

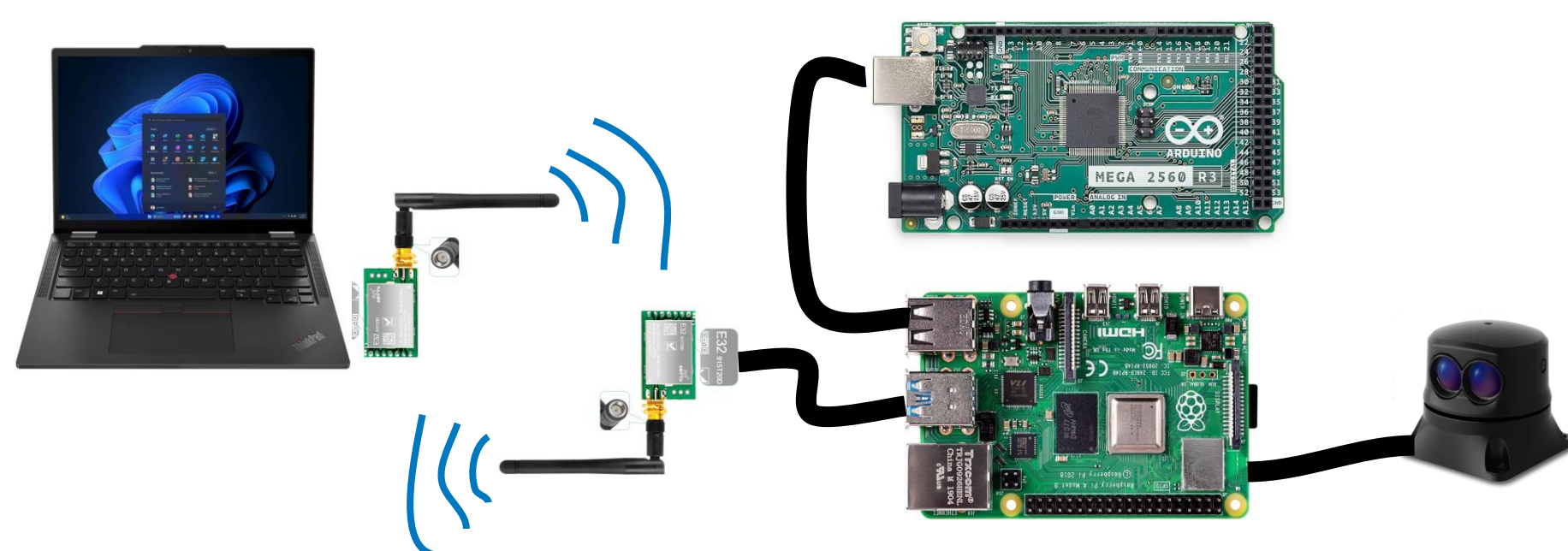
QuadRover Autonomous Navigation Robot Software Upgrade

*Alex Coit, Emann Rivero, Greyson Kirkley, Nick Polickoski,
Sponsor: Dr. John Piccirillo*

