Varun Kotian

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Current Location: Delft, The Netherlands (Ready to Relocate)

Education

PhD in Mechanical Engineering at TU Delft and Toyota Motor Europe — *Finishing Sep 2025*

MSc in Vehicle Engineering at TU Delft — *Graduated 2021*

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

Experience

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

- Conducted user-centric research in human factors engineering with automated vehicles and driving simulators, focusing on motion comfort improvement.
- Advanced development of motion perception and sickness models
    - through human data modelling through control design,
    - rigorous experimental methods designed, using ROS2 and IPG Carmaker, and,
    - quantitative and statistical data analysis using MATLAB, Simulink, Python and C/C++.
- Expertise in orchestrating large-scale experiments and user research, utilizing advanced driving and flight simulator, research vehicles, virtual reality, physiological sensors and motion capture systems.
- Collaborated with Toyota Motor Europe (Belgium), Toyota Motor Corporation (Japan), and TNO (Netherlands).
- Designed and manufactured tools for measurement using SolidWorks (CAD), EasyEDA (PCB Design), and 3D Printing.
- Published more than 7 papers in peer reviewed journals and filed 2 patents.

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 systems using ESP32 microcontroller for human response data collection and utilized 3D printing for custom measurement device. Firmware written in C. PCB deigned in EasyEDA.

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

- Simulated vehicle dynamics to predict lap times and enhance racing bike performance, supporting vehicle development.

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 race car, applying tools like CAD using SolidWorks, FEA using ANSYS, and CFD using SimScale and ANSYS.
- Facilitated the integration of vehicle systems and spearheaded the transition to electric vehicles, supporting sustainable performance development.

Patents

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

Projects

Motion Cueing Algorithm for Motion Sickness Control (Patent Filed)

- Used the personalised motion sickness model to develop a Model Predictive Control (MPC) based motion cueing algorithm to reduce or recreate the motion sickness in a driving simulator.
- The algorithm was developed using MATLAB and Simulink and tested on the Delft Advance Driving Simulator (DAVSi) at Faculty of Mechanical Engineering at TU Delft.

Predicting Motion Sickness from Skin Conductance

- Developed a framework to predict motion sickness levels from skin conductance data using neural networks and machine learning.
- Used Python for analysis and modelling.

Personalised Motion Sickness Model (Patent Filed)

- Developed a model framework, based on observer feedback control, that can predict motion sickness for various susceptibility of sickness.
- This was facilitated by creating a probabilistic distribution of parameters and sampling it based on the probability of getting motion sick.
- Used MATLAB and Simulink for analysis and modelling. Created a tool in Python for ease of use and sharing between teams.

Remote Operation (Teleoperation) of Toyota Prius

- Designed and built the remote operation capabilities for the Toyota Prius research vehicle in the Intelligent Vehicles group at TU Delft.
- The system was based on Autoware using ROS2, Python and C++. Used Docker and Git/GitLab to collaborate with other teams.
- Arranged all the network connections from The vehicle to the remote control tower on a Linux-based operating system to stream audio and video and send steering, acceleration and brake inputs back to the vehicle.

Investigating Postural Stability and Motion Comfort in Automated Vehicles

- Designed and conducted experiments with human participants in an automated vehicle at the Valkenburg Naval Air Base to understand the effects of prolonged driving on postural stability and comfort.
- Measured motion sickness levels, motion of the vehicle, motion of the participant (head and body), muscle activity, eye motion, seat pressure, foot pressure and skin conductance.
- Developed custom scripts to synchronise all sensors in Python.

Comparison of IMU-based, Camera-based and 3D Motion Capture Systems for Pose Estimation

- Carried out a quantitative analysis of various pose and head estimation methods to help find the best tool to measure head and body motion in a moving vehicle.
- Tested XSens body suit, Microsoft Azure Kinect and OptiTrack. Software written in Python to synchronise all systems.
- Analysed the data in MATLAB.
- This was done in collaboration with Toyota Motor Europe.

HMIs to Reduce Motion Sickness

- Designed and supervised human experiments in Wizard of Oz setup in a real vehicle at the Zaventem Proving Ground within Toyota Motor Europe to understand the effectiveness of trajectory visualization and Holoride VR.
- Analysed the data using MATLAB and modelled it using Simulink.
- This was done in collaboration with Toyota Motor Europe.

Measuring Amplitude Dynamics of Motion Sickness

- Designed and Conducted user-centric experimental research in the SIMONA Research Simulator at the Faculty of Aerospace Engineering at TU Delft to understand the relationship of motion sickness and amplitude of stimuli.
- Analysed the data using MATLAB and modelled this using Simulink.

Publications

Please find my publications on Google Scholar or ResearchGate

References

Available on request