

NSF Engineering Research Center
for Computer Integrated Surgical
Systems and Technology



MICRON RANGE-OF- MOTION VISUALIZATION

Check Point Presentation

Team-14

Preetham Chalasani

Department of Computer Science

The Johns Hopkins University

pchalas1@jhu.edu

Mentors - Dr. Russell Taylor, Marcin Balicki, Balazs Vagvolgyi

**WHITING
SCHOOL OF
ENGINEERING**

THE JOHNS HOPKINS UNIVERSITY





CONTENTS

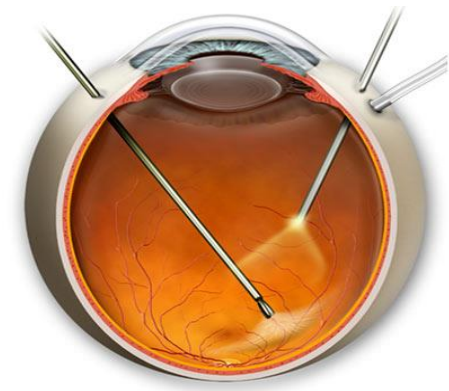
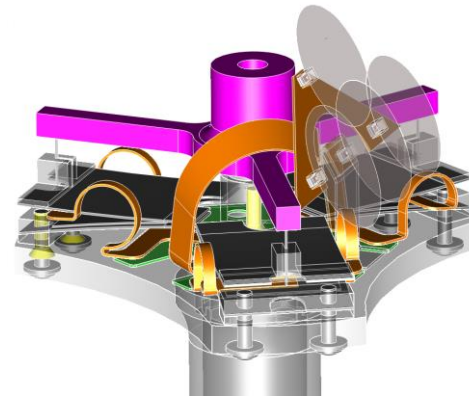




SUMMARY



- **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.



Summary

Background

Progress

Deliverables

Dependencies

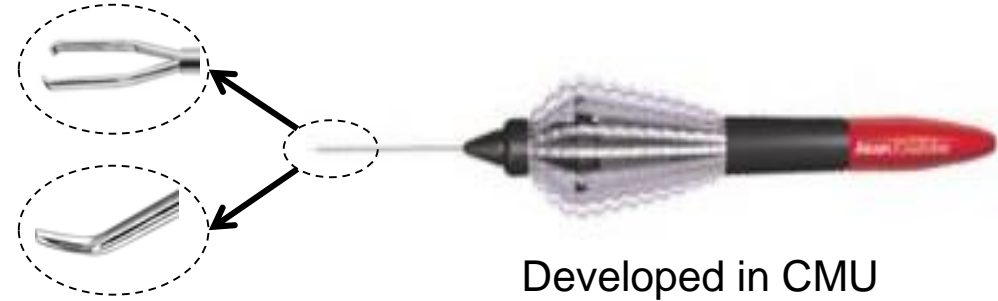
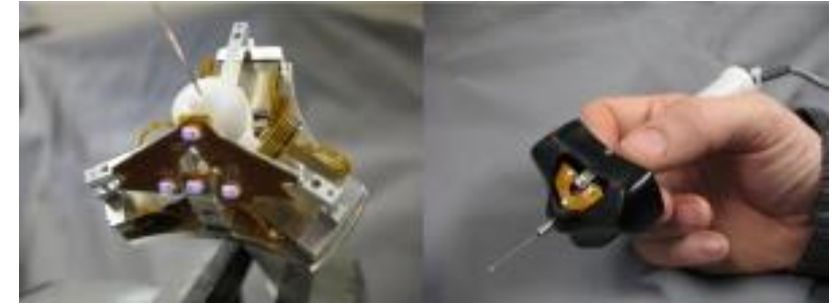
Timeline

