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# RFID: A WORLD OF OPPORTUNITY

## Ingenious uses of the technology worldwide

You might be tempted to think that RFID is all about logistics, stocktaking and supply chain improvements. After all, it's likely the best technology we have to increase logistics visibility and efficiency. It's no great surprise that RFID is spreading across business categories. The amazing part is the ingenious uses to which the technology is being put.

Did you know that RFID is now helping to detect early infection in orthopaedic implants? This and many other uses of the technology are pulling us closer to the Internet of Things, in which researchers and academics foresee RFID playing a leading role. The idea behind the Internet of Things is that objects like light switches, refrigerators and cars become uniquely identifiable, with their information visible within a virtual, Internet-like structure. Things like smart light switches, for example, could be remotely controlled.

Here's how RFID helps with the task. RFID tags store information about an object, and allow more information to be added along an object's journey. These tags will relay the information that an authorized interrogator 'asks' for.

“When you add wireless sensing capabilities such as measurement of motion, temperature or oxygen saturation,” observes Jorma Lalla, CEO of handheld RFID computer firm Nordic ID, “you’ve got an object that can inexpensively yield many kinds of real time information from anywhere in the world. There is tremendous potential here.”

It all boils down to getting better and better at tracking the things that make up civilization. In this article, we look at the types of RFID use blossoming in different business verticals and where in the world it’s taking place, starting with the medical field.

## BUSINESS VERTICAL: MEDICAL/PHARMACEUTICAL

**RFID implementations: Finland, Spain, USA, Australia, Haiti, Colombia, UK, Nigeria, India**

Professor Marlin H. Mickle, PhD, Executive Director of the University of Pittsburgh's RFID Centre of Excellence, is a big proponent and a driving force behind the Internet of Things. He thinks that nowhere is the future of virtual tracking brighter than in the medical sphere. Pharmaceutical companies are already experimenting with RFID to guard against counterfeiting and misplacing medicines, but Mickle and fellow researchers are busy putting RFID into practice in a more direct way.

"Our research recently spun off a company called Ortho-tag," says Mickle. "If there is a recall of orthopaedic implants, for example, a quick scan by your doctor will reveal if your implant forms part of the recall. RFID will also signal the early onset of infection with the help of subcutaneous sensors. Approximately 1.1% of implants result in an infection, which is low, but in the US the average cost of hospitalization in these cases is around $100.000."

Mickle also foresees medical uses of RFID that will help improve conditions in the developing world. His team is currently developing smart dressings, which include an RFID tag, a sensor and a transmitter. "If a wound becomes infected," he explains, "the dressing will auto-transmit so that the person can be tracked and attended to, if they have gone back to their village, for instance." The only hurdle the team is still facing is how to integrate the system into gauze and bandages.

RFID is not only helping in the area of infection. Mickle's researchers are currently working on a water purity and safety application very relevant for the developing world. In a similar vein, patients with visual deficiencies or cognitive issues are benefitting from a pilot program in which medicines come with RFID tags integrated. An interrogator mounted in patient bathrooms uses voice technology to tell the user what the medicine is, the frequency and dosage required, and other details.

**Sample uses of RFID in this category worldwide:**

- Intel (USA) has developed a prototype of a system that helps people suffering from Alzheimer's disease to function more normally
- FBSTIB (Spain), a blood bank, uses RFID in tracking and optimizing use of frozen bags of blood
- Australian Nursing Homes (Australia) is using RFID-chipped underpants to monitor the incontinence of the inhabitants. Care plans are made based on the frequencies
- The municipality of Salo (Finland) has built a unit for sheltered housing that is assisted with RFID-enabled wellbeing technology solutions

## BUSINESS VERTICAL: HOSPITALITY

**RFID implementations: Switzerland, France, Netherlands, USA, Spain**

The hospitality industry shares one facet with the field of medicine: both involve people management. Where one tends to their health needs, the other concerns their entertainment and enjoyment.

Would you enjoy an event more if you didn't have to worry about keeping track of your entry ticket and drink vouchers? That's the idea that the organizers of Eurosonic Noordeslag—Europe's premier new music festival—had in implementing RFID. A wristband with RFID tag integrated gained festivalgoers entry at many entry points at concert halls, clubs and cafés throughout the city of Groningen, Holland. The wristband reduced bottlenecks, served in the place of drink vouchers, and initiated emails sent to those who had asked for more information about certain performances.

