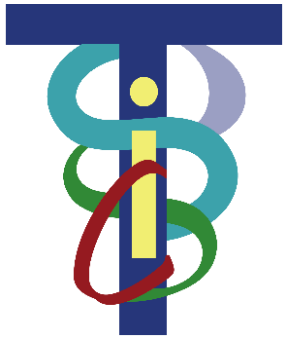

NSF Engineering Research Center
for Computer Integrated Surgical
Systems and Technology

MICRON RANGE-OF-MOTION VISUALIZATION

Check Point Presentation II Team-14

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Department of Computer Science

The Johns Hopkins University

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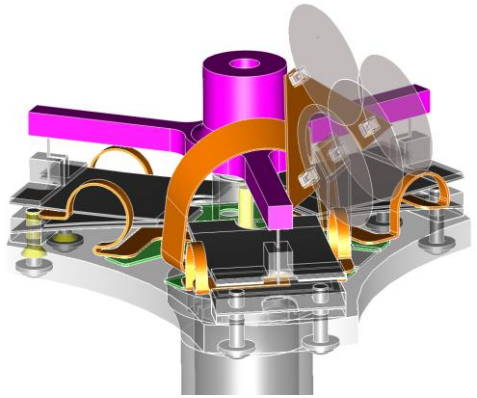
WHITING SCHOOL OF ENGINEERING
THE JOHNS HOPKINS UNIVERSITY

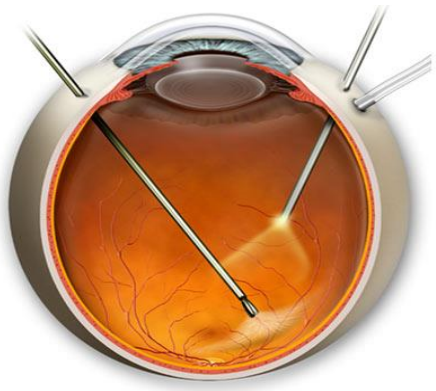
CONTENTS


Summary
Background
Progress
Deliverables
Dependencies
Timeline
Reading Lists

SUMMARY

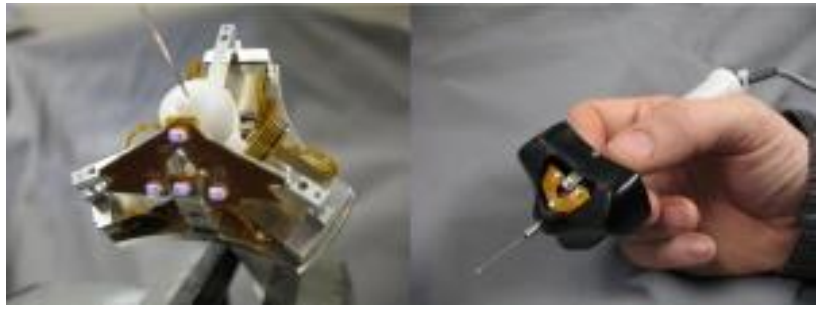
- Need :- Surgeons don't always know the position of the micron in its range of motion
- Goal :- Develop a visual alert assistance system for the surgeons dealing with very small anatomy.

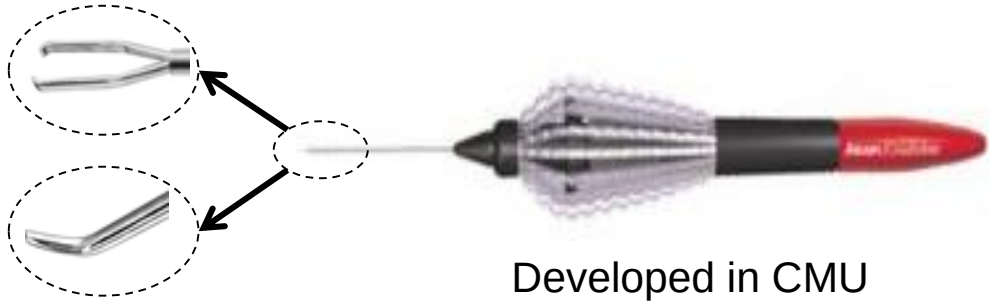




MICRON

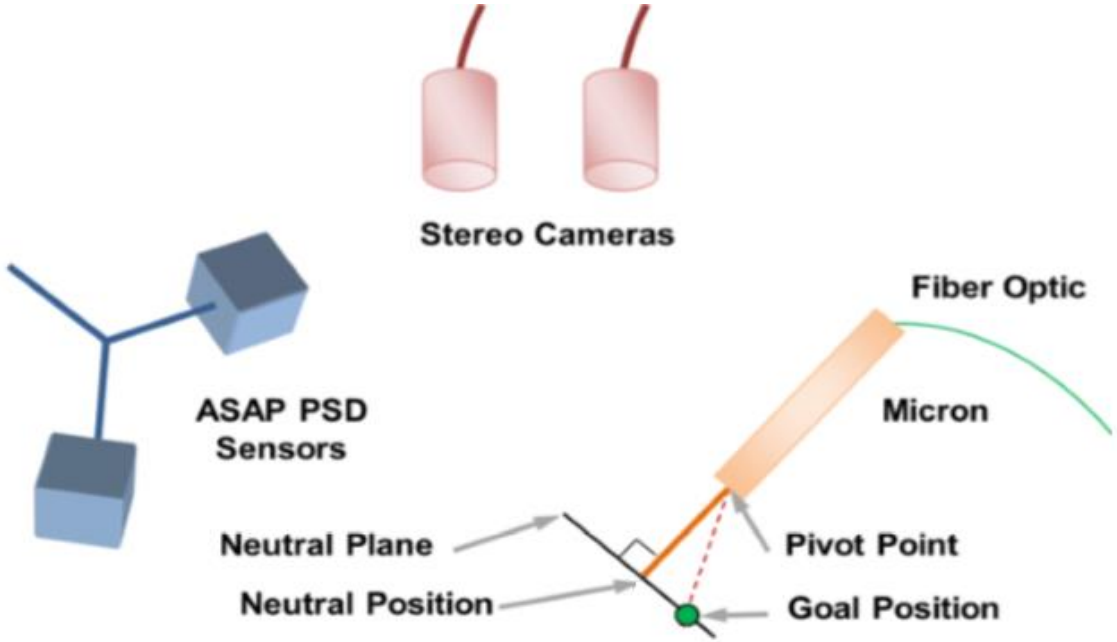
- Tremor Cancellation
- Move actively to compensate

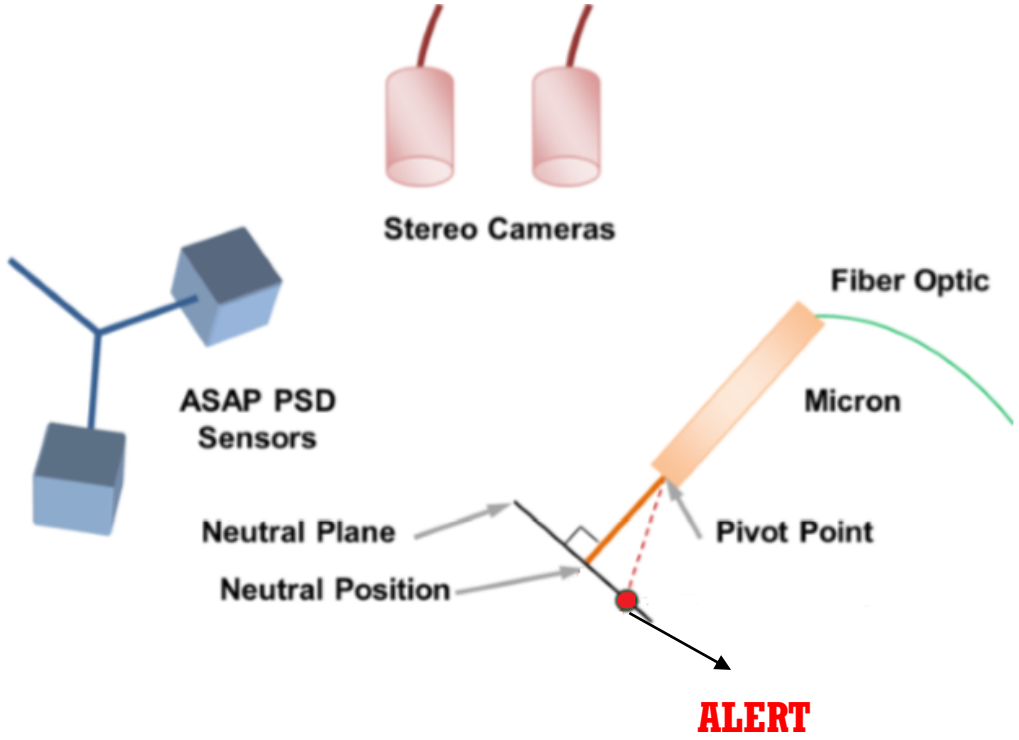




Developed in CMU

SOLUTION


Stereo Cameras
Fiber Optic
Micron
ASAP PSD
Sensors
Neutral Plane
Neutral Position
Pivot Point
Goal Position


