Burhanuddin Shirose

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Education

Carnegie Mellon University **May 2024**
Master of Science, Research Specialization: Robotics *Pittsburgh, PA*
Relevant Coursework: Planning and Decision Making, Optimal Control and Reinforcement Learning CGPA - 3.90/4

National Institute of Technology, Tiruchirappalli **May 2022**
Bachelor of Technology in Mechanical Engineering *Trichy, India*

Publications

- **Shirose, Burhanuddin** Et al. "Graph-based Ergodic Search in Cluttered Environments" IEEE/RSJ International Conference on Intelligent Robots and Systems. **(IROS 2024)**
- Noren, C. and **Shirose, Burhanuddin** Et al. "An interaction-aware two-level robotic planning and control system for vegetation override" International Society for Terrain-Vehicle Systems **(ISTVS 2024)**
- Vundurthy, B. and **Shirose, Burhanuddin** Et al. "Generalized Multi-Agent Multi-Objective Ergodic Search" 6th International Workshop on Multi-Agent Path Finding Part of the 39th AAAI Conference. Full draft to be submitted to IEEE Robotics and Automation Letters **(RA-L)**
- Sriganesh, P. and **Shirose, Burhanuddin** Et al. "A Bayesian Modeling Framework for Estimation and Ground Segmentation of Cluttered Staircases" Submitted to IEEE Robotics and Automation Letters **(RA-L)**
- Sriganesh P, Maier J, Johnson A, and **Shirose, Burhanuddin** Et al. "Modular, Resilient, and Scalable System Design Approaches - Lessons learned in the years after DARPA Subterranean Challenge" Workshop on Field Robotics **(ICRA 2024)**
- **Shirose, Burhanuddin** Et al. "Robotic arm for brake performance testing" Robotics and Artificial Intelligence **(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" International Conference on Robotics and Mechatronics **(ICRoM 2021)**

Research Experience

Robotics Engineer II - Carnegie Mellon University **Jan 2023 – Present**
Local Planner for Autonomous Robots - Advised by Prof. Matthew Travers *Pittsburgh, PA*

* Developed a high-performance local planner algorithm for **autonomous driving robots**, focused on high-speeds **6m/s**
* Implemented obstacle avoidance techniques, incorporating dynamic robot footprint to navigating compact environments
* Developed an observer-based PID controller integrated with an **iLQR** controller to mitigate steering actuation delays

Decentralized multi-agent convoying architecture *Pittsburgh, PA*

* Designed and implemented a **decentralized multi-agent system** for autonomous fleet management, enabling **heterogeneous robots** to perform search missions in unmapped environments with minimal human intervention.
* Developed a novel **decentralized formation control** algorithm, obtaining significant reduction in convoy formation time, with the approach demonstrating exponential scalability in formation efficiency as the number of agents increases.
* Engineered a **multi-agent rendezvous** algorithm capable of identifying reliably rendezvous points within split second.

BioRobotics Lab, Carnegie Mellon University **Sep 2023 – Jan 2024**
Graph Based Ergodic Planner - Graduate Research Assistant Advised by Prof. Howie Choset *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 the highly non convex ergodic function

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.

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

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

Technical Skills

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