Cover page (1 page)

Research Development Fund – SPRING 2019 Application Template

Application Title: Development of Laboratory for Human Augmentation and Rehabilitation (HAR) at Texas A&M

Names: Reza Langari* and Richard Kreider**
Departments: *Mechanical Engineering /Engineering Technology & Industrial Distribution (ETID)
**Health and Kinesiology, HCRF
Email addresses: *rlangari@tamu.edu, **rbkreider@tamu.edu
Phone numbers: *845-4949, **458-1498

Key Participating Units:

- **College of Engineering:** Mechanical Eng (P. Hur), Electrical and Computer Eng (H. Park), and ETID (J. Kim)
- **College of Education and Human Development:** Health and Kinesiology (J. Buchanan, M. Engelen)
- **College of Medicine:** Neuroscience and Experimental Therapeutics (M. Hook)
- **College of Science:** Mathematics (J. Jung)
- **Centers:** Health Science Center, Human Clinical Research Facility (HCRF), and the Center for Translational Research in Aging and Longevity (CTRAL; N. Deutz)

Anticipated Request Amount ($): $1,130,000

Executive summary of this application to utilize Research Development Funds:

Improving quality of life for people with disabilities has been a focus across a broad range of disciplines. Several interdisciplinary and collaborative approaches at TAMU have worked to address this topic; recovery and enhancement of physical human capability is one of the primary focus areas in this respect. Specifically, the PIs on this team have focused on the following research themes: 1) development of wearable and rehabilitative robotic devices, 2) evaluation of neural (i.e., sensory and motor) feedback, and 3) quantitative analysis and optimization.

The goal is to build a shared research facility, laboratory for **H**uman **A**ugmentation and **R**ehabilitation (HAR), by a team of investigators from several colleges at TAMU in the areas of biomechanics, biomedical electronics, neuroscience, and rehabilitation research. The proposed facility will be utilized for current and future research that focuses on *quantitative analysis of human behavior* with interventions involving physical human augmentation (i.e., robotic exoskeletons such as the TAMU CLEVERArm[1]) and electrical stimulations (i.e., peripheral sensory stimulation, brain stimulation, motor stimulation). These techniques are essential in addressing severe disabilities such as stroke, spinal cord injuries and neurological disorder.

For this purpose, HAR will be housed in the Human Clinical Research Facility (HCRF), which is well suited for clinical studies. The facility will be equipped with several quantitative experimental settings that includes human balance and gait, upper limb movements, and activities of daily living (ADLs) in a simulated home/workspace to evaluate the human performance with certain interventions. The HAR facility will include a Computer Assisted Rehabilitation Environment (CAREN) system, which supports versatile, multi-sensory clinical analysis, rehabilitation, evaluation and registration of the human balance system, a KINARM End-Point system for study sensory, and a fully-equipped simulated home and workspace with motion analysis system. The facility can evaluate human motion performance with sensory augmentation and rehabilitation interventions, and measure/quantify the quality of life in daily activities. This facility can expand the research area includes wearable and robotic rehabilitation, mobile health applications, biomedical and neural engineering and human augmentation with sensory feedback for people with a wide spectrum of disabilities, the elderly, healthy population, athletics and military personnel.

While the individual laboratories of the participating investigators are presently equipped with some of these functionalities, the RDF funding will enable a more focused and interdisciplinary collaboration with state-of-the-art technologies. The proposed facility will allow common usage by researchers from across the areas noted in the heading of this cover sheet and will enable true interdisciplinary effort in an area where funding opportunities are extensive but require effective infrastructure for TAMU to be truly competitive.

[1] TAMU CLEVERArm is developed at Texas A&M University as a lightweight versatile robotic exoskeleton for upper limb rehabilitation. See https://twitter.com/tamu/status/1016349334395392002.