Attempted teleoperation of a robotic hand using optical sensing and haptic feedback

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ME 571: Medical Robotics

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SIGNIFICANCE

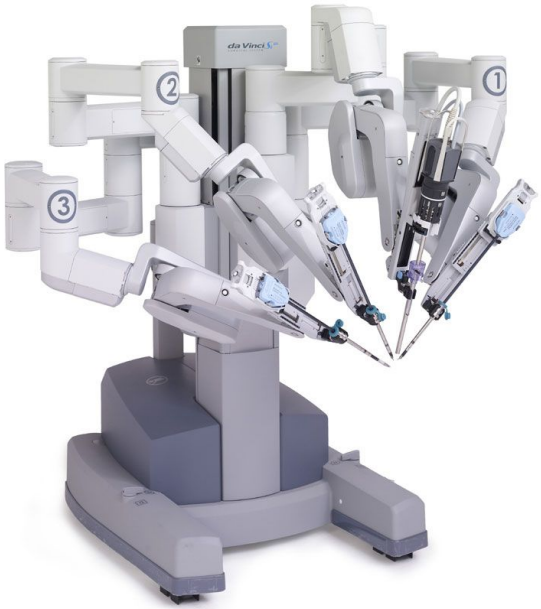
- Benefits of robot assisted minimally invasive surgery

- DaVinci robot
  - Controls- Joystick like controller
  - Haptic feedback- None currently

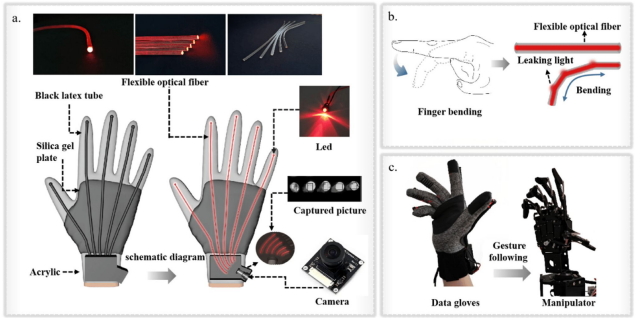
- Goals: A teleoperated robot that accurately mimics the motion of the index and middle fingers with fingertip haptic force feedback, without limiting the operators free-hand movement

