Real Time Location System
Refrigeration & Equipment Tracking

Application for 2011 University of California Larry L. Sautter
Award for Innovation in Information Technology
–
University of California Davis Health System

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Project Information

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Project Name

Real Time Location System Refrigeration & Equipment Tracking

Submitter

Jim Gunn, Business Continuity Planner, Security & Emergency Preparedness
University of California Davis Health System
2315 Stockton Blvd. Sacramento, CA. 95817
Phone: 916-734-7091
Fax: 916-734-7309
Email: james.gunn@ucdmc.ucdavis.edu

Project Leads & Team Members

Glynis Foulk, CIH, Emergency Preparedness & Security Administrator, UCDHS
Jim Gunn, Business Continuity Planner, Security & Emergency Preparedness, UCDHS
Sylvia Wong, Pharm.D., Medication Security Pharmacist, UCDHS
Chamayo Yniguez, Food Service Manager, Food and Nutrition Services, UCDHS

Department Partnership

Center For Health & Technology	Patient Care Services
Food and Nutrition Services	Perioperative Services
Emergency Department	Pharmacy
Information Technology	Radiology

Executive Sponsors

Jerrold Bushberg, PhD – Director EH&S, Security, & Emergency Preparedness
Judie Boehmer RN, MN - Assistant Director, Hospital & Clinics, UCDHS
Marty Gothard, Manager - Food and Nutrition Services, UCDHS
John Grubbs, MS, MBA, RPh – Director of Pharmacy, UCDHS

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Project Description

Healthcare organizations face a variety of challenges, including increasing financial pressure, regulatory mandates, an ongoing need for improved use of staff time, and patient and staff safety concerns. Many of the problems which contribute to these challenges share a common cause--a lack of "visibility" into the real-time location, status and condition of patients, staff, medical equipment and other mobile assets.

Real time locating system brings much-needed solutions to these challenges, increasing visibility within the hospital and delivering the tools to drive operational efficiency. Real Time Location System (RTLS) for refrigeration and equipment tracking is accomplished using Radio Frequency Identification (RFID) technology.

RFID technology was initially evaluated and tested at UC Davis Medical Center in the Emergency Surge Capacity and Partnership Effort (ESCAPE) grant, which was funded by the U.S. Department of Health and Human Services. The grant piloted technologies to enhance the tracking of critical medical resources and equipment that would be needed in the event of a disaster. For the purposes of the grant, a real time locating system utilizing RFID technology was selected to expedite counting and locating available resources. Center for Health & Technology was the grant administrator. UCDMC, two remote rural hospitals and two ambulances were equipped with RFID tags as a proof of concept. On January 31, 2010 the period of performance for the ESCAPE grant ended.

Using the experience gained from the ESCAPE success, a multi phased RFID expansion was initiated within UCDMC to address 2 pressing issues, to achieve compliance with refrigeration temperature monitoring and to expedite locating a broad range of medical equipment throughout the hospital. Phase 1 extended automated temperature monitoring to all pharmacy, patient nourishment and dietary refrigerators. Phase 2 extended location tracking to medical equipment throughout the main hospital.

As of May 2011, 800 medical equipment assets and 235 refrigeration temperatures are being tracked in the 1,667,000 sq. ft. main hospital.

Types of Medical Equipment Tracked	
Wheelchairs & Gurneys	Patient Monitors & Defibrillators
Portable Imaging Equipment.	Ventilators
Surgical Equipment	Light Sources & Lasers
IV Poles	Distribution Carts

Key Areas of Benefit

- Patient quality of care
  Improved quality of care through constant monitoring of safe temperature ranges (medications/patient nourishment) and analysis of logged data to identify trends.

- Compliance
  Improved regulatory compliance with temperature data collection requirements (California Department of Public Health and Title 22 CCR and Sacramento County health code).

- Improves operational efficiency
  Increased staff efficiency by automating equipment searches and temperature monitoring. Enable departments to manage assets and temperature using single solution.

