Aaron John Sabu

Ph.D. Researcher in Robotics | Perception, Estimation, and Control for Autonomous Systems

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Education

University of California, Los Angeles (UCLA) — Los Angeles, CA
Ph.D. in Mechanical & Aerospace Engineering | GPA: 3.725/4.00 — *Sep 2023 - Dec 2027*
- Thesis: *Building a GPU-Accelerated Autonomous Robot for Marine Infrastructure Inspection and Perception*

University of California, Los Angeles (UCLA) — Los Angeles, CA
M.S. in Electrical and Computer Engineering | GPA: 3.557/4.00 — *Sep 2021 - Dec 2023*
- Thesis: *Capturing Tumbling Objects in Orbit with Adaptive Tube Model Predictive Control*

Indian Institute of Technology Bombay (IIT Bombay) — Mumbai, India
B.Tech. in Electrical Engineering (Honors); Minor in Aerospace Engineering | CPI: 9.07/10.00 — *Aug 2017 - Aug 2021*
- Thesis: *Decentralized Spacecraft Assembly of Megastructures in an Elliptic Orbit*

Publications

1. ORACLE: Language-Grounded Semantic Planning for Marine Infrastructure Inspection
Aaron John-Sabu, Sriram Narasimhan
Manuscript in preparation.

2. Capturing Tumbling Objects in Orbit with Adaptive Tube Model Predictive Control
Aaron John-Sabu, Brett T. Lopez
IEEE Aerospace Conference 2025. DOI: 10.1109/AERO63441.2025.11068695

3. Scalable Techniques for Autonomous Construction of a Paraboloid Space Telescope in Elliptic Orbits
Aaron John-Sabu, Dwaipayan Mukherjee
Indian Control Conference 2021. DOI: 10.1109/ICC54714.2021.9703189

4. User Based Design and Evaluation Pipeline for Indoor Airships
Zhaoliang Zheng, Jiahao Li, Parth Agrawal, Zhao Lei, *Aaron John-Sabu*, Ankur Mehta
arXiv 2021. arXiv: 2110.09748

5. Robust and Scalable Techniques for TWR- and TDoA-based Localization using Ultra-Wideband Radios
Rakshit Ramesh*, *Aaron John-Sabu**, Harshitha Sreejith* *et al.*
arXiv 2020. arXiv: 2008.04248

Skills

Robotics & Estimation: SLAM, State Estimation, Motion Planning, Graph Optimization, Mobile Robotics
Control & Learning: Model Predictive Control, Robust & Adaptive Control, Reinforcement Learning
Perception & Autonomy: Computer Vision, Multi-Sensor Fusion, Active Perception, Vision-Language-Action Models
Programming & Systems: Python (PyTorch, OpenCV), C/C++17, CUDA, ROS/Gazebo, Docker, Git, Linux
Supporting Tools: MATLAB, MuJoCo, Multiphysics Simulation, Electrical Prototyping, Agentic Engineering, LaTeX

Research Experience

UCLA | Civil & Environmental Engineering — Los Angeles, CA
Researcher, Autonomous Marine Robotics — *Jun 2025 – Present*
- Integrated a **multi-modal marine perception stack** with horizontal/vertical VLP-16 LiDAR, Forge IP67 GigE cameras, Xsens IMU, and Imagenex DT100 sonar for above-water, overhead, vertical, and underwater inspection.
- Developed ORACLE, a **language-grounded semantic planning** layer that converts high-level inspection commands into structured mission intents, reachable navigation goals, exploration actions, and inspection viewpoints.

- Developed an **end-to-end autonomy stack** for the **Clearpath Heron USV** spanning synchronized sensing, LiDAR-inertial odometry, mapping, navigation, semantic planning, operator tooling, and field logging.
- Built **MoCap calibration and synchronization tools** for perception and navigation ground-truth validation.
- Mentored **8 students** (7 undergraduate, 1 high-school) in marine robotics research and hardware integration.

UCLA | Mechanical & Aerospace Engineering Los Angeles, CA
Researcher, Orbital Robotics *Apr 2022 – Sep 2024*

- Reachability Analysis for Powered Descent Guidance: designed and trained neural nets to classify landing reachable sets; integrated GANs to model and validate set shapes; **97%** accuracy on **40k** sparsely populated cases (PyTorch).
- ORBEX-A: Orbital Rendezvous and Capture Experiment with Adaptive Tube MPC: designed adaptation with set membership parameter estimation; achieved real-time feasible, robust, optimal trajectories under orbital constraints

UCLA | Electrical & Computer Engineering Los Angeles, CA
Researcher, Aerial Multi-Robot Systems *Jun 2021 – Jan 2022*

- FORAY, an Autonomous Agile Airship Armada: Designed fleet control and real-time vision for inflatable airships; OpenCV-based detection and multi-agent coordination; precise airship mechanical design on SolidWorks.

IIT Bombay | Electrical Engineering Mumbai, India
Researcher, Multi-Agent Space Assembly *Jun 2020 – Jun 2021*

- MACRO: Megastructure Assembly via Collaborative Robots in Orbits: Developed distributed task/position allocation (auction vs. greedy), collision-avoidant planning, and attitude consensus for formation assembly in simulation.

Indian Institute of Science (IISc) | RBCCPS Bengaluru, India
Research Intern, UWB Localization *Jun 2019 – Aug 2019*

- Optimized ultra-wideband (UWB) anchor geometry and clock-drift correction for drone localization in GPS-denied indoor environments; improved robustness under multipath environments with adaptive Kalman filtering.

Selected Research Software

Manta-LMPC: Decentralized Safe-Set Learning MPC GitHub

- A Python/CasADi framework for decentralized 3-agent learning MPC, using APF warm-starts, learned safe-set terminal hulls, time-to-go costs, SVM separation hyperplanes, and softened collision constraints.

SQuAT Plan: Smooth Quadrotor Agile Trajectory Planning GitHub

- A Python framework for time-optimal, jerk-constrained quadrotor trajectory planning in complex environments with collision avoidance over convex obstacles or occupancy grids; supports ROS and 3D visualization.

FlexiForce: EMG-Driven Robotic Resistance Training Simulator GitHub

- A simulation framework in MuJoCo and OpenSim for EMG-driven robotic resistance training, where a redundant manipulator modulates end-effector forces via hybrid force-position control to maintain target exertion levels.

Service

Teaching Fellow, UCLA 2021 – 2026
Mentored capstone teams and led instruction across engineering, physics, and humanities

Reviewer, AIAA SciTech 2023 – 2024
Conducted peer review for control systems, robotics, and aerospace engineering papers

Board Member, John Wooden Center Board of Governors 2023 – 2026
Provided oversight for $35M renovation project and facility management decisions

Representative, UCLA Legislative Assembly 2025 – 2026
Advocated for graduate student interests in Academic Senate policy decisions and governance

Representative, Committee on Academic Freedom, UCLA 2025 – 2026
Safeguarded rights to free expression, inquiry, and instruction for the university community

Panel Member, Student Conduct Committee 2023 – 2026
Adjudicated academic integrity violations and campus policy disciplinary cases

Awards & Achievements

- **Semi-finalist, UCLA Grad Slam 2026**; recognized among the top 19 graduate communicators university-wide
- **All-India Rank 94, JEE Advanced** among 1.6M candidates; perfect score in Mathematics
- **Winner, Undergraduate Research Award** for thesis research, IIT Bombay
- **Honorable Mention, High Performance Scientific Computing**, IIT Bombay