

# 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-May 2023**

1. **Watch :-** [Autonomous Robot \(ROS and Gazebo\)](#)
2. **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.
3. **SLAM :-** Used Gmapping on a TurtleBot3 robot in ROS gazebo to generate an image of size 384x384 pixels.
4. **Occupancy Grid :-** Performed image processing to generate an occupancy grid matrix of 400x400 pixels.
5. **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.
6. **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.
7. **Localization :-** Calculated the pose of the robot in the world frame with almost 100% accuracy.
  - a) Updated robot's pose from AprilTag detection by a ROS Server-TF Broadcaster & Client-TF Listener node.
  - b) Updated robot's pose using its own linear and angular velocity through trigonometric calculation.
8. **Recognition :-** Programmed a mathematical algorithm which estimates the true position of a plant from continuously updated robot's pose and robot to plant transform.
9. **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.
10. **Navigation & Control :-** Executed a controller node, driving the robot 80% faster from start to goal/plant location.
11. **Plant Watering :-** Enabled the robot navigating a shortest path for watering all the plants in least time.

**Neural Network and CNN on Income & Fashion-MNIST Dataset**

**Apr 2022**

1. Introduced a Neural Network for income prediction from an Income dataset of size 32500 and achieved accuracy of 85.6% by Hyperparameter Tuning for optimization.
2. Built Object Recognition implementing CNN utilizing Fashion-MNIST dataset of 70000 sample images and obtained 92% accuracy.

**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.

**PLC Process Automation (Ladder Logic)**

**Aug 2019 - Dec 2019**

1. Automated Bottle Filling System (Silo Process)
  - a) A conveyor belt run by 1-phase motor running empty bottles until detected by a photo-switch sensor.
  - b) Sensor stops motor from starting LFM (liquid filling machine) for 3 seconds. Level sensor stops the LFM.
  - c) The conveyor begins running again to fill new empty bottles repeating each cycle for 6 seconds.
2. Batch Mixer Process Control
  - a) Two pumps pouring different fluids into 1 container until detected by a level switch sensor.
  - b) The fluid mixture is heated and processed by heater and spinning motor for a set timer of 30 seconds.
  - c) Finally, an output valve opens and a third pump supplying the resultant fluid out in 10 seconds.

**Electrical/Electronics and Automation**

**2019 – 2021**

1. Miniature adapter to set timer to any device/machine from 1-99 minutes with automatic turn-off functionality.
2. Reconstructed Indoor automatic lighting system controlled in 3 ways (PIR/IR Remote/Phone/Ambient Light).
3. Built an automatic system that detects & prevents water wastage and measures water consumption.

## INTERNSHIP AND WORK EXPERIENCE

### Teaching Assistantship, University at Buffalo

Feb 2023 – May 2023

- Teaching assistant for professor Dr. Vojislav Kalanovic (Program Director) in the course MAE594 Robotics 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 X-Y-Z-axis, home position and localization.

### Grader Assistantship, University at Buffalo

Sept 2022 – Dec 2022

- Grader assistant for professor Dr. Minghui Zheng in the course MAE340 Dynamic Systems.

### 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 programming. Recognized various control valves and industrial sensors.
  - b) Learned about 6 motor starters: 2-3-4 point, VFD's, Soft starter and DOL starter.

### Internship at Niyantras Automation

Dec 2018

- Prototyped an Indoor Air Quality Monitoring System operating on Arduino, MQ135, and MQ5 sensor modules for detecting particulate matter, N2O, SO2, H2, LPG, CH4, CO, and alcohol.