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ROBOTICALLY ASSISTED PEDIATRIC COCHLEAR IMPLANT SURGERY

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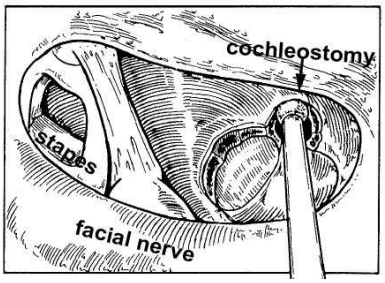
Medical robots for minimally invasive surgical procedures are increasingly gaining acceptance among both patients and surgeons. Surgeons are also progressively making use of digital data in the operating room, providing a more complete view of the anatomy, and reducing the risks of errors during the surgical procedure. This project aims to develop a new system integrating medical robotics with digital imaging data to increase the precision and the safety of pediatric cochlear implant surgery. Cochlear implantation is used to restore hearing in deaf children, making a dramatic impact in their ability to integrate into the auditory world and achieve mainstream speech and language function.

Current clinical practice requires the freehand drilling of a 0.6-1 mm diameter cochleostomy through a mastoidectomy and posterior tympanotomy approach, while avoiding critical structures such as the temporal dura and the facial nerve (Figure 1). Accuracy of both cochleostomy placement and the cochlear implant electrode array insertion angle are critical factors for device function and clinical outcome. By developing a co-robot system, image overlay, and navigation/planning software, we aim to improve the precision and accuracy of this procedure while increasing the safety margin.

The integrated system we plan to develop is shown in Figure 2. The major system components are: 1) Imaging and planning workstation; 2) Optical tracker; 3) Pentero microscope from Zeiss; 4) Kuka robot with a tool holding/changing mechanism; 5) Control workstation; and 6) Haptic device. The surgeon and patient are also shown. The presentation will highlight our progress to date as well as give a detailed overview of the system architecture.



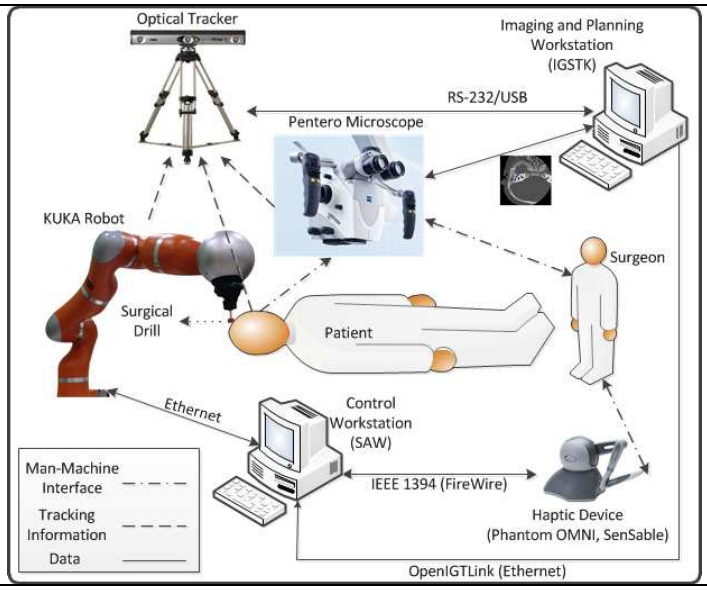


Figure 1. Facial nerve, a critical structure, lies near the cochleostomy and must be avoided	Figure 2. Integrated system concept