Reading List



MICRON

- Tremor Cancellation
- Move actively to compensate



Developed in CMU

Summary

Background

Progress

Deliverables

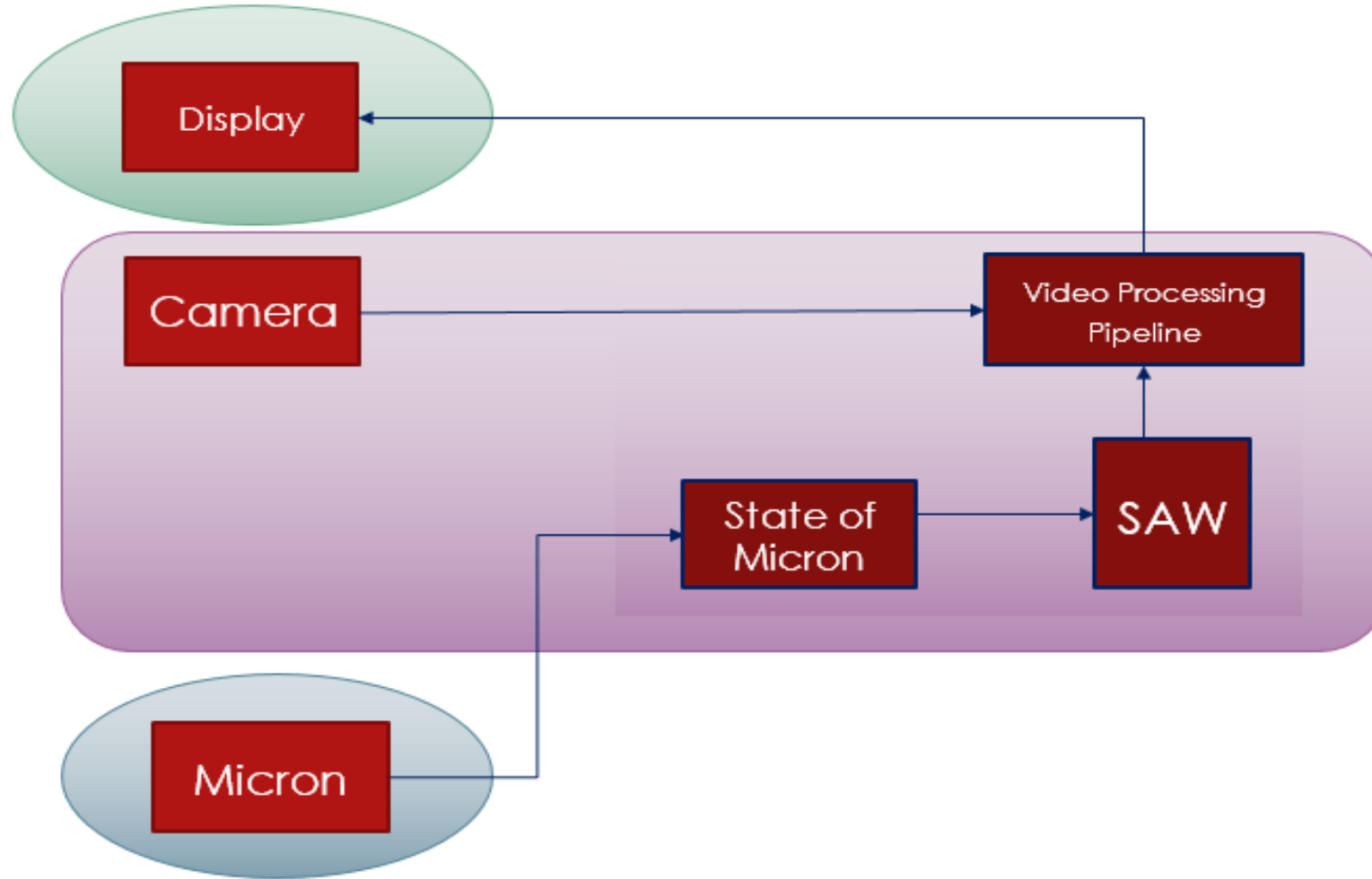
Dependencies

Timeline

Reading List

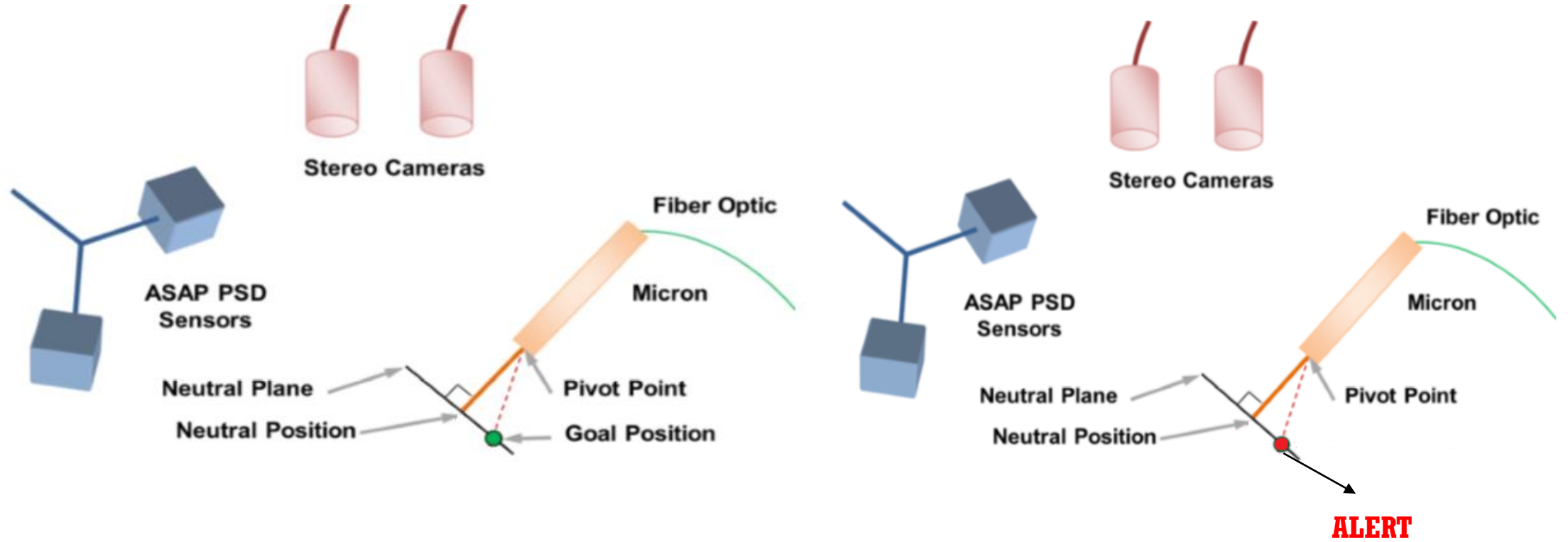


HARDWARE





SOLUTION





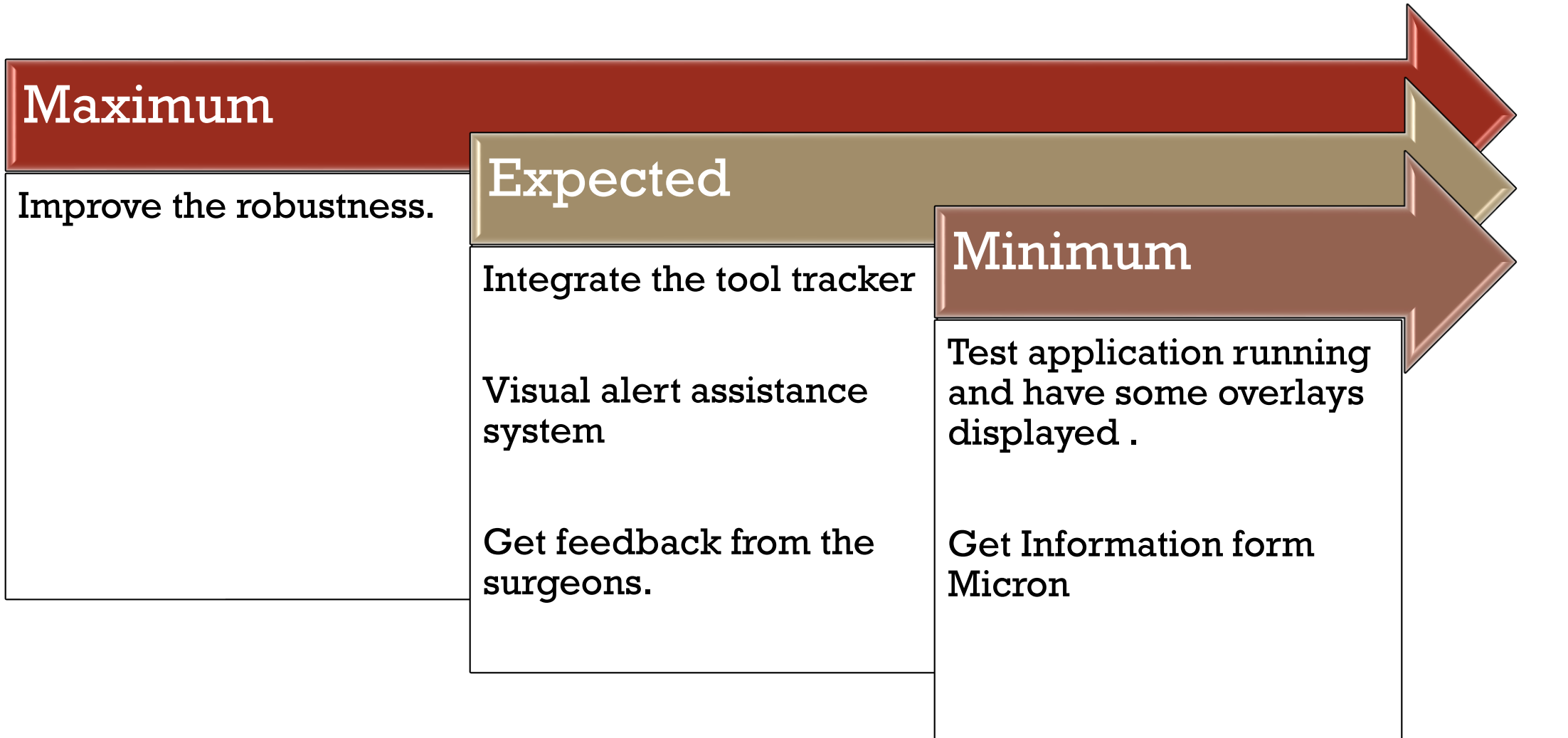
TIMELINE

		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	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		
	Understanding CISST and SteroVision libraries	Green	Green	Green				Spring Break									
	Setting up development Environment	Green	Green	Green													
	Understanding the Existing Framework				Orange												
	Create a test Application				Blue	Blue											
	Include some overlays				Blue	Blue											
	Communicate with the micron and get the information				Blue	Blue											
	Develop Application using simulated data						Blue			Blue	Blue	Blue					
Feedback											Blue						
PHASE - II	Alert system									Blue	Blue						
	Feedback											Blue					
	Debugging											Blue	Blue	Blue			
	Improve the tracker											Blue	Blue	Blue			





