Project #	Project Name	Project Track	Project Family
P09029	Robotic Hand Improvement	Assistive Devices and Bioengineering	Artificial Organ
Start Term	Team Guide	Project Sponsor	Doc. Revision
Winter 2008	Dr. Lamkin-Kennard	Dr. Lamkin-Kennard	10

Project Description

Project Background:

The long-term goal of this project is to design a robotic arm with full range of motion capability. Prior phases of the project focused on finger motions. This iteration will focus on wrist, forearm, and elbow motion. 3-D solid models of wrist, forearm, and elbow designs will be generated and a software package will be implemented that links the solid models to control software. The software package must accurately predict the kinematics of the robotic arm, forces applied to the arm from pneumatic muscles, and the interactions between the controls software and solid models. To ensure the accuracy of the simulation, breadboard level prototype joints will be made and compared the computer model. The completed project will provide the customer with a validated design as well as a design methodology that can be used in support of future project phases.

Problem Statement:

Current remote controlled manipulators are not intuitive to control because of the difference in machine motion and human motion. This family of projects' final goal is to have a scalable robotic arm that moves exactly like the human controller with simple and intuitive controls, such as a glove, that captures human motion. The arm will be scaled down for use in microsurgery or up for workings in hazardous environments. This iteration needs to solve the design challenges of the wrist, forearm and elbow to be incorporated with previous designs. The project also needs to develop a controls system that can control any robotic arm prototypes that are to be built, but more importantly, control a computer model (CAD) for testing how a prototype might behave.

Objectives/Scope:

1. Develop designs for the wrist, forearm and elbow.
2. Develop a physics-based computer model controllable in the same way a physical prototype would be.
3. Incorporate designs for the already made hand.

Deliverables:

- A physically and kinematically accurate computer model.
- A controls system that can control both a computer model and a prototype joints.
- Demonstrate design feasibility for the wrist, forearm and elbow.
- Thorough documentation of all designs.

Expected Project Benefits:

- This iteration of the robotic arm will solve the design challenges of wrist, forearm and elbow motion.
- First use of a computer model to accurately portray output from the controls system.
- Will streamline the design process for current and future customer needs.
- Will enable optimization of designs prior to construction of full physical prototypes.

Core Team Members:

- Casey Dill – Team Lead
- Andrew Torkelson
- Arthur Connors

Strategy & Approach

Assumptions & Constraints:

1. Knowledge of how the air muscles work and designs for the hands will be acquired from other iterations of the project.
2. The project may not infringe on patents, and all members must follow all the rules and regulations of RIT and the law.

Issues & Risks:

- Air muscles work non-linearly. This has created controls problems in the past.
- Further funding might not be found, limiting the scope of the prototype.
- No one on the team has a strong biomedical background, increasing the amount that the team needs to learn as the project progresses.
- Only three team members.
- There is no one on the team with experience in integrating SolidWorks and LabVIEW, so the work involved is unknown.