CNS1928695: FW-HTF-RM: Augmenting Spatial Cognition Capabilities of Future Workforce to Enhance Work Performance in Altered Environments Using Virtual Reality. PI(s): Manish Dixit, Texas A&M University, mdixit@tamu.edu

Overview: Understand spatial performance degradation in **altered environments** of space travel, other planets, North & South poles & hot & cold deserts: (1) measure the impact of static and dynamic misalignment of idiotropic and visual frame of reference & a lack of spatial cues on spatial abilities; (2) examine mental allocation & spatial strategies to inform design principles for a training method.

Future Technology: Integrated Virtual Reality, eye-tracking & electroencephalography (EEG) simulation to augment spatial cognitive performance
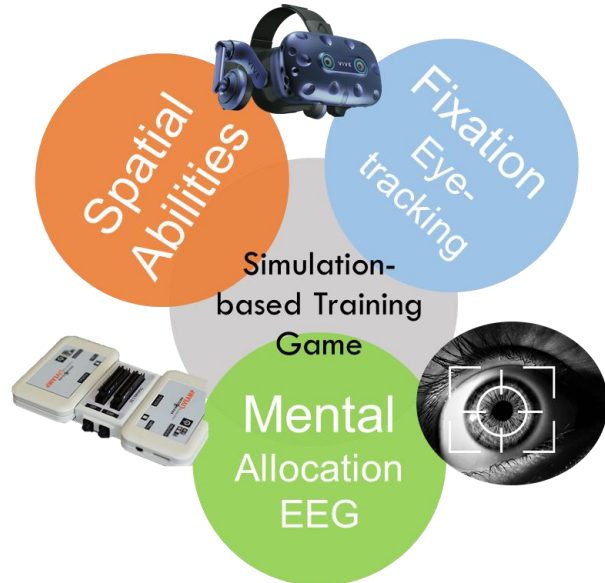
Future Work: Scientific/military explorations of Poles, Moon/Mars, deep oceans, low earth & lunar orbits: inspection, maintenance & repair with tele-operated robots/in-person; Operate polar/lunar rovers; Aerial reconnaissance using UAVs; Spacecraft rendezvous & docking

Future Workers: High risk workers from a wide array of STEM fields : Polar & marine researchers; Astronauts; Divers; Oil rig workers; Flight engineers/fighter pilots (e.g., Space Force); a broad logistics workforce in extreme conditions (e.g., Moon base/space station)
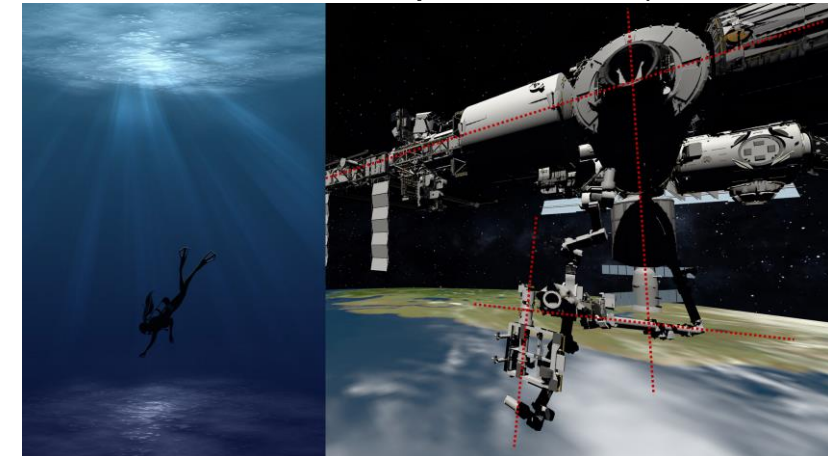
2026622 - Improving the Future of Retail and Warehouse Workers with Upper Limb Disabilities via Perceptive and Adaptive Soft Wearable Robots

Hao Su[1] hsu4@ncsu.edu, Chen Feng[2] cfeng@nyu.edu, Ludovic Righetti[2], Vikram Kapila[2], Douglas Kruse[3] dkruse@smlr.rutgers.edu, Lisa Schur[3], Hazen-Alle Johnson[3], Mason Ameri[3]

[1]North Carolina State University, [2]New York University, [3]Rutgers University

