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

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.

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

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

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
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- In process of submitting to journal