

## **Design of weight distribution monitoring system**

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**Client:** Dr. Willis Tompkins

**Function:** Stroke is a major issue in the United States with more than 800,000 yearly occurrences and 133,000 deaths every year. Many stroke survivors experience brain damage that can leave their body permanently injured. A hemiplegic individual who suffered a stroke five years ago lost all sensation on her left side of the body. She is ambulatory but suffers from improper gait and standing positions due to her left side. We are working on a portable device that will allow her to practice how it feels to stand with proper weight distributions. We hope that by practicing with our device, our client will be able to improve her walking and improve her overall quality of life.

### **Client Requirements:**

- The client must be able to carry the device in one hand for convenience and portability
- The device should not contain any lengthy wires or bulky displays that require excessive interaction by the client
- The device must not require the client to look downwards, which causes her to lose balance
- The device must not contain any hinges or metal parts that may damage flooring

### **Design requirements:**

#### **1. Physical and Operational Characteristics**

- Performance requirements:* The device must be able to perform numerous tests with up to 800 N of force.
- Safety:* The device should be constructed so that the client will be able to stand and balance easily without any risk of falling or other harm.

- c. *Accuracy and Reliability*: The device should be accurate enough to discern changes in weight distribution but not too precise as the body is never in rest, even when standing. A threshold of 10% will be adapted to allow the client to practice weight distribution.
- d. *Life in Service*: The device will be operated on the timescale of half-hours and at a maximum an hour. It should not consume an excessive amount of power, as batteries can be costly to the client.
- e. *Shelf Life*: The device must be able to be stored and easily retrieved for further use over a period of at least a year.
- f. *Operating Environment*: The client intends to use the device in standard living environments with chances of humidity or other weather effects. The device will be used on a flat surface and at room temperature.
- g. *Ergonomics*: There should be minimal interaction required by the client while attempting to measure her weight distribution. It should be simple to use and easily understood.
- h. *Size*: The device must be portable - small enough so that the client can take it with her and use it in places other than her residence. Additionally, it must have minimal height, as the client struggles to lift her impaired leg off of the ground.
- i. *Weight*: The device must be light enough to maintain portability.
- j. *Materials*: The materials must be lightweight yet durable enough to withstand the clients weight.
- k. *Aesthetics, Appearance, and Finish*: The device should provide clear and easily interpreted feedback for the client.

## **2. Production Characteristics**

- a. *Quantity*: There must be at least one device fabricated
- b. *Target Product Cost*: Price is not an issue for this device.

## **3. Miscellaneous**

- a. *Standards and Specifications*: Pending further results.

b. *Customer*: The device is being created for one specific client, however, there could be a potential market for this device.

c. *Patient-related concerns*: The client is unable to lift her left leg up very high so extra precautions will be taken to make sure that our device is low enough for her to conveniently get on and off. Additionally, looking downwards towards her feet causes the client to lose her balance.

d. *Competition*: Similar products have been designed to measure a person's weight distribution. The Wii Balance Board has been proven to be extremely effective in assessing weight distribution. It utilizes four force sensors to calculate the center of a given weight distribution. However, the client considers this device to be bulky as well as too tall.