AYUSH KUMAR

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EDUCATION

Purdue University, West Lafayette *Aug 2025 - present*
Master of Science in Robotics
Coursework: Robotic systems, Artificial intelligence, Design & analysis of control systems, Computer vision

Indian Institute of Information Technology Design and Manufacturing, Jabalpur *Jul 2019 - Jul 2023*
Bachelor of Technology in Electronics and Communication Eng. (Gold Medalist), CGPA: 8.3/10.0
Coursework: Biomedical Robotics, Neural Networks, Sensors and Actuators, Data Structure and Algorithm, CyberPhysical Systems

TECHNICAL SKILLS

Areas:	Robotics, SLAM, Computer Vision, RL, AI, Motion Planning, Force Control Loop, Human-Robot Interaction, Embedded Systems, Sensor Fusion, Deep Learning, VR/AR, Real-Time Systems, Linux, Multi-threading
Programming:	C/C++ (14/17), Python, Matlab, Lua, Shell scripting, C#, Data Structures and Algorithms, Design Patterns
Frameworks:	ROS/ROS2, TensorFlow, PyTorch, Scikit-learn, Unity, Isaac Lab/Sim, OpenGL, Git/GitHub
Hardware:	Quadrupeds, COBOTs, Haptic Devices, BeagleBone Black, Nvidia Jetson Orin, 3D/2D LiDAR, Realsense Camera, STM-32
Protocols:	I²C, SPI, UART, CAN, TCP/IP, EtherCAT, Modbus

EXPERIENCE

IDEAS Lab *West Lafayette, IN*
Graduate Research Assistant, Advisor: Prof. Aniket Bera *Sept 2025 – present*
- Developing advanced navigation algorithms for Eli Lilly's warehouse robots, integrating deep scene understanding and human behavior modeling to enhance safety, efficiency, and collaboration in human-robot environments.
- Integrating reinforcement learning with perception-driven frameworks to optimize warehouse processes while ensuring safety.

Addverb Technologies *Noida, India*
Advanced Robotics Team - Robotics Engineer *Sept 2023 – Jul 2025*
- Developed a visual–inertial SLAM system for a quadruped robot, employing an ORB-based frontend with a tightly coupled Levenberg–Marquardt graph optimizer backend, achieving 1.15% translation error and 0.0027°/m rotational accuracy.
- Developed the navigation stack for a quadruped robot, including a Hybrid A* based global path planner, Model Predictive Path Integral (MPPI) based velocity controllers, and Adaptive Monte Carlo Localization (AMCL) modules.
- Implemented a torso-angle calculator module for the quadruped's disturbance rejection system by fusing camera-based ground plane detection with plane estimation from leg contact points.
- Achieved functional safety (SIL-3 level) with on-demand cross-comparison (ODCC) on RTOS, incorporating inter-VM communication from a Yocto-based OS to RTOS via shared memory for a collaborative robot (COBOT), achieving a safety timeout of 4 ms.
- Developed a novel RANSAC-based planar segmentation algorithm utilizing IMU sensor data as an initial orientation guess, achieving a 46.8% improvement in efficiency by reducing computation time.
- Contributed to the deployment of various robots in research institutions, including IIT, IIIT, and Columbia University.

Addverb Technologies
Advanced Robotics Team - Robotics Eng. Intern *Jan 2023 – Sept 2023*
- Developed a VR-based simulator for a haptic device to train doctors, achieving real-time force feedback with sub-100 ms latency.
- Devised a particle filter-based self-calibrating algorithm for a haptic device, reducing recalibration frequency by 60%.
- Developed a lightweight bit-manipulation encoding–decoding scheme for lossless communication between the robot and connected devices, achieving a stable 1000 Hz rate.

Orangewood Labs *Noida, India*
Research and Development Eng. Intern *Sept 2021 – Jun 2022*
- Developed a comprehensive software stack for an AMR, incorporating localization and mapping pipelines, planners, and velocity controllers, built on ROS 2 as the core framework.
- Designed the kinematic control system for a collaborative robot using a force control loop, achieving a repeatability of 1 mm.
- Developed low-level sensor and actuator drivers (over CAN, I²C, and UART), implemented Kalman filtering for noise reduction, and performed timestamp alignment to synchronize data from multiple sources.

PATENTS AND PUBLICATIONS

- "A Sensor-based system for real-time three-dimensional positioning of crane hook and method thereof," published by Intellectual Property India, Application No.202321075984 *12/15/2023*
- "Haptic device for 6 DOF parallel manipulation ", published by Intellectual Property India, App. No. 202311074914 *11/02/2023*
- "Design of Mechatronic Rehabilitation Glove," granted by Intellectual Property India, Application No. 361771-001 *07/08/2022*

PROJECTS

Navigation Among Movable Objects *West Lafayette, IN*
IDEAS Lab, Advisor: Prof. Aniket Bera *Jul 2025 - present*
- Developed a reinforcement learning policy to jointly control a quadruped (SPOT) and its mounted arm for efficient 6-DOF pose reaching.
- Trained a supervised learning model with a UNet backbone to predict optimal grasp locations, leveraging CLIP embeddings and integrated object detection in a semantics-aware approach to improve grasp accuracy.
- Leveraged a Vision-Language Model (VLM) as a decision-making module to handle high-level navigation decisions.