DEMIANA R BARSOUM

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EDUCATION

PhD in Mechanical Engineering, Northwestern University, Evanston, IL — Sep 2022 - Present

- **Research Areas/Interests:** Assistive and Rehabilitative Robotics, Robot Learning, Human-Robot Interaction, Machine Learning, Embedded Systems, Participatory Design, Computer Vision
- **Awards:** Dr. L. Lewin Graduate Fellow, Walter P. Murphy Fellowship (2022-2023),
- **Courses:** Robotic Manipulation, Embedded Systems (ROS2), Machine Learning and Artificial Intelligence for Robotics, Active Learning for Robotics, Deep Learning, SLAM (ROS2), Additive Manufacturing, Design: Learning to See People and Their Patterns

BS in Mechanical Engineering, University of Tennessee, Knoxville, TN — Aug 2018 - May 2022

- **Minor:** Mathematics
- **GPA:** 3.82/4.0 (Magna Cum Laude)
- **Leadership:** President of Orthodox Christian Campus Ministries (OCCM)
- **Awards:** Carlos and Winnie Simpson Scholarship, Dean's List (2018 - 2022)

RESEARCH EXPERIENCE

PhD Student, Argallab, Northwestern University — Jan 2023 - Present
Advisor: Dr. Brenna D. Argall

- Conducted human subject studies to evaluate learning patterns across multiple sessions of teleoperation of a Jaco v2.0 robotic arm using IMU sensors placed on the upper body.
- Analyzed eye gaze behavior and assessed mental workload during assistive device control studies with injured participants utilizing eye gaze interfaces. Employed physiological measures, including ECG data, to quantify mental workload during study tasks.
- Managed participant recruitment for eye gaze study and engaged with potential end-users of robotic arms.
- Establishing simulation using Coppeliasim and ROS for teleoperation of robotic arms.
- Migrating robotic arm workspace from ROS to ROS2.

Undergraduate Researcher, Advincula Group, UTK — Jan 2018 - Apr 2018
Advisor: Dr. Rigoberto Advincula

- Operated Direct Ink Writing (DIW) Hyrel 3D printers to print tensile bars and sandwich structures using fabricated epoxy based materials I synthesized in the lab.
- Conducted research to optimize our formula for improved 3D printing performance.
- Trained for creating faces of sandwich structures through a Vacuum Infusion Process.
- Conducted rigorous testing on printed tensile bars and sandwich structures consisting of 3D printed epoxy based cores.
- Configured and calibrated a Dobot Magician robotic arm for accurate and reliable prints using PLA.
- Presented research findings to the lab to communicate results and led reading group sessions.

WORK EXPERIENCE

Manufacturing Engineer Intern, HBD Industries: Thermoid Inc., Oneida, TN — May 2021 - Aug 2021
Supervisor: Mr. Keith Taylor

- Responsibilities included working with the plant staff on the implementation of Lean Manufacturing principles, troubleshooting production issues, and material testing.
- Worked closely with Manufacturing and Quality teams to resolve production issues with machinery, tooling, and material.
- Worked with Quality and Technical Departments on product testing. Experience in rubber testing (Rheometer) and product testing (burst & tensile testing).
- Created the process flow map for the Hose production line. Worked with the Continuous Improvement leader to develop product families.
- Updated old and wrote new procedures within the cells to reflect current state operations (used by workers until today).
- Reported updates on project status in the Daily Visual Management meetings.

Nissan Summer Engineering Program Participant, Smyrna, TN — May 2017 - Jun 2017
Location: Smyrna Nissan Plant

- Developed skills for research and development of manufactured products by performing tests to figure out problems and solutions for future designs.
- Collaborated with a team to determine a problem in a 2017 Nissan Altima and come up with solutions to fix it.
- Presented research in front of bosses (including VP of Nissan), co-workers, and mentors.