More contentious uses of RFID have also been trialled in the hospitality industry, including RFID biochips. In Barcelona, a nightclub injected RFID chips under VIP customers' skin. To enter the VIP area, all that patrons had to do was to wave their hands. The chip worked also as a credit card—obviating the need to search for cards or cash.

**Sample uses of RFID in this category worldwide:**

- The Open de Saint-Omer (France) event deployed passive RFID to streamline access to VIP areas
- Eurosonic Noordeslag (Netherlands) uses RFID wristbands to supervise admission to seminars and performances, and to receive beverages and gain additional information about particular programs and bands
- A Swiss wine retailer and delicatessen increased sales by providing additional information to customers via RFID regarding each selection

## BUSINESS VERTICAL: APPAREL

**RFID implementations: Japan, USA, Germany, Italy, China, France, UK, Spain, Netherlands, Sweden, Australia, Belgium, Canada, Chile, India, Mexico, Norway, Portugal, Taiwan, Austria, Finland**

RFID implementations have multiplied quickly in the apparel industry, and for good reason. Fashion retailers can stock 10,000 or more distinct items on the sales floor—a potential logistical nightmare. Before the advent of RFID, the industry suffered from many business problems including the production of gray market apparel knock-offs, poor inventory management, shrinkage, inefficient distribution processes, lack of inventory visibility, double digit out-of-stocks, and more.

Nobody knows how well RFID can help fix these woes better than Jorma Lalla, CEO of Nordic ID. “We have helped provide over a dozen solutions in the fashion industry,” he says. “Handheld RFID computers on the sales floor, in the stockroom and in the distribution centre increase accuracy and speed to an incredible extent.”

To date, several vertically integrated retailers such as Gerry Weber have implemented RFID end-to-end—from shipping labels with RFID tags integrated to manufacturers around the world to gaining visibility into reseller processes and sales statistics—producing tremendous business results. For one major US retailer, an RFID rollout has delivered an average sales increase of 14% per store due to a reduction in out-of-stocks and higher sales staff availability.

Fashion houses are also experimenting with different kinds of RFID implementations to heighten the customer experience and provide valuable feedback, from smart mirrors that suggest complimentary clothing and record customer comments on clothing items, to virtual mirrors that mimic the look of clothing on the body.

The trend of end-to-end RFID use is spreading quickly both across industries and within individual companies' logistics chains. Justin Patton, Managing Director of the RFID Research Centre at the University of Arkansas' Sam M. Walton College of Business, has recently been busy fielding calls from companies inquiring about how best to implement RFID in Central America and Asia with respect to data capture, managing serialization, and other topics. "Companies are looking into upstream applications," says Patton. "They are manufacturing goods in developing countries and have poured investment into RFID printers and source tags there. Now that they have the tags," he explains, "they want to put readers in place to monitor handling points throughout the supply chain."

**Sample uses of RFID in this category worldwide:**

- Goldwin Sportswear (Italy) has reduced grey market knockoffs through by affixing tags at point of manufacture
- Sanyo Shokai (Japan) uses RFID for warehouse and inventory management
- Charles Vögele (Switzerland) has complete merchandise visibility through RFID
- Roberto Verino (Spain) uses smart mirrors to enable customers to see how clothes would look before entering fitting rooms
- Gant (United Arab Emirates) has rolled out the use of RFID in item-level tagging

## BUSINESS VERTICAL: HORTICULTURE

**RFID implementations: The Netherlands, USA, Germany**

RFID use in the field of horticulture is just beginning to blossom. There are a number of companies in the industry, like the Netherlands' BAAS Plantenservice, that have implemented RFID for logistics purposes. At the height of the season, BAAS has more than 100 trucks per hour coming and going from its distribution centres. RFID has had a major impact in untangling logistics there, greatly increasing efficiency. In addition, many of BAAS' major growers have joined an RFID pilot that greatly improves visibility into shipment timing and specifics.

