

Badrikanath Praharaj

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Experience

- **BuildMachineLabs (Co-Founder & Head of R&D)** (Jan 2026 - Present)
Launched an early-stage **open source research venture** addressing the scarcity of robotics data for **foundation-model post-training** by building curated datasets for **niche, hard-to-source** domains that established pipelines underserve; research output spans **6 papers at ICRA & RSS 2026**, across Digital Twins, Perception & Multi Agent Path Finding.
- **Indian Institute of Science, Bengaluru (Control and Optimization Intern)** Aug 2025 - Present
Designed a **real-time** multi-robot coordinator using a custom quadrant-token abstraction that partitions shared grid cells into sub-cell waypoints, robust to spatio-temporal conflicts and collision-free under quadrant mutual exclusion; validated across **100+ live** OptiTrack experiments (4 robots, scalable to 10), cutting average inter-robot wait to **about 0.1 s**.
- **Intel (LLM Inference & Optimization Intern)** (May 2024 - Sept 2024)
Optimized T5-small inference with OpenVINO using quantization and operator fusion, reducing CPU latency from **120ms to 84ms (-30%)**. Fine-tuned on CNN/DailyMail via LoRA and layer-wise LR decay, enhanced **ROUGE-L by 4.2%**. Utilized Seq2SeqTrainer and mixed-precision GPU acceleration for boosted training efficiency and convergence.

Selected Projects

- **MineSwarm: Multi-Robot Mining Digital Twin** (Jun 2025 - Present)
Engineered a **multi-agent RL digital twin** (MADDPG+TD3, PyBullet) for robust decentralized navigation of 3 LiDAR-equipped robots in a GPS-denied mine, using curriculum learning, phase-aware replay, and twin-critic stabilization. Reached **91% goal-success** across an 8-phase difficulty curriculum, scaling zero-shot to real-world hardware.
- **WeedSense: Autonomous Precision Agriculture Robot** (Jul 2024 - Jul 2025)
Countering **34% weed-induced crop loss** constructed an autonomous weed detection robot through IoT, **Mask R-CNN**, and LiDAR. Simulated navigation in **ROS 2 Gazebo**, and facilitated cloud-based monitoring via **ThingSpeak**.
- **HexaGrip: 6-DOF Industrial Robotic Arm** (Jan 2024 - Jul 2024)
Enabled students to explore industrial automation, reducing prices by **75%** (100–25) via refurbished servos, plastic gears, and weight-based motor placement. Refined trajectory control using forward kinematics for closed-loop pick-and-place.

Current Research

- **MineXplore: A RL Exploration Benchmark for GNSS-Denied Environment (ICRA 2026@Xplore)**
Addressing the absent mining-RL benchmark, built an open-source MuJoCo simulation of a **real Chilean copper mine** via a contour-to-MJCF pipeline, achieving **95.38%** geometric IoU and validating PPO policies at **88.9% coverage**.
- **Teaching Robots to Say 'I Don't Know': SENTINEL for Uncertainty-Aware SLAM (ICRA 2026@UOWR)**
Engineered a **training-free** reliability layer flagging silent LiDAR failures on sub-\$300 robots, fusing scan geometry with LiDAR/RGB-D depth consistency to reject corrupted scans via reliability scores, validated across **5 failure modes**.
- **CADENCE: Predicting Realized MAPF Execution Time Beyond Sum of Costs (ICRA 2026@MARS)**
Built a **480-trial robotic hardware corpus** (7 robots) to predict completion time, showing **primitive motion burden** cuts held-out error by **48.6–59.8% MAE** over Sum-of-Costs via scenario-held-out ridge and mixed-effects models.
- **Subterra: A Validated Benchmark for GNSS-Denied Tunnel Navigation (RSS 2026 @WPCIS)**
Lacking a real-geometry tunnel-RL testbed, rebuilt a **351 m** metro tunnel from LiDAR scans as a MuJoCo POMDP, validated at **97.1%** fidelity (**2.46 cm** surface error) across 199 metrics, where a PPO agent reached **90.02%** coverage.
- **REVEAL: Reasoning & Evaluation of Visual Evidence through Aligned Language (NeurIPS 2025@WiML)**
Fine-tuned forgery detectors fail to generalize; reframed detection as zero-shot VLM prompting via **eight-factor scoring** and **3×3 region grids**, lifting Gemini's Columbia F1 **118% (0.39→0.85)** and GPT-4.1 to **0.92**, rivaling baselines.

Education

Vellore Institute of Technology, Bhopal
B.Tech in Electronics and Communication (AI and Cybernetics)

Sept 2022 - Ongoing
CGPA: 8.9/10

Achievements

- **Conference Reviewer:** Evaluating submissions in the Robotics track of **Mexican AI & Data Science Conference**.
- **Department Topper:** Scored a perfect **10.0 GPA** in final year, and ranked **1st** overall in 1st, 2nd & 4th years.
- **LycheeAI x REVEL Hackathon:** **55+ public votes** won our Isaac Sim pick-and-place build the Community Favorite.
- **Eureka Club Co-Founder:** Co-lead a **10+ member** R&D team in a 70+ club; guided **7+ papers** & a patent idea.