PErCeptive and Adaptive SOft (PECASO) Wearable Robots

Scope: modeling, perception, and control of soft wearable robots to provide physical assistance and skill training for people with physical disabilities in work.
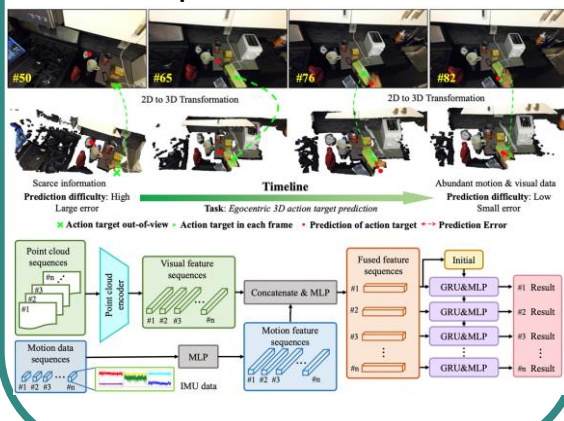
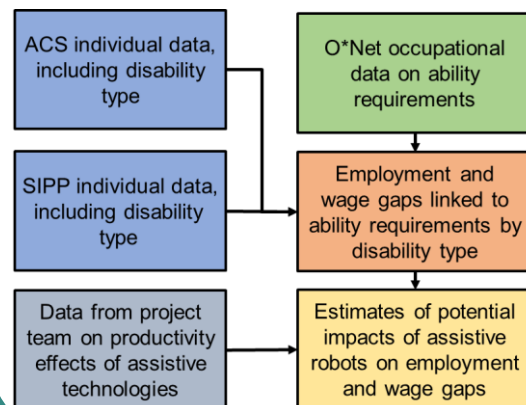### Wearable Robot
Design of lightweight and compliant soft wearable

Wearable Camera
Shoulder Exo Module
Elbow Exo Module
Wrist Exo Module

Perception and Control
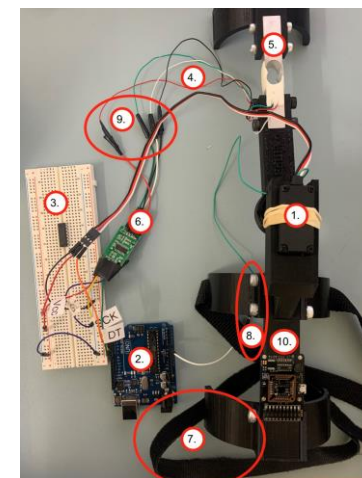Develop intelligent motion anticipation and control

Policy and Economics
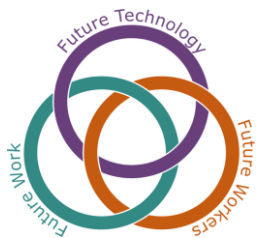Impact on employment and wage gaps

Training
Elbow Educational Kit

Impact: the convergent efforts of these multiple activities have the potential to enhance employment, inclusion and integration of people with physical disabilities in job tasks that are relevant to retail, warehouse, and manufacturing.

FW-HTF-P: Integrating Practitioner Knowledge and Technology for the Future of Water Treatment

PI(s): J. Camp (VU) - janey.camp@vanderbilt.edu, J. Gilligan (VU), Z. Tzankova (VU), S. Ivey (UofM), A. Hill (UofM), B. Waldron (UofM), and P. Sengupta (Calgary)

<u>Background</u>: Many WTP Operators are nearing retirement with a huge workforce pipeline to fill. Much of plant operations are straightforward chemical formulas, but some require experience and intuition. Nearly half of all operators surveyed in TN (2019) said their work is as much art as science. We must find a way to capture the "art" of water treatment to train the next generation.

<u>Objectives</u>: There is an urgent need to create tools and/or models that capture and replicate the experiential knowledge of current WTP operators (i.e., the experts) to improve and augment decision support for operators as we transition to the future workforce.

<u>Key tasks</u>:
- Establish **advisory committee** (provide evaluation and feedback on key deliverables and tasks)
- Literature review
- **Survey of operators** (nationwide)
- Hold **workshop of operators** focused on
  - Understanding context around survey responses,
  - Refine research questions
  - Initial development of conceptual models
- Prepare full research proposal for NSF submission
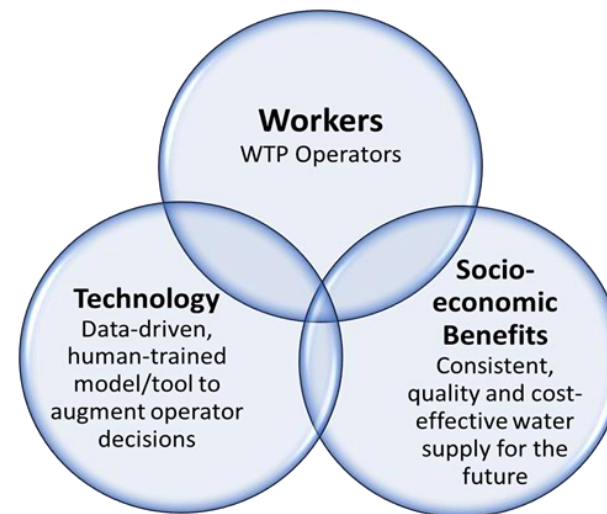
Advisory Committee - Partners:
- State Government Agency
- Researchers
- Water Utility Representatives (Small and Large)

