Pradnya Sushil Shinde

Worcester, MA 01609
Phone:(765) 532-9604 | **Mail**: pshinde1@wpi.edu | LinkedIn | GitHub | Portfolio

Education

Worcester Polytechnic Institute **Aug 2023 - May 2025**
*Master of Science in Robotics Engineering (**GPA: 4.0/4.0**)* *Worcester, MA*
Relevant Coursework: Computer Vision, Vision-based Robotic Manipulation, Motion Planning, Advanced Robot Navigation

Symbiosis Skills and Professional University **Aug 2019 - May 2023**
*Bachelor of Technology in Mechatronics Engineering (**GPA: 9.128/10.0**)* *Pune, India*

Skills

Languages: Python, C++, C
Libraries, Tools, and Software: Linux OS, ROS, ROS (2), Nav2, Gazebo, RViz, Blender, OpenCV, PCL, SLAM Toolbox, NumPy, Matplotlib, Sklearn, PyTorch, Eigen, CUDA, Git, Docker, CMake, Arduino, MATLAB, Visual Basic for Application, Solidworks, Jira, Confluence.
Hardware: Arduino, ESP32, ESP8266, Raspberry Pi, LiDAR

Experience

Graduate Student Researcher **August 2024 - Present**
Worcester Polytechnic Institute *Remote*
- Contributing to distributed SLAM for Agricultural robotics that builds upon, Kimera, an Open-Source Library for Real-Time Metric-Semantic Localization and Mapping.

Robotics Software Engineer Intern **August 2024 - Present**
Celltrio Inc. *Fremont, CA*
- **R&D**: Integrating tool transform functionality in the kinematics model of a **7-axis SCARA** robot to account for tool orientation and position, enhancing precision in end-effector manipulation for cell culture automation.

Robotics Software Engineer Intern **May 2024 - August 2024**
National Robotics Engineering Center *Pittsburgh, PA*
- Deployed a localization and mapping pipeline for a warehouse mobile manipulator, integrating perception and navigation components.
- Performed **unit testing** and **hardware-in-the-loop** validation to ensure robust performance of the robotic sub-systems.

Robotics Software Engineer Intern **June 2022 - May 2023**
Technodune Pvt. Ltd. *Pune, IN*
- Led software testing and embedded systems integration for the "**Wirelessly Controlled Bionic Arm**" and "**Real-Time Robot Localization using Vision**" projects using **Python** and **C/C++**.
- Contributed to developing: A 7DOF robotic manipulator with wireless gesture control and web interface; A real-time robot localization platform with Fiducial markers and Yolo V5, achieving **85**% accuracy in robot pose detection.

Projects

Deep and Un-Deep Visual Inertial Odometry GitHub | Python **April 2024**
- Engineered a stereo visual-inertial odometry system using the Multi-State Constraint Kalman Filter (MSCKF), optimizing real-time state estimation by fusing visual and inertial sensor data.
- Designed and evaluated deep learning-based VIO models, including vision-only, inertial-only, and visual-inertial fusion architectures, enhancing accuracy in pose estimation and sensor fusion.

Einstein Vision: A Perception Pipeline for Autonomous Vehicles GitHub | Python **April 2024**
- Integrated lane detection, pedestrian pose estimation, road sign recognition, depth estimation, object detection, and scene classification into a unified perception stack, enabling seamless environmental visualization for an autonomous vehicle.

Motion and Trajectory Tracking of Aerial Vehicle GitHub | Python **March 2024**
- Implemented state estimation and global positioning algorithms such as **EKF**, **UKF**, **Particle Filter** and **GNSS/INS** to track the motion of an aerial vehicle effectively.

SfM: Structure from Motion GitHub | Python **March 2024**
- Engineered a robust a Structure from Motion (SfM) system to reconstruct 3D scenes and estimate camera poses from a monocular camera using images from multiple viewpoints.

3D Scene Reconstruction using NeRF GitHub | Python **March 2024**
- Developed a **NeRF**-based 3D scene reconstruction pipeline using a 5D coordinate system and **MLP** to optimize scene rendering from 2D images, and applied differentiable rendering to minimize residuals between synthesized and ground truth images.

Zhang's Camera Calibration: Optimizing Distortion Correction GitHub | Python **Feb 2024**

- Computed camera Intrinsic and Extrinsic Parameters by minimizing image distortion and reprojection error to perform Zhang's **Camera Calibration** method on checkerboard images.

Homography Estimation:Classical and Deep Leaning Methods GitHub | Python **Jan 2024**

- Designed a panorama stitching algorithm with corner detection, ANMS, feature matching, and **RANSAC**; trained CNN with TensorDLT and STN to predict homography, achieving $\mathbf{3.5} - \mathbf{5.0}\%$ RMSE.

Probability-based Edge Detection: A Classical Approach to Boundary Detection GitHub | Python **Jan 2024**

- Derived a sophisticated probability-based **edge detection** algorithm by generating filter banks, half-disc masks, clustering image responses based on texture, brightness, and color features, and integrating the results with **sobel** and **canny** baselines.
- Employed k-means clustering to generate texton, brightness, and color maps, integrated with half-disc masks and weighted Canny and Sobel baselines for .

Language Embodied Indoor Navigation GitHub | Python **Dec 2023**

- Deployed an Object Navigation workflow that enables robotic agents to interpret spoken language for goal object identification and further navigation in Habitat Simulation Environment.
- Implemented path planning using **RRT*** and **A*** algorithms, coupled with the retrieval of sensory observations of RGB, depth, and semantic data during navigation towards target objects.

Rigid Body Motion Planning GitHub | Python **Oct 2023**

- Developed and optimized **RRT**, **RRT***, **Informed RRT***, and **Probabilistic Roadmap**(PRM) based path planners tailored to a point robot, a 2D omnidirectional robot, and a 4-link kinematic chain.

Vision-based Object Grasping for Robotic Manipulation assuming Symmetry GitHub | C++ **Oct 2023**

- Implemented a vision-based grasp pose analysis algorithm for effective object manipulation by processing an input depth point cloud of the object, leveraging **Gazebo** and **ROS 2**.
- Estimated a best plane fitting model to complete symmetry of point cloud and computed best grasping points on the object surface.

Miniature Hexapod GitHub | Python **May 2023**

- Developed a miniature version of Hextorq, a six-legged robot for surveillance applications integrated with an ESP32 module.
- Deviced an automated servo test setup to compare the performance of servo motors and select an optimal servo for robot mobility.

Technical Paper

Paper Title: "Marathi Sign Language Hand Gesture Recognition Using Accelerometer and 3D Printed Gloves" Paper
Status: Published in 2022 14th International Conference on Computational Intelligence and Communication Networks (CICN)
Publication Date: January 13, 2023