INNOVATION

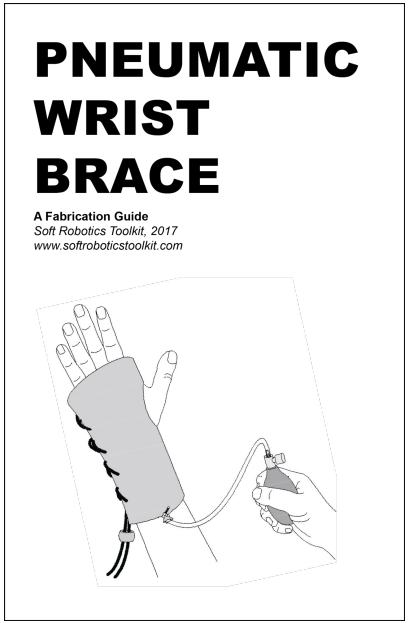
Teleoperated Robotics



Optical Sensing

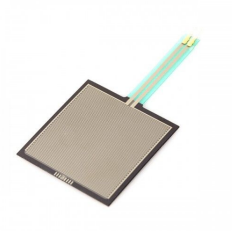


Pneumatic Haptic Feedback

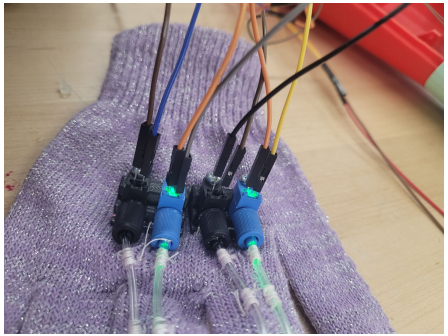


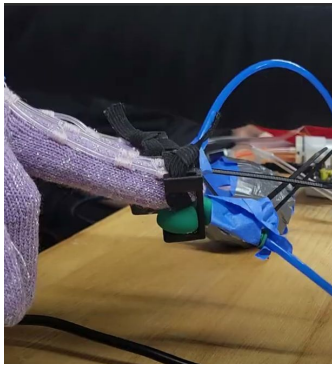
APPROACH

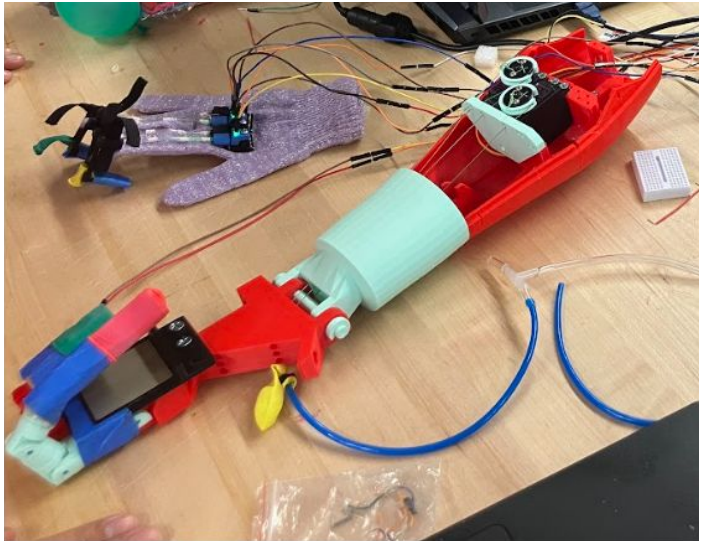
- Control Method- Optical waveguide sensor
- Sensing- Force Sensor



- Feedback Method- Fingertip pressure feedback
- End Effector- Robotic fingers



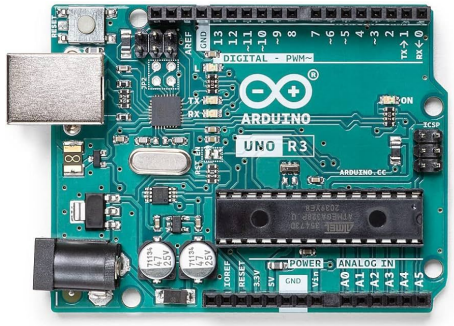




Shortcomings

Failure of the Optical Waveguide Sensor:

- Limitations of the Arduino



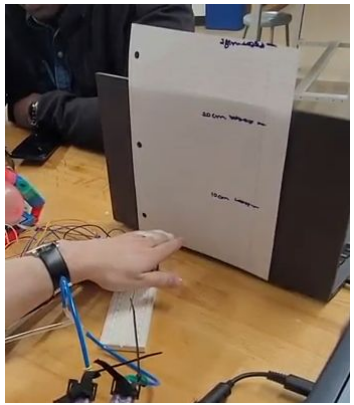
- Limitations of the power supplies

- Limitations of the photodiode

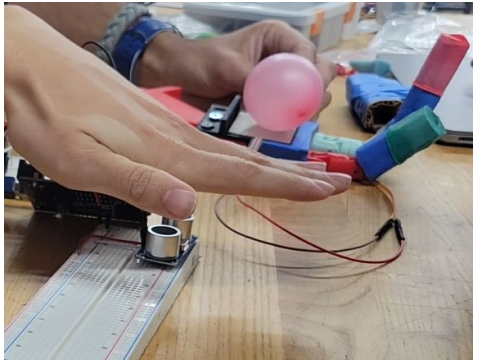
Secondary Solution

Ultrasonic Distance Sensing

- Control by hovering hand

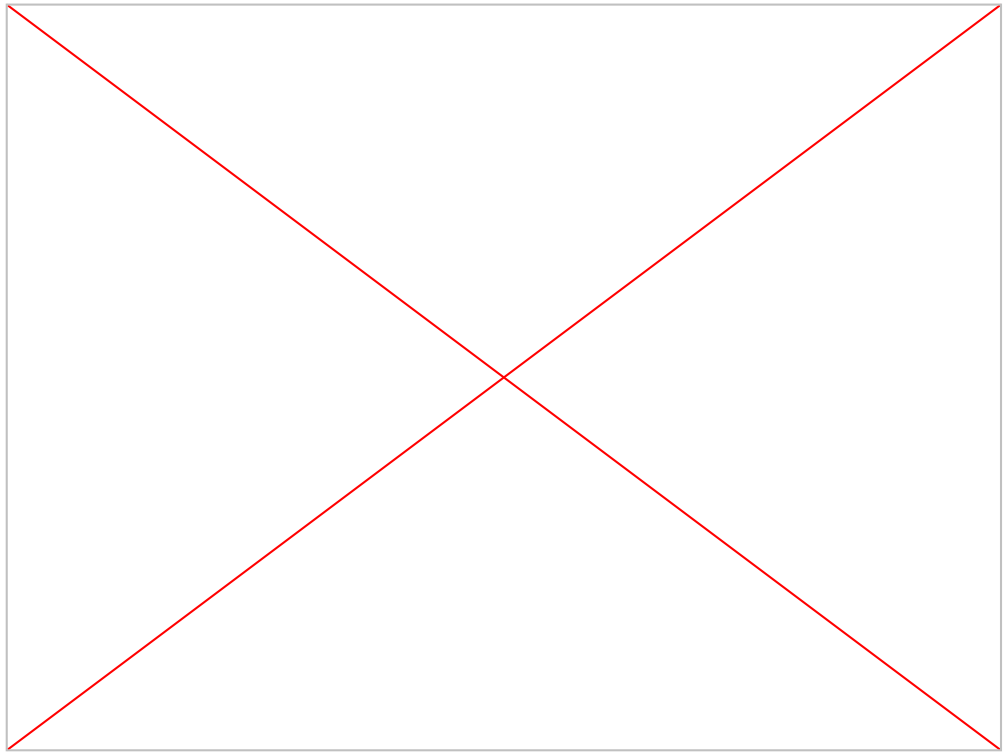


- Limited sensitivity

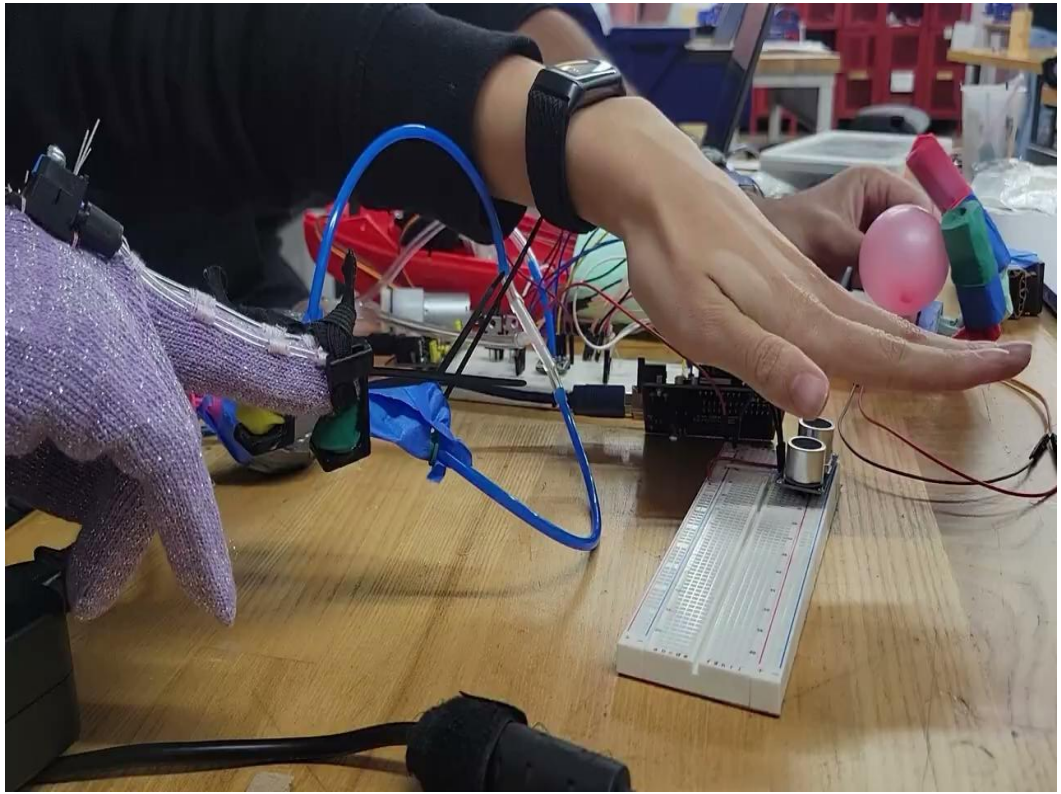