- Cost Savings
  Reduce waste of medication and food supplies due to out of range refrigeration temperatures. Substantially reduce labor requirements to manually monitor refrigeration temperatures and to quickly locate medical equipment. Theft and loss reduction through real-time asset tracking and alerting (an unintended benefit).

- Innovation
  Leverages existing Wi-Fi infrastructure eliminating the need to install a separate wireless network. RFID tags utilize network bandwidth efficiently and will not impact other Wi-Fi devices. RTLS can be used by other departments within the medical campus. No additional infrastructure is required.

Success Criteria

Criteria	Goal	Actual
Improved regulatory compliance for all medication & patient nourishment temperature monitoring.	Automate temperature event/alert process. Utilize electronic corrective actions log.	100% compliance achieved.
Improve quality of care by increased monitoring of safe temperature ranges.	Increase the twice daily monitoring (2.7%) to continuous.	100% (continuous monitoring)
Reduce time for staff to locate medical equipment in the main hospital.	50% reduction.	95% reduction.

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Temperature Monitoring Workflow

Pharmacy Refrigerators Old Workflow	Pharmacy Refrigerators New Workflow
Department Steps: (no audible alarms) 1) Nurses are required to manually monitor unit refrigerators twice a day. 2) A log sheet is used for each refrigerator. 3) Date, time, minimum/maximum temperatures, and employee's name are recorded. 4) Temperature data is cleared for next reporting period. 5) If refrigerator is out of range, a corrective action is also documented. **Department Steps: (audible alarms)** 1) Unit refrigerators equipped with audible alarm thermometers with staff present at all times do not require logging of temperature. An audible alarm thermometer is programmed to alarm when temperature is out of range. 2) Corrective action is done by nursing. 3) When refrigerator temperature is back in range, the alarm is turned on.	**Department Steps:** 1) RTLS monitors refrigerator temperatures continuously. 2) A text message alert is sent to the pharmacist's on call pager and/or cell phone. A duplicate alert is sent to an email account as backup. 3) The pharmacist or pharmacy technician inspects the refrigerator. 4) The pharmacist enters a corrective action using the RTLS web portal—accessible from any computer on the UCDHS network.
Dietary Old Workflow	Dietary New Workflow
Department Steps: 1) Nurses are required to manually monitor unit refrigerators twice a day. 2) A log sheet is used for each refrigerator. 3) Date, time, minimum/maximum temperatures, and employee's name are recorded. 4) If refrigerator is out of range, a corrective action is also documented. 5) Corrective action is done by nursing.	**Department Steps:** 1) RTLS monitors refrigerators continuously. 2) An e-mail alert is sent to the designated Department Manager on call cell phone. A duplicate alert is sent to an email account as backup. 3) The department Manager communicates the alert to the nursing floor. The nursing floor takes the appropriate corrective action. 4) The Nutrition Services Manager enters a corrective action using the RTLS web portal—accessible from any computer on the UCDHS network.

Equipment Tracking Workflow

Old Workflow	New Workflow
1) At the start of each shift, a unit staff member will roam the hospital searching for medical equipment. Depending on the unit and type of equipment a search can take from 30 to 90 minutes. 2) Located equipment is returned to its home unit for redeployment to various areas of the hospital as needed.	1) Unit staff access the RTLS via any computer to locate equipment as needed. Search time about 1 minute. Some units are notified by text/email messaging when equipment leaves their unit for a specified amount of time.

