Mertcan Kaya

Robotics R&D Engineer • Motion Planning • Control Systems • HRI

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Professional Summary

Robotics Engineer and PhD Candidate specializing in motion planning, advanced control systems, and Human-Robot Interaction (HRI). Proven track record of architecting real-time trajectory generators and deploying ROS/ROS 2 software stacks on commercial robotic platforms (Franka Emika, UR3). Strong expertise in Object-Oriented C++, Python, and algorithm development, focused on bridging complex kinematic theory with robust, scalable software implementations for collaborative autonomous systems.

Key Engineering Achievements

- **Algorithm Development:** Engineered adaptive control algorithms utilizing recursive online parameter estimation, resulting in a peer-reviewed publication in JIRS.
- **Systems Integration:** Designed and integrated ROS-based human-robot interaction software architectures across four distinct hardware platforms (Franka Panda, UR3, Pepper, NAO).
- **Data Architecture:** Built scalable Python data pipelines automating the processing and feature extraction of large-scale kinematic datasets, reducing manual data-analysis time by approximately 80%.
- **Motion Planning:** Developed real-time trajectory-generation frameworks utilizing inverse optimal control for predictive, human-aware robot motion.

Core Technical Stack

Languages:	C/C++ (OOP), Python (NumPy, SciPy, Pandas), Java, R
Robotics Software:	ROS, ROS 2 (Nodes, Action Servers), MoveIt, Gazebo, Linux (Ubuntu), Git, CMake
Domain Expertise:	Human-Robot Interaction, Collaborative Robotics, Motion Planning, Trajectory Optimization, Robot Control, State Estimation, Robot Kinematics
Hardware Platforms:	Franka Emika Panda, Universal Robots (UR3), Stäubli RX160, Nvidia Jetson
Simulation & Tools:	MATLAB, Simulink, CoppeliaSim (V-REP), Siemens NX, SolidWorks

Engineering & Research Experience

Robotics R&D Engineer / Researcher — Dec 2025 – Present
Coburg University of Applied Sciences and Arts (CoSMoC Project) — *Coburg, Germany*

- **Software Architecture:** Architecting a hierarchical C++/Python motion-planning framework, leveraging inverse optimal control and dynamic state estimation for human-robot spatial negotiation.
- **ROS 2 Deployment:** Implemented ROS 2 trajectory-generation modules for human-aware robot motion, dynamically adapting robot kinematics based on predicted human task sequences.
- **System Integration:** Engineering the bridge between high-level predictive models and low-level hardware controllers to ensure safe execution in shared workspaces.

Guest Lecturer (Control Engineering) — May 2025 – Aug 2025
Coburg University of Applied Sciences and Arts — *Coburg, Germany*

- Instructed advanced control theory modules and supervised technical lab sessions, ensuring engineering students successfully compiled and deployed control algorithms on test hardware.

Robotics Software Engineer / Researcher — May 2021 – Apr 2025
Coburg University of Applied Sciences and Arts — *Coburg, Germany*

- **Hardware & ROS Integration:** Built and deployed ROS-based experimental architectures incorporating MoveIt and custom nodes to control collaborative arms (Franka Panda, UR3) and social robots.
- **Data Pipelines:** Developed Python processing pipelines automating preprocessing, feature extraction, and statistical analysis for large-scale kinematic datasets across 30+ experimental trials.

- **Controller Optimization:** Integrated behavioral tracking metrics into adaptive controller tuning workflows for human-aware motion generation.

Software Projects (GitHub)

Adaptive Controller Architecture [GitHub Repository]

- Implemented adaptive controller simulations in MATLAB/C++, including recursive parameter estimation and online dynamics updates.
- Built a modular software architecture supporting real-time controller evaluation, reducing computational overhead.

Probabilistic Autonomous Navigation [GitHub Repository]

- Developed OOP-based implementations of mapping, localization (SLAM), and motion planning algorithms, demonstrating proficiency in core autonomous navigation mathematics.

Kinematic Simulation Engine [GitHub Repository]

- Engineered a standalone application using MATLAB App Designer for real-time 3D kinematic trajectory visualization and direct robot simulation control.

Selected Research Output

Author of 9 peer-reviewed publications driving advancements in HRI and robot control software.

- **Control Systems:** Authored a novel recursive algorithm for the implementation of adaptive robot controllers (*Journal of Intelligent & Robotic Systems, 2024*).
- **Kinematics & Planning:** Published frameworks for predictive spatial negotiation and congruency-sensitive trajectory generation (*Interaction Studies 2026; HCII 2025; IEEE ROBIO 2024*).

Honors & Awards

- **Vehbi Koç Scholar Award** Apr 2012
  Awarded by Koç University administration for outstanding undergraduate academic excellence, maintaining a high-honor Semester GPA (SPA) of 3.60 / 4.00 within the engineering track.

Education

Doctoral Candidate in Electrical Engineering & Information Technology Apr 2023 – Present
Technical University of Munich (TUM) & Coburg University *Munich, Germany*
• **Focus:** Hierarchical motion planning, control systems, and human-robot physical interaction.

Master of Science in System Dynamics and Control Engineering 2015 – 2019
Istanbul Technical University (ITU) *Istanbul, Turkey*
• **Thesis:** Compliance Control of Collaborating Robots

Bachelor of Science in Mechanical Engineering 2009 – 2014
Koc University *Istanbul, Turkey*

Languages

Turkish (Native), English (Advanced C1), German (B1 Certified), Russian (A1)