

Software for an Intra-Operative “Kinect” with a Flexible Endoscope

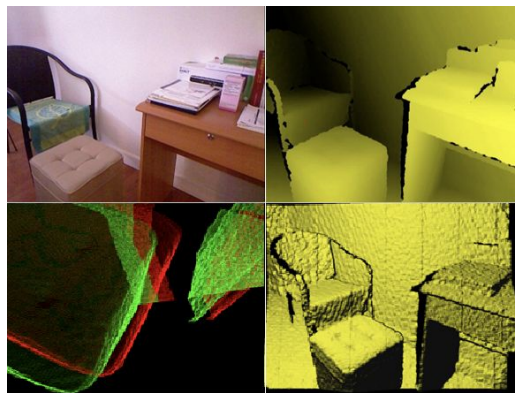
Group 13: Shohini Ghosh and Elli Tian

Mentors: Dr. Austin Reiter and Dr. Russell Taylor

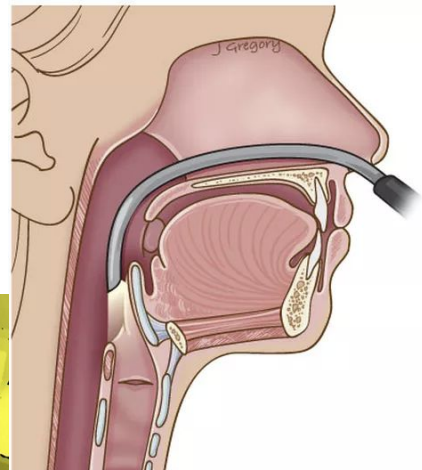
Computer Integrated Surgery, Spring 2017

Relevance

- “Depth cameras” have spurred the popularity and approachability of real-time 3D reconstruction
- 3D reconstruction based on images captured by endoscope
- Small laser allows for structured light approach with endoscope

