Siddharth Singh

Ph.D. Candidate in Robotics · University of Virginia

122 Engineer's Way, Charlottesville, VA, 22903

+1 669-210-7505 | sks4zk@virginia.edu | https://30siddharth.github.io/portfolio/

Summary

I am a Ph.D. candidate at the University of Virginia, researching on developing solutions that can generalize to real-world environments. My research encompasses learning based methods, classical methods and/or a combination of both. With expertise across the complete robotics motion planning stack, I bring in-depth knowledge spanning mechatronics, product design/fabrication, and computer vision additional to my knowledge and experience in control theory and planning, all grounded in a solid theoretical foundation. My extensive teaching experience further reflects my commitment to knowledge sharing and academic leadership.

Research Areas: Robotics for Manufacturing, Robotic Manipulation, Reinforcement Learning, Long Horizon TAMP, LfD, Motion Planning, Predictive Control, 3D Reconstruction, Photometric Stereo

Education

University of Virginia   *Charlottesville, VA, US*
Doctor of Philosophy, Mechanical Aerospace & Engineering   *Jan 2021 – Dec 2025 (Expected)*
- Advisor: Prof. Cindy Chang
- *Research*: Robotic Learning, Task & Motion Planning, Multi-Agent Systems

University of Pennsylvania   *Philadelphia, PA, US*
Master of Science & Engineering, Mechanical Engineering   *Aug 2018 – May 2020*
- *Research*: Predictive Control for Learning based Systems
- *Focus*: Robotics, Control Theory, Mechatronics

Netaji Subhas Institute of Technology (NSIT)   *Delhi, India*
Bachelor of Engineering, Mfg. Process and Automation Engineering   *Aug 2014 – May 2018*
- *Advisor*: Prof. Vineet Kumar and Dr. Pradeep Khanna
- *Thesis*: Non-Linear MPC for Electro-Hydraulic Actuated Active Suspension System

Skills

Programming Languages: Python, C, C++, HTML, CSS, MATLAB

Softwares & Tools: Simulink, RViz, Gazebo, SolidWorks, Fusion 360, OnShape, LaTeX, Git

Library & Packages PyTorch, Tensorflow, RtabMap, MoveIt, RelaxedIK, PyBullet, MujoCo, Genesis, VMAS

Robotic Frameworks: ROS/ROS2, NavStack

Robots & Hardware: UR5/5e/10e, Kinova Gen-3, ClearPath Husky, Custom built UGVs, MiR, Intel RealSense (D435i, T265, L515), Zed-2, Ouster OS1/2

Work Experience

2021-Now	**Graduate Research Assistant**, Mechanical & Aerospace Engineering, UVA
2023-2023	**Data Science R&D Intern**, CCC Intelligent Solutions, *Remote*
2020-2020	**Graduate Research Assistant**, Electrical & Systems Engineering, University of Pennsylvania, Philadelphia, PA
2019-2019	**Li-ion Battery Research Intern**, Bosch Research, Sunnyvale, CA
2018-2020	**Lab Assistant**, Mechanical Engineering & Applied Mecahnics, University of Pennsylvania, Philadelphia, PA

Publications

JOURNALS

[J1] **Singh S.***, Yu T.*, Chang Q., Karigiannis J. & Liu S., Hybrid Robot Learning for Automatic Robot Motion Planning in Manufacturing, *Equal Contribution, Under Review, Preprint: https://arxiv.org/pdf/2502.19340*

[J2] Xu T., **Singh S.** & Chang Q., Collaborative Multi-Agent Closed-Loop Motion Planning for Multi-Manipulator Systems, *Under Review*

[J3] Xu T.*, **Singh S.*** & Chang Q., Generalizing kinematic skill learning to energy efficient dynamic motion planning using optimized Dynamic Movement Primitives, *Equal Contribution, Robotics and Computer-Integrated Manufacturing, Volume 94, 2025, 102983, ISSN 0736-5845, https://doi.org/10.1016/j.rcim.2025.102983.*

