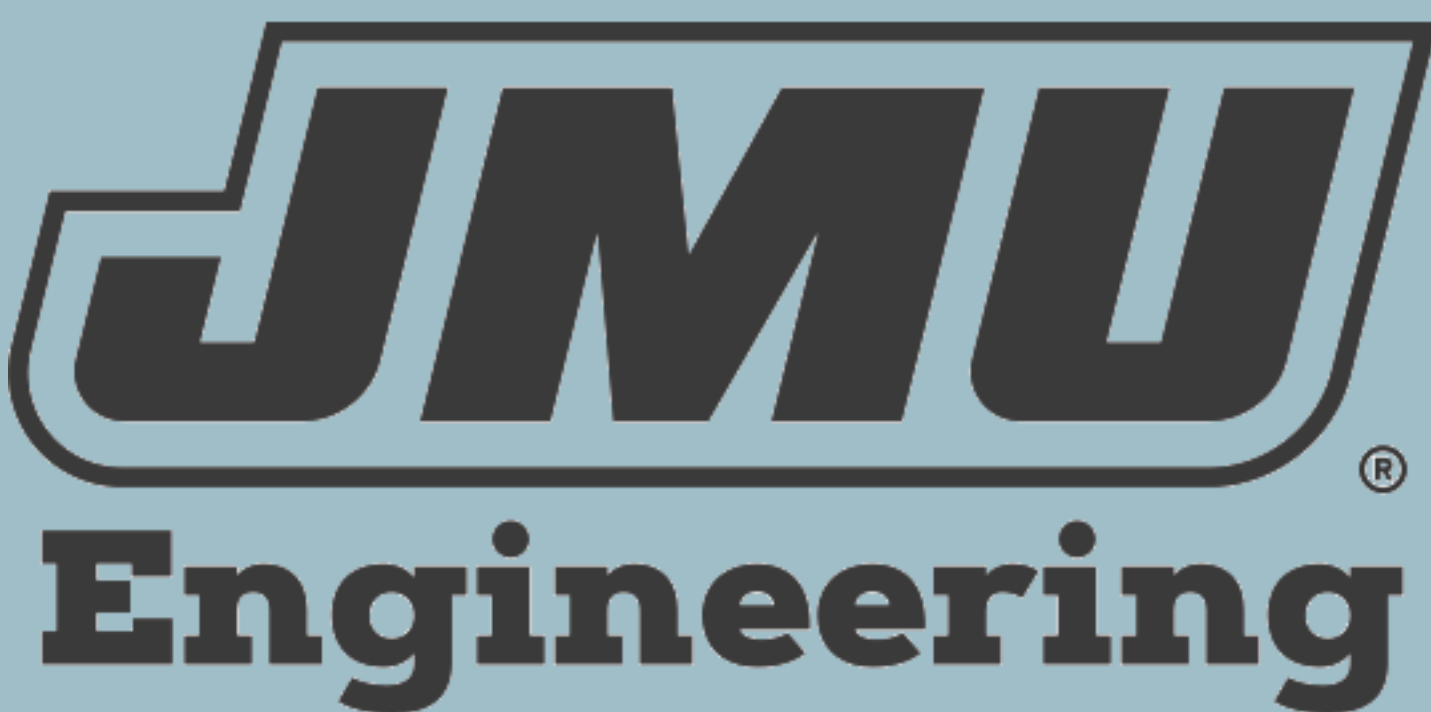


Do you feel the burn? Exploring lightweight haptic feedback and how it can improve exercise performance.



Julia Larson (larso2ja@dukes.jmu.edu)
Dr. Jason Forsyth (forsy2jb@jmu.edu)
Department of Engineering
James Madison University



Abstract

Research has shown a significant downward trend in adherence to at-home physical therapy programs. To address this issue, many automated and computerized systems have been proposed to monitor and provide live feedback to patients during their at-home exercise programs.

Although, some of these proposed feedback methods can be confusing. This research proposes a more simple and lightweight wearable feedback system to be used to improve accuracy of exercise execution in an at-home setting.

