







Image-Guided Neurosurgery Masters Thesis

System Prototype developed for MIT graduate thesis sponsors Massachusetts General Hospital and Radionics, Inc.

- Independently formulated and funded master's thesis at MIT.
 - Chased lead from human factors lab to MGH surgeon who posed a problem statement.
 - Created in-lab initial prototype, and secured funding.
 - Completed pre-planning and camera tracking system.
- Thesis



MIT M.S.

MASSACHUSETTS
GENERAL HOSPITAL

CIMIT
Center for Integration of Medicine
& Innovative Technology

MIT Rohsenow
Fellowship

MGH CIMIT Fellowship

Built independent project through MIT with Mass. General Hospital and Radionics Inc. Solicited and received project funding through the partnership.

GRAPHIC-ON-VIDEO

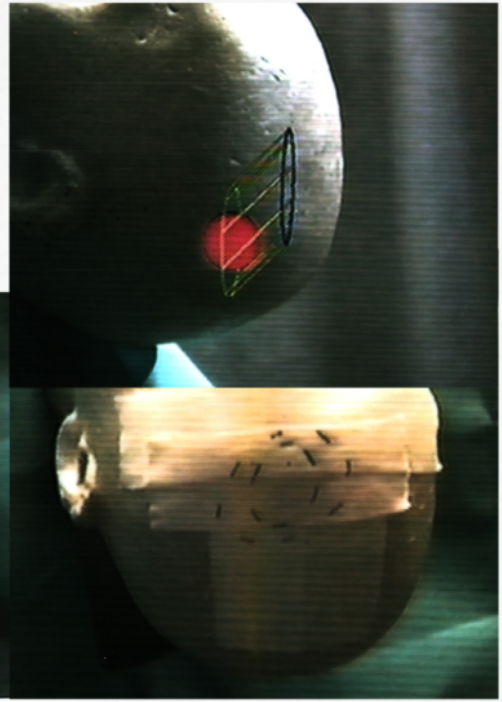
Thesis project:
Augmented reality for craniotomy planning



Initial Prototype Secured Funding

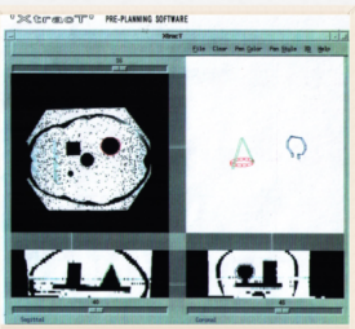
Project Goals

- Track hand-held video camera over patient
 - Overlay graphic extracted from MR/CT data sets on real-time video from camera's point-of-view.
 - Permit surgeon to plan incision based on projection of graphic overlay on scalp, skull, dura, and brain tissue.
- Provide following components to complete prototype system
 - Graphic extraction software for pre planning (pre-op).
 - Target graphics
 - Trajectory indicators
 - Constraints: tissue to avoid
 - Phantom-to-image registration.
 - Real-time camera tracking and graphic overlay (intra-op).



MIT Human Factors Lab (Professor Tom Sheridan): Initial Prototype.

Final Result: Planning and real-time software and tooling



Intra-operative components

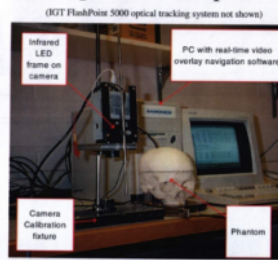
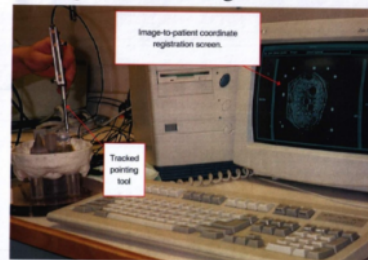
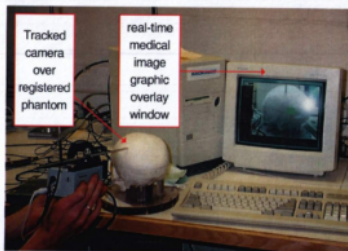


Image-to-Patient Registration...



Dynamic video overlay...

- Real-time overlay of target graphics
 - Green is pre-extracted base of phantom cone
 - White is arbitrary constraint graphic
 - Red stick is pre-planned trajectory.



- On desired trajectory...
- Can now mark perimeter of target in sterile field



System Complete: OpenGL (Linux) pre-planning MR/CT image extraction. Image-to-space registration. Real-time video overlay