

ME, ECE, BE Capstone Design Programs

Team #36: An Experiment for ME4201 (Machine Design Lab)

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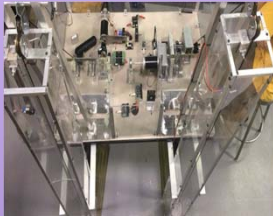
Laitram

Project Objective

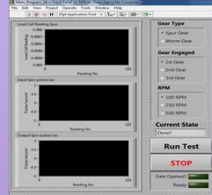
- Conceive and design an experiment for the Machine Design Lab

Background

- Prerequisites are Machine Design I and II
- Concepts reinforced through use of lab



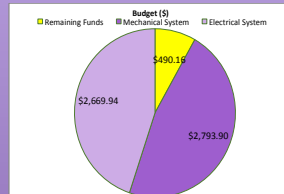
Entire Apparatus



LabVIEW Interface

Constraints

- Relevance to Machine Design
- Remotely Operable
- Footprint of 20 square feet
- Height of 8 feet
- Budget of \$5,000



Budget Breakdown

Functional Requirements

- Illustrates Machine Design principles
- Relates to industry
- Operates remotely

Safety

- Emergency shut off
- Casing resistant to impact
- Weight Limit Switches
- Motor governor



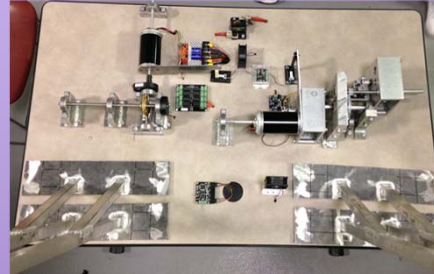
Limit Switch



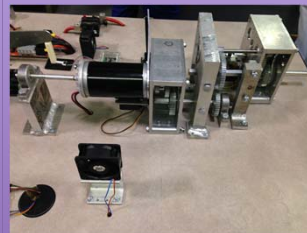
Emergency Shut off

Major Components

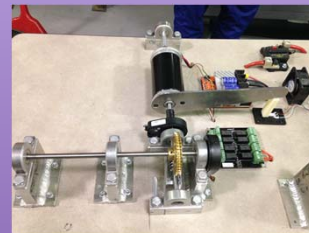
- Aluminum 6061 Frame with Acrylic Panels
- 4140 Steel Gear Box and Worm Gear
- 12 Volt DC Motors
- Windows Remote Desktop
- LabVIEW- Student interface



Experimental Apparatus

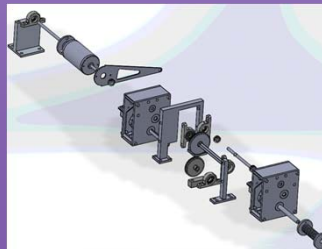


Spur Gear System

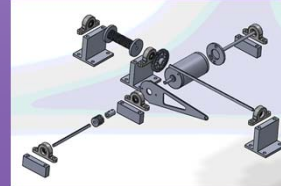


Worm Gear System

Assembly



Spur Gear System



Worm Gear System

Experiment Description

- Gear Transmission System
- Torque, speed, power vs. RPM of a motor
- Experimental vs. ideal situation
- Efficiency across gear types

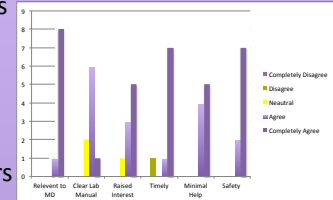
Student Objective

- Calculate torque
- Examine rotational motion
- Compare efficiency of gears
- Analyze power

Analysis



Input Torque for Gear Ratios



Results of Student Survey



Efficiencies of Gear Systems

- Input torque decreases as gear ratio increases
- Ideal values lower than measured values due to frictional losses
- Worm gear system less efficient than spur gear system

Timeline