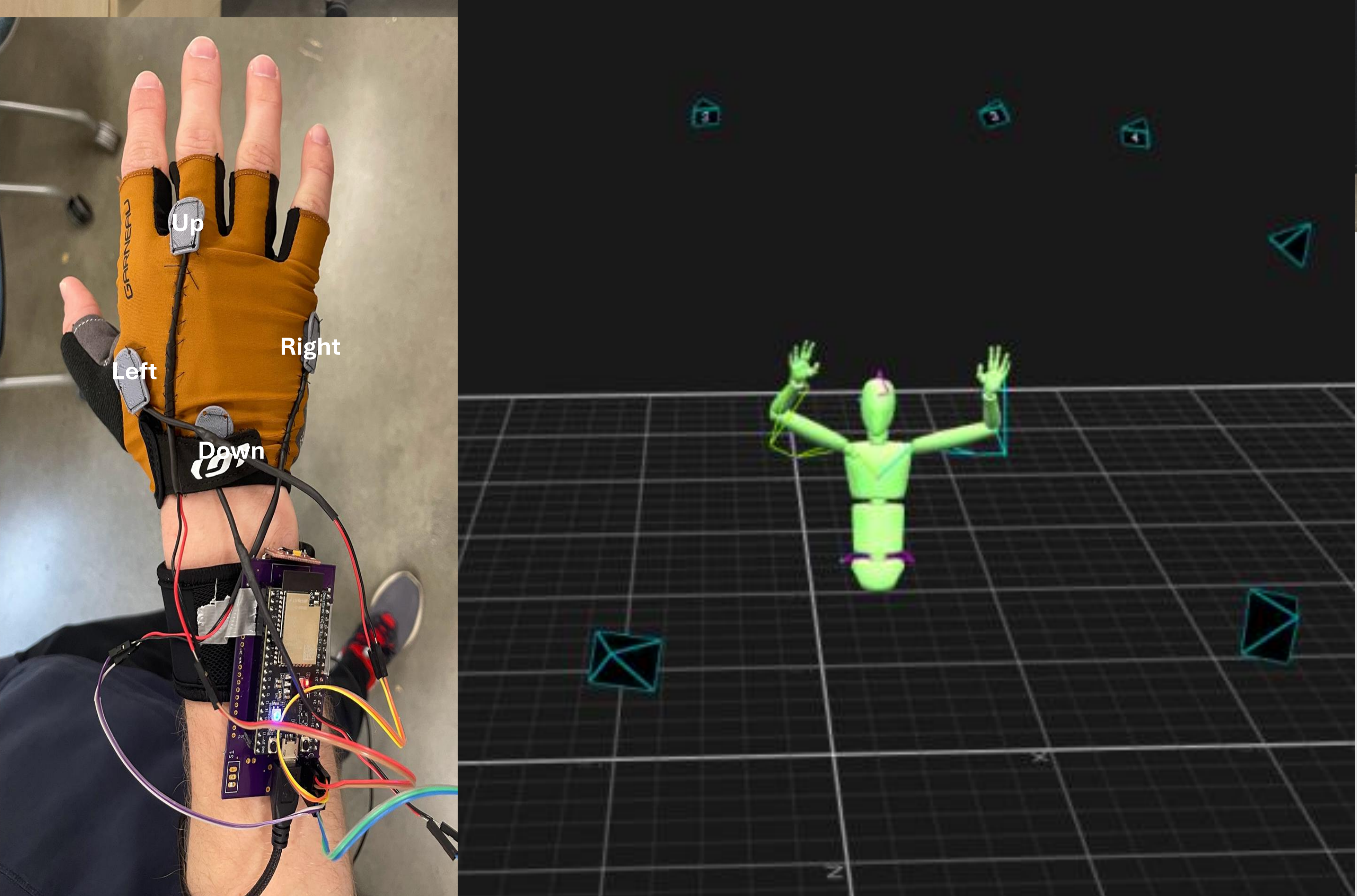
Feedback

Many feedback methods have been proposed and evaluated for motion guidance applications such as visual, audio, and multimodal feedback. However, our focus is on haptic feedback, which can convey simple sensory information in complex environments, where multiple feedback metaphors exist.

Alert metaphors utilize vibrational patterns like a phone notification vibration to remind users to move. **Push metaphors** provide cues that direct the user to move away from vibrations, while **pull metaphors** direct users toward the vibrations. The **cutaneous rabbit illusion** is perceived to be small jumps between vibrotactile actuators. Each of these feedback metaphors come with benefits and drawbacks.

Benefits	Drawbacks
Decrease time to target in 3D space	Cues can be ambiguous and confusing
Improve gesture formation	Deciphering origin of feedback is difficult
Improved accuracy of directional movement	Limited to end-target focused applications

Motion Capture System



Proposed Experiment

To determine the efficacy of our proposed **tapping/touch feedback method**, we plan to conduct a 30-person user study with various physical therapy exercises. Each participant will be randomly assigned a selected feedback method, either the tapping/touch feedback, pull feedback, or no feedback. All participants will engage in a training session with the feedback, then participate in two sessions with the feedback. The third and final session will have participants exercise without feedback. During the sessions, quantitative measurements were taken using the MOCAP system to evaluate the coefficient of variation between exercise trials. Additionally, the NASA-TLX survey will be used to collect qualitative information about the workload of the exercises with feedback to evaluate if the simple feedback is more easily understood than other methods.

Motion Curves

