# APURV KUSHWAHA

Robotics, Perception and Embedded Systems
+1-971-488-6640 | kushw022@umn.edu | LinkedIn | GitHub | Minneapolis, MN

## Summary

Robotics engineer with experience developing mechatronic and embedded systems for autonomous and intelligent applications, with additional experience in computer vision and machine learning. Strong foundation in system integration, prototyping, cross-functional collaboration, and team coordination, with a proven ability to turn ideas into functional prototypes.

## Education

**Master of Science in Robotics** — Aug 2025 – May 2027
*University of Minnesota, Twin Cities* — *Minneapolis, MN*

**Bachelor of Technology in Engineering Physics** — Jul 2020 – May 2024
*Indian Institute of Technology, Guwahati* — *Guwahati, India*

## Professional Experience

**Lead Technical Engineer** — Nov 2024 – Jun 2025
*Samaritan AI* — *New Delhi, India*

- Led end-to-end development of a smart medical device, covering mechanical design, electronics integration, embedded firmware, and prototype validation.
- Designed and fabricated mechanical parts using CAD and 3D printing, assembled electronic subsystems, and integrated sensors into a working prototype presented to 3+ investors and hospitals.
- Developed ESP32 firmware for real-time sensing and device operation, and built 24-hour reliability tests that improved signal stability and reduced measurement inconsistency by 87%.

**Research & Development Engineer** — May 2024 – Nov 2024
*Swachh.io* — *New Delhi, India*

- Supported end-to-end development of environmental monitoring and pollution-control prototypes, contributing to design, testing, and system integration for real-world deployment.
- Coordinated 4+ interns across mechanical, electronics, and software domains, and contributed simulation and validation work used in reports that helped secure a $50K+ grant.

## Selected Projects

**Semantic-Aware Image Retargeting** | Code | Demo | *PyTorch, DINOv3, Depth Anything 3, OpenCV* — Dec 2025

- Built a semantic-aware image retargeting pipeline that combines saliency detection, depth estimation, and seam carving to resize images while preserving important content and visual composition.
- Trained a DINOv3-based classifier on the PICD dataset (∼43K images), achieving repo-reported 75–80% validation accuracy for composition-aware retargeting.

**Autonomous Car Parking Bot** | Code | *ROS 2, Gazebo, Nav2, OpenCV* — Nov 2025

- Built an autonomous indoor parking system in ROS 2 and Gazebo, combining overhead-camera vehicle detection, Nav2-based navigation, and a towing robot with lift control.
- Implemented coordinate transformation and fine-positioning logic for a parking lot, yielding highly precise orientation detection, ±10 cm positioning accuracy, and 100% navigation success in tests.

**Warehouse Pick-and-Drop Optimization** | Code | *A*, Hill Climbing, Simulated Annealing* — Dec 2025

- Developed a warehouse pick-and-drop optimization system by modeling task sequencing as an extended Traveling Salesman Problem with precedence constraints and A* path planning.
- Implemented and compared greedy, hill climbing, and simulated annealing approaches, with experiments showing 5–12% route-cost improvement over the greedy baseline.

## Skills

**Programming & Robotics:** Python, C++, Embedded C, MATLAB, ROS 2, Gazebo, Path Planning, SLAM
**Perception & AI:** OpenCV, Sensor Fusion, Computer Vision, Machine Learning, Reinforcement Learning
**Mechatronics:** ESP32, Arduino, PCB Design, CAD, Embedded Systems, Sensor Integration, I2C, SPI, UART, CAN
**Engineering Tools:** Linux, Git, Docker, CMake, SolidWorks, Fusion 360, ANSYS, 3D Printing