PRATHAMESH SARAF

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EDUCATION

University of California, San Diego — San Diego, USA
MS in Electrical & Computer Engineering (Intelligent Systems, Robotics, & Controls) — *2022 - 2024*
Courses: Robot Motion Planning, Sensing and Estimation, Co-operative Control of Multi-Agent Systems, Statistical Learning, Convex Optimization, Linear Algebra, Non-Linear Controls, Stochastic Processes in Dynamic Systems

Birla Institute of Technology & Science, Pilani — Hyderabad, India
B.E. Electronics & Instrumentation; Minor in Robotics & Automation — *2017-2021*
Courses: Modern Control Systems, Control Systems, AI for Robotics, Robotics

SKILLS

Programming & Scripting: Python, C/C++, RUST, Java, HTML, Verilog, PLC Programming Simulation,
Robotics & Control Tools: MATLAB, ROS, Simulink, Gazebo, Webots, PyBullet, MuJoCo, LabVIEW
CAD/Hardware: SolidWorks, SolidWorks Electrical, Fusion 360, AutoCAD, DraftSight, HDL, Allen-Bradley PLC, Benchtop

EXPERIENCE

Controls Engineer, **ASML** — *June 2024 - Present*
- Designed a closed-loop control for the Energy Controller using system identification by modeling the plant through Bode, Nyquist, and step response analyses; computed optimal gains and validated performance via simulation and source testing. Also implemented feedforward control to improve behavior in edge cases.
- Led end-to-end delivery of open-loop control: updated requirements and the Simulink model, designed test cases, performed unit/bench testing, and coordinated with cross-functional team integration to deliver ahead of schedule.
- Built the 'Sensor Acquisition' HIL simulator using Simulink-HDL, deployed it on an FPGA, and validated it with regression tests on a testbench. Revived and upgraded the Python simulator to emulate the hardware for High-NA machines.
- Provided rapid escalation and integration support by debugging issues in less than 1 day, delivering FW/control patches, and assisting proto engineers during feature bring-up.

Control Systems Engineering Intern, **Entegris Inc.** — *June 2023 - Sept 2023*
- Developed electrical schematics and CAD models for Gas Purifier Systems, updated redlines, and Bill of Materials.
- *Established* Solidworks Electrical foundations and revamped Purifier Systems, reducing labor and rework costs.
- Increased throughput by 98% within two months by rectifying engineering errors and implementing changes.

Dynamics and Controls Intern, **N Robotics** — *May 2023 - Sept 2023*
- Developed velocity and position-based gait transitions, enabling autonomous bipedal gait switching for targeted navigation, and implemented it in a ROS-PyBullet framework.
- Trained a multi-clip policy for humanoid robot locomotion via motion imitation (MoCapAct), enhancing agility and efficiency in the MuJoCo simulation environment.

Research Assistant, **Stochastic Robotics Lab, Indian Institute of Science** 🔗 — *June 2021 - May 2022*
- Led a team of 4 in developing velocity-based gait transitions, a state estimator, and a whole-body impulse control + model predictive controller, thereby increasing the stability of the 'Stoch' quadruped robot.
- Verified and optimized controllers using the OROCOS framework and ROS-Gazebo simulation, and presented our results to a space organization, paving the way for future collaboration.

Research Intern, **Multi-Agent Robotic Motion Lab, National University Singapore** 🔗 — *Jan 2021 - Nov 2021*
- Designed a gradient descent-based inexpensive cost function to analyze the ground reaction forces and obtain the required body pose, thus empowering stable complex hexapod robot locomotion using Central Pattern Generators.
- Increased the robot's stability by ~40% in PyBullet and Webots environment.

Electronics Subsystem Lead, **Hyperloop India** 🔗 — *Aug 2019 - Oct 2020*
- Designed a distributed on-board electronics architecture and vehicle controller, with localized control loops for motor fine-tuning and executing an Emergency Braking Protocol for enhanced pod safety and operational reliability up to 98%.
- Developed a real-time Kalman filter for Hyperloop pod pose estimation, reducing acceleration RMSE by **91.7%** and velocity RMSE by **67.4%**, critical for precise vehicle control and motion planning.
- Engineered a comprehensive sensor fusion system, integrating IMUs, tachometers, optical encoders, and fiducial markers for accurate state estimation and feedback, validated through simulations over 120 discrete time-steps.