FW-HTF-RL: Collaborative Research: The Future of Remanufacturing: Human-Robot Collaboration for Disassembly of End-of-Use Products (#2026533/2026276)

University at Buffalo: Minghui Zheng (mhzheng@buffalo.edu) and Xiao Liang
University of Florida: Sara Behdad (sarabehdad@ufl.edu), Boyi Hu, and Gulcan Onel

Feb 2022

Zheng   Behdad
Liang   Hu   Onel

Overview

Cameras   Operator   Robot   Operator

Human Motion Identification and Prediction

Main Tasks: Predict human motion with quantified uncertainty.

Vicon camera   Markers   Screwdrivers   Motion A (0.0044, 0.0134)m

University at Buffalo
UF | UNIVERSITY of FLORIDA

Workshop

WORKSHOP
Advances in AI-Powered Collaborative Robots
Ben Amaba — IBM's Chief Technology Officer for the Industrial Sector
Robert Radwin — Duane H. and Dorothy M. Bluemke Professor of the Industrial and Systems Engineering at the University of Wisconsin Madison
Friday, April 9, 2021 2:00 - 5:00 p.m. EST
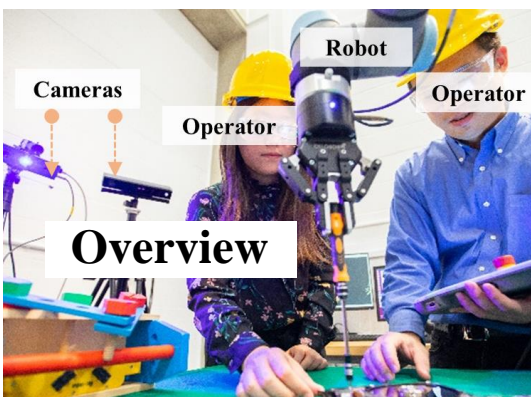Registration (Free!)
https://nsf-fw-workshop.eventbrite.com
Organizers: Minghui Zheng, Sara Behdad, Boyi Hu, Xiao Liang, and Gulcan Onel

Trajectory Planning of Co-Robot

Main Tasks: Fast hybrid trajectory planning with collision avoidance.

Deep Learning for E-Waste Sorting

Main Tasks: Sorting used devices based on types and models.

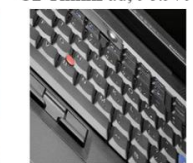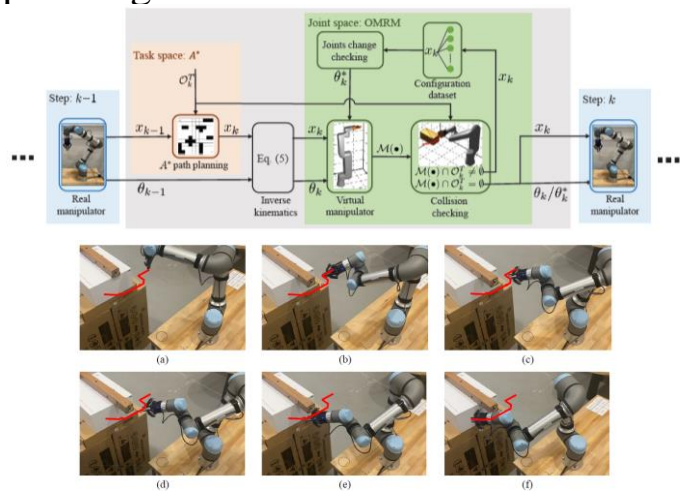C1 Hp, 70.2%   C0 Apple, 42.5%   C2 ThinkPad, 75.4%   C0 Apple, 100%   C2 ThinkPad, 96.9%   C1 Hp, 87.9%

Multi-attribute Optimization of Disassembly Sequence under Uncertainty

Main Tasks: Finding the optimal disassembly sequence considering safety, cost, and complexity.