# Shivam Bhardwaj

### FOUNDER & ROBOTICS ARCHITECT │ BUILDING AI-NATIVE HARDWARE SYSTEMS

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Portfolio │ LinkedIn │ GitHub

## PROFESSIONAL SUMMARY

**Visionary Engineer & Founder** with 6+ years architecting zero-to-one automation for **Meta, Applied Materials, and Saildrone**. Specialist in collapsing development cycles (100x speedups) via custom **AI-driven CAD & Manufacturing engines**. Now building the next generation of **autonomous industrial robotics**.

## EXPERTISE

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| **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), PLC (Beckhoff TwinCAT) | **Software & DevOps:** | Rust (Tokio, Axum), Docker/Kubernetes, CI/CD (GitHub Actions), Linux/Bash, AWS (IoT Core), React/Next.js |

## EXPERIENCE

**Founder & Lead Engineer** │ Design Visionaries                                     May 2023 – Present
*Consulting for Applied Materials, Saildrone, Industrial Clients*

- **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 Lead** │ Advanced Engineering Services                                  Oct 2022 – Apr 2023
*Led cross-functional teams for Meta & Applied Materials*

- **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                                       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                                                                                    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 key innovation drove **Zimmer Biomet's acquisition of Monogram** in late 2025 to challenge industry leaders.

**Visiting Researcher** | AI4CE Lab (NYU)                                                                        Jun 2019 – Dec 2019
*Advisor: Prof. Chen Feng*

- **Autonomous Construction:** Researched **Collective Robotic Construction (CRC)**, developing algorithms for multi-agent systems to build structures autonomously.

- **Computer Vision:** Implemented **SLAM** and object detection pipelines for real-time site monitoring and robot localization in dynamic environments.

- **Research Publication:** Contributed to research findings on **topological structural analysis** for robotic assembly, laying groundwork for future lab publications.

**Graduate Research Assistant** | NYU Tandon School of Engineering                                Aug 2017 – May 2019
*M.S. in Mechatronics & Robotics*

- **Mechatronics Systems:** Designed and fabricated a **Miniature Wall-Climbing Robot** using magnetic adhesion and compliant locomotion, achieving vertical traversal speeds of 5cm/s.

- **Embedded Control:** Developed real-time control firmware on **STM32** microcontrollers for multi-DOF robotic arms, implementing PID control for precise trajectory tracking.

- **Teaching Assistant:** Mentored 30+ students in "Introduction to Robotics," leading lab sessions on **ROS**, python scripting, and sensor integration.

## EDUCATION

**M.S. Mechatronics & Robotics** , *New York University* - Research: AI4CE Lab – Real-time visual localization using Deep Learning (SLAM without GPS)
**B.Tech Electronics** , *I.P. University, Delhi* - Award: Top 3 University Projects – Developed ArduPilot-based Autonomous Drone