

## Education

### **Worcester Polytechnic Institute**

Master of Science in **Robotics Engineering** (In progress)

GPA: 3.83/4.00

Worcester, Massachusetts

*August 2022 - May 2024*

### **Sardar Patel College of Engineering (University of Mumbai)**

Bachelor of Technology in **Mechanical Engineering**

Capstone Project: Design and Development of an Autonomous Cooking System

CPI: 8.95/10.00 (Class Representative)

Mumbai, India

*August 2018 - May 2022*

---

## Technical Skills

**Computers:** Python, C, C++, Java, Arduino, MATLAB, Simulink, Bash, Embedded C, LaTeX, ROS/ROS2, Gazebo, WeBots, MS Excel, OpenCV2, Point Cloud Library, TensorFlow, Numpy, PyGame, Git, OOP, Linux/Unix, Windows, Deep Learning, Machine Learning, Reinforcement Learning, Computer Vision, TCP/IP & UDP, Socket Programming

**Electronics and Electrical:** Arduino, Embedded C, Motor Drivers, Servo Motor Control, Stepper Motor Control, ESC for BLDCs, SMPS, Sensors and Sensor Fusion, Control System Design, Automation Engineering, Electro-mechanical Systems, Actuators

**Mechanical:** Ansys, ADAMS, SolidWorks, Creo, AUTOCAD, FluidSim, CURA, PLC/HMI Programming, Fast Prototyping, 3D Printing, Pneumatics/Hydraulics, GD&T, Mechanical Drawings, BOMs

---

## Work Experience

### **Void Robotics**

*Robotics Software Intern*

Marathon, Florida

*September-December 2023*

- Enhanced delivery robot localization accuracy by implementing ZED and F9P GPS-based odometry fusion, contributing to robust localization results that aided the sales team in raising \$6 million in funding.
- Integrated RTK technology, setting up rover and base stations, to further refine localization precision from 6 meters to 0.03 meters.
- Orchestrated communication and control pipelines using Micro ROS and Blynk IoT in a multi-site team, streamlining project communication by reducing the processing time by 30% and reduced hardware costs by 10%.
- Collaborated with various teams to identify and resolve system integration issues, ensuring seamless operation of navigation and control systems, leading to a 15% increase in efficiency.

### **The Innovation Story, Mumbai**

*Robotics Mechanical Engineer Intern*

Mumbai, India

*October-December 2021*

- Led the design and fabrication of a modular pick and place tele-op robot for educational purposes using SolidWorks and Arduino Uno with Wi-Fi module, resulting in a successful functional prototype which improved conceptual understanding based on 20% improvement in average feedback rating.
- Conducted workshops and training sessions on robot operation and design for local students, enhancing their technical skills and future prospects in STEM.

### **Bridgestone India Pvt Ltd**

*Mechanical R&D Intern*

Pune, India

*June-September 2021*

- Contributed to a research initiative investigating the correlation between manufacturing stresses and early tire wear. Utilized APDL scripting in Ansys for advanced material analysis and conducted in-depth analysis of over 200 customer feedback reports on tire wear patterns. This comprehensive approach led to identifying a lack of significant correlation, guiding strategic decisions and preventing unnecessary process upgrades, saving potential costs of \$20,000-\$50,000.
- Collaborated within a multi-disciplinary team on a complex project, focusing on effective communication and data integration. Demonstrated skills in interfacing with various engineering teams and departments, ensuring a high tolerance for ambiguity in project outcomes. This collaborative effort ensured the successful navigation of project challenges and contributed to the team's collective achievements.

---

## Achievements and Publications

### **Publications:**

Mepani, M. M., Gala, K. B., Mishra, T. A., Bhole, K. S., Gholave, J., & Daingade, S. (2022). Design of robot arm for domestic culinary assistance. *Materials Today: Proceedings*, 68, 1930-1945.

Bhoir, A. A., Mishra, T. A., Narayan, J., & Dwivedy, S. K. (2023). Machine Learning Algorithms in Human Gait Analysis. In *Encyclopedia of Data Science and Machine Learning* (pp. 922-937). IGI Global.

**DD-Robocon:** Collaborated in a team of 20 students to earn National Rank 1 in Round 1 in 2019 and 2021. Rank 9 attained in the Final Round in 2019 and 2020, special prize for Best Solution Idea, 2019.

