

CHARMIN PRITESH DESAI

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EDUCATION & SKILLS

The State University of New York at Buffalo (UB), NY, USA

Aug 2021 – May 2023

- Master of Science in Robotics (Robotics & Artificial Intelligence)
- ✓ Python programming, Robot Algorithms, ROS, Gazebo, AI/ML, OpenCV, Computer Vision, Engineering Mathematics

Sardar Vallabhbhai Patel Institute of Technology (SVIT), Gujarat, India

Aug 2016 – Aug 2020

- Bachelor of Engineering in Instrumentation & Control (Industrial Automation)
- ✓ C programming, Arduino, MATLAB & Simulink, PLC, PID Control, Electrical/Electronics, Embedded Systems

ACADEMIC PROJECTS

Autonomous Plant Watering Robot (ROS)

Sept 2022-Present

1. **Objective** :- Development of a mobile robot to water household plants autonomously. It explores an unknown environment, builds a map, while also searching for plants. The robot localizes itself and navigates autonomously.
2. **SLAM** :- Used Gmapping on a TurtleBot3 robot in ROS gazebo to generate an image of size 383x383 pixels.
3. **Occupancy Grid** :- Performed image processing to generate an occupancy grid matrix of 400x400 pixels.
4. **Path Planning** :- Used homogenous transformation method to formulate two opposite coordinate frame transformations from Gazebo world frame to occupancy grid frame and vice-versa. Optimized A* algorithm from scratch and planned a 95% improved shortest path for the robot.
5. **Perception** :- Deployed AprilTags in gazebo. Executed AprilTag continuous detection node to derive the transform from any AprilTag's frame to robot's camera frame and world frame.
6. **Localization** :- Calculated the pose of the robot in the world frame with 99.9% accuracy.
 - a) Through AprilTag detection by creating a ROS Server-TF Broadcaster and Client-TF Listener node.
 - b) Using robot's own linear and angular velocity with trigonometric calculation.
7. **Recognition** :- Programmed a mathematical algorithm which estimates the true position of a plant from continuously updated robot's pose and robot to plant transform.
8. **Exploration** :- Robot explores the environment parallelly searching for plants to save their position in its memory.
 - a) Programmatically came up with random points in the occupancy grid for robot exploration.
 - b) Implemented K-Means Clustering algorithm with A* planning as a distance metric to cluster the points.
9. **Navigation & Control** :- Executed a controller node, driving the robot 80% faster from start to goal/plant location.
10. **Plant Watering** :- Enabled the robot navigating a shortest path for watering all the plants in least time.

Analysis of Fanuc LR Mate 200-iD Robot Arm Manipulator

Sept 2021 - Nov 2021

1. Standardized position of 6-DOF robot manipulator's end-effector in base frame and world frame.
2. Used Denavit-Hartenberg methodology and Forward Kinematics for calculations.
3. Derived 6x6 Jacobian Matrix to generalize the linear and angular velocities of the end-effector using DH Table.
4. Used Euler-Lagrange method to derive the mathematical model of the 6-DOF robot manipulator.

INTERNSHIP AND WORK EXPERIENCE

Teaching Assistantship, University at Buffalo

Feb 2023 – May 2023

1. Teaching assistant for professor Dr. Vojislav Kalanovic (Program Director) in the course MAE594 Robotics 2.
2. Conducted lectures on mathematical modelling of robot mechanisms and LABs on 6-DOF Jetmax Robot Arm.
 - a) Simulated and controlled the robot on Gazebo and controlled it via ROS nodes and commands.
 - b) Calibrated robot's different end-effectors (electromagnetic suction cup, grippers, pen) with AprilTag.
 - c) Performed operations like color & waste sorting, block stacking, gesture recognition, numeric calculation.
 - d) Interfaced different sensors like ultrasonic scan and display, dot matrix, touch control, fan tracking, etc.
 - e) Programmed a ROS node to move the robot's end-effector in Z-axis.

Internship at Tara Mechcons Pvt. Ltd.

Apr 2020

- ✓ Devised an Automatic Turn-Off Electrical Cutting Machine for operator safety in a team of 4 members.
- a) Used a 4-pole relay contactor to interface 3-phase induction motor that powers the machine.
- b) NC contact switch breaks the circuit when the lever arm of the machine is released, turning it off.
- c) When the level arm is pulled, the NC switch closes completing the circuit, powering the machine.

Internship at Larsen and Toubro Power Training

Jun 2019

- ✓ Engaged in Training on Industrial Instrumentation & 3 popular Automatic Control Systems (PLC, DCS, SCADA).
- a) Learnt about PLC and Ladder Logic programing. Recognized various control valves and industrial sensors.
- b) Learned about 6 motor starters: 2-3-4 point, VFD's, Soft starter and DOL starter.