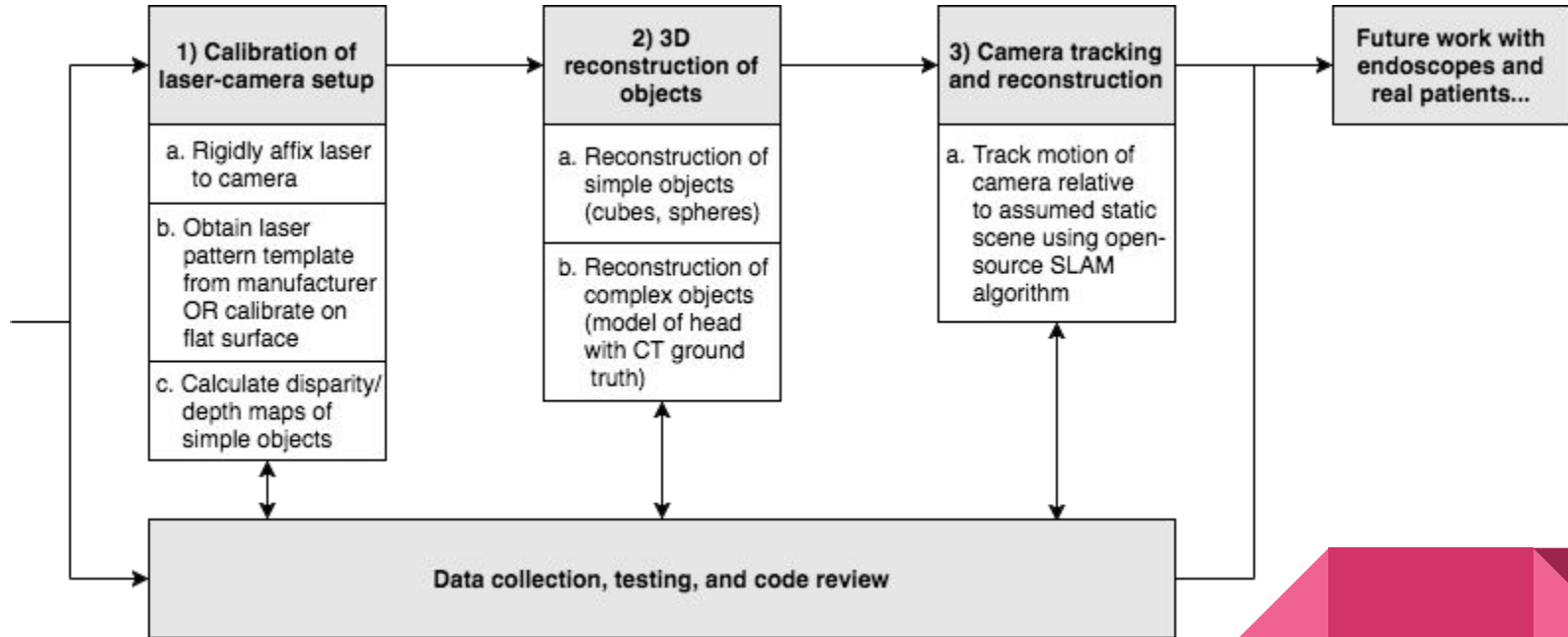


<http://jiaaizhang.com/project/real-time-3d-reconstruction/>



<http://www.zaghimd.com/sleep-endoscopy>

Technical Approach



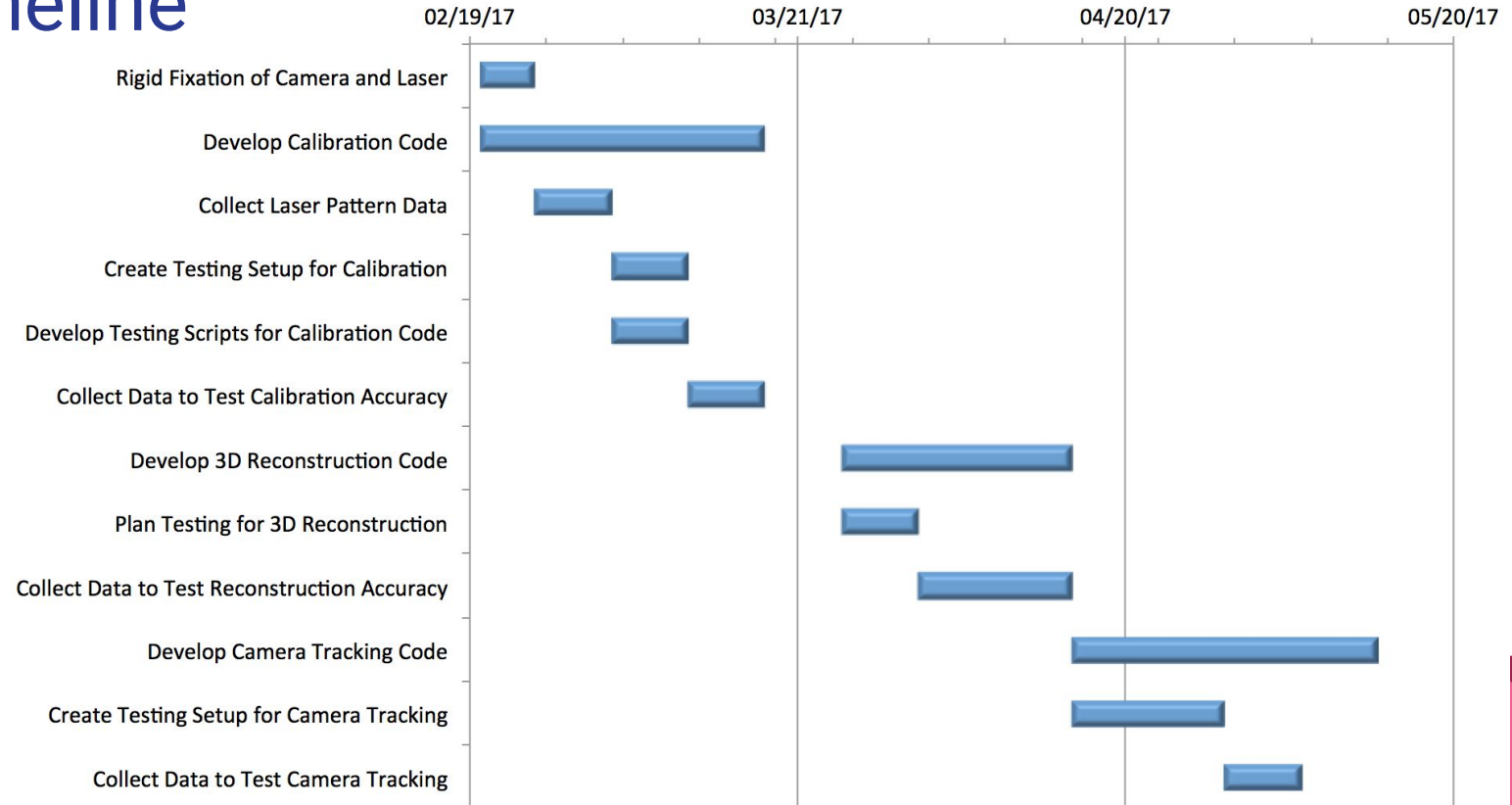
Deliverables

- Minimum
 - Rigid fixation method of camera to laser
 - Template for laser pattern in appropriate coordinates relative to camera
 - Code to compute depth map for camera's field of view**
 - Code to create 3D reconstruction of simple objects based on depth map**
- Expected
 - Code to create 3D reconstruction of complex objects based on depth map**
- Maximum
 - Code to track camera movement relative to static scene to stitch together static 3D reconstructions**

** Includes testing scripts to verify mm accuracy



Timeline



Dependencies

Dependency	Plan for Resolving
Access to laser & camera	Resolved on 2/10
Access to lab space for storage/testing	Resolved on 2/17
Reliable fixation method for camera and laser	Work with Tae Soo Kim on 2/23
Development of testing setup	Work with Tae Soo Kim
3D reconstruction depends on calibration	Seek guidance from Dr. Reiter if problems arise
Camera tracking depends on 3D reconstruction	Seek guidance from Dr. Reiter if problems arise
Obtaining Tae Soo Kim's prior work	Reach out to Tae Soo Kim and Dr. Reiter to obtain
Obtaining calibration code	Dr. Reiter will reach out, otherwise we will develop code

Management Plan

- Weekly meeting with Dr. Reiter for updates and guidance
