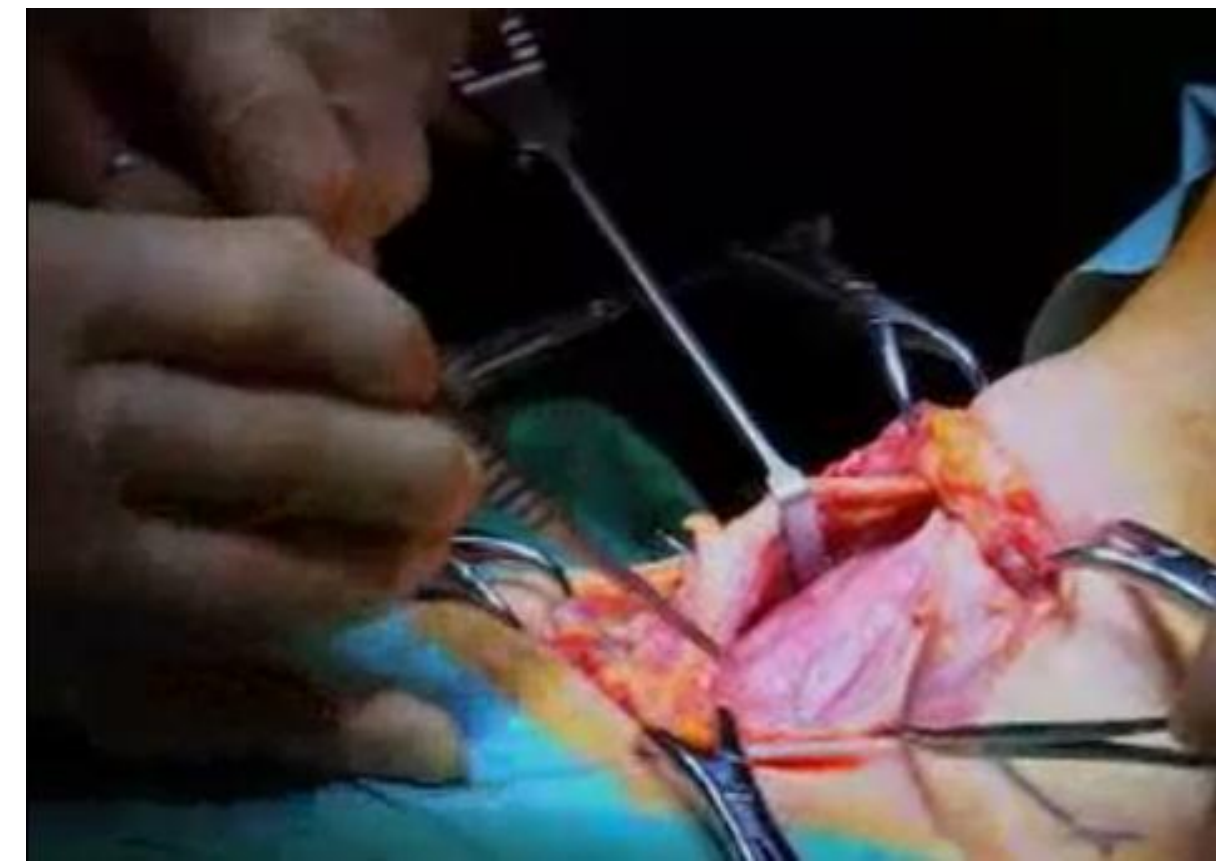


Problem

- Surgery is preferred method for procedures in the throat but conventional surgeries have more complications
- Intra-airway surgery has limited visibility and working room and flexible endoscopes require many hands to control
- Operating space is crowded and visibility is poor
- Other systems cannot use commercial scopes and are not specialized for the movement of the entire system



