Laparoscopic Tremor Suppression

Tiffany Bui, Taylor Bryson, Karilyn Cuthbertson, Kevin Dilger, Ellery Wong, Josh Yakel
Project Advisor: Dr. Samir Shreim, Please contact: tiffantb@uci.edu if you have further questions

Our vision is to reduce tremors by 80% via an afforadable, compact device that restores direct surgeon control.

Background

Laparoscopic surgery is a minimally invasive technique intended to reduce recovery time and patient pain. Hand tremors of the surgeon reduce precision and can cause adverse effects. For this reason, robotic laparoscopy has been designed to increase surgeon performance.

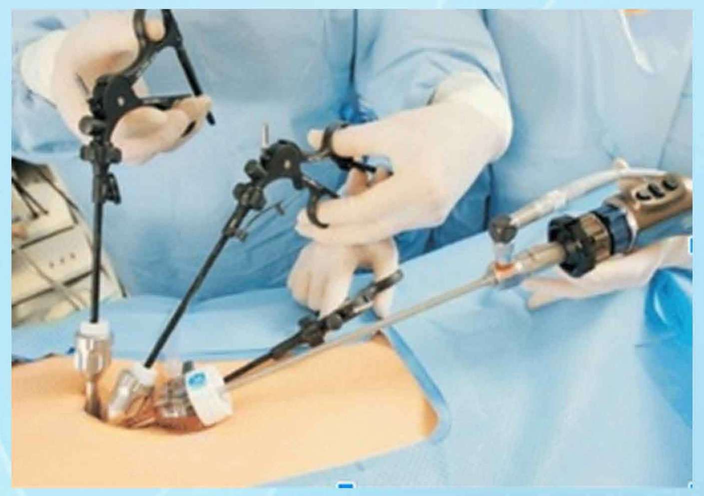

Figure 1: Laparoscopics surgery

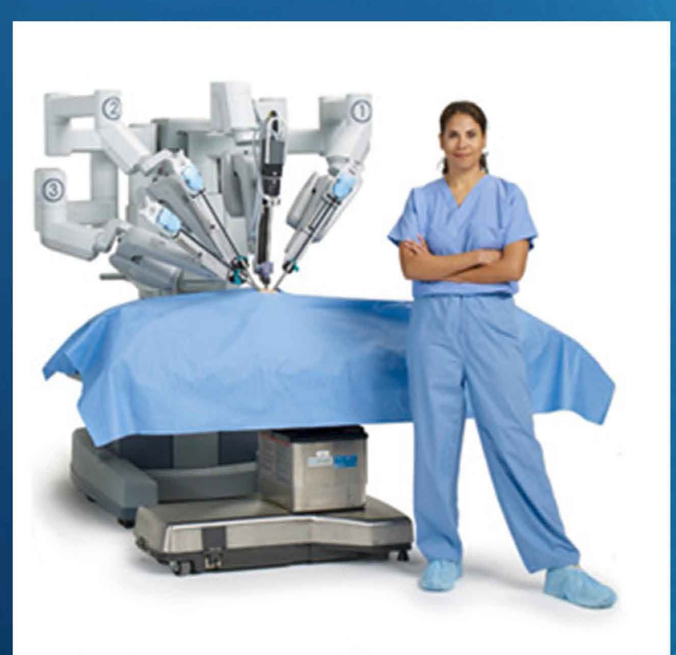

Figure 2: The Da Vinci Robot is a currently existing solution

Limitations of Current Solutions

- Too expensive
- Too large for operation room
- Indirect User Interface
- Incompatible with existing instruments

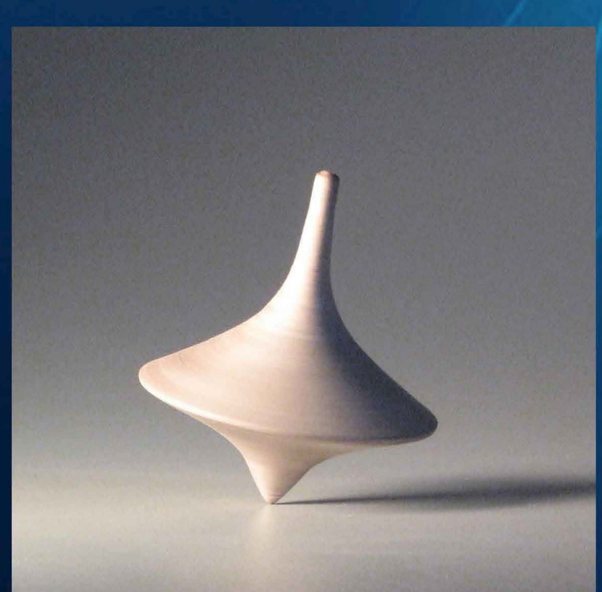

Figure 3: Similar to how the tremor suppression device works, a spinning top remains stable at its point of contact by the gyscopic forces created by its spin.

