

Project Title: Autonomous Outdoor Ground Navigation

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Autonomous navigation is still one of the challenges engineering field is trying to solve, due to the uncertainty of terrain, weather and road conditions. In this capstone project, we will try to overcome some of those problems and build fully autonomous system which can go to any destination from its current location. As a further scope, In the case where Google Maps API is not able to provide definitive path to move forward or no GPS signal available, a drone can be used to map the route for the rover and the drone provides waypoint navigation for rover to move forward.

The goal is to eliminate the requirement for manual control of the rovers by programming it to follow a model-based prescribed trajectory. The rovers will be designed to maneuver and collaboratively use SLAM methodology using GPS and LiDAR.

Learning Objectives:

1. Study and Analysis:
 - a. Waypoint navigation
 - b. Autonomous Path planning
 - c. Object detection and avoidance
 - d. Deep reinforcement learning
2. Optimization:
 - a. Shortest path based on time constraint and shortest distance
 - b. Surface detection and check if path is drivable
 - c. Semantic Segmentation
3. Extended scope
 - a. Design drone to map rough terrain.

Technologies and Tools:

- Image Processing and Computer Vision (OpenCV)
- TensorFlow and Keras
- SLAM
- ArduPilot MissionPlanner and Pixhawk

