

# Data Collection System for Smart Endoscope Project

## Progress Report

Team Member:

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Mentors:

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Dr. Masaru Ishii  
Dr. Chien-ming Huang

# Project Summary

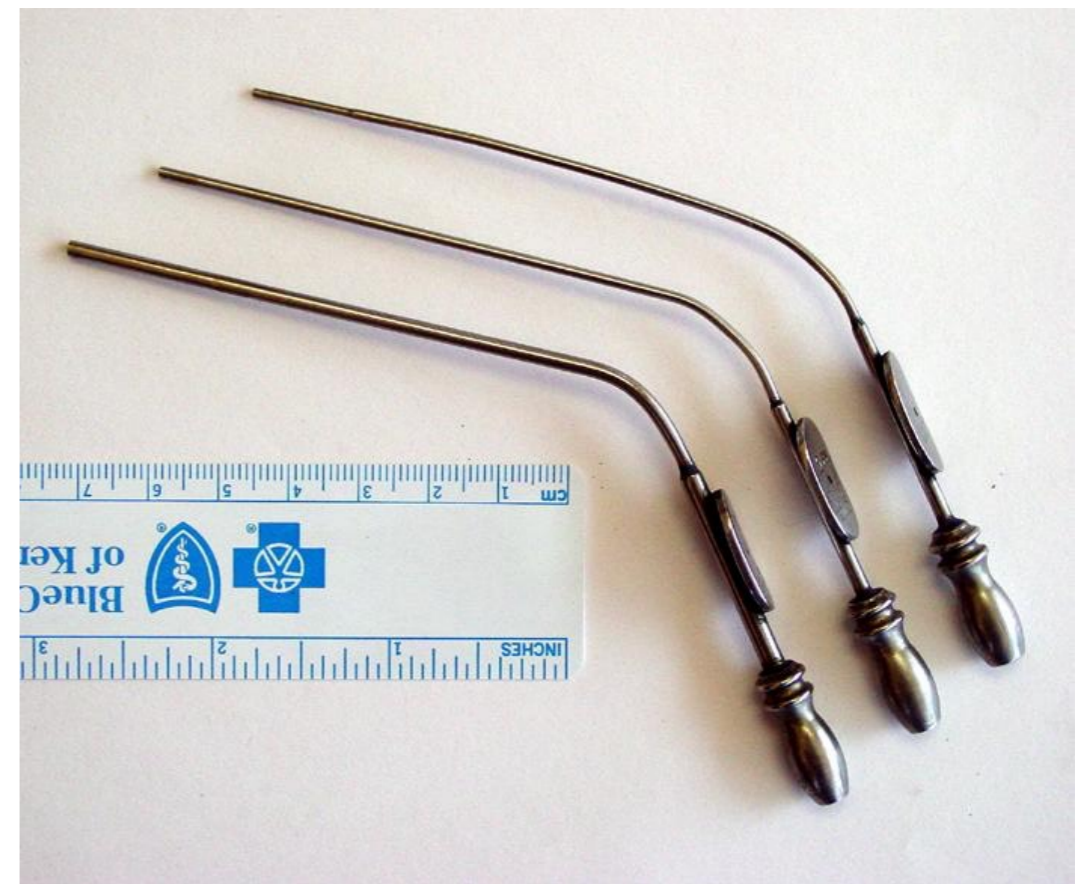
- Data Collection System for Smart Endoscope Study
  - Hardware: 1. Sensor Adapters 2. Aurora EM Tracker 3. Gaze Tracker
  - Software: 1. Aurora Driver and GUI 2. Gaze Tracker Driver and GUI 3. Camera Driver 4. ROS Integration
  - Experiment Design: 1. Workflow 2. User Manual

