A primer on RFID and RTLS technologies for healthcare facilities

December 2012 / White paper

by Steve Nibbelink, CHPA
Table of contents

Executive summary........................................................................................................3
Enhancing patient care and safety with RFID and RTLS.................................4
What is RFID?..............................................................................................................4
What is RTLS? ............................................................................................................4
A real simple definition...............................................................................................5
RFID and RTLS usage in healthcare facilities .....................................................5
RFID and RTLS in action............................................................................................6
A step-by-step process for successful RFID and RTLS implementations........8
The components of the technology........................................................................9
Healthcare-specific applications.............................................................................9
Conclusion..................................................................................................................10
References...................................................................................................................10
Executive summary

As healthcare facilities continue to grow, they are challenged with the need to care for an increased number of patients and manage the acuity of those patients’ medical challenges, all while trying to save money and resources.

One of the primary responsibilities and mission of any healthcare organization is to ensure patient safety and quality care. Security and safety teams, recruitment, training and education of personnel, policies, and procedures, as well as technology tools and solutions are all designed to help the patients, visitors, and staff at healthcare facilities.

For instance, in a hospital, you’ll find support for the organization’s life-saving mission — with machines available to perform most any task to enable the caregivers and promote a healthy patient outcome.

This white paper will look at the specific use of RFID and RTLS technologies in healthcare settings. These technologies are used to ensure safety and security for the most vulnerable of patients, such as infants, elderly, and those with mental illness. We will define both technologies and their similarities and differences, use cases, and benefits to individuals, as well as the healthcare organization as a whole.
Enhancing patient care and safety with RFID and RTLS

To provide better care and increased safety, organizations are now taking advantage of evolving new technology-based solutions such as the application of radio frequency identification (RFID) and real-time location systems (RTLS). These technologies provide healthcare facilities with the ability to identify, locate, track, and monitor patients, visitors, staff, assets, and equipment. Using radio waves, RFID and RTLS are able to locate and identify items and people that have “tags.” Tags range from simple adhesive stripes to more complex devices incorporating radios and soft clients.

The placement of RFID and RTLS in the healthcare environment is still in its infancy. In fact, North America currently leads the world in adoption of these technologies, but these systems are only installed in an estimated 15% of North American healthcare facilities. With these new technologies, healthcare security leaders can add one more solution to their toolbox to help promote a safe and secure environment for their patients, visitors, and staff.

What is RFID?

RFID helps hospitals identify objects, locations, and people through the remote use of radio waves. Simple RFID devices use an identification system, such as serial numbers to track and manage objects. Other more sophisticated RFID systems, such as the kind used in operating systems, have built-in sensors that communicate data on location, as well as other data, including environmental conditions, for identification purposes.

In either case, there is a wireless, non-contact system that uses radio frequency fields to transfer data from a tag attached to or embedded in an object that automatically identifies and tracks that object.

What is RTLS?

Extending the benefits of RFID, RTLS is used to identify and track the locations of objects and people in real time, typically within a building or other contained area. The RTLS physical layer is usually some form of radio frequency, but some systems use optical (infrared) or acoustic (ultrasound) technology instead of or in addition to radio frequency. RTLS provides real-time tracking location of people and physical assets with more precision, higher granularity, and greater level of accuracy than RFID or other identification systems.

RTLS uses active or passive transponders (also known as tags) and readers to identify and locate assets, equipment, patients, and staff. In systems with passive tags, the RTLS transponder has no power source and cannot broadcast a signal. Systems with active tags have transponders with power sources that broadcast a location signal to the reader. The readers are sometimes referred to as interrogators, because they collect, interpret, and transmit data.
RTLS also has a software component that manages the application, providing information on the status of tags that are attached to the assets, equipment, patients, and staff. The software also shares information with other security, safety, building management, and power control solutions within the facility. RTLS also uses middleware to interpret, filter, and sort the data. Additionally, these systems can generate reliable and effective data to improve safety, security, and hospital efficiency, with a quick and documented return on investment.

A real simple definition

- RFID typically uses “passive” tags, which means a scanner or reader is needed to get the information from the tag.
- RTLS typically uses “active” tags, which means there is a radio in the tags that remotely transmits its location to the system.

RFID and RTLS usage in healthcare facilities

As organizations continually work to provide better and more efficient healthcare to their patients, there are a variety of applications of RFID and RTLS technologies that can add value throughout a healthcare facility.

Patient and staff safety—RFID and RTLS improve safety by preventing patient elopement through integration with access control, video surveillance, and other electronic security and building technology. Not only is there increased patient and staff safety, but in many cases, facilities are also realizing lower insurance costs. Typical RFID and RTLS applications in this area include access control, emergency response, infant protection, patient management, and enhanced video surveillance.

Hospital efficiency—Facilities can also streamline and improve the quality of patient care by increasing efficiencies through reduced time and costs spent in locating assets, equipment, patients, and staff. Hospitals can implement RFID and RTLS applications for asset and equipment tracking and utilization, inventory and laundry management, and loss prevention.

Hospital finance—With RFID and RTLS, organizations experience less theft, and equipment hoarding, as well as reduced rental and “late return” fees for important hospital equipment. Improved asset and equipment visibility leads to improved utilization and often results in a ROI of less than a year, especially for the RTLS technology. Applications in this area include anti-counterfeiting, product authorization, and bed and operating room management.
Patient satisfaction—Providing the very best in care and customer service to the patients, visitors, and staff improves patient experience and outcome. Hospitals that use an RTLS will often find that their Press Ganey scores, a common measure of patient satisfaction, increase because of the benefits of the technology.

