Borescope Imaging for Surgical Safe Path Planning

Xingchi He, Saumya Gurbani, Alperen Degirmenci

Mentors: Dr. Taylor, Dr. Iordachita
Clinical Advisor: Dr. Chien

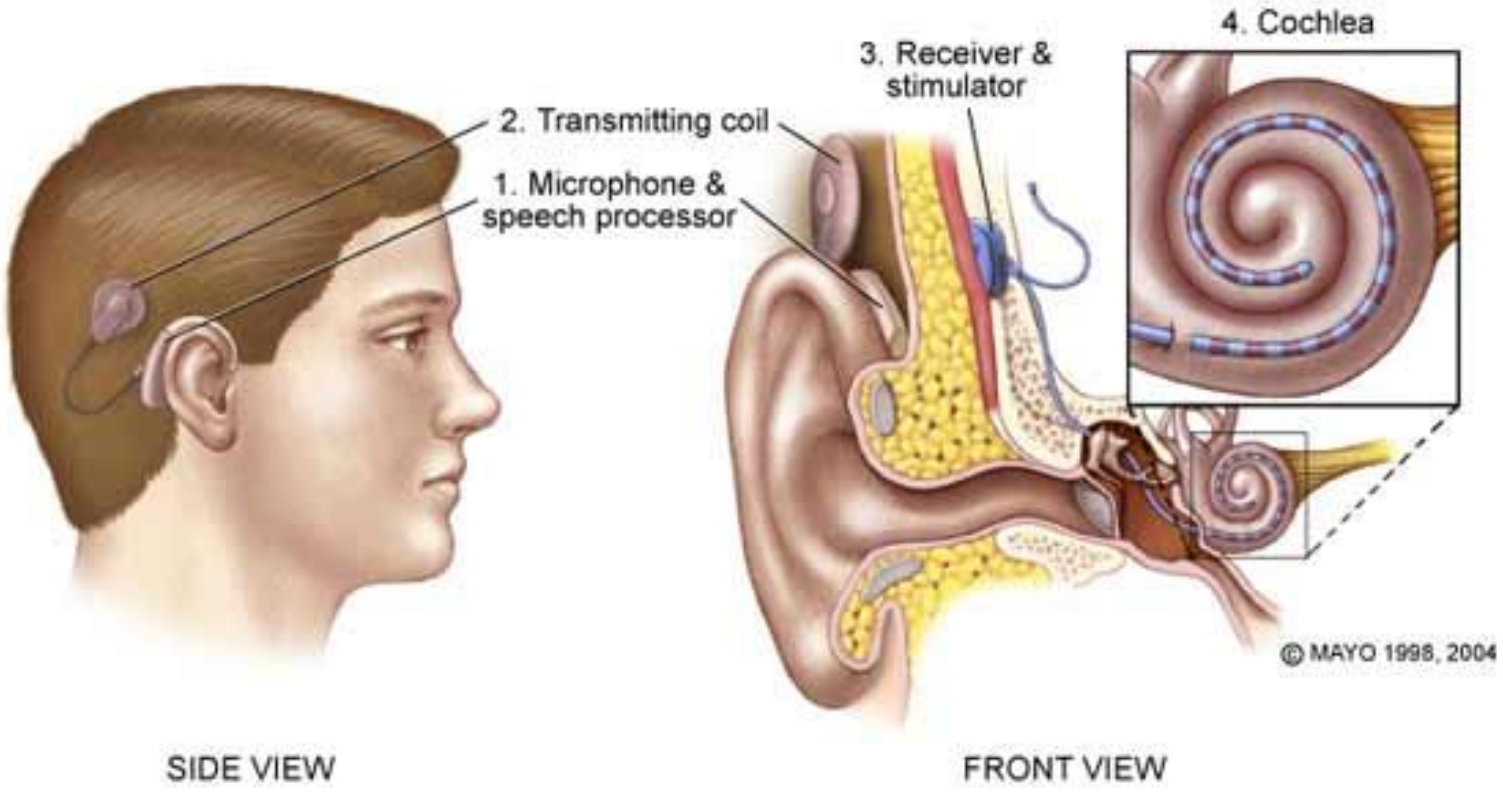
JOHNS HOPKINS
UNIVERSITY

LABORATORY FOR
Computational
Sensing + Robotics
THE JOHNS HOPKINS UNIVERSITY

Outline

- Background & Motivation
- Project Goal
- Technical Approach
- Deliverables
- Timeline
- Dependencies
- Reserposibilities
- Management Plan
- Reading List