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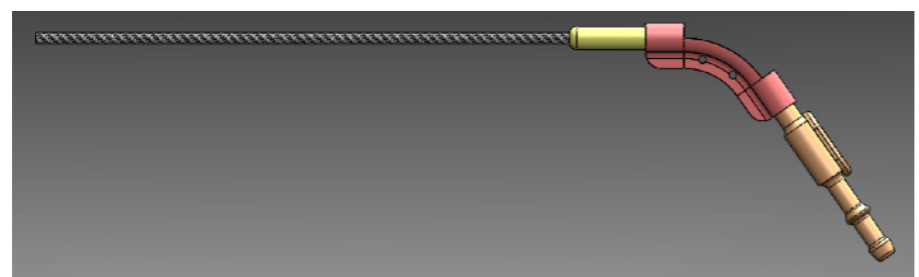
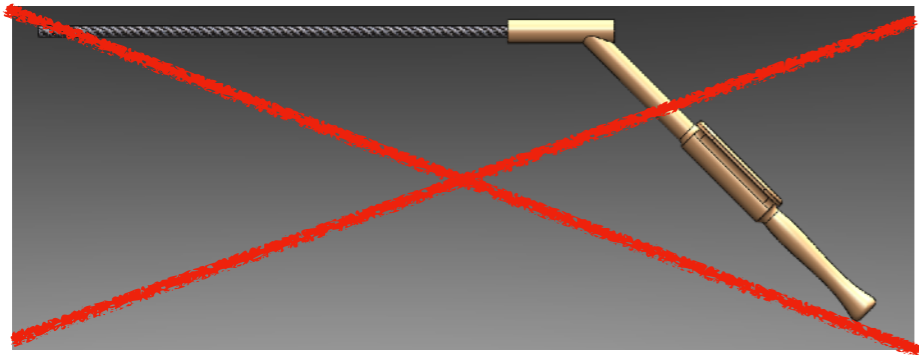
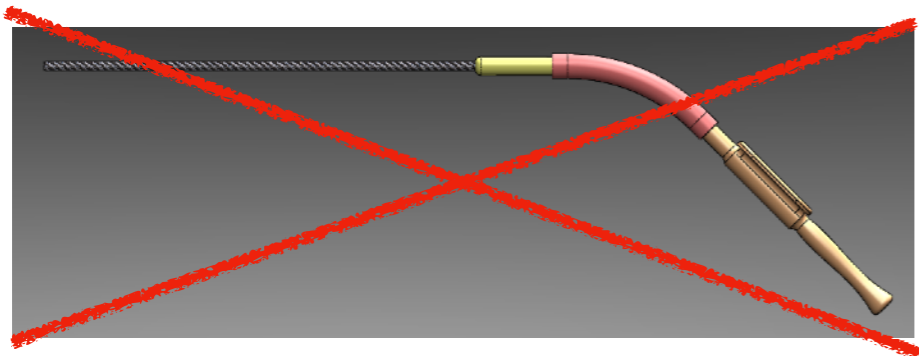
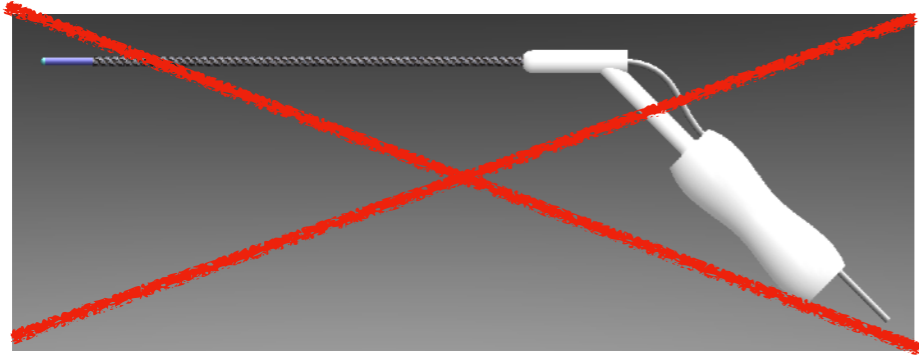
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# Hardware: Sensor Adapters

- Suction/Pointer Tool
- Goal: Mimic Real Suction Tool while Housing a EM Sensor
- Challenges: Manufacturability, Compatibility with Sensors, Interference with Metal, Ergonomics



