NiceLabel™ RFID Technology

White Paper

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Executive Summary

Radio frequency identification (RFID) refers to technologies that use radio waves to automatically identify individual or groups of items. RFID promises to become the fastest growth technology in the automatic identification and data collection (AIDC) industry. In addition, RFID provides opportunities to improve service, reduce costs, and make business processes such as product warehousing, shipping, identification, and tracking more effective and efficient.

Since Wal-Mart, the U.S. Department of Defense, and others require their suppliers to use RFID technology as intelligent packaging tools, the RFID market has experienced rapid growth. However, suppliers face huge costs in implementing RFID technology and are overwhelmed in deciding among the different software, hardware solutions, and standards. NiceLabel offers an easy-to-use, cost effective smart labeling solution that meets the latest standards of current RF tags and printers.

NiceLabel™ is the most advanced labeling software available for desktop, enterprise, and mobile users supporting both traditional bar code and RFID-based smart label design and printing. NiceLabel™ offers an easy-to-use label design solution that enables you to transfer easily and cost-effectively from traditional (bar code) labeling to smart tag labeling. Using NiceLabel™ in connection with RFID technology, you benefit from the following:

- Simple label design and printing of bar code and RFID smart labels
- Multiple connectivity options
- Cost-effective transition from traditional bar code labeling to smart labeling
- Widest range of tag and printer support

Introduction to RFID

Technology

Radio frequency identification (RFID) uses small devices to store information that can be transmitted wirelessly through many forms of obstruction in an automated fashion to specialized RFID readers. Unlike bar codes, the data transmission process between smart label and RFID reader works regardless of the orientation of RFID devices and presence of dirt or obstructions.

Smart labels include implants containing arrays of micro wires, thin films, or integrated circuits that are attached to thin antennas. The information is stored in the wired implant and sent to the receiver via the antenna. The smart labels can be integrated into the product or as part of the packaging.

Currently, the market offers different types of smart labels. According to cost, operating range, and purpose of RFID application, companies can choose between passive and active tags as well as read-only and read-write tags. Regarding NiceLabel's capability for label design and data storage of smart labels, different label types do not make a difference. NiceLabel™ supports design and data storage for most smart label types.

Because standards are still being established, RFID applications use different low-, high-, and ultra-high radio frequencies. Again, NiceLabel's easy-to-use label design and tag programming solution can be applied regardless of the frequency level of the smart label.

Application

The most common applications of RFID technology and smart labels are tracking goods in the supply chain, tracking assets, tracking parts moving to a manufacturing production line, security (including controlling access to buildings and networks), and payment systems that let customers pay for items without using cash.

In addition, RFID is commonly used in the healthcare industry on patient wristbands to provide tamper-proof, accurate identification for facility access control and security. Hospitals can also use RFID to track medication dispensing, laboratory samples, and blood bags. RFID saves time and improves accuracy because it automatically records all item movements and does not require human intervention to record data on a form.

Regardless of the application context, NiceLabel™ is your tool of choice for any smart labeling application. NiceLabel™ supports smart label design and tag programming for manufacturing, supply chain, and patient identification applications.

Trends

Market research estimates that spending in the global RFID market will grow to more than $3.1 billion by 2008, from about $1.3 billion in 2003. Industries that will increase spending include consumer packaged goods and retail, automotive, military, and homeland defense.[1] Other reports estimate that through the year 2007, the total U.S. market for smart labels will grow more than 23 percent annually, approaching 11 billion units and a value of $460 million. By 2008, the RFID label market is estimated to grow 180 percent annually from around 10 million RFID labels sold in 2002.[2]

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1 Collins, Jonathan. “Smart Labels Set to Soar.” RFID Journal 23 Dec. 2003. <http://www.rfidjournal.com/>.

