Shlok Agarwal

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EDUCATION

MS in Robotics Engineering **2016-2018**
Worcester Polytechnic Institute, MA, USA *GPA: 3.8/4.0*

BTech Mechatronics **2010-2014**
Manipal Institute of Technology, India *GPA: 3.6/4.0*

EXPERIENCE

Sr Controls Engineer, Low-Level Software Lead **November 2024- Present**
Ghost Robotics, Philadelphia

- Developed the arm behavior development for door opening, stowage, payload tuning and enhanced the joint-level torque safety algorithms.
- Directed software release planning and testing along with resolving high-priority customer support tickets.

Senior Behavior and Controls Engineer **March 2021- November 2024**
Ghost Robotics, Philadelphia

- Maintained and improved the recovery controller and self-righting behaviors with continued performance improvements.
- Managed interface between low-level software and autonomy stack, including diagnostics and docking integration.
- Led development of blind gait strategies and auto-transition behaviors for steep inclines, enabling critical defense base demos.
- Built a proprioceptive force observer for contact detection and helped transition behaviors to a whole-body control framework (WBC).
- Represented the company in high-stakes defense demos, international deployments, and technical conferences.
- Led development of adaptive, sensor-free gaits using proprioception to traverse stairs, curbs, and 45-degree slopes without visual data.
- Integrated and tuned the arm control stack for behaviors like door opening, sit-stand transitions, and teleoperated bomb defusal missions.
- Created a new finite state machine (FSM) to better coordinate all the leg and body reflexes.
- Maintained the high level mode behavior FSM and added extended support for key mode transitions across locomotion and manipulation tasks.
- Provided hands-on support and custom behavior solutions to major defense and industrial clients including the US Air Force, Australian Army, and Verizon.
- Mentored new hires and contributed to internal tooling, debugging, and release documentation workflows.

- Coordinated logistics and demos during two strategic visits to India, contributing to successful field trials and order of 100 robots.

Behavior and Controls Engineer **June 2018- March 2021**
Ghost Robotics, Philadelphia

- Designed and implemented recovery behaviors, including robust self-righting algorithms across various fall configurations.
- Developed early versions of proprioceptive gait algorithms for stairs, hills, curbs, and slippery terrains.
- Developed blind reflexes and terrain-agnostic locomotion for obstacle courses and real-world testing environments.
- Designed a two-stage recovery framework to stabilize the robot post-disturbance and perform full-body self-righting.
- Contributed to optimization-based stance control and parametric Cartesian swing trajectory modules for gait generation.
- Improved swing leg tracking and contact detection by refining the robot's dynamic leg model for better terrain adaptability.
- Participated in robot assembly, repair, field testing, and QA for early deployments of the Vision series robot.
- Supported initial field deployments and testing efforts across multiple terrains and use cases.

Design Engineer, Mechatronics **Sept 2014- July 2016**
Sirena Technologies, Bangalore, India

- Designed the structural CAD model and formulated a ZMP based walking controller for the 16 DOF humanoid Nino.
- Contributed to design, analysis, vendor management and procurement for motors, enclosures and gears.

CORE COMPETENCIES

Robot dynamics and kinematics ■ legged locomotion control ■ legged gait design ■ proprioceptive control ■ trajectory optimization ■ whole-body control ■ self-righting and recovery behaviors ■ state estimation ■ sensor fusion ■ motion planning ■ behavior state machines (FSMs) ■ arm-manipulation control ■ embedded systems for robotics ■ real-time control architecture ■ simulation and hardware testing ■ ROS/middleware interfaces ■ C++ ■ Python ■ bash ■ CI/CD ■ AWS

PEER REVIEWED PUBLICATIONS

1. V Jagtap, **S Agarwal**, A Wagh, M Gennert. *Transportable open-source application program interface and user interface for generic humanoids: TOUGH.* International Journal of Advanced Robotic Systems, 2020
2. **S Agarwal**, M Popovic. *Study of toe joints to enhance locomotion of humanoid robots.* 2018 IEEE-RAS 18th International Conference on Humanoid Robots (Humanoids)

3. V Jagtap, **S Agarwal**, S Nirmal, S Kejriwal, MA Gennert. *Extended State Machines for Robust Robot Performance in Complex Tasks*. 2018 IEEE-RAS 18th International Conference on Humanoid Robots (Humanoids)
4. C Mummolo, WZ Peng, **S Agarwal**, R Griffin, P Neuhaus, J H Kim. *Stability of mina v2 for robot-assisted balance and locomotion.* Frontiers in neurorobotics, 2018
5. **S Agarwal**, A Mohan, K Kumar. *Design and fabrication of twinrotor UAV*. Comput. Sci. Inf. Technology, 2013
6. **S Agarwal**, A Mohan, K Kumar. *Mathematical Modeling and Control System Design of Tiltrotor UAV*. International Journal of Scientific & Engineering Research, 2013

PEER REVIEW ACTIVITY

1. Reviewer in peer-reviewed journal**, Transactions on Control Systems Technology** (3 papers reviewed, 2025/26)**. Impact factor of journal (2025): 4.9**
2. Reviewer in peer-reviewed journal**, IEEE Robotics and Automation Letters** (4 paper reviewed, 2022/23, 2025/26)**. Impact factor of journal (2023): 4.6**
3. Reviewer in peer-reviewed conference**, International Conference on Intelligent Robots and Systems** (1 paper reviewed, 2025/26)**. H-index (2025): 160 and #5 in top robotics conferences in google scholar**
4. Reviewer in peer-reviewed conference**, IEEE Conference on Decision and Control** (6 papers reviewed, 2025/26)**. H-index (2025): 144 and #15 in top automation and controls conferences in google scholar**
5. Reviewer in peer-reviewed conference**, Modeling, Estimation and Control Conference** (2 papers reviewed, 2025/26)**. H-index (2025): 56 and #10 in top automation and controls conferences in google scholar**
6. Reviewer in peer-reviewed conference**, ACM Special Interest Group on Computer-Human Interaction** (4 papers reviewed, 2025/26)**. H-index (2025): 129 and #1 in top human computer interaction conferences in google scholar**

HONORS AND AWARDS

- Finalist in **NASA Space Robotics Challenge,** Houston 2017.

TEACHING EXPERIENCE

- **Assisted in teaching the** course RBE 500 Foundations of Robotics **in Spring 2018** at Worcester Polytechnic Institute.
    - Assisted in teaching topics such as Probability Concepts, Sensor Fusion, Localization and Mapping and Robot Motion during office hours
    - Delivered a lecture on Introduction to Robot Operating System (ROS).

PROFESSIONAL AND DEVELOPMENT ACTIVITIES

<u>Professional Organizations</u>

- Associate Editor for 2025 IEEE/ASME International Conference on Advanced Intelligent Mechatronics
- IEEE Senior Member (2023 onwards)
- Technical Program Committee for 2025 IEEE International Conference on Advanced Robotics and its Social Impacts
- Judge for Society of Women Engineers Rising Technical Contributor Award

Professional Meetings Attended

- Dynamic Walking 2024
- ICRA 2023
- Humanoids 2018
- Dynamic Walking 2018