Shivam Bhardwaj

SENIOR AI-AUGMENTED ROBOTICS & AUTOMATION ENGINEER

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shivambhardwaj.com | LinkedIn | GitHub | Resume Source Code | H-1B Transfer Ready

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PROFESSIONAL SUMMARY

Senior Robotics & Automation Engineer with 6+ years shipping embedded and mechatronic systems across **C++/Rust**, **Linux/ROS2**, motion control, and hardware integration. Collaborative, cross-functional executor delivering safety-critical support across self-driving systems, robotic forensics, datacenter automation, AR hardware, harness production, and semiconductor equipment; supported **Meta, Tesla, Apple, Applied Materials, Amazon Robotics, and Saildrone**.

EXPERTISE

Robotics & AI:	ROS/ROS2 (Nav2, MoveIt), C++ (14/17), Python (AsyncIO), SLAM (GMapping, Cartographer), Computer Vision (OpenCV, YOLO), Sensor Fusion (Kalman Filters), LLM Agents (LangChain)	**Hardware & CAD:**	Siemens NX (Open API), SolidWorks, Rhino3D, GD&T (ASME Y14.5), DFMA, Rapid Prototyping, 3D Printing
Embedded & EE:	Embedded C, Rust (Embedded Hal), PCB Design (Altium/KiCad), Microcontrollers (STM32, ESP32, Ambiq), Industrial Protocols (EtherCAT, Modbus), Interfaces (I2C, UART, CAN), PoE	**Software & DevOps:**	Rust (Tokio, Axum), Docker/Kubernetes, CI/CD (GitHub Actions), Linux/Bash, AWS (IoT Core), React/Next.js

EXPERIENCE

Mechatronics Engineer | Design Visionaries — San Jose, CA   May 2023 – Dec 2025
Clients: Applied Materials, Saildrone, Industrial IoT

- **AutoCrate Design Engine:** Invented a parametric design engine by reverse-engineering **Siemens NX Expressions** (bypassing slow NX Open API), reducing design time from **5 days to <1 hour**. Built a **React/Python** GUI to generate ASTM-compliant drawings, increasing custom crate adoption from **20% to 50%**.
- **AR Glasses Electronics:** Designed a **10-layer Flex PCB** for AR glasses, integrating an **Ambiq MCU**, USB power delivery, micro-projector data path, and **I2C** ambient light sensing within a compact form factor.
- **Harness Production Scaling:** Scaled harness production from **25 to 70 units/day** (2.8x increase) and reduced RMA rate from **70% to 10%** by implementing lean manufacturing systems and optimizing assembly workflows.
- **Custom Instrumentation:** Invented a real-time **Laser/LDR** soil leveling sensor for slurry injection, solving a critical feedback gap where CV failed. Developed an automated metrology machine for recycled metal classification.
- **MBD & GD&T:** Transitioned a major semiconductor lab (Plasma ALD) from 2D drawings to **Model-Based Definition (MBD)** in NX, defining **GD&T** and PMI directly in 3D models to meet critical deadlines.

Engineering Manager | Advanced Engineering Services — San Jose, CA   Oct 2022 – Apr 2023
Clients: Meta (Reality Labs), Applied Materials, Hummingbird EV, AAA

- **Multi-Modal Robotic Forensics:** Architected a robotic workcell for counterfeit detection in server systems, integrating **RF, Thermal (+/- 0.5°C), Capacitance, and Optical** (85mm industrial lens) sensing to achieve **0.5% repeatability**.
- **EV Conversion & Simulation:** Led the mechanical reverse-engineering for a **Class-8 Diesel-to-Electric** conversion (AAA); executed **3D scan post-processing** and **Harmonic Analysis** to validate structural integrity and transient response of mounting systems.
- **AR Hardware Development:** Managed the mechanical and industrial design of a **Waveguide Frame** for a semiconductor research lab; coordinated with vendors for high-fidelity finishing (painting/3D printing) to meet **tight tolerance specifications** for executive demos.
- **Feasibility & Automation:** Conducted feasibility studies for **containerized ad-hoc EV charging** and **datacenter server pin testing automation**, delivering technical roadmaps for niche industrial problems.