2 Zaragoza, Sandra. “RFID – Smarter Than the Average Chip.” Dallas Business Journal 06 Oct. 2003. <www.bizjournals.com>.

The driving forces in the RFID market are the military and retail industry. Late 2002, the U.S. Department of Defense required that all goods can be tracked with RFID tags. The commercial sector increases spending in RFID because standards are emerging, the cost of RFID technologies is decreasing, and vendors are teaming up to offer integrated packages that include installation, software, and hardware components. Since Wal-Mart and other retailers are driving RFID initiatives to track pallet and cases, highest growth rates are expected in the consumer packaged goods and retail verticals.

Sectors also showing high growth potential for RFID technology and smart labeling are the automotive, pharmaceuticals, and health care industries. Niceware and Euro Plus cooperate with partners in all industries that use smart labeling. NiceLabel™ is your solution for smart label design and printing regardless of industry and application environment.

Smart Label versus Bar Code Labeling

Today, manufacturers wouldn't think of operating their distribution centers without bar codes because of the proven efficiency improvements the technology provides. RFID promises the same potential to improve operations. However, RFID will not replace bar code technology but can effectively enhance bar code-based data collection systems where additional visibility or automated processing is desirable.

RFID is not necessarily "better" than bar codes. RFID smart labels and bar code labels are two different technologies and have different applications that sometimes overlap. The greatest differences are the required hardware tools and the way both technologies exchange data.

Bar code is an optical technology and RFID is a radio technology. Bar codes are line-of-sight technology and require a scanner that has to "see" the bar code in order to read it. However, radio frequency identification does not require line of sight. RFID tags can be read as long as they are within range of a reader. Bar codes have other shortcomings as well. If a label is ripped, soiled or falls off, there is usually no way to scan the item. In addition, standard bar codes identify only the manufacturer and product, not the unique item. The bar code on one cereal box is the same as every other, making it impossible to identify which one might pass its expiration date first.

As a radio technology, RFID requires no line-of-sight between the reader and the tag to exchange data. RFID tags therefore can be read through packaging, including cardboard containers and plastic wrap used to seal pallets. RFID tags enable unattended reading, are reusable and can improve efficiency in many operations by reducing labor and materials costs. However, RFID is subject to interference, in particular from metal. When implementing RFID, companies must recognize and avoid potential sources of interference.

Many companies use smart labels to tag, monitor, and identify their products. Smart label printers encode the RFID chip inside of the label and print text, bar codes, and graphics on the outside. NiceLabel™ is the software tool that helps you design and organize the data storage for both the traditional bar code and smart label. Note that RFID compliance labeling initiatives are not aiming to replace bar codes. In contrary, companies will still require both bar coded data labeling and RFID smart labeling. NiceLabel™ is your solution of choice for both bar code and smart labeling.

Application: Patient Identification with Smart Labels

An easy way to improve patient care is by ensuring that staff can easily identify patients before providing treatment. NiceLabel Pro includes a feature that is a simple yet powerful solution for improving patient identification. Using NiceLabel Pro, programmers can design and program smart label wristbands with RF tags and bar codes that symbolize the patient's medical record or patient visit number. NiceLabel™ offers a perfect way to ensure easy patient identification. Clearly imaged

text, including patient name, DOB, medical record number, and other identifiers give caregivers the information they need in crisp print with a clear laminate to protect the image.

Whether you are trying to improve compliance with the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) patient identification requirements, thinking about moving to a smart label point-of-care system, or are simply frustrated with maintaining the "blue card" system and paying for its costly consumables, the self-laminating wristband and NiceLabel Pro software are your best solutions. This state-of-the-art patient identification system is "forward compatible" with new technologies – a key consideration when you invest in new technology.

