NO TOOL LEFT BEHIND

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BACKGROUND

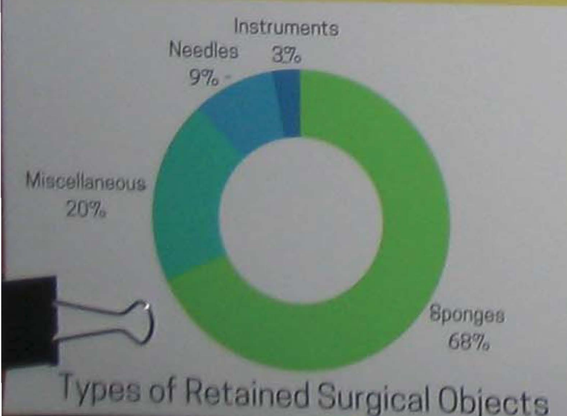
Our aim is to design a device that tackles the issue of surgical tools being left behind in a patient's bodyafter an operation. Such objects are referred to as Retained Foreign Objects (RFO).

Unintentionally retained surgically placed foreign bodies have been associated with increased morbidity and mortality, as well as increased costs and medicolegal consequences.

Hence the need to develop a technology that can detect RFO's arises, since there is no room for error. Small pieces of magnets are attached to a surgical sponge (RFO). The magnets will help detect the sponges if they are left behind. by wrapping two mats around the patient securing them using a safety strap.

The tiles on the mats have magnetometers that detect the presence of the sponge in the patient's body. Two readings are taken using the mats. The first one is taken before the operation and the second one, after.

This allows us to measure the change in the earth's magnetic field by comparing the two readings. The data is sent to a smartphone device where the heat maps are generated and compared to pinpoint the location of the sponges.



Types of Retained Surgical Objects

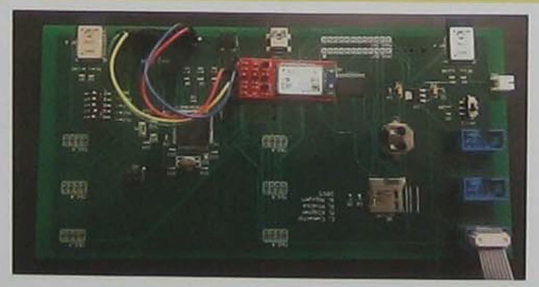
HARDWARE

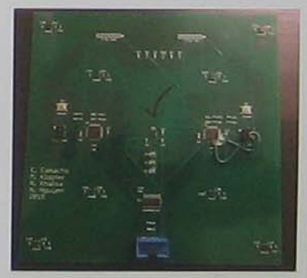
The hardware design consists of 10 Printed Circuit Boards (PCB). A MAT (Magnet Array Tile-Set) will be fabricated which will have four "tiles" on each side and two "hubs."

Each tile has 8 magnetometers which is used to detect a deviation from the earth's natural magnetic field. It also has an accelerometer which will be used for tilt correction.

The tiles then communicate with the hub through Serial Peripheral Interface (SPI) protocol, to transmit its detection of disturbances.

The hub has a Bluetooth module attached to transfer the data to an Android device in order to plot graphical visuals, called "heat-maps," (as shown in the figure below) that help pinpoint the location of the tool retained.t





SOFTWARE

For this project we have developed on an easy solution to send the data collected by the MAT to an Android smart-device.
In the software side, a dialect of a communication protocol known as MAVLink, which is commonly used on small UAV's, has been implemented. The android application plots the heat-maps in real time so that pinpointing the retained surgical tool is easier even when the MAT is not static. The application also includes a function for tilt correction which uses the data from the tiles' accelerometers. The heat-maps are plotted after tilt-correction in order to make sure the determination of the location of the retained object is as accurate as possible. The application also permits taking screenshots of the heat-map plots for the purpose of future analysis and research.

FABRICATION

There are two mats which contain 4 tiles and a hub each. The tiles are placed in a 2X2 square and the hub is placed to the side. For the mat to be placed on the bottom of the patient we used a gel cushion wheelchair seat and for the mat on top of the patient we used a yoga mat. Two pairs of belts were used to ensure that the mat could be secured around the patient's body. We used Velcro safety straps to secure each tile and the hub. The Velcro were used to ensure that tiles could be easily accessed in case of any damage.
Each tile is connected to their respective hubs.

FUTURE IMPACT

The impact this project can have on the future is tremendous. The Washington Post, estimated in 2014 that surgical tools are left behind in on in every 5500 to 7000 surgical procedures performed in 2010, according to the National Center for Health Statistics. Thus, the project can prevent thousands of casualties. This not only helps the patient remain healthy but also saves cost for future treatments and procedures caused by the RTO.

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