Stereo Cameras
Fiber Optic
Micron
ASAP PSD
Sensors
Neutral Plane
Neutral Position
Pivot Point
ALERT

TIMELINE

	Week Starting with	Feb. 4	Feb. 11	Feb. 18	Feb. 25	Mar. 4	Mar. 11	Mar. 18	Mar. 25	Apr. 1	Apr. 8	Apr. 15	Apr. 22	Apr. 29	May 6
PHASE -I	Understanding CISST and SteroVision libraries							Spring Break							
	Setting up development Environment														
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	Create a test Application														
	Include some overlays														
	Develop Application using simulated data														
	Communicate with the micron and get the information														
	Develop Application using Micron data														
PHASE - II	Integrate Tool Tracker														
	Continuous Feedback														
	Rigorous Testing														
	Debugging														
	Include the micron tip workspace														
	Improve the tracker														

DELIVERABLES

Maximum

Improve the robustness.

Show the workspace of the micron tip.

Audio Feedback

Expected

Integrate the tool tracker

Visual alert assistance system

Get feedback from the surgeons.

Minimum

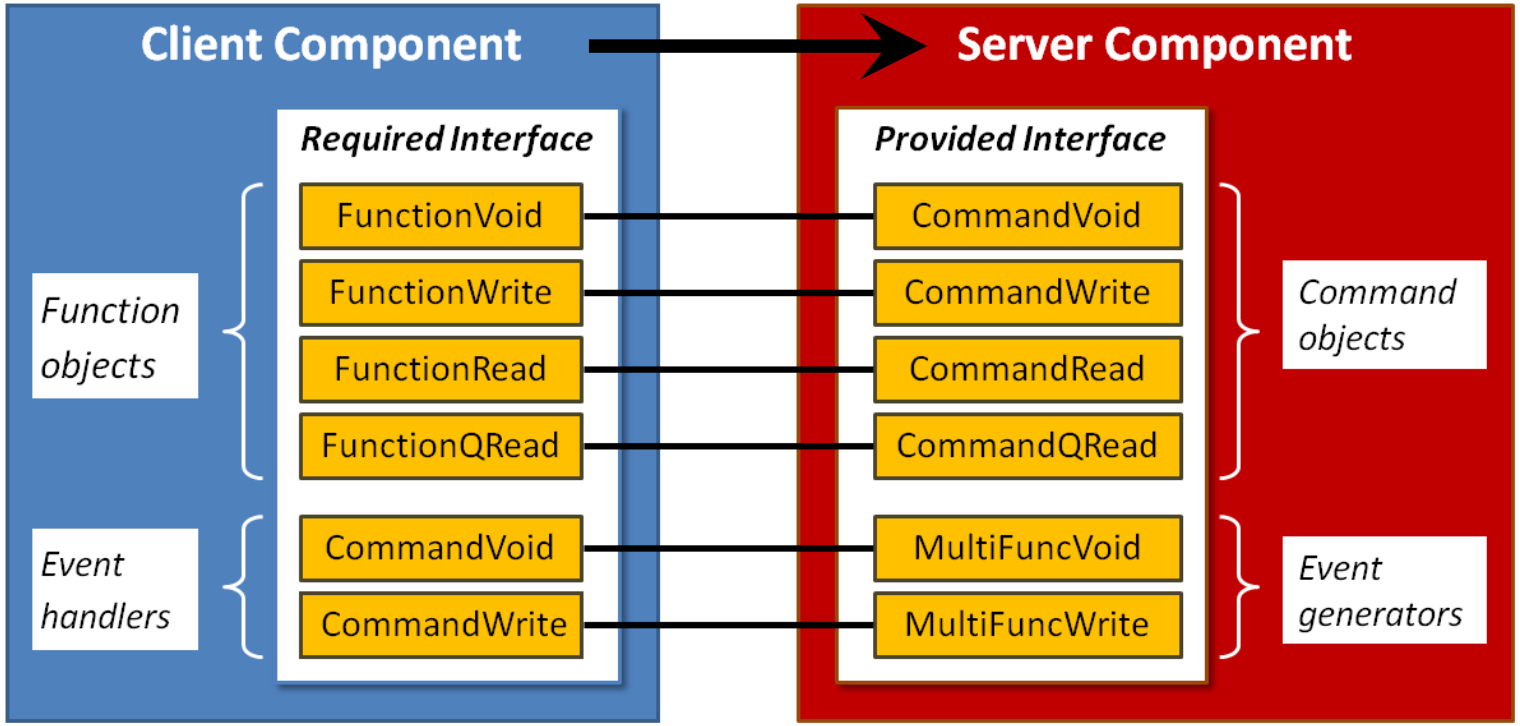
Test application running and have some overlays displayed .

Get Information form Micron

CURRENT PROGRESS

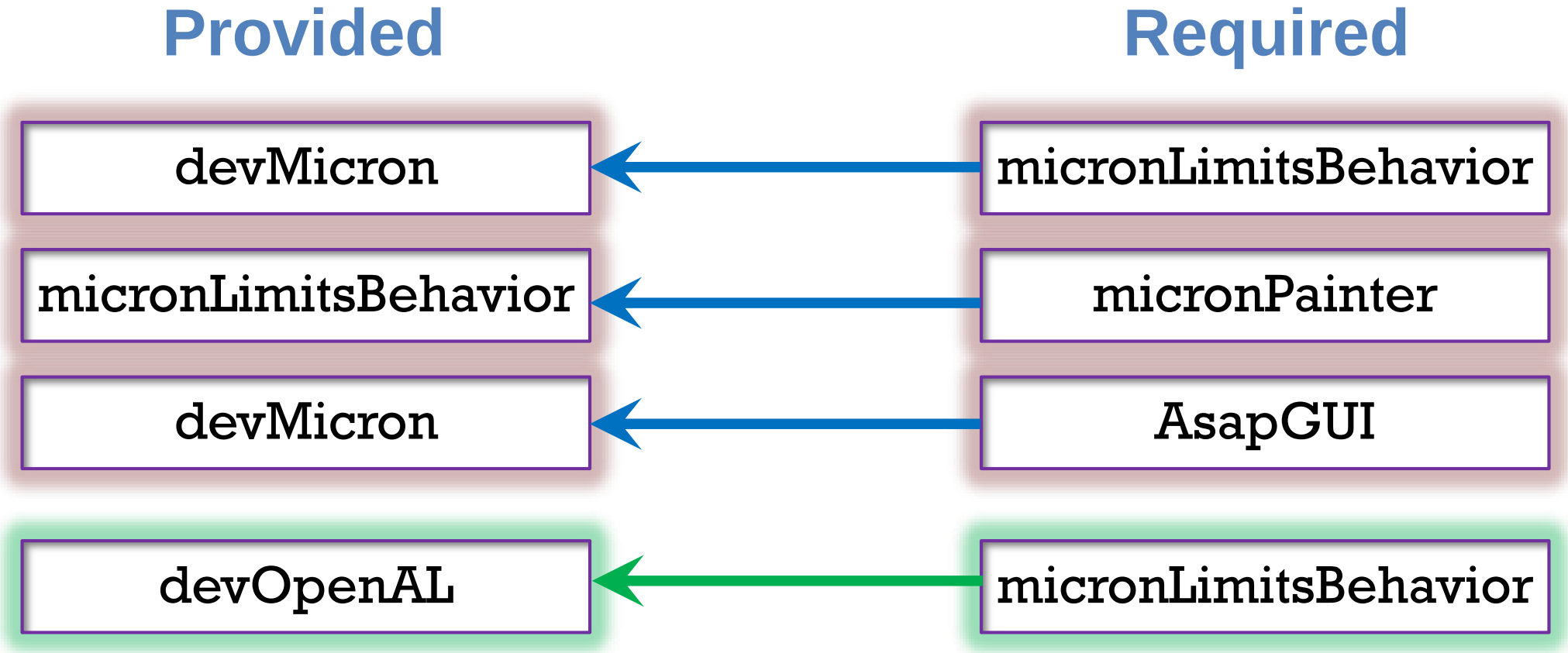
- Component Connections
- Random Data
- Actual Data
- Experimental Data
- Audio Feedback
- Micron Range (Cube) Display