Technology

RFID tags are small wireless devices that are attached to assets to track their location. Each tag sends a small, unique, wireless signal, allowing the RTLS software to recognize the specific tag and its movements. The tags have a battery (replaceable) life of up to four years and include a call button, temperature/humidity sensing capabilities, tamper sensing and motion detection. Moreover, any Wi-Fi devices such as laptops or Wi-Fi enabled medical devices can be tracked without a tag or any software client installed.
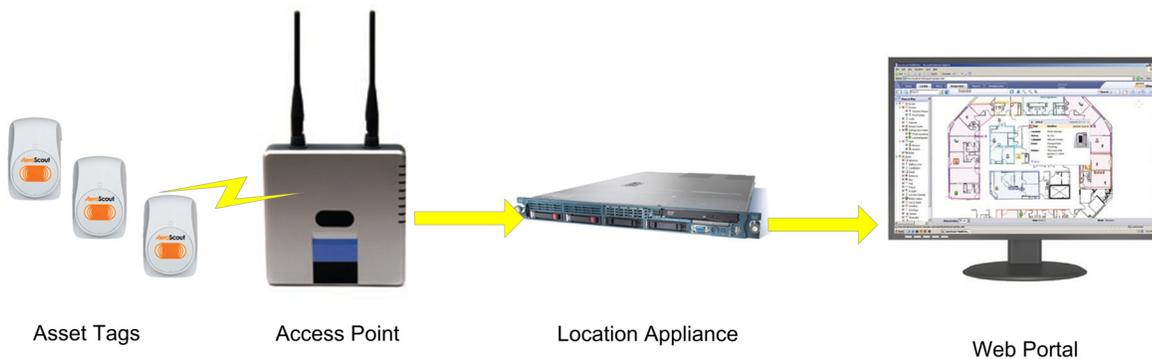

Infrastructure

Standard Wi-Fi access points receive all RFID tag transmissions and forward those to an appliance called the location engine. The location engine determines accurate location of each asset and stores this information along with telemetry data in an SQL database. This allows our hospital to use the existing Wi-Fi network for real-time visibility.

Software

The RTLS utilizes a Web-based portal allowing users to view, locate and check status on assets being tracked. The Web application includes searching capabilities, rules-based alerts, and advanced reporting. Message alerts have been customized using XML. The web portal is accessible from any web browser anywhere on the health system network.

Asset Tags   Access Point   Location Appliance   Web Portal

Timeframe of Implementation

Having Wi-Fi infrastructure already in place greatly accelerated Phase I & II implementation.

Item	Timeframe
Web portal XML customization	January 2010 to February 2010
Phase I Temperature tag testing & deployment	March 2010 to May 2010
Phase II Medical equipment tag testing and deployment	June 30, 2010 to September 2010

Objective End User Data

From our standpoint it's really allowed us to get through the last two hospital/pharmacy surveys without problems. From a safety standpoint, we've identified problems with refrigerators that we didn't know had problems prior to implementing this system. It's also saving a lot of time for staff who previously were logging temperatures--overall it's a big improvement.

Pharmacy Manager

An out of temperature range refrigerator may be quickly detected by the use of this technology before any harm to the medications may occur. Some medications are very expensive and temperature fragile, this may result in thousands of dollars in savings. The use of this technology has not only increased patient safety but has improved quality of care.

Our Investigational Drug Service department found that they may quickly produce a refrigerator/freezer temperature history log when requested by a sponsor. In the past, they would have to dig through pages and pages of documentation to find the data that they were looking for. This greatly improves efficiency.

Medication Security Pharmacist

The RTLS program in the post anesthesia care unit has been very helpful. In the past we had to send people on "treasure hunts" looking for our equipment. They would have to go to almost 20 different nursing units. Now we only search as needed and have a very specific location to start in. So even if the equipment is hiding it doesn't take long to locate. Great for saving time and improving staff satisfaction!
Thanks,

Manager Preoperative & Post Anesthesia Care Unit

RTLS - The Future

From the beginning of this project it was clear that there are many other uses for a real time locating system. Several possibilities are being explored. We foresee expansion of RTLS into the following areas tracking upwards of 3000 assets.

- Asset Management – automated inventory management, par level management.

- The use of autoclave tags to allow tracking of medical equipment that requires routine sterilization.

- Equipment Maintenance – Automates manual processes that we have for locating equipment requiring preventive maintenance, repair or recall.

- Patient Elopement - Tracking patients throughout the hospital and alerting staff when a patient exits a wing or room.

- RTLS integration into our nurse-call system to detect staff presence in patient rooms and automate processes.