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The Design of a Multi-Terrain Therapy Treadmill

Dr. George D. Ricco, University of Indianapolis

George D. Ricco is an assistant professor of engineering and first-year engineering coordinator at the University of Indianapolis. He focuses his work between teaching the first two years of introductory engineering and engineering design and research in student progression. Previously, he was a special title series assistant professor in electrical engineering at the University of Kentucky, and the KEEN Program Coordinator at Gonzaga University in the School of Engineering and Applied Science. He completed his doctorate in engineering education from Purdue University's School of Engineering Education. Previously, he received an M.S. in earth and planetary sciences studying geospatial imaging, and an M.S. in physics studying high-pressure, high-temperature FT-IR spectroscopy in heavy water, both from the University of California, Santa Cruz. He holds a B.S.E. in engineering physics with a concentration in electrical engineering from Case Western Reserve University. His academic interests include longitudinal analysis, visualization, semantics, team formation, gender issues, existential phenomenology, and lagomorph physiology.

Dr. Najmus Saqib, University of Indianapolis

Najmus Saqib is an Assistant Professor in the R.B. Annis School of Engineering at the University of Indianapolis (UIndy). Saqib received his Ph.D. in Mechanical Engineering from Colorado School of Mines (CSM), focusing on "Optical Diagnostics of Lithium-Sulfur and Lithium-Ion Battery Electrolytes using Attenuated Total Reflection Infrared Spectroscopy". He likes to use innovative pedagogical techniques to facilitate student learning.

Dr. David Olawale, R.B. Annis School of Engineering, University of Indianapolis

Dr. David Olawale is a professor of Industrial and Systems Engineering at the R. B. Annis School of Engineering, University of Indianapolis. He has diverse experience in research and development, as well as technology commercialization and entrepreneurship. His research areas include multifunctional composite materials and manufacturing, as well as technology entrepreneurship. His research work resulted in two patents and over fifty peer reviewed journal, book chapters, and conference publications. He is the lead editor of the only book on Triboluminescence (Triboluminescence: Theory, Synthesis and Application), published by Springer in 2016. He has co-authored several book chapters including a chapter in the book, Nanotechnology Commercialization: Manufacturing Processes and Products, published by Wiley in 2017. He is also the lead author of the 7th most cited article in Journal of Luminescence from 2011-2016. His paper, "Triboluminescent Composite with In-situ Impact Sensing Capability" won an Outstanding Paper Award for the Non Destructive Evaluation track at the 2015 CAMX –The Composites and Advanced Materials Expo. His work led to the formation of a technology startup company and in 2015, he led the startup company in receiving the highly competitive National Science Foundation (NSF) Small Business Technology Transfer (STTR Phase 1) award and successfully completed the project in 2016. He also served as the entrepreneurial lead for the NSF ICorps Team 377 (Fall 2014). He is a project management professional (PMP) and a technology entrepreneur.

Tyler J Nolan, University of Indianapolis
Mr. Teangelo Rayner, University of Indianapolis
Tyson Burton
Jacob Michael Rohrig

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Derek Elam
Univ. of Indianapolis
elamd@uindy.edu

Tyler Nolan*
Univ. of Indianapolis
nolantj@uindy.edu

Teangelo Rayner
Univ. of Indianapolis
raynert@uindy.edu

Jacob Rohrig
Univ. of Indianapolis
rohrigj@uindy.edu

Tyson Burton
Univ. of Indianapolis
burtonta@uindy.edu

Najmus Saqib
Univ. of Indianapolis
saqibn@uindy.edu

David Olawale
Univ. of Indianapolis
olawaled@uindy.edu

George Ricco
Univ. of Indianapolis
riccog@uindy.edu

Students at the R.B. Annis School of Engineering at the University of Indianapolis (UIndy), collaborated with therapists at NeuroHope to design and create a multi-terrain therapy treadmill. Team members, with the help of NeuroHope, identified requirements and constraints using Design for Six Sigma (DFSS) protocols under a four-stage design framework called the DesignSpine in order to create a novel design for a multi-terrain therapy treadmill. The treadmill will be used to help recovering patients practice walking on different terrains while being supported in a LiteGait harness. The different terrains will aid in the recovery process of a patient by stimulating many different muscles needed to walk properly. Utilizing Voice of the Customer (VoC) tools along with methodologies from IDEO and the Stanford d.School, such as translation worksheets and empathetic interview, the team identified and honed in on a set of critical requirements needed for the treadmill's redesign. Next, the team moved on to the ideation and conceptual design phase to develop either a design focused on retrofitting an existing treadmill or creating a more robust treadmill design. This process, after receiving feedback at the end of a planned stage gate review, ultimately produced a novel custom treadmill design that reduces the overall time needed to simulate different terrains during a patient's therapy session. With help from expert designers, the team came up with a custom design that will allow the therapists to easily and safely remove slats and replace them in a timely manner. The treadmill will be compatible with a LiteGait, a support device widely in use in body weight assisted therapy. As an advantage over retrofitting an existing treadmill, the custom treadmill allows for the incorporation of all NeuroHope's requirements. Ongoing efforts include prototyping, testing, and iterating different treadmill base designs that will allow for trainers to swap out multiple different types of tread, including a turf tread as well as a foam tread to mimic a variety of walking surfaces one might encounter on their day-to-day activities.