DELIVERABLES





CURRENT PROGRESS

Internal Component Connections

Dummy Source

Random Data

Transformation between Frames

Add Overlays

Get motion Information from Micron



Summary

Background

Progress

Deliverables

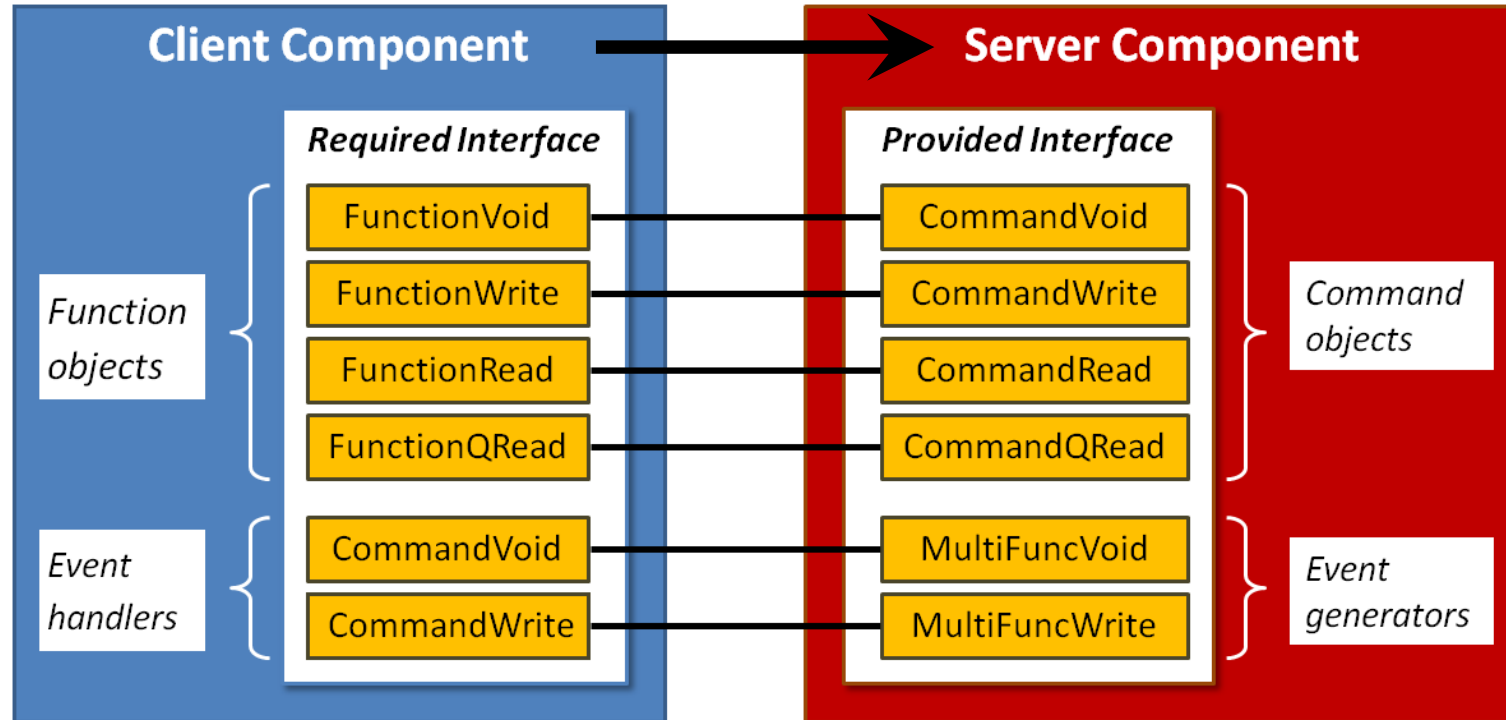
Dependencies

Timeline

Reading List



INTERNAL COMPONENT CONNECTION



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





MY CONNECTIONS

Provided

devMicron

micronBehavior

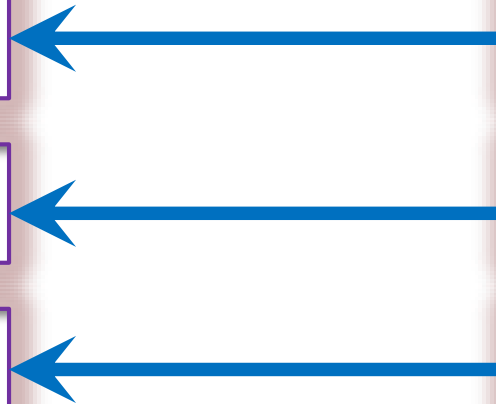
devMicron

Required

micronBehavior

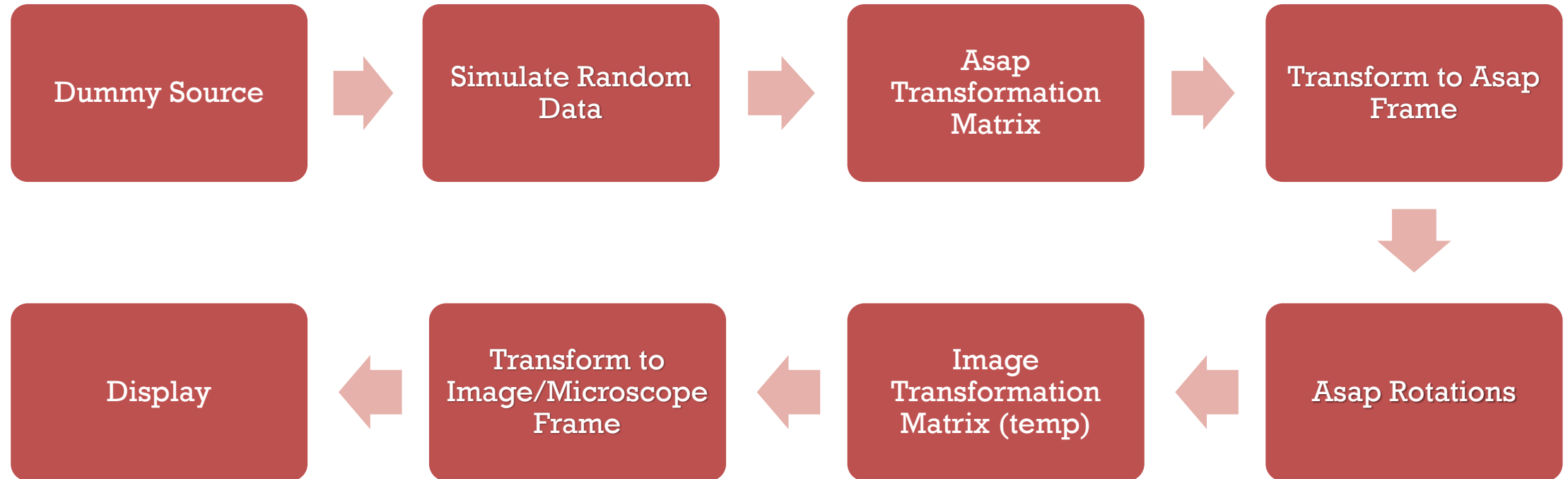
micronPainter

AsapGUI



