Data Collection System
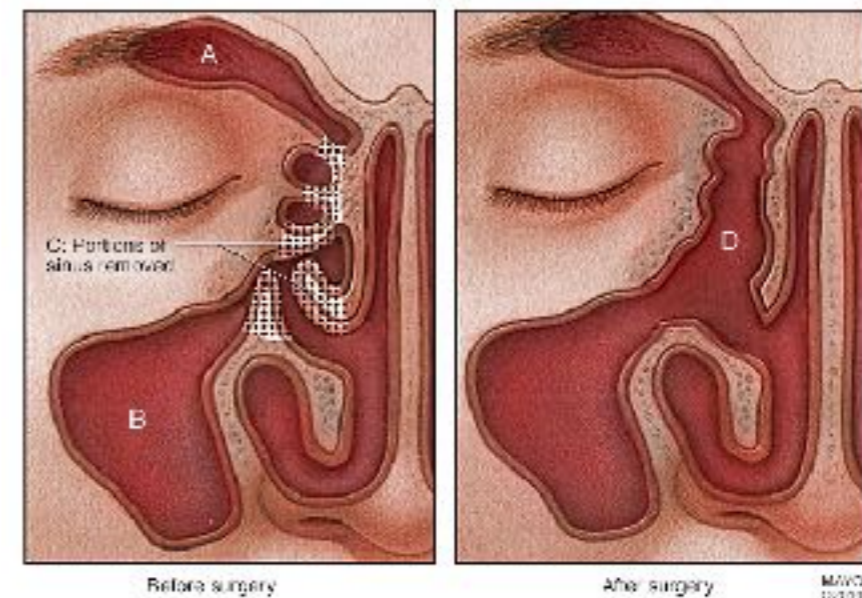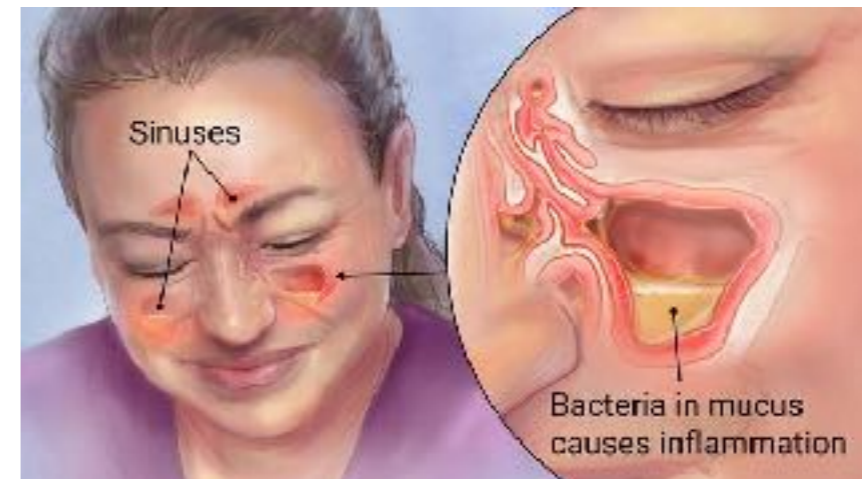## for Smart Endoscope Project

Team Member:
Ruiqing Yin
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Mentors:
Dr. Russell Taylor
Dr. Masaru Ishii
Dr. Chien-ming Huang

Background

- What is Sinusitis?

- What is Sinus Surgery? [2]

  - Traditional

  - Ballon

  - Endoscopic(FESS)

[1]

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Motivation

- Surgeons have to manually operate the endoscope during the entire operation.

- The whole surgery can take up to one and a half hours.

