Device for Acute Rehabilitation of the Paretic Hand After Stroke
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This device will assist in hand rehabilitation in stroke victims in the first three months after stroke. The device should use FES to assist in the supination and pronation movements of the wrist.

Stroke is the leading cause of long-term disability in the United States. Hand impairment is prevalent in stroke patients and is particularly debilitating since it limits independence and the ability to use the hand to do real tasks like eating and drinking. The goal is to design a device to facilitate hand rehabilitation in the acute phase, first 3 months, after stroke.

Design requirements:
- easily to attach to the impaired arm
- comfortable to wear
- accommodates various sized hands and forearms
- attach to either the left or the right arm
- portable and mobile to be used while seated in a wheelchair
- use functional electrical stimulation via an existing TENS unit, FES
- use electromagnets to assist in grasp and release of an object
- pronation and supination motions of the wrist

1. **Physical and Operational Characteristics**
    a. *Performance Requirements*- The device will be used during physical therapy sessions. The sessions will be 3 times a week, for a maximum use time of 2 hours per sessions, and the sessions will continue for 6 weeks. Also, no more than 3 patients will use one device within a therapy session. So, the device will be used on an average of 18 hours a week. Loading and unloading of the device onto the wheelchair will be done by a physical therapist. The device should be able to be used on either arm and be used with a wide range of arm sizes. The device will focus on the supination and pronation movements of the wrist.
    b. *Safety*- The FES should not cause discomfort to the user. The device should be easy to use for sanitary reasons. Also, the device should not impede with the movement of the wheels of the wheelchair.
    c. *Accuracy and Reliability*- The device should allow for 270° rotation. The device should be able to rotate repeatedly for the durations of the sessions without change in rotational resistance of the device.
    d. *Life in Service*- The system should work for 3 years, after that time the system would be replaced with a new system. The battery life for an alkaline battery in use is 140 hours.

e. *Shelf Life*- The shelf life should be able to sit on a shelf for 10 years. The only component that would have a shorter shelf life would be the battery, which is easily replaced.
f. *Operating Environment*- The device will be used within a hospital, in a clinical setting. It will be used indoors.
g. *Ergonomics*- The range of sizes of our device will fall within 2 standard deviations of the average size arm. Be able to accommodate any size arm without causing discomfort, itching. Also should not debilitate arm function by being strapped into a fixed position. The device should also be allowed to be adjusted and released by their good arm.
h. *Size*- Work within the confines of a desktop for a wheelchair which is the size 24" x 20", and also attach our system to any part of the wheelchair. The maximum volume of our device will be 24"x 20"x 18".
i. *Weight*- Less than 15 lbs
j. *Materials*- Hypo-allergenic materials that are easily cleaned.
k. *Aesthetics*- Should not be intimidating, unimposing, and interactive.

2. **Production Characteristics**
   a. *Quantity*- 1
   b. *Budget*- $750.

4. **Miscellaneous**
   a. *Standards and Specifications*- Since our device will be in the prototype phase, there are no FDA regulations that govern our project.
   b. *Customer*- The user of this device will be within the age range of 45-80, so the device should be geared toward that audience. Variations could be made to the system to accommodate other ages.
   c. *Patient-related concerns*- sterilization
   d. *Competition*- A BME design group from Marquette University.