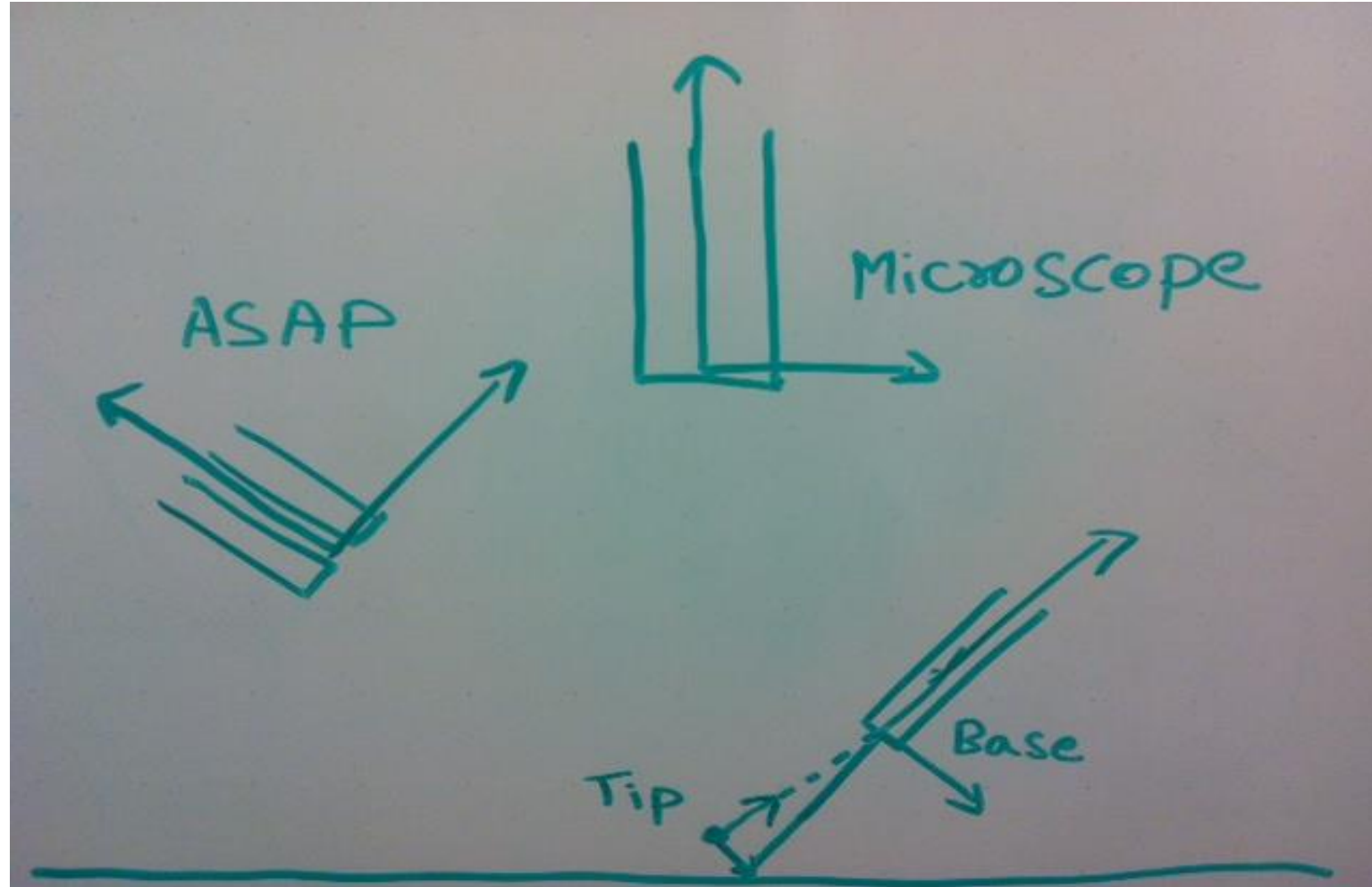


GUI FLOW DIAGRAM





FRAMES



Summary

Background

Progress

Deliverables

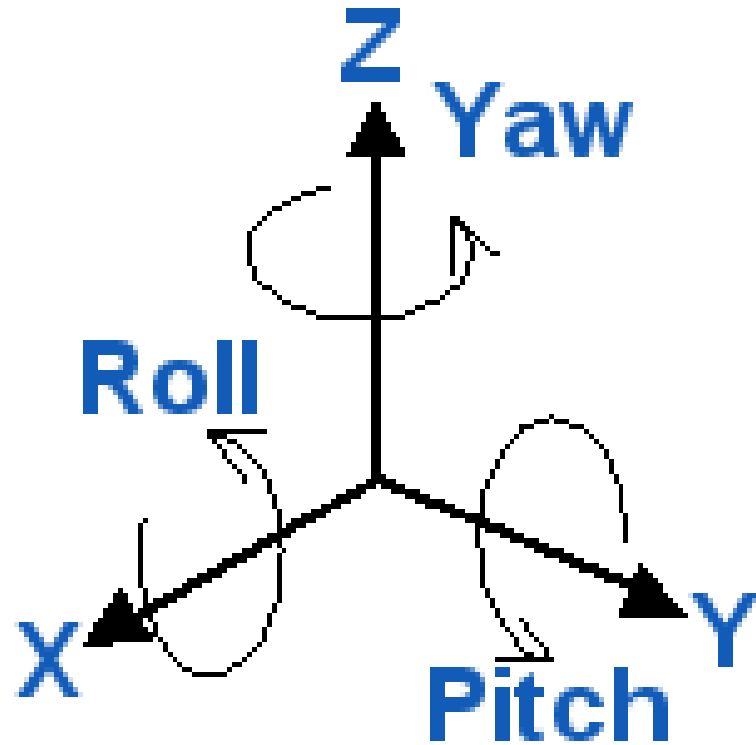
Dependencies

Timeline

Reading List



ASAP ANGLES



YAW = $R_z(\alpha) = \begin{pmatrix} \cos \alpha & -\sin \alpha & 0 \\ \sin \alpha & \cos \alpha & 0 \\ 0 & 0 & 1 \end{pmatrix}.$

PITCH = $R_y(\beta) = \begin{pmatrix} \cos \beta & 0 & \sin \beta \\ 0 & 1 & 0 \\ -\sin \beta & 0 & \cos \beta \end{pmatrix}.$

ROLL = $R_x(\gamma) = \begin{pmatrix} 1 & 0 & 0 \\ 0 & \cos \gamma & -\sin \gamma \\ 0 & \sin \gamma & \cos \gamma \end{pmatrix}.$

