

Rintaroh Shima

✉ rshima@u.northwestern.edu

☎ (626)695-4089

🔗 r-shima.github.io

📄 github.com/r-shima

EDUCATION

Northwestern University

M.S. in Robotics

Evanston, IL

September 2022 – December 2023

Case Western Reserve University

B.S. in Mechanical Engineering | Cum Laude

Cleveland, OH

August 2017 – December 2021

EXPERIENCE

Motiv Space Systems, Inc.

Robotics Software Engineering Intern

Pasadena, CA

June 2023 – September 2023

- Established a simulation environment in C++ that modeled actuator physics for a brushless DC motor, using the ros2_control hardware abstraction
- Implemented a cascaded PID control system with position, velocity, and current loops in the hardware abstraction to simulate motor controller behavior
- Architected a tuning GUI using Python and PyQt, allowing intuitive, real-time PID parameter adjustments and laying the groundwork for future software refinement and iterative robot performance improvements

Lincoln Electric

Mechanical Engineering Intern – Plant Engineering

Mentor, OH

May 2021 – August 2021

- Modified design of machine guarding, using Solid Edge, to resolve quality and safety issues
- Designed a cart to ease the process of moving and emptying an iron oxide hopper

Lincoln Electric

Mechanical Engineering Co-Op – Machine R&D

Euclid, OH

September 2020 – December 2020

- Designed sheet metal and bracketry for the industrial products group; created associated drawings using Solid Edge
- Developed CAD assembly prints for a new 300-amp inverter; released part orders to build a prototype for validation testing

PROJECTS

Semantic Mapping for Wheelchair Navigation

Spring, Fall 2023

- Created a real-time mapping system for power wheelchair users to autonomously navigate to semantically-identified landmarks via a tablet
- Trained YOLOv8 on a custom dataset for detecting doors and tables, and integrated it into ROS 2 to retrieve real-world object coordinates relative to the camera
- Engineered a Python-based GUI for tablet use that displays detected landmarks and allows users to save them and cancel navigation commands, providing increased user control and ensuring operational safety
- Constructed a semantic labeling pipeline in ROS 2 and C++ that manages coordinate transformations and publishes distinct markers in the map for detected doors and tables

Stereo Visual Odometry

Spring 2023

- Built visual odometry for a stereo camera setup in Python using the KITTI dataset, leveraging OpenCV for feature detection and matching, and generating disparity maps for depth estimation
- Employed RANSAC to determine 3D rigid body transforms between frames, achieving vehicle position and orientation estimations with less than 66m drift at loop closure

3D Simultaneous Localization and Mapping (SLAM) and Object Detection for Jackal Navigation

Winter 2023

- Configured the Clearpath Jackal unmanned ground vehicle to operate on ROS 2 Humble, overcoming unsupported platform limitations and enabling the integration of RTAB-Map, Nav2, and YOLOv7 for perception, mapping, and navigation
- Filtered noisy LiDAR data, using C++ and PCL, to generate a refined occupancy grid map, improving the robot's environmental awareness and navigation precision

Extended Kalman Filter SLAM from Scratch

Winter 2023

- Implemented EKF SLAM and landmark detection with unsupervised and supervised learning, using ROS 2 and C++, on TurtleBot3 in simulation
- Wrote a kinematics and control library for differential drive robot and created a custom simulator to evaluate the effectiveness of the SLAM algorithm

Balloon Volleyball with a 7-DOF Robot Arm

Fall 2022

- Collaborated with a team of five to develop software in ROS 2 that enabled the Franka Emika Panda robot to track a balloon in real-time, predict its landing position, move to that location before the balloon, and push it back up
- Designed a perception pipeline, using Python and OpenCV, to determine the 3D location of a moving balloon

SKILLS

- **Software:** Python, C++, C, MATLAB, Git, Linux, OpenCV, PCL, CMake, Docker, Unit Testing
- **Robotics:** Robot Operating System (ROS/ROS 2), Gazebo, RViz, Foxglove Studio
- **CAD:** Solid Edge, SolidWorks
- **Language:** Japanese (native proficiency)