# Hardware: Sensor Adapters

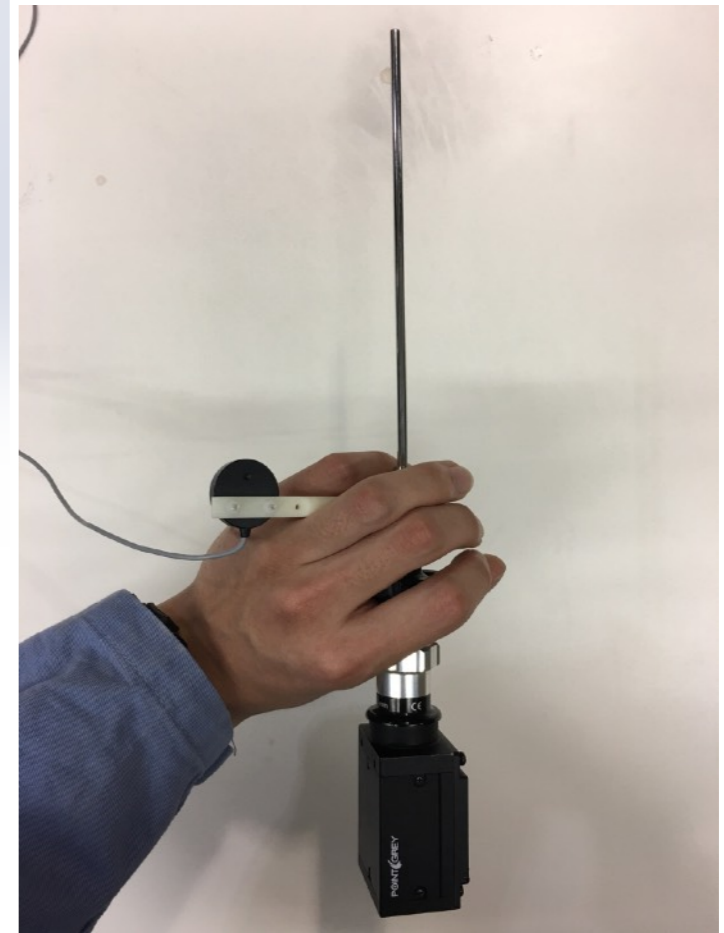
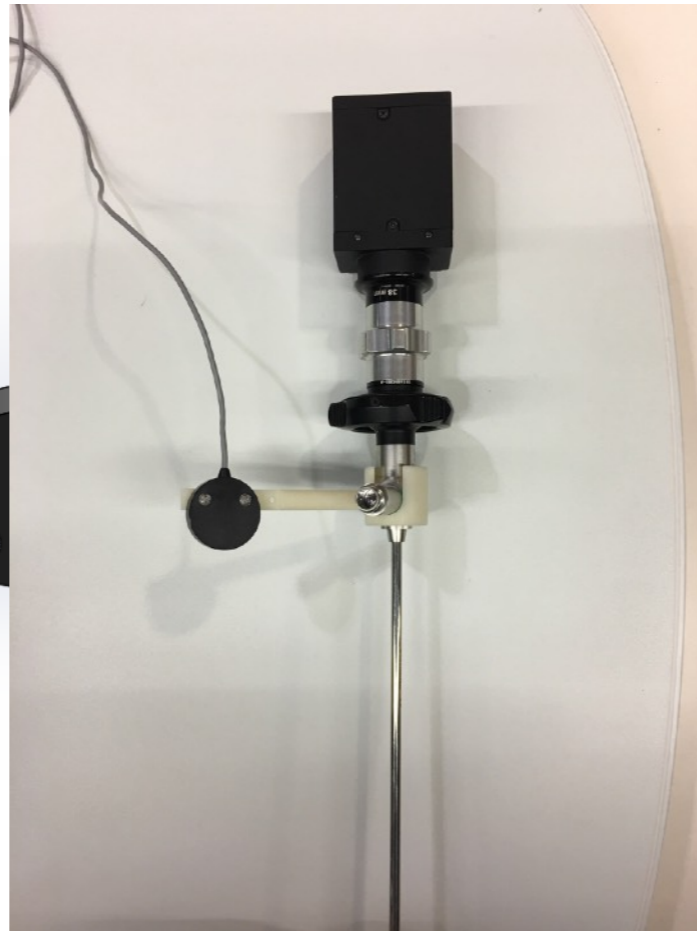
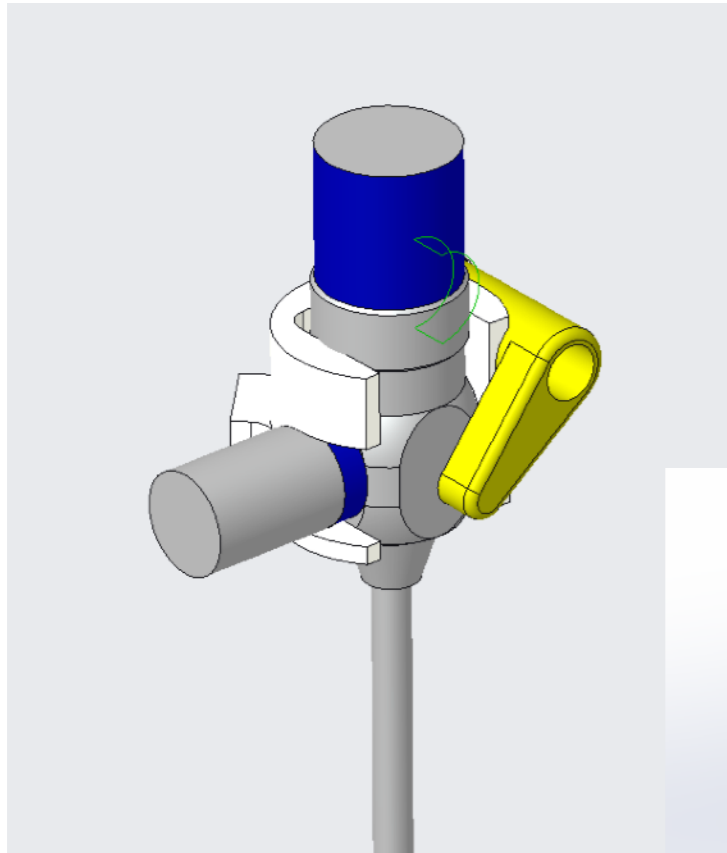


# Hardware: Sensor Adapters

- Endoscope Adapter
- Goal: Rigidly Attach a Reference to the Endoscope
- Challenges: Ergonomics, Interference with Metal, Rigidity