INTERNAL COMPONENT CONNECTION

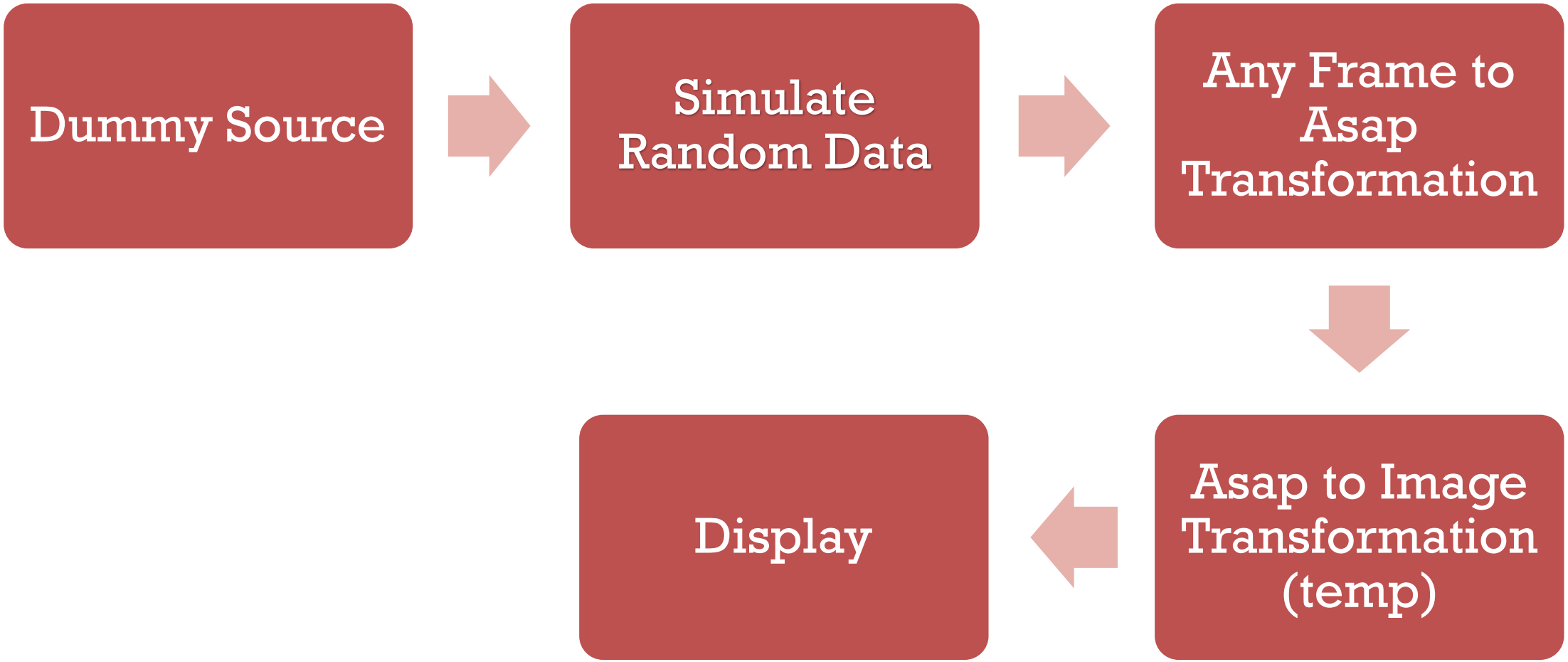


Source : https://trac.lcsr.jhu.edu/cisst/wiki/cisstMultiTaskTutorial

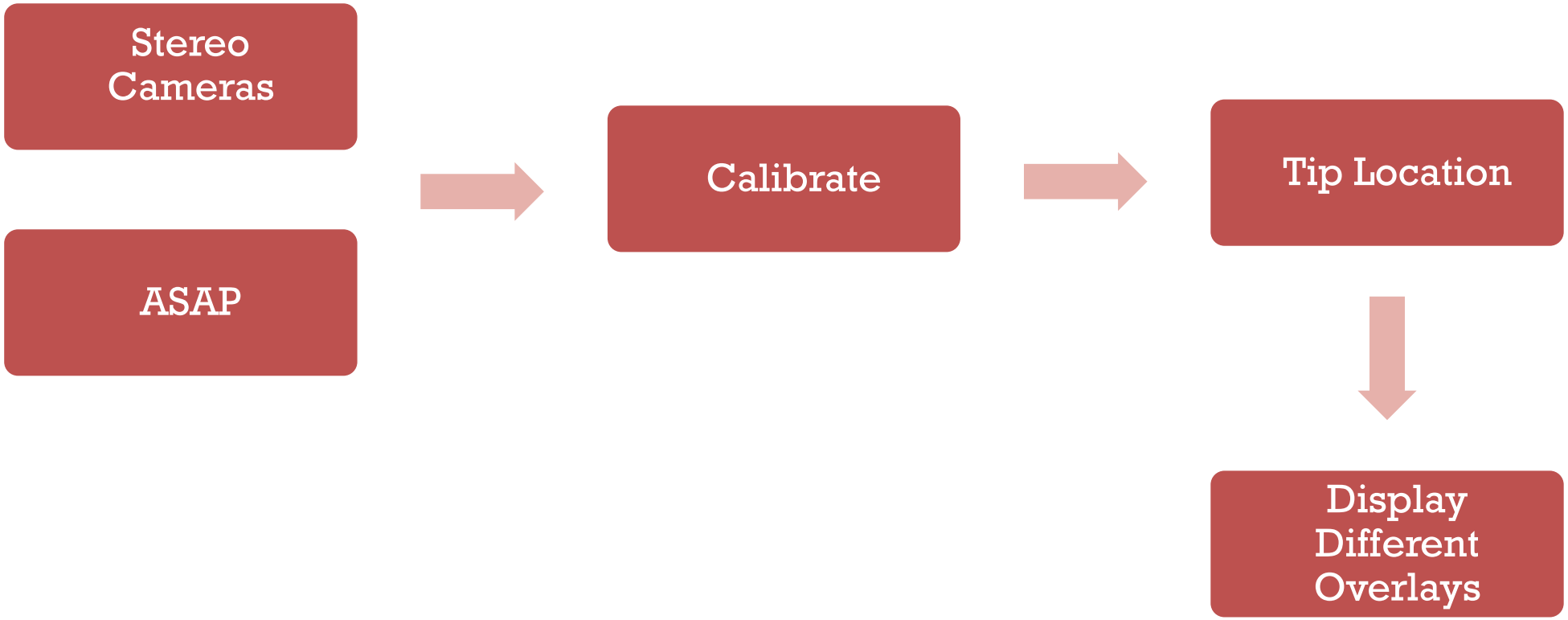
MY CONNECTIONS



GUI FLOW DIAGRAM

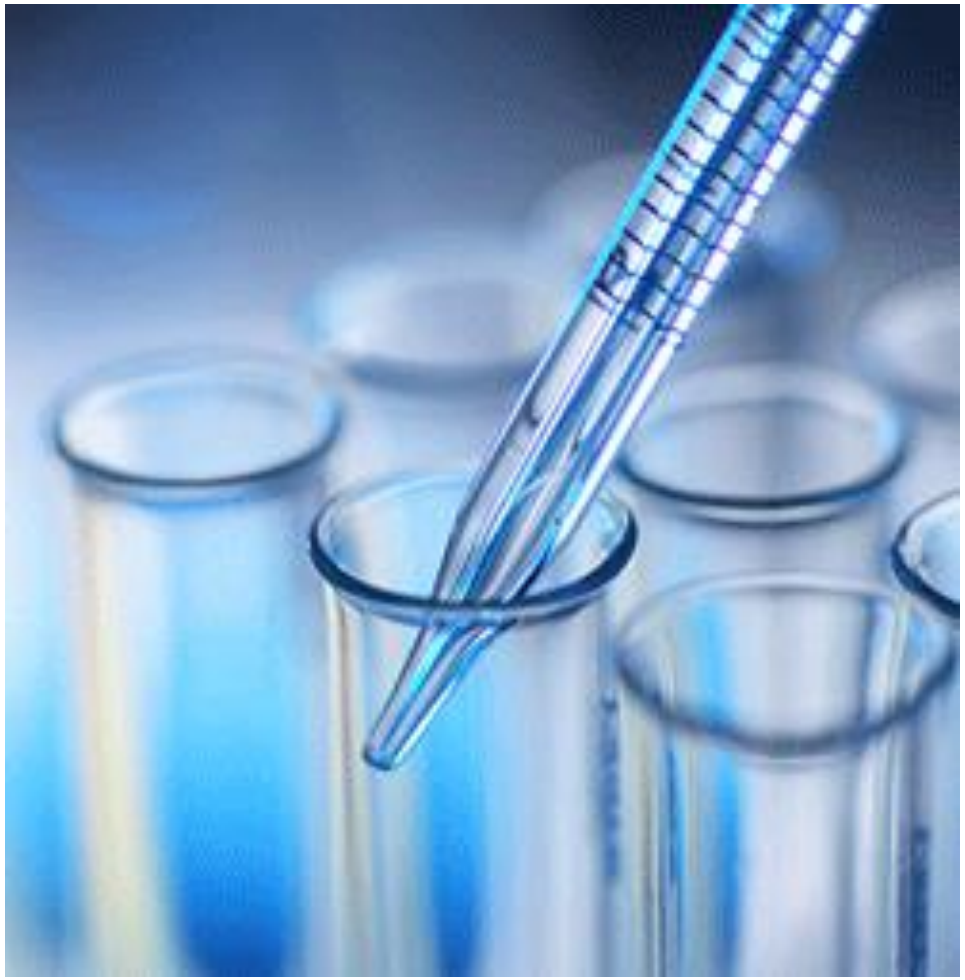


FLOW DIAGRAM

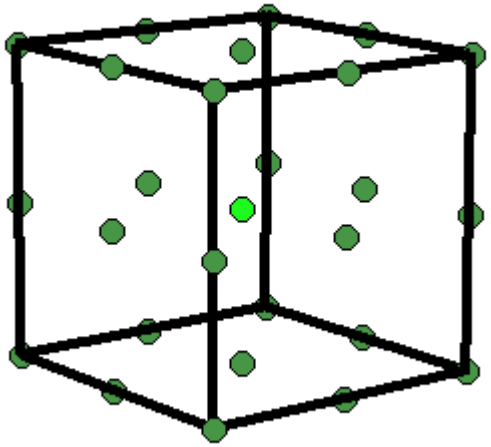


EXPERIMENTAL DATA

- Calibration (ASAP)
  - Yaw : 22.5