Conventional Throat Surgery



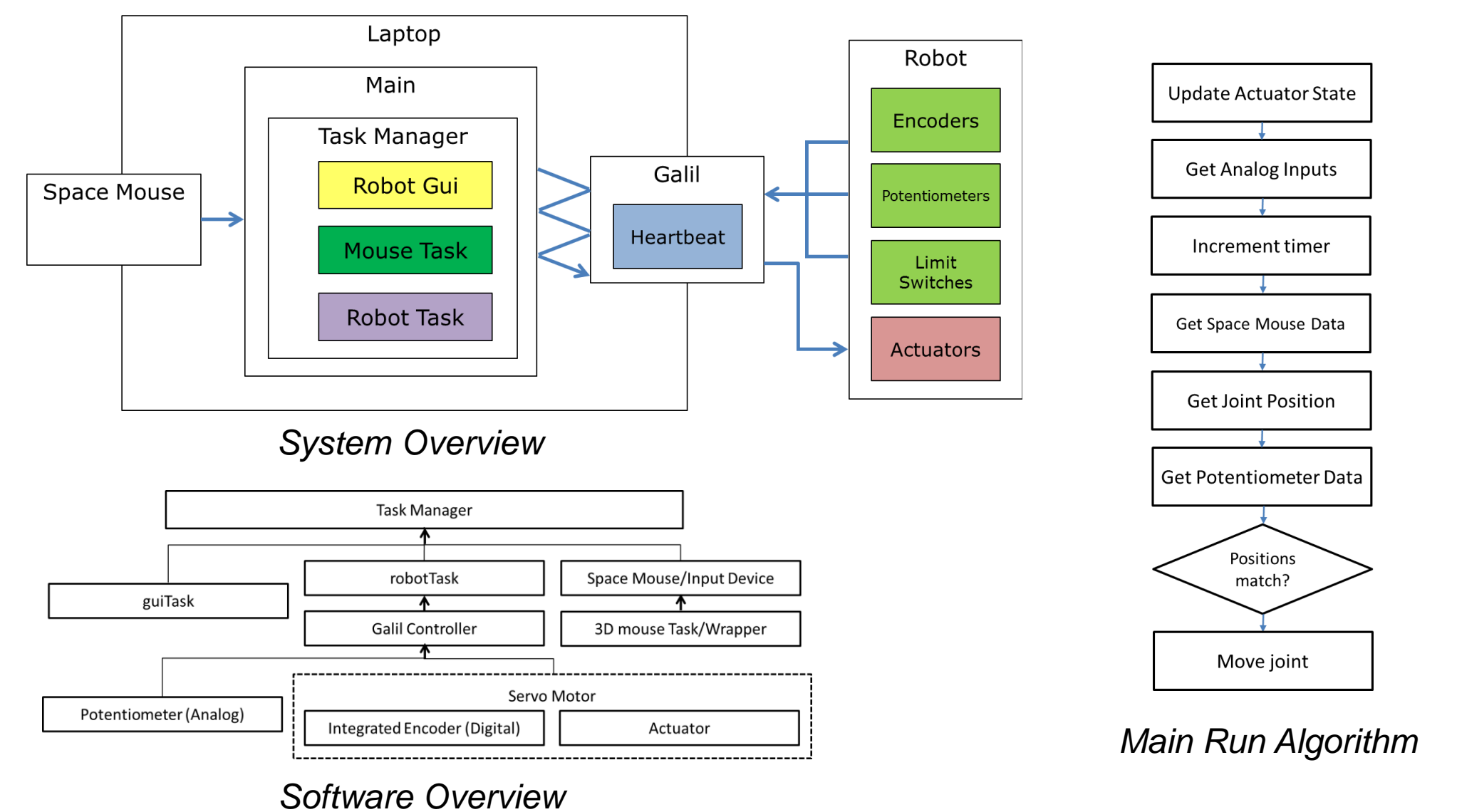
Intra-airway surgery with endoscope

Significance

- Newer endoscopes have working channels that can fit lasers or other tools allowing the surgeon to perform a procedure using the endoscope
- Giving the surgeon control of an entire surgical system in one hand allows for just one surgeon to do the whole procedure
- Utilizing a flexible endoscope allows the surgeon to see across the bends in tissue and a second free hand can use a separate tool.

