# Suraj Kiron Nair

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## EDUCATION

**New York University** New York, NY
*MSc in Mechatronics and Robotics,* GPA: 3.933 Sept 2022-May 2024
Related Coursework:Deeplearning, Robot Perception, Robot Localization and Navigation

**Ramaiah Institute of Technology** Bangalore,India
*BSc in Mechanical Engineering,* GPA: 8.48/10 Aug 2017-July 2021
Related Coursework: Mechatronics, Control Systems, Machine Learning

## TECHNICAL SKILLS

**Proficien**t: C/C++, Python, MATLAB and Simulink, ROS/ROS2, Pytorch, Gazebo, Point Cloud Library, Open3D;
**Familiar:** Docker, Tensorflow,CAN , CUDA, NVIDIA Isaac Sim

## WORK EXPERIENCE

**Agile Robotics and Perception Lab** New York, NY
Graduate Research Assistant Jan 2023 – present

- Assisted in teaching the Robot Localization and Navigation course as a Graduate Teaching Assistant.
- Developed ROS C++ packages for Linux in the L1 Adaptive Controller project, enabling UAVs to adapt to wind gusts and propeller damage. Analyzed experimental data from both simulation software and onboard UAVs.
- Integrated and tested software on the ModalAI VOXL2 board and Jetson Orin, collecting and analyzing data using ROS/ROS2.
- Setup the Px4 EKF to fuse the IMU data with Motion Capture data for accurate state estimation.
- Demonstrated UAV systems for mapping and exploration to the Army Research Lab (ARL), implemented mapping for the drone autonomy stack in ROS 2. Developed using Nvidia Isaac simulator and nvblox.

**Interdisciplinary Center for Energy Research (ICER IISc)** Bangalore, India
Research Associate Sept 2021-May 2022

- Simulated heat exchangers by creating a 2D model of a printed circuit heat exchanger using Python and analyzed the design for optimal footprint.
- Conducted fluid dynamics simulations for an SCo2 Brayton cycle power generation engine using Ansys and Python.

**Formula Student** Bangalore, India
Lead Drive train engineer Jan 2018 - Jul 2021

- Assisted in the research and developmentof Model Predictive Controllers for formula student vehicles.
- Vehicle Dynamics Simulations: Simulated vehicle dynamics to optimize lap times and determine Electric drive train parameters. Reduced the acceleration time by 40%.
- System Integration: 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:**

- **Pedestrian Detection using MobileSAM:** Deployed a real-time neural network for segmenting objects in various environments (optimized for GPU inference using Nvidia Tensorrt)
- **Multi Object Tracking using DeepSort:** Used Deepsort, a YOLO based object tracking method to track vehicles and passengers in traffic.
- **Visual Place Recognition(VPR) and SLAM:** Explored and mapped a maze using a virtual robot. Used VPR and SLAM techniques to localize the robot and navigate to the location of the target images. Completed Top 3 in the competition.

**Control Projects**

- **Dynamic Control of a SCARA Robot:** Generated trajectories for obstacle avoidance and simulated an inverse dynamic Controller for a SCARA robot.
- **Implemented Fault Tolerant Control onboard a quadrotors:** Fault Tolerant Control enables quad-rotors experiencing rotor failure to track position trajectories by conceding yaw control.
- **L1 Adaptive control for Micro Aerial Vehicles:** Implemented the L1 adaptive control scheme on a quadrotor.

**Localization and Estimation**

- **State Estimation using Extended Kalman Filters:** Fused GPS/Vicon positions with IMU measurements using an EKF for drone localization
- **Optical Flow based State Estimation:** Implemented velocity estimation using Optical flow and fused with IMU measurements of a quadrotor using Unscented Kalman Filter (UKF).

## PUBLICATIONS

**From Propeller Damage Estimation and Adaptation to Fault Tolerant Control:Enhancing Quadrotor Resilience**
IEEE Robotics and Automation Letters: Under the guidance of Professor Giuseppe Loianno