Department of Electrical & Computer Engineering

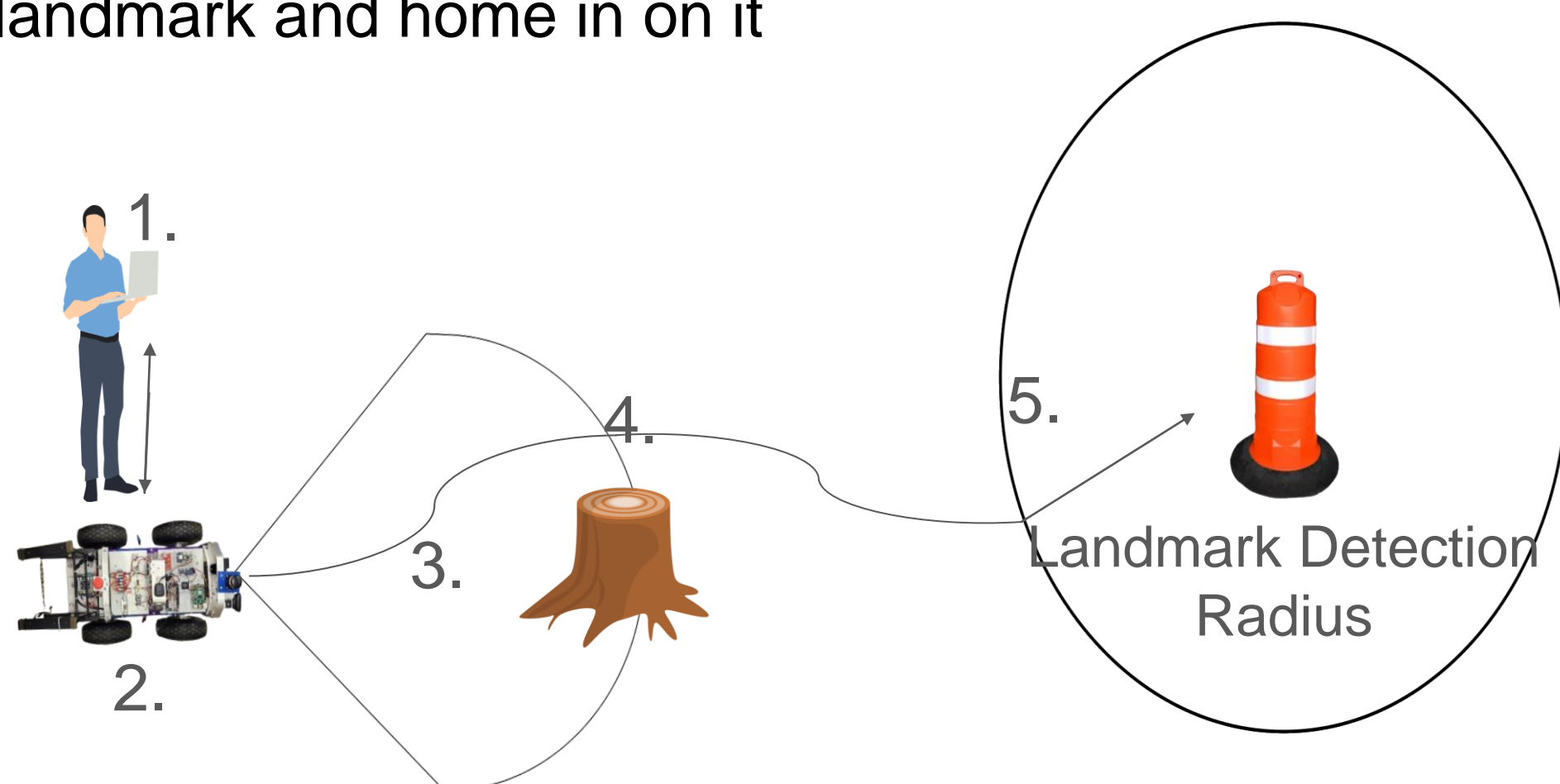
Project Overview

- Autonomous Robots are useful assets for remote and dangerous tasks
- Navigation through an unfamiliar environment is a difficult task, and most of the research into it has involved using a map collected in preliminary runs of an area
- The QuadRover Autonomous Navigation Robot Software Upgrade only requires the starting point and approximate locations of landmarks can serve as recognizable waypoints to navigate through an unfamiliar area



Big Picture

- 1) A user generated map is used to mark waypoints, which are sent to the rover
- 2) Rover aligns itself with a waypoint before heading towards it
- 3) The LiDAR continuously scans the area in front of the rover
- 4) When an obstacle is detected, the rover navigates around it
- 5) Once near a waypoint, the LiDAR will locate a landmark and home in on it



Results/Impact

The project expands on the capabilities and research of autonomous navigation systems at UAH. While providing an upgrade to a legacy system allowing for LiDAR detection and waypoint navigation for future projects with the university rover.

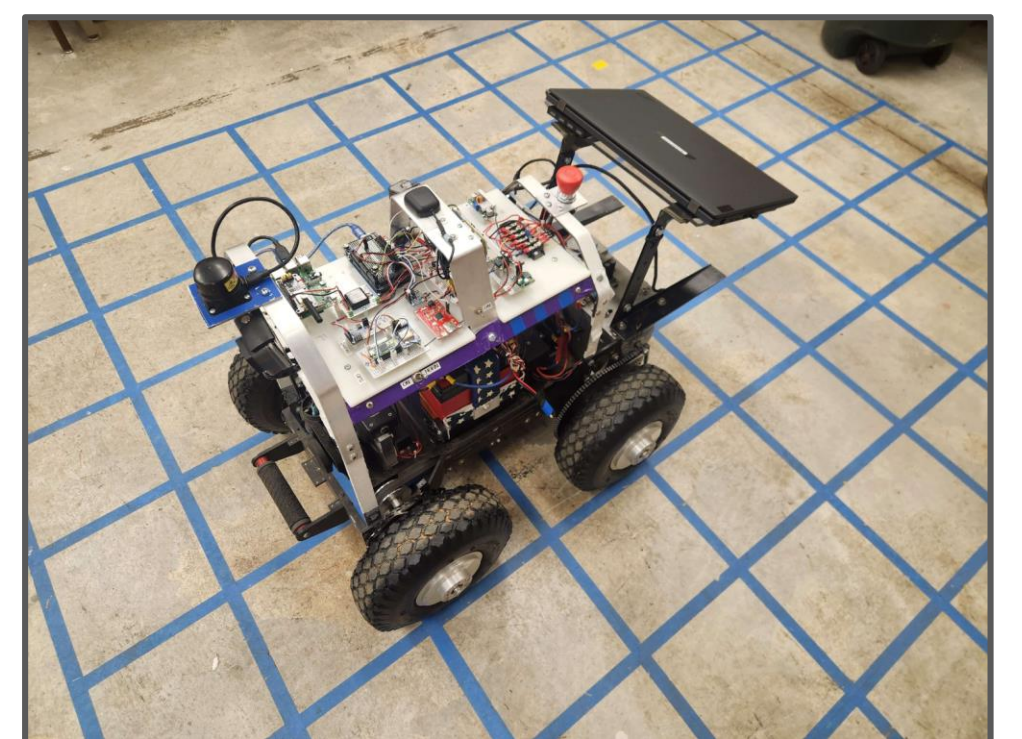
Requirements

- Create an autonomous navigation system to traverse an outdoor mission area to within ~3m of waypoints.
- Implement Obstacle Avoidance protocol utilizing LiDAR
- Actualize navigation through Dead-Reckoning and local coordinate system
- Design GUI for user-friendly operation of missions