  - Pitch : 50
  - Roll :-10
- Range – Cylindrical
  - Height : 4mm
  - Radius :2mm
- 1mm : 100 px



EXPERIMENTAL FEATURES

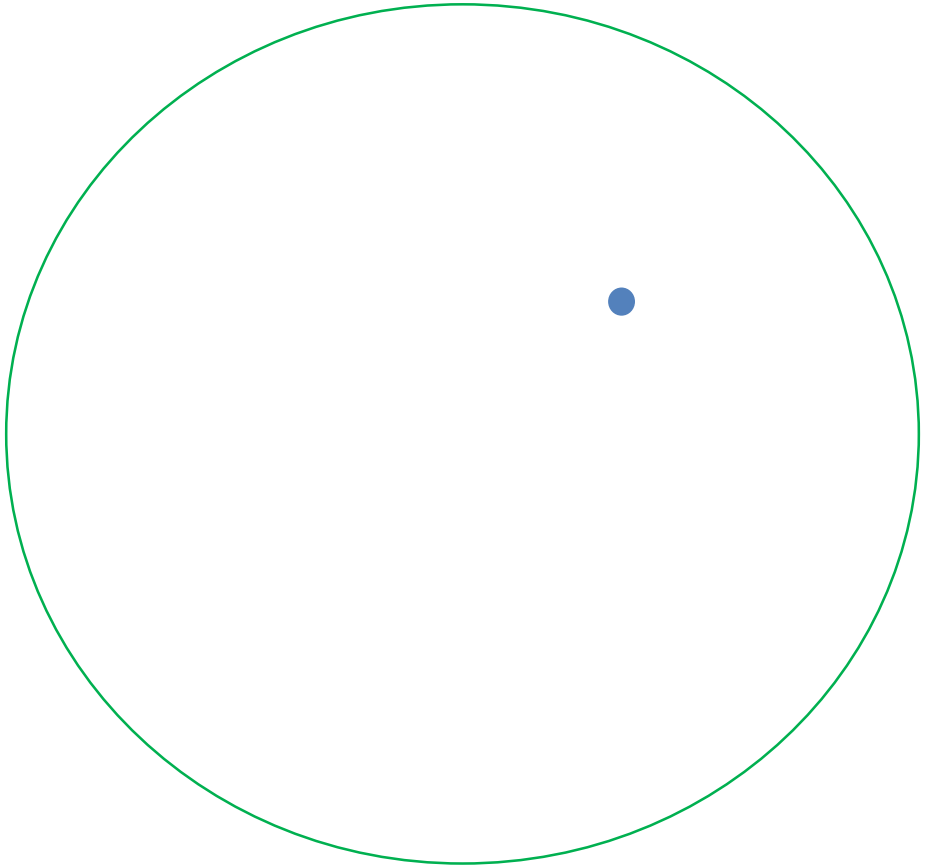


AUDIO FEEDBACK

- Safe
  - (Tip – HomeTip) < (MicronRadius – 15 px)
- Warning
  - (MicronRadius – 15 px) < (Tip – HomeTip) < (MicronRadius – 8 px)
- Red Alert
  - (Tip – HomeTip) > (MicronRadius – 8 px)