[J4] **Singh, S.**, Chang, Q. & Yu, T. (2025), Hierarchical Learning for Robotic Assembly Tasks Leveraging Learning from Demonstration. Advanced Robotics Research, 1: 2400024. https://doi.org/10.1002/adrr.202400024

[J5] Smith W., Qin Y., **Singh S.**, Burke H., Furukawa T. & Dissanayake G., A Multistage Framework for Autonomous Robotic Mapping with Targeted Metrics, Robotics 2023, 12, 39. *https://doi.org/10.3390/robotics12020039*

CONFERENCE

[C1] **Singh S.**, Xu T. & Chang Q., Collaborative motion planning for multi-manipulator systems through Reinforcement Learning and Dynamic Movement Primitives, To be presented at ICRA, IEEE 2025, Atlanta, GA, Pre-print: *https://doi.org/10.48550/arXiv.2410.00757*

[C2] Smith K., Lothrop H., **Singh S.**, & Furukawa T., Design of a Photometric Stereo Based Depth Camera for Robotic 3D Reconstruction, 2023 International Conference on Precision Engineering and Mechanical Manufacturing, Atlanta, Georgia, USA, January 11-14, 2023. *https://doi.org/10.1117/12.2675449*

[C3] **Singh S.**, Smith K. & Furukawa T., Photometric Stereo Enhanced Light Sectioning Approach for Microtexture Road Profiling, Proceedings of the ASME 2022 IDTEC/CIE Conference. St. Louis, Missouri, USA. August 14–17, 2022. *https://doi.org/10.1115/DETC2022-91154*

Projects

Deploying LfD based Motion Planning for Industrial Robots
UVA/ARM Institute

GRADUATE RESEARCH ASSISTANT
Aug 2023 – Dec 2023

- Successfully developed a PyBullet environment and implemented LfD based motion planning method for robotic bolting in automotive manufacturing line.
- Worked in collaboration with General Motors, Siemens & GE Research funded by ARM Institute; the final deliverable is successfully validated on a GM manufacturing line.

High Resolution 3D Reconstruction
UVA/Honda

GRADUATE RESEARCH ASSISTANT
Jan 2021 – Jan 2023

- Developed a mobile photometric stereo based robotic scanning apparatus for high resolution 3D reconstruction.
- Devised a novel adaptive approach to overcome diverse reflectance criteria in real-world scenes.
- Designed and developed a mobile road profiling setup for generating 3D profile up to 30 μm resolution for Honda Research; Fused feature matching to reconstruct large surfaces **[C2, C3]**.

Multi-robot Maintenance
UVA/ONR

GRADUATE RESEARCH ASSISTANT
Jan 2021 – Jun 2022

- Led a 6-member team to develop a multi-robot team for the inspection and maintenance.
- Developed motion planning, navigation, and vision stack; developed mobile-manipulator planner and controller for visual servoing **[J4]**.

Assured Autonomy
UPenn

GRADUATE RESEARCH/RESEARCH ENGINEER
Jan 2020 – Oct 2020

- System Identification for Underwater Unmanned Vehicle (UUV) in simulation.
- Validated a Neural-Network based system identification approach.
- Designed a cascaded PID controller for low-level control of UUV actuators.

NSIT Solar Car   *NSIT*
Team Lead/Engineering Lead   *May 2015 – May 2018*
- **Led a team of 30 students** to fabricate India's fastest single-seater solar electric vehicle.
- Developed novel negative die-based in house CFRP fabrication technique.
- **Raised $30,000** from government and private agencies.
- Project received special recognition from the Hon' Prime Minister of India's Office.

Awards and Fellowships

Raven Society Fellow   *UVA*
Elected by Raven Society Fellows, University of Virginia   *Fall 2024*
Oldest society at the University of Virginia. Elected by the existing members for "Service to the University and Scholastic Achievements"

SEAS Teaching Fellowship, $20000   *CTE/UVA*
Awarded by University of Virginia & Center of Teaching Excellence   *Fall 2023*
For designing and co-teaching a graduate level course "MAE 6210 Analytical Dynamics"

