Amzaar Faisal

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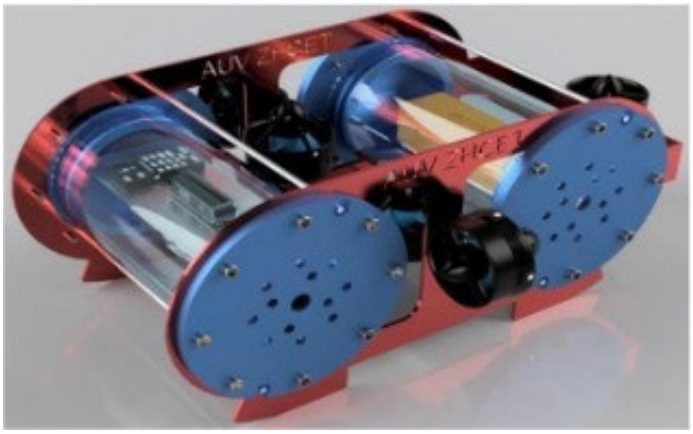
Autonomous Underwater Vehicle

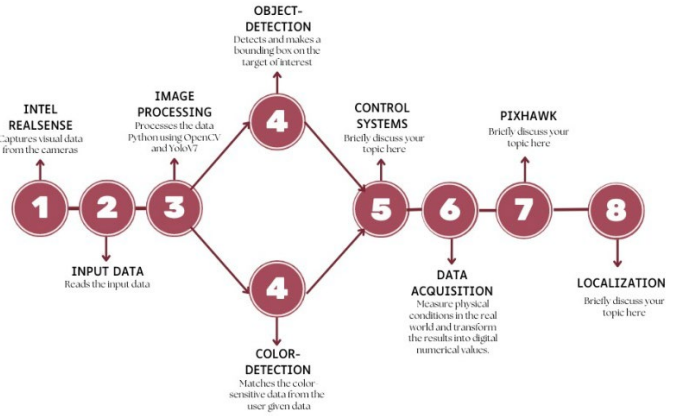
What?

Designed and fabricated a low-cost, dual-hull, five-thruster Autonomous Underwater Vehicle for underwater navigation and performing tasks using Al-6063.



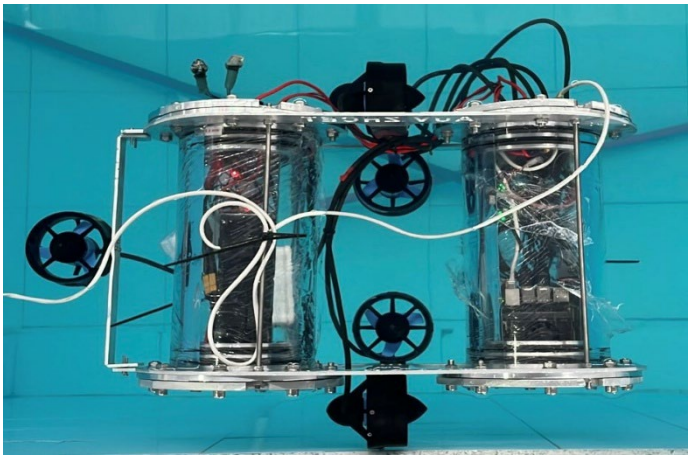
How?

Performed CFD-based optimization achieving reduced drag and improved stability, integrated Jetson Xavier, Pixhawk, and Intel RealSense D435 for vision-guided navigation using YOLOv7 and OpenCV.



Results

Achieved 8.3% drag reduction, 61.7% mAP in object detection, and validated autonomous performance through simulation and field trials. Published in IEEE ICRoM 2023.



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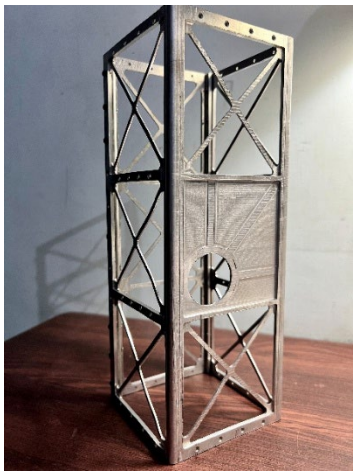
CubeSat - Chassis

What?

Designed and fabricated a 3U monolithic aluminum CubeSat chassis for the Harika Mark-1 satellite.

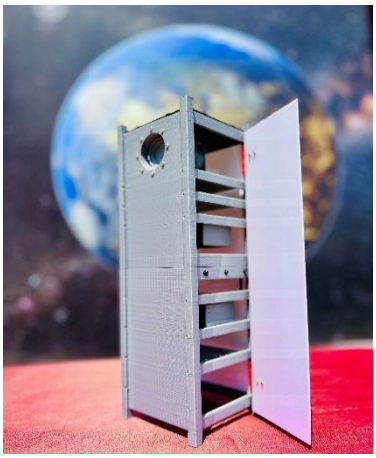
How?

Developed a CNC-machined single-piece Al-7075 structure, eliminating fasteners, conducted FEA and modal analysis in ANSYS using PSLV launch load parameters to ensure compliance with CubeSat standards.



Results

Recorded 4.7 MPa maximum stress, 0.0078 mm deformation, and >270 Hz natural frequency, meeting all launch criteria, published in IEEE SPACE 2025, achieving 25% higher rigidity and 15% lower mass than standard frames.



