Vision-based Navigation and Improved GUI for the Robo-ELF
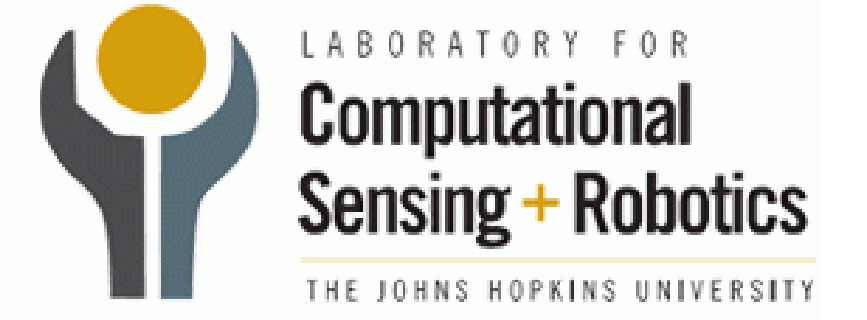
Computer Integrated Surgery II
Spring, 2012
Jonathan Kriss
Mentors: Dr. Russ Taylor, Kevin Olds
Collaborators: Renata Smith, Dr. Jeremy Richmon

Introduction

- The Robo-ELF, a robotic flexible endoscope manipulator, is meant to assist surgeons performing minimally invasive surgery inside the airway

- The system allows a single surgeon to operate with two hands while maintaining a view that is both stable and capable of a large range of motion

Goals

- Our main goal was to complete FDA requirements for human clinical trials with the RoboELF

- Requirements include:
  - Full documentation, testing and validation
  - Risk analysis and mitigation
  - Mechanical and software design updates and fixes
  - User manual

- Ensuring that the system is safe for the surgeon and the patient is the highest priority. We implement multiple safety checks to minimize the risk of injury.

- Our secondary goal was to add vision-based navigation to the system.

Technical Approach

- A Failure Mode Effects Analysis(FMEA) for the system verified that all potential risks have been accounted for and minimized.

- Testing and validation of all safety features

- A centralized, systematic software safety failure detection and handling scheme. Failures are separated into high- and low-risk requiring a full stop and removal of the system from the procedure or a simple restart and continuation

System Overview of the Robo-ELF

Outcomes and Results

- Our validation tests show that our safety features work as intended and minimize risks associated with the system.

- We produced a detailed user manual including step-by-step setup, breakdown and cleaning instructions, operating instructions, and an explanation of software error reports.

- We designed a new GUI that is more easily readable and useful to surgeons using the system in the OR.

