# Ashok Kumar Jakkula

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## **Education**

University of California, Riverside

**April. 2024** 

M.S. in Robotics

Bennett University, India

Jul. 2018 - May. 2022

**Bachelor's in Computer Science** 

# **Work Experience**

Indian Air-Force, IAF & DRDO - India

Jan. 2023 - Aug. 2023

- Developed and deployed a Multi-Agent Control System to manage aerial and ground robots for Foreign Object Debris (FOD) detection and clearance on active runways.
- Integrated mmWave Radar with ROS2 for precise detection and localization of minute debris, optimizing data transmission through feature-level sensor fusion, improving system efficiency by 4%.
- Designed and validated a robust positioning pipeline via Gazebo simulations, optimizing spatial accuracy across diverse flight trajectories. Developed a spatial filtering module to improve UAV multi-lateration, ensuring rapid and accurate least-square convergence in target positioning.
- Implemented multi-modal fleet control, enabling seamless interoperability between aerial and ground robots in high-pressure, time-sensitive environments.

## Robotics Engineer, Kit-O-Lit Labs Pvt Ltd, India,

Aug. 2022 - Dec. 2022

- Delivered a range of robotics projects, including static robot prototypes, robotic arms, and autonomous robots, within specified time-frames and budgets. Leveraged ROS-2, NAV-2 package, and advanced vision technology to meet project objectives.
- Led the product development of innovative robotic systems, accelerating time-to-market by **12**%, integrating high-quality off-the-shelf software into iterative Software Development Life Cycle (SDLC) processes.

## Junior Robotics Engineer, UAVTECH Pvt Ltd, India,

Dec. 2020 - Jun. 2022

- Engineered precision landing systems for large-scale logistics UAVs, optimizing landing accuracy and safety for both urban and rural deployments while ensuring full compliance with Indian UAV regulations.
- Designed and executed full-scale logistics UAV simulations using high-fidelity simulators, facilitating operations between tier-1 and tier-2 cities in strict adherence to DGCA guidelines for airspace management and UAV deployment.
- Developed and implemented the NPNT (No Permission No Takeoff) package within a secure environment, streamlining drone mission authentication and ensuring robust regulatory compliance.
- Played a key role in shaping national UAV regulations by contributing to the development of autonomous UAV operational rules within the DGCA Consortium, promoting safe and efficient drone usage across India.

# Research - Graduate Student Researcher, CRIS LAB

# Fleet Management System leveraging Nvidia Omniverse

**Submitting to ICRA 2024** 

- Engineered and implemented a Fleet Management System using the ISAAC SDK and VDA5050 protocol, deploying Carter and Turtlebot-4 robots with scalability.
- Deployed digital twins in NVIDIA Isaac Sim and conducted SITL and HITL simulations for advanced fleet management.
- Evaluated multi-task loop missions with co-simulation techniques to optimize obstacle avoidance, state transitions, traffic management, path planning, and battery efficiency.
- Developed dynamic task allocation algorithms to enhance system efficiency and adaptability in real-time operations.

# **Academic Projects**

# Distributed edge-based Localisation - Masters Capstone Project

Sept. 2024 - Dec. 2024

- Engineered an edge-computing 3D localization package utilizing Surfer-Based SLAM to facilitate real-time mapping and localization across multiple robots in a distributed network, with Reinforce-Learning based Pose-Optimisation to reduce errors by **9**%.
- Integrated communication between robots using the Contract Net Protocol, enabling dynamic task allocation and collaboration between the robots in a decentralized manner, leading to efficient resource utilization, from both UAV and Ground-based Robots.
- Optimized the system for scalability and low-latency communication, enabling efficient data aggregation and edge-based processing, reducing reliance on centralized computing resources, with full VDA5050 compliance.
- Implemented advanced sensor fusion techniques, combining lidar and vision data for accurate mapping and enhanced environmental understanding in dynamic and complex environments.

## V2X Data Share for Intelligent Vehicles

Apr. 2024 - Jun. 2024

- Developed a package that enables intelligent vehicles to share sensor data at the feature level, significantly enhancing their collective field of view, with effective operation in low-bandwidth environments.
- Tested the solution in the Clara Simulator using real-world data from Culver City.
- Implemented and tested 3D model detection using PointPillar and VoxelNet models.
- Optimized performance, achieving an average precision of 89.4% at an IoU of 0.5 with an error margin of ±0.5m.
- Deployed Multi-Agent communication strategies with various fusion techniques (late, intermediate, and early).

## Instance Selective Whitening to reduce image blur in real-time

Jan. 2024 - Mar. 2024

- Implemented a real-time Instance Selective Whitening Loss on ResNet-50 models to effectively reduce image glare for autonomous vehicles.
- Significantly improved the model's performance in challenging lighting conditions, leading to more accurate and reliable visual data processing.
- Achieved a 40.33 iMoU, providing better data generalization compared to traditional methods.
- Ensured more robust model behavior across diverse environments.

# Finding Correctness Bugs in ROS2 UAV Systems

Jan. 2024 - Mar. 2024

- Developed a feedback-driven framework for testing and identifying bugs in ROS systems.
- Created a data mutation strategy that intelligently alters data to challenge the system.
- Combined real-world and simulated data to detect unexpected issues.
- Built a feedback engine to guide the testing process, enhancing its effectiveness in identifying critical bugs.
- Tested the framework using a PX4 Quadcopter, identifying issues during long-duration missions.
- Provided insights into Redundant Sensor Inconsistency Feedback, Control Error-based Feedback, and State Distance-based Feedback.

## Technical Skills

**Programming Languages:** Python, MATLAB, Bash, Rust

Software Tools and Libraries: ROS, ROS2, OpenCV, PCL, TensorFlow, Keras, Git, Jupyter, URDF-XACRO

Robotic Simulators: NVIDIA Isaac Sim, Gazebo, Microsoft AirSim

Robots: Clearpath Jackal & Husky, TurtleBot 4, PX4, Nova Carter, BMW STR

Tools: Cesium3D, MapboxSDK