System Design

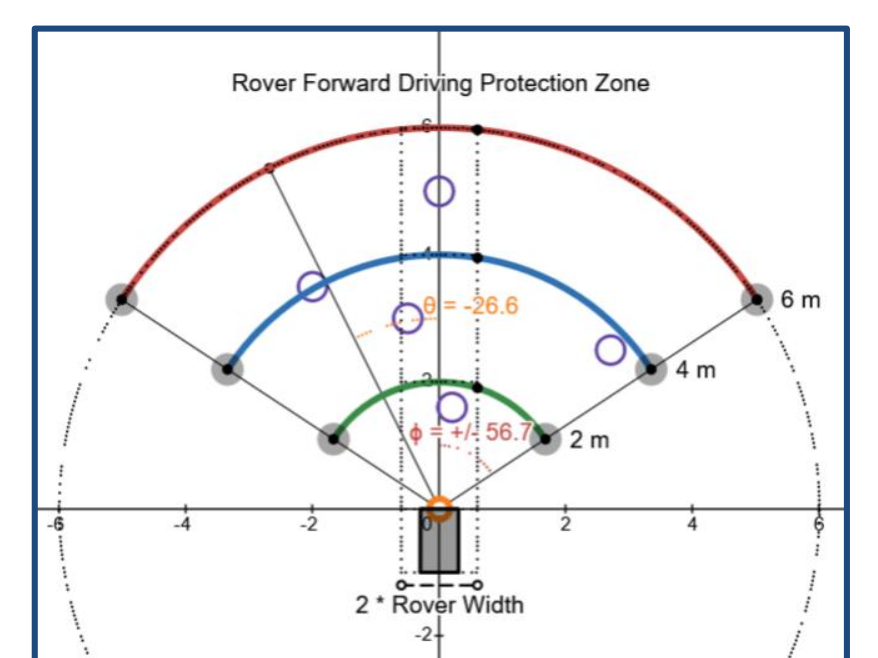
Navigation System:

- Controlled by Arduino Mega running a state machine Utilizes GPS and IMU to traverse to user-defined waypoint Combines movement with LiDAR data to avoid previously unknown obstacles found on traversal



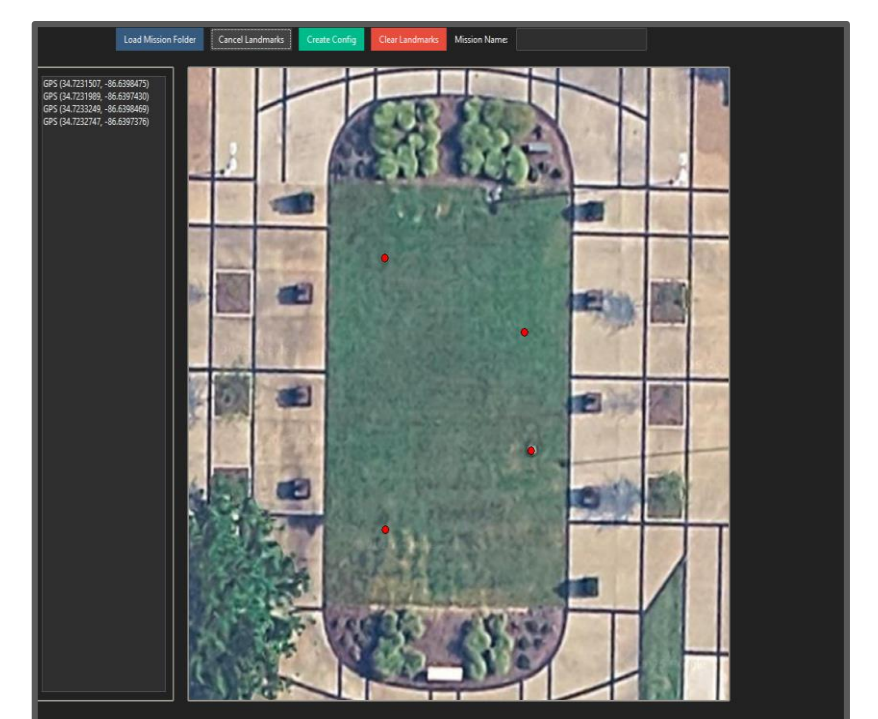
LiDAR Systems:

- Processes LiDAR distance and angle data in Raspberry Pi 4B.
- Sends motor control commands via Obstacle Avoidance and Landmark Homing Algorithms



Custom GUI:

- Displays Real Time Positioning of the Rover
- Creates Reports detailing Missions
- Used by the user to select the landmarks



Acknowledgements

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