But it's those using RFID in novel ways that capture the imagination. The NASA Jet Propulsion Laboratory has implemented wireless sensing, which many believe to be the next evolution of RFID, at Huntington Botanical Gardens in San Marino, California. The sensors automatically start sprinklers in dry areas, optimizing the use of precious water as well as plant health.

**Sample uses of RFID in this category worldwide:**

- FloraHolland (The Netherlands) supervises flower storage with RFID
- Huntington Botanical Gardens (USA) is using RFID to auto-start sprinklers in dry areas
- Michigan State University's 4-H Children's Garden (USA) teaches children about plants by giving each child a "Personal Science Assistant" (an RFID reader) that the child uses to read plant labels and gain information about plants. This includes pictures of plant parts and plant uses
- BAAS Plantenservice (the Netherlands) receives all the information about their product movements

## BUSINESS VERTICAL: LARGE SCALE SUPPLY CHAIN LOGISTICS

**RFID implementations: Denmark, Netherlands, Saudi Arabia, Germany, Denmark, Spain, USA, South Africa**

Supply chain logistics cuts across many business verticals, but this section deals with logistics on a massive scale: things like tracking millions of carts and pallets, and adding visibility to a national postal service.

In a bid to improve service accuracy and usher in a new level of efficiency, Saudi Post has outfitted each of 10 million mailboxes across the Kingdom with an RFID tag. Postal workers use mobile RFID computers to identify mailboxes before inserting letters. After letters go in, they are read once more so that the national mail service can verify delivery. Handhelds are also equipped with GPS and wireless communication capability so that managers can track postal carriers and deliveries.

Enabling postal processes with RFID is an intuitive move, but another massive implementation involves an industry that often escapes public attention: waste and recycling. Charleston County, South Carolina has more than doubled recycling participation with the help of waste management solution provider Sonrai Systems.

RFID tags on trucks and containers have also helped with truck route management, but the big news is the effectiveness of RFID in getting more waste out of trashcans and into recycling containers. The success of the program hinged on getting the data needed to validate the benefits associated with a shift from curb-sorted, manual bin collection to a wheeled cart program.

”We worked closely with Sonrai to refine the RFID-based system,” explains Justin Patton of the University of Arkansas’ RFID Research Centre. “It’s been a great success and since then the program has been duplicated in upwards of 30 US cities.”

**Sample uses of RFID in this category worldwide:**

- Container Centralen (Denmark) installed 150 RFID readers at plant nurseries, greenhouses and fields in order to track millions of metal carts
- Saudi Post (Saudi Arabia) has tagged the mail boxes of homes across the whole country to ensure accurate delivery
- Deutsche Post DHL (Germany) lowered fuel consumption with RFID-enabled delivery vans
- Procter & Gamble (Spain) has sped truck loading with RFID-labelled pallets to avoid bottlenecks at loading docks
- Air Canada (Canada) is tracking the food carts it uses at airports

## BUSINESS VERTICAL: AUTOMOTIVE

**RFID implementations: Norway, USA, Canada, Brazil, Tanzania, United Arab Emirates, Finland, Germany**

Almost as daunting as managing postal delivery is managing the flow of thousands of parts that keep massive 24-hour assembly lines running. When Toyota and General Motors opened new joint production facilities in Livermore, California, the ante went up for Johnson Controls. Johnson supplies interior components for many of the biggest auto manufacturers in the US, and for this new production facility they faced the challenge of supplying 1,500 car seats per day in the exact order that they were required. If any of the dozens of deliveries made each day had a single seat out of sequence, entire production lines could come to a halt.

Johnson Controls found that RFID held many advantages over clipboards or even barcodes: no line-of-sight reading required, dirty labels were not a factor in reading—in fact, tags were encased in hard plastic for protection. The result? Not only did accuracy climb to 99.9%, but the company found that introducing RFID into their environment spawned other efficiencies as well.