RELEVANT PROJECTS

Traffic Wave Dampening using Autonomous Vehicles | *Python*🔗 — *Apr 2023 - Jun 2023*
- Modeled complex traffic flow dynamics using a state-space representation to validate Lagrangian control strategies for autonomous vehicles, proving a single AV's capacity to significantly dampen traffic waves and ensure system stabilizability.
- Implemented a Follower Stopper controller, reducing velocity standard deviation by **80.8%**, fuel consumption by **42.5%**, and excessive braking by **98.6%**, while concurrently increasing traffic throughput by **14.1%**.

Multi-Modal Sensor Fusion for Robotic Localization and Mapping | *Python*🔗 — *Jan 2023 - Mar 2023*
- Implemented comprehensive Simultaneous Localization and Mapping solutions for autonomous robots, fusing IMUs, encoders, 2D LiDAR (up to 30m range), and stereo/RGBD camera data to construct 2D occupancy grids to track landmarks
- Optimized a 100-particle Particle Filter for differential-drive robot localization and an Extended Kalman Filter (EKF) for visual-inertial SLAM, ensuring robust and accurate pose tracking.
- Validated high-fidelity sensor processing pipelines, encompassing IMU calibration, 10Hz yaw rate filtering, and gradient descent optimization for quaternion-based orientation tracking for precise vehicle control and panoramic mapping.

A Convolutional Neural Network Approach Towards Self-Driving Cars | *C++, Python*🔗 — *Sept 2018 - Mar 2019*
- Implemented a Convolutional Neural Network (CNN) for Level 2 autonomous vehicle steering control, achieving a Mean Squared Error (MSE) loss of **0.0003798** after 30 epochs by directly mapping camera input to steering commands.
- Integrated a robust obstacle avoidance system with ultrasonic sensors and the RRT*-Connect algorithm, enabling autonomous lane changes based on obstacle velocity tracking within a **20cm** detection threshold.
- Engineered the vehicle's control architecture, integrating a Raspberry Pi for image processing and an Arduino Mega for motor control, resulting in an **86.43%** autonomy rate during testing on the CARLA open-source driving simulator while adhering to ISO26262 functional safety principles.

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PUBLICATIONS / PROJECT REPORTS

1. **P. Saraf,** M. Shaikh, M. Phan, "*Convex Optimization in Legged Robots*," Project Report MAE 227
2. **P. Saraf,** "Traffic Wave Dampening using Autonomous Vehicles," Project Report MAE 247 🔗
3. **P. Saraf,** Y. Jangir, R. N. Ponnalagu, "*Implementation and Testing of Force Control on a Spherical Articulated Manipulator*," IEEE International Conference on Mechatronics and Automation (ICMA), 2022
4. **P. Saraf,** et al, "*Terrain Adaptive Gait Transitioning for a Quadruped Robot using Model Predictive Control*," IEEE International Conference on Automation and Control (ICAC), 2021 🔗
5. **P. Saraf,** et al, "*Onboard Electrical, Electronics, and Pose Estimation System for Hyperloop Pod Design*," IEEE 7th International Conference on Control, Automation and Robotics (ICCAR), 2021 🔗
6. **P. Saraf,** R. N. Ponnalagu, "*Modeling and Simulation of a Point-to-Point Spherical Articulated Manipulator Using Optimal Control*," IEEE International Conference on Automation, Robotics, and Applications (ICARA), 2021
7. **P. Saraf,** M. Gupta, and A.M. Parimi, *"A Comparative Study Between a Classical and Optimal Controller for a Quadrotor,"* IEEE 17th India Council International Conference (INDICON), 2020
8. A. Agnihotri, **P. Saraf,** and K.R. Bapnad, "*A Convolutional Neural Network Approach Towards Self-Driving Cars*," IEEE 16th India Council International Conference (INDICON), 2019 🔗

TEACHING / LEADERSHIP

- **Electrical Subsystem Lead**, Hyperloop India, BITS Pilani *Aug 2019 - Oct 2020*
- **Teaching Assistant** - Control Systems Laboratory, BITS Pilani *Jan 2020 - May 2020*
- **Robotics Mentor** - Student Mentorship Program, BITS Pilani *Aug 2019 - Dec 2019*