# Hardware: Sensor Adapters



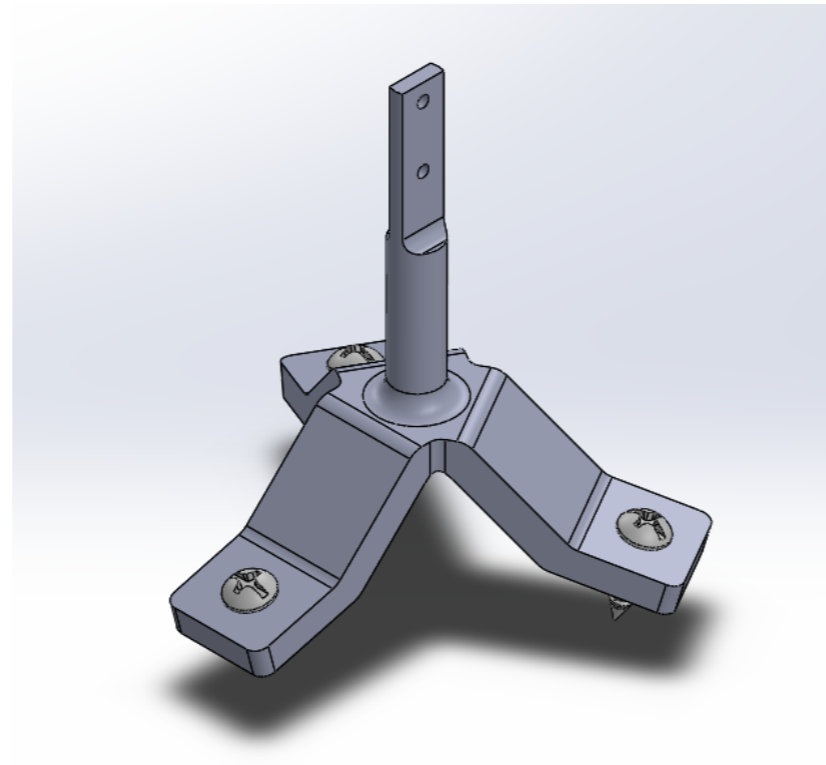
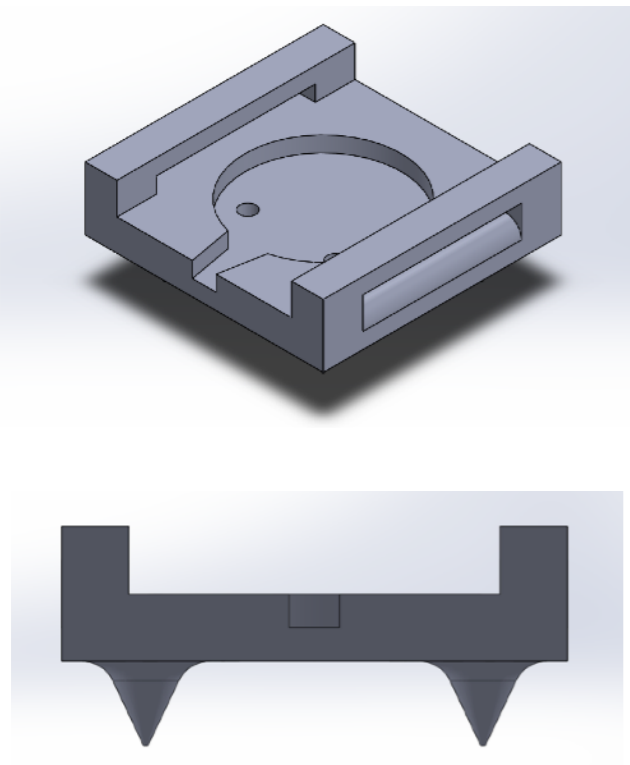
# Hardware: Sensor Adapters

- Head Reference Fixture
- Goal: Rigidly Fix a Reference on a Cadaver Head
- Challenges: Rigidity, Metal Interference, Lack of Experience with Cadaver Heads



