



Department Seminar and Case ASCE Joint Speaker

Human Gait Health Monitoring using Structural Vibration Sensing

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Abstract

Gait health is a large component of assessing fall risk with studies showing that elders with gait balance problems are 2.9 times more likely to fall than those who do not. Further, the Center for Disease Control estimates that approximately 3 million elders are treated in Emergency Departments each year from injuries resulting from falls, with approximately 800,000 of those individuals being hospitalized, and the total cost associated with falls is around \$50 billion annually. Current approaches for monitoring gait include visual observation by specialized medical staff, pressure sensing mats, and wearable accelerometers, but they are limited due to the need for specialized staff, dense deployment, and requiring direct action by those being monitored (i.e. putting on a device). My research overcomes these limitations by utilizing footstep-induced structural vibrations to enable a passive, non-intrusive sensing approach that can also achieve sparse sensor deployment. This sensing system builds off the intuition that the recorded vibration signals contain information about the footstep-floor interaction, including detailed gait health information (e.g., ground reaction forces, balance symmetry, stride time/length, etc.).

About the speaker:



Jonathon Fagert is a Ph.D. candidate in Civil and Environmental Engineering at Carnegie Mellon University. He received his bachelor's degree and master's degree in Civil Engineering from Case Western Reserve University in 2009 and 2010, respectively. He is a registered Professional Engineer in New York State and has over 6 years of experience as a structural design engineer. Jonathon's research is highly interdisciplinary and focuses on combining physical and databased models for indoor occupant monitoring using structural vibration sensing. This research field fuses concepts from Civil/Structural Engineering, Electrical/Computer Engineering, Computer Science, and the medical domain. Specifically, his research focuses on how to leverage structural vibration sensing to monitor human gait health. Through his research he has collaborated with Allegheny Health Network in Pittsburgh, PA, Nationwide Children's Hospital in Columbus, OH, and elder care facilities in the Pittsburgh area including Baptist Homes and Vincentian Homes. His research is published in several top-tier EECS Conferences and high impact Civil/Mechanical Engineering Journals, and he has received Best Student Paper (EMI Dynamics Committee 2020) and Best Poster Awards (IPSN 2019).