

TANAY MISRA

Sr. Mechatronics Engineer | Motion Control, Embedded Systems & Robot Integration

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Summary

Mechatronics engineer, five years, on the hardware/software seam. On a surgical robot's arm I tuned frameless-torque-motor and harmonic-reducer joints at bench level and wrote the EtherCAT master. On a humanoid, in a four-person team, I own the C++ coordinator, the transport between compute boards and the safety path. M.Tech in Robotics (DIAT, DRDO); two peer-reviewed publications.

Technical Skills

Motion Control & Drives: Servo tuning of frameless torque motors with harmonic-reducer joints (dual-encoder feedback, compliance, lost motion, two-mass resonance, backlash); EtherCAT master (PySOEM, CiA 402 CST/CSV/CSP state machine, PDO/SDO); PID and cascaded current/velocity/position loops; drive commissioning; safety-clamped command paths

Systems & Embedded: C++17, Python, Rust; SCHED_FIFO threads, lock-free seqlock shared-memory IPC, 100 Hz safety monitor, core isolation and CPU affinity, latency profiling; CycloneDDS transport and QoS, Modbus TCP; NVIDIA Jetson (AGX/NX)

Robotics & Perception: ROS 2 Humble, MoveIt 2 motion planning (OMPL, Pilz, CHOMP), BehaviorTree.CPP; LiDAR (Livox MID-360), IMU, cameras, tactile sensing; extrinsic calibration and time-sync; localization integration on an existing FAST-LIO2 and 3D-BBS stack; ONNX Runtime, TensorRT

Electrical, Mechanical & Practice: Electrical harnessing design; SolidWorks, PTC Creo, design for manufacturing; hardware bring-up and cross-layer debugging; golden regression harnesses and pre-registered on-hardware bench protocols; Docker, Git

Work Experience

Sr. Mechatronics Engineer

Jan 2025 – Present

SS Innovations | surgical robot & humanoid robotics program

Gurugram, India

- **Surgical-arm motion control, bench level.** Tuned frameless-torque-motor and harmonic-reducer joints through cascaded current, velocity and position loops with dual-encoder feedback, working directly with joint compliance, lost motion and two-mass resonance. Wrote the EtherCAT master in PySOEM (PDO mapping, CiA 402 state machine, drive commissioning) behind safety-clamped command paths.
- **Humanoid coordinator.** On a four-person team I own the C++ coordinator: 6,900 lines across three SCHED_FIFO threads on dual Jetsons, and an independent 100 Hz safety monitor at priority 90 on its own core, reading rt/lowstate off DDS so it can force a damp without going through the coordinator.
- **Middleware and motion planning.** Designed the CycloneDDS command transport between compute boards and the Modbus TCP link to the hands; built the MoveIt bridge for the dual 7-DOF arms with a cubic-spline interpolator streaming joint targets at 500 Hz. Found MoveIt 2 silently ignoring velocity scaling and fixed it by trajectory-timestamp rescaling, a measured 10× swing in execution time.
- **Thread scheduling.** Traced an intermittent gait stutter to a 500 Hz command writer running as an ordinary time-shared thread: its real-time priority capability was zero at the service level, so the in-code request had been failing silently. Partitioned the compute onto isolated cores behind a flag-gated SCHED_FIFO promotion.
- **Localization and autonomous navigation.** On an existing FAST-LIO2 and GPU 3D-BBS stack, cut cold LiDAR relocalization from ~13 min to ~1.5 min and replaced a 20–95 s brute-force sweep with a 0.2 s CPU FFT cross-correlation search (0.91 fit, 3.2 cm RMS), gated by a golden regression harness; recalibrated a LiDAR-to-IMU extrinsic from 2.20° to 0.67°. Took the navigation chain on from selftest to a supervised goal-reach on hardware, a 1.10 m walk landing within ~10 cm of a goal 1.5 m out and 90° off heading, owning the nav-to-motor bridge and its safety layer: velocity and yaw-rate shaping under caps, fail-closed on stale localization (kill to emergency stop in a measured 1.53 s), disarmed-by-default arming. Planning (A*, elastic band, pure pursuit) sits in the existing stack.

Mechatronics Engineer (earlier: Robotics Software Intern, Jun 2021 – May 2022)

Jun 2021 – Dec 2024

SS Innovations

Gurugram, India

- Motion control and validation on a 12-DOF safety-critical surgical platform in a regulated environment, inside a 20+ engineer organisation.

Personal Engineering

- **EtherCAT servo drive-bench (personal rig).** A drive-commissioning and tuning pipeline, motor server plus GUI, around a CiA 402 EtherCAT drive. Every register is cross-checked against two or more independent sources and bench-verified at the e-stop before it commands the actuator; torque-ceiling clamp on the command path.
- **Side projects.** An offline speech-to-text desktop and Android app (347-test CI, three-OS installers); an LLM-driven desktop CAD tool in Rust; a multi-agent developer tool with public releases.

Education & Research

Master of Technology, Robotics | GPA 8.05/10

Aug 2020 – Jun 2022

Defence Institute of Advanced Technology (DIAT), DRDO

Pune, India

Bachelor of Technology, Electronics & Communication Engineering

2016 – 2020

Shiv Nadar University

Greater Noida, India

Research Intern, National University of Singapore (Feb–Jun 2020, under Dr. Marcelo H. Ang Jr.): designed and fabricated soft pneumatic actuators achieving variable curvature through a viscosity gradient, and a squid-inspired soft robot's pneumatic locomotion.

Publications: Springer IAS 2022 (soft pneumatic actuators); IEEE ICCAR 2020 (amphibian hexapod, computer vision).