

TARIQ ANWAAR JAHEER HUSSAIN

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EDUCATION

Carnegie Mellon University

Master of Science in Mechanical Engineering – Research | GPA: 4.0/4.00

Coursework: Optimal Control and Reinforcement Learning, SLAM, Path Planning for Robotics, Machine Learning

Pittsburgh, PA

May 2025

National Institute of Technology – Tiruchirappalli (NIT-T)

Bachelor of Technology in Mechanical Engineering | GPA: 8.47/10.00

India

May 2023

RESEARCH EXPERIENCE

Real-Time Cloth State Estimation using EKF for Robotic Manipulation

Aug 2024 – Present

Research Assistant, RCHI Lab, Carnegie Mellon

- Developing a first-of-its-kind, data-driven state estimation framework for robotic cloth manipulation using an Extended Kalman Filter (EKF), integrating differentiable physics simulation models and camera stream outputs for precise tracking of cloth dynamics in dynamic manipulation scenarios
- Built a full-fledged optimized C++ pipeline, achieving a sub-0.7s latency which is ~10x faster than typical SOTA cloth state-estimation models
- Improving current stack to track cloth state for more actions like folding and optimizing the number of cloud points for computational efficiency.

Engineering Intern – Autonomy, Oshkosh Corporation

May 2024 – Aug 2024

Pittsburgh Centre of Excellence - AV

- Developed a semantic segmentation model (0.6 IoU) for the perception stack, capable of detecting road signs, traffic lights, and other objects for AV
- Integrated the model into the ROS 2 autonomy stack with sub-0.5s latency on the NVIDIA Orin Drive System, tested end-to-end on the vehicle.
- Worked on more ROS node scripts to communicate inferences to planning and controls stack, reducing dependency on high-definition maps for navigation

State Estimation of Sensorized Knee brace

Nov 2023 – May 2024

Research Assistant, RCHI Lab, Carnegie Mellon

- Developed a sensorized knee brace for continuous monitoring and analysis of post-surgery knee movements, designed for use outside clinical settings
- Designed a data-driven system with ~80% accuracy that classifies user activities and provides alerts for improper movements through user prompts
- Applied state estimation and sensor fusion technique, employing diverse filters to enhance gait analysis estimation using soft robotic capacitive sensors

Gamma Technologies LLC

Jan 2023 - Apr 2023

System Simulation Intern

- Explored diverse GT-Suite packages with a prime focus on Electric Vehicle Modeling, Thermal Management of Batteries and autonomy development models

RESEARCH PROJECTS

Rough terrain navigation for quadruped in dynamic environment

Oct 2024 -

Present

- Enhanced an existing global planner for quadrupeds (that used RRT planner) for Center of Mass planning in a 2.5D state space, improving dynamic obstacle avoidance and enabling navigation along z-direction, allowing Spot quadruped to be robust (planning time) and efficient (path cost)
- Addressed the limitations of the conventional PRM algorithm by integrating it with weighted A*, improving the planning time (experimented D* as well)
- Implemented dynamic obstacle avoidance by replanning and ensuring that new plan is free of obstacles by calculating obstacle trajectories

Implementation of Semantic ORB-SLAM

Jan 2024 - May 2024

- Improved upon ORB-SLAM 3 framework by integrating semantic segmentation to improve feature selection, keyframe selection and localization accuracy
- Developed a method to extract features from semantically labeled objects (0.75 IoU), masking out dynamic elements to optimize computational efficiency and improve landmark recognition (L1 score of 0.12 for MAE), using nearest neighbors search and geometric consistency checks.
- Utilized NVIDIA Isaac Sim to generate synthetic data for validating the proposed mode, demonstrating improved localization under dynamic conditions

Optimal Controls of Trapeze jumping AcroBOT

Jan 2024 - May 2024

- Developed Control strategy using DIRCOL optimization to enable smooth trapeze jumping transitions for an underactuated acrobatic robot
- Modeled the acrobot as a two-link system with revolute joints and modeled the complex dynamic constraints during the different phases of motion
- Incorporated free-time variables to enhance robot's adaptive decision-making, allowing it to autonomously adjust timing for effective trajectory

SKILLS

Programming : Python, C++, MATLAB, Octave, Arduino

Tech Stack : Computer Vision, Object Detection & Segmentation, Depth Estimation, RNN, LSTM, GRU, Transformers, GAN, VAE, Diffusion models

Simulation Tools : ROS2, Gazebo, CARLA, NAV2, NVIDIA Isaac Sim, CoppeliaSim, GTSuite

Frameworks : TensorFlow, Pytorch, OpenCV, Sickit-Learn, Git, Docker, Hugging Face, OpenMM Lab

Hardware : NVIDIA Orin Drive, RP LIDAR, Stretch RE2, JETSON Boards, micro-controllers, soft robotic sensors

TEACHING ASSISTANT EXPERIENCE

Course – Large Scale Multimedia Analysis (LSMA)

Nov 2024 – Dec 2024

- Conduct lab sessions for Deep Learning topics ranging from Audio Processing, Neural Networks, Object Detection, Semantic Segmentation, 3D Reconstruction, Stereo Vision, RNN, Vision Transformers, Multimodal Models (BLIP, CLIP), Generative Models (GAN, VAE, Diffusion Models)