Pranav Shah

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Education:

- **University of Pennsylvania, Philadelphia, PA.** (Aug 2021 – May 2023)
  Master's, Artificial Intelligence and Robotics GPA: 3.94 / 4.0
  Awards: **Outstanding Research Award**
  Relevant Course Work: Learning in Robotics, Advanced Robotics (Path Planning, State estimation and Control of UAVs), Machine Perception, Machine Learning, Deep Learning, Control and Optimization for Application in Robotics, Mechatronics
- **Veermata Jijabai Technological Institute (V.J.T.I.), Mumbai, India** (July 2016 – Sep 2020)
  Bachelor of Technology (B.Tech) – Electronics Engineering CGPA: 9.29 / 10.00

Skills:

- Programming: Python, C++, Robot Operating System (ROS1 and ROS2), PyTorch, PostgreSQL, C, Embedded C
- Tools: AutoCAD, Git, LaTeX, MATLAB, Simulink, Cuda, Docker, Arduino, Drake, Excel, NI Multisim
- Product Development: Laser cutting, Electronic Circuit Design, PCB designing, CNC milling, machining processes, Jira, Agile

Work Experience:

- **Positioning and Controls Engineer, Caterpillar Inc.** (Apr 2024 – Current)
- Designing, Developing and Testing state estimation and control algorithms for different heavy-duty vehicles.
- Utilizing tools like MATLAB, Simulink and C++ to maintain CI/CD pipelines and test algorithms.
- Performing root-cause analysis, collaborating with multi-disciplinary teams to provide swift solutions to customer issues to reduce downtime
- **Research Engineer, GRASP Lab, University of Pennsylvania** (May 2021 – Apr 2024)
  Project 1: Migration of open-source library from ROS1 to ROS2
  Collaborating with a cross-functional team to migrate the open-source library of Kumar Robotics for drones from ROS1 to ROS2.
  Project 2: Path Planning and Control of swarm of mini drones
  - Designed and developed a simulator using Python for a swarm of mini drones which can fly in proximity in an indoor environment.
  - Implemented a Hamiltonian path planning algorithm along with a PID controller for swarm of drones.

  Project 3: Motion planning of multi-agent micro-robots
  - Developed a simulator for a swarm of micro-scaled robots, designing local – rules for a de-centralized multi-agent system using Python.
  - Designed and tested a macro-scaled prototype of the micro-bot to analyze the dynamics of the robot.
- **Data Scientist, Loylty Rewardz Management Pvt. Ltd**. (Dec 2020 – June 2021)
- Developed Machine Learning models to perform customer segmentation and predict future propensities for effective marketing.
- Coded PostgreSQL and Python scripts for database management, data analysis and automating several monthly report processes.
- **R&D Intern, Larsen and Toubro (L&T) Electrical and Automation** (May 2019 – July 2019)
  Designed and simulated the electronic circuit and control algorithm for a Solar PV Grid Tied Inverter using MATLAB and Simulink.

Project Experience:

- **SICK Lidar TiM 10K Challenge** (1st Prize Winners) (Oct 2022 – Apr 2023)
- Designed and developed an autonomous solution for the public space sanitation industry, along with a team of 5 which is one of the 20 teams shortlisted in the USA.
- Skills involved: ROS1, path planning, control, mechanical product design, mechatronics, electronic circuit design, perception.
- **Chance constrained Multi-Agent Non-Linear Model Predictive Control** (Nov 2022 – Dec 2022)
- Formulated a non-linear model predictive control (NMPC) for a differential drive robot to perform decentralized path planning.
- Built the project in ROS 2, simulated in Gazebo environment, and used 'drake' as the mathematical framework to solve the optimization.
- Algorithms compared: Model Predictive Control (MPC), Linear Quadratic Regulator (LQR) and Iterative LQR (iLQR)
- **Attention-based Networks for Human Trajectory Prediction** (Nov 2022 – Dec 2022)
  Designed and trained a Transformer neural network (using PyTorch) to predict a human's trajectory on the TrajNet dataset.
- **Ensemble Kalman Filter** (Apr 2022 – May 2022)
  Developed an Ensemble Kalman filter using a Neural Network (using PyTorch) which combined the filter outputs of an Error State Kalman filter, Complementary filter and Unscented Kalman Filter.
- **Autonomous VIO-based Quadcopter** (Jan 2022 – May 2022)
  Implemented the path planning (A* and Dijkstra algorithm), trajectory generation (minimum-snap trajectory), geometric controller and visual-inertial odometry (VIO) based state estimation and localization (sensor fusion of IMU data and stereo-images) for a UAV.
- **Simultaneous Localization and Mapping (SLAM)** (Mar 2022)
  Implemented a mapping and localization algorithm with a particle filter using data from IMU and LiDAR sensor.
- **Franka Panda Robot arm manipulation** (Dec 2021)
- Used kinematics concepts to control and maneuver a Franka Panda robotic arm to perform tasks in a dynamic environment.
- Implemented a graph-based path planning algorithms (RRT, A*) to obtain a path for the 7 DOF robotic arm.