- About 260,000 sinus cases performed in the US annually. [3]

- Endoscopic Sinus Surgery has been becoming the mainstay. [4]

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Proposed Solution

REMS by Galen Robotics

+

Machine Learning

=

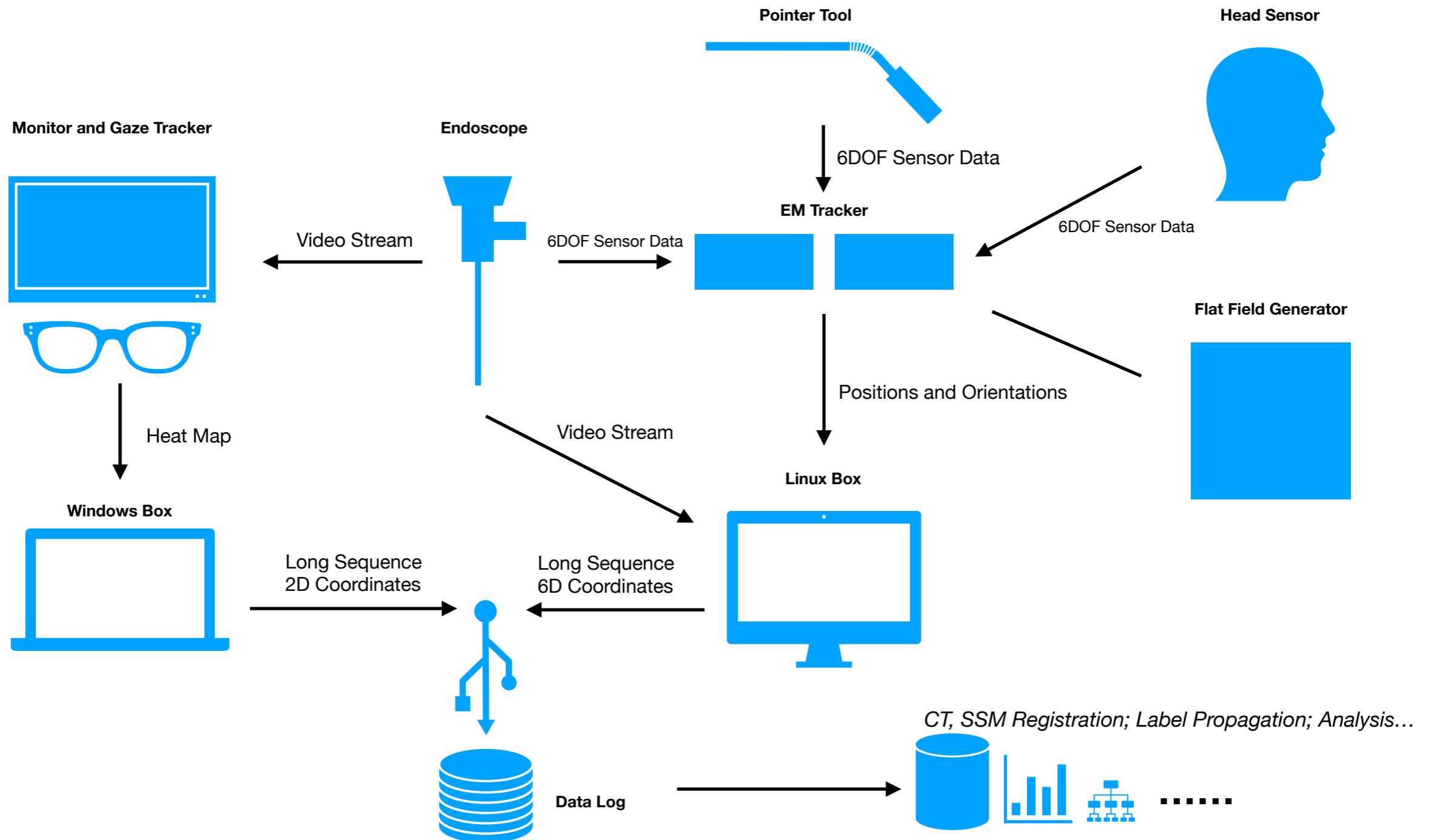Smart Endoscope + a happy Dr. Ishii :)

