Atharva Nayak

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Education

Northeastern University, Boston, USA — May 2026
Masters of Science in Robotics, Concentration: Electrical and Computer Engineering
Coursework: Robot Sensing and Navigation, Robot Mechanics and Control, Mobile Robotics, Computer Vision

Vivekanand Education Society's Institute of Technology, Mumbai, India — May 2024
Bachelors of Technology in Electronics and Telecommunication Engineering,

Skills

Languages: Python, C++, C, Bash, Verilog, CUDA

Software and Frameworks: ROS2, Gazebo, Isaac Sim, Linux, MATLAB/Simulink, Rviz, SolidWorks, Vivado, Xilinx ISE

Tools and Libraries: NumPy, SciPy, OpenCV, Git, Raspberry Pi, Arduino, FPGA, Jetson Nano, TensorFlow, PyTorch

Communication Protocols: I2C, SPI, UART, USB, CSI-2, Ethernet, TCP/IP, UDP, SSH

Technical Domains: SLAM & Localization, Path Planning & Navigation, Sensor Fusion & State Estimation, Deep Neural Networks, Autonomous Systems, Real-time Perception, Embedded Systems, Control Systems, Reinforcement Learning

Projects

3D Drone Racing Trajectory Optimization & Motion Planning, Northeastern University — Nov 2025

- Developed a hierarchical motion planning pipeline combining **RRT** initialization with **Direct Transcription**, utilizing **256 decision variables** to optimize 6-DOF trajectories and reduce path length by **68.6% (116m to 36m)**
- Implemented a non-linear constrained optimization solver using **SciPy (SLSQP)** and **GTSAM** to minimize control jerk, achieving **100% collision-free** navigation in cluttered environments with **near-zero constraint violations**

Output Sampled Model Predictive Path Integral (o-MPPI) Controller, Northeastern University — Apr 2025

- Developed model predictive control algorithm using path integral methods, achieving **12x computation reduction (98ms to 8ms)** through inverse dynamics modeling and output-space sampling optimization for real-time vehicle control
- Validated controller performance through Gazebo simulation and hardware testing on TurtleBot across **15+ track configurations**, analyzing path tracking accuracy and control loop stability to verify robustness across varying dynamics

Live Feed Firearm Detection and Alerting System, Northeastern University — Apr 2025

- Engineered real-time object detection system by fine-tuning YOLOv8 deep neural network on 2,376 training images, achieving **87% mAP@0.5, 100% precision, and 92% recall** with real-time inference at **15+ FPS** on live video feeds
- Architected automated alerting pipeline with Twilio API integration, time-based cooldown mechanism, and intelligent frame capture (5 pre/post-detection frames), **reducing incident response time** by **40%** through instant SMS and voice notifications

Multi-Sensor Dead Reckoning Navigation System, Northeastern University — Oct 2024

- Developed modular sensor fusion framework with custom sensor drivers for GPS and IMU at 100 Hz, achieving **2-meter positioning accuracy** over **50-meter GPS-denied segments** and **60% heading drift reduction**
- Implemented dead reckoning pipeline with adaptive low-pass filtering and zero-velocity updates, achieving **95% correlation** to GPS ground truth and maintaining **5% trajectory deviation** in field tests

Experience

Vivekanand Education Society's Institute of Technology (VESIT), Mumbai, India — Jun 2023 – Dec 2023
Research Intern

- Designed FPGA-based motor controller with **8-bit 25kHz PWM generator** in Verilog and real-time commutation logic on MicroBlaze processor, achieving resource-efficient synthesis at **4,500 LUTs** on Xilinx Spartan-6
- Built complete motor control system integrating FPGA with custom PCB and three-phase MOSFET drivers, validating stable operation of 12V BLDC motor across varying speeds and load conditions with scalability for closed-loop control

Tata Institute of Fundamental Research (TIFR), Mumbai, India — Sep 2022 – Apr 2023
FPGA Research Intern

- Implemented custom **8-bit SPI protocol** at **100 MHz** for Wi-Fi-to-FPGA data transfer, achieving **35% throughput improvement** and less than **2ms latency** for reliable bidirectional communication between WizFi360 and Spartan-6 FPGA
- Created a embedded web server on WizFi360 module enabling remote FPGA configuration and real-time monitoring over Wi-Fi, achieving greater than **98% connection stability** and **40% reduction in system setup time**