- We did not have time to complete vision-based navigation.
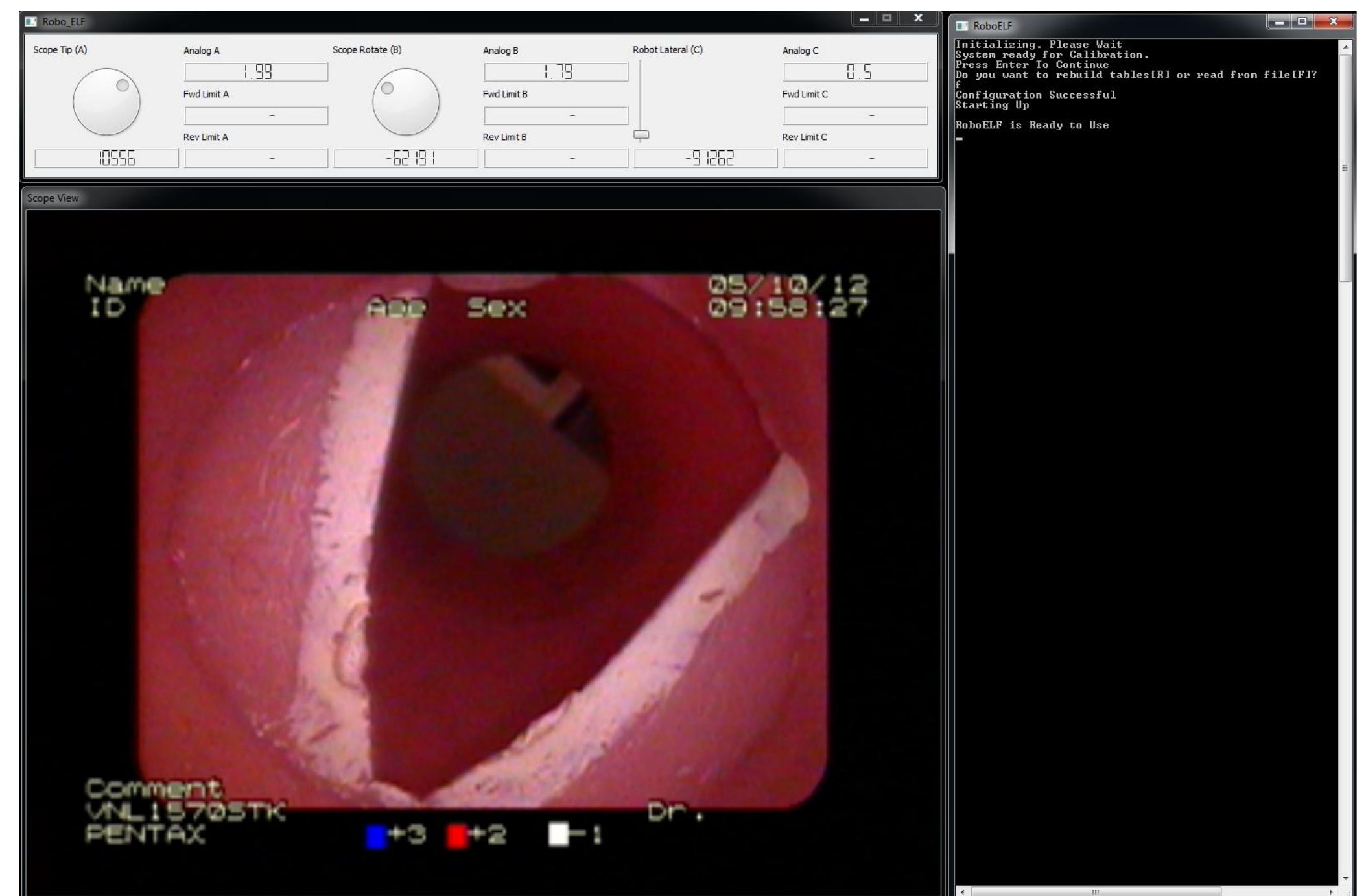
Redesigned GUI for the clinical system
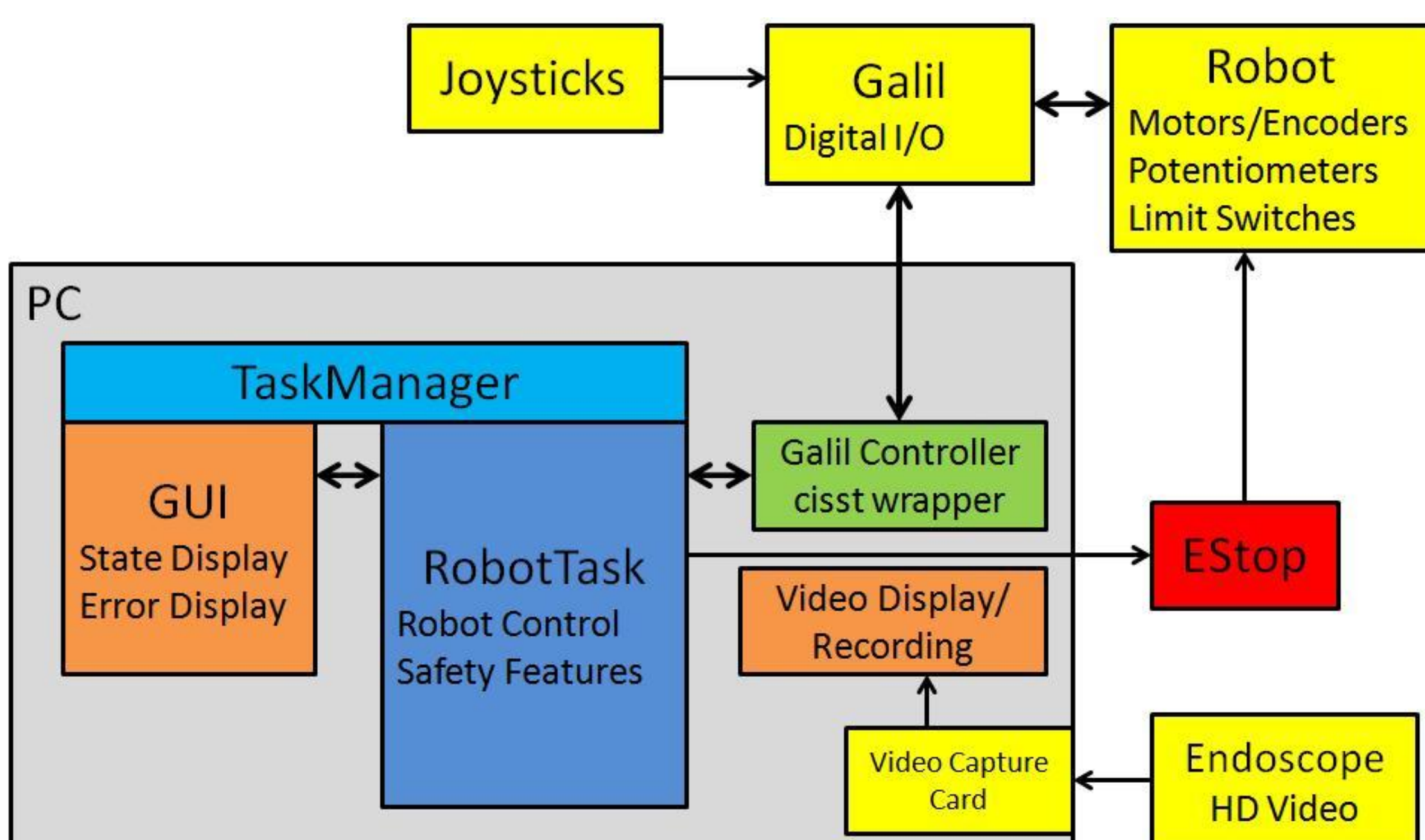
Future Work

- We are preparing to send our FDA submission within the next month. Clinical trials will hopefully begin before the end of the year.

- Upgrades to the navigation and interface system will continue to be made. We would like to implement vision-based navigation during summer 2012

Lessons Learned

- Make sure electronics are done right the first time.

- Most work will take longer than expected to complete. Conservative goals and expectations are easier and more realistic.

Acknowledgements

- Thank you to all mentors and collaborators for their hard work and assistance.

- Special thanks to Min Yang Jung, Dr. Kazanzides and Dr. Taylor for their valuable input on software design.