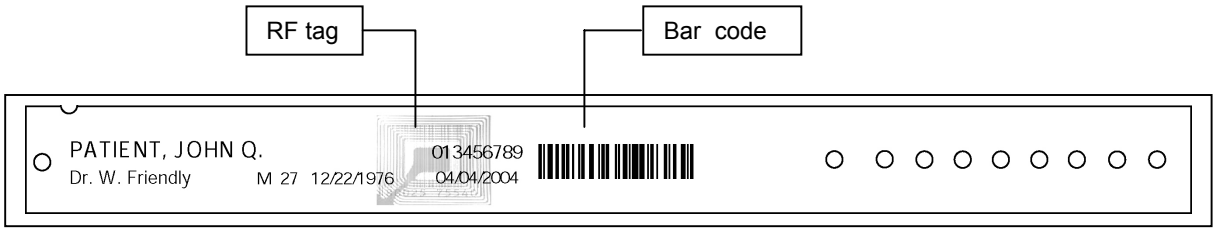


Figure: Patient ID wristband with embedded RF tag and bar code

NiceLabel™ Software for Your RFID Solution

NiceLabel™ is a family of the most advanced professional labeling software products for desktop, enterprise, and mobile users that provides complete solutions for both bar code and smart label printing. NiceLabel™ supports the widest range of RFID printers and tags in the industry as well as the most cost effective integration tools available. Regardless of RF tag type and frequency used, NiceLabel™ enables you to design and print virtually any type of smart label.

Smart Label Encoding with NiceLabel™

NiceLabel™ supports any type of RF tag that most smart label printers can output. Due to the fast development of the RFID technology, check our Web site at www.nicelabel.com/applications/app_rfid.php to receive the latest list of RF tag types that are supported by NiceLabel™. Currently, NiceLabel™ supports the following tag types:

- **RF Tags**
  - Alien: EPC Class 1 (64/96 bit)
  - Matrics: EPC Class 0 (64/96/128/256 bit), Class 0+
  - Philips I-Code: 1/ISO 15693/SLI/EPC/EPC UID
  - TI Tag-It: 13.56MHz/ISO 15693
  - Infineon: ISO 15693 and My-d
  - Pico Tag

- **EPC™ Encoding**

  The Electronic Product Code™ (EPC™) is an identification scheme to identify physical objects via RF tags. The standard EPC data consists of an EPC (or EPC Identifier) that uniquely identifies an individual object and an optional filter value to enable efficient reading of the EPC tags. The EPC Identifier is a meta-coding scheme designed to support the needs of various

industries by accommodating both existing coding schemes where possible and defining new schemes where necessary. EPC represents a family of coding schemes and a means to make them unique across all possible EPC-compliant tags. NiceLabel supports the following EPC types:

- GIAI-64
- GRAI-64
- SGLN-64
- SGTIN-64
- SSCC-64
- GIAI-96
- GID-96
- GRAI-96
- SGLN-96
- SGTIN-96
- SSCC-96

Smart Label Printing with NiceLabel™

RFID technology has created demand for a printer capable of simultaneously printing bar codes, text, and graphics on the surface of the label in addition to reading, programming, and verifying the RF tag embedded in the label. RFID printers have to accomplish both traditional bar code label printing and RF tag data encoding. Smart label printers function as traditional printers when creating bar codes, graphics, and human-readable text. However, they also have RFID encoders and readers embedded inside. Before the printer outputs the label, the RFID data is encoded, copied to and from printed and non-printed fields in the label templates. NiceLabel™ links the printer with your data repository, thus accomplishing data selection for both encoding and label surface design.

NiceLabel™ works with the leading manufacturers of RF tags and printers. For example, Niceware International partners with Avery Dennison and Precision Dynamics in the health care industry. Companies use NiceLabel™ to design and store data on bar code and smart labels, such as wristbands for patient identification.

Furthermore, NiceLabel™ supports industry leading RFID printers from the following manufacturers:

- Avery
- Datamax
- Imaje
- Intermec
- Markpoint
- Novexx
- Printronix
- Sato
- Zebra

Please visit our Web site at www.nicelabel.com/nicedrivers/ndriv_overview.php to receive the latest list of printers NiceLabel™ supports.

Smart Label Deployment with NiceLabel™

NiceLabel™ offers several connectivity options of how to retrieve data for your smart label and print these data to a client or network printer. NiceLabel™ enables you to retrieve data from any type of database, data stream or another software application.