Summary

Background

Progress

Deliverables

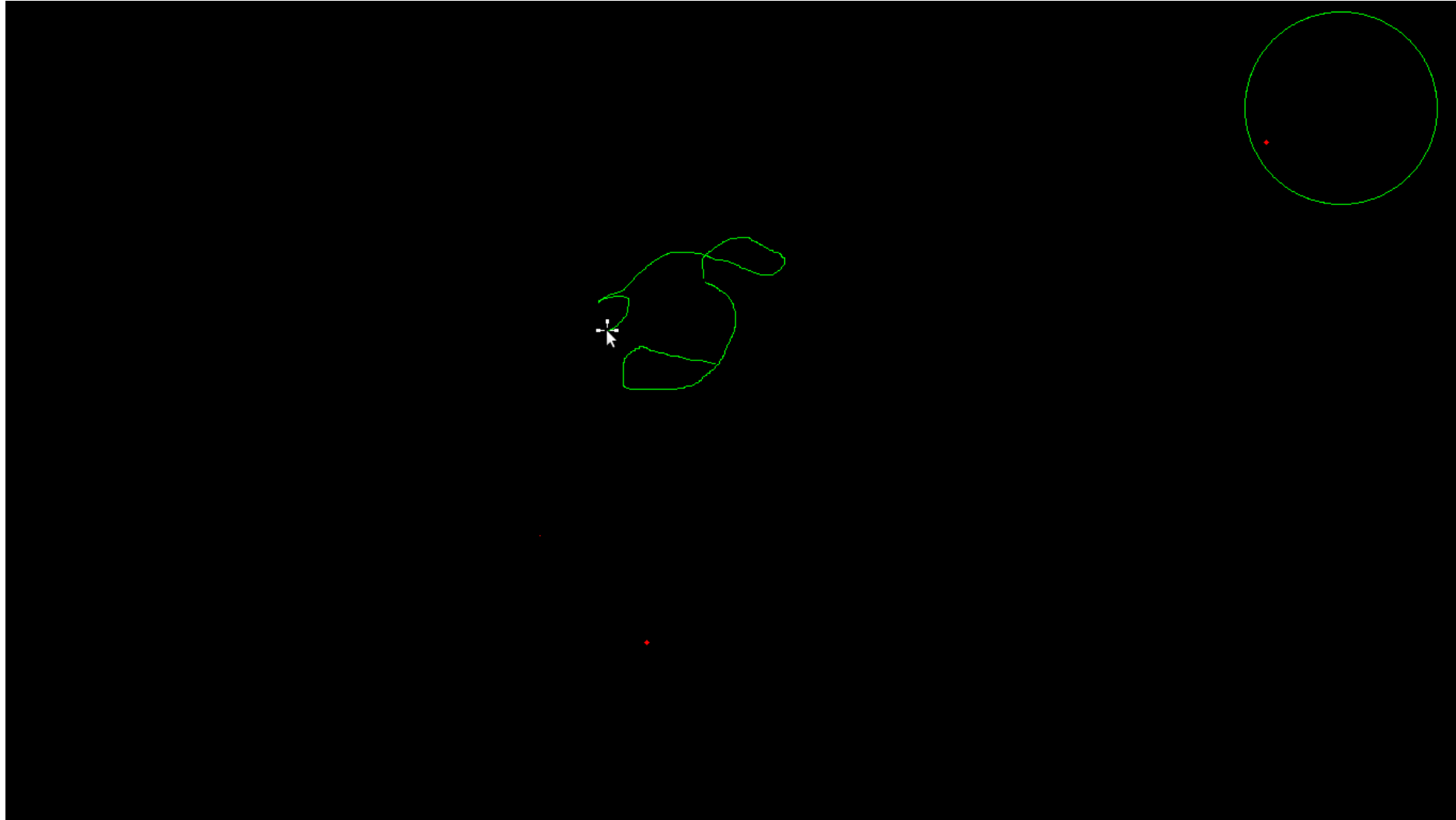
Dependencies

Timeline

Reading List



SCREENSHOT - I



Summary

Background

Progress

Deliverables

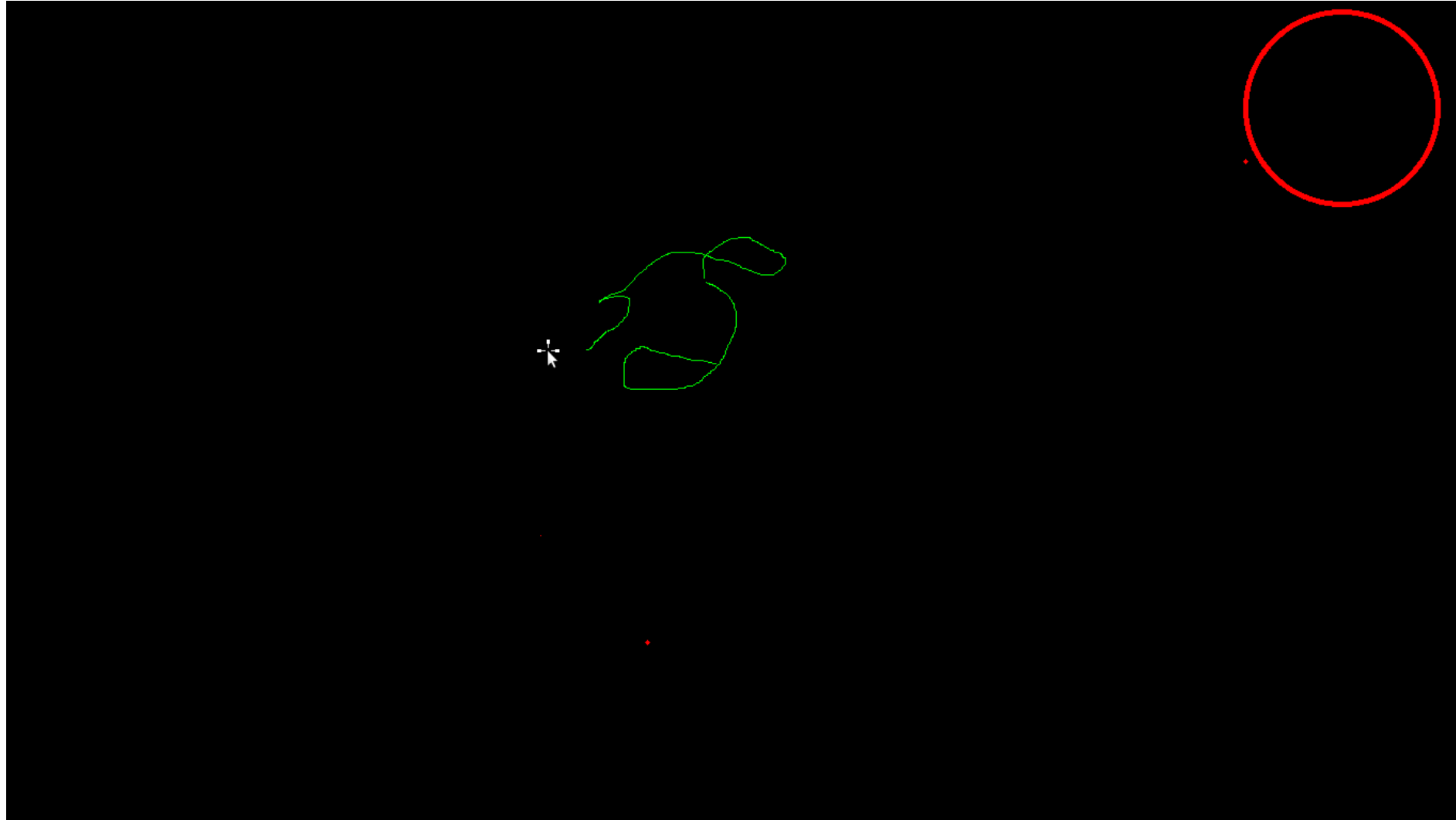
Dependencies

Timeline

Reading List



SCREENSHOT - II



Summary

Background