- Periodic meetings with Dr. Taylor for guidance
- Elli - physical setup, writing scripts to test accuracy of code
- Shohini - writing code to compute depth map and 3D reconstructions
- Elli & Shohini together - data collection, code review



Reading List

1. Neibner, Matthias et al. (2013). Real-time 3D Reconstruction at Scale using Voxel Hashing. Retrieved from <http://www.graphics.stanford.edu/~niessner/papers/2013/4hashing/niessner2013hashing.pdf>
2. Real-time 3D Reconstruction at Scale using Voxel Hashing (YouTube).
https://www.youtube.com/watch?v=XD_UnuWSaoU
3. Al-Naji, A. et al. (2017). Real Time Apnoea Monitoring of Children Using the Microsoft Kinect Sensor: A Pilot Study.
<https://www.ncbi.nlm.nih.gov/pubmed/28165382>
4. Filko, Damir et al. (2016). Wound detection and reconstruction using RGB-D camera.
<http://ieeexplore.ieee.org/document/7522325/?reload=true§ion=abstract>
5. Khongma, A. et al. (2014). Kinect Quality Enhancement for Triangular Mesh Reconstruction with a Medical Image Application.
http://www.springer.com/cda/content/document/cda_downloaddocument/9783319046921-c2.pdf?SGWID=0-0-45-1445170-p176547379
6. Tae Soo Kim's reports from CIS 2 project (and maybe code and MS thesis)
7. Patent application by Tae Soo Kim and Drs. Taylor and Reiter:
<http://www.freepatentsonline.com/y2016/0143509.html>
8. SLAM algorithm: <https://github.com/simondlevy/BreezySLAM>

Questions?