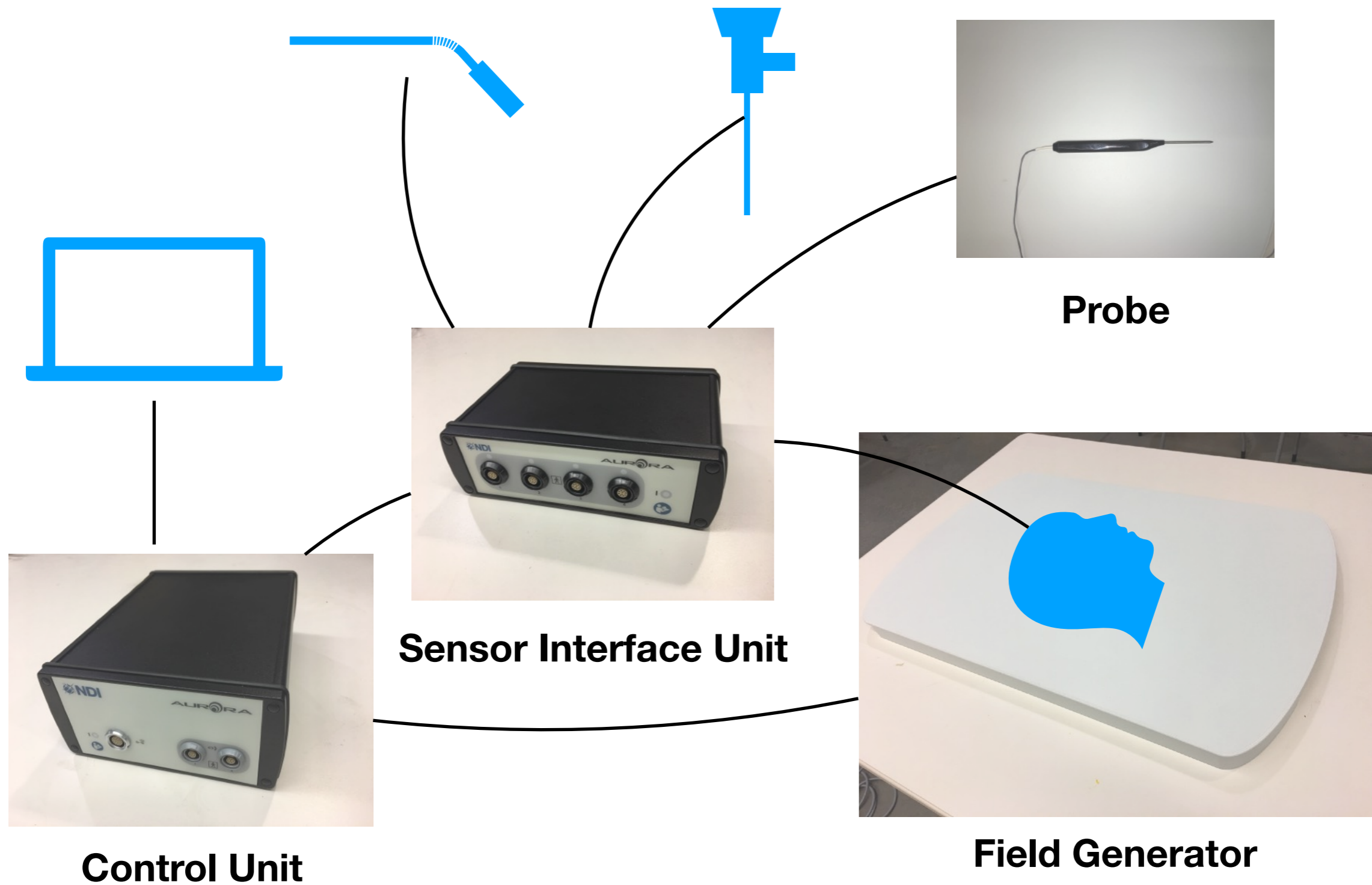


# Hardware: Sensor Adapters



**Set Up on Phantom**

# Hardware: Aurora System



# Hardware: Gaze Tracker

- Delivered Before Spring Break
- Mounted Under Endoscope Video Screen
- Mini Windows PC Ordered
- Cong in Charge



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# Software: Aurora

The screenshot shows the sawNDITracker application window. On the left, there are controls for 'Connect' (checked), 'Port' (/dev/ttyUSB0), 'Track' (checked), and a 'Beep' button set to 3. A table displays timing and sampling data:

50.112±0.016 ms	19.576±0.257 ms	1.000 s
0.020 KHz	39.1 %	20 samples
50.077/50.130ms	38.1 /40.0 %	0 > period

The central log window shows the following messages:

```

16:13:00 Status #6: NDI: command VER 3 returned:
ERROR23
16:13:00 Status #7: NDI: command VER 4 returned:
Aurora Control Firmware
NDI S/N: D4-06078
Characterization Date: 2018-01-11
Freeze Tag: AURORA Rev 008.000
Freeze Date: 2013-07-25
(C) Northern Digital Inc.

16:13:00 Warning #1: NDI: device firmware is not what we're expecting, got: 013. It might still
work
16:13:01 Status #8: NDI: device initialized
16:13:09 Status #9: NDI: tool handles initialized
16:13:09 Status #10: NDI: passive tool handles enabled
16:13:09 Status #11: NDI: active tool handles enabled
    
```

Below the log are four 3D coordinate system visualizations:

- Endoscope/Head**: Time 00:01:33. Axes are red, green, and blue.
- Head/Camera**: Time 00:01:33. Axes are red, green, and blue.
- Probe/Head**: Time 00:01:33. Axes are red, green, and blue.
- Suction/Head**: Time 00:01:33. Axes are red, green, and blue.

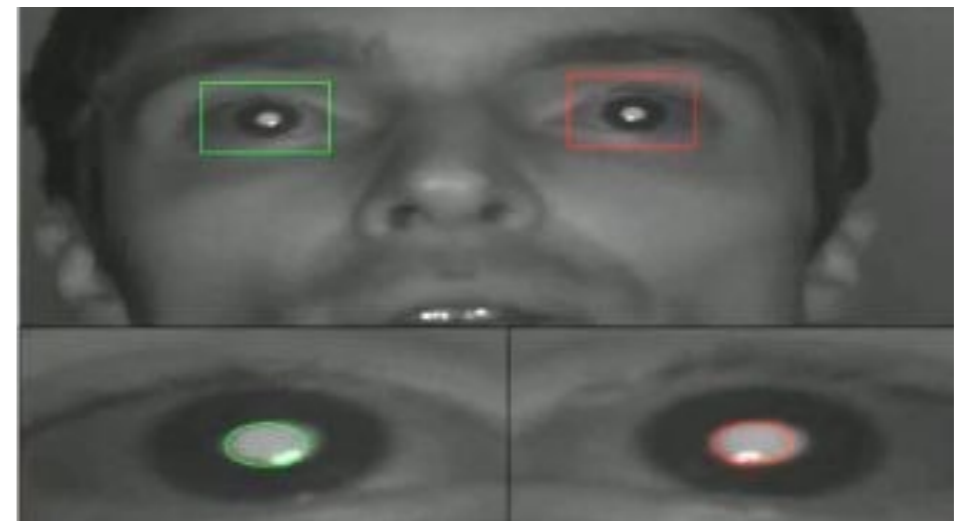
Coordinate values for Endoscope/Head: [0.000, 0.000, 0.000, 7.010, 125.040, -313.620]