Project Design

Problem:

Reduce Tremor while minimizing the impact of the tremor suppression device on the surgeon.

Solution:

By rapidly spinning a small mass, the gyroscopic forces created can passively reduce tremor, while allowing full freedom of motion for the surgeon.

Works Cited:

http://commons.wikimedia.o=rg/wiki/File:The_University_of_California_Irvine.svg
http://medind.nic.in/jbe/t11/i1/JMinAccessSurg_2011_7_1_83_72391_f1.jpg
http://www.medscape.com/viewarticle/466691_9
http://en.wikipedia.org/wiki/Vibration_isolation

Our Design

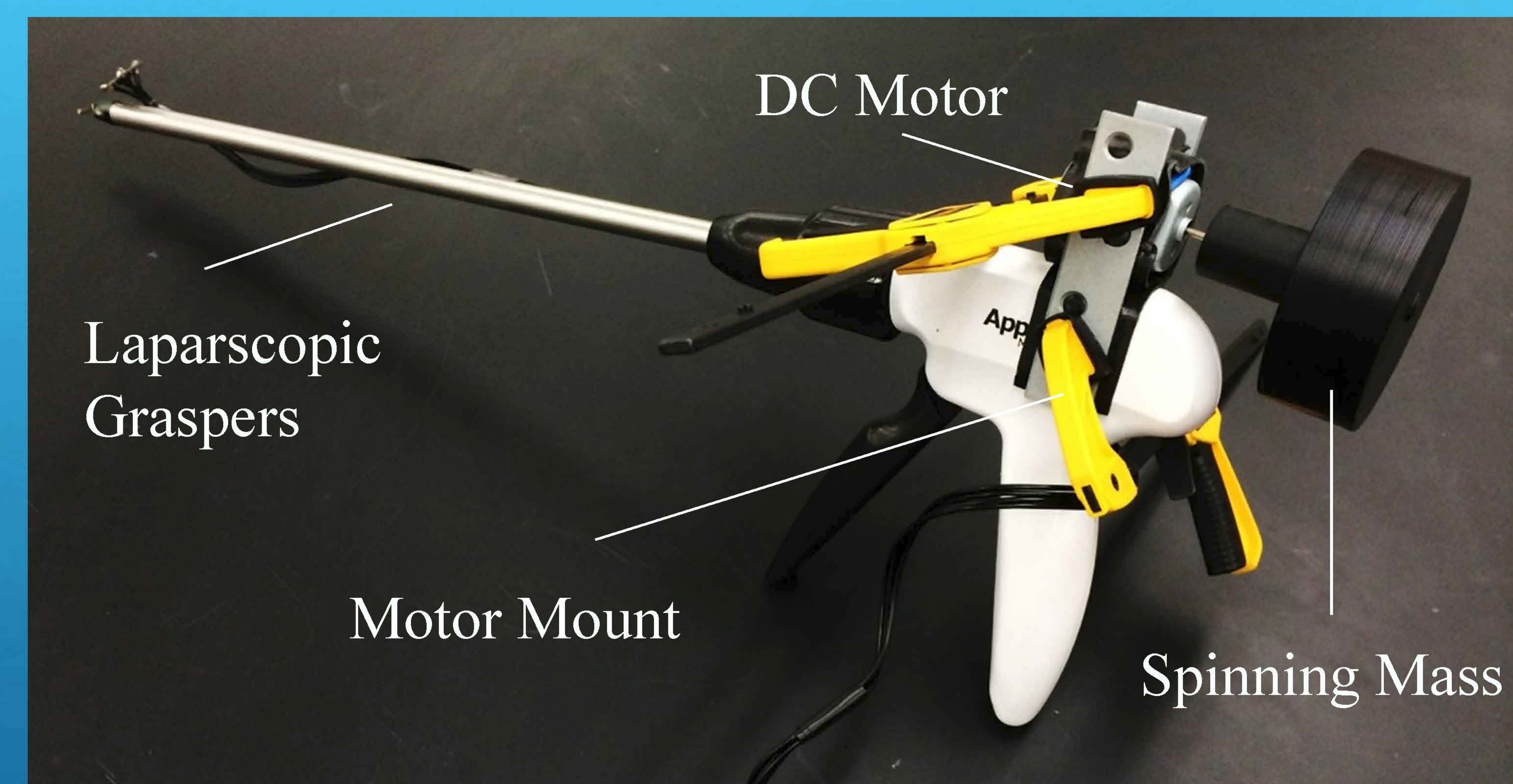

Figure 4: Passive vibration control mechanism. This is the initial prototype. The final product will consist of a specialized housing to contain all components.