The NiceLabel Suite edition offers the NiceWatch module that is an excellent tool to apply smart label printing in an environment where only a limited number of RFID printers are available. NiceWatch is an event-driven application capable of monitoring and detecting data in many different formats to trigger the start of label production. At times, automated printing is required in a multi-

operating system environment (Unix, AS/400, etc.) or complex application environment (ERP, WMS, etc.) where it is not possible to write program code using automation commands.

NiceWatch can monitor and detect data in many different formats to trigger the start of label production without operator intervention. For example, NiceWatch provides an affordable solution which enables writing data or command files from an ERP system to a shared network drive and printing from other local or remote applications running within local or wide-area the network.

NiceLabel™ ensures connectivity without limitations between the following:

- Database and smart label printing
- Host computer, variable data stream, and smart label printing
- Software application, print engine, and smart label printing

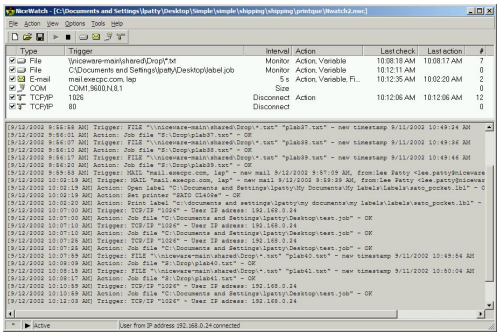
Database connectivity

A user-friendly database wizard, built-in query builder, and even a custom SQL scripting are available ***to retrieve data from any type of database*** – enterprise or local. Whether the database is a plain ASCII text file, Excel spreadsheet, or enterprise database (like Oracle or SQL Server), there are ***no limitations to connectivity options***.

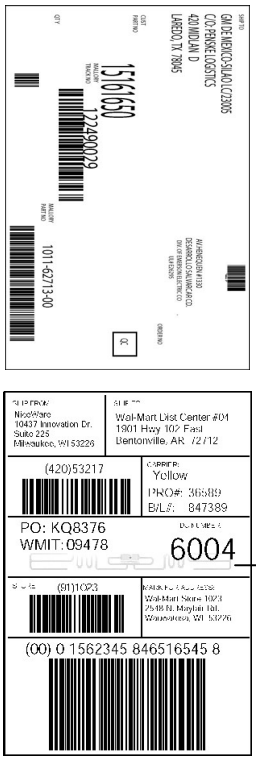
Data stream connectivity

NiceWatch provides an affordable middle-ware solution when ***automated printing*** is required in a multi-operating system network or complex application environments. NiceWatch can monitor and detect **data in many different formats** to trigger the start of label production without operator intervention. One of the standard scenarios involves writing data or command files from an ERP system to a shared network drive. Even with the rich functionality, deployment is done in a quick and easy manner, requiring no extensive knowledge or training.

