NIRANJAN SUJAY

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EDUCATION

Master of Science in Mechatronics and Robotics Engineering   **Aug 2022 - Jun 2024**

New York University, Tandon School of Engineering **CGPA:3.7/4.0**

Courses: Robot Localization and Navigation, Robot Perception, Artificial Intelligence.

Bachelor of Technology in Robotics and Automation   **Aug 2018 - Jun 2022**

Jain University, School of Engineering & Technology **CGPA: 8.9/10 ~ 3.68/4.0**

Courses: Foundations of Robotics, Mathematics for Robotics, Kinematics & Dynamics of Machinery, Machine learning, Electronic Devices & Control.

ROLES & RESPONSIBLITIES

Volunteer Robotics Mentor, *Collaboration with NYU Tandon and Poly Prep High School*   **Sep 2022 - Feb 2023**

- Mentored 15+ high school students in robotics, leading two teams to win in a national robotics competition while nurturing their engineering skills and passion for robotics and computer science.

Robotic Research Intern, *Green Quest Solutions Private Limited, Singapore*   **Sep 2021 - Aug 2022**

Contribution:

- Built a custom model using YOLO algorithm for precise detecting of recyclable waste. Utilized Intel RealSense camera to accurately measure the height, length and width of the detected object.
- Integrated the object detection algorithm and Intel RealSense camera into the ROS framework, allowing the rover to navigate autonomously in unfamiliar surroundings.
- Specially designed and built a flexible robotic arm with advanced sensors. This arm could wrap around trees of various shapes, helping us monitor tree health in real-time for a comprehensive ecological system. Which reduced the measure time one million trees within just 6 months, a task that would usually take more than year.

Tools Used: NVidia Jetson Nano, Intel RealSense Camera, Tomographic Sensors, ROS, Gazebo, Shaper 3D.

Robotic Intern, *Flux Auto, Bengaluru, India*   **Dec 2019 - Feb 2020**

- At Flux Auto, I pioneered real-time object recognition while gaining expertise in the seamless integration of diverse sensors with the NVidia Jetson Nano developer board. This experience also involved understanding motion planning and decision-making systems for autonomous vehicles, with a primary focus on ensuring the vehicle's behavior remains safe, smooth, and predictable.

SKILLS

- **CAD:** Proficient in Shaper 3D and Fusion360 for mechanical design.
- **Programming Languages:** Skilled in C, Python, and MATLAB for algorithm development, data analysis, and control systems. Along with experience in PLC, LabVIEW, and Simulink.
  - **Software and Libraries:** Experienced with ROS and ROS2 for robot middleware and NVIDIA Isaac ROS, OpenCV for computer vision, and deep learning frameworks like CUDA, Keras, PyTorch, and TensorFlow. Proficient in simulation environments such as NVidia Omniverse, Gazebo and MATLAB Robotics Toolbox. Microsoft suite – Word, Excel and PowerPoint, Outlook and Google suite- Docs , Sheets, Slides, Forms.
- **Kalman Filtering:** Proficient in implementing EKF and UKF for state estimation in robotics.
- **Computer Vision:** Experienced in gesture tracking, object recognition, and tracking using OpenCV and Mediapipe.
- **Control Systems:** Skilled in designing and implementing control systems for robotics applications.
- **Soft Skills:** Demonstrated leadership in team environments, strong research abilities, and technical writing expertise.

PROJECTS

MappingNYC Project, AI4CE Lab, NYU: **Aug 2023 - May 2024**

- Led a project to improve autonomous vehicle navigation in urban settings using YOLOv8 for object detection, and Kalman filters and SORT for tracking accuracy.
- Designed and built a custom hardware mount that houses a variety of sensors including Livox Mid360, Velodyne VLP 16, RTK GPS, Insta360 Air, and Insta360 X2. This setup was instrumental in collecting a unique New York City dataset.
- Trained models on this NYC-specific dataset, overcoming urban challenges like noise and dynamic obstacles.

Visual Odometry using RGB-D Camera: **Jan 2024 - May 2024**

- Developed algorithm for estimating camera motion in real-time using RGB-D camera data by FAST feature detection and Lucas-Kanade Optical Flow for feature tracking and created 3D point clouds from successive RGB images and estimated motion between them. Fused rotation and translation data to predict camera trajectory. Attained precise pose estimation and navigation for autonomous robots.
- Utilized Python, OpenCV, and ROS-Noetic in a Linux Ubuntu environment And Published educational materials for wider community engagement.

Visual SLAM with NVIDIA's Isaac ROS: **Dec 2023 - Jan 2024**

- Implement Visual SLAM system using the Isaac ROS package, merging NVIDIA's Isaac SDK and ROS for advanced localization and mapping by utilizing stereo cameras, along with feature extraction algorithms, for real-time pose estimation and map creation.

Deep Learning Model with ResNet-50 on CIFAR-10:   **Oct 2023 - Dec 2023**

- Developed a model using ResNet-50 to classify images from the CIFAR-10 dataset, employing data augmentation techniques to enhance robustness. Trained and optimized the model, achieving high classification accuracy.

