Closed Loop Functional Electrical Stimulation

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Introduction

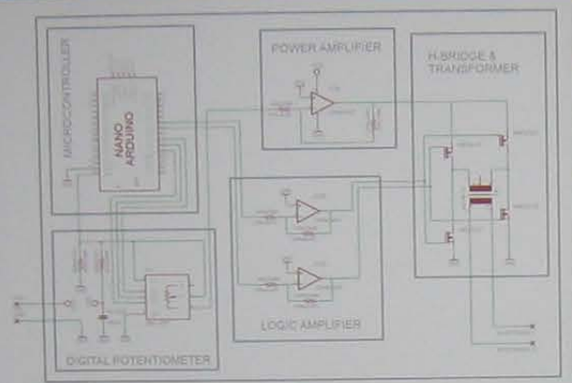
Our motivation for this project is to provide mobility to patients with nerve damage which may have resulted from injury or disease. To accomplish the feat of bridging nerve communication and muscle contraction, we turn to functional electrical stimulation (FES). Functional electrical stimulation uses low level electrical current to activate the nerves responsible for muscle contraction and has been used to restore or to improve muscle function. However, current systems rely on a constant stimulation and causes muscle fatigue. We want to create a closed loop system to prevent oversaturation of muscle contraction.

Goals

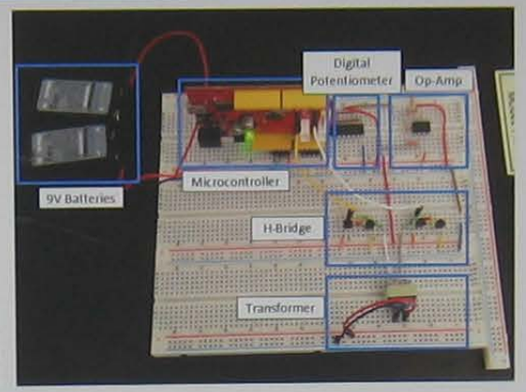
To create a closed-loop FES system, we must meet these five aims:

1. Build an EMG system
2. Build a FES device
3. Create a model relating EMG and stimulation
4. Design algorithm for FES control system
5. Validate the system with human trials

FES Prototyping



Design: FES Circuit capable of a programmable signal at 120V & 200mA



Build: Low Cost FES at around $65 for component cost.

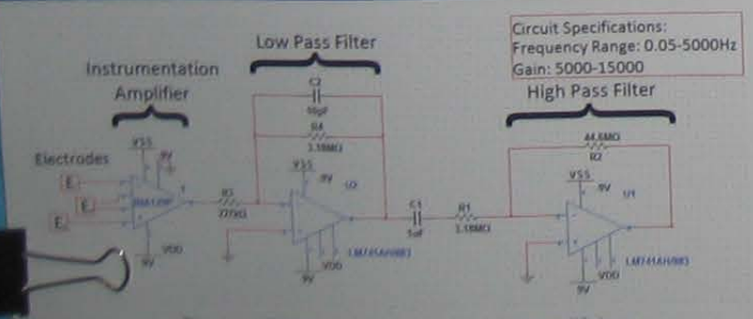
FES Circuit Overview

- Digital Potentiometer - regulates a 5V input supply to control signal strength
- Power Amplifier - amplifies 5V power to 15V for H-Bridge
- H-Bridge - creates AC signal from DC input for muscle stimulation
- Microcontroller - activates H-bridge Mosfets to control signal profile and timing.
- Transformer - steps up 15V output from H-Bridge to 125V for surface electrodes

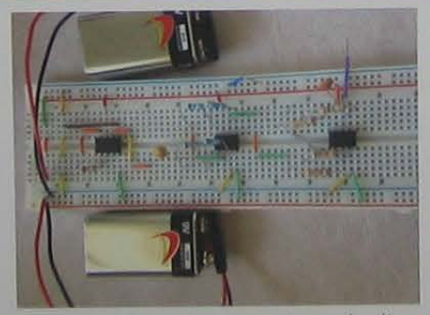
Schedule

Task	Fall	Winter	Spring
Literature Research			
FES Prototype			
EMG Prototype			
MATLAB Model			
EMG Data Collection			
Real-Time Testing			
Final Revisions			

EMG Prototyping



Design: EMG Circuit capable of amplifying muscle signal by 10,000.



Build: Ordering parts to make it portable and affordable.

Test: Surface Electrodes pick up signals for viewing on an Oscilloscope

Current Status

- Initial prototype of EMG constructed
- Initial prototype of FES constructed
  - Human trials to begin soon
- Research on feedback model
  - Outline model in MATLAB

Contacts

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