

# PARAMJIT SINGH BAWEJA

paramjitbaweja@cmu.edu

<https://www.linkedin.com/in/paramjitbaweja>

+1 (214) 940-9658

## EDUCATION

**CARNEGIE MELLON UNIVERSITY**, *School of Computer Science*

*Master of Science in Robotic Systems Development (MRSD)*

**Pittsburgh, PA**

*May 2025, GPA: 3.99*

**MANIPAL INSTITUTE OF TECHNOLOGY**

*B. Tech Electrical and Electronics Engineering*

*Minor Specialization in Fundamentals of Computing*

**Manipal, India**

*June 2023*

*Rank: 3/158, CGPA: 8.29/10*

## PROJECTS

**Surgical Robot for Orthopedic Surgery**

*MRSD Capstone Project in collaboration with Smith & Nephew Robotics*

**Pittsburgh, PA**

*September 2023 – December 2024*

- Developed an autonomous robotic assist for total knee arthroplasty, using a KUKA LBR Med manipulator.
- Achieved an accuracy of 2 mm and 2 degrees, utilizing consumer-grade RealSense cameras and an off-the-shelf drill mounted on a custom 3D-printed end effector, effectively eliminating invasive fiducial trackers.
- Reduced calibration error from 12 mm to under 2 mm by performing repeated intrinsic and extrinsic camera calibration and developing an auto-calibration routine for the external camera, ensuring robust patient registration.
- Registration achieved near perfect theoretical accuracy using DINO + SAM for global registration and ICP for local refinement.
- Implemented OMPL-constrained planning for predictable manipulator motion and integrated it into a hybrid planning architecture with a local planner performing real-time validity checks during execution.
- Collaborated with a 5-member agile team, adhering to robust software development practices, including Docker environments and Git-based version control, ensuring scalability, reproducibility, and efficient teamwork.

## EXPERIENCE

**ST ENGINEERING, AETHON**

*Robotics Software Engineering Intern*

**Pittsburgh, PA**

*May 2024 – August 2024*

- Developed environmental motion forecasting for hospital AMRs using point cloud-based, sensor-agnostic methods.
- Created a CPU-only algorithm that uses AMCL localization, ICP alignment, and density-based clustering, for object tracking and prediction via Hungarian algorithm and particle filtering, optimized for older robots currently deployed in the field.
- Achieved 80% accuracy in 20 real-robot tests, predicting motion up to 6 meters ahead.

**BAJAJ FINSERV HEALTH LIMITED**

*Software Intern*

**Pune, India**

*January 2023 – June 2023*

- Migrated backend from MySQL to Elasticsearch, resulting in a 60x reduction in API response time under load and no spike-related downtimes due to the 95% reduction in load on the MySQL database. Top 1% of all interns across 7 sister companies.

**MANIPAL INSTITUTE OF TECHNOLOGY**

*Undergraduate Research Assistant*

**Manipal, India**

*August 2021 – December 2022*

- Implemented a data augmentation approach mimicking human behavior of Spatial Pyramid Mapping and Super Resolution while handling fundus images, resulting in a 6% increase in accuracy for multiclass segmentation with 92 data points.
- Generated pseudo-labels to perform semi-supervised binary classification using EfficientNetb0-based U-Net model, which fetched an F1 score of 0.74, a 4.9% increase in F1 score for vessel extraction.

**UNIVERSITY OF TORONTO**, *Mathematical & Computational Sciences*

*Robotics Research Intern (MITACS Globalink)*

**Toronto, Canada**

*May 2022 – August 2022*

- Collaborated with [SickKids Toronto](#) to advance surgical subtask autonomy using the da Vinci Research Kit (dVRK).
- Designed a novel motion generator with trajectory generation and tracking with time-optimal path parameterization with a shared autonomy approach optimized for laparoscopic pattern cutting on tissue-like materials.
- Method completes FLS circle-cutting 12s faster than the manual proficiency time. Published at ISMR 2023, Atlanta. ([paper](#))

**CSIR – NATIONAL INSTITUTE OF OCEANOGRAPHY**

*Robotics Intern*

**Goa, India**

*January 2021 – March 2022*

- Developed a QT-based interface for low-bandwidth (200 b/s) serial communication between the Coral Reef Monitoring and Surveillance Robot (CBOT) and ground station, capable of lossless image transfer, to facilitate monitoring of marine life.
- Incorporated shape-fitting on the point cloud for outlier removal and used the robot's motion for 3D perception of the dock.
- Built a novel planar imaging sonar-based docking system replacing traditional systems for navigation and homing of an AUV, enabling functionality in low lighting and visibility conditions. Work published at OCEANS 2022, Chennai. ([paper](#))

## SKILLS

**Programming & Software:** Python, C, C++, Java, JavaScript

**Robotics:** ROS, Gazebo, OpenCV, RaspberryPi, Arduino, SolidWorks, Qt, TensorFlow, PyTorch, Keras, Git, Linux, PCB design

**Data Engineering:** Elasticsearch, Nest.js, Kafka, DevOps, Docker, SQL, NoSQL