AUDIO FEEDBACK

Safe

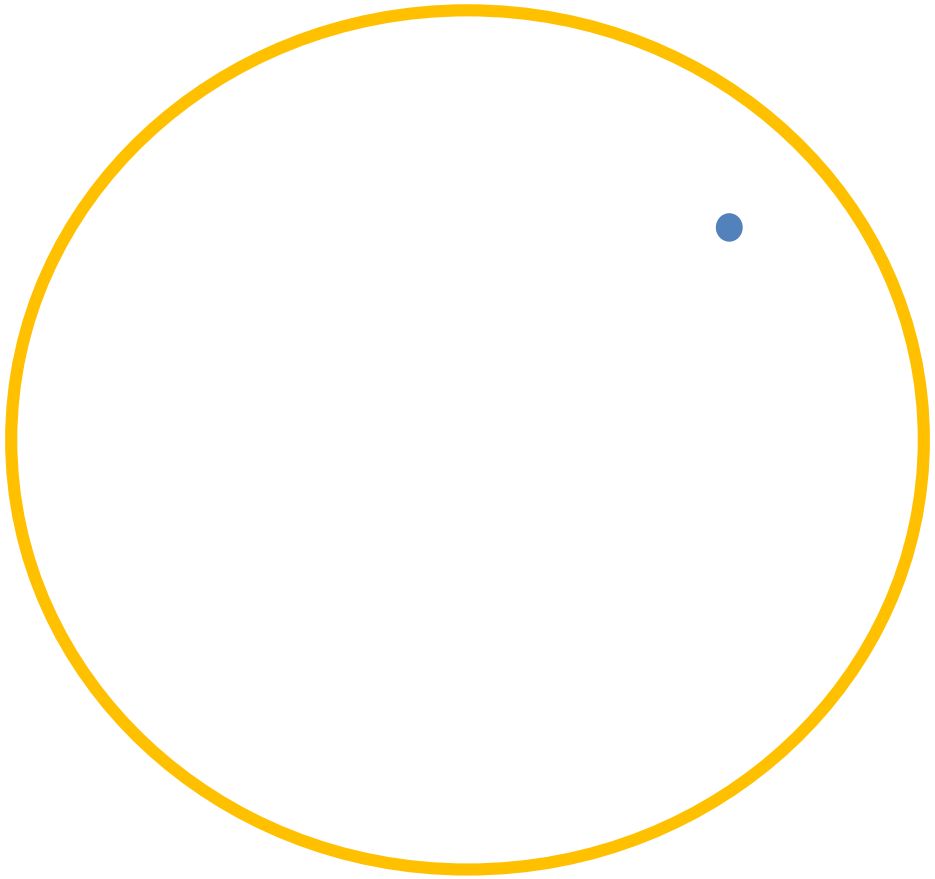


Micron Tip

Micron Workspace

AUDIO FEEDBACK

Warning

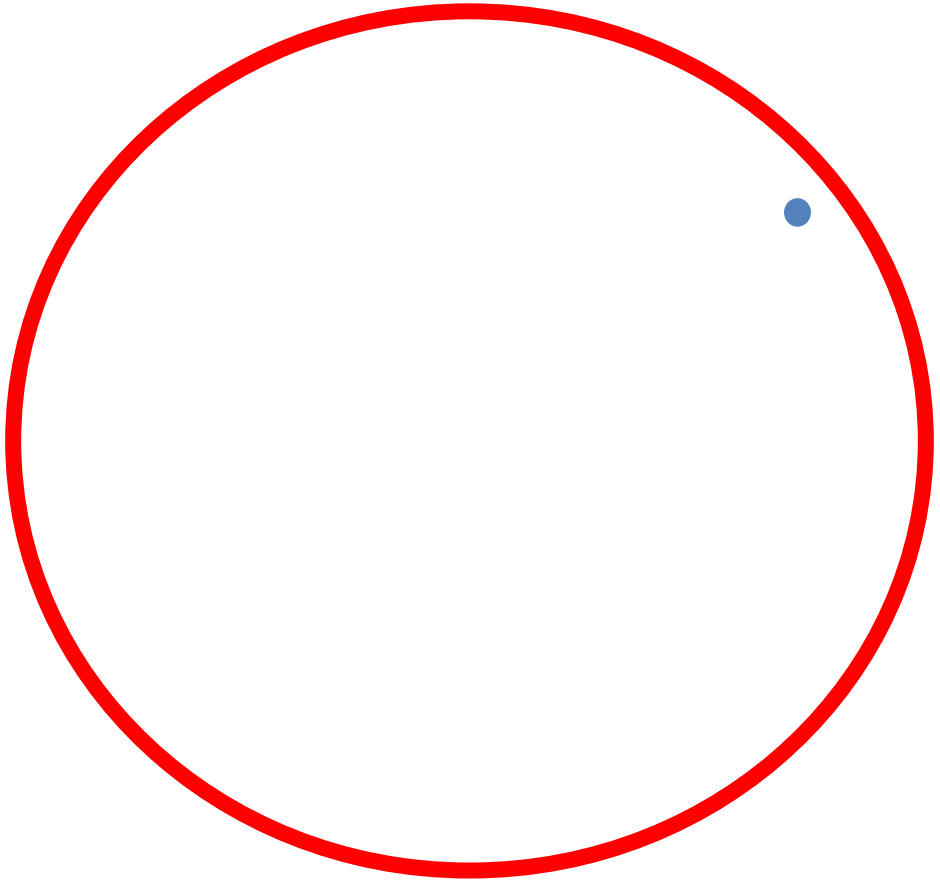


Micron Tip

Micron Workspace

AUDIO FEEDBACK

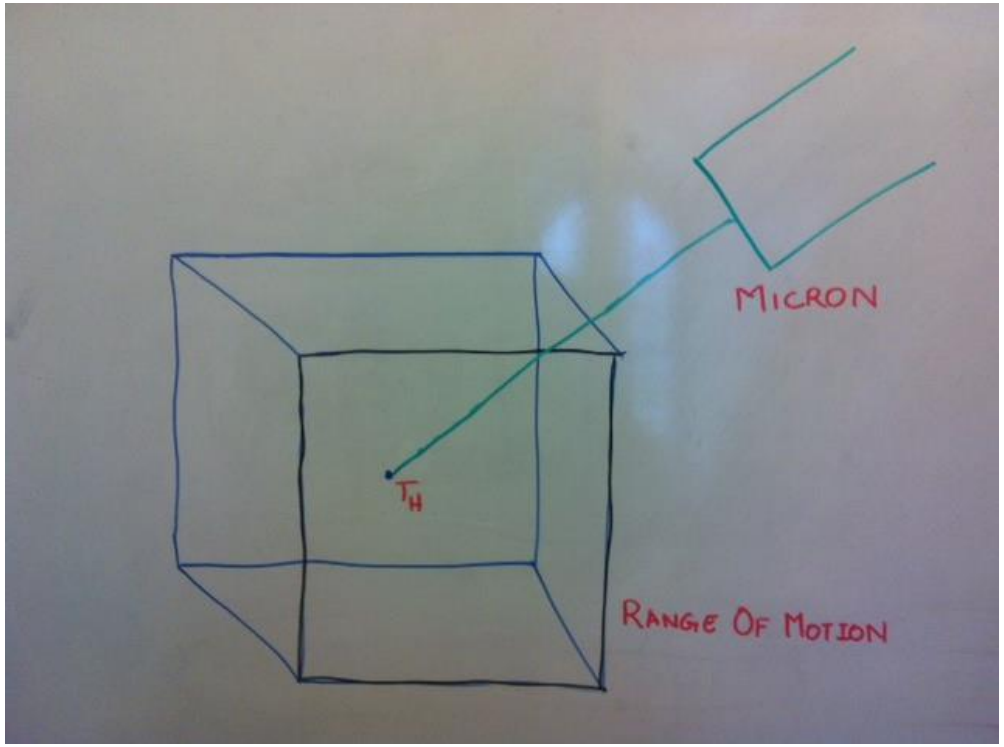
Alert

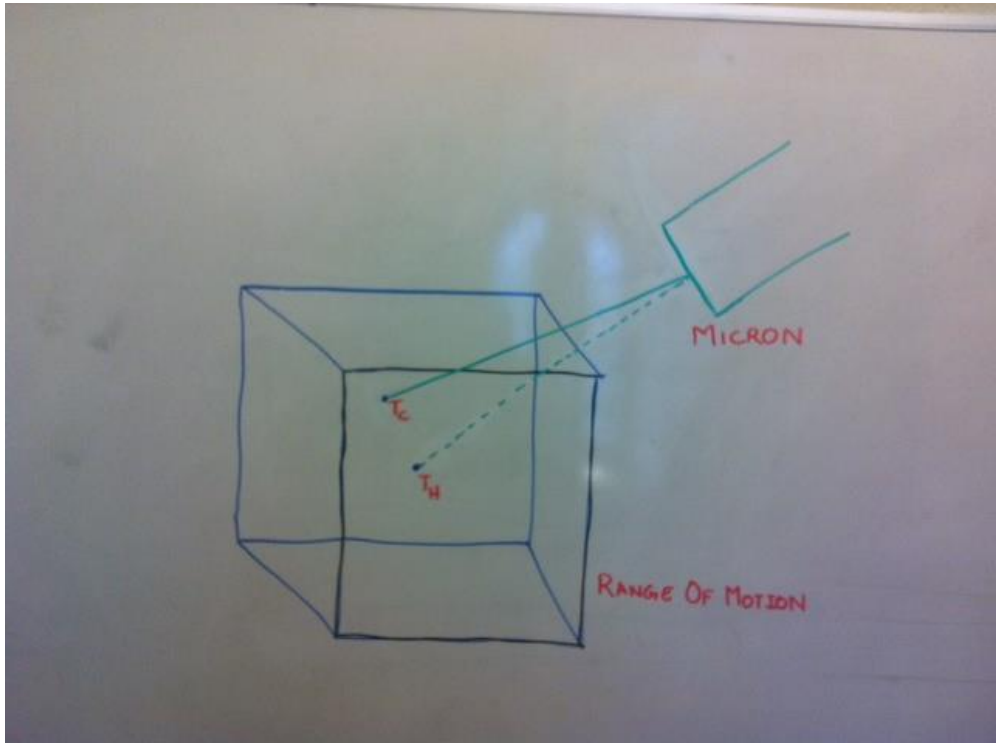


Micron Tip

Micron Workspace

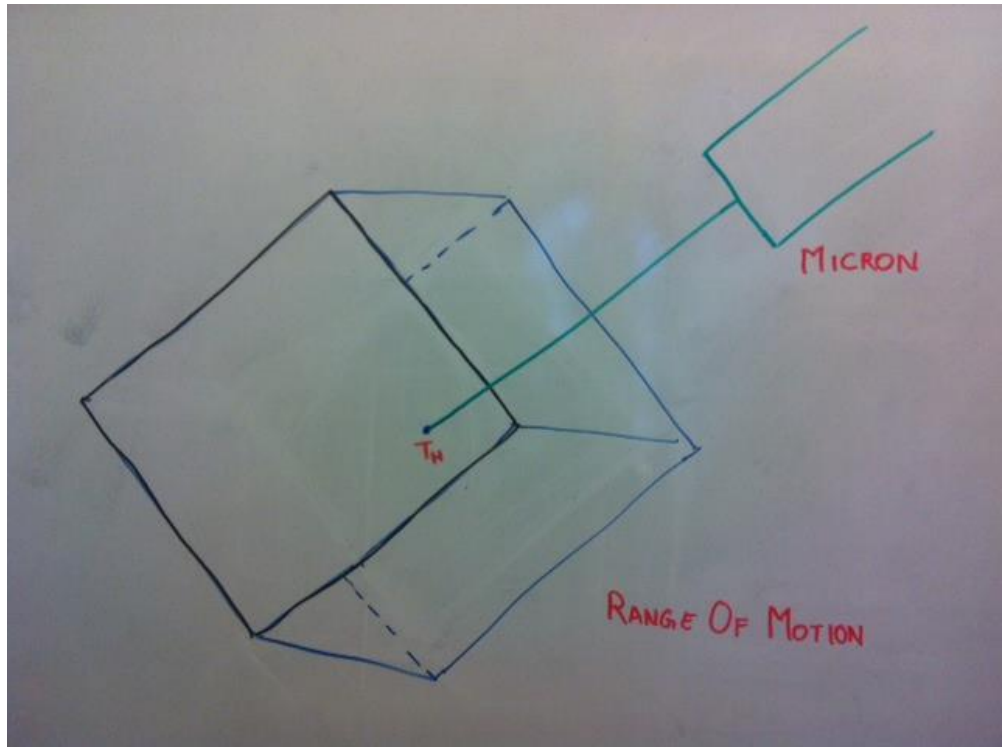
MICRON RANGE DISPLAY

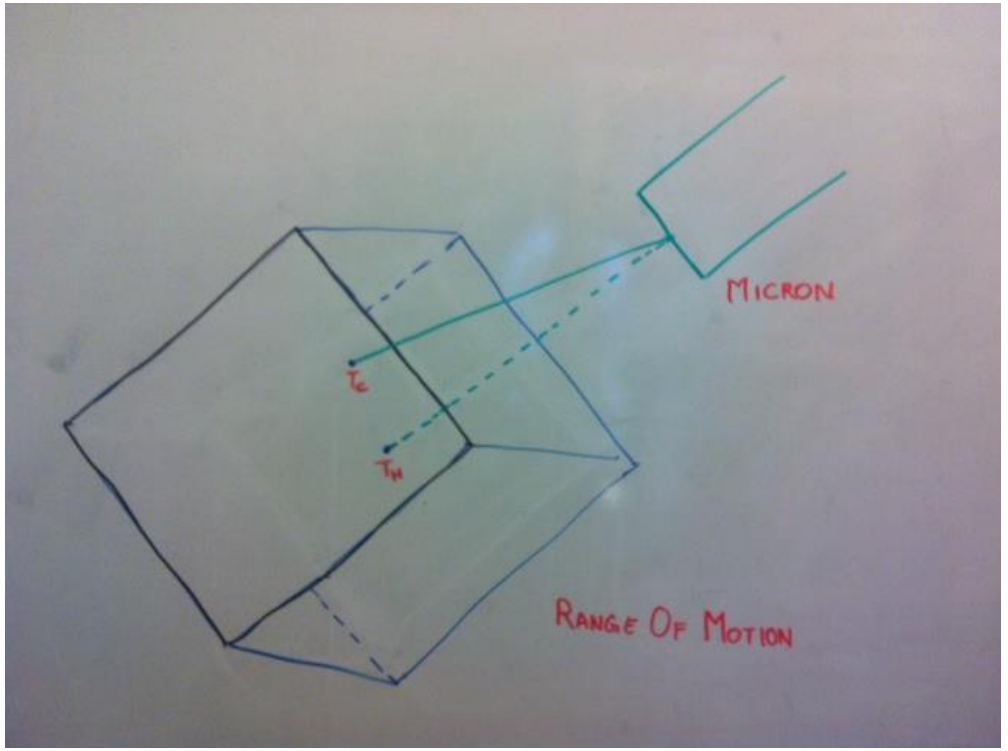




Without Depth

