Suraj Kiron Nair

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Summary

Versatile Robotics Engineer with expertise spanning perception, control systems, and autonomous navigation. Experienced in full-stack robotics development from sensor integration to motion planning, with a proven track record of implementing autonomous systems for UAVs. Strong background in both software development (ROS2, C++) and hardware integration, complemented by hands-on experience with various robotic platforms including drones and manipulators.

Education

New York University New York, NY
MSc, Mechatronics and Robotics Sep 2022 - May 2024
- Achievements: GPA: 3.933, Master's Project: Enhancing quadrotor safety using fault tolerant and adaptive control.
- Courses: Deep Learning, Robot Perception, Robot Localization and Navigation

Ramaiah Institute of Technology Bengaluru, India
BSc, Mechanical Engineering Aug 2017 - Jul 2021
- Achievements: GPA: 8.48/10, Mechatronics, Control Systems
- Courses: Python, Machine Learning

Skills

C/C++, Python, Rust, MATLAB and Simulink, ROS/ROS2, OpenCV, Pytorch, CUDA, Gazebo, Linux, Docker, Git version control

Work Experience

Agile Robotics and Perception Lab New York, NY
Research Engineer (Robotics Systems) Jan 2023 - Present
- Integrated and tested real-time 3D reconstruction on Jetson Orin with Realsense cameras and Nvidia Nvblox.
- Implemened Monocular Depth Estimation based mapping using the Depth anything foundation model and TensorRT for real time inference achieved 30fps inference.Troubleshooted, tested and analyzed data using ROS/ROS2, which enhanced the accuracy of 3D mapping capabilities for autonomous flight.
- Set up Px4 EKF to fuse VIO with GPS, enabled robust state estimation for outdoor flight, and improved navigation accuracy
- Showcased UAV systems for mapping and exploration to the Army Research Lab (ARL), implementing mapping for the drone autonomy stack in ROS 2 using Nvidia Isaac simulator and Nvblox. and localization using Openvins.
- Assisted in teaching the Robot Localization and Navigation course, graded assignments, prepared and presented class materials enhancing student understanding of key mathematics concepts.
- Developed hardware interfaces and drivers for Basler Dart and Realsense cameras, and performed sensor calibration.
- Implemented L1 Adaptive Controller (in ROS C++), enabling UAVs to adapt to wind gusts and propeller damage. Analyzed experimental data from both simulation software and onboard UAVs.

Interdisciplinary Center for Energy Research (ICER IISc) Bengaluru, India
Research Associate Sep 2021 - May 2022
- Simulated heat exchangers by creating a 2D model of a printed circuit heat exchanger using Python, which optimized the design for a reduced footprint and improved efficiency
- Conducted fluid dynamics simulations for an SCo2 Brayton cycle power generation engine using Ansys and Python, leading to enhanced performance predictions and design improvements.

Formula Student New York, NY
Lead Drive train engineer Jan 2018 - Jul 2021
- Assisted in researching and developing MPC for formula student vehicles, enhancing vehicle control and performance.
- Analyzed vehicle dynamics to optimize lap times and determine drive train parameters. Reduced the acceleration time by 40%.
- Coordinated tasks between the mechanical and electrical teams. Managed the electronics and hardware integration of the electric vehicle. Ranked 1st in engineering design Formula Green 2020.

Projects

Computer Vision and Robot Perception
- Developed a real-time neural network for human object detection in various environments using vision foundation models.
- Optimized Openvins Visual Inertial Odometry for Drone localization.
- Used Deepsort, a YOLO based object tracking method to track vehicles and passengers in traffic.

Control and Motion Planning
- Generated trajectories for obstacle avoidance and simulated an inverse dynamic Controller for a SCARA robotic arm.
- Setup and programmed a Universal Robots UR3e Manipulator in NYU Makerspace.
- Fault-Tolerant Control enables quad-rotors experiencing rotor failure to track position trajectories by conceding yaw control.
- Implemented minimum snap trajectory planning and L1 adaptive control scheme on a quadrotor.

Localization and Estimation
- Fused GPS/Vicon positions with IMU measurements using an EKF for drone localization
- Implemented velocity estimation using Optical flow and fused with IMU measurements using Unscented Kalman Filter.

Publications

- From Propeller Damage Estimation and Adaptation to Fault Tolerant Control:Enhancing Quadrotor Resilience.
  IEEE Robotics and Automation Letters