Background & Motivation

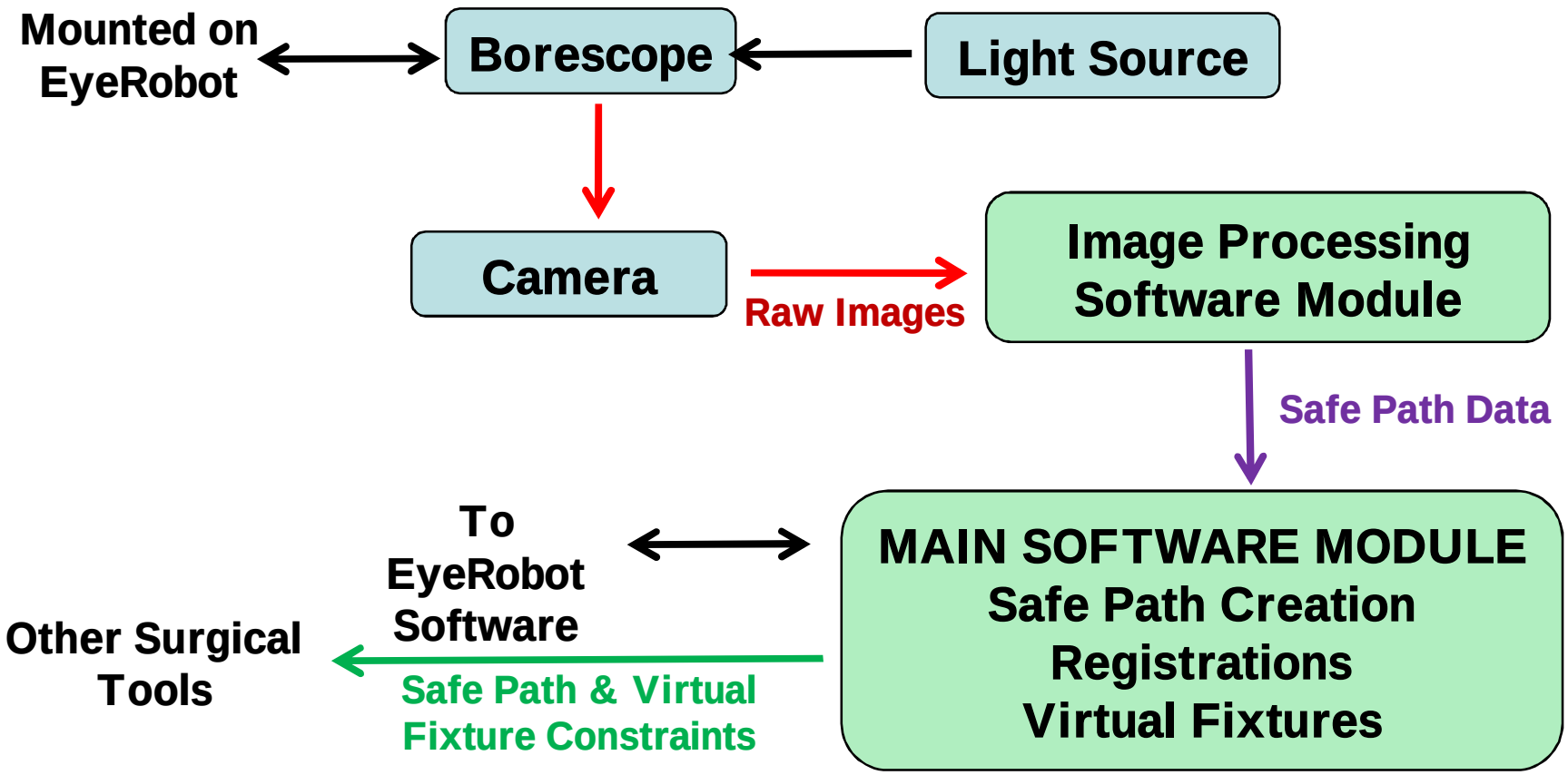


Project Goal

- The goal of this project is to create safe insertion paths for surgeons using a borescope.

- Components of this project:
  - A hardware adapter which mounts the borescope system on the EyeRobot
  - Software to generate safe paths
  - Software to register the safe path / virtual fixtures with subsequenct surgical tools.

Technical Approach / Work Flow



Deliverables

	Deliverable	Status
Minimum	Hardware to mount borescope system on to the EyeRobot setup.	**EXPECTED 04/29/2011**
Minimum	Develop software for “manual” safe-path generation	**EXPECTED 05/03/2011**
Expected	Develop software to register the boroscope & safe path with subsequent surgical tools	**EXPECTED 05/17/2011**
Maximum	Generate virtual fixtures from safe path	**EXPECTED SUMMER 2011**
Maximum	Automate the safe path generation process	**EXPECTED SUMMER 2011**
Maximum	Use optical flow to create a 3D reconstructions of the cochlea	**EXPECTED SUMMER 2011**

LABORATORY FOR Computational Sensing + Robotics THE JOHNS HOPKINS UNIVERSITY

Borescope Safe Path Planning Timeline (4/5/11)

ERC | CISST

STAGE	WEEK TASK	8	9	10	11	12	13	14	Summer				
0	Project Planning												
1	Build Light Source/Cable adapters												
2A	First prototype of mounting adapter												
3	Software for "manual" safe path creation												
2B	2nd prototype of mounting adapter												
4	Borescope-Surgical Tool Registration												
	Final Presentation + Demo												
5	Automated Safe Path Creation												
