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Research Development Fund – FALL 2018 Application

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

Lead contact for RDF Application:

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Key Participating Units:

- **College of Engineering:** Mechanical (P. Hur), Electrical (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 ($): $972,000

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 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, motor and cognitive functions and a Transcranial Magnetic Stimulation (TMS) system for non-invasive direct brain stimulation.

The proposed facility will allow for measurement of human motion performance and in-situ evaluation of prototype wearable and rehabilitation robotic exoskeletons, biomedical and neural engineering studies with sensory feedback, mobile health applications for human behavior, and human augmentation for people with a wide spectrum of disabilities, the elderly, healthy population, athletics and military personnel.

The proposed facility will allow the research team to collect quantitative human behavior data with existing and new devices that developed by TAMU PIs and can further enable TAMU to seek federal funding from NSF, NIH, DoD/DARPA. 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 a state of the art technologies. These instruments 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.