Project Design Specifications- October 26, 2011
Wii Balance Board Center of Pressure Software

<u>**Team Members**</u>
Kate Howell – Team Leader
Molly Krohn – Communicator
Chris Fernandez – BSAC
Tony Schmitz - BWIG

<u>**Problem Statement**</u>
Currently there is no inexpensive and widely accessible device which measures the center of pressure for balance and postural rehabilitation training. The Wii Balance Board System has been proven to be a possible solution to this but software which displays the information is needed.

<u>**Client Requirements**</u>
- The device system needs to be portable, inexpensive, and accessible.
- It needs to be able to supply continuous audio feedback in real time and in graded increments. Eventually the feedback will need to be visual as well.
- The software should be able to collect data but does not necessarily need to store it.
- The software needs to be compatible with a Mac or PC

<u>**Design Requirements**</u>
1. Physical and Operational Characteristics
    a. *Performance requirements*: The device must be able to withstand normal wear and tear from daily use. The software and feedback must be easily understandable by its users.
    b. *Safety*: The device must be able to withstand a person standing and shifting weight that has balance and gait disorders.
    c. *Accuracy and Reliability*: Using intraclass correlation coefficients, the COP path length test-retest reliability within the device should be between 0.66-0.94 and when compared to laboratory grade force plate, the device should be between 0.77-0.89.
    d. *Life in Service*: The device must run 20 minutes daily for the length of study which could last between three months to one year long.
    e. *Shelf Life*: The device should be functional for at least five years of use. The Wii Balance Board requires four AA batteries to power 60 hours of use.
    f. *Operating Environment*: The device will be operated in a variety of different household environments from bedrooms and family rooms, to garages and basements.
    g. *Ergonomics*: The device must be able to withstand a maximum weight of 150 kg.
    i. *Weight*: The device must be able to be moved by an average sized adult, so it needs to weigh less than 18 kg.
    j. *Materials*: The system will include a Wii Balance Board or an external weight shift sensing device, Bluetooth capable computer and accessories, and a system for audio output.
    k. *Aesthetics*, *Appearance, and Finish*: The audio output needs to produce non-irritable noises and the visual output needs to be easily understood in relation to their current position.
2. Production Characteristics
    a. *Quantity*: The design team is only responsible for producing one product, but the client may use multiple balance systems to distribute to all of the research participants.
    b*. Target Product Cost*: The entire system should cost a total of under $600.

3. Miscellaneous

a. *Customer*: The client wants a device that captures signals at 40 Hz and to be low pass filtered with a cut-off frequency of 4-12 Hz. Input gain should be adjustable to +/- 10% increments.

b. *Patient-related concerns*: The device must be easy and enjoyable to use for the patient.d. *Competition*: The Wii Balance Board has already been used for physical rehabilitation with video game-like displays of feedback and auditory feedback via personal headphones. Currently there are no patents impeding our prospects of a unique design aligning to our client's wanting. Virtual Wiihab from the article "Lean on Wii: Physical Rehabilitation With Virtual Reality and Wii Peripherals" by F. Anderson, M. Annett, and W. Bischof. As well as eBaViR from the article "Effectivness of a Wii balance board-based system (eBaViR) for balance rehabilitation: a pilot randomized clinical trial in patients with acquired brain injury" by J. Gil-Gomez.