- Difficult to achieve high precision

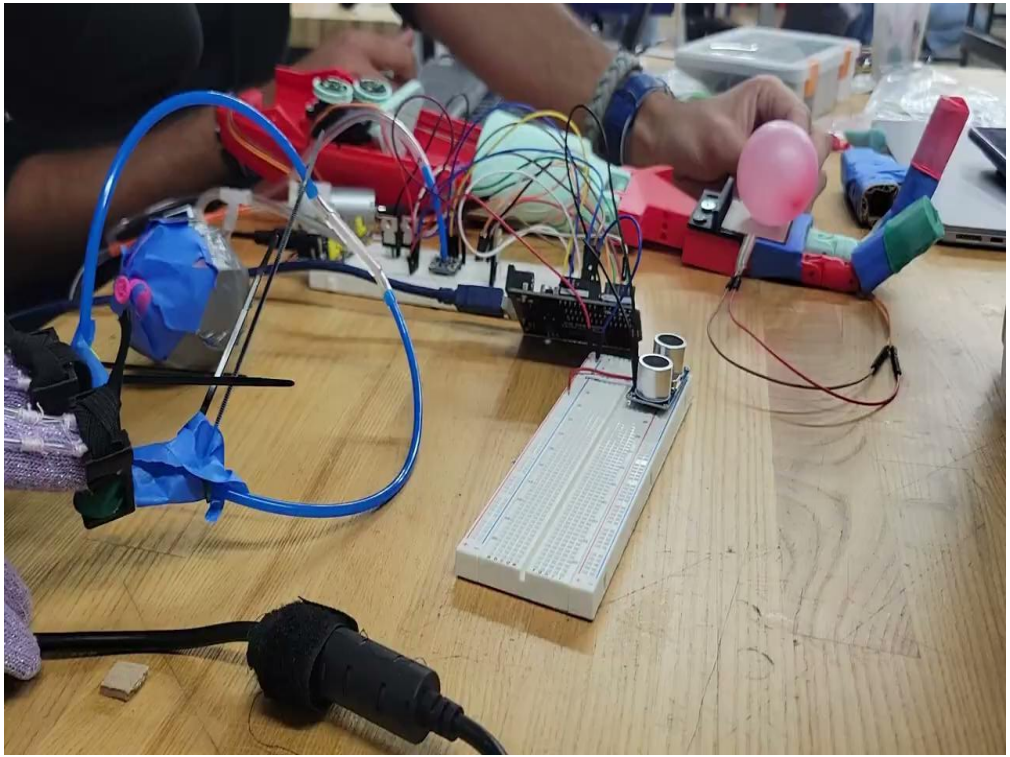
Demo- Control Method



DEMO- Haptic Feedback



Demo- Finding Equilibrium



FUTURE DEVELOPMENTS

Assuming a return to optical sensor...

- Add a thumb for pinching and grasping movements
- Scale down the robotic grasper
- Separate force sensing/pressure for each finger

Thank you!