Alp Sahin

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SUMMARY

PhD student in Robotics with 4+ years of experience in motion planning, algorithm design, and robotic system integration. Proven track record of strong written and verbal communication skills, demonstrated through publications and presentations at respected robotics and controls venues. Enthusiastic about bridging the gap between research and practical applications, with a focus on creating transparent algorithms that enhance interpretability and reliability.

EDUCATION

Lehigh University, Bethlehem, PA   Expected Graduation: May 2026
PhD in Mechanical Engineering & Mechanics
Focus: Topological and Geometrical Methods for Robot Motion Planning
Awards: Dean's Fellow (Rossin College Doctoral Student Support Program)
Related Coursework: Robot Motion Planning and Control, Convex Optimization, Linear Systems and Control, Geometric Control of Robotic Systems, Analytical Methods in Dynamics and Vibrations, Differential Geometry I

Worcester Polytechnic Institute, Worcester, MA   Graduated May 2021
MS in Robotics Engineering
MS Thesis: Region-based Planning for a 3D In-Hand Manipulation Platform Leveraging Variable Friction Fingers and External Surfaces
Awards: 2nd Place at WPI Graduate Research Innovation Exchange, WPI Robotics Engineering Graduate Student Travel Award (for presenting at the American Control Conference 2021)
Related Coursework: Artificial Intelligence, Robot Dynamics, Robot Control, Optimal Control

Bogazici University, Istanbul, Turkey   Graduated June 2019
BS in Mechanical Engineering
Senior Project: Design and Development of an Optical Force Sensor for an Extensible Colonoscopy Robot

RESEARCH EXPERIENCE

Autonomous and Intelligent Robotics Lab   Aug. 2021 – Present
Lehigh University, Bethlehem, PA
Search-Based Multi-Path Planning
- Developed a search-based planning algorithm that enables the systematic computation of multiple locally optimal paths. The algorithm generalizes to robot configuration spaces with complex topology and geometry and finds a larger number of paths up to 3 times faster than sampling-based methods.
- Implemented the algorithm in C++, with visualizations created using OpenCV, OpenGL, and Blender.
- Deployed the algorithm for the autonomous navigation of a tethered quadrotor in 3D environments with obstacles.
- Conducted real-robot experiments using the OptiTrack motion capture system and the Crazyflie quadrotor platform.
- Implemented path tracking and collision avoidance algorithms for Freenove mobile robots to demonstrate the use of multi-path planners in congestion reduction, achieving up to 50% decrease in average travel times.

Kinematic Control Framework for FLX BOT
- Developed an optimization-based real-time controller that addresses the control challenges near the singular configurations of the FLX BOT, a user teleoperated inspection robot.

Network Graph Optimization for Resonance Reduction
- Developed a second-order dynamics model of signal transmission on a network graph.
- Implemented an algorithm that estimates and minimizes the vulnerability of a network against adversarial resonance attacks via MATLAB Optimization Toolbox.
- Achieved up-to 40% reduction in signal amplitude in a mobile robot network under attack and up-to 60% reduction in a Facebook Social Graph Dataset.

Manipulation and Environmental Robotics Lab   Jan. 2020 – June 2021
Worcester Polytechnic Institute, Worcester, MA
Region-based Planning for 3D Within-Hand-Manipulation via Variable Friction Fingers and Extrinsic Contacts

- Designed a region-based cost function and developed an A*-based motion planning algorithm that computes a sequence of manipulation primitives for a robotic manipulation platform featuring a Franka Emika Panda arm and a variable friction gripper
- Conducted simulated experiments using ROS and Gazebo, creating custom plugins to simulate the variable friction mechanism, and developing user interfaces using Qt for gripper control and parameter tuning
- Implemented the motion planning algorithm in Python and conducted real robot experiments integrating it with MoveIt to control the Panda arm and the gripper
- Presented the work at the IEEE Conference on Robotics and Automation (ICRA 2021)

Robotics, Mobility and Cyber-physical Systems Lab   May 2020 – June 2021
Worcester Polytechnic Institute, Worcester, MA
Development and Benchmarking of Feedback-Based Dynamic Data Acquisition Methods
- Developed a feedback-based dynamic feature selection algorithm, a reinforcement learning approach that dynamically collects data and revises its policy based on performance in supervised learning tasks, implemented using Python and the scikit-learn library
- Created a benchmarking tool to evaluate the performance of dynamic data collection policies
- Presented findings at the IEEE American Control Conference (ACC 2021) and SAE WCX 2021 Digital Summit

PUBLICATIONS

[1] **A. Sahin**, N. Kozachuk, R. S. Blum and S. Bhattacharya, "Spectrum Optimization of Dynamic Networks for Reduction of Vulnerability Against Adversarial Resonance Attacks," Front. Complex Syst. 3:1575210, https://doi.org/10.3389/fcpxs.2025.1575210

