

# Khashayar (Kash) Ghanizadegan

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## Profile

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- 4+ years in computer vision, image processing, machine learning, and sensor fusion for robotics and resource-constrained systems.
- 1+ year deploying production on-device computer vision and machine learning features in industry.
- Strong in stochastic filtering, visual-inertial state estimation, real-time algorithm optimization, and rigorous testing and validation under noisy real-world sensing conditions.
- Additional background in mechanical design, simulation, and electromechanical product development.

## Education

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**M.A.Sc. Mechanical Engineering**, Carleton University 2023 – 2025

*Thesis: Novel Quaternion-based Nonlinear Kalman-type Filters for GPS-denied Visual-Inertial Navigation*

GPA: 10.5/12

**B.Sc. Mechanical Engineering**, University of Tehran 2017 – 2021

*Thesis: Feasibility study of electric bus equipped with solar panels*

GPA: 3.65/4

## Experience

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**Research Assistant**, Warranty Life / University of Toronto Nov. 2024 – Jan. 2026

- Developed, deployed, and maintained production on-device computer vision features for cracked-smartphone detection, achieving 89% accuracy.
- Built and optimized dynamics-aware algorithms for real-time detection and evaluation of smartphone drop events from onboard Inertial Measurement Unit (IMU) streams, achieving 80% accuracy with validation on real-device data.
- Delivered data- and energy-efficient on-device battery health estimation to support mobile reliability workflows.
- Developed a 3D post-drop orientation visualization tool to support debugging and product validation.
- Documented algorithm methodologies, validation results, and recommendations for cross-functional stakeholders.

**Graduate Research Assistant**, Robotics, Navigation, and Control Systems Laboratory Jan. 2023 – Jan. 2025

- Designed and validated machine learning pipelines for visual-inertial navigation and Unmanned Aerial Vehicle (UAV) localization under noisy, real-world sensing conditions, including work published in *Expert Systems with Applications* (DOI [🔗](#)) with 33% performance improvement.
- Developed quaternion-based Unscented Kalman Filter (UKF) and particle-filter approaches in Python and MATLAB for 6-DoF GPS-denied navigation and real-time state estimation; outcomes published in *IEEE Transactions on Instrumentation and Measurement* (DOI [🔗](#)) with 77% better performance compared to a state-of-the-art baseline.
- Fused vision and inertial sensor outputs in multimodal pipelines to benchmark navigation quality, tune estimators, and improve robustness under sensing noise.

**Graduate Research Assistant**, Artificial Intelligence in Mechanical Engineering Lab Jul. 2019 – Dec. 2022

- Investigated sequence-model approaches, including Recurrent Neural Networks (RNNs), for Simultaneous Localization and Mapping (SLAM) with RGB-D sensing.
- Developed Python localization pipelines using Kinect RGB-D datasets for pose-estimation and mapping

experiments.

- Led planning and control work for an autonomous-vehicle team, designing high- and low-level controllers for path planning and path following while collaborating closely with the computer vision team.



**Mechanical Design Engineer**, Vehicle, Fuel, and Environment Research Institute      *Oct. 2019 – Mar. 2022*

- Led mechanical design of B-sample battery packs for electric vehicles in SOLIDWORKS, ensuring compliance with safety and packaging constraints.
- Performed engineering calculations and structural and thermal simulation (CAE, Finite Element Analysis (FEA), and Computational Fluid Dynamics (CFD)) to validate design integrity and performance.
- Produced technical documentation, material specifications, and Bills of Materials (BOMs) to support procurement and manufacturing.
- Collaborated with manufacturing and testing teams, suppliers, and industry customers to align designs with production capabilities, quality-control requirements, and customer needs.
- Supported Design for Manufacturing (DFM) reviews and electromechanical subsystem validation testing.

## Independent Projects

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**ros2qnukf** *2026*

- Rebuilt my Quaternion-based Unscented Kalman Filter (QNUKF) from MATLAB/Python into a ROS 2 Jazzy C++ package for real-time visual-inertial state estimation.
- Engineered robustness for real ROS 2 topic behavior, including timestamp mismatch, delayed inputs, and dropped sensor messages.
- Structured workload across iterations and parallelized components to maintain real-time throughput without blocking; project: [github.com/Khashayar-Gh/ros2qnukf](https://github.com/Khashayar-Gh/ros2qnukf) , overview: [kash-g.com/projects/ros2qnukf](https://kash-g.com/projects/ros2qnukf) .

## Skills & Abilities

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**Languages & Systems:** Python, C++, MATLAB, Linux, Docker, Git, LaTeX, Arduino

**Robotics & Navigation:** Visual-Inertial Navigation and Localization, SLAM, Motion Planning, Sensor Fusion, ROS 2, CARLA, Gazebo, Vehicle Dynamics, Occupancy Grids, Bird's-Eye-View (BEV) representation

**Sensors & Filtering:** Inertial Measurement Unit (IMU), LiDAR, RADAR, RGB-D, Stereo Cameras, Extended Kalman Filter (EKF), Unscented Kalman Filter (UKF), Particle Filters

**Machine Learning (ML):** PyTorch, TensorFlow, scikit-learn, OpenCV-based pipelines, model training and optimization, model evaluation, sequence models, Recurrent Neural Networks (RNN), Gated Recurrent Units (GRU), reinforcement learning

**Computer Vision & 3D:** OpenCV, Visual SLAM, feature tracking, point clouds, quaternion algebra, rigid-body transformations, mesh analysis


**Mechanical Design & Simulation:** SOLIDWORKS (CAD and Simulation), 3D Printing, Design for Manufacturing (DFM), CAE, FEA, CFD, Bills of Materials (BOM), Product Lifecycle Management (PLM)

**Professional:** Cross-functional collaboration with hardware/software teams, technical documentation, clear technical written and verbal communication, adaptability in fast-paced environments

## Publications








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K. Ghanizadegan and H. A. Hashim, "Quaternion-Based Unscented Kalman Filter for 6-DoF Vision-Based Inertial Navigation in GPS-Denied Regions," *IEEE Transactions on Instrumentation and Measurement* (5.6 Impact Factor), [10.1109/TIM.2024.3509582](https://doi.org/10.1109/TIM.2024.3509582) 

K. Ghanizadegan and H. A. Hashim, "DeepUKF-VIN: Adaptively-Tuned Deep Learning Unscented Kalman Filter for 3D Visual-Inertial Navigation Based on IMU-Vision-Net," *Expert Systems with Applications* (7.5 Impact Factor), [10.1016/j.eswa.2025.126656](https://doi.org/10.1016/j.eswa.2025.126656) 

## Certifications

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<a href="#">Quick Start to Modern C++ for Programmers [2024 Edition]</a> 	Apr. 2026
Udemy	
<a href="#">ROS 2 for Beginners (ROS Jazzy - 2026)</a> 	Mar. 2026
Udemy	
<a href="#">AWS Machine Learning Foundations</a> 	Oct. 2021
AWS – Udacity	
<a href="#">Robotics: Perception</a> 	Oct. 2021
University of Pennsylvania – Coursera	
<a href="#">State Estimation and Localization for Self-Driving Cars</a> 	Mar. 2021
University of Toronto – Coursera	
<a href="#">Motion Planning for Self-Driving Cars</a> 	Sep. 2020
University of Toronto – Coursera	
<a href="#">Introduction to Self-Driving Cars</a> 	Aug. 2020
University of Toronto – Coursera	