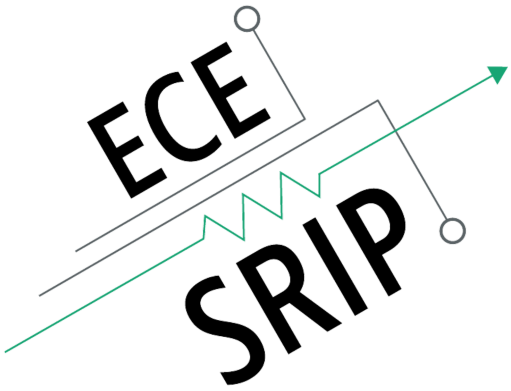



## FACULTY MENTOR

Nikolay Atanasov

## PROJECT TITLE

Python Robotics

## PROJECT DESCRIPTION

This project focuses on implementing baseline robotics algorithms for localization, mapping, planning, and control and integrating them in the PyBullet (https://pybullet.org/) physics simulator. Specific algorithms that will be considered include occupancy-grid mapping, particle-filter localization, A* motion planning, and proportional-derivative control for an Ackermann-drive robot. The objective is to document the algorithm implementations and provide visualization and accessible demonstrations of the algorithm operation. The project is inspired by the Pacman project (http://ai.berkeley.edu/project_overview.html) and the Python Robotics project (https://github.com/AtsushiSakai/PythonRobotics) and aims to create a 3D robotics version integrated into the PyBullet simulator. To achieve this, the developed algorithms, demos, visualization, and documentation will be provided on a website with a Jupyter (https://jupyter.org/) and Google Collab (https://colab.research.google.com/) interface.

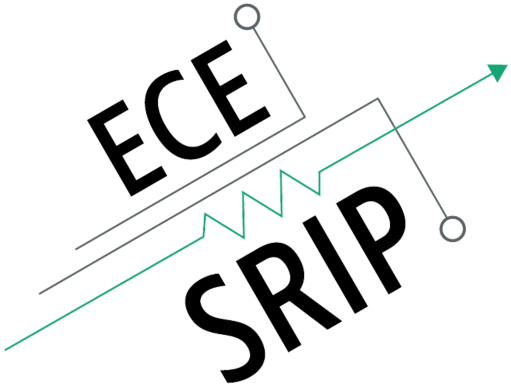
This project can accommodate both remote and in-person students.

## INTERNS NEEDED

2 Students

## PREREQUISITES

- Experience with object-oriented programming, data structures, and algorithms is required.
- Experience in robotics, e.g., at the level of Probabilistic Robotics by Thrun, Burgard, and Fox, is preferred but not required.




## FACULTY MENTOR

Nikolay Atanasov

## PROJECT TITLE

Quadrotor Robot Design and Autonomous Flight

## PROJECT DESCRIPTION

This project focuses on building a fully functioning quadrotor robot, including sensors (cameras, inertial measurement unit, lidar), a flight controller, a computer, motors, and a battery. The project requires experience with 3D printing, electrical design, and CAD modeling to connect and power all robot components. Besides hardware design, the project focuses on sensor calibration and synchronization and using the robot operating system (ROS) to provide drivers for the sensors and flight controller. Once the hardware and software components are in place, the project will consider autonomous flight using geometric control techniques both in simulation and on the physical robot platform.

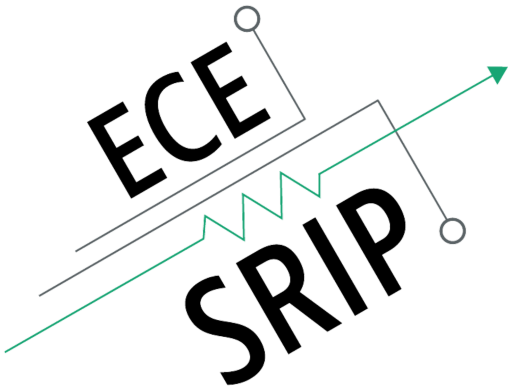
This project will be in person.

## INTERNS NEEDED

2 Students

## PREREQUISITES

- Candidates are expected to have experience with CAD software, soldering, 3D printing, and C++ programming.
- Experience with the robot operating system (ROS) is preferred but not required.




## FACULTY MENTOR

Nikolay Atanasov

## PROJECT TITLE

Robot Motion Planning for Mobile Target Tracking

## PROJECT DESCRIPTION

This project focuses on designing algorithms for planning the viewpoint trajectory of a robot team to track the motion of mobile targets in an environment which may contain obstacles and occlusions. The objectives include developing (1) learning and inference algorithms for estimating dynamic target motion and intent, handling multi-modal (non-Gaussian) target probability distribution and sensing occlusions, (2) planning and control algorithms for environment exploration and target uncertainty minimization, (3) techniques for adversarial information acquisition where target information is maximized, while leaked information minimized.

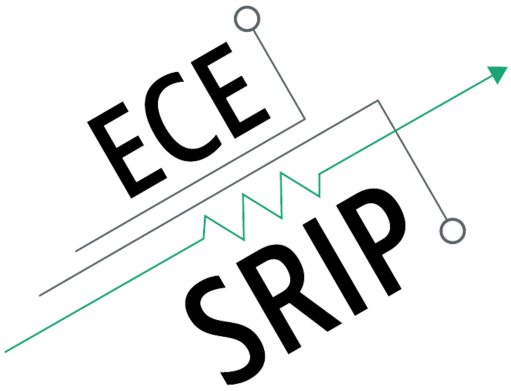
This project will be in person.

## INTERNS NEEDED

1 Student

## PREREQUISITES

- Candidates are expected to have knowledge of Bayesian estimation algorithms, e.g., at the level of ECE276A, control theory, e.g., at the level of ECE276A, and data structures and algorithms, e.g., at the level of ECE141A.




## FACULTY MENTOR

Nikolay Atanasov

## PROJECT TITLE

Inverse Reinforcement Learning of Robot Manipulation Skills

## PROJECT DESCRIPTION

This project focuses on learning robot manipulation skills from a demonstration. The objective is to develop inverse reinforcement learning algorithms that compress visual or tactile observations into an environment representation and infer the cost function used by the demonstrator to replicate the demonstrated behaviors. The project will involve learning manipulation policies in the MuJoCo or Sapien simulators and potentially transferring the learning policies to a real robot arm.

This project will be in person.

## INTERNS NEEDED

1 Student

## PREREQUISITES

- Experience with machine learning and reinforcement learning, as well as proficiency in Python or C++, are required.