2026 Spring – NASA Lunabotics Non-GPS Navigation Subsystem

Project Objective

Design and implement a non-GPS indoor navigation subsystem for a NASA Lunabotics rover capable of estimating position and heading in GPS-denied, low-lighting, high-slip environments.

Project Description

This project focuses on developing a robust navigation subsystem that fuses wheel odometry, inertial measurement, and LiDAR-based perception to provide reliable localization for autonomous rover operation.

Key Technical Features

- Wheel encoder-based odometry with interrupt timing
- IMU-based heading estimation and drift compensation
- 2D LiDAR SLAM or EKF-based sensor fusion
- Slip detection and confidence estimation
- Real-time pose output for motion control

Suggested Hardware

2D LiDAR (RPLIDAR or equivalent), IMU, wheel encoders, Raspberry Pi 5 or Jetson Nano, power regulation, mounting hardware.

Software Components

Real-time sensor drivers, kinematic modeling, EKF or SLAM algorithms, logging and replay tools, integration with motion control.

Team Organization

Three ECE students:
Student A – Embedded Systems
Student B – Estimation & Algorithms
Student C – Integration & Validation

Timeline

Semester 1: Sensor bring-up, dead-reckoning, drift characterization
Semester 2: Sensor fusion, SLAM, integration, autonomous navigation demos

Budget

Total requested budget: $800

Learning Outcomes

Students will gain experience in embedded systems, sensor fusion, robotics navigation, and multidisciplinary system integration.