

A wireless tracker platform for 6D surgical navigation

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Tracking in image-guided micro-surgeries

Overview and principle

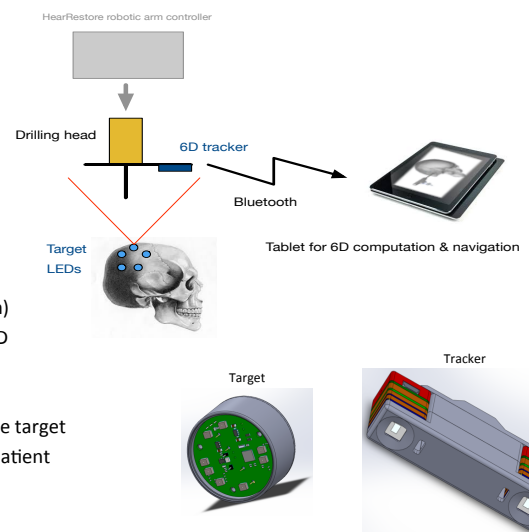
- Goal: Use a 6D tracking system to provide highly precise and accurate tracking for minimally invasive microsurgeries, such as cochlear implants, hip replacement, ...
- HearRestore: Need to know the position of the robotic tool with respect to the patient at all times under varying conditions
- The tracker can be placed on the surgical tool, and the target on the patient
- Teams: Atracsys (industrial partner), CSEM (R&D partner), ARTORG (R&D partner)

The tracking system

- Consists of a tracker, a 5-LEDs target, a 6D tracking algorithm and a navigation application
- The tracker itself has two cameras, synchronization (infrared) and communication (Bluetooth) modules, and an embedded 2D spaceCoder algorithm computing the 2D position of each LED on the target
- The tracker synchronizes the camera with the LEDs, computes 2D positions, sends them to the computer that uses a 6D tracking algorithm to compute the position of the target
- The navigation application shows in real time the 6D position of the instrument w.r.t to the patient

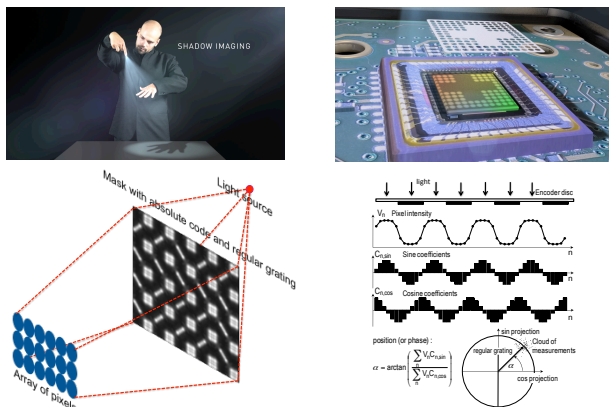
Towards the industrialization of the HearRestore demonstrator

- Uses two tracking devices (stereo system)
- Higher accuracy thanks to better depth estimation
- Wireless
- The tracker communicates with the computer via Bluetooth
- Both the target and tracker are battery operated
- Better optical front-end: Novel mask-on-filter
- More compact



spaceCoder principle

- A light source projects the shadow of a particular pattern onto the sensor
- Each pixel carries information about the 3D position of the light source
- A Fourier-like analysis of the shadow assesses the 3D position



What's next

- Finalize communication module
- Algorithms
 - Stereo 6D algorithm
 - Calibration methods for 2D and 6D computation
 - Binning methods to increase the frame rate
- Performance evaluation
 - Accuracy and precision benchmark lab experiments
- Calibration methods for 2D and 6D positions
- Navigation application (with ARTORG)
- System integration

Patents

- "6D positioning system using a shadow sensor", US application number 14597434, filed 15-Jan-2015