PUBLICATIONS

- Larisa YC Loke, **Demiana R Barsoum**, Todd D Murphey, and Brenna Argall. "Characterizing Eye Gaze and Mental Workload for Assistive Device Control" (2024). *Under Review.*
- **Demiana R Barsoum**, Mahdieh Nejati, and Brenna Argall. "Learning from Limited Demonstrations Through Motor Impaired Teachers" (2024). *Workshop Paper for the ACM/IEEE International Conference on Human Robot Interaction (HRI) 2024.*
- Andrew Thompson*, Fiona A Neylon*, Fabio Rizzoglio*, **Demiana R Barsoum**, Lucy E Ammon, Maximus N McCune, Lee Miller, and Brenna Argall. "An Evolution of Assistive Robot Control to Meet End-User Ability" (2024). *To appear in Proceedings of the ACM/IEEE International Conference on Human Robot Interaction (HRI) 2024.*
- Larisa YC Loke, **Demiana R Barsoum**, Todd D Murphey, and Brenna Argall. "Characterizing Eye Gaze for Assistive Device Control" (2023). *To appear in Proceedings of the IEEE International Conference on Rehabilitation Robotics 2023.*
- Zane J Smith, **Demiana Barsoum**, Zahariah Arwood, Dayakar Penumadu, and Rigoberto C Advincula. "Characterization of micro-sandwich structures via direct ink writing epoxy based cores" (2023). *To appear in the Journal of Sandwich Structures & Materials.*

PROJECTS

SLAM Implementation on TurtleBot3 using ROS2 and C++ Jan 2024 - Mar 2024

- Wrote libraries for geometry, se2d, forward kinematics, inverse kinematics in preparation for controlling a turtlebot3.
- Implemented an Extended Kalman Filter (EKF) SLAM algorithm in C++ and ROS2.

Painting Robot: BotROS in ROS2 Iron Sep 2023 - Dec 2023

- Worked in a team of 4 to program Franka Emika Robotic arm to paint specified images.
- Worked on the control of the robot: Motion required to complete the task (Cartesian Path Planning) and pick-and-place of the paintbrush.
- Wrote a MoveIt2 Planning Library to coordinate the motion for this project.

A Star Implementation

- Implemented of Online and Offline A* pathfinding on a 2D grid.
- Implemented path planning for autonomous navigation with obstacle avoidance in Python.
- Designed a PI controller for precise robot navigation.

GAN to Generate Super Mario Bros Levels Mar 2023 - Jun 2023

- Worked in a team of 4 to optimize an CDCGAN model to generate playable Super Mario levels.

Design & Development of a Shredder for Repurposing Plastics into 3D Printing Filament Aug 2021 - May 2022

- Project funded by the US Navy.
- Worked in a team of 4 to design and develop a plastic shredder for use aboard U.S. Navy Ships. Shredded plastics were to be used as filament for 3D printing.

SKILLS

Programming Languages	Python, C/C++, Lua
Operating Systems	Ubuntu Linux, Robot Operating System (ROS & ROS2), Windows
Software	Solidworks, Matlab, FEA Analysis, 3D Printing/Rapid Prototyping
Tools	Git/GitHub, LaTeX, PyTorch/Tensor, Docker, Microsoft Office
Languages	Arabic and English (Native)

EXTRA-CURRICULAR ACTIVITIES

Museum of Science and Industry - Robotics Week, Chicago, IL Apr (Yearly since 2023)
Volunteer

- Volunteer to demo robotic platforms from our lab for robotics week to children.

STEM Outreach, UTK and Bowers Elementary School (Harriman, TN) Nov 2019 - Dec 2019
Mentor: Dr Stephanie TerMaath

- Volunteered to spread the love of engineering to underprivileged girls under the guidance of Dr. Stephanie TerMaath.
- Helped them operate tools like tinkerCAD, which allowed them to design airplanes and later 3D print them.
- Learned importance of exposing children to STEM and importance of giving back to the community and of service.