Progress

Deliverables

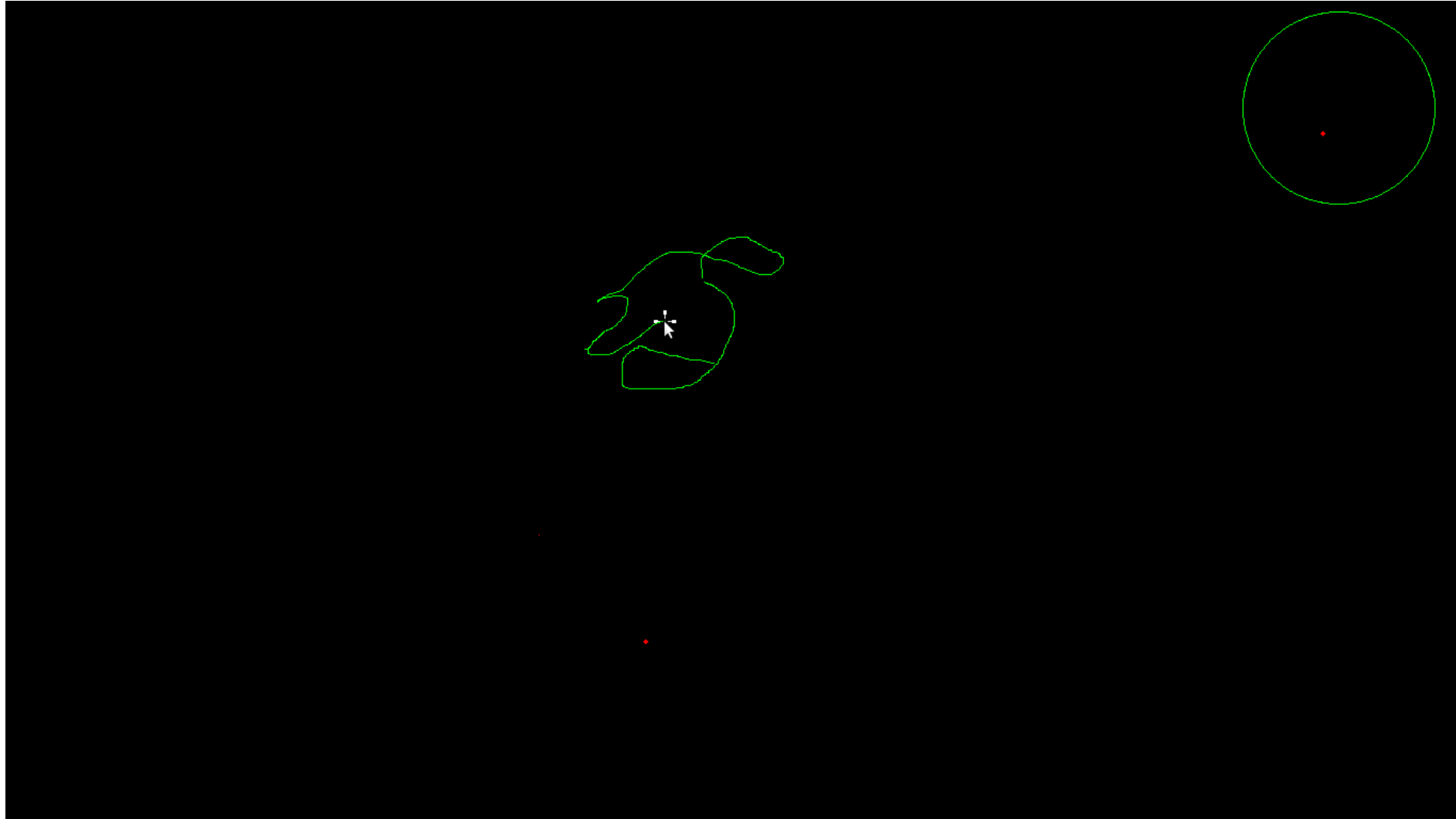
Dependencies

Timeline

Reading List



SCREENSHOT - III





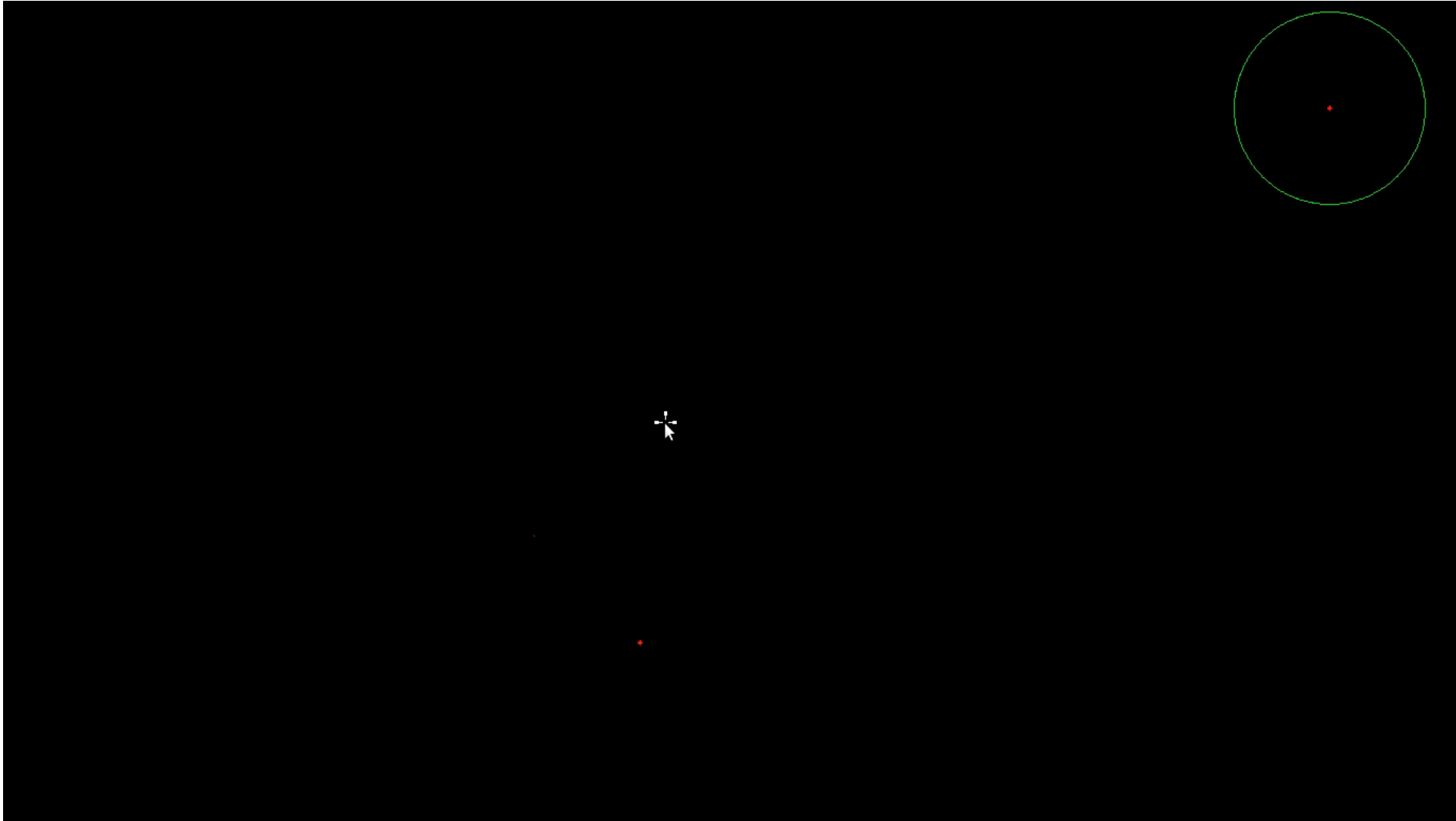
PROBLEMS FACED

- Few complications with cisstVector
- Access to Micron
- 3D transformation not supported by CISST
- Build/Compile Delay





