New technology, not widely accepted. No formalised industry standards. Expensive. Possible interference from other electrical devices. Possible interference of reading RFID transponder due to proximity to metal objects. Not tamper proof.	Not very durable. Direct line-of-sight required for reading. Not tamper proof. Limited amount of information storage.
<b>Opportunities</b>	Can provide new methods for the transporting and storage of goods, for example, intelligent stock management. A lot of possibility for growth. Prices will fall as technology becomes more common. Can provide competitive advantage over others that still use barcode. Frequent new development of RFID technology. Industry standards are being put in place.	Ability to couple with RFID technology.
<b>Threats</b>	Industry and public acceptance. Possible security and privacy implications. Technology not yet secure against tampering and scanning by third parties. Lack of standards. As tags become more advanced, possibility of virus or malware software being introduced.	Could possibly be replaced by RFID technology in the future. Not tamper proof.

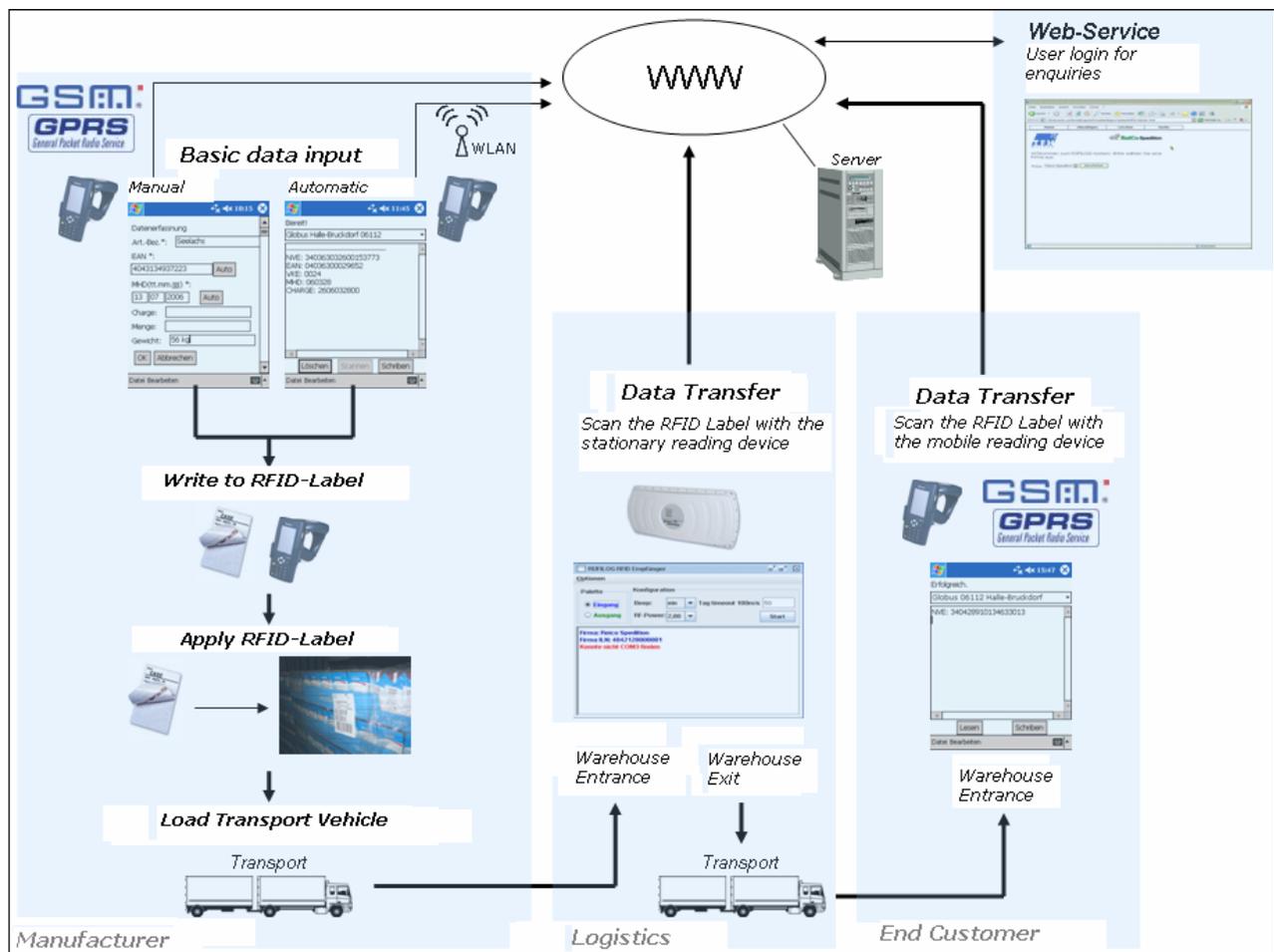
## IT CONCEPT TO ENSURE THE BACKTRACKING OF GOODS

