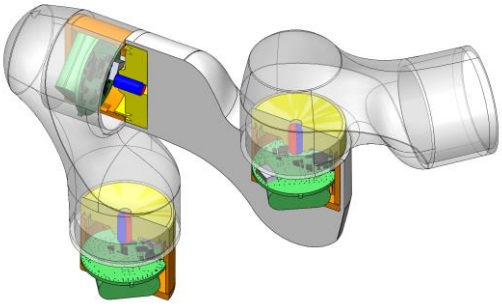
Armature Joint Module

By: Flynn Stilwell Supervisor: Frank Beinersdorf Client: MechAdept

Prototype 4, disassembled

Prototype 5, charging battery



Envisioned armature implementation by Frank

INTRODUCTION

Prototyping large robots at a miniature scale is a great way to validate a robot's design. It allows the engineer to test a robot's mechanical structure design and its range of motion in the real world, at a low cost. MechAdept employs this method for their high-performance mechatronic systems, but they do not give useful joint position feedback without manual measurement.

The aim of this project was to develop a functional prototype of a single joint module to prove the concept of a puppeteering armature which would be manipulated by hand and stream out position information to a user terminal via Bluetooth. The design had to be compact, battery powered, modular and simple.

DEVELOPMENT

This project required the development of systems of three different types; mechanical, electronic, and embedded software.

Mechanical Structure

The mechanical structure was rapidly prototyped using Solidworks 3D CAD software for the modelling and 3D printing for the manufacturing. Two main concepts were produced and evaluated, and the preferred one was iterated upon to experimentally validate design decisions.

Electronic system

The electronic system elements were prototyped on a breadboard to validate the magnetic position measurement system. High speed signal Printed Circuit Board (PCB) design considerations and electronic components were researched for implementing the design on a PCB. This was designed electronically using Autodesk Eagle, manufactured by PCBZone in NZ, and assembled with the help of MechAdept.

Reference circuitry from Nordic Semiconductor was used for the Bluetooth-capable System on Chip (SoC) section of the PCB to help ensure its sufficient Radio Frequency (RF) performance.

Embedded Software

Nordic Semiconductor's Software Development Kit is being used to learn the microcontroller platform and provide a base for the embedded software.

CONCLUSION

Multiple mechanical test iterations have been produced and the best mechanical interface was found to be a snap-fit design with a balance of actuation friction, simplicity, and ease of assembly/disassembly. Six of the PCB's have been produced, all of which have passed power cycle tests, and one is undergoing troubleshooting and programming. This project involved the development of a single joint module. It provides a base platform to build upon. However, the vision is to have multiple of these connected to interchangeable links to provide a hand manipulated virtual model and miniature robot prototyping platform.