



RFID Revolutionizing Healthcare with Smart Surgical Tools

RFID Moves Beyond Asset Tracking to Optimize Clinical Operations

Radio frequency identification (RFID) technology is already in use at many hospitals for asset tracking applications. Both active and passive RFID tags have been utilized to manage supply inventories, and keep track of assets like wheelchairs, beds, infusion pumps, and other equipment. Hospitals spend a significant amount of time and money searching for equipment, in addition to incurring the cost of overstocking items that are difficult to locate and replacing expensive assets that have been lost. RFID can save both time and money in this environment by providing real-time location data.

Research firm TechNavio forecasts the RFID healthcare solution market to grow at a compound annual rate of 29 percent from 2010 to 2014. This has been driven, in part, by falling prices for RFID tags and associated hardware. But healthcare facilities have also expanded their use of RFID to other applications, including access/security, patient tracking, medication management, and file tracking. With the introduction of small, durable RFID tags, solutions are available that can even be used to manage clinical operations in the operating room, including tracking surgical instruments. In an even more innovative application, RFID has been used for navigation during non-invasive surgical procedures.

The U.S. Food and Drug Administration, meanwhile, has been working with the RFID industry to ensure that RFID technology does not interfere with the function of medical devices (like pacemakers), and is participating in the development of RFID standards for the healthcare industry.

In this whitepaper, you will learn how RFID is being used in the healthcare market today; what new applications are being made possible thanks to recent technological innovations; and the benefits of using passive RFID technology in these applications.

Healthcare Requirements

A hospital can be a challenging place to implement an RFID solution. These facilities are increasingly "radio dense," sometimes operating multiple wireless networks on several floors. In addition, there are numerous sources of potential tag interference, including large metal carts and other equipment. Placing RFID readers can be a challenge because of limited space or safety considerations, and the RFID system has to operate in such a way as not to interfere with sensitive medical equipment.

That said, using RFID for asset tracking and other applications has a significant advantage over other types of identification solutions like bar codes -- namely, there is no line-of-sight requirement. Assets or personnel can be identified and located in real time from a central location.

Hospitals have typically implemented one of two types of RFID technology: passive RFID solutions, and active RFID or WiFi-based systems (sometimes referred to as real time location systems, or RTLS).

RTLS solutions typically provide a high level of location accuracy. However, not all applications require that level of detail. RTLS solutions are also more expensive to implement, with tags costing 30 to 40 times what a passive RFID tag would cost. And although these systems can utilize an existing wireless LAN infrastructure, they usually require the installation of new access points to enable accurate location of tagged items.

Passive RFID solutions provide significant cost advantages. Here again, there are two varieties of tag typically used in these applications: high frequency (HF) and ultra-high frequency (UHF). HF tags traditionally had an edge because they could be used to uniquely identify items at close range, and they could be used on metal and near liquids (which typically interfere with an RFID signal).

But there are now UHF tags available that can be used in these environments, and UHF interrogators can be tuned to avoid unwanted tag reads. In an operating room, the advantage of UHF would be the possibility of reading a large number of tagged surgical tools at once -- and for complex surgeries, the number of tools used can number as many as 600.



FIGURE 1: SURGICAL INSTRUMENT TRAY WITH XS ENABLED TOOLS

Passive UHF tags are also inexpensive and flexible, and can be modified to work on any type of asset, or even on patient wristbands. In research published in the journal *Patient Safety in Surgery*, Steffen et al. 2010, passive RFID tags have been shown to function properly for patient tracking applications even during exposure to MRI and CT scanning procedures.

But are these types of RFID tags safe to use near sensitive medical instruments and devices? In testing, UHF tags have shown some degree of electromagnetic interference (EMI) with hospital equipment. A study conducted in a non-clinical setting by the University of Amsterdam and published in the *Journal of the American Medical Association*, van der Togt et al. 2008, found that passive RFID technology did generate some interference with medical devices when the RFID equipment was placed very close by. A follow-up study conducted by researchers from Indiana University, Purdue University and RFID vendor BlueBean, "RFID Usage in the Patient-Care Environment," found no such interference in tests conducted in an actual clinical setting.

While the risk is quite low, hospitals should conduct a thorough EMI assessment to avoid any potential interference.

Not Just for Asset Management Anymore

Asset management is one of the primary applications for RFID in a hospital environment. As AMR Research has reported, between 10 percent and 20 percent of a typical hospital's mobile assets are lost or stolen during their useful life at an average cost of nearly \$3,000 per item.

Using RFID to track these assets can reduce costs and improve efficiency, while reducing the amount of time clinical staff spend on non-clinical activities — like searching for missing equipment.

As noted before, RFID can also be used for patient tracking (i.e., to prevent patients with dementia from wandering out of a building, or to prevent baby switching). Other applications have also emerged, and innovative systems have been developed that take advantage of passive RFID in the operating theater.

No Instrument Left Behind

Any given surgery typically requires dozens or even hundreds of different instruments, from complex scopes to tiny sponges. Unfortunately, the smallest of these items can occasionally be left behind in a patient unless every item is accounted for at the end of a procedure.

Retained surgical instruments left behind in a patient can lead to infections and other complications, greatly increasing the cost of care. If an item is unaccounted for at the end of a procedure, staff must locate it before the procedure can be completed, at a cost of approximately \$150 to \$400 per minute of clinical time.



FIGURE 2 XS TAGS CAN BE EMBEDDED IN SURGICAL TOOLS

The most frequently missing items are sponges or towels. The technical term for a retained surgical sponge is gossypiboma, and if the condition is not quickly identified and corrected, the items can form masses that are often mistaken for tumors.