Coordinate values for Probe/Head: [-5.048, -39.610, -18.190, 0.000, 0.000, 0.000]

- cisst-
- Messa

# Software: Gaze Tracker

- Track Pupil Positions and Angles
- Heat Map Generated After the Experiment
- Problem: Not Robust when Wearing Glasses
- Cong in Charge



# Software: Camera Driver

- Point Grey Camera Driver ROS Package Downloaded
- To Be Tested



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  - **Experiment Design: 1. Workflow 2. User Manual**

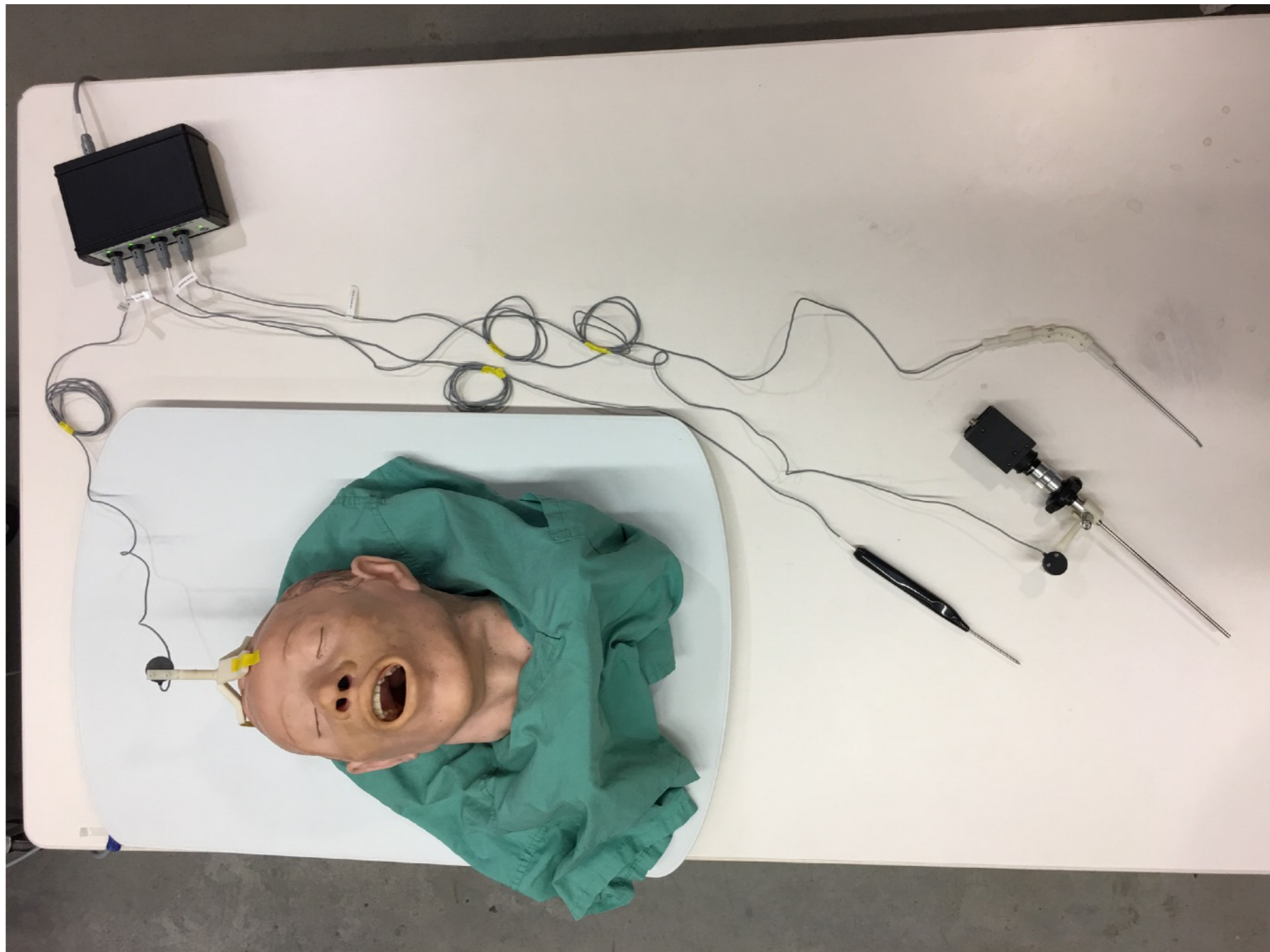


# Experiment: Workflow

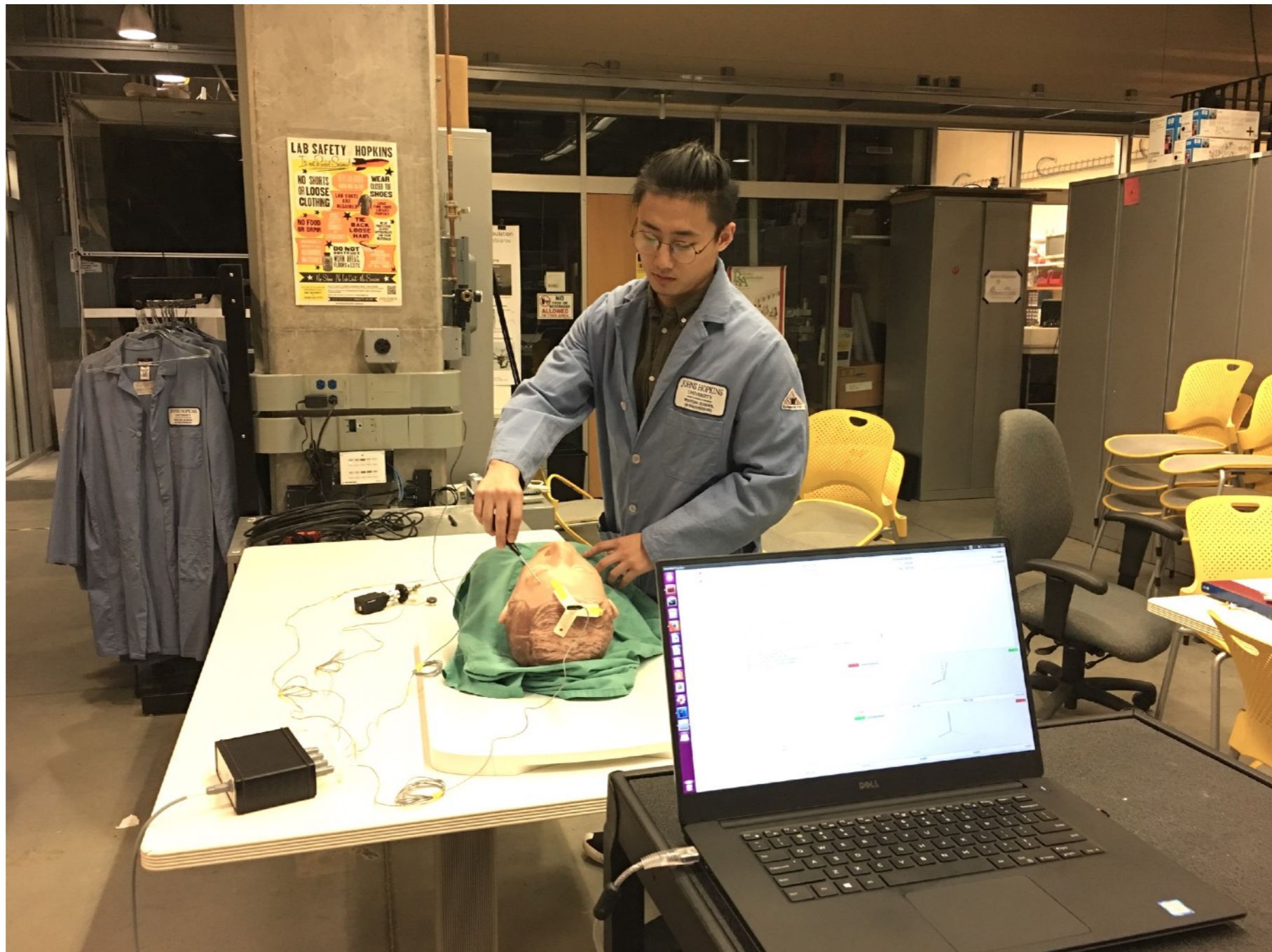
- Mobile Platform
- 10 Mins Setup Time
- Self-containable Except Field Generator



