

Neelkumar Ahir

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Summary

Robotics Software Engineer with a passion for building intelligent, autonomous systems that work reliably in the real world. Experienced in C++, ROS2, and advanced control strategies like NMPC, with a sharp ability to translate complex robotics problems into elegant, efficient solutions. Known for fast learning, clear thinking, and delivering results across research and applied robotics projects.

Education

California State University, Sacramento, CA

Aug 2023 – Dec 2025

Master of Science in Mechanical Engineering

GPA: 3.8/4

Awards:

- **Provost's Award (1st Place)** – Sacramento State Spring Symposium, 2025
- **Honorable Mention (3rd Place)** – CSU *Statewide Student Research Competition*, 2025

Gujarat Technological University, Gujarat, India

July 2019 – May 2023

Bachelor of Engineering in Mechanical Engineering

GPA: 3.1/4

Technical Skills

Programming Languages: C++, Python, MATLAB/Simulink, HTML, Ladder Logic (PLC)

Frameworks/Tools: ROS2, Gazebo, Isaac Sim, OpenCV, CasADi, TensorFlow, Git/GitHub

Control & Planning: PID, NMPC, State Estimation, Path planning, Behavior trees

Perception & Localization: Sensor Fusion, SLAM, OpenCV

Simulation & CAD: SolidWorks, CATIA, Ansys, FEA

Hardware Platforms: Pixhawk(PX4), IMU, Encoders, GPS, Linux (Ubuntu), HITL/SITL setups

Experience

Robotics Software Engineer – Planning and Control

Dec 2024 – Present

Competitive Robotics Club – Firefighter Project

California State University, Sacramento

- Developed motion planning algorithms and **PID** controllers in **C++** for autonomous rover navigation.
- Built a real-time **sensor fusion** system integrating dual IMUs to enhance localization and state estimation.
- Conducted **system-level debugging** for hardware-software integration issues during field testing.
- Collaborated in version-controlled team setup using **Git/GitHub**, designed behavior tests in simulation before deployment.

Graduate Teaching Assistant

Aug 2024 – Jan 2025

California State University, Sacramento

Sacramento, California

- Assisting/Grading for Advanced Mathematics (ME201, ME202).

Robotics Software Engineer – Controls Intern

Jan 2023 – May 2023

Larsen and Toubro Defense IC (L&T)

Surat, India

- Designed and tuned multi-axis **PID** and feedforward controllers for robotic actuators to mimic electric drivetrain response.
- Simulated and validated joint dynamics in **Simulink** to analyze torque-dependent actuator behavior.
- Integrated IMU and encoder data for **sensor fusion**, enhancing control stability under load variation.
- Automated inspection report processing with a tolerance-filling system, cutting manual work time by over **40%**.

Design and Manufacturing intern

June 2022 – July 2022

Rockman advanced composites Pvt Ltd

Surat, India

- Designed molds and patterns for complex composite parts using **CATIA**, enhancing production readiness.
- Assisted in composite manufacturing processes including lamination, curing, and trimming to ensure component quality.
- Operated 5-axis CNC machinery for precision machining of advanced composite components.

Projects

Thesis: Nonlinear Model Predictive Control of a Quadrotor

Jan 2024 - Present

- Built a 12-state nonlinear quadrotor model using **MATLAB** and Simulink, including motion and actuator constraints.
- Designed a **cascaded-loop PD** controller, with gains optimized via gradient-based optimization for accurate trajectory tracking.
- Developed an **NMPC** controller using **CasADi**, incorporating position, velocity, and orientation angle errors in the cost function.
- Achieved **86.7% ISE** and **92.6% ITAE** improvement with NMPC over PD, validated in MATLAB.
- Performed experimental flight tests on **DJI Phantom 4 Pro V2.0** across 3 trajectories to validate controller performance.
- Currently integrating Reinforcement Learning for adaptive, **learning-based MPC**.

Autonomous Rover Design

Sep 2024 – Present

- Developed an autonomous rover using **C++**, **ROS 2**, and **Pixhawk** for GPS-based waypoint navigation.
- Implemented the **Pure Pursuit algorithm** to achieve smooth and accurate trajectory tracking.
- Used **QGroundControl** for mission planning, live telemetry, and real-time control.
- Enabled user-defined waypoint selection with automatic **path planning**, tested in simulation.

Multipurpose Safety Frame for Construction Workers

Jan 2022 – May 2022

- Led a team to design a multipurpose safety frame for construction workers to address on-site hazards.
- Modeled in **SolidWorks** and validated structural strength through **Ansys** simulations.
- Built a stainless-steel prototype with optimized cost (**\$120**) and weight (**~7 kg**) for practical use.