2.04: Drone Recovery Rover

Team Members:

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Project Intro

The Drone Recovery Rover consists of:

- Autonomous Rover Platform
- Utilizes PX4 Open-Source Flight Stack
- Communication Over Robot Operating System (MAVROS)
- Computer Vision for Drone Detection
- LIDAR for Navigation Assistance
- Real-Time Kinematic GPS
- Robotic Arm Used to Pick Up Race Drone

Project Purpose

- Recover race drones inside the DroneDome to allow for continuous racing and reduce cost of labor
- Prioritize safety by keeping users outside of the racing area via robotic rescue sequences
- Highly scalable platform able to take on broader applications utilizing PX4, Real-Time Kinematic GPS, and ROS

Drone-Dome Racing Space

More Info

PX4 Software

ROS

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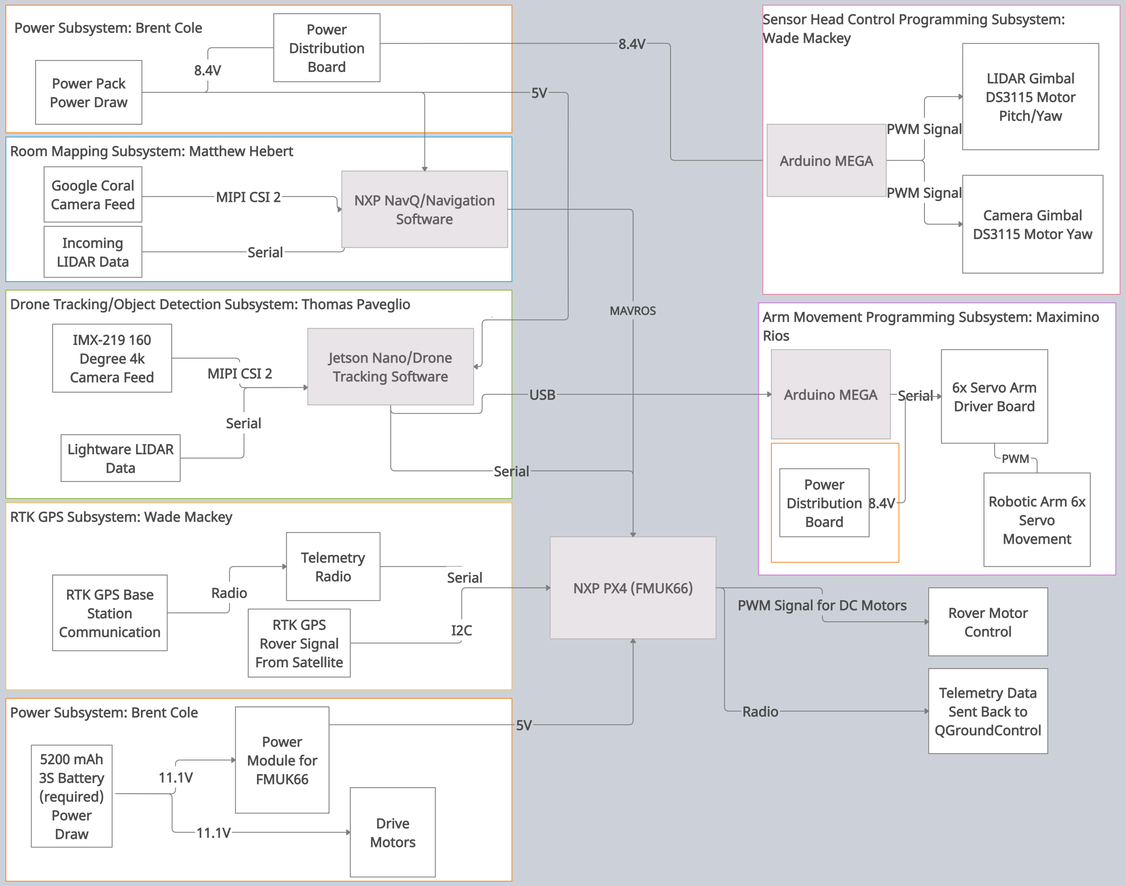
Full Block Diagram



Results

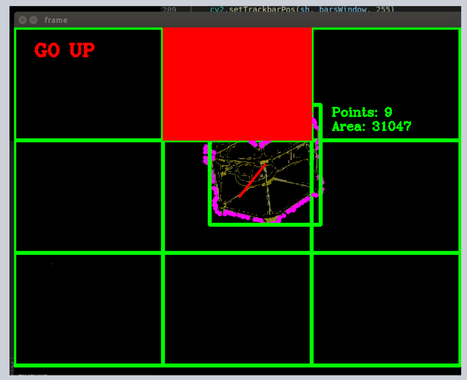
Test	Expected	Result
MAVROS Communication between NavQ and FMUK66	Telemetry data sent between NavQ and FMUK66	PASS: GPS location, waypoints, and rover telemetry received to NavQ at a set 10 second interval. Messages sent to FMUK66 to control rover direction and speed
Telemetry communication over 915 MHz radio past 10 ft	Rover telemetry transmission greatly exceeds 10 ft	PASS: Rover transmission of telemetry data loss at worse 100 yards in flat plane distance test
RTK GPS accuracy less than 10cm	Rover GPS accuracy consistently at 10cm or less	PASS: Rover GPS accuracy measured at 7cm in worst case accuracy test repeated 10 times with an average of 20 satellites
Drone Tracking Vision Distance	Without LEDs: 1 Foot With LEDs: 10 Feet	PASS: 4 Feet with bounding without LEDs, 12 Feet bounding or better depending on ambient brightness with LEDs
Arm Pickup Weight	Arm can pickup objects up to 500 grams	Successful pickup of simulated weight at 514 grams

Approach

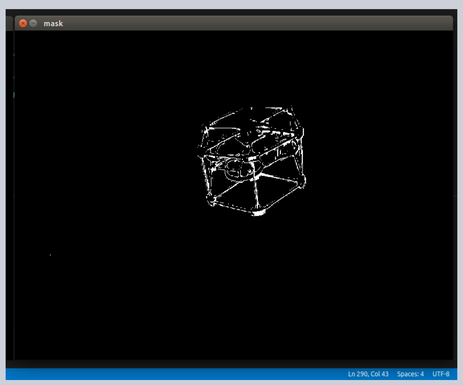
The rover operation sequence is designed as follows:

- When a drone crashes, the rover navigates using MAVROS commands to the area using camera vision with LIDAR range assistance
- The rover arrives to the crash site and initiates a rescue sequence using the IMX-219 camera mounted to the robotic arm
- The arm-camera detects when a fallen drone is within reach using bounding area, and collects the fallen drone. The rover can then return to the racing stand to deliver the drone.

Drone Detection



Arm Movement Algorithm



Live Color Filtering on Drone