Host

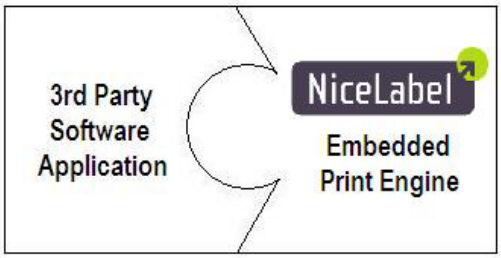


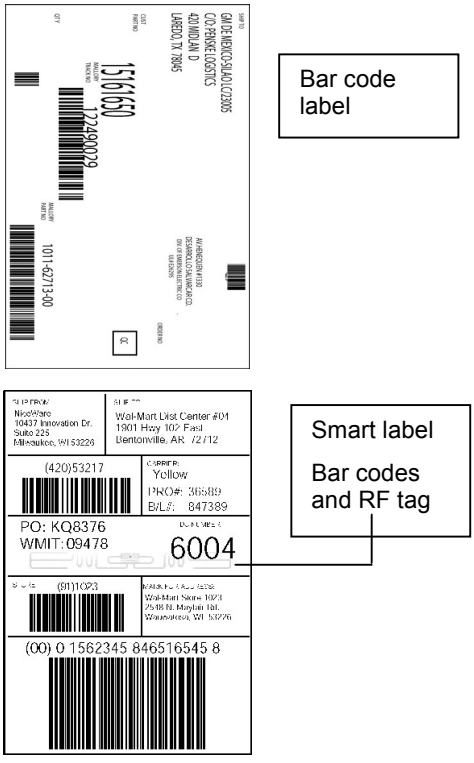
NiceWatch



Print engine – software to software connectivity

Using NiceLabel™ as a print engine running in the background, application developers can call NiceLabel™ through a rich ActiveX programming interface. You can even print bar code and smart labels directly from your SAP R/3 system utilizing NiceLabel™ only as a label design tool and printing without need for a middle-ware solution.





Easy and User-friendly Smart Label Design with NiceLabel™

Using NiceLabel™, you can easily design any label including elements such as RF tags, bar codes, text, lines, boxes, and graphics. The method of designing labels is very user-friendly and flexible.

NiceLabel™ provides an easy-to-use wizard setup to create new labels. Using the wizard, you can easily select label printer and label type, as well as test, preview, and print the label. NiceLabel's simple user interface allows you to use the same data that is printed on top of the label to be programmed to the RF tag as it passes beneath the print head. You can use data from a database, keyboard input field, serial number, Visual Basic script, and more to be programmed on the label or RF tag. Data can be entered in the process of designing the label or later, using variable data from various sources (keyboard, file, database).

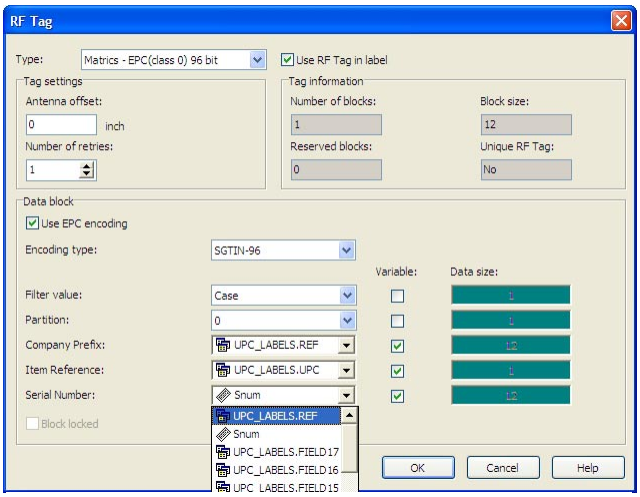


Figure: RF tag programming with NiceLabel Pro

The designer has the flexibility to select which data to use on the label or on the RF tag; or on both!

Figure: Wal-Mart smart label - Bar codes and embedded RF tag

Using NiceLabel™, you can easily design smart labels to meet the RFID requirements of large organizations such as the U.S. Department of Defense or Wal-Mart. In addition, NiceLabel™ enables you to develop proprietary smart label formats or base formats on international or industry standards.

Smart Label System Requirements

There are several reasons why companies implement RFID technology. Companies can benefit from RFID technology in any process where items are moved, identified, and tracked. Key drivers for RFID implementation are supply chain requirements of large organizations such as the U.S. Department of Defense or Wal-Mart. In addition to meeting RF tag performance and data requirements, companies must comply with all relevant international regulations that govern electronic data communication. As with bar code labels, companies may develop proprietary smart label formats or base formats on international or industry standards.

EPCglobal is the leading organization for the development of industry-driven standards for the Electronic Product Code (EPC) Network and has developed specifications and standards how to use RFID technology. EPC is a number designed to uniquely identify a specific item in the supply chain. The EPC number sits on the RF tag which is communicated to a reader that passes the number to a computer or local application system. The number tells the computer systems where to locate information, such as when and where the item was produced, on the network.

Successful RFID implementation requires planning for RF tag encoding, RFID media selection and the right software solution. Labeling software has to support smart labeling and RFID encoding. NiceLabel™ offers a variety of modules that support smart label design and printing as well as RFID encoding. NiceLabel Suite, with its modules NiceForm and NiceWatch, links the printer with the data source and guarantees a reliable, on-demand smart label data encoding and design. NiceLabel™ works with all RF tag and media types that are supported by current RFID printer technology, such as EPC, I-Code, ISO 15693, Tag-IT, and Pico tags.

