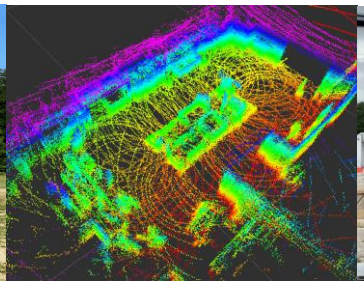
Perception Algorithms for Autonomous Fuel Port Manipulation


Company Background:

At Stratom, we are driving the future of automation by developing unmanned ground vehicles and autonomous robotic systems for commercial and defense applications — whether in safe, controlled settings or dynamic and challenging terrain.

Specializing in unmanned cargo movement, autonomous mobile robots (AMR) and robotic refueling, our proven tools, methods, technologies and strategic services continuously meet our customers' unique and evolving needs in logistics and operations. Our solutions enable them to reduce monotonous, difficult or dangerous tasks to optimize uptime and efficiencies, address labor shortages, increase profitability, and keep people safe.

Project Description:


Beyond just the transfer of fuel, working with a system that can autonomously refuel vehicles involves the development of several auxiliary manipulation tasks. One such task is the ability to autonomously remove and replace fuel port caps that present a physical barrier to refueling operations. To be effective at this task, the autonomous robot must make use of its on-board sensors to have precise and accurate knowledge of the location of the fuel port and its cap in 3D space.

This project will focus on the perception algorithms that enable the autonomous manipulation of fuel port caps. In particular, students will work with both real and simulated stereo depth cameras to collect a dataset of images and point clouds of a fuel port equipped with a cap. Students will use this data to

develop both traditional image or point cloud based perception methods in addition to machine learning based approaches to locate the position of the cap in 3D space. These algorithms will run real time in a ROS-based software stack with the ability to visualize the algorithms' outputs in RViz, ROS's visualization library.

Students will gain experience in all parts of the perception algorithm pipeline, from data collection and labeling to the development of sophisticated object detection algorithms to the testing and evaluation of perception methods. Moreover, this project provides a great opportunity for students to gain hands-on experience in integrating perception algorithms into a robotics-focused software stack and gain practical skills needed to translate theoretical algorithms into functional applications in the context of autonomous robotics.

Desired Skillset:

- C++, Python
- ROS2
- Linux
- Docker
- Point cloud processing, computer vision, and machine learning techniques

This project is an excellent way for students to leverage their foundation in C++ or Python to develop skills in computer vision, machine learning, and object localization and gain experience using ROS, an industry standard for robotics work. While experience in all of these skills is not strictly required, students should be up for the task of fast paced learning in these areas.

Team Size: 3-4 Students

Location:

Meetings will primarily be held remotely using Teams or Zoom. Our office is located in Louisville at 331 South 104th Street, Suite 235, which is the location where students will be able to test their code against Stratom's autonomous robotic refueling test rig towards the completion of the project.

Post-Project Internship Opportunities:

Stratom is looking to hire interns and would be happy to consider students on this team!

Note: All intellectual property developed as part of this project will be owned by Stratom