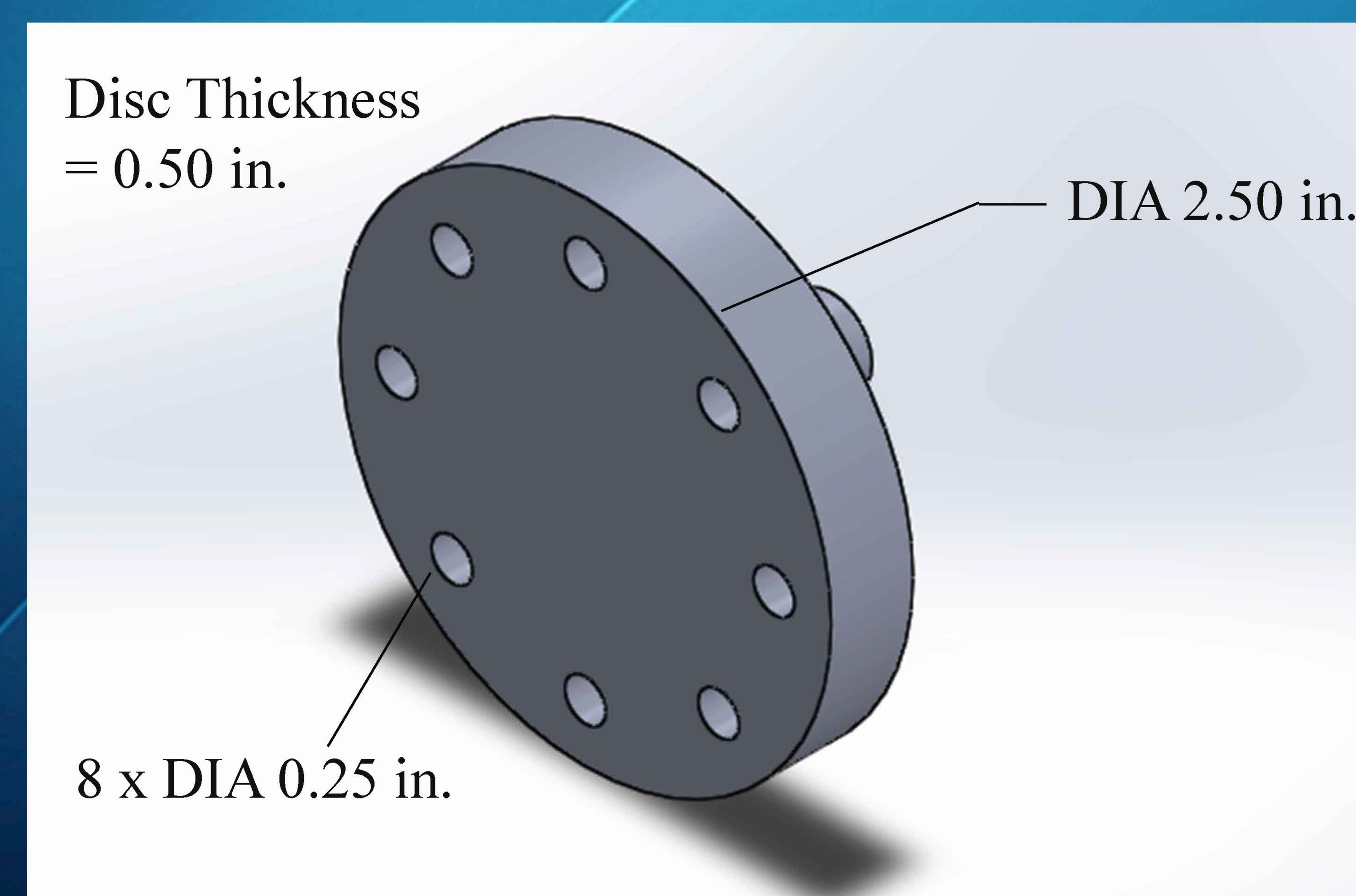

Figure 5: This is the spinning mass of the gyroscope. The mass stabilizes tremor by resisting motion. According to Newton's First Law of Motion, a body will continue its state of motion until an outside force acts upon it. If a spinning gyroscope is moved, then it will try to compensate for this movement due to those forces. Increasing the speed and mass will increase an object's inertia.

Progress and Current Status

Assembling initial prototype in order to gather additional experimental data with different masses and angular velocities.

