

# Pushkar Dave

<https://pushkardave.com>

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## SKILLS

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**Programming:** Python, C, C++, MATLAB, C#, Git, Bash, Linux, Docker

**Robotics:** ROS2, ROS, MoveIt, Arduino, CoppeliaSim, Gazebo, Unity, RViz, Onshape

**Libraries:** NumPy, Matplotlib, SymPy, ModernRobotics OpenCV

## EDUCATION

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**Northwestern University**

*Master of Science in Robotics*

**September 2024 - Present**

*Evanston, IL, USA*

**Visvesvaraya National Institute of Technology**

*Bachelor of Technology in Electrical and Electronics Engineering*

**December 2020 - May 2024**

*Nagpur, India*

## EXPERIENCE

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**Multi-robot Systems Group, Czech Technical University**

*Research Intern*

**May 2023 – September 2023**

*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**

*Summer Intern*

**July 2021 – October 2021**

*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

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**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