

# Siddharth Singh

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📄 <https://30siddharth.github.io/>

## Summary

My research focuses on developing solutions for robotic problems which can be implemented in real-life environments. The emphasis of my research is to reduce computation for long horizon planning tasks by leveraging human demonstrations, diffusion models and hierarchical learning.

## Education

- 2021 – 2025 **University of Virginia**, Mechanical & Aerospace Engineering  
**Doctoral Student**, Advisor: *Prof. Cindy Chang*  
*Research*: Robotic Learning, Task & Motion Planning, Multi-Agent Systems
- 2018 – 2020 **University of Pennsylvania**, Mechanical Engineering & Applied Mechanics  
**Master's Science & Engineering**  
*Focus*: Robotics, Control Theory, Mechatronics
- 2014 – 2018 **University of Delhi (NSIT)**, Manufacturing Process & Automation Engineering  
**Bachelor's in Engineering**  
*Thesis*: Non-Linear MPC for Electro-hydraulic Actuated Active Suspension System

## Work Experience

- June 2023 - **CCC Intelligent Solutions**, *Data Science R&D Intern*, Charlottesville, VA.  
Aug 2023 Designing streamlined software system for image based Labour Hour and Repair Cost prediction using AI tools
- Jun 2020 - **University of Pennsylvania**, *Research Engineer*, Philadelphia, PA.  
Oct 2020 Developing a MPC and cascaded PID controller for an UUV in simulation.
- Jun 2019 - **Bosch Research LLC**, *Li-ion Battery HIL Testing Intern*, Sunnyvale, CA.  
Aug 2019 Developed a Matlab software pipeline for processing with interactive GUI for analysis of experimental data of Li-ion battery cycling tests
- Oct 2018 - **University of Pennsylvania**, *Lab Assistant*, Philadelphia, PA.  
Dec 2019 Digital archiving lab design as interactive CAD models; worked with lab manager to design new experimental setup; maintained lab inventory and supplies

## Awards

- Raven Society Fellow (UVA) - For extraordinary service to UVA 2024
- SEAS Teaching Fellowship (UVA) Fall 2023
- Link Lab/CCI Interdisciplinary Research Proposal (\$2000) (UVA) Spring 2023
- International Student Citizen Leader Fellowship (UVA) Fall 2022
- Link Lab Flash Talk Awardee (UVA) Spring 2022

## Skills

- Research Areas** Robotic Manipulation, Reinforcement Learning, Long Horizon TAMP, LfD, Motion Planning, Predictive Control, 3D Reconstruction, Photometric Stereo
- Programming Languages** Python, C, C++
- Softwares & Tools** Matlab,  $\LaTeX$ , SolidWorks, Simulink, CoppeliaSim, Issac Sim, RViz, Gazebo, PyTorch, Tensorflow
- Robotic Frameworks** ROS/ROS2, PyBullet, NavStack, RtabMap, MoveIt, RelaxedIK
- Robots & Hardware** UR5/5e/10e, Kinova Gen-3, ClearPath Husky, Custom built UGVs, Intel Realsense (D435i, T265, L515), Zed-2, Ouster OS1/2

## Projects

- 2023-2023 **Deploying LfD for Industrial Robots**, Graduate Research Assistant, UVA/ARM Institute.  
Successfully developed a PyBullet environment and implemented LfD based motion planning method for robotic bolting in automotive welding robot; worked in collaboration with General Motors, Siemens & GE Research funded by ARM Institute; the final deliverable is successfully implemented on a GM manufacturing line.
- 2021-2023 **High Resolution 3D Reconstruction**, Graduate Research Assistant, UVA/Honda.  
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 upto 30  $\mu m$  resolution for Honda Research; Fused feature matching to reconstruct large surfaces [C1, C2].
- 2021-2022 **Multi-robot Maintenance**, Graduate Research Assistant, UPenn.  
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 [J3].
- 2015-2018 **NSIT Solar Car**, Team Lead/Engineering Lead, NSIT.  
Led a team of 30 students to fabricate India's fastest single-seater solar electric vehicle; developed novel negative die CFRP fabrication technique; raised \$30,000 from government and private agencies; project received special recognition from the Honorable Prime Minister of India.

## Selected Publications

- [J1] Xu T., **Singh S.**, Chang Q., Generalizing kinematic skill learning to energy efficient dynamic motion planning using optimized Dynamic Movement Primitives *Under Review, Equal Contribution*
- [J2] **Singh S.**, Chang Q., Tian Y., Hierarchical Learning for Robotic Assembly Leveraging LfD *Under Review*
- [J3] 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>
- [C1] **Singh S.**, Xu T., Chang Q., Collaborative motion planning for multi-manipulator systems through Reinforcement Learning and Dynamic Movement Primitives, *Under review*
- [C2] **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.
- [C3] 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

## Teaching

### Teaching Assistant

- Fall 2023 MAE 6210 (UVA) (**Co-Instructor**, UVA) - Analytical Dynamics
- Fall 2023 MAE 2330 (UVA) - Mechanics Lab
- Fall 2022 MAE 6592 (UVA) - Experimental Robotics
- Spring 2022 MAE 6260 (UVA) - Robotic Autonomy
- Fall 2021 MAE 6592 (UVA) - Experimental Robotics
- Fall 2021 MAE 4620 (UVA) - ME Design I
- Spring 2021 MAE 4710 (UVA) - Mechatronics

### Grader

- Spring 2024 MAE 2320 (UVA) - Dynamics
- Spring 2020 ESE 619 (UPenn) - Model Predictive Control
- Fall 2019 ESE 615 (UPenn) - Non-linear Control

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## Services

### Journal Peer Review

Signal, Image and Video Processing, Springer Nature

Robotic Automation Letters, IEEE

Transactions on Automation Science and Engineering, IEEE

### Conference Peer Review

2023 ICRA, IROS, IDETC/CIE

2022 ICRA, IROS, IDETC/CIE

2021 ICRA

### Volunteering

2023-2024 International Student Liaison, GESC (UVA)

2022-2023 International Student Volunteer, GESC (UVA)

2021-2022 Social Chair, MAE-GSB (UVA)