**Sample uses of RFID in this category worldwide:**

- A Norwegian car window manufacturer is tracks all deliveries since it promises to deliver within Norway in 24 hours
- Johnson Controls (USA) tracks all spare parts it delivers to 3 large car manufacturers in order to provide just-in-time production

## BUSINESS VERTICAL: GROCERY

**RFID implementations: France, Germany, UK, Canada, India, Japan, Norway, Russia, New Zealand, Sweden, Spain**

Following Wal-Mart's early lead, grocery retailers in record numbers are jumping into RFID to improve supply chain efficiency and reduce out-of-stocks. Many have also begun automating checkout processes to reduce or eliminate queues. Perhaps the most interesting uses in trial today, however, are those surrounding freshness, temperature and encouraging customers to buy more.
A.F. Blakemore & Son Ltd, part of SPAR UK, instituted a program to monitor fluctuations in refrigerator, freezer and hotplate equipment temperatures. The goal of the pilot was to ascertain whether the temperature in any refrigeration unit falls outside of new parameters set by the European Food Safety Authority (EFSA).

The automated solution, built in close collaboration with Nordic ID, allows management to set up notification parameters or look at real time readings in any way that they wish. Instead of relying on service engineers to fix problems as they arise, with little visibility into the overall performance of the units, managers can manipulate statistical information to see for themselves whether a unit is malfunctioning and engage the manufacturer to correct the problem.

"A solution like this puts management back in control," says Jorma Lalla, CEO of Nordic ID. "Imagine having visibility into the efficiency of all systems, from HVAC units to refrigerators and light fixtures. That's where we are headed."

Another use for RFID that grocery industry experts see just around the corner is having tags monitor the freshness of meats and produce, including ambient temperature over time, duration of shelf time, and other factors.

**Sample uses of RFID in this category worldwide:**

- Wal-Mart (USA) started with tracking the pallets and boxes; now the company is receiving only tagged items from its suppliers
- NLP (Norway) is using RFID to track and manage plastic boxes and pallets, in use throughout the Norwegian grocery retail ecosystem
- Auchan (France) handles and tracks plastic boxes
- X5 (Russia) is launching a Store of the Future

## BUSINESS VERTICAL: LAUNDRIES

**RFID implementations: Canada, France, UK, Norway, Australia**

Using RFID to improve laundry logistics is not a new concept, but a new Vancouver hotel is using RFID tracking of 25,000 high-value linens to achieve other goals as well. Aside from logistical improvements, the Fairmont Pacific Rim Hotel Canada has two other main objectives: reducing the storage space needed for linens through intimate knowledge of their whereabouts, and tracking linen lifecycles to inform future procurement choices. Soft rubber tags embossed with the hotel's logo and capable of withstanding temperatures in excess of 200 degrees Celsius can be read from up to 1.8 metres away, making tracking fail-proof.

Another spin on the laundry model comes from Disney, whose 100 million dollars' worth of theme park and cruise ship costumes now carry RFID identification. Workers can simply locate an outfit, bring it to self-service kiosk, present their ID badge and take it away. The entertainment juggernaut has found that RFID speeds costume retrieval, improves visibility of items through laundering and repair, and has cut the time required for inventory checks from an average of 180 hours to two, while increasing accuracy from 90 to almost 100%. The surprise bonus, however, was that it has also been a factor in increased job satisfaction.

**Sample uses of RFID in this category worldwide:**

- Canadian Linen and Uniform Service (Canada) uses RFID tags to help the customers to drop the garment into a right laundry bin as well as in replacing the manual sorting of soiled items
- The Fairmont Pacific Rim Hotel Canada uses RFID tags to manage the inventory of 10,000 employee uniforms and 25,000 bathrobes, towels, sheets and other linens
- YMCA (France) is monitoring work outfits in laundry.

## BUSINESS VERTICAL: TRANSPORTATION

**RFID implementations: Finland, Singapore, Kuwait, Malaysia, India, Argentina**

The most common applications for RFID in transportation are logistical control of vehicles, such as truck chassis, and automating highway toll processes. The 407 Electronic Toll Route (ETR) near Toronto, Canada is one such implementation. Cars and trucks that use the highway regularly carry active RFID tags that send a signal to interrogators as vehicles enter or exit the highways. Billing is handled electronically, and motorists never have to slow to pay a toll. Similar systems exist in Argentina and, as of quite recently, Panchkula, India.

More novel uses of RFID in the transport sector include allocation of parking and vehicle tracking through RFID-based mesh networking. The US Army is experimenting with the alternative RFID technology at a military base in Kuwait, where military vehicles used in Iraq must be thoroughly cleaned and inspected before being shipped home.