---

## Projects

### **Design and development of an autonomous cooking system**

*January-June 2022*

- Collaborated in a team of 3 to build a 5 DOF Robot arm starting from conceptual design and conceptual generation including CAD Modeling, Machining, Electronic circuits, and Control algorithms along with subsidiary systems to enable cooking actions.
- Applied different software at various levels of development including SolidWorks, Ansys and WeBots (for simulation).
- Optimized linkage cross section and longitudinal section area and consequently, overall weight using stochastic optimization over preset parameters and verified the same using FEA on Ansys
- Overall decrease of 30% in cost with comparable systems despite prototyping overruns and higher versatility

### **Soft Gripper Design for a Soft Robot @ WPI Manipulation and Environmental Robotics Lab**

*June-August 2023*

- Fabricated a soft finger gripper for a soft robot with 20% lower weight than comparable mechanisms
- Devised a mounting and actuation system for the same emphasizing modularity and weight using a press-fit design via SolidWorks.
- Fabricated mount and subsidiary parts using 3D printing, improving grip stability without a significant weight increase.

### **SCARA Robot Control using ROS2 and Gazebo**

*November-December 2022*

- Collaborated in a team of 3 to implement velocity-based and position-based controllers for a 3DOF SCARA Robot from scratch.
  - Implemented PID control for position/velocity using ROS service to accept values and perform analytical inverse kinematics.
- Pick and place on a UR5e robot using ROS and node based networking** *October-December 2022*
- Collaborated in a team of 5 to implement pick and place operations on a real UR5e robot.
  - Used `ur_robot_driver` ROS library to interface with the robot through a static network address.
  - Derived forward kinematic equations from scratch and used Newton-Raphson for numerical inverse kinematics.
- RRT Based Motion Planner for pick and place on a UR5e robot** *March-April 2023*
- Implemented a MATLAB simulation of RRT based motion planning on UR5e in the presence of obstacles.
  - Performed collision detection and used numerical inverse kinematics for pose estimation.
- Grasp Generation using Point Cloud data and Robot Control Using Visual Servoing** *September-October 2023*
- Utilized Point Cloud library and ROS2 to process point cloud data from a simulated RGB-D camera (RANSAC, DBSCAN, etc)
  - Applied grasp quality metrics and grasp matrix to a parallel jaw gripper to synthesize effective grasping points for objects.
  - Implemented robot control using the analytical Jacobian for a 2D RRBot, and feedback using image features to achieve the grasp.
- Parallel Parking Non-Holonomic Motion Planner using Hybrid A\*** *February-March 2023*
- Developed a 2D environment from scratch using PyGame to simulate a car moving in an environment with obstacles.
  - Enabled convex polygon collision detection using separating axis theorem and optimized calculations by 60%.
  - Developed a kinematically consistent motion planner to park the car between 2 obstacles using hybrid A\*.
- Deep Q-Learning based model for controlling a car in a 2D Environment** *November-December 2022*
- Collaborated in a team of 4 to implement a deep reinforcement learning model that drove a car on a racetrack with other cars
  - Used TensorFlow and OpenAI Gym to build the model and generate the environment respectively.
  - Devised a novel exploration strategy using q-values as probability measures for each action that improved performance by 3%.
- Tool changing mechanism for a PLC integrated Manufacturing System** *July-September 2023*
- Collaborated on the development of a tool changing system for a robotic arm
  - Integrated an ABB IRB 1600 robotic arm as the core element and engineered a tool changer mechanism for efficient tool swapping, achieving enhanced system flexibility.
  - Programmed the ABB IRB 1600 arm using Robot Studio, implemented control systems with a Programmable Logic Controller (PLC) to ensure precise gripper jaw motion, and managed logical statements for safety and operational limits.
- Impact Launching (Kicking) Mechanism for a Mobile Robot** *September 2019-June 2020*
- Designed, engineered, simulated, and methodically validated a precision-oriented mechanism for propelling an object (football)
  - Employed software applications like SolidWorks, Ansys, Adams, and Webots at different development stages.
  - Introduced design adjustments backed by calculations that improved the range by 12% and achieve a 15m range benchmark.
-