Experimental Results

A DC brushed motor was used to spin the gyroscope. 5 volts was used in order to spin a 130 g mass at an undetermined velocity. Preliminary data showed a decrese in the range of frequencies attributed to tremor: 5 to 10 Hz. The 7.1 Hz critical frequency magnitude determined during tests decreased by over 50% with the gyroscope attachment.

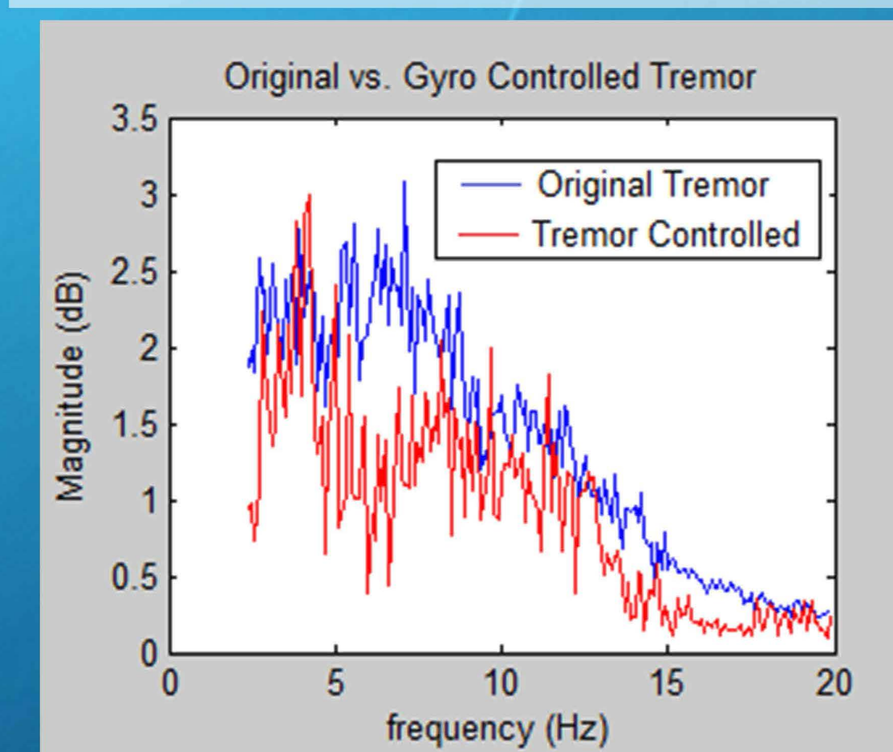

Figure 6: Original and Gyro Frequency Magnitudes as a result of vibration control