In the Annals of Surgery 2008, Health Care Informatics reported that tool and sponge count mistakes occur in 12.5 percent of surgeries. Other estimates put the incidence rate at somewhere between one in every 1,000 surgeries, and one in every 5,000 surgeries.

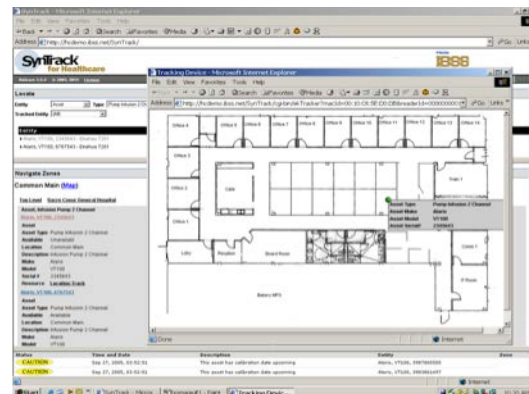


FIGURE 3: IBSS SYNTRACK FOR HEALTHCARE

With the advent of small, passive RFID tags such as Xerafy XS Series tags, most surgical items can be tagged and accounted for automatically. Using RFID, staff would no longer have to manually count tools before or after a procedure, and tools could be tracked through the disposal or the sterilization process to ensure every item has been properly sanitized after an operation.

Greenville Hospital System University Medical Center



RFID can also be used to ensure surgical items aren't lost after a procedure. Greenville Hospital System University Medical Center has deployed UHF RFID to help track expensive surgical instruments and other equipment to reduce loss and the time spent locating equipment.

Integrated Business Systems and Services (IBSS) and Jamison Door deployed a heavy-duty RFID portal for the OR linen cart exit to the laundry and decontamination rooms. The portal includes ThingMagic Mercury5 RFID readers and antennas to read RFID tags attached to the surgical instruments. The Xerafy tags, because of their small size, can attach to surgical instruments without interfering with the use of the tool.



FIGURE 4 MINIMALLY INVASIVE SURGERY

The problem was probes were typically lost within bundles of bed linens and scrubs. Now, if a probe or other instrument is read by the portal, an audible alarm lets the OR attendant know to locate and retrieve the device. The hospital reports that no devices have been lost since the RFID system went live, and return on investment was expected within one year. The hospital is also in the process of tracking 5,000 mobile medical assets.

A Different Type of Navigation

We typically think of navigation technology as the GPS device in your car that provides driving directions. However, a different type of navigation helps precisely position instruments during minimally invasive, computer-assisted surgical procedures, such as orthopedic surgery, spinal surgery, neurosurgical procedures, and some ear/nose/throat procedures. Right now, surgeons rely on optical and electromagnetic systems to position instruments in real-time.

Researchers in Germany at Amedo Smart Tracking Solutions GmbH, Bochum, Germany, are testing a system that uses passive UHF-RFID transponders for tracking and accurate surgical navigation of various medical devices, providing millimeter-scale precision at a much lower cost compared to current technologies.

Surgical procedures that use navigation technology result in better outcomes and fewer complications; RFID provides a more cost-effective and accurate way to accomplish this, with technology that is much easier to use for clinicians.

RFID has also been used for patient tracking in the field of image guided radio therapy (IGRT) treating cancer patients; RFID tags are placed on the patient to detect if they have moved out of the safety range of the radiation beam. This type of tracking can help prevent destruction of healthy tissue (particularly brain tissue) during these complex procedures.

Xerafy XS Tags

Xerafy has developed a family of small, durable UHF passive RFID tags that can be used to track surgical instruments in an operating theater.



The Xerafy Dash XS tag (15mm x 3mm x 1.5 mm) and Dot XS round tag (6mm x 2mm) have a read range of approximately 2 to 3 meters.

The extremely low profile and ability of Xerafy's XS tags to be embedded in metal allows surgical tools such as scalpels and scissors to be RFID-enabled at the point of manufacture.

Use of these types of tags during surgical procedures could improve the efficiency and accuracy of tool tracking by eliminating the manual counting process. By doing so, patient safety would be significantly improved.

The XS Series is designed to comply with the most stringent FDA requirements for to CPG Sec. 400.210 for RFID use and ISO-10993 for Biocompatibility and FCC compliance to Part 15.231a. The tags are rugged and will withstand 1000 repeated autoclave sterilization cycles.

Conclusion

Hospitals and other medical facilities are under tremendous pressure to improve patient safety and health outcomes, while at the same time attempting to cut costs and increase productivity. RFID has a proven track record of improving efficiency and productivity at hospitals in asset tracking, patient tracking, security, specimen tracking, and medication management applications. Now, passive RFID can further promote patient safety and improve outcomes by helping hospitals manage surgical tools, tracking the use and sterilization of equipment, and even guiding surgeons during complex procedures.

About Xerafy

Xerafy is committed to bringing our customers the world's smallest and most reliable passive UHF RFID-On-Metal (ROM) and iN metal tags that are qualified and tested to meet extreme conditions over the lifetime of the asset. Xerafy's innovative technology offers the industrial, manufacturing, defense, IT, and supply chain markets, an affordable, durable, high temperature smart tag that can be easily attached to or embedded to metal assets. Xerafy enables packaging solutions for automatic check-in / check-out tools, work in progress, IT auditing, product authentication and asset management with a competitive advantage in size, cost, design, quality, and performance of tags. Xerafy is headquartered in Hong Kong, and maintains sales and support offices in Dallas, Texas, Maryland and in Shanghai, China.

Contact Us

For more information on RFID tag applications, product overviews or any other questions, please visit Xerafy, www.xerafy.com.