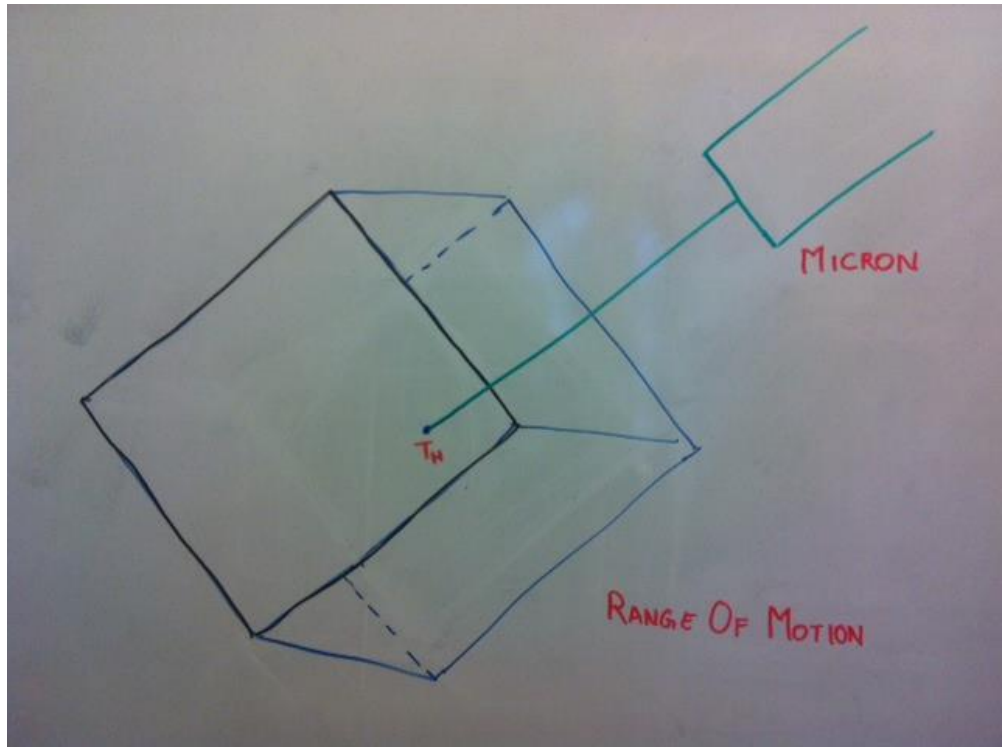
MICRON RANGE DISPLAY

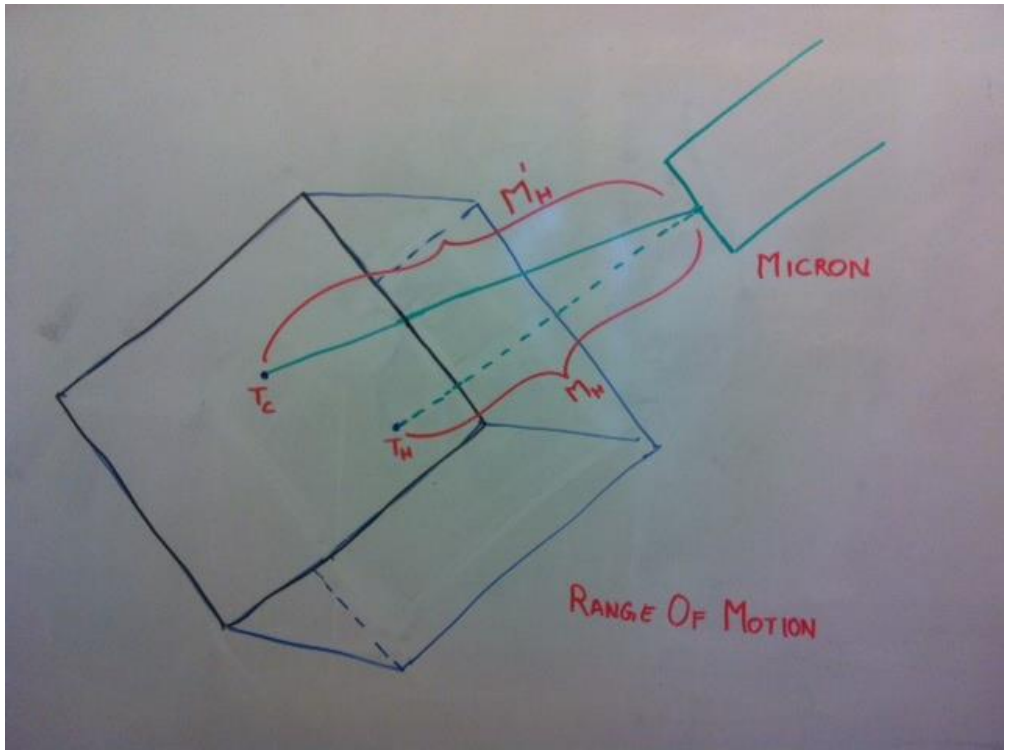




Without Depth

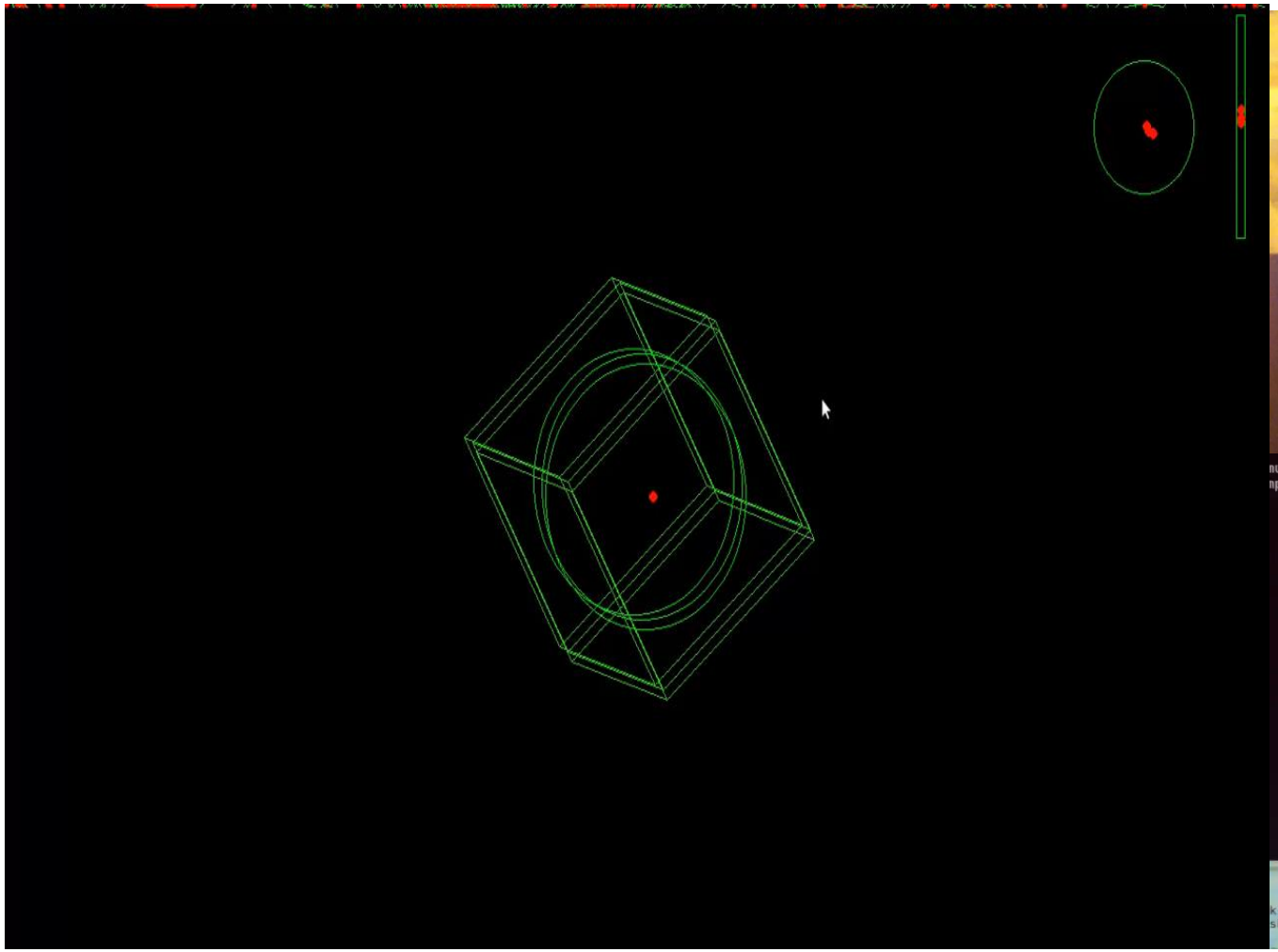
MICRON RANGE DISPLAY

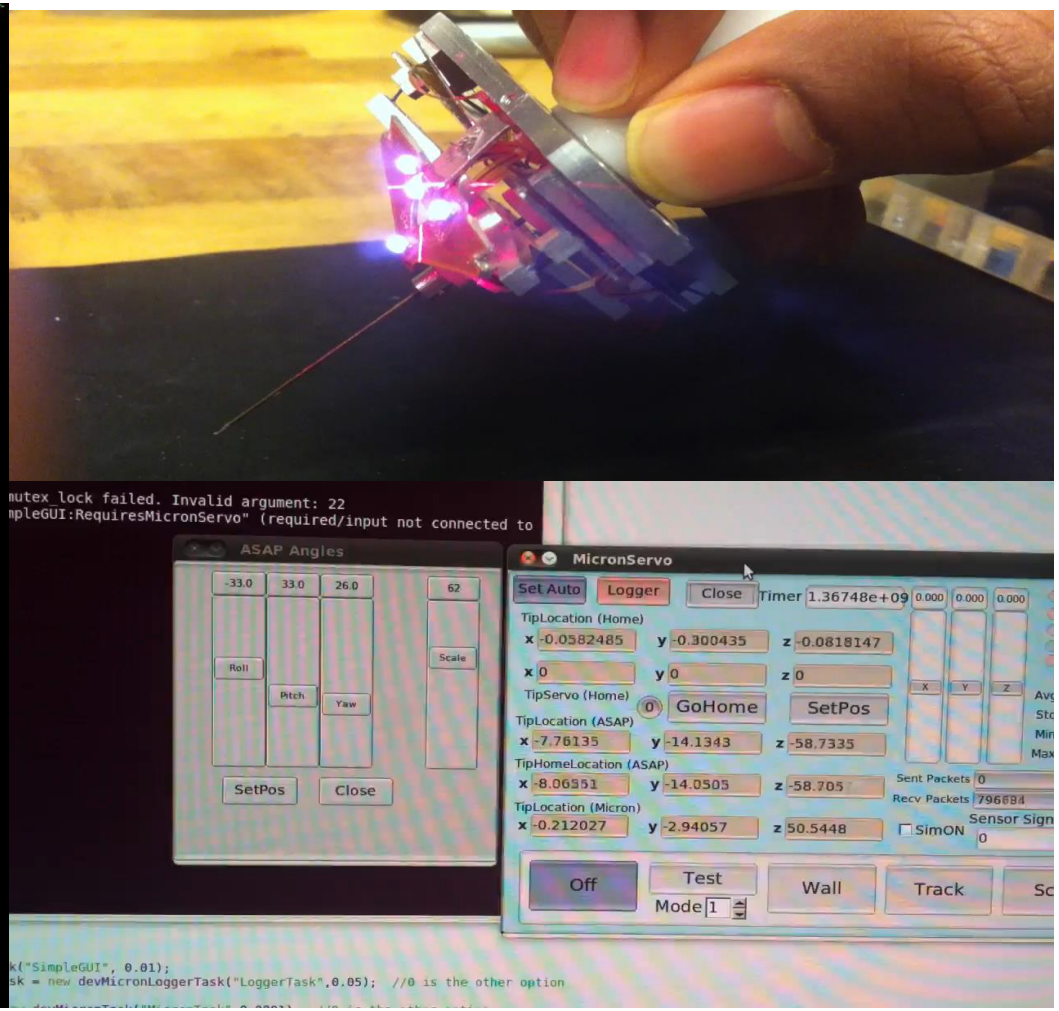




With Depth

VIDEO




mutex lock failed. Invalid argument: 22
mpleGUI:RequiresMicronServo" (required/input not connected to
ASAP Angles
-33.0
33.0
26.0
62
Roll
Pitch
Yaw
Scale
SetPos
Close
MicronServo
Set Auto
Logger
Close
Timer 1.36748e+09
TipLocation (Home)
x -0.0582485
y -0.300435
z -0.0818147
x 0
y 0
z 0
TipServo (Home)
GoHome
SetPos
TipLocation (ASAP)
x -7.76135
y -14.1343
z -58.7335
TipHomeLocation (ASAP)
x -8.06551
y -14.0505
z -58.705
Sent Packets 0
Recv Packets 796684
TipLocation (Micron)
x -0.212027
y -2.94057
z 50.5448
SimON
Off
Test
Mode 1
Wall
Track
k("SimpleGUI", 0.01);
sk = new devMicronLoggerTask("LoggerTask",0.05); //0 is the other option

CONFUSION !!

