Varun Kotian

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About Me

Researcher with a PhD at the intersection of human factors and vehicle/simulator control. Proven in end-to-end algorithm development, from modelling and data analysis to real-time implementation and validation in simulators and research vehicles. Expertise in observer-based control, real-time systems, experimental design and validation, physiological and motion sensors, and quantitative/statistical analysis. Aspiring to advance research in human-centered automated driving and ADAS.

Education

PhD Mechanical Engineering, TU Delft and Toyota Motor Europe — *Finished Sep 2025 (Defence in March 2026)*

MSc Vehicle Engineering, TU Delft — *Graduated 2021*

BTech Mechanical Engineering, K J Somaiya College of Engineering — *Graduated 2018*

Experience

PhD Researcher — *October 2021 – September 2025*
TU Delft, Netherlands & Toyota Motor Europe, Belgium

- Developed motion comfort prediction models using state-observer feedback control and LSTM-based machine learning in MATLAB, Simulink, and C++, improving prediction accuracy by 34%.
- Led validation experiments in driving and flight simulators, research vehicles, and virtual reality, designing and executing these studies using IPG CarMaker, ROS 2, Unity, and MATLAB.
- Developed algorithms that reduced motion sickness in moving-base driving simulators by 50% compared to the state of the art.
- Built Python-based data acquisition systems to capture skin conductance (EDA), heart rate, muscle activity (EMG), eye movements (eye tracking), and body motion (IMU- and camera-based).
- Collaborated across time zones with TU Delft, Toyota Motor Europe, Toyota Motor Corporation, NAIST, TNO, and DLR to deliver joint results across Europe and Japan.
- Communicated ideas and findings to academia and industry through two conference presentations and numerous live demos, adapting content for both technical and non-technical audiences.

Visiting Researcher — *May 2024 – July 2024*
Nara Institute of Science & Technology, Nara, Japan

- Executed experiments on a 6DOF simulator with virtual reality headsets to gather user-centric data, contributing to motion perception model performance optimization.
- Developed wireless data-collection systems using ESP32 microcontroller (in C) designed custom PCBs in EasyEDA, and 3D-printed measurement fixtures for rapid, field-ready instrumentation.

Research Engineer — *October 2023 – April 2024*
TU Delft, Netherlands

- Designed and built end-to-end teleoperation for a Prius research vehicle using Autoware on ROS 2 with Python and C++.
- Set up Linux-based networking and WebRTC for low-latency two-way audio/video. Routed steering, acceleration, and brake commands to the vehicle.
- Used Docker and Git/GitLab for collaborative development and deployment.

Visiting Researcher *October 2022 – October 2023*
Toyota Motor Europe, Belgium

- Designed and executed user studies to evaluate HMI modalities that convey motion intent/preview in AVs, quantifying impacts on motion sickness and comfort.
- Benchmarked in-vehicle sensing solutions for head/trunk motion (IMUs, XSens, OptiTrack), assessing accuracy, latency, robustness, and integration trade-offs.
- Analysed results with statistical methods to inform HMI and sensor selection for comfort-focused AV features.

Vehicle Dynamics Engineer *September 2020 – August 2021*
Nova Electric Racing, Delft, Netherlands

- Developed and validated lap-time and vehicle-dynamics simulations to guide chassis, suspension, and powertrain decisions for the electric race bike.
- Ran parameter sweeps and telemetry-based model calibration in MATLAB/Simulink and Python to quantify trade-offs and optimize setup.

Aerodynamics Head & Assistant Technical Coordinator *August 2015 – August 2018*
Orion Racing India, Mumbai, India

- Led the design and development of a carbon fibre aerodynamic package for a Formula Student car, executing CAD (SolidWorks), structural FEA (ANSYS), and CFD (SimScale & ANSYS) to balance downforce, drag, and manufacturability.
- Drove integration of aerodynamics with chassis, powertrain and cooling by defining structural requirements and assembly processes.
- Supported the team's transition to an electric platform, aligning aero, packaging, thermal, and HV/LV considerations to enable sustainable performance gains.

Technical Skills

Programming	MATLAB, Simulink, C, C++, Python
DevOps & Tooling	Git, GitLab, Docker, CI/CD, Scripting/Automation
Data/Analysis	Statistical analysis, experimental design, signal processing, time-series analysis, hypothesis testing, regression/ML basics
Control & Modelling	Model Predictive Control (MPC), vehicle dynamics modelling, human-in-the-loop modelling, motion comfort modelling
Embedded & Systems	CAN bus, microcontrollers, sensor/IMU integration, data acquisition
Simulation & Platforms	ROS 2, Linux, IPG CarMaker, 6-DOF driving/flight simulators, VR
Experimentation	User studies, HMI evaluation, motion capture, physiological sensors

Soft Skills

Communication, collaboration, leadership, problem solving, adaptability

Patents

- Reducing Discomfort in Driving Simulators: Motion Cueing Algorithm for Motion Sickness Control (2025)
- Personalized motion sickness modelling and predictive mitigation in automated driving and simulation environments (2025)