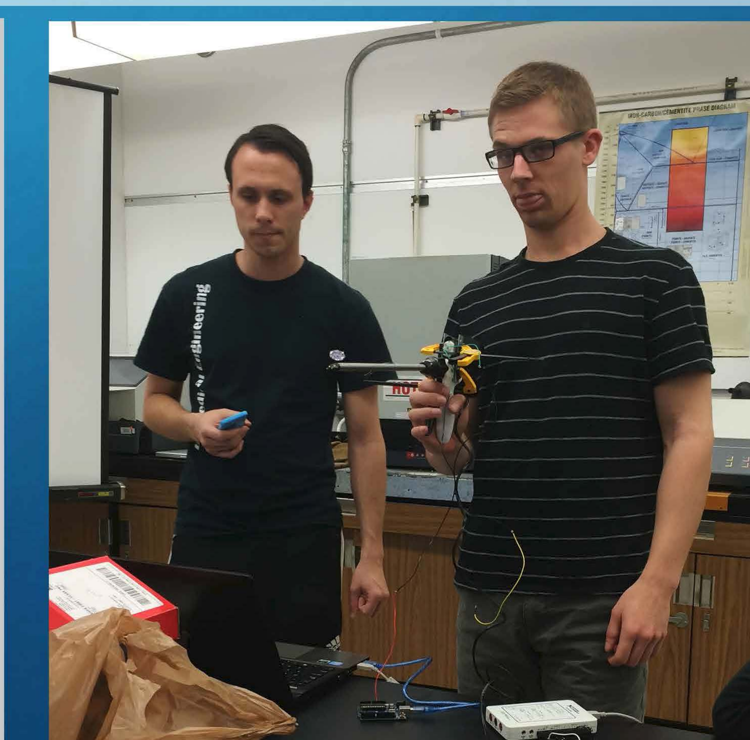

Figure 7: Testing and acquiring preliminary data

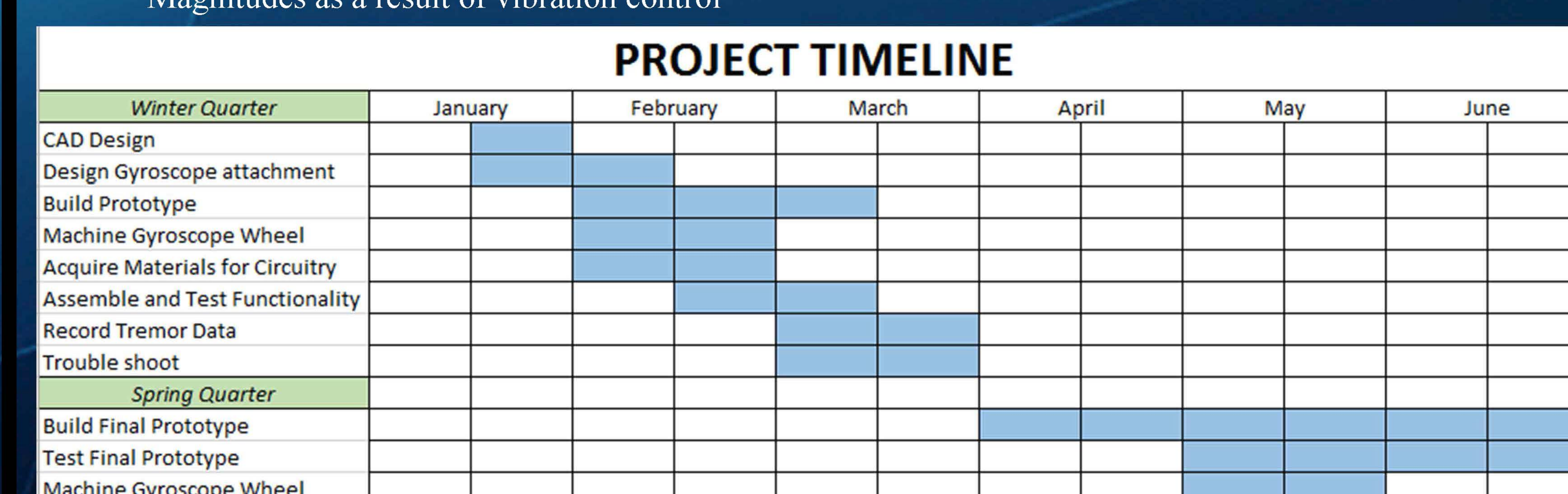

Figure 8: Gantt Chart of team milestones

Team Member	Major	Responsibilities
Tiffany Bui	BME	Team Leader, CAD/Solidworks 3D Modeler
Taylor Bryson	MSE	Materials/Fabrication of Device, Research Specialist
Karilyn Cuthbertson	BME	Python/Labview Programmer, Research Specialist
Kevin Dilger	BME	Python/Labview Programmer, Data Collector
Ellery Wong	BME	Matlab/Labview Programmer
Josh Yakel	BME	Mathematical Solver, Research Specialist