Cube

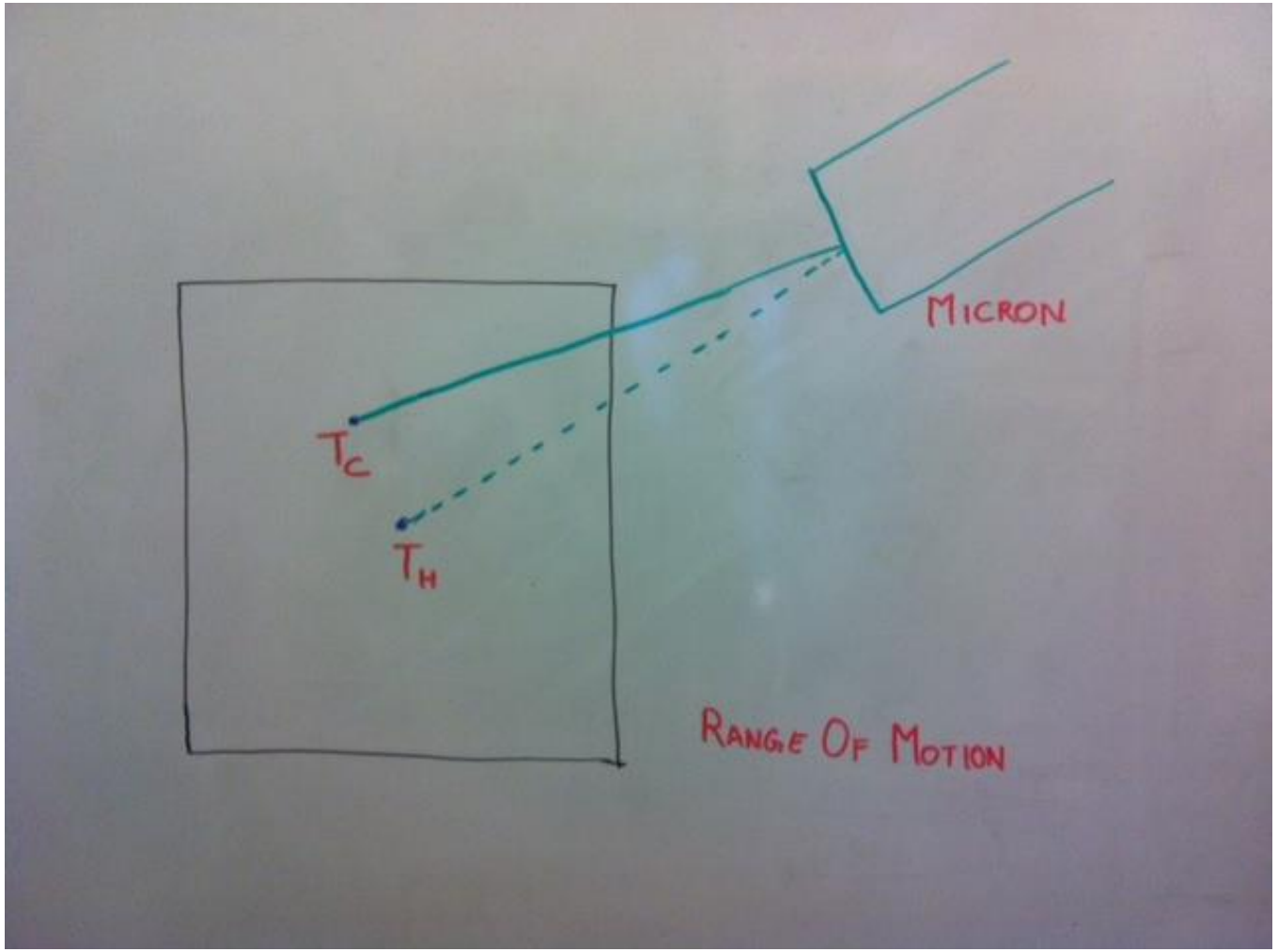
?????

Sphere

PROBLEMS FACED

- Access to Micron
- Build/Compile Delay (Lot of Sleeps)
- 3D on 2D

3D ON 2D



UPDATED DELIVERABLES

Maximum

Improve the robustness.

Show the workspace of the micron tip.

Audio Feedback

Expected

Integrate the tool tracker

Visual alert assistance system

Display the depth of the micron

Get feedback from the surgeons.

Minimum

Test application running and have some overlays displayed .

Get Information form Micron

DEPENDENCIES

Dependency	Source	Status/Comments	What If ??
PC or Laptop	Self	Acquired	Project Delayed
CISST and Stereo Vision Libraries	Open Source-Online	Installed	Custom Libraries
QT Creator - IDE	Open Source-Online	Installed	Use other free IDEs available
Material to understand Micron better	Dr.Russel Taylor	Acquired	Learn Myself
Documentation of previous work	Marcin Balicki/Balazs Vagvolgyi	Acquired	Learn myself
Access to micron	Marcin Balicki/Balazs Vagvolgyi	Acquired - Not always available	Work on simulated data/Project Delayed
Access to Stereo video Microscope	Marcin Balicki/Balazs Vagvolgyi	Acquired - Not always available	Work on simulated data/Project Delayed

UPDATED TIMELINE

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	Continuous Feedback														
	Rigorous Testing														
	Debugging														
	Include the micron tip workspace														
	Improve the tracker														

READING LISTS

[1] B. C. Becker, S. Voros, R. A. MacLachlan, G. D. Hager, and C. N. Riviere, "Active Guidance of a Handheld Micromanipulator using Visual Servoing", in IEEE International Conference on Robotics and Automation, Kobe, Japan, May 12-17, 2009. pp. 339-344.

[2] B. Becker, R. MacLachlan, and C. Riviere, "State estimation and feedforward tremor suppression for a handheld micromanipulator with a Kalman filter", in EEE RSJ Int Conf Intell Robot Syst, 2011. pp. 5160-5165. NIHMSID: 345014.

[3] B. Becker, R. MacLachlan, L. Lobes, and C. Riviere, "Vision-Based Retinal Membrane Peeling with a Handheld Robot", in IEEE Int Conf Robot Autom, 2012. pp. 1075-1080. NIHMSID: 368417.

[4] B. Becker, S. Yang, R. MacLachlan, and C. Riviere, "Towards vision-based control of a handheld micromanipulator for retinal cannulation in an eyeball phantom", in Proc IEEE RAS EMBS Int Conf Biomed Robot Biomechatron, 2012. p. accepted for publication. NIHMSID: 368431.

[5] B. Gonenc, M. A. Balicki, J. Handa, P. Gehlbach, C. N. Riviere, R. H. Taylor, and I. Iordachita, "Preliminary Evaluation of a Micro-Force Sensing Handheld Robot for Vitreoretinal Surgery", in IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), Vilamoura, Algarve, Portugal, 7-12 October, 2012. pp. 4125-4130.

READING LISTS

[6] R. MacLachlan, B. Becker, J. Cuevas-Tabarés, G. Podnar, L. Lobes, and C. Riviere, " Micron: an actively stabilized handheld tool for microsurgery", IEEE Trans Robot., vol. 28- 1, pp. 195-212, 2012. NIHMSID:345015.

[7] S. Yang, M. Balicki, R. A. MacLachlan, X. Liu, J. U. Kang, R. H. Taylor, and C. N. Riviere, "Optical Coherence Tomography Scanning with a Handheld Vitreoretinal Micromanipulator ", in IEEE Engineering in Medicine and Biology Conf, San Diego, Aug 28-Sep 1, 2012. pp. 948-951. NIHMSID: 383510.

[8] S. Yang, R. MacLachlan, and C. Riviere, "Design and analysis of 6 DOF handheld micromanipulator", in Proc IEEE Int Conf Robot Autom., St. Paul, MN, May 14-18, 2012. pp. 1946-51. NIHMSID: 368427.

[9] B. Becker, R. MacLachlan, L. Lobes, G. Hager, and C. Riviere, "Vision-Based Control of a Handheld Surgical Micromanipulator with Virtual Fixtures", IEEE Transactions on Robotics, pp. Acepted Nov 27, 2012, 2013. NIHMSID: 429749.

[10] M. Balicki, J.-H. Han, I. Iordachita, P. Gehlbach, J. Handa, R. H. Taylor, and J. Kang, "Single Fiber Optical Coherence Tomography Microsurgical Instruments for Computer and Robot-Assisted Retinal Surgery", in Medical Image Computing and Computer Assisted Surgery (MICCAI 2009), London, September 20-24, 2009. pp. 108-115. PMID: 20425977

QUESTIONS?