ROB-GY 7863 Project 1 Proposal

Raman Kumar Jha
NYU Tandon School of Engineering
Brooklyn, New York
ramanjha@nyu.edu

Denis Akola
NYU Tandon School of Engineering
Brooklyn, New York
dma9300@nyu.edu

Lunar Space Rover Terrain Navigation Simulation

1 Mission:

This project focuses on developing a control and estimation framework for a simulated lunar rover [1][2] tasked with autonomous traversal over uneven lunar terrain. Building on an existing dynamic and terrain simulation, the emphasis is on Terrain-Relative Navigation (TRN) and adaptive speed control under low-gravity conditions. The control system will allow the rover to estimate its motion relative to local terrain, maintain stability, and adjust its speed dynamically to ensure safe, efficient traversal.

Objectives

1. Implement Terrain-Relative Navigation (TRN) to localize the rover using terrain imagery and onboard sensors.
2. Develop a Kalman Filter (KF) - based sensor fusion framework for accurate state estimation under noise and slippage.
3. Design a speed control policy that adapts rover velocity based on terrain slope, roughness, and stability metrics.
4. Demonstrate autonomous traversal across a mission path in the simulated lunar environment.

Experiments

1. Evaluate terrain-relative control during navigation around rocks and craters.
2. Assess TRN and KF accuracy.

References

[1] Karl Iagnemma and Steven Dubowsky. *Mobile robots in rough terrain: Estimation, motion planning, and control with application to planetary rovers*, volume 12. Springer Science & Business Media, 2004.

[2] Mark W Spong, Seth Hutchinson, and M Vidyasagar. Robot modeling and control. *John Wiley &amp*, 2020.