The hub of the RÜFILOG System is the RÜFILOG Web Server. This acts as the central data storage and the main data processing points for all partners involved in the transport chain. All information gathered from other sources is transmitted back to the central server via the http protocol, where it is processed and stored in a database. The RÜFILOG Web Server is a flexible, open-ended IT system, which has potentially unlimited room for expansion, which ensures that other partners and further, longer, more complex transport chains can be included into easily into the system.

In order to ensure that all partners involved in the RÜFILOG System can have quick and easy access to the information stored on the central server, the database can be accessed through an Internet based user interface. Secured through a user login process, which ensure that sensitive information cannot be seen by those without the proper access, qualified users can view, edit and delete information related to their transport chains, as well as perform searches on goods and pallets stored in the database, the results of which display the entire transport chain for the returned items, from manufacturer to retailer.

The information that is stored in the RÜFILOG Web Server can be gathered through a variety of ways, for example through the scanning of pallet barcodes using hand-held mobile devices, manually

added the information via the web server portal, or through the connection of the RÜFILOG Web Server to an existing Warehouse Management System.



Source: Intermec Technologies, Deister Electronic, Own design

Fig. 1. Overview Functional  
 Rys. 1. Schemat przepływu

Thus, to accomplish the successful backtracking of goods within a transport chain, a robust, adaptable IT solution must be developed that utilises the advantages provided by modern RFID technology, including the use of mobile RFID readers, WLAN and GPRS, coupled with ease of use and open availability of information to all those involved in the supply chain. A mixture of this new RFID hardware technology, supported by a strong Java web server, can provide a firm base on which to build a solid, multi-functional, IT application.

## HOW DOES THE OVERALL SYSTEM FUNCTION AND WHERE IS RFID USED EXACTLY

With the pre-project technical tests it turned out that the selection of suitable technical components containing RFID technology would play a central role. At present there are numerous RFID systems which can be used for a task such as this that can be found on the market. Within the range of stationary devices, the decision fell to a system from Deister Electronics, specifically their UDL-500, which works in the UHF band and with its compactness, efficiency and functionality for development within the RÜFILOG system it was almost ideally suited. In the range of mobile devices, the selection

was narrowed down to the joint system from Intermec, comprising a 700 series mobile computer with an integrated bar code reader and the IP4 RFID reading device. This system works likewise in the UHF-band and is multi-protocol-capable, which means that it can read and write to transponders both of the ISO Standard 18000-6B range and the Philips UCODE 1.19 range. In the project two different device configurations were tested, which differ in communication techniques. One system communicated with the central RÜFILOG Server via the Internet over WLAN, the other could send data directly to the server via a GPRS interface.

In the selecting of the RFID label, it was made certain that both the stationary reader and the mobile devices could be developed with an acceptable level of communication with the appropriate label. In laboratory tests the UHF-RFID Label from Intermec with the ISO 18000-6 specification proved suitable. For the future has been recommended that the label should be changed to the new standard of EPC Class 1 Gen 2 since this label has a higher range.

