

# MiHEER DIWAN

✉ [msdiwan@wpi.edu](mailto:msdiwan@wpi.edu)

📄 [miheer-diwan](#)

🔗 [miheer-diwan](#)

🌐 [miheer-diwan.github.io](#)

## Education

### Worcester Polytechnic Institute

*Master of Science in Robotics Engineering — GPA: 3.87*

May 2024

Worcester, MA

### Mukesh Patel School of Technology Management & Engineering, NMIMS University

*Bachelor of Technology in Mechatronics Engineering (Minor: Robotics & IoT) — GPA: 3.46*

Mumbai, India

## Experience

### Graduate Researcher, *Perception and Autonomous Robotics (PeAR) Group*

Aug 2023 – Dec 2023

- Developed a **Generative, Procedural environment** for quadrotor simulation and learning using Blender software.
- Employed **RRT\*** algorithm and **Minimum Snap Trajectory** generation to navigate a dense, simulated forest.
- Designed a **Model Predictive Control** for precise trajectory tracking and traversal of optimal trajectories.

### Graduate Researcher, *Embedded Computing Lab*

May 2023 – July 2023

- Developed the **perception stack** for autonomous vehicles with camera images, **LiDAR** point clouds and **Voxel Grids**.
- Estimated absolute and relative depth using both **Stereo Photogrammetry** and Intel's **MiDaS depth model**.
- Used **YOLOv8** for **Object Detection** and **Instance Segmentation** for road vehicles, traffic signs, and pedestrians.
- Detected lanes on **custom dataset** with a 97.8 % accuracy using Cross Layer Refinement Network (**CLRNet**).

### Control Systems Intern, *NMIMS University, Mumbai*

June 2021 – Nov 2021

- Conducted comprehensive research, exploring and analyzing multiple non-linear methods for BLDC motor speed control.
- Constructed a closed-loop model for **sensorless control** of BLDC motors using Back-EMF and zero-crossing detection.

## Projects

### Sim2Real Mini Drone Racing | *Github*

- Deployed algorithm on **DJI TelloEDU** drone for autonomously detecting and navigating windows and arbitrary gaps.
- Trained a custom deep-learning network using only simulated data and **domain randomization** to segment windows in the real world with an accuracy of **92 %** and determined the 3D pose with Perspective-n-Point (PnP).
- Leveraged **Optical Flow** and Spatial Pyramid Network (SPyNet) to navigate arbitrarily shaped gaps in walls.

### Classical and Deep Visual Inertial Odometry (VIO) | *Sensor Fusion, State Estimation, Kalman Filter*

- Implemented “Robust Stereo VIO for Fast Autonomous Flight” paper for a state-of-the-art sensor fusion using **MSCKF**.
- Fused camera images and IMU data using **LSTM** based network to perform state estimation in real time.

### Structure from Motion (SfM) | *Multi-View Geometry, Triangulation*

- Extracted and matched monocular camera image features using SIFT descriptors and **RANSAC** algorithm.
- Calculated the Fundamental matrix and the Essential matrix based on **Epipolar geometry** constraints and leveraged camera triangulation to determine camera poses ensuring adherence to Cheirality Condition.
- Performed **3D scene reconstruction** by refining camera poses using Bundle Adjustment and the Visibility matrix.

### Neural Radiance Fields (NeRF) and Gaussian Splatting | *Volume Rendering, CUDA Optimization*

- Implemented the original NeRF method to synthesize novel views by optimizing a continuous volumetric scene function.
- Evaluated performance against SOTA Gaussian Splatting for **real-time** radiance field rendering on **custom dataset**.

### Camera Calibration | *Corner Detection, Feature Extraction*

- Devised a robust camera calibration algorithm using Zhang's method to estimate camera intrinsics and extrinsics.
- Predicted distortion coefficients and minimized distortion errors of the camera, employing **Non-linear optimization**.

## Skills

**Robotics** : Dynamics, Controls, Computer Vision, Machine Learning, Aerial Robots, Advanced Robot Navigation

**Software** : Python, C++, ROS/Gazebo, PyTorch, OpenCV, TensorFlow, MATLAB, Docker, Git, SolidWorks

**Machine Learning Tools** : CNN, ResNet18, DenseNet, LSTM, TCN, HomographNet, Regression, Clustering, NLP

## Leadership Experience

### Co-Head: Design & Simulation Department, Team Technotix, MPSTME

2019 – 2021

- Headed a team of 15 people to develop two mobile robots: Arrow-Shooting robot and Ball-Throwing robot.
- Fabricated a custom swerve drive mechanism for the robots which provided **30 %** increase in the speed of the robots.
- Secured **India National Finalist** positions in ABU Robocon 2020 and 2021, with a flawless score in the Design Phase.