# Experiment: Workflow



# Experiment: Workflow



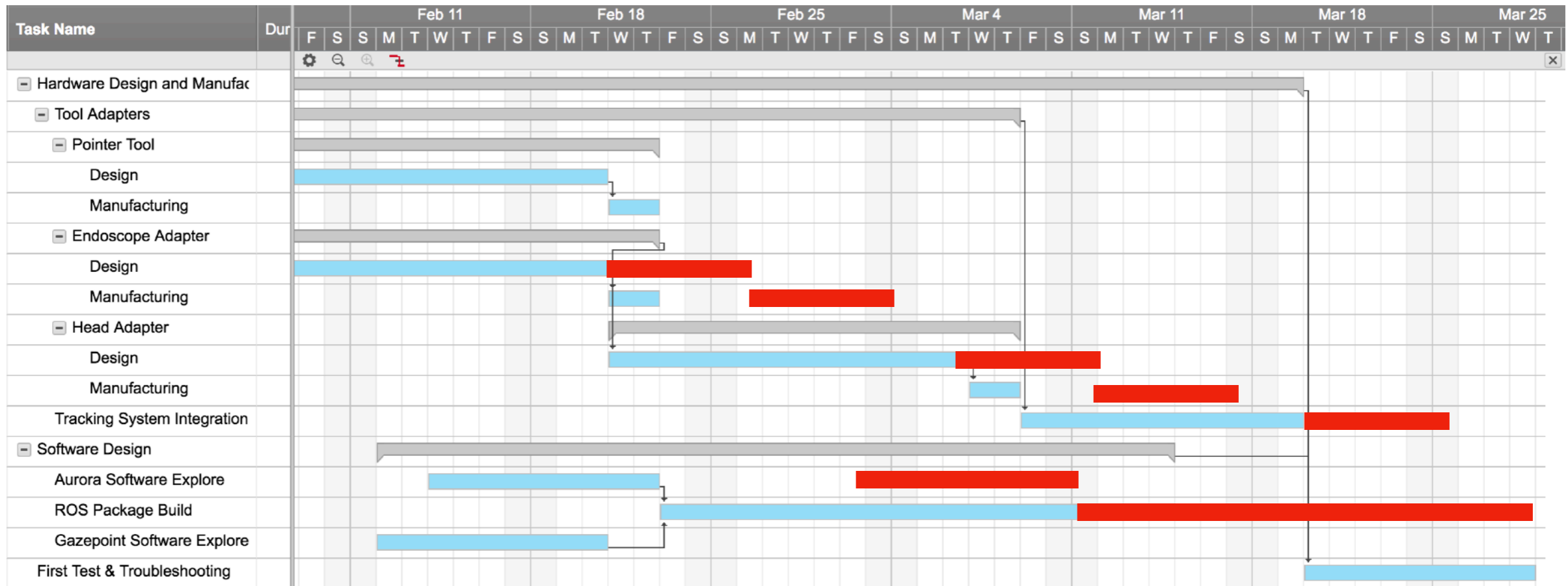
# Experiment: Workflow



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  - ~~Experiment Design: 1. Workflow~~ 2. **User Manual**

# Updated Timeline



# Updated Milestones

~~Feb 26th: Project proposal completion (Completed)~~

~~Mar 9th: Tool adapters design completion (In Progress)~~

~~Mar 19th: Hardware integration completion~~

**Apr 12th** ~~Apr 2nd:~~ Data logging software completion

**Apr 18th** ~~Apr 18th:~~ Workflow Completion

**Apr 20th** ~~Apr 5th:~~ First Test and Troubleshooting

**May 4th** ~~Apr 20th:~~ Second Test and Troubleshooting

~~May 4th: Third Test and Troubleshooting~~

# Updated 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 Surgical Tools	Communicate with Dr. Inshii and Dr. Iordachita	Contact Dr. Razavi	Solved
5	Continuous Feedback from Mentors	Schedule a weekly meeting	Communication thru Emails	Solved
6	Familiarity with Surgery Process	Contact Dr. Ishii to shadow real cases	Read Papers about FESS	Due Apr 18th
7	Experience with Tracking Systems	Communicate with Dr. Taylor and Dr. Boctor	Contact Equipment Manufactuers	Solved
8	Experience with ROS	Taking Robot System Programming with Dr. Whitcomb	Contact Paul Wilkening	Solved
9	Cong finishing Gazeport Software	Communicate with Dr. Huang, Cong	Contact Gazeport	Due Apr 12st
10	Availability of Dr. Ishii	Schedule ahead with Dr. Ishii	No Alternative	Due Apr 20th



# Updated Deliverables

- **Minimum:** (Expected by **April 18th**, 2018)
  1. Hardware for a functional data collection system.
  2. **Workflow for the experiment.**
- **Expected:** (Expected by **April 18th**, 2018)
  1. Hardware for a functional data collection system.
  2. **Workflow for the experiment.**
  3. **Software for a functional data collection system.**
- **Maximum:** (Expected by **May 11th**, 2018)
  1. Hardware for a functional data collection system.
  2. **Workflow for the experiment.**
  3. **Software for a functional data collection system.**
  4. **Software for post-processing the collected data.**

# Reference

1. James Carroll, Desktop eye tracking solution utilizes Point Grey machine vision camera, <https://www.vision-systems.com/articles/2013/11/desktop-eye-tracking-solution-utilizes-point-grey-machine-vision-camera.html>, November 28, 2013
2. Chad Rockey, [pointgrey camera driver](http://wiki.ros.org/pointgrey_camera_driver#Usage), [http://wiki.ros.org/pointgrey\\_camera\\_driver#Usage](http://wiki.ros.org/pointgrey_camera_driver#Usage)
3. Duann, Shapeways 3D Printing Helps to Bring Gazepoint Eye Tracking to Market, <https://www.shapeways.com/blog/archives/2213-shapeways-3d-printing-helps-to-bring-gazepoint-eye-tracking-to-market.html>, Aug 2, 2013

# Q&A