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Project Scope

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- Robot Development

- **Experiment Design and Setup**

- **Experiment and Data Collecting**

- **Data Processing**

- Machine Learning

…

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Technical Approach

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Technical Approach

- Tracking System Integration

    - Aurora EM Tracking System

    - 3 6DOF Sensors

    - Flat Field Generator

    - Gazepoint Gaze Tracker

- Tool Adapters Design

    - Pointer Tool

    - Endoscope Sensor Adapter

    - Head Sensor Adapter

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Technical Approach

- Data Logging System

  - Linux OS: Arurora Software/SDK, ROS

  - Windows OS: Gazepoint Software/SDK

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Apparatus/BoM

1. Aurora System (Ordered)

    1. Aurora 6DOF Reference, 25mm Disc x 2

    2. Aurora 6DOF Cable Tool, 2.5 x 12mm

    3. Aurora 6DOF Probe

    4. Aurora Tabletop 50-70 Field Generator

    5. Aurora V3 System Control Unit Kit

    6. Aurora 4-port Sensor Interface Unit

2. Gazepoint GP3 Eye Tracker (Ordered)

3. Monitor for Endoscope Video Streaming

4. Windows Workstation

5. Linux Workstation

6. 3D Printed Adapters

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Deliverables

- **Minimum**: Hardware for a functional data collecting system.

- **Expected**: Hardware and software for a functional data collecting system.

- **Maximal**: Hardware and software for a functional data collecting system; data post processing program.

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Dependencies

	Dependency	Solution	Alternative Plan	Status
1	Tracking Systems	Communicate with Dr. Taylor and Dr. Huang	Borrow similar equipment from Dr. Boctor	Solved
2	CAD Program	Download thru WSE Software Support	Student Design Lab/ CIIS Lab	Solved
3	3D Printers and Machine Shop	Contact WSE Manufacturing	Contact Outside Vendors	Solved
4	Familiarity with Surgery Process	Contact Dr. Ishii to shadow real cases	Read Papers about FESS	In Progress
5	Familiarity with Surgical Tools	Communicate with Dr. Inshii and Dr. Iordachita	Contact Dr. Razavi	In Progress
6	Experience with Tracking Systems	Communicate with Dr. Taylor and Dr. Boctor	Contact Equipment Manufactuers	Planned
7	Experience with ROS	Taking Robot System Programming with Dr. Whitcomb	Contact Paul Wilkening	In Progress
8	Gazepoint Software Able to Log	Communicate with Dr. Huang, Cong and Xingtong	Contact Gazepoint	Planned
9	Continuous Feedback from Mentors	Schedule a weekly meeting	Communication thru Emails	In Progress
10	Availability of Dr. Ishii	Schedule ahead with Dr. Ishii	No Alternative	Planned