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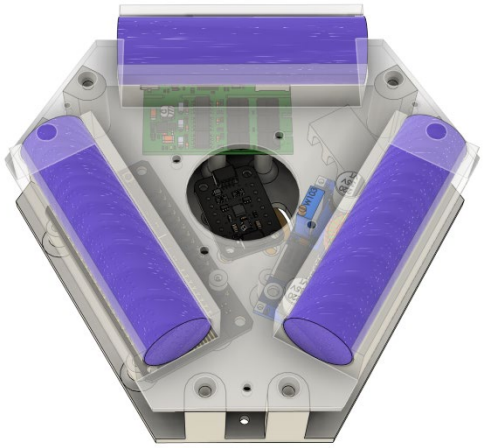
CubeSat – Attitude Determination & Control System

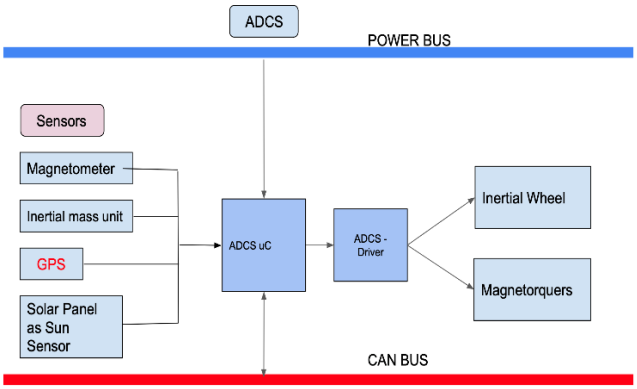
What?

Developed in-house ADCS for a 3U CubeSat Harika Mark-1 enabling precise 3 axis orientation and stabilization in orbit.



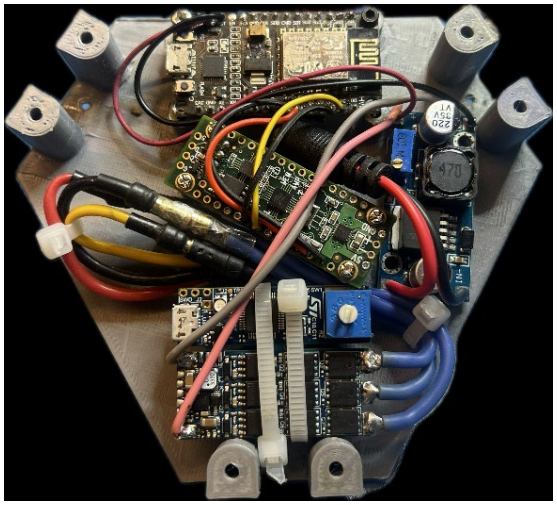
How?

Integrated IMU, magnetometer, GPS, and sun sensors with reaction wheels. Implemented PID + Extended Kalman Filter for accurate attitude estimation and control, validated using a custom air-bearing testbed and Helmholtz coil.



Results

Achieved <2° steady-state attitude error and 40% faster stabilization over baseline systems, findings published in IEEE ISTEMS 2024.



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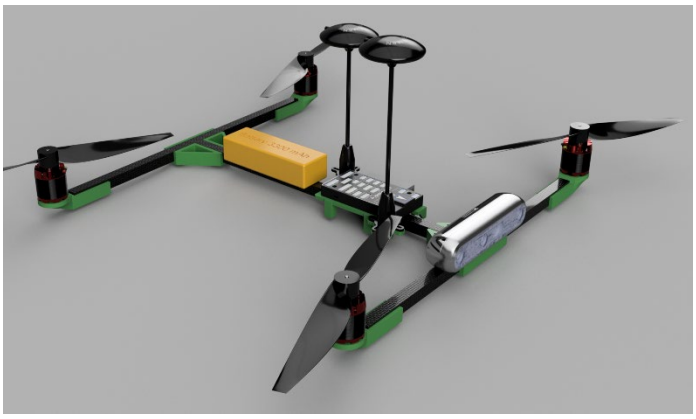
Drone

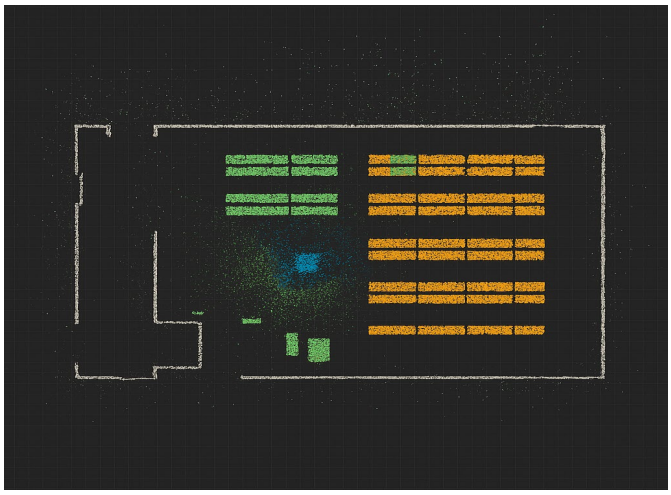
What?

Built a custom framed drone for inventory scanning in GPS denied multi-level warehouse.



How?

Integrated 2D LiDAR and Intel RealSense depth camera for obstacle detection and 3D perception. Implemented ROS2 Nav2 for autonomous navigation through 2 m aisles, validated using a Gazebo digital twin, and optimized Costmap2D parameters to ensure reliable collision-free flight.



Results

Reduced overall drone weight by 20% compared to conventional frames, extending flight endurance by 2 minutes per mission. Enabled 4× faster inventory scanning of top-shelf pallets and ensured safe, autonomous nighttime operation during warehouse closed hours.