

Healthcare Innovations: Operational Excellence with RFID

Small, inexpensive RFID tags, once used only in supply chain applications, have become valuable tools for doctors and nurses.

From the admittance desk to the operating room, RFID has emerged as a transformative technology in the healthcare industry. By applying RFID tags to must-have equipment, hospitals are saving millions each year through improved visibility, process flow and better asset utilization.

NXP is a key provider of multiple RFID applications in the healthcare industry; its HiTAG, ICODE and UCODE product families provide the foundation for robust, industry-standard and interoperable RFID solutions, without compromise.

In recent years, usage of RFID technology across the healthcare industry has soared. Here are just a few examples of the many ways it is being put to use in an effort to cure what ails hospital administrators and other staff, while leading to safer, shorter stays for patients.

Patient Identity

Wristbands have long been standard-issue in hospitals. They serve to identify and link each patient with his or her file and case history, as well as to ensure they are brought to the correct rooms for x-rays, surgeries and other procedures.

Despite the use of wristbands, which generally show the name of the patient, the doctor's name and the date of admittance, accidents still happen. Sometimes, mix-ups are easily remedied and result in nothing more than an embarrassment for the responsible staff. But if a mix-up leads to the wrong drugs being administered or the wrong surgery performed, that small error can cost a life.



Positive ID. Replacing bar codes with RFID tags on wristbands aids doctors and nurses in quickly, accurately identifying their patients and quickly accessing their medical files.



RFID provides another layer of security and certainty when it comes to identifying patients, and it also speeds and improves the accuracy of each patient interaction and movement, from the point of admittance to the time of release.

RFID identification wristbands act as an extension of a patient's electronic medical records. Depending on the hospital's specific needs and existing (if any) RFID infrastructure, it might choose to deploy them with either a high frequency (HF) 13.56 MHz tag, or a longer-range ultra high frequency (UHF) 915 MHz tag, either solution supported by NXP.

Nurses and doctors use an RFID reader to quickly retrieve patient files on a tablet or bedside monitor. When staff can positively identify patients and access their case histories, they can devote more time and energy to caring for the patient.

While many healthcare centers have already transitioned to electronic medical records, paper files are still widely used—and RFID makes finding paper files a quick and painless process. That's especially true when NXP's ICODE ILT ICs are used. The ILT is optimized for reading many tags, packed densely together, at very high speeds, which makes it a perfect fit for file tracking.

Tracking Tools and Treatments

A successful surgery depends on the combination of highly skilled doctors working in a tightly knit team of other physicians and nurses. And of all the things that could go wrong during these intense minutes and hours, accidentally leaving a surgical sponge inside a patient probably doesn't jump to the front of your mind. But it happens. Because they become blood-soaked when used during surgery, disposable surgical sponges are sometimes inadvertently left inside a patient—and not noticed even as the patient is sutured.

In fact, the Journal of the American College of Surgeons reported that foreign objects are left behind in 1 out of every 5,500 surgical procedures.

Here again, RFID—powered by NXP technology—is playing an important role. ClearCount Medical Solutions, a Pittsburgh, Pennsylvania-based developer of medical devices and safety systems has developed an innovative solution to this very vexing problem that can have tragic, even deadly, results for patients. Plus, it's a very expensive problem for hospitals, which stand to be sued for malpractice.



Tools of the Trade. *From surgical sponges to IV pumps, RFID helps ensure all of the right assets are in the right place at the right time. Plus, it automates equipment calibration, to ensure safety and save time—for medical staff and patients, alike.*

ClearCount's solution is comprised of surgical sponges, embedded with NXP ICODE RFID based tags, as well as an RFID-enabled kiosk, and a SmartBucket (a special RFID disposal container used for collection of discarded sponges). The system also includes a handheld RFID reader to scan the body one final time, before suturing the patient. ClearCount developed software for the kiosk to help guide nurses through the counting and reconciliation process, insuring no sponge is left behind.

RFID can also provide a reliable, seamless tracking technology for reusable surgical tools, such as scalpels. Here, some challenges remain, because these tools are typically metallic with limited surface area and must be able to withstand the harsh environment associated with repeated sterilization. But the industry is making progress toward enabling this application.

And outside the surgical theater, hospitals are using RFID to track many single-use and reusable assets, from infusion pumps to individual doses of drugs. Oftentimes RFID-enabled storage cabinets play an integral part in these solutions, by allowing users to monitor the inventory levels, location and expiry information of pharmaceuticals they stock without having to manually track this information. This liberates hospital staff from clerical duties and gives them more time to tend to their patients' needs. It's also a cost-saver because the passive RFID tags attached to the pharmaceuticals can play an important role across the whole supply chain by enabling automated, accurate tracking of the drug products, starting at their point of manufacture. The tags also allow pharmaceutical companies to comply with government regulations that call for electronic pedigree records to ensure safety.

When selecting a kit of tools for surgery, such as a prosthetics kit, in which all of the individual pieces and fittings must be precisely matched to the patient during surgery, some hospitals count on RFID to ensure that the right kit is fully stocked and available for the procedure.

And inside medical labs, pipettes are as important to clinicians as wrenches are to mechanics, so it's not surprising that RFID is being used to ensure that these instruments, used to transfer precise amounts of liquids between vessels, are accurately calibrated.