During the software development of the control interface for the mobile device, attention was paid to making it as simple and intuitive as possible for user operations. Therefore a substantial part of the component is the status screen of the mobile collection device, which displays the most important actions and information to the user. Thus the user can always see whether their actions were successful or whether some complications arose.

## TEST APPLICATION

In the Nordmilch transport chain, the data for the backtracking is collected with a hand barcode scanner (integrated in the mobile device) and is sent over a WLAN interface via the internet to the information system. Afterwards the NVE (Nummer der Versandeinheit, the German equivalent of the SSCC, or Serial Shipping Container Code) data is written to an RFID-label on the associated dispatch unit. Thus the collected dispatch units are stored in the information system as outgoing goods of the manufacturer.



Source: Nordmilch eG

Fig. 2. Scanning a pallet bar-code with a hand-held mobile computer  
Rys. 2. Skanowanie etykiety z kodem kreskowym przy użyciu terminala przenośnego

If the dispatch units are then dispatched, in this case to ReiCo Spedition, the goods are then registered at the warehouse entrance. In addition at ReiCo Spedition, the stationary RFID reading device is placed directly by the in/out-going ramps of the warehouse. As soon as the dispatch unit with an RFID label approaches the reader, an acoustic and optical signal is given. This signal signifies that

the dispatch unit has passed this reader and identification of the goods in the warehouse entrance has taken place.

The receiving software is configured in such a way that in the case that a double reading is taken, only one data record is accepted, and all others are ignored. Through the information system it is viewable where this dispatch unit can be found in the transport area and who transported it. The warehouse exit routine follows the same principle as the warehouse entrance. The documented information regarding the path of the dispatch unit can be reconstructed with the help of the information system and can be used for research and control purposes.

In the case of Frischdienst Berlin, the process of the first version turned out some-what differently. Identification systems such as bar codes or their equivalents do not exist here. The collectable data of the commodity is accessible only via a delivery note, which is on conventional paper as plain language. In order to be able to collect the article data, a form for the mobile device was developed, into which all of the necessary information is entered. This part is somewhat complex in regards to entering the data, but is necessary if the relevant data is to be collected for backtracking purposes. A second version of the data collection software for the mobile device already exists. It makes possible the selection of default articles that are related to a chosen manufacturer, so that errors are avoided during input. Since in this transport chain no NVE exists, a unique NVE number is automatically generated, which is then written to the RFID-Label of the associated dispatch unit. Future transport and goods collection processes are more likely to follow the Nordmilch transport chain.

## RESULTS

ReiCo Spedition, as partners of the research development project, promises itself a substantial reduction of search and investigation times and a closer connection to the customer due to the service offered. Beyond that a competition advantage exists by the advertisement of integrated contract logistics services.

Further, ReiCo Spedition sees that the labeled products can be completely back-tracked, from the place of manufacture, to the place where they will be sold on the shelves, whereby further multilayered advantages can result:

- Continuous transport status from acceptance up to the distribution.
- Transparent and permanent Temperature and Quality control.
- Automatic transport location - Security components.
- Automatic loading aid management - Pallets.
- Automatic empties control and management (E2-Boxes, H1-Pallets etc.).
- Automatic transport collection in the logistics program as well as transport accounting.
- Automated evaluations etc.

After the initial costs of purchasing equipment, and once RFID-Label reach an optimum price (the cost of RFID-Labels, although expensive now, is generally considered to drop to around 0.05€ within the next two years), a SME company could see a return on their investment of nearly 80% after 2 years, with an amortisation of the investment after just over 2 years.

Implementing the RÜFILOG System or, indeed, any other type of RFID system, into other small or medium sized transport companies would require an investment not only in terms of money, but also in the training of staff and the readjustment of internal processes in order to accommodate the new system. However, as shown above, these initial costs could be mostly recouped within 2 years, with the added possibility of increased revenue due to increased efficiency and more satisfied customers.

