Keeping Track of Surgical Instruments

John Lewis

The Project: Effectively read a 2D Data Matrix barcode off surgical instruments that differ in terms of reflectivity and shape.

The Solution: Use an ID reader that employs an innovative combination of lighting, software, and optics to achieve success.

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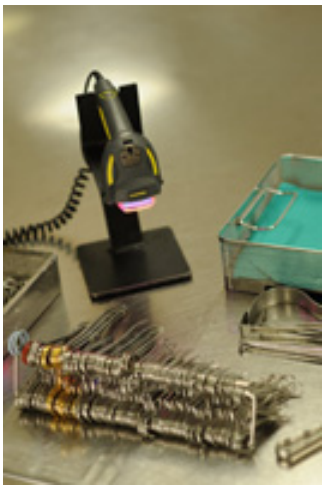
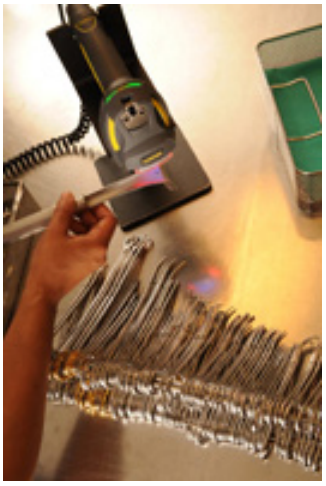


Assembling accurate sets of instruments for the many different types of surgery performed in a typical hospital is a time-consuming and difficult manual task at most hospitals. Technicians in the central sterile department typically wash instruments, re-assemble them into sets based on pick lists provided by surgeons, and sterilize them so they are ready for the next day's surgery. The problem is that when surgeons open the kit the next day, instruments may be missing and it may be necessary to delay surgery while technicians race around looking for them.

Censis has developed a software product called Censitrac that allows hospitals to set up surgical set pick lists and then ensures that the correct instruments are loaded into surgical sets. A 2D Data Matrix barcode is electrochemically applied to each instrument and this barcode is scanned during the assembly process to ensure accurate set assembly and track the location of every instrument. The challenge is that it is very difficult to read a barcode on the shiny surface of a surgical instrument. Censis went through five different generations of ID readers before it found one, the Cognex DataMan 7500, that provides the accuracy, speed, and ease of use required by this critical application.

The Surgical Set Assembly Challenge



“In the past we assembled instruments based on a document that we called a count sheet,” said Pat Stefanik, registered nurse and central sterile manager at Saint Thomas Hospital, Nashville, TN. “This task was complicated by the wide range of individual preferences among the different surgeons and by the large number of non-traditional instruments that are used by our surgeons. For example, some like all their curettes together and all their scissors together while others want all the ringed instruments together. The result was that the relationship between Central Sterile and Surgical was not as good as it should have been. An instrument would turn up missing and the first thought was that Central Sterile had made a mistake.”

“There are many problems with the traditional approach of using count sheets,” said Janice Hardrath, chief technology officer for Censis. “Count sheets are often produced on a spreadsheet and then photocopied. When the list changes, it is difficult to retrieve all of the old incorrect paper lists and replace them with accurate information. The biggest problem comes when surgical sets reach the OR with incorrect instruments or instruments missing. This often causes delays in the OR, risks to the outcomes of the surgical procedures, and dissatisfied surgeons.”

Another problem with the old approach is that there is no way to identify or document instruments or track their movements. In the event of a biological test problem with a sterilizer load, the hospital needs to know exactly which instruments were in the load and their current location. This is difficult with the conventional approach because it is necessary to rely upon handwritten notes and the memory of the person who assembled the set. Hospitals often lose large numbers of instruments and spend considerable amounts of money for replacements. Maintenance is also supposed to be performed on instruments after a certain number of uses but with the manual system, there’s no way to know how often each instrument is used so instruments are often over- or under-maintained.