Pipette manufacturer Mettler Toledo Rainin has replaced manual and barcode-based pipette calibration tools with an RFID-system. The technology, which includes passive RFID tags, made with NXP's HiTAG 125KHz LF chip, that are embedded in the pipettes, as well as a desktop RFID reader and software. The software collects the tag number as well as other data encoded to the tag, such as any restrictions on the use of that particular pipette, to ensure compliance with government regulations.

Keeping Tabs on Blood and Tissue

In June 2011, the Advisory Committee on Blood Safety and Availability of the US Department of Health and Human Services said research showed some US hospitals give patients unnecessary blood transfusions, which is not only a waste of money but also a potential threat to patient health. It suggested that new standards are required to help healthcare providers decide which patients need transfusions.

This report also underlies the need for reliable, accurate tracking technology so that blood centers and hospitals—which in 2007 collected 15.7 million units of blood, according to

American Association of Blood Banks—can ensure efficient collection and distribution of this precious resource.

Toward that end, hospitals and research centers all over the world are using RFID to secure and improve the movement of blood and tissue. Everything from biopsy samples to bags of blood for transfusions are enabled with RFID tags to allow personnel to quickly find what they're looking for and ensure blood is properly transported, stored and paired with its intended recipient.

Like perishable foods, some types of blood and tissue have very short shelf lives and their location, movement and temperature must be closely monitored.

Bar codes have for many years been the standard means by which samples and transfusion bags have been tracked.

But RFID is a more reliable and efficient means of identification, since bar codes can get smudged, bent or otherwise be rendered hard to capture with a bar code scanner, especially if frost or condensation builds up on the refrigerated content. Plus, capturing the unique RFID number encoded to each RFID label does not require the one-by-one, line-of-sight reading that a bar code does. The RFID tag ID number is associated, in the user's back-end computer system, with the electronic records related to the tissue or blood.

Because blood and other liquids tend to absorb radio frequency waves, HF tags have largely been the tag of choice for tracking liquids. However, recent advancements in UHF technology, such as the NXP UCODE i-Series ICs, have led to UHF tags that perform exceptionally well, even when placed directly on liquids—and even if many of the tags are stacked and placed in close proximity to each other.

Home-based Healthcare

RFID is playing a role in the tools diabetics use to manage their blood sugar. The most popular of these devices is a lancet, which is used to prick a fingertip to obtain a blood sample, and which work in tandem with a mobile glucose meter that measures the blood sample's glucose level. These meters utilize consumable testing strips, which come with calibration codes that users key into their glucose meters to calibrate the devices, in order match the specifications of the test strips. But RFID has removed this time-consuming step by allowing the manufacturers of these devices to embed an RFID tag into a pack of testing strips so that when the user loads



Precious Cargo. *In a hospital, an adequate supply of blood is as essential as electricity. RFID makes tracking this inventory easier, faster and more accurate than bar codes.*

them into the glucose meter, an RFID reader inside the device can read the calibration data from the tag and automatically calibrate the meter to ensure that accurate reads are provided.

Also, the tag contains expiry information, allowing the meter to alert the user when a pack of testing strips has expired or soon will expire.

These two features help ensure the safe operation of the glucose monitor while ensuring that the user is taking the correct dose of insulin and making the whole process easier.

Other, newer types of glucose meters employ sensors that users can adhere to their bodies for days at a time. These sensors are able to determine glucose levels through means other than drawing blood. But they are very small and require the use of a mobile device to collect the glucose readings. A cellular phone containing a near field communication (NFC) module, which reads and writes to passive, high frequency RFID tags at close range, can collect the data from the sensor, which contains a tiny embedded RFID tag.

Home-based healthcare providers are finding many ways in which RFID can automate and improve the products and services they offer. Smart medicine cabinets use RFID readers and RFID-tagged medicine bottles to help caregivers remotely monitor their patients—especially those with vision problems, mental health problems (such as dementia) or other limitations—to ensure they take the correct dosage of drugs, on a regular schedule.

RFID can also open doors to some types of health monitoring that would not be feasible or cost-effective within hospital settings. For example, NFC-enabled phones can be used to download data collected on a sensor that a patient with sleep problems wears while sleeping. The sensor tracks the patient's movement patterns, and this information is first downloaded to the user's phone and then sent from the phone to a web-based application where his or her doctor can view and analyze the patterns, in order to suggest treatments or therapies.

In Summary

Supporting multiple frequency bands and standards, and offering industry-leading extra functionality, NXP chips are the foundation for RFID-based solutions for asset tracking, business process or safety improvements across the healthcare industry.

Bringing applications such as these from concept to reality takes vision, testing, and a partner. NXP's RFID Applications and System Center provides developers with assistance in every step of the process, from concept to product design to production and compliance, insuring quick and trouble-free implementations to maximize ROI.

About NXP Semiconductors

NXP Semiconductors (Nasdaq: NXPI) is the leading global provider of RFID ICs. NXP creates semiconductors, system solutions and software that deliver better sensory experiences in RFID identification applications, eDocuments, mobile phones, TVs, set-top boxes, automobiles and a wide range of other electronic devices. A global semiconductor company with operations in more than 25 countries, NXP posted revenue of \$4.4 billion in 2010. For additional information, please visit www.NXP.com or our RFID specific website at www.NXP-RFID.com.

