Autonomous Multi-Spectral Relative Navigation, Active Localization, and Motion Planning in the Vicinity of an Asteroid

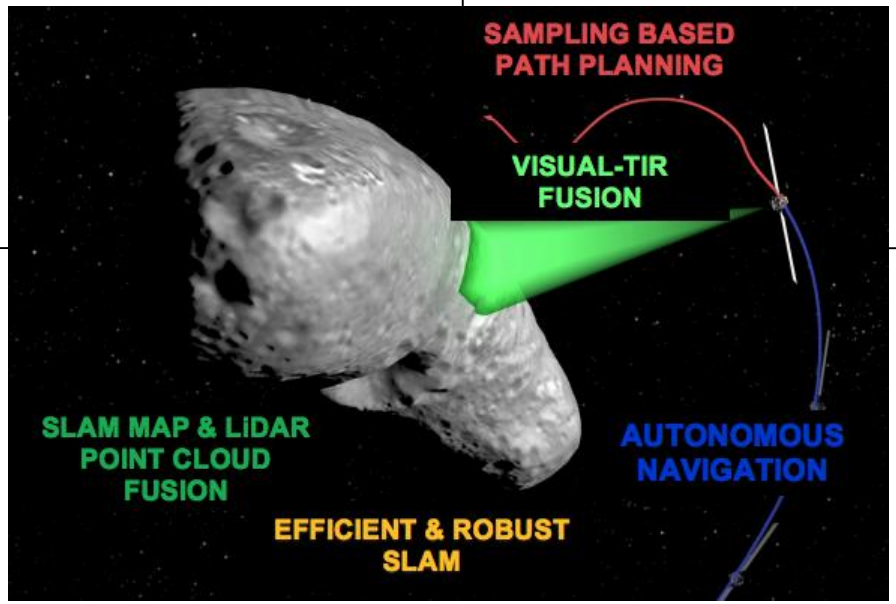
PI: Prof. Panagiotis Tsiotras, Georgia Tech

Team: Mehregan Dor, PhD candidate

Graduate student

Research Objectives

- Develop and test theories and algorithms for inspection, geometric reconstruction and tracking of a small celestial bodies
- Accurate navigation and control to enable safe, collision-free maneuvering
- Initial TRL= 2→ Numerical simulations of ground robots Final TRL=3→ Lab experiments verifying algorithms on ASTROS



Solution Concepts and Summary Overview

- Current SOA : No known complete solution fusing different sensor modalities

Approach

- SLAM-based solution
- ORB-SLAM for images
- iSAM for sensor fusion
- Orbital motion priors
- Active SLAM via Relative Entropy Minimization
- Gravity model refinement
- Randomized algorithms for collision-free path planning
- Dual quaternion controller for simultaneous translation and rotational motion tracking

Potential Impact

- Advance SOA in autonomous navigation around small celestial bodies
- Characterization, sample return, resource utilization
- Provide crew support
- Natural hazard avoidance, mission recovery
- Enable autonomous decision-making