Variational Autoencoder for Digit Generation   **Oct 2023 - Dec 2023**

- Developed a VAE in TensorFlow to generate digit images, leveraging MNIST data. Focused on latent space exploration and model optimization with RMSprop and Optuna, achieving significant performance improvements and demonstrating generative model capabilities.

Comparative Study on Optimization Techniques   **Oct 2023 - Dec 2023**

- Analyzed optimization methods, contrasting Adam with SGD on MNIST using logistic regression. Highlighted Adam's convergence properties and the critical role of hyperparameter tuning in achieving optimal model performance.

YOLO-based Drone Detection System   **Oct 2023 - Dec 2023**

- Implemented a drone detection system with YOLO, Python, and OpenCV. Trained on a drone-specific dataset, the project improved real-time object detection accuracy and introduced novel bounding box visualization techniques for effective surveillance.

Statistical Analysis of Glove Size Distribution   **Oct 2023 - Dec 2023**

- Conducted a statistical study on glove sizes using Python's statistical libraries to model distribution, correlation, and multivariate analysis. Demonstrated data visualization prowess through histograms and pair plots, underscoring the importance of statistical methods in data analysis.

SLAM for Maze Navigation   **Oct 2023 - Dec 2023**

- Led a SLAM project to navigate mazes using Pose Graph Mapping and OpenCV. Enhanced robot perception with SIFT for feature extraction and A* for path planning, showcasing the integration of graph optimization and visual place recognition for autonomous navigation.

Sensor Fusion and State Estimation for Aerial Robot   **Jan 2023 - Apr 2023**

- Individual coursework project involving the estimation of an aerial robot's position, orientation, velocity, and angular velocity using data from IMU, VICON, and a camera.
- Implemented Extended Kalman Filter EKF and Unscented Kalman Filter UKF in Matlab and Simulink for state estimation and visual localization that enhanced the robot's situational awareness, showcasing proficiency in sensor fusion techniques.

Animetronic Hand   **Apr 2023 - Apr 2023**

- Created during "Byte into Hardware" Hackathon at NJIT, a proof-of-concept gesture-controlled animetronic hand. Utilized computer vision for precise gesture tracking, integrating 3D printed animetronic hand, Tower Pro Servos, and an IMU by implemented Mediapipe for accurate actuation using keypoint technique.

Autonomous Robotic Systems   **Jan 2023 - Apr 2023**

- *AutoInventoryBot*: revolutionized inventory management through robotics. It featured QTI sensors for line-following, a Parallax Propeller microprocessor, Raspberry Pi for image processing, and an array of sensors. ArUco tags were employed for precise item identification and counting. The project harnessed theoretical analysis for optimized navigation and tracking, demonstrating the potential to reduce manual labor.
- *AutoParkBot*: introduced an intelligent parking system, utilizing QTI sensors for line following, ultrasonic sensors for obstacle detection, and an Arduino Uno microcontroller. The project integrated theoretical control algorithms for automated parking solutions, enhancing user convenience and parking efficiency.
- *WidgetMover*: enhanced factory operations with adaptive navigation, employing the A* algorithm. The system featured QTI infrared sensors, Parallax Continuous Servo actuators, and Propeller Board. The project leveraged theoretical principles for optimal path planning, streamlining widget transportation, and adaptability to diverse factory layouts. Proficiently applied theoretical and practical skills in teamwork, Kalman filtering, line following, autonomous navigation, and control systems to create these autonomous robotic systems.

Trajectory Planning and Inverse Dynamic Control of Manipulator   **Oct 2022 - Dec 2022**

- Built and simulated a trajectory and inverse dynamics-based controller for UR5 modeled manipulator using MATLAB and Simulink.

Bi-Rotor Trajectory Tracker   **Oct 2022 - Nov 2022**

- Developed a Python-based controller for bi-rotors, enabling precise hovering and trajectory tracking, demonstrating control system proficiency and understanding practical experience in birotor trajectory control.

Biped robot   **Jan 2022 - Apr 2022**

- Designed the biped structure with 8 degrees of freedom and that would be able to withstand 5 kgcm of torque, alongside was able to integrate control the movement of the motors with the sensory feedback from the IMU sensor.

Robotic arm   **Jan 2020 - Mar 2020**

- Basic robotic manipulator with all revolute joints for a pick and place controlled using Bluetooth module. Optimized motor resolution for precise location targeting which intend had effect in the time that it reached the location.

Electric Car   **Aug 2016 - Apr 2016**

- Built a 2-seater electric car with hub motors and BLDC controllers, offering a top speed of 60 mph and a 40-mile range at an average speed of 30 mph on an 8-hour charge.

Python Based Projects   **Apr 2018 - Aug 2021**

- Developed a Machine learning model for genre prediction on an online music platform where it predicts and recommends the genre of music according to the age, with the dataset taken from Kaggle.
- Automated data extraction from websites into Excel spreadsheets, streamlining information handling processes.

CERTIFICATES

- Robotics Certification Course by IIT kharagpur **SWAYAM**
- Python Certification Course by **Mosh Hamedani**
- Google Cloud Certification course by **Google**
- Introduction to Machine Learning Certification Course by **Udacity** and **AndrewNgs**
- Nanodegree in Deep Learning Certification Course by **Udacity**