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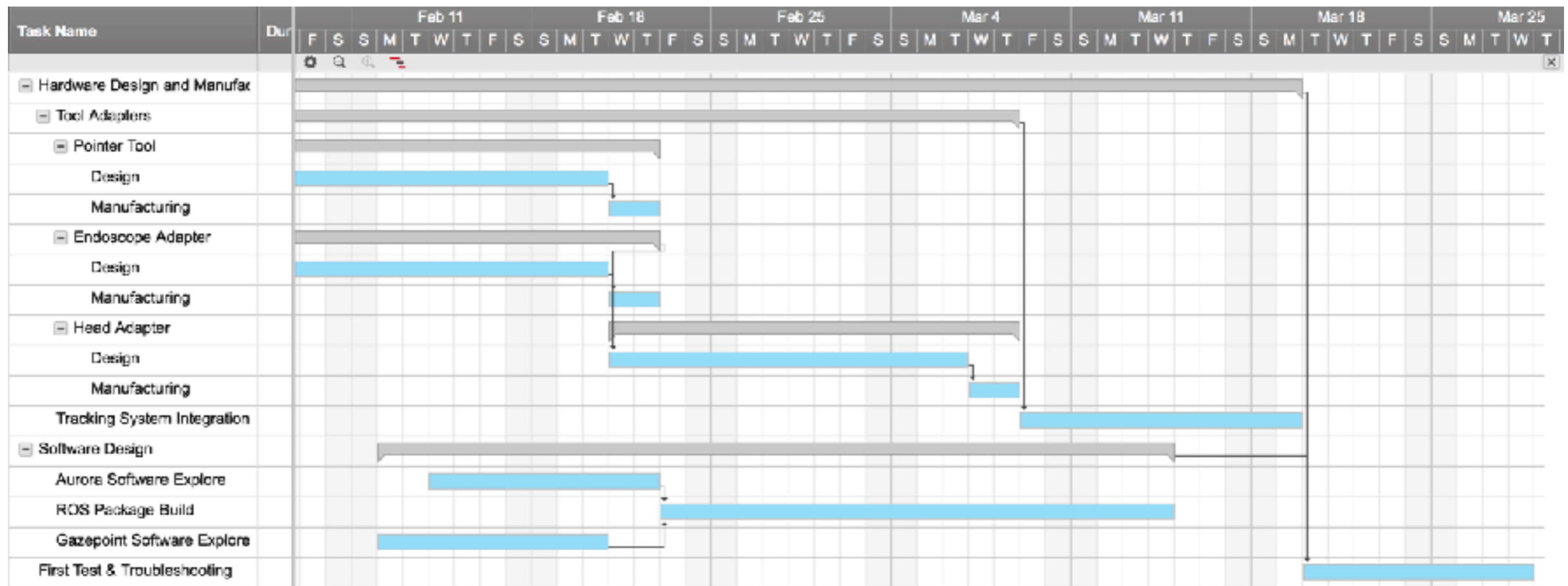
Schedule

Milestones

1.   Project Proposal
2.   Tool Adapters Design Completion
3.   Hardware Integration Completion
4.   Software Development Completion
5.   First Test and Troubleshooting

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Management Plan

1. Weekly meetings with mentors

2. Follow schedule and milestones

Reading List

1. Wormald, P. J. (2007). *Endoscopic sinus surgery* Thieme.
2. Amershi, S., Cakmak, M., Knox, W. B., & Kulesza, T. (2014). Power to the people: The role of humans in interactive machine learning. AI Magazine, 35(4), 105-120.
3. Akgun, B., Cakmak, M., Yoo, J. W., & Thomaz, A. L. (2012, March). Trajectories and keyframes for kinesthetic teaching: A human-robot interaction perspective. In Proceedings of the seventh annual ACM/IEEE international conference on Human-Robot Interaction (pp. 391-398). ACM.
4. Cakmak, M., & Thomaz, A. L. (2012, March). Designing robot learners that ask good questions.
5. In Proceedings of the seventh annual ACM/IEEE international conference on Human-Robot Interaction (pp. 17-24). ACM.
6. *Recording and playing back data: http://wiki.ros.org/ROS/Tutorials/Recording%20and%20playing%20back%20data*

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Reference

1. *MAYO FOUNDATION FOR MEDICAL EDUCATION AND RESEARCH. https:// www.mayoclinic.org/endoscopic-sinus-surgery/img-20007106*
2. *AMERICAN SINUS INSTITUTE. https://www.americansinus.com/types-of-sinus-surgeries/*
3. *Bhattacharyya, N. (2010). Ambulatory sinus and nasal surgery in the united states: Demographics and perioperative outcomes. The Laryngoscope, 120(3), 635-638.*
4. *Venkatraman, G., Likosky, D. S., Zhou, W., Finlayson, S. R., & Goodman, D. C. (2010). Trends in endoscopic sinus surgery rates in the Medicare population. Archives of Otolaryngology–Head & Neck Surgery, 136(5), 426-430.*

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Q&A