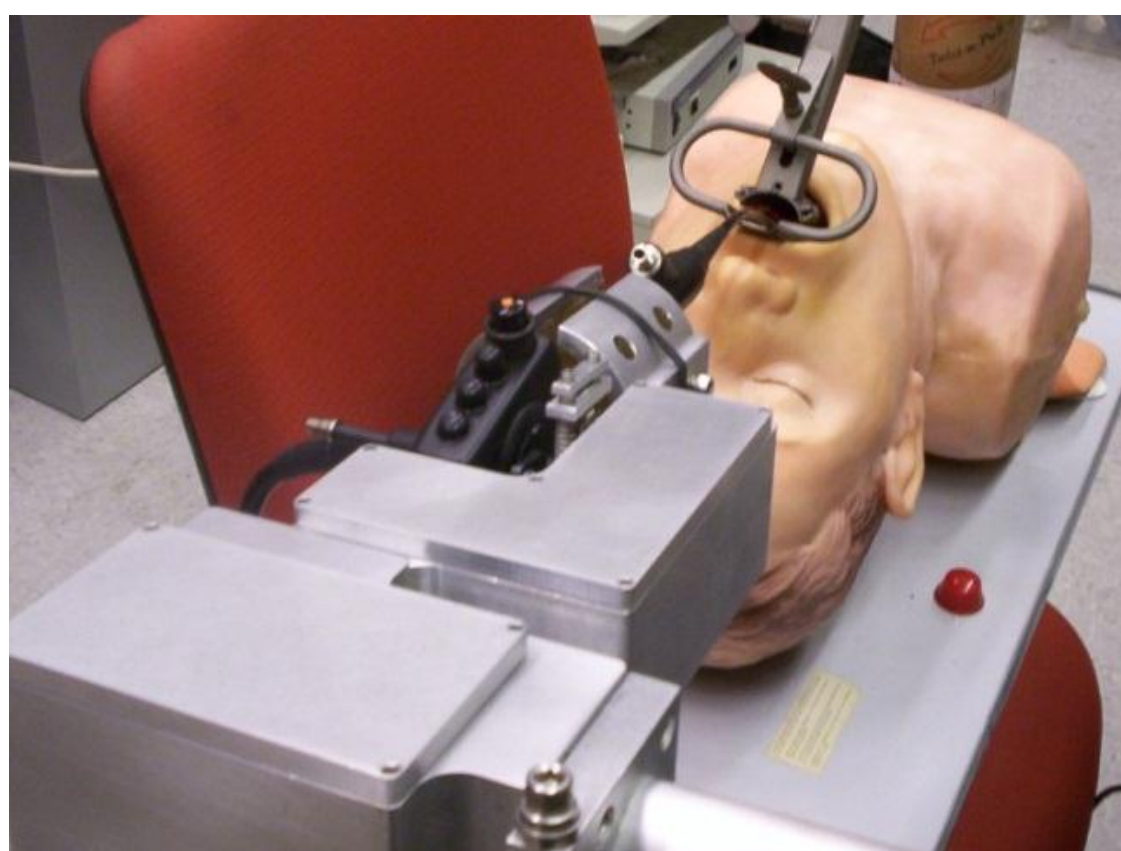
Method

- Uses Galil Controller to receive and send all inputs and outputs to sensors and actuators
- 3D mouse takes surgeon input
- CISST libraries uses component system to manage various tasks including Robot, GUI and Input Device



Solution

- Create a robotic manipulation system with:
 - Single hand operation
 - 3 axes of freedom that controls all motion of endoscope
 - Compatible with pre-existing commercial flexible endoscopes
 - Intuitive input device
 - Attachable to any surgical bed
 - Clinically safe and well documented



Prototype in phantom



Prototype in cadaver

- Uses Space Mouse as input device
- Galil Motion Controller allows for digital and analog inputs
- Utilizes the CISST libraries
- User Interface (QT) that allows user to control movement without input device
- Debug Version of GUI

Outcome and Results

- Cadaver testing showed positive results
- Full documentation of the system
- Movement was refined, control loop implemented and safety features added through software
- User environment was implemented

Future Work

- Stringent testing and completion of safety features
- New input device
- Completion of safety features
- Further clinical studies and evaluation
- Integration of vision for point and click functionality

Lessons Learned

- Documentation is everything
- Back up code
- Double the time you think you need for any task
- Always keep upgrades and future work in mind

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Publications

- Submitted conference paper
- In process of submitting to journal