RFID and RTLS in action

The scenario below highlights specific cases in which RFID and RTLS could be used to enhance healthcare applications and the patient experience during outpatient surgery at a hospital.

7AM—A patient arrives at the hospital for outpatient surgery and receives a patient identification tag. The patient’s wife also receives a visitor tag. Now, both the patient and his spouse are identified in the hospital information and security systems.

8AM—The patient enters the surgical pre-op area to meet the medical team and prepare for surgery. At this time, medical devices (assets) in the patient’s room are aligned with his patient number so an accurate assessment of available technology is readily available and any charges for the use and application of equipment or medical supplies can be applied to the patient’s chart and billing.

9AM—The patient enters the operating room for his procedure and his wife enters the waiting room where she can monitor his status through the hospital’s automated messaging system. She can monitor and receive this information throughout the hospital complex. In the operating room, all of the technology is assigned to the patient, and the billing system accumulates the usage information for insurance and medical reports. Meanwhile, the inventory system analyzes the usage data for re-ordering, when available supplies dip below a set threshold point.

10AM—The patient’s surgery is complete and he is sent to the recovery room while his wife is located through the system and notified that she can now join him.

11AM—The patient is ready for discharge from the recovery area. The system accumulates the final data for the insurance, billing, and medical reports, the patient summary and discharge report, and the medical equipment/supply usage report. The nurse collects the patient and visitor tags from the family and they leave the hospital.

The RFID and RTLS solution above is used to identify, locate, monitor, and track all information pertaining the patient’s hospital visit. It is designed to improve hospital efficiency and patient satisfaction, reduce costs, and above all protect the patient and his spouse.
This advanced use case integrates RFID and RTLS with the hospital’s access control, video surveillance, alarm systems, building management, inventory management, information systems, Wi-Fi infrastructure, and other sub-systems to:

- Identify medical technology, equipment, and supplies by treatment zone (in this case: the pre-op, the operating room, the post-op and the recovery zones) and match them with the patient and the planned procedure.
- Provide immediate information on the patient, his wife, and any visitors and staff in case of an adverse event.
- Provide the proper environmental and power requirements for the planned procedure, as well as specific requirements of the medical and clinical caregivers.

The solution can be further highlighted by two functions:

- **Assets**—it knows where the assets are to increase utilization, ROI, control, and compliance.
- **People**—it knows where the people are to provide a safe, secure, and welcoming environment.
A step-by-step process for successful RFID and RTLS implementations

Almost every hospital security and safety team wants to create an identifiable and repeatable process that protects patients, staff, and visitors while improving care. Like many solutions, such a process is critical to the successful design and installation of RFID or RTLS technology. Below is a four-step process designed to help healthcare security leaders successfully implement RFID and RTLS.

1. Identify key issues and objectives. The first step is for your organization to clearly identify and define the security and safety issues you are experiencing and what you hope to achieve with the installation of this solution. While this sounds simple, getting your organization to agree on these fundamental concepts can be daunting. To design a successful solution, however, it is important to gain acceptance and compliance from all key areas of the hospital that will be affected. Therefore, the team spearheading this process must analyze both the issues and intended outcomes for each of the affected workgroups to develop the best possible solution and implementation.

2. Plan carefully. A site survey and Wi-Fi network planning are to a successful implementation. Consultants can analyze the Wi-Fi network in place for the strength of signals, interference, and need for more focused and finite read ranges. Executing this step carefully will help ensure the best installation and optimal use of the system to meet intended goals.

3. Set clear expectations. The next step involves setting clear expectations as to the solution performance and output. At this point, services from any integrator or vendor involved in the process should be well documented and agreed upon before the work proceeds. This step helps avoid assumptions during the planning, design, and installation phases.

4. Incorporate training. Users of the new solution must commit and participate in the training of the technology to achieve the best system performance and highest potential expected outcome. It is vital to the process that the users have a comprehensive understanding of the issues and the value the solution brings to the healthcare organization.
The components of the technology

The design and installation of RFID and RTLS involves several technological components, including:

- **Transponder**—often referred to as the “tag.”
- **Reader**—sometimes called an interrogator, is a computer for interpretation and transmission of data.
- **Antenna**—for the transponder and the reader—either internal or external.
- **Middleware**—software that supports the solution, interpreting and filtering (sorting) the data for the control solution.
- **Software**—in a variety of formats, which manage the application, provide data to the end-user and communicate with other safety, security, building management and power control solutions.

Healthcare-specific applications

As healthcare organizations continually work to provide better and more efficient healthcare to their patients, RFID and RTLS can assist in a variety of applications to help streamline processes, reduce human error, and speed billing times. The applications include: ¹

- Access control-enhanced
- Anti-counterfeiting / product authentication
- Asset and equipment tracking / utilization
- Bed / operating room management
- Document / file management
- Emergency response
- Environmental conditions monitoring
- Expiration date monitoring
- Hand sanitization monitoring
- Infant protection
- Inventory management
- Laundry management
- Loss prevention
- Patient management
- Specimen tracking
- Staff management
- Surgical sponge tracking
- Video surveillance-enhanced

Conclusion

Hospitals and other healthcare facilities are dedicated to patient care. The utilization of RFID and RTLS in the healthcare setting can provide advanced and comprehensive solutions that protect and safeguard patients, visitors, staff, assets, and equipment, as well as provide your facility with a measurable ROI.

The integration to current and future solution tools can provide healthcare security, IT, facilities, and clinical leaders with a seamless information flow for financial and operational decision making—all while supporting the life saving mission of the healthcare facility.

References

Ekahau.

