

HAPTIC THERMAL FEEDBACK FOR BRAIN-CONTROLLED PROSTHETIC ARM

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ABSTRACT

The purpose of this project is to redesign a Brain-controlled prosthetic arm to be fully equipped with thermal sensors and haptic feedback. Through these different modules, the arm will be able to sense the environment and objects the patient wishes to manipulate. As the arm attempts to manipulate an object with dangerous temperature levels, the brain-controlled arm will provide haptic feedback through vibration motors to alert the operator. In doing so, this can prevent injury to the operator as well as provide prosthetics users with a well-defined way to sense the environment. Thus, returning the ability for a user to sense through touch.

Keywords: Brain-controlled, Haptic, Thermal

INTRODUCTION

Prosthetics have shown drastic improvements throughout the years to allow for operation through reading brain waves. This advancement has given patients more efficient and effective prosthetics that can function in day to day tasks. However, these advancements still have a long path ahead to being fully robust and efficient. All modern prosthetic arms lack the ability to properly sense the environment.

Objective: The object of this project is to design, build, and program a haptic thermal feedback system for a brain-controlled prosthetic that 1. can accurately sense the surface temperature of an item and 2. can alert the operator of dangerous surface temperature levels. To accomplish these goals first, it is necessary to have a temperature-sensing device embedded within the prosthetic that does not reduce its functionality. To achieve the second goal, it is necessary to install strong vibration motors housed in the prosthetic to alert the user through haptic feedback. This will create a brain-controlled prosthetic that gives the user the ability to sense their environment.

Related Background: For the haptic thermal feedback system for a brain-controlled prosthetics arm prototype, a thermal sensing system was added to a previously developed brain-controlled robotic prosthetic hand [1].

InMoov: The design for the arm came from an open-source website called InMoov. InMoov contains an entire step-by-step manual and computer-aided design (CAD) files for building a complete robot. Each independent CAD file is imported into CAD software and assembled to simulate the prosthetic before 3D printing an actual model. Fig. 1 shows the design of the hand, wrist, and forearm used for the prototype.