## RESUME

Through the RÜFILOG project, it has been proven that the use of RFID technology within a transport chain can provide real benefits including greater efficiency, less user-interaction and, of course, faster traceability of goods that have passed through the transport chain. However, this has only been the first phase in the development of the RÜFILOG system, and although the current system can already prove the benefits of RFID technology, there is more than can be done to improve the capability and the usability of the system and the hardware.

Although the current cost of RFID technology is high in relation to existing methods, such as barcodes, with international companies such as Wal-Mart or Gillette pushing for greater use of RFID, then the prediction is that the cost of the hardware and the transponders will fall to levels more in line with the resources available to small and medium enterprises.

The hope is that through the high acceptance of the project by potential customers, in co-operation with the projects exclusive partner - Technische Fachhochschule Wildau - the test phase will shortly be completed and gradually the investments, as well as the subsequent, necessary development of the software, which will provide a higher level of automation for the benefit to the customer and will allow the project to be converted to a larger, genuine enterprise.

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## **ŚLEDZENIE TOWARÓW PRZY ZASTOSOWANIU RFID W SPEDYCJI REICO**

**STRESZCZENIE.** Niemiecka firma logistyczna ReiCo Spedition z Nunsdorf (Zossen, Brandenburgia) we współpracy z Wyższą Szkołą Techniczną w Wildau z sukcesem wdrożyła i przetestowała system śledzenia dystrybuowanych towarów, należących do dwóch dużych dostawców żywności: Nordmilch i Frischdienst. Projekt pilotowy pod nazwą RÜFILOG - "Śledzenie żywności mrożonej i świeżej w transporcie, w małych i średnich przedsiębiorstwach przy zastosowaniu technologii RFID" jest realizowany pod patronatem Fundacji Rozwoju Przemysłu. Europejska dyrektywa nr 178/2002, obowiązująca od 1 stycznia 2005 r., stworzyła potrzebę istnienia efektywnej procedury śledzenia towarów, przewożonych przez firmę ReiCo.

**Słowa kluczowe:** RFID, logistyka transportu, śledzenie towarów, system informacyjny, identyfikacja.

## **RFID IN DER RÜCKVERFOLGUNG VON WARENSTRÖMEN BEI REICO**

**ZUSAMMENFASSUNG.** Die Rückverfolgung von Warenströmen ist spätestens seit der gesetzlichen Vorgabe der EU (in Kraft seit 1. Januar 2005) durch die Richtlinie 178/2002 vorgeschrieben. Alle Unternehmen, die an einer Lieferkette beteiligt sind, d.h. vom Hersteller über Logistikdienstleister bis zum Endkunden, sind verpflichtet diese Warenflüsse zurück zu verfolgen und zu dokumentieren. Dies kann konventionell mit Papier und Bleistift oder mit Hilfe von innovativen Technologien durchgeführt werden. Mit dem Projekt RÜFILOG wurde eine Lösung geschaffen, die Rückverfolgung vom Hersteller zum Kunden und retrograd vom Kunden zum Hersteller mit neuen Technologien wie RFID und einem webbasierten Informationssystem sicherzustellen. Die Lösung sieht vor, die gesammelten warenbezogenen Rückverfolgbarkeitsdaten der Beteiligten in einem Schadensfall (z.B. verdorbener Jogurt) in kürzester Zeit abrufbar zu halten und als Dokumentation an die, falls gefordert, zuständige Behörde zu übergeben. Damit werden die Such- und Recherchezeiten verringert und zeitnah alle betroffenen Produkte identifiziert. Bei konventioneller Dokumentation kann eine Recherche nur mit hohem zeitlichem, personellem und finanziellem Aufwand bewältigt werden, was bei lückenhafter Dokumentation zu erheblichen Folgen für die Unternehmen führen kann.

**Codewörter:** RFID, Transportlogistik, Rückverfolgbarkeit, Informationssystem, Identifikation.

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