




# KEVIN PAULOSE

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## Education

### University of Pennsylvania

exp. May 2025

Master of Science in Engineering, Mechanical Engineering (Robotics), GPA: 3.9/4.0

Philadelphia, PA

Coursework: Introduction to Robotics, Design of Mechatronics Systems, F1/10 Autonomous Racing Cars, Machine Perception, Learning in Robotics

### Indian Institute of Technology, Bhubaneswar

May 2023

Bachelor of Technology, Mechanical Engineering (Robotics), GPA: 3.62/4.0

Bhubaneswar, India

## Technical Experience

### Modular Robotics Lab, University of Pennsylvania

Dec 2023 - present

Researcher under Prof. Mark Yim

Philadelphia, PA

- Inventing an innovative 20-degree-of-freedom hyper-redundant robot arm inspired by a biological snake/elephant trunk, with efficient chained actuation via motor multiplexing and associated control methods for high versatility with precision manipulation.

### MITACS Globalink Research

May - Aug 2022

Research Intern at Laboratoire de Robotique et Systèmes Autonomes, Université du Québec en Outaouais

Quebec, Canada

- Demonstrated precise indoor obstacle avoidance algorithm for an autonomous 6-DOF quadcopter drone in an unknown environment using Nagumo's invariance theorem and Bouligand tangent cones
- Orchestrated seamless integration of this deadlock-free algorithmic approach on a quadcopter drone by employing 3D LiDAR & depth camera, with PixHawk and GPS

### Bhabha Atomic Research Centre

May - Jul 2021

Research Intern at Design and Manufacturing Section, Control Systems Development Division

Mumbai, Maharashtra

- Utilized Topology Optimization in 3D printing by achieving enhancements in flexure-strength, weight and fatigue resistance for wind turbine rotor blades and compliant trabecular bone implant design
- Projected a novel idea for cost-effective small-scale earth-to-space and space-to-space "Extra-Terrestrial" manufacturing using additive manufacturing methods

## Projects

### Grand Theft Autonomous- Mobile Robot Competition | ESP32, Arduino, Sensors, Registers, Opamps

Sep - Dec 2023

- Manufactured a 4-wheel autonomous mobile robot using ESP32 S2 as an access point, TB6612FNG motor drivers and ATmega32u4, IR phototransistor-opamp frequency detection circuit
- Enhanced the robot's capabilities by integrating HTC Vive for precise localization, implementing beacon (IR LED emitter) tracking through frequency detection circuit and enabling remote control via UDP, ESP-NOW, I2C, CAN, SPI protocols

### Pick and Place with 7-DOF Franka Emika Panda arm | ROS, Gazebo, Inverse Kinematics

Sep - Dec 2023

- Architected an end-to-end pipeline for a 7 DOF robot arm within the ROS and Gazebo frameworks. Engineered advanced motion planning incorporating geometric inverse kinematics and bi-directional Rapidly Exploring Random Trees (RRT) for precise and swift control, enabling efficient picking and placing of both static and dynamic blocks.

### NeRF (Neural Radiance Fields) | PyTorch, Numpy, Multi-layer Perceptron

Oct - Dec 2023

- Employed MLP for training Lego scene images, mapping 3D coordinates to color and density, resulting in high-quality novel view reconstruction, by implementing ray casting, hierarchical volume sampling, skip-connected MLP, and volumetric rendering.

### Augmented Reality using AprilTags | Python, Procrustes problem, trimesh, imageio

Sep - Oct 2023

- Developed an Augmented Reality application that enables the placement of virtual objects at specified pixel locations within a real-world scene via AprilTags, by solving the Perspective-Three-Point (P3P) and Procrustes problem

### Adaptive Control in UAVs & High Performance Aircrafts | MATLAB, Simulink, Control Systems

Jul 2022 - May 2023

- Designed a guidance algorithm with state estimation for reactive collision avoidance for a 6-DOF non-linear model of a Flying Wing UAV using L1 adaptive control with 92% accuracy (PX4 benchmark) in MATLAB simulations
- Streamlined an LQR-based safe landing approach with the guidance algorithm inside a Simulink 3D Animation arena with Gazebo (ROS Melodic) and Robotics Systems Toolbox

### Obstacle Avoidance Algorithms for Unmanned Aerial Vehicles | PX4, ROS Melodic, LiDAR

May - Aug 2022

- Engineered a Holybro drone X500 V2 mounted with RPLiDAR A1m8 & Occipital Structure Core camera, CUAV V5+ Autopilot running PX4 and Neo V3 Pro GPS for real-time flight tests
- Optimized a robust obstacle avoidance algorithm for the 6-DOF quadcopter drone achieving 86% success rate, primarily by tuning the formulated Bouligand tangent cones (Safety Velocity Cones)

## Technical Skills

**Languages:** Python, C, C++, MATLAB

**Softwares:** ROS/ROS2, RViz, Gazebo, Simulink, PX4, Scikit-learn, PyTorch, SolidWorks, ANSYS, COMSOL Multiphysics, QGroundControl

**Technologies/Frameworks:** Linux, Windows, Arduino, ATmega32u4, ESP32, Jetson Nano, LiDAR, Intel Realsense D435i, UAV & Robotics System toolbox, Google Colab, Jupyter Notebook, UDP, ESP-NOW, I2C, CAN, SPI, Microsoft Office