

# Siddharth Singh

122 Engineer's Way, Charlottesville, VA

☎ Contact: 669-210-7505

✉ sks4zk@virginia.edu

📄 <https://30siddharth.github.io/>

## Summary

I specialize in developing robotic solutions for real-world environments, emphasizing computational efficiency in long-horizon planning tasks. My research leverages human demonstrations, diffusion models, and hierarchical learning to create scalable, efficient systems. With expertise across the complete solution stack, I bring in-depth knowledge spanning mechatronics, product design, and computer vision, all grounded in a solid theoretical foundation. My extensive teaching experience further reflects my commitment to knowledge sharing and academic leadership.

## 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

## 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, L<sup>A</sup>T<sub>E</sub>X, SolidWorks, Simulink, CoppeliaSim, 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, ESP32, Arduino

## Projects

- 2023-2023 **Deploying LfD based Motion Planning 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; worked in collaboration with General Motors, Siemens & GE Research funded by ARM Institute; the final deliverable is successfully validated 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 Hon' Prime Minister of India's Office

## 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

## 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 for long-horizon motion planning and cascaded PID controller for low-level actuator control of an Unmanned Underwater Vehicle 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 Building interactive CAD models of experimental setup mechanisms; worked with lab manager to design new experimental setups; maintained lab inventory and supplies

## Teaching

### Teaching Assistant

- Fall 2023 MAE 6210 (UVA) - Analytical Dynamics - (**Co-Instructor**)  
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

## Awards & Fellowships

- Raven Society Fellow (UVA) Fall 2024  
- \*For extraordinary service and scholastic achievements at UVA
- 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

## Talks & Posters

- March 2024 Leveraging Human Demonstrations for Long Horizon Robotic Assembly - *UVA Engineering Research Symposium (Poster)*
- Oct 2022 Combining Light Sectioning and Photometric Stereo for High Resolution 3D Reconstruction - *MAE Fall Research Fair (Poster)*
- Feb 2022 Structure from Intensity: High Precision 3D Reconstruction - *Link Lab Flash Talks (Awardee)*
- Feb 2022 Structure from Intensity: High Precision 3D Reconstruction - *MAE Graduate Seminar Speaker*

## Service & Volunteer

### Journal Peer Review

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

### Conference Peer Review

- ICRA, IROS, IDETC/CIE 2023
- ICRA, IROS, IDETC/CIE 2022
- ICRA 2021

### Volunteering

- International Student Liaison, GESC (UVA) 2023-2024
- International Student Volunteer, GESC (UVA) 2022-2023
- Social Chair, MAE-GSB 2021-2022
- Panel Speaker TAGS Workshop, CALC-UVA 2022-2024