An Innovative Solution

The founders of Censis developed the concept of putting a bar code on each instrument and maintaining the pick list within a software package. The technician assembling the kit then scans in each instrument and the software ensures that all of the proper instruments are in the kit. The process of marking the instruments and then accurately reading that mark has proved to be the most difficult part of the entire concept. “We started out using a laser to etch the instruments, then went to an adhesive label with a 2D Data Matrix barcode,” Hardrath said. It was difficult to keep the adhesive working during wash and sterilization so Censis tried laser bonding the label. Finally, the company went to an electrochemical marking technique that applies a 3.0 mm Data Matrix barcode. This marking method has been demonstrated to provide the durability and readability needed to stand up to surgery, washing, and sterilization.

Finding the Right ID Reader

Finding the right ID reader has also been a challenge. “We went through five different generations of scanners,” Hardrath said. “Each generation was better than the previous one, yet only the latest generation has met our requirements in terms of reading the mark quickly and reliably.” The instruments are typically a silvery metal, normally either stainless steel or aluminum. Some have a matte surface while others have a mirror surface. Some instruments are flat and others are curved. The reflectivity of the surface makes it difficult to form a good image of the mark.

Generally, the scanners that Censis has tried in the past were able to read the marks by using algorithms that account for the reflectivity of the surface. The problem is that the scanning and computation took too long. When delays occurred, technicians typically pulled the instrument away and started over again or went back to the previous manual methods. The best results are achieved by moving the instrument slowly from one side to the others so that the scanner can view the mark from different angles and apply algorithms to account for the reflectivity.

Hardrath set up what she called a scan-off competition to find the best possible vision system for the job. “I put together an assortment of 30 different instruments of various types including curved, flat, shiny, matte, colored, and uncolored. I lined up three of the preferred models on the market, including the Cognex DataMan 7500. We asked a number of different people to scan each of the instruments. Then we measured the results, the amount of time required to scan each instrument, and the reaction of the people participating to each scanner.”

“The Cognex DataMan 7500 was noticeably superior to the other devices,” Hardrath said. “Most of the people that did the scanning commented that it was faster and easier to get a good scan with this ID reader. So we made the decision to exclusively offer the Cognex instrument with Censitrac. We now have 250 DataMan 7500 scanners out in the field. The average hospital has five of these scanners and the largest has 30. Our customers love them. Most have decided to replace their earlier generation scanners with the new Cognex units.”

Cognex DataMan 7500 series ID readers achieve their unique capabilities with an innovative combination of lighting, software, and optics. These ID readers incorporate software that handles a wide range of degradations to the appearance of the code. DataMan readers can illuminate marks of any type on any surface. The integrated diffuser provides soft illumination required for highly reflective parts such as electrochemical etched marks on shiny round surfaces. The unit is the first to offer a handheld verification solution that meets the requirements of the Association for Automatic Identification and Mobility (AIM) 2D Data Matrix code quality grading requirements.

Censitrac overcomes the problems associated with manual methods of tracking instruments and automated methods that track the set rather than the individual instrument. The software automates the set assembly process to ensure 100% accurate assembly and automatically tracks the movement of each instrument, whether it is in a set or in loose inventory. This makes it easy to locate any instrument immediately. Censitrac measures instrument usage, including which instruments in sets were used in procedures and which were not and determines exactly when maintenance is due.

Major Improvements at Saint Thomas Hospital

“From the first day that we started using Censitrac, we saw a substantial reduction in the number of errors,” Stefanik said. “Just as important, we now know where every instrument set is located. Sometimes the OR will call and say that an instrument is missing. In most cases, I will look it up in Censitrac and discover that it was scanned and put into the set that was sent to the OR. I will let the OR know and in most cases, they will look around and find it in the OR. If not, we will scan and send them up a replacement without wasting time looking for the one that was already placed into the set.”

“We saw a major improvement when Censis upgraded us to the Cognex DataMan 7500 series handheld ID readers,” Stefanik added. “The first two scanners that we used were stationary and we had to run the instrument under them which was somewhat awkward. The DataMan 7500, on the other hand, is portable so we can move it over multiple instruments at a time, which saves time. The DataMan scanner is much faster than others we have used and the accuracy of the instrument is 100%. The DataMan scanner is also the most rugged we have seen. In the past, we were breaking them right and left but as far as I know, we have never broken a Cognex scanner.”

Online

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