# Pushkar Dave

https://pushkardave.com

Email: pushkar@u.northwestern.edu
Mobile: (773)-997-5871

## Skills

**Programming**: Python, C, C++, MATLAB, C#, Bash, Git, Bash, Linux
**Robotics**: ROS2, ROS, MoveIt, Arduino, CoppeliaSim, Gazebo, Unity, RViz, Onshape
**Libraries**: NumPy, Matplotlib, SymPy, ModernRobotics

## Education

**Northwestern University** **September 2024 - Present**
*Master of Science in Robotics* *Evanston, IL, USA*

**Visvesvaraya National Institute of Technology** **December 2020 - May 2024**
*Bachelor of Technology in Electrical and Electronics Engineering* *Nagpur, India*

## Experience

**Multi-robot Systems Group, Czech Technical University** **May 2023 – September 2023**
*Research Intern* *Advisor: Dr. Martin Saska*

- Developed a C++ algorithm to estimate the position of a focal UAV in a swarm, mitigating noisy rangefinder data
- Integrated the novel UVDAR localization system and applied sensor fusion with a Linear Kalman Filter
- Recorded and analyzed data using rosbag and visualized UAV's tracked states with PlotJuggler

**IvLabs, VNIT** **July 2021 – October 2021**
*Summer Intern* *Advisor: Dr. Shital Chiddarwar*

- Built an MNIST digit classifier from scratch using gradient descent implemented with NumPy
- Programmed and implemented an image denoising autoencoder model on the MNIST dataset using PyTorch
- Tuned model hyperparameters by applying mini-batching, regularization techniques, and the Adam optimizer.

## Projects

**Whack A Mole with 7-DOF Robot Arm** **November 2024 - December 2024**

- Led a team of 4 in developing a Python, ROS2 package for a Franka 7-DOF robot arm to play the whack-a-mole game
- Set up serial communication between a ROS2 node and Arduino to control a servo-driven hammer end effector
- Wrote a custom Python wrapper for the MoveIt2 API to plan, inspect, save and modify the robot's trajectories

**Feedback Control of Omnidirectional Mobile Manipulator** **October 2024 - November 2024**

- Generated a trajectory for the end effector of a 5-DOF robot arm to perform a pick-and-place task in CoppeliaSim
- Simulated the kinematics of the omnidirectional robot with odometry equations to determine its next configuration
- Implemented and tuned a feed forward PI controller to minimize the error between the current and desired robot states

**Multibody Dynamics Simulation** **November 2024 - December 2024**

- Modeled a free falling jack and box system using Lagrangian mechanics with NumPy and SymPy
- Simulated impacts between the jack and box using Runge-Kutta method for integration
- Created animations of the dynamic trajectories for the jack and box using the Plotly library in Python

**Sequential Planner for Multi UAV Mobility** **August 2023 - December 2023**

- Designed a high-level sequential approach to prevent collisions between UAVs operating in the same airspace
- Tested and optimized the approach in multi-robot ground and aerial environments in MATLAB

**ESP32 based Navigation Device** **March 2023 - May 2023**

- Developed a program to showcase animations synchronized with audio signals using an ESP32 and LED matrix display
- Integrated the Waze navigation app as an audio source, transmitting data to the ESP32 for real-time navigation display
- Utilised Fast Fourier Transform (FFT) to extract frequency components from an audio sample

**Quadrotor Control and Trajectory Generation** **December 2021 - January 2022**

- Created a PD control system for 3D quadrotor in MATLAB, enabling accurate tracking of linear and helical trajectories
- Generated and visualized a minimum snap trajectory using a seventh-order polynomial for the quadrotor model