Project Plan

IPRO 332 – Tournitech: Smart Clothing for Sensing Muscle Development

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Project Objectives:

This IPRO is the second of a two phase design project. Its objective is to continue the work of the Summer 2004 IPRO 332 team, advancing from feasibility study and conceptual design to prototype development. This IPRO will focus on the specific material selection and design specifications of a successful prototype that meets the following design objectives: low cost, easy to use, easy to produce, and meets the requirements outlined in the research studies. The finished prototype will then be sent to La Crosse Exercise and Health Program at the University of Wisconsin where the effectiveness and safety concerns will be addressed.

Project Background:

When muscles work they call upon muscle fibers in order from smallest to largest. There are two types of fibers with in the skeletal muscle. The largest fibers are fast twitch muscles and use sugars during glycolysis and benefit more from anaerobic conditions during exercise. A by product of anaerobic exercise is lactic acid that contributes to cramping and fatigue. When fast twitch muscles are exercised they respond by growing larger, thus making the individual stronger and faster with greater circulation to that region of the body. Small muscle fibers or slow twitch muscle use oxygen for an energy source during glycolysis and benefit more from aerobic exercise.

The best example of how Tournitech works can be seen in runners who train in higher altitudes. Long distance runners who train in higher altitudes are forced to run for shorter distances because of a faster onset of fatigue. The faster onset of fatigue is cause by a lower lever of oxygen in the atmosphere, which results in a lower level of oxygen in the blood and subsequently, a lower level of oxygen available to the slow twitch muscle of the legs. Less oxygen available to the legs means the slow twitch muscle fatigues faster leaving the fast twitch muscle to work alone. Overtime, runners in higher altitudes experience greater endurance, speed, and strength when competing in lower altitudes, not because of greater oxygen levels at a lower altitude, but because the fast twitch fibers within the muscle have increased in size. Larger fast twitch muscles increase circulation to the entire region. This carries with it a greater degree of endurance when slower twitch muscle fibers requiring oxygen are used.

The same can be said for the muscle in the arms. Both the arms and the legs have more slow twitch muscle when compared to fast twitch muscles, this becomes a barrier when one tries to gain strength, speed, endurance and circulation. Results are often left to those with the right muscle fiber make up. While we can not change the number of slow or fast twitch fibers we are born with, we can increase the size of the fast twitch fiber, which benefits both. This is easier said than done. With so many smaller slow twitch fibers in the arms and legs, it can be virtually impossible to recruit the larger fast twitch fibers when exercising.

This is where Tournitech comes in. Tournitech allows decreased oxygen levels to take place locally where it is needed most, in the arms and legs. With Tournitech, athletes can experience all the benefits of higher altitudes without geographical constraints or exposure to an increased risk of stroke by depriving areas of the body of oxygen that should not be deprived, Tournitech is designed to break the genetic barrier.

Research Methodology:
The objectives of this IPRO will be met using the following techniques:

- Develop an understanding of the conclusions that were made during the Summer IPRO.
- Brainstorming as a group for one or two prototype designs that can be constructed prior to the end of the semester.
- Research to find the best materials for the prototype and future manufacture.
- Defining the specific design dimensions of the Tournitec, and the possible need for different sizes based on body type.

Expected Results:
At the conclusion of this IPRO, we intend to have developed a successful prototype that meets the design objectives. The prototype will also be sent to the sponsor so that the safety concerns and effectiveness of the product can be research by La Crosse Exercise and Health Program at the University of Wisconsin.

Project Schedule:
The following is a schedule of events and deliverables that must be turned into the IPRO office.

IPRO First Class	August 31
Project Plan	September 10
Mid-Term Progress Report & Seminar-Style Discussion	October 22
Professional-Exhibit is Organized	November 29
One-Page Abstract	November 29
Web Site	December 1
Final Oral Presentation	December 1
Final Project Report	December 3
Team Information	December 3
Comprehensive Deliverables CD	December 3
IPRO Projects Day Conference	December 3
IPRO Team Debriefing	December 6 -13

Individual Team Member Assignments and Team Deliverables:
Each team member has been assigned or has volunteered to one of two design groups to help accomplish the objectives stated above. The list bellow entails the group members and the deliverables assigned to each group.

Prototype Design:

Team Members:	Deliverables:
Craig Rohe	Project Plan
Jonathan Beckman	Midterm Progress Report
Jose Zamzcona	Professional Style - Poster
Nate Godfrey	Final Project Report

Material Selection:

Team Members:	Deliverables:
Jotvinge Vaicekauskaite	Website
Dan Latuszek	Oral Presentation
Alexis Dulinskas	Team Log
Hakan Ozmen	One Page Abstract