

ASSIST - Automated System for Surgical Instrument and Sponge Tracking

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THE CISST ERC, THE JHU DEPARTMENT OF SURGERY, the JHU School of Engineering, and the JHU Applied Physics Laboratory are collaborating to develop a system that automates the error-prone manual counting procedure used during surgery to ensure that no surgical item is left inside a patient. Our immediate goal is to develop a prototype that can serve as proof of concept.

A dangerous medical error that can occur during

couple of minutes, with at least three counts per surgical procedure, taking up a significant portion of a nurse's time during surgery. When a miscount is found there is a significant increase in the OR time since an x-ray of the patient is often required.

We are developing ASSIST, an automated system for surgical instrument and sponge tracking that increases the safety of surgical procedures. ASSIST uses Radio Frequency Identification (RFID) technology to detect and identify each surgical item at various stages during surgery. The use of low frequency RFID enables reliable detection of tags even when in the vicinity of metallic objects such as surgical tools, soaked in body fluids, or inside a patient's body. A check-in station verifies the content of the package and registers each tagged item in an inventory database, and a check-out station uses a smart bucket, where the used sponges are discarded, to account for used sponges (Fig. A3).

At the time of writing (June, 2008), we have a fully working prototype of ASSIST. Our initial investigation shows that the system can account for 100% of tagged sponges during surgery. This high level of reliability is attained by RFID verification at a check-in station, and detecting used sponges with multiple orthogonal antennas at a check-out kick-bucket. The measured check-in time for a ten-sponge packet is just two seconds, while regular check-out time is between one to five seconds. Preliminary tests also show that we can reliably detect missing sponges inside in vivo porcine model.

An abstract of the system was presented at a medical conference, a full paper was presented at an academic conference, and a utility patent was filed to the USPTO. Future endeavors aim to develop a system for detecting every type of surgical instrument that can be retained in a surgical procedure. We plan to continue to assess the technology and partner with the appropriate external entities that can quickly bring ASSIST to the OR.

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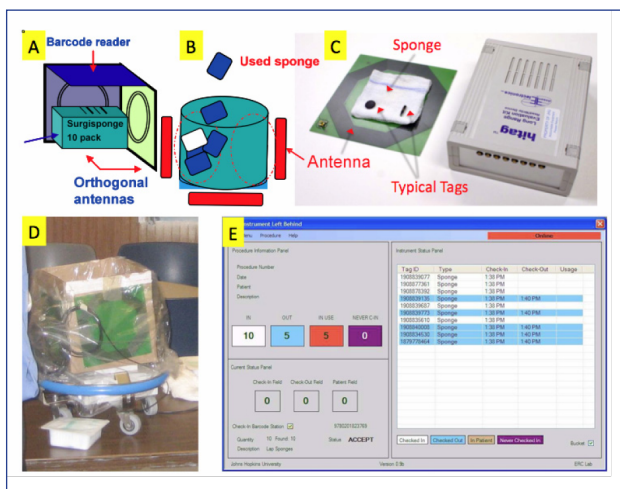


Fig. A3: ASSIST System -- A) check in station; B) bucket; C) RFID components and sponge; D) current prototype kick bucket; E) intraoperative display.

surgery is unintentionally leaving a surgical instrument or sponge inside a patient. Commonly known as a “retained foreign object,” this error can lead to inflammation, obstruction, perforation, sepsis, and sometimes death. The problem is thought to be avoidable when stringent manual counting guidelines are followed by Operating Room (OR) personnel. While these guidelines are very effective in reducing the risk, the problem persists. Some estimates report that the incidence can be as high as one in 1500 surgeries.

Human error is not the only drawback of manual counting. During sponge counting, nurses are unable to provide support for the surgeon as they focus on accurately counting sponges. Each sponge count lasts a