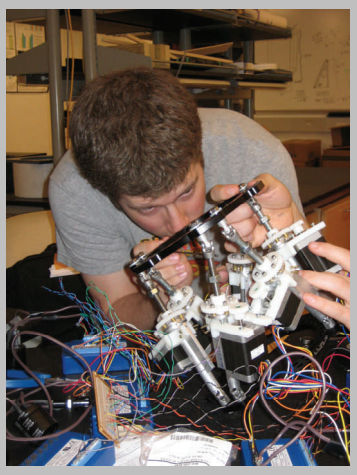
BIOE 451/452: Bioengineering Design

An opportunity for students to tackle and solve a design problem in bioengineering

April 2008

Automating the Taylor Spatial Frame



Team Members:
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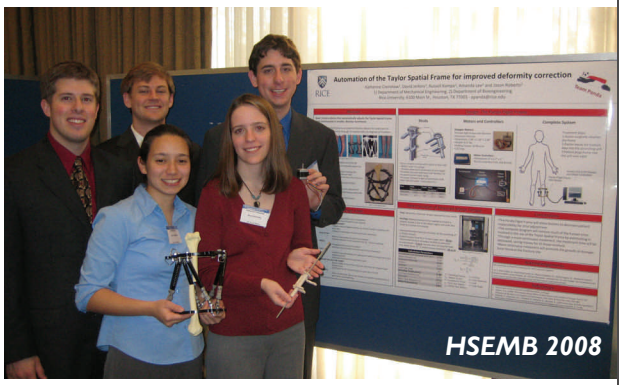
Bioengineering Design Challenge

The Taylor Spatial Frame (TSF) is an external fixation device with motion in six degrees of freedom, allowing for the correction of bone deformities and fractures by moving attached bone to the correct orientation and length. Currently, the frame's six struts are adjusted manually once a day, with a maximum of 1mm of correction per day. This requires patients to keep track of which struts to adjust and the amount of adjustment for each strut. Dr. Gogola of the Houston Shriner's Hospital for Children, who treats 150 TSF patients annually, approached us for a solution to this problem with the information that more frequent smaller adjustments have been shown to promote better healing and allow for more bone correction each day. Thus, ***our goal is to create a device that automatically adjusts the Taylor Spatial Frame, semi-continuously, in small discrete increments in order to shorten treatment time, improve the quality of the regenerated tissue and reduce adjustment error.***

Our Solution :The Panda Flight Frame System

The Panda Flight Frame System is composed of six motorized struts connecting two rings, motor controllers and a computer. The computer takes a file of doctor prescribed strut adjustment data and sends instructions via RS-232 to the motor controllers, which run the motors as instructed. Gears attached to the motor turn a threaded gear on the strut, which increases or decreases strut length. For the treatment duration, patients hook into the device nightly for 8 hours of gradual deformity correction.

Project Status & Future Plans



Team Panda has assembled the motorized frame and established computer controlled motor movement . Currently, we have five out of six struts functioning correctly and are close to having the last one working. We have done accuracy testing on the strut adjustments, but fatigue testing as well as assessing the effectiveness of our user interface still must be done. The next steps from there involve the miniaturization needed to make our device a usable orthopedic product, especially replacing the computer with a microcontroller.

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