TrackStar:
Motion Tracking Stagelight Mount

Bradley Beady
Michael Bjorge
Ezra Dantowitz
Jason Gurney
Team 13

Bradley Beady, ME
Ezra Dantowitz, EE

Michael Bjorge, CSE
Jason Gurney, ME

Advisor: Tilman Wolf
System Requirements

- Real-time motion tracking
- Full Range of Motion
  - 300° Pan (Yaw)
  - ±45° Tilt (Pitch)
- Compatible with common fixed lights
  - Ellipsoidal, Fresnels, Washes
- Configure individual lights through DMX
- Quiet
Updated Block Diagram

- Lighting Control Board
- IR Beacon
  - IR LEDs
  - LED Controller
  - Power Supply
- Controller
  - DMX Receiver
  - IR Camera
  - Processing
  - Motor Controller
  - Power Supply
- Mechanical
  - Structural Housing
  - Shafts
  - Bearings
  - Actuation
    - Motors
    - Pulleys
    - Belts
IR Beacon

- Blinks pattern on IR LEDs
- User selects one of 8 patterns
- Battery powered
IR Tracking

- Camera with IR band pass filter
- Tracks an IR beacon
- Detects pattern of blinking beacon LEDs
DMX

- Manual configure mode
  - Sets pan angle
  - Sets tilt angle
- IR Tracking mode
  - Selects pattern to track
Frame & Shafts

- Aluminum 6063 U-Channels
- Solid Pan Shafts
- Hollow Pan Shafts
Bearings, Pulleys & Belts

- Roller Bearings for Tilt Shafts
- Thrust Bearings for Pan Shaft
- 2:1 Flanged pulleys with belt
Motor Selection

- **Stepper Motor**
  - 11.25 in.-lb. Holding Torque
  - 200 Steps/Revolution
  - Phase draws 2.8 A at 2.5V

- **Brushed DC Motor**
  - 6.875 in.-lb. Stall Torque
  - 30:1 Gearbox
  - 64 CPR Encoder
  - 5A Stall Current at 12 V
Fall Semester Schedule

- Finish PCB design
- MDR Report
- MIE Final Presentation
- MIE Poster Session
- MIE Final Report
Gantt Chart for Spring Semester
Questions
PCB
Power Calculations

- 280mA at 6V
  - \((.280) \times 6 = 1.68\text{W}\)
- 4 AAA batteries at 860-1200 mAh
  - 3.44Ah-4.8Ah
  - Duty Cycle: 58%-86%
  - At least 14 hours
PSpice
Previous Design
Current Design
Toque Calculations

\[ T = J \alpha \]
\[ \alpha = \frac{\omega_1 - \omega_0}{t} \]
\[ J = \frac{m}{4} \left( r^2 + \frac{L^2}{3} \right) \]
\[ T = 8.5 \text{ in lbs.} \]
Material Selection

- Stress = My/I
- M = 10 in lbs.
- y = D/2
- \( I = \frac{\pi D^4}{64} \)
- D = 3/8 in
- Stress = \(~2000\) psi