Link Lab - CCI Interdisciplinary Proposal Writing Competition, $2000   *CCI/UVA*
Awarded by Commonwealth Cyber Initiative (CCI) and Link Lab   *Fall 2023*
For proposal titled "Designing and Developing Texture-Aware Soft Robotics for Enhanced Tactile Perception and Manipulation"

International Student Citizen Leader Fellowship   *UVA*
Center of Contemplative Sciences & International Studies Office, UVA   *Fall 2023*
Developing a university-wide Pre-orientation program with ISO and ISSP at UVA

Link Lab Flash Talk Awardee   *UVA*
Link Lab   *Sp. 2022*
Presenting a flash talk on "High-resolution Shape from Intensity"

Presentations

Conference Presentations

S. Singh, K. Smith and T. Furukawa, " Photometric Stereo Enhanced Light Sectioning Approach for Microtexture Road Profiling, ASME IDTEC/CIE Conference. St. Louis, Missouri, USA. August 14–17, 2022

Poster Presentations

March 2024 *Leveraging Human Demonstrations for Long Horizon Robotic Assembly* at University of Virginia Engineering Research Symposium, UVA, Charlottesville, VA

October 2022 *Combining Light Sectioning and Photometric Stereo for High Resolution 3D Reconstruction* at MAE Fall Research Fair, UVA, Charlottesville, VA

Talks and Guest Lecture

February 2025 *Introduction Rotation: Rotation Matrices, Lie-Theory and Quaternions*. Guest Lecture MAE 6210 (Advanced Dynamics) at UVA, Charlottesville, VA

November 2024 *Jack of all Trades: MPC v/s RL*, STEM Communication Practice at UVA, Charlottesville, VA

March 2022 *MATLAB Tools & Tips for Image Processing* at Link Lab at UVA, Charlottesville, VA

Mentoring

2020-2023	**William Smith**, Research Scientist, ARA	*M.S., UVA*
2021-2023	**Julia Rudy**, Researcher, Naval Research Lab	*M.S., UVA*
2022-2023	**Gilchrist Johnson**, Ph.D. Student at CalTech	*B.S., UVA*
2021-2022	**Hudson Burke**, M.S Student at UVA	*B.S, UVA*
2021-2023	**UVA Solar Car**, Mentored a team of undergrads to build and participate in the US-FSGP	*UVA*
2021-2023	**Honda/UVA**, Mentored two M.S. students to build a mobile Photometric stereo setup	*UVA*

Volunteering & Service

OUTREACH & VOLUNTEERING

• C'ville High School - Link Lab Volunteering, (UVA)	2025
• International Student Liasion, GESC (UVA)	2023-2024
• International Student Volunteer, GESC (UVA)	2022-2023
• Social Chair, MAE-GSB (UVA)	2021-2022
• Panel Speaker, CALEC TAGS Workshop (UVA)	2023, 2024
• Panel Speaker, ISSP Pre-Arrival Orientation (UVA)	2023, 2024

JOURNAL & LETTERS PEER REVIEW

- Signal, Image and Video Processing, Springer Nature
- Robotic Automation Letters, IEEE
- Transactions on Automation Science and Engineering, IEEE

CONFERENCE PEER REVIEW

- IEEE ICRA - 2021, 2022, 2023, 2024
- IEEE IROS - 2022, 2023
- ASME IDETC/CIE - 2022, 2023

Teaching Experience

TEACHING ASSISTANT

Sp. 2024	**MAE 3820**, Aerodynamics Lab	*UVA*
Fall 2023	**MAE 6210**, Analytical Dynamics, **Co-Instructor - CTE Fellow**	*UVA*
Sp. 2023	**MAE 2330**, Mechanics Lab	*UVA*
Fall 2022	**MAE 6592**, Experimental Robotics	*UVA*
Sp. 2022	**MAE 6260**, Robotic Autonomy	*UVA*
Fall 2021	**MAE 6592**, Experimental Robotics	*UVA*
Fall 2021	**MAE 4620**, ME Design Capstone I	*UVA*

GRADER

Fall 2024	**MAE 2320**, Dynamics	*UVA*
Sp. 2020	**ESE 619**, Model Predictive Control	*UPenn*
Fall 2019	**ESE 615**, Non-Linear Control	*UPenn*