Orthodontic Wire Mechanical System Tester

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Introduction: Client

- Dr. Michael Holbert
  - UConn Health Center School of Dental Medicine
    - Leads field of Biomechanics Research
    - Researching biomechanics principles and how they effect tooth movement
Introduction: 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.
Introduction: Previous Work/Patents

- Other than the original device, there has been no previous work or patents dealing with wire forces on the mouth.
- The original device was not accurate and needed to be completely rebuilt.
Device Features

- Motion in three dimensions
  - Precise to .0009mm
- Force and Torque sensing in three dimensions in two locations
  - Precise to 1/320N, 1/64 N*mm
- User friendly Interface
Design

- Major Components:
  - Mechanical
  - Electrical
  - Software
  - Peripherals
    - Sensors
    - Linear Slides
Design: Mechanical

- Vertical Base slide setup
- Sensor Attachments
Design: Software

• Features:
  - Visual, User Friendly
  - Ability to simultaneously control motion in all three dimensions
  - Real time input and display from sensor
  - Comprehensive data organization and storage
  - Standalone application (no LabVIEW required)
Design: Software
Design Electrical

- PC board from PCBExpress
- RS485 and USB 6210 communication
Design: Sensors

- ATI Industrial Automation- Nano17
  - Force and Torque in Three Axes
  - Miniscule Size
    - 17mm Diameter
    - 9.1 Grams
  - Superior Resolution
    - Force: +/- 1/320 N
    - Torque: +/- 1/64 N*mm
Design: Linear Slides

- Anaheim Automation LS100 Series
- Three dimensional configuration
- Each slide has 6 in range of motion
Budget

- 2 Sensors $7700.00
- 3 Linear Slides $3616.92
- DC Power Supply $260.00
- Metal from Yarde Metals $488.00
- National Instruments USB 6210 $461.00
- Printed Circuit Board $62.00

- Total estimated costs before machining: $12,587.00
  - Machining costs up to $90 per hour
- Total expenditures LESS THAN $15,000.00
Conclusion

- To conclude the device is functional and all software, mechanical and electrical components have been completed and are operational
- At this point in time the client is left with the option of improving experimentation to better meet their satisfaction.
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Unfortunately I had extenuating circumstances that kept me from being able to be here today. Thank you for your understanding!

-Max