[2] **A. Sahin** and S. Bhattacharya, "Topo-Geometrically Distinct Path Computation Using Neighborhood-Augmented Graph, and Its Application to Path Planning for a Tethered Robot in 3-D," IEEE Transactions on Robotics, vol. 41, pp. 20-41, 2025, https://doi.org/10.1109/TRO.2024.3492386

[3] **A. Sahin**, S. Brawner, M. Bilsky and S. Bhattacharya, "Real-Time Joystick-based Kinematics Control of a Snake-like Robot with Robustness Near Singular Configurations," 2024 IEEE Conference on Control Technology and Applications (CCTA), Newcastle upon Tyne, United Kingdom, 2024, pp. 663-668, https://doi.org/10.1109/CCTA60707.2024.10666648

[4] Z. Wang, **A. Sahin** and X. Zeng, "Efficient Data Collection for Connected Vehicles With Embedded Feedback-Based Dynamic Feature Selection," in IEEE Transactions on Intelligent Vehicles, vol. 9, no. 1, pp. 2509-2519, Jan. 2024, https://doi.org/10.1109/TIV.2023.3314788

[5] X. Wang, **A. Sahin**, and S. Bhattacharya, "Coordination-free Multi-robot Path Planning for Congestion Reduction Using Topological Reasoning," Journal of Intelligent & Robotic Systems, vol. 108, no. 3, p. 50, Jul. 2023, https://doi.org/10.1007/s10846-023-01878-3

[6] **A. Sahin**, A. J. Spiers and B. Calli, "Region-Based Planning for 3D Within-Hand-Manipulation via Variable Friction Robot Fingers and Extrinsic Contacts," 2021 IEEE International Conference on Robotics and Automation (ICRA), Xi'an, China, 2021, pp. 6549-6555, https://doi.org/10.1109/ICRA48506.2021.9561376

[7] **A. Sahin** and X. Zeng, "Feedback-Based Dynamic Feature Selection for Constrained Continuous Data Acquisition," 2021 American Control Conference (ACC), New Orleans, LA, USA, 2021, pp. 3507-3512, https://doi.org/10.23919/ACC50511.2021.9483180

[8] **A. Sahin** and X. Zeng, "A Framework for Benchmarking Feedback-Based Dynamic Data Collection Methods in Connected Vehicle Networks," SAE Technical Paper 2021-01-0184, 2021, https://doi.org/10.4271/2021-01-0184

INDUSTRY EXPERIENCE

Tooling Process and Design Intern   Jan. 2019 – Feb. 2019
Beycelik GESTAMP Teknoloji ve Kalip A.S., Bursa, Turkey
- Observed and participated in the design procedures of steel stamping dies in CATIA V5

Press and Die Production Intern   June 2018 – July 2018
TOFAS Turk Otomobil Fabrikasi A.S., Bursa, Turkey
- Automated the process capability reporting procedures for the stamped automobile parts using Office VBA
- Gave a presentation on Lean Production and Six Sigma

Process Engineering Intern   July 2017 – Aug. 2017
GESTAMP Metalbages, Santpedor, Spain
- Studied types of sheet metal forming lines including progressive dies and transfer dies featuring robotic arms

LEADERSHIP, OUTREACH and SERVICE

Scholarly Reviewer │ IEEE Publications   May 2023 – Present
- Conducted scholarly reviews for the journals and conferences: IEEE Robotics and Automation Letters, IEEE Transactions on Intelligent Vehicles, IEEE Transactions on Robotics, IEEE International Conference on Robotics and Automation

Robotics Activity Organizer │ CHOICES, Lehigh University   June 2022 and June 2023
- Lead a team of graduate students in developing an interactive capture the flag game using mobile robots equipped with raspberry pi
- Designed a user friendly interface for observing and commanding the robots through a mouse and a keyboard
- Supervised 20+ middle school students, who successfully navigated robots to their goals as a part of the activity

MS Trainee │ FORW-RD NSF NRT Program, Worcester Polytechnic Institute   Aug. 2020 – May 2021
- Completed a course on Robot/AI Ethics, featuring discussions on the communication of ethical and societal impacts of scientific research and technology development
- Participated in seminars and workshops focusing on user experience design and applications
- Authored a broader impacts chapter as a part of the MS Thesis, focusing on the societal and ethical implications of the work

Vice President and Diving Instructor │ Underwater Sports Club, Bogazici University   May 2016 – July 2019
- Provided theoretical and in-water diving training across various certificate levels in CMAS
- Organized (transportation, accommodation, diving) 50+ people diving trips in Turkey as a member of the club board
- Managed and maintained club-owned diving equipment including breathable air cylinders, regulators, buoyancy vests, air compressors

SKILLS

Computer skills: MATLAB, C++, Python, HTML, CSS, Mathematica, Qt, OpenCV, OfficeVBA
Software: SolidWorks, ROS, Gazebo,
Drawing and Typesetting: Inkscape, Office, Latex
Manufacturing: Silicone molding, Plastic injection, General machine shop skills
Language proficiency: English (fluent), Turkish (native), German (intermediate)