Ishika Saijwal

Robotics Research | Autonomous Systems | State Estimation & Control
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Research Statement

I am interested in **mobile robot autonomy**, with emphasis on **probabilistic state estimation, motion planning under uncertainty, and robust navigation in real-world environments**. My work combines **hands-on system development** with **experimental evaluation**, spanning sensor fusion, ROS-based navigation, and real-time control. I am particularly interested in **optimization-based estimation and control methods**, and in studying their behavior under **modeling errors and sensor degradation**.

Publications

- **I. Saijwal**, et al., *Human Activity Recognition through Wi-Fi CSI.* Springer PCCDA, 2024.
- **I. Saijwal**, et al., *Navigation and Control of ROV.* International Journal of Satellite Communication & Remote Sensing, 2022.
- **I. Saijwal**, et al., *Autonomous Mobile Robot for Inventory Management.* Springer FTNCT, 2022.

Education

Nirma University Jun 2019 – Jun 2023
B.Tech in Electronics and Communication Engineering *Ahmedabad, India*

Research Projects

Modular Autonomous Navigation Framework (ROS2) Sep 2025 – Present
Independent Research Project

- Designed a **modular ROS2 navigation framework** integrating mapping, localization, and planning, enabling systematic evaluation of estimation and control components.
- Benchmarked classical global planners (A*, Dijkstra) under varying **costmap resolutions and obstacle densities**, analyzing effects on path optimality and planning latency.
- Analyzed **PD and Pure Pursuit local planners** under kinematic and collision constraints, studying stability, tracking error, and failure cases.
- Formulated and validated **EKF-based IMU–odometry fusion**, analyzing observability properties and sensitivity to process and measurement noise.
- Evaluated **system robustness** using lifecycle-managed bringup and controlled sensor degradation, identifying failure modes in localization and control.
- Ongoing work explores **Model Predictive Control (MPC)** for local navigation, focusing on constraint handling and comparison with classical controllers.

Autonomous Underwater Vehicle Navigation and Control Aug 2021 – Dec 2022
AUV / ROV Research Project

- Investigated **depth and altitude control** using PID controllers with IMU and pressure sensor fusion, analyzing closed-loop stability.
- Developed and validated **3D localization pipelines** combining Ping SONAR and depth sensing, evaluated through repeated pool trials.
- Analyzed control stability and localization accuracy through systematic field trials and competition deployments.

Research & Technical Experience

Associate Software Design Engineer Jun 2023 – Present
Silicon Labs *Hyderabad, India*

- Developed and optimized **real-time Wi-Fi LMAC firmware** under strict latency and power constraints, gaining experience with deterministic system behavior and low-level performance modeling.
- Applied systematic profiling and regression testing to identify performance bottlenecks, reducing sleep current by **21%**.
- Analyzed and resolved system-level performance bottlenecks, improving throughput by **28%** under constrained hardware resources.
- Worked with large-scale codebases requiring robustness, determinism, and long-term maintainability.

Robotics Software Intern Jun 2022 – Jul 2022
OttonomyIO *Noida, India*

- Developed reproducible autonomy simulation pipelines using Gazebo and CARLA (UE4).
- Implemented LiDAR-based curb and road segmentation and integrated perception outputs into the navigation stack.
- Benchmarked navigation latency and achieved stable **9–10 Hz** performance on Jetson Xavier NX.

Robotics Intern Jun 2021 – Jul 2021
IIT Delhi – AIA Foundation for Smart Manufacturing *New Delhi, India*

- Implemented autonomous indoor navigation using the ROS1 Navigation Stack.
- Developed 2D LiDAR-based mapping and **AMCL particle-filter localization** pipelines.
- Performed parameter sweeps and stress testing to improve localization stability and trajectory smoothness.

Technical Skills

- **Robotics & Autonomy:** ROS1/ROS2, Navigation, Localization, SLAM
- **State Estimation:** Kalman Filtering, Sensor Fusion
- **Planning & Control:** A*, Dijkstra, PID Control, Trajectory Tracking, Constraint-based Control
- **Programming:** C, C++, Python
- **Systems:** Linux, Embedded Systems, Gazebo, CARLA

Honors & Competitions

- 1st Place — AMUROVc Nationals (2023)
- 3rd Place — AMUROVc Nationals (2022)
- 7th Place — SAUVC, Singapore (2022)