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| **I/UCRC Executive Summary - Project Synopsis** | **Date**: March 31, 2017 |
|  **Center/Site**: iPerform Center for Assistive Technologies to Enhance Human Performance |
|  **Tracking No**.: |  **Phone :** (972) 872 - 9096 |  **E-mail : rgregg@utdallas.edu** |
|  **Center/Site Director:** Dr. Fillia Makedon | **Type: New** |
|  **Project Leader: Robert Gregg** | **Proposed Budget**: $50,000 |
|  **Project Description**: Compliant robotic joints have been an area of increasing interest in industry and academia. The compliance they offer enables robots to interact more safely and naturally with their environment and humans, and can result in power and energy savings. Certain applications, such as robotic prosthesis and orthoses (P&O), can additionally benefit from the ability to tune the stiffness of robotic joints. This project will develop a compliant robotic joint with electrically modulated stiffness with the aim of enabling smooth, natural interaction between robotic P&O and their users. In particular, the joint will be designed into a powered knee orthosis to assist stroke patients. This technology will be valuable for other applications involving human-robot interaction. |
|  **Experimental plan**: Design joint and testbed – 2 mo., order materials and assemble joint and testbed – 2 mo., test joint on testbed – 1 mo., iterate joint design and integrate into knee orthosis – 3 mo., analytically and quantitatively characterize joint with human experiments – 2 mo., finalize documentation and prepare for knowledge transfer – 2 mo. |
|  **Related work elsewhere**: DLR Floating Spring Joint, KIST Variable Stiffness Unit, Vrije Universiteit Brussel MACCEPA, and others. |
|  **How this project is different**: This device will use dielectric elastomer technology to modulate stiffness of the joint electrically, resulting in a robust, lightweight joint with rapidly adjustable compliance. These are important traits for a knee orthosis used by a stroke patient. |
|  **Milestones for the current proposed year**: First design iteration assembled – October 1, 2017; final iteration completed – February 1, 2018; characterization completed – April 1, 2018; knowledge transfer complete – May 31, 2018 |
|  **Deliverables for the current proposed year**: 1) Design of a prototype compliant robotic joint in a knee orthosis, 2) characterization of the joint’s performance, 3) documentation explaining the functioning of the joint |
|  **How the project may be transformative and/or benefit society**: This technology will make elastic robot-human interaction more versatile resulting in increased adoption of powered orthoses for stroke patients. These assistive devices will help stroke patients regain mobility in the home and community for greater quality of life. |
|  **Research areas of expertise needed for project success:** This project requires expertise at the interface of wearable robotics and material science. This project is ideally suited for PhD student David P. Allen, who is co-advised by Prof. Gregg (Biomedical Engineering) and Prof. Walter Voit (Material Science). |
|  **Potential Member Company Benefits:** Access to compliant robotic knee orthosis with electrically modulated stiffness that can be more robust, lightweight, and compliant than state-of-the-art robotic orthoses. |
| **Progress to Date:** We have already invested 2 years into a benchtop linear actuator with a prismatic variable stiffness unit based on dielectric elastomer technology. We are in the final stages of validating this preliminary design, which will enable rapid progress in the proposed work. |
| **Estimated Start Date**: 6/1/17 | **Estimated Knowledge Transfer Date**: 5/31/18 |

The Executive Summary is used by corporate stakeholders in evaluating the value of their leveraged investment in the center and its projects. It also enables stakeholders to discuss and decide on the projects that provide value to their respective organizations. **Ideally, the tool is completed and shared in advance of IAB meetings to help enable rational decision making.**