SAMPLE VIDEO



Summary

Background

Progress

Deliverables

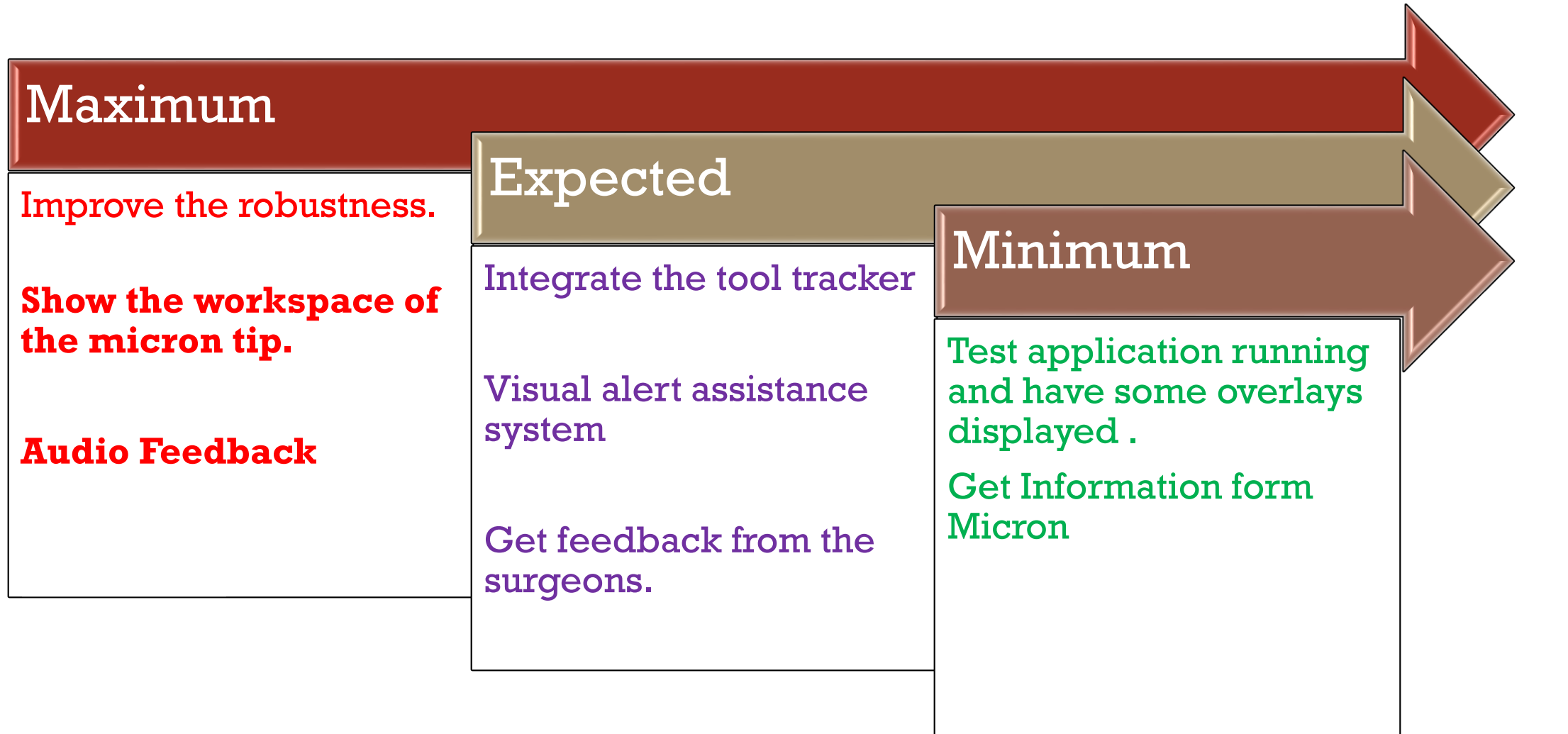
Dependencies

Timeline

Reading List



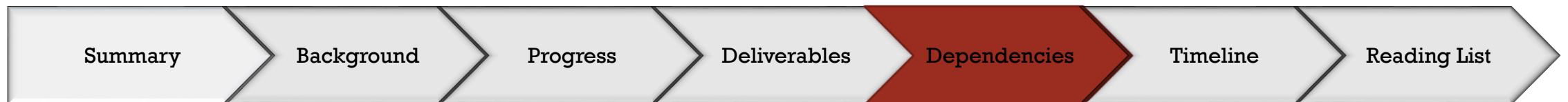
UPDATED DELIVERABLES





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	In progress	Work on simulated data/Project Delayed
Access to Stereo video Microscope	Marcin Balicki/Balazs Vagvolgyi	In progress	Work on simulated data/Project Delayed





UPDATED TIMELINE

		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	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		
	Understanding CISST and SteroVision libraries	Green	Green	Green				Spring Break									
	Setting up development Environment	Green	Green	Green													
	Understanding the Existing Framework				Green												
	Create a test Application				Green	Green											
	Include some overlays				Green	Green											
	Develop Application using simulated data				Green	Green											
	Communicate with the micron and get the information						Green			Green							
	Develop Application using Micron data						Green			Yellow	Yellow						
	Integrate Tool Tracker									Yellow	Yellow						
PHASE - II	Continuous Feedback											Blue	Blue				
	Rigorous Testing											Blue	Blue	Blue			
	Debugging											Blue	Blue	Blue	Blue		
	Include the micron tip workspace											Blue	Blue	Blue	Blue		
	Improve the tracker											Blue	Blue	Blue	Blue		





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 IEEE 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. Accepted 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

Summary

Background

Progress

Deliverables

Dependencies

Timeline

Reading List

QUESTIONS?