Senior Robotics Engineer | Velodyne Lidar — Alameda, CA   Jan 2021 – Sep 2022
R&D Software Team Lead

- **Next-Gen Lidar Validation:** Validated next-generation LiDARs (including **Velarray directional** sensors) at highway cruising speeds. Engineered custom 80-20 testing jigs for diverse platforms, ensuring robust data collection for **all product lines**.
- **Infrastructure Automation (SaaS Deployment):** Pioneered the deployment strategy for Velodyne's **first-ever SaaS compute stack**. Developed **Ansible** playbooks to automate the provisioning of the **Vella vision stack** on **Jetson-based NRU** controllers, enabling scalable customer deployments.
- **Sensor Integration & Development:** Developed onboard IMU capabilities and implemented Precision Time Protocol (PTP) synchronization. Built data collection platforms integrating RTK GPS for high-fidelity georeferencing.
- **Field Engineering & Operations:** Led **7+ standardized IEAB tests** at GoMentum Station. Generated massive data annotation pipelines for **Scale AI**, supporting the training of perception models across the entire product line.
- **Strategic Technical Partnerships:** Acted as a **Hardware-Software Liaison** for key accounts (**Ford, Amazon Scout, Knightscope**). For **Bluecity** (Smart Cities), conducted **3D blindspot analysis** to optimize Lidar placement and maximize coverage efficiency.

Robotics Software Engineer | ARI — Sunnyvale, CA   Jan 2020 – Dec 2020
Surgical Robotics & Compliance

- **Surgical Registration Algorithm:** Developed a **C++** registration algorithm using **VTK** and **PCL**, processing **10,000+ points** to compute the transformation matrix between a patient's femur and a surgical drill. Implemented **Iterative Closest Point (ICP)** to align **OptiTrack** motion capture data with MRI-based 3D point clouds.
- **High-Performance Metrics:** Achieved **0.1mm translation** and **0.3° rotation accuracy** with a registration time of **300ms** (data collection: 20s), directly enabling precise robotic milling of the femur head.
- **Robot Control System:** Engineered the control logic for a **6-DOF Kuka Robot** using **Beckhoff PLC**, orchestrating **100%** of the surgical workflow from registration to execution with **1ms** cycle times.
- **FDA Compliance:** Performed system-level risk analysis and contributed to design validation documentation for **FDA 510(k)** submission, ensuring **100%** safety-critical software compliance under **IEC 62304** standards.
- **Data Pipeline Architecture:** Implemented **DDS** middleware and **Protobuf** serialization to process and feed real-time sensor data into the **Computer Vision (CV)** pipeline with **<5ms latency**, ensuring seamless integration between subsystems.
- **Industry Impact:** Pioneered **"Active Milling"** (autonomous cutting), moving beyond standard "jig-holding" robotics. This innovation drove **Zimmer Biomet's acquisition of Monogram** in 2025.

Visiting Researcher | AI4CE Lab (NYU) — Brooklyn, NY   Jun 2019 – Dec 2019
Advisor: Prof. Chen Feng

- **GPS-Denied Visual Localization:** Built an end-to-end pipeline (video → frame extraction → blur filtering → **COLMAP** 3D reconstruction) to recover **6-DoF** camera pose vectors in urban environments.
- **Single-Image Relocalization (Transfer Learning):** Fine-tuned a pre-trained neural network to predict position + orientation from a single photo, achieving ~**10 cm** relocalization accuracy and ~**8 deg** orientation error on a typical Brooklyn block (**demo available**).
- **Experimental Rigor:** Automated dataset generation, reconstruction runs, and evaluation loops on **Linux**, enabling repeatable comparisons of frame filtering and model variants.

Graduate Leadership & Research | NYU Tandon School of Engineering — Brooklyn, NY   Aug 2017 – May 2019
M.S. in Mechatronics & Robotics

- **Makerspace Operations (Manager):** Operated and maintained fabrication equipment (**3D printing, laser cutting, CNC routing, waterjet, electronics lab**) and coached **50–150** student project teams on safe prototyping and iteration.
- **Self-Driving VIP (Founder/Lead):** Secured dean funding and converted the team into a **Vertically Integrated Project (VIP)**; led a ~**12**-person team to place **1st** in Novel Design and **3rd** overall execution at the **26th** IGVC.
- **Autonomy Stack (IGVC):** Led integration of sensors + compute and guided development of **ROS-based** navigation, including motion planning (e.g., RRT, RRT∗, A∗) and **PID** control for an autonomous ground vehicle.

EDUCATION

M.S. Mechatronics & Robotics , *New York University* - Research: COLMAP-based visual relocalization; swarm robotics
B.Tech Electronics , *I.P. University, Delhi* - Award: Top-3 Projects; built ArduPilot autonomous drone