Orthodontic Wire Mechanical System Tester

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Overview

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Client Description

- Dr. Michael Holbert
  - UConn Health Center School of Dental Medicine
    - Leads field of Biomechanics Research
  - Researching biomechanic principles and how they effect tooth movement
Objective

- To create a device to measure the mechanical forces and torques in three dimensions applied by an orthodontic wire in a relevant configuration.
- To design a user-friendly interface which would not require prior knowledge to manipulate.
- To produce an apparatus with variability that would be relevant to various testing capacities.
Previous Work / Patents
Optimal Design: Overview

- Components
  - Sensors
  - Slides
  - Motors
  - Electrical
Optimal Design: Sensors

- ATI Industrial Automation- Nano17
  - Force and Torque in Three Axes
  - Strain Gauge Technology
    - Silicon Strain Gauges
    - Flexing Beams
  - Miniscule Size
    - 17mm Diameter
    - 9.1 Grams
  - Superior Resolution
    - Force: +/- 1/320 N
    - Torque: +/- 1/64 N*mm
Optimal Design: Linear Slides

- Anaheim Automation Positioning Slides
- Two Dimensional Slide with motor attachment
- One Dimensional Slide for vertical motion, also with motor attachment
- Improve precision, accuracy
- Prevents backlash with locking mechanism
Optimal Design: Motors
Optimal Design: Electrical

- Block Diagram:

```
Signal -> Amplifier -> Filter and Conditioning -> DC Offset
```

- Analysis <-> LabVIEW <-> DAQ <-> ADC

- The Circuit:

```
Signal IN -> Amplifier -> Filter and Conditioning -> DC Offset
```

- ADC:
  - Texas Instruments ADS1255IDBT A/D converter
    - 30kHz Sampling Rate
    - 24 Bits of Resolution
Optimal Design: LabVIEW

- **User Controls:**

- **Data Display:**

- **Functionality:**
## Orthodontic Mechanical System Tester: Projected Expenses

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<th>Vendor</th>
<th>Model</th>
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Timeline

By Mid-February
- Create LabVIEW interface, test sensors (Max)
- Test, assemble and attach motors (Scott)
- Create mechanical apparatus, machine parts, attach slides (Bethany)

By Mid-March
- Assemble entire device
- Test LabVIEW with various working parts
- Do trial runs
Conclusions

- This design provides the ability to test in three dimensions
- LabVIEW interface will not require prior knowledge to use
- Accuracy and precision through use of slides, motors reduce human error
- Completely new design from original
- Allows for variations in testing for numerous experimental applications
- User-friendly and exceeds the needs of the client