Burhanuddin Shirose

+1 412-909-7497 bshirose@andrew.cmu.edu linkedin.com/in/burhan-shirose

Education

Carnegie Mellon University **May 2024**
Master of Science in Mechanical Engineering, Research: Robotics *Pittsburgh, PA*
Relevant Coursework: Planning and Decision making, Optimal Control and reinforcement learning, Modern control systems,
Teaching Assistant: Machine Learning and Artificial Intelligence for Engineers CGPA - 3.92/4

National Institute of Technology, Tiruchirappalli **May 2022**
Bachelor of Technology in Mechanical Engineering *Trichy, India*
Relevant Coursework: Industrial Robotics, Programming with C++ CGPA - 8.41/10

Experience

MattLab, Carnegie Mellon University **Jan 2024 – Present**
Graduate Research Assistant *Pittsburgh, PA*

- Designed and implemented a robust local planner algorithm optimized for autonomous driving robots
- Successfully integrated obstacle avoidance mechanisms, with robot footprint checking even at high speeds **6m/s**
- Utilized modern C++ features for code efficiency, enabling processing of up to 6000 trajectories in less than 20 ms

MattLab, Carnegie Mellon University **Jan 2023 – Dec 2023**
Graduate Research Assistant *Pittsburgh, PA*

- Engineered a decentralized multi-agent system, allowing users to manage **multiple fleets** of heterogeneous robots with **no human intervention**, while accomplishing search and rescue missions in challenging un-mapped environments
- Brought convoy formation time for the current system of **4** robots to under **5** seconds by inventing a **novel decentralized formation** control algorithm, with exponential savings with additional agents in the system
- Developed a **robust multi agent rendezvous algorithm**, which identifies the optimal rendezvous location within **1** second and brings robots within **7m** of each other while coordinating the convoy's actions, all with a single command

BioRobotics Lab, Carnegie Mellon University **Sep 2023 – Jan 2024**
Graduate Research Assistant *Pittsburgh, PA*

- Developed **SOTA** ergodic trajectory generator that avoids obstacles while producing dynamically feasible trajectories
- Used a combination of specialised **PRMs with Djikstra** backbone to generate a solution in the order of minutes
- Designed an ergodic solver under MPC formulation to avoid local minimas for a highly non convex function

Eduvance **Apr 2019 – June 2019**
ML Intern *Mumbai, India*

- Implemented K-Nearest Neighbours, Support Vector Machine, Random forest and Decision Tree algorithms to train diverse machine learning models to be employed in refining and cleaning user datasets
- Engineered a user assist model based on Apriori Algo for a Supermarket which achieved a prediction accuracy of $\sim$ **75 %**

Projects

Real-time Lattice Based A* Planning for RC Cars **Sept 2023 – Dec 2023**

- Developed a local planner focusing on kinodynamically feasible paths for an RC car using a kinodynamic bicycle mode
- Utilized **A* search** in the implicit graph, culling paths hitting obstacles identified by simulated Velodyne lidar.
- Implemented path execution with **iLQR controller** and demonstrated successful testing in a simulated Gazebo world

Robust Bi-Copter Control **Feb 2023 – May 2023**

- Implemented and tested **H-infinity Loop-shaping, H-infinity Optimal Control, H2 Optimal Control, and Mu-synthesis** on the Quanser Bi-copter system
- Attained a robust stability margin of **0.15** demonstrating the robust control under high uncertainty

Race Car Control Optimization and LQR Integration **Aug 2022 – Dec 2022**

- Utilized state-space analysis and control theory principles to fine-tune controllers and achieve peak performance
- Incorporated a combination of controllers, including PID, LQR, State Feedback, and an MPC, into the car simulation
- Reduced the track traversal time by **2x** over the stock tuned controller with a mean deviation of **0.48m**

Technical Skills

Softwares:Python, C/C++, ROS, Solidworks, Ansys **Tools**: PyTorch, OpenCV, SKlearn, pandas, NumPy, Docker, Git

Publications

- **Shirose, Burhanuddin** Et al. **"Robotic arm for brake performance testing" (RoAI 2021)**
- V, Nandha Kizor and Shirose, Burhanuddin Et al. **"Design of a Remotely Operated Vehicle (ROV) for Biofoul Cleaning and Inspection of Variety of Underwater Structures" (ICRoM 2021)**