6	3D Reconstruction Using Optical Flow												
7	Virtual Fixture Generation												
		April				May			July/August				

Dependencies

Dependency	Status as of 04/05/2011
Micro-Borescope	DAMAGED (resolution: use backlighting)
Camera for recording boroscope images	RESOLVED 04/05/2011
Light Source/Cable (Purchased or Created)	RESOLVED 04/08/2011
Access to EyeRobot and Marcin	RESOLVED 02/28/2011
Access to Machine Shop and Rapid Prototyping Machine	RESOLVED 02/14/2011

Management Plan

1. Weekly meeting with Dr. Iordachita(if he is available)
2. Weekly meetings with each other on Tuesday and Thursday
3. 50 man hrs total per week

Reading List

[1] Cohen, Noel L. and J. Thomas Roland Jr. “Complications of Cochlear Implant Surgery”.Cochlear Implans. Ed. Susan B. Waltzman and J. Thomas Roland. Thieme Medical Pub, 2006. 126-132.

[2] I. Fleming, M. Balicki, J. Koo, I. Iordachita, B. Mitchell, J. Handa, G. Hager, and R. Taylor, “Cooperative robot assistant for retinal microsurgery.,” *Medical image computing and computer-assisted intervention : MICCAI ... International Conference on Medical Image Computing and Computer-Assisted Intervention*, vol. 11, Jan. 2008, pp. 543-50.

[3] C.G. Wright, P.S. Roland, and J. Kuzma, “Advanced bionics thin lateral and Helix II electrodes: a temporal bone study.,” *The Laryngoscope*, vol. 115, Nov. 2005, pp. 2041-5.

[4] D. Zhang et. al., “Inspecting the cochlear scala tympanic with flexible and semi-flexible micro-endoscope.” Journal of Clinical Otorhinolaryngology Head and Neck Surgery, vol. 20 issue 4, 2006. pp 169-71.