Each active RFID tag transmits its unique ID number along with the US Department of Defense (DoD) vehicle tracking number, passing information from tag to tag until it is received by a fixed mesh gateway. Tag data and location are then processed by middleware before being integrated into the DOD's database. In this way, data is constantly being fed into the system in real time.

At 6,500 units, this is believed to be the largest mesh deployment ever, and represents a great advance over a traditional RFID setup, where vehicle status would only be 'on the radar' when they pass through a portal or are manually interrogated.

**Sample uses of RFID in this category worldwide:**

- U.S. Army Logistics Innovation Agency (Kuwait) is installing active mesh-networking tags
- Panchkula, Haryana (India) has introduced RFID-based toll plazas on freeways

## BUSINESS VERTICAL: LIBRARIES & ARCHIVES

**RFID implementations: Finland, India, UK, USA, China, France**

If you have ever needed help in finding something at the library, you will appreciate this RFID application. Imagine using a mobile computer with Geiger counter technology to help you find the book you were looking for. That is part of a grand plan for the Finnish National Library in Helsinki. The library is taking part in the development of an international standard data model for the use of RFID in libraries—something that will encourage the adoption of a common system for use worldwide.

The logistical benefits of RFID in libraries are self-evident, and they extend to a similar domain, that of public and private archives. Tagged shelves can facilitate retrieval, and tagged items can be found more easily. Entire databases of archived items can be monitored thanks to RFID technology, and item security gets an immediate boost thanks to longer reading distances at strategic locations.

**Sample uses of RFID in this category worldwide:**

- Finnish National Library (Finland)

## BUSINESS VERTICAL: FIELD SERVICE

**RFID implementations: Kuwait, Germany, Netherlands, Finland, USA, Canada, Argentina, Saudi Arabia**

When you need to send people to perform maintenance or check the status of a system or object, RFID can help. Not only will maintenance personnel be able to file reports electronically and on-site, but you can also be more certain that inspection or maintenance actually took place.

Frankfurt Airport is a good example of RFID-enabled field service, as it has adopted RFID to monitor inspections of fire safety equipment for that very reason. The company that runs the airport, Fraport, attached passive RFID tags to the fire shutters in its air-conditioning and heating ducts. These ducts must close in the event of a fire to limit the spread of fire and smoke, and their maintenance is federally mandated.

Before the RFID installation, maintenance engineers were given paper forms and maps of the shutter locations. They had to fill out reports by hand and submit them back at the office for input into the company's ERP system. Now they are equipped with handheld RFID computers to identify each shutter and document all inspections, repairs and maintenance work. As one administrator noted, you can fill out paperwork anywhere, but you can only interrogate an RFID tag within close proximity.

The new system worked so well that Fraport added 80,000 fire doors, emergency lights and smoke detectors to the 50,000 shutters already tagged. RFID is now an indispensable part of the airport's operations, bringing efficiency and greater accuracy to its safety infrastructure.

**Sample uses of RFID in this category worldwide:**

- Frankfurt Airport (Germany) uses RFID to confirm the proper inspections of safety equipment
- Schippol Airport (Netherlands) tags luggage to speed up handling and to ensure that travellers and luggage wind up in the same plane
- The Impivaara swimming hall in Turku (Finland) uses RFID wristbands to enable customers to enter dressing rooms and use lockers

## A WORLD OF OPPORTUNITY

This survey of industries and processes provides some insight into the diverse ways in which RFID is being put to use worldwide. The horizons for the technology are expanding quickly, not only within their core use in logistics improvements, but also in optimizing many kinds of detection, tracking and processes in areas as diverse as patient care and customer experience.

Justin Patton, Managing Director of the University of Arkansas' RFID Research Center, believes that the benefits of the technology await every industry in the world, but he has identified one challenge common to us all: "There's a river of tags out there," he says. "It's not hard to collect information from those tags, and you're looking at about 100% accuracy. But it is difficult to figure out how to leverage it. It can be simple, but not for someone without experience in the area."

Our great hope for technology has always been that it would make life easier and better for humanity. As we get closer to the concept of the Internet of Things becoming a reality, it is becoming apparent that the professionals working in RFID are truly moving us in that direction.

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