NiceLabel™ Software Specifications

Software specifications

GENERAL — NiceLabel Editions:	EXPRESS	PRO	SUITE
Certified for operation on Windows 95, 98, NT, ME, 2000 and XP	✓	✓	✓
Up-to-date user interface with capable design Wizards and tools	✓	✓	✓
Completely Wizard driven label design environment	✓		
True Print Preview saving time, labels and money	✓	✓	✓
Multi-lingual user interface and label design*	✓	✓	✓
Advanced label design elements (paragraph text) and tools (Label Inspector)		✓	✓
Printing to all Windows printers, plus high performance thermal transfer printing (NiceDrivers)	✓	✓	✓
All standard graphics files and elements supported (JPG, WMF, GIF, BMP...)	✓	✓	✓
Clipart gallery and fonts with industry commonly used symbols		✓	✓
User log in protection, customizable log file of printed labels		✓	✓

DATA HANDLING AND PROCESSING			
Prompted fields with data validation	Limited	✓	✓
Serialization with custom base, roll over and increment control	Limited	✓	✓
Date and time fields with selectable format	✓	✓	✓
Linked fields, Visual Basic Scripting for advanced data processing		✓	✓
String manipulation and arithmetical function		✓	✓

BAR CODE AND RFID SUPPORT			
All industry-standard linear, 2-D, EAN.UCC 128 and RSS (Linear and Composite) bar code types	✓	✓	✓
Advanced support for standards like FACT, HIBC, Transfer Syntax and bar code compliance proofing		✓	✓
Support for all the latest 2-D symbologies, including PDF 417, Data Matrix, MaxiCode, Aztec and others	✓	✓	✓
InfoGlyph glyph creation and integration capabilities		✓	✓
RFID smart label support (EPC, I-Code, ISO 15693, My-d, Picotag, Tag-IT)		✓	✓

DATABASE SUPPORT — NiceLabel Editions:	EXPRESS	PRO	SUITE
Import text, paragraph, bar code and graphics fields from database	Limited	✓	✓
Native text (ASCII) file support	✓	✓	✓
BDE, ODBC and OLE DB database driver support for all database types, including Unicode		✓	✓
Wide range of record selection possibilities	✓	✓	✓
Multiple database connections, built-in query builder and custom SQL scripting		✓	✓
NiceData – Full-featured database manager			✓

INTEGRATION & CONNECTIVITY			
Internal command language (job files, command line options, DDE)		✓	✓
ActiveX (Automation) programming interface		✓	✓
Label layout export to SAP R/3 (ITF files)			✓
Stand-alone printing support		✓	✓
Data-detection module (network printing; non-Windows systems and other applications like WMS, inventory, etc.)			✓
NiceWatch – Integration middle-ware with data filtering support			✓
NiceWatch – Serial (COM) port connectivity			✓
NiceWatch – Internet and distributed printing (POP3 and TCP/IP socket interfaces)			✓

SPECIAL			
NiceForm – Data-entry and label printing application design			✓
NiceMemMaster - Font and graphics download utility for thermal transfer printers			✓

ADDITIONAL EDITIONS			
Print Only		✓	✓
Network			✓
"with Windows CE" Support (Mobile wireless label printing, Pocket NiceLabel)			✓
"with Linux" Support (Linux label printing and data-detection module, NiceLabel for Linux)			✓
Standard (limited to office printers like lasers and inkjets)		✓	✓

* Full Unicode data processing support is available in NiceLabel Pro label design environment on Windows NT, 2000, XP and 2003 platforms

System requirements

Pentium based computer (may be a dedicated print server) with at least 32 MB of RAM

32-bit Windows OS (9